OPERATING EFFICIENCY OF INDIAN RAILWAY

A CRITICAL ANALYSIS (FROM 2000-01 TO 2020-21)

A Dissertation for the award of Master Diploma in Public Administration (MDPA) in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration (APPPA)

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Certificate

I have the pleasure to certify that Shi Neelesh Singh has pursued his research work and prepared the present dissertation titled **"Operating Efficiency of Indian Railways – A Critical Analysis (From 2000-01 to 2020-21)"** under my guidance and supervision. The same is the result of research done by him and to best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. This is being submitted to Indian Institute of Public Administration, in partial fulfillment of the requirement for the Advanced Professional Program in Public Administration of Indian Institute of Public Administration IIPA, New Delhi.

I recommend that the dissertation of Shri Neelesh Singh is worthy of consideration for the award of Master's Diploma of Indian Institute of Public Administration.

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Abbreviations

AI	Artificial Intelligence
AC	Air Conditioned
ART	Accident Relief Train
BG	Broad Gauge
BCL	Braithwaite & Co. Limited
CAGR	Compounded Annual Growth Return
CMIE	Centre for Monitoring India Economy
CONCOR	Container Corporation of India Limited
COVID-19	Corona virus disease
Cr	Crores
CR	Central Railway
CRS	Commissioner of Railway Safety
CRIS	Centre for Railway Information Systems
DFCCIL	Dedicated Freight Corridor Corporation of India Limited
D. No.	Demand Number
DRF	Depreciation Reserve Fund
DRM	Divisional Railway Manager
ER	Eastern Railway
ECR	East Central Railway
ECoR	East Coast Railway
Gr	Group
GDP	Gross Domestic Product
GM	General Manager
GOI	Government Of India
GTKMs	Gross Tonne Kilometres
HR	Human Resources
HODs	Head of Departments
PHOD	Principle Head of the Departments
PSU	Public Sector Undertakings
HQ	Head-quarter
ICF	Integral Coach Factory, Chennai
INR	Indian National Rupees
IR	Indian Railways
IRFC	Indian Railway Finance Corporation
IRCTC	Indian Railway Catering and Tourism Corporation
IRCON	Indian Railway Construction Limited
IT	Information Technology

JSC	Joint Stock Company
KMs	Kilo Metres
KRCL	Konkan Railway Corporation Limited
LHB	Linke-Hofmann-Busch
ML	Machine Learning
mph	Miles per hour
MG	Metre Gauge
MRVC	Mumbai Railway Vikas Corporation
NAIR	National Academy of Indian Railways
n.d.	Not dated
NR	Northern Railway
NCR	North Central Railway
NER	North Eastern Railway
NFR	North East Frontier Railway
NWR	North Western Railway
NG	Narrow Gauge
NLP	Natural Language Processing
OR	Operating Ratio
POL	Petroleum
PTI	Press Trust of India
RB	Railway Board
R&D	Research & Development
RCF	Rail Coach Factory
RDSO	Research Design and Standards Organization
RITES	Rail India Technical and Economic Service
RKms	Route Kilometers
RLDA	Rail Land Development Authority
RVNL	Rail Vikas Nigam Limited
SR	Southern Railway
SCR	South Central Railway
SER	South Eastern Railway
SECR	South East Central Railway
SWR	South Western Railway
TL	Train Lighting
WCR	West Central Railway
WR	Western Railway
MTP	Metro Railway
w.r.t	With respect to

Executive Summary

Indian Railways is the lifeline of India. It is a statutory body under the ownership of Ministry of Railways, Government of India, which operates India's national railway system. It spans the entire nation, providing the connectivity and integration needed for growth that is both balanced and coordinated. The system never stops; for the past many decades it has been operating continuously. It is an essential component of every Indian's identity. It is one of the basic and most important infrastructure foundations of the country which contributes approximately 1% to Indian GDP (Indian Railways, Year Book 2011-12).

Railway is one of the preferred modes of transportation for both people and freight. Railway transport is cost effective, has capacity to move people and goods efficiently, and it is more safe and cheaper as compared to road transport. It is also more environment friendly and energy efficient than road transport. It is capable of hauling large loads as compared to trucks.

The Indian Railways sometimes referred as "imperium in imperio," or empire within an empire. Only nations with longer railway distances in kilometres are United States, China, and Russia. It is the only government agency in India that fully covers salaries, pensions, and benefits for its entire staff through its own resources.

On April 16 1853, the first passenger train service ran between Bori Bunder (Bombay) and Thane, spanning a distance of 34 KMs. Starting in 1853, from the year in which railroad was first brought to India, it has grown to be a very big organisation in all aspects and has become an indispensable part of life of citizens of India. So much so that, it is called life line of India. It is fourth largest international network in the world which

manages total 1,26,611 track kilometres and 68,103 route kilometers (Indian Railway Year Book 2020-2021). It carried 1250 million passengers, which is more than population of year 2020 of countries like USA, Indonesia, Pakistan, Brazil, Russia, Japan, Mexico (Population by Country (2023) - Worldometer, n.d.).

As per year book of 2020-21 of Ministry of Railways, Indian Railway transported 1,233 million tonnes of goods and merchandise in 2020-2021. It ran 2,140 passenger trains and 8,021 goods trains daily. It employed 1.25 million employees and their wage bill for them was Rs 1,56,730 crores It earned Rs 15,248 crores in passenger services and Rs 1,15,738 crores from freight transportation.

Due to the rapid increase in population, the movement of people has increased tremendously. This has put pressure on transport sector as a whole and people are asking for better, faster and safe travel. Because of importance of railways in providing cheaper and safer transport and its contribution in economy directly and indirectly, it is important that the railway function properly and efficiently.

One of the measures for measuring the operating efficiency of railway is operating ratio (OR). The operating ratio is the amount spent to earn every 100 rupees. The lower it is the better. Higher the operating ratio, lower the financial resources available for expansion and growth.

The OR of the Indian Railways was analysed from different yearbooks and other data published by Ministry of Railways from 2000-01 to 2020-21 and it was found that the over time it has deteriorated drastically. For last five years it increased and remained more than 97%. Starting from peak of 98.34% in year 2000-2001 operating ratio started declining till 2007-2008 and came to 75.94%, but after 2007-2008, again it started rising

steadily remaining above 90%. In recent years it has remained more than 95%. In 2016-17 it was 96.5%, 2017-18 it came to 98.8%, again in 2018-19 it declined slightly to 97.3% but again rose to 98.4%, in F.Y. 2020-2021 it was 97.45%. In recently released year book by railways for year 2021-22 the OR has reached 107.39%.

Operating ratio is the ratio of Total working expenses (excluding suspense but including Appropriation to Depreciation Reserve Fund (DRF) and Pension Fund) to Gross traffic earnings expressed in percentage. Total working expenses is the sum of total ordinary working expenses, Appropriation to DRF and Appropriation to Pension Fund. Total Working expenses can be grouped under five major groups. These five major groups are General Superintendence of service on Railways (Demand No. 3), Repairs & Maintenance(Demand No.4,5,6,7), Operation (Demand No. 8,9,10), Staff Welfare, Retirements benefits & misc(Demand No.11,12,13) and contribution to various railway funds (Demand No.14). The expenditure on various demand heads were analysed and was found that cost on staff is the highest and it consists more than 50% of total ordinary expenses. On analyzing the trend of total ordinary working expenses, Appropriation to DRF and Appropriation to Pension Fund, it was found that while the total ordinary working expense has increased over time, appropriation to DRF and appropriation to Pension Fund has decreased. It was found that demand No.10 and Demand No. 9 are next big contributor to the operating cost. Demand no. 10 is Operating Expenses-Fuel and Demand No. 9 is Operating Expenses-traffic. On an average Operating cost of Fuel is 23% of the total operating cost. Hence it is important to concentrate on this area.

The revenue of railways comes from freight transportation; passenger services, other coaching earnings and sundry earnings. Majority of earnings come from freight

earnings and next is passenger earnings. As far as revenue generation is considered, it was seen that it has risen consistently from 2000-01 onwards but decreased after 2018-19. From year 2000-01 to 2020-21, on an average goods earning was 67 % to total gross traffic earnings. Coal is the major commodity of freight basket and constitutes on an average 46% of the total freight loading. Freight loading of coal has increased year on year. But there is slight decline in 2018-19 onwards and in subsequent years. In 2018-19 it was 605.84 million tonnes which reduced to 586.87 million tonnes and then subsequently it further went down to 541.82 million tonnes. Next to coal, Iron ore is next major commodity railway is transporting which constitutes 13.41% of total loading. After that, comes cement loading with 10.13% and other commodities with 8.47%.

In case of passenger earnings, it constitutes about 27% of total earnings and in recent years its growth has stagnated. Passenger services of the Indian Railways are available on both Suburban and Non suburban sections. Non suburban traffic is the primary contributor to the passenger earnings. On passenger originating basis 57% passenger are suburban passengers but revenue wise suburban passengers constitute only around 7% of total earnings. While 80% passenger kilometres are travelled by non suburban passengers. Lead represents the average distance each passenger is transported. Average lead of suburban traffic was 32.2 KMs and for non urban traffic, average lead was 254 KMs. Average rate per passenger per kilometer is the rate at which a passenger is charged for travelling for one kilometer. Average rate has increased from approx 22.9 paise per passenger per kilometres to 65.97 paise per passenger per kilometres.

On analyzing the performance of different zonal railways in terms of operating ratio we find that East Coast railway is the best performing railway which has maintained

an average OR of 51.14% for the period from 2003-04 to 2020-21. While the worst performing railway in terms of average operating ratio is North Eastern Railway for the period from 2003-04 to 2020-21 is pegged at 184.41%.

The dissertation suggests some recommendations to improve the operating performance of the railways. Staff cost is the highest of the revenue expenditure the railway incurs. It constitutes of around 50% of the total expenditure. Hence it is important to work in this area. It is important to measure the effectiveness of staff based on revenue generation and taking suitable action to improve the performance and productivity. It is also important to depute more staff in revenue generating areas. There is need for up-skilling, multi-skilling and training of the human resource. Staff cost can be reduced by using latest technologies like Artificial Intelligence, Machine Learning, Natural Language processing etc in different areas. They can help in predictive maintenance, improving passenger experience, better traffic management, better asset management, better safety and security and predicting failures. It is also important to invest more in research and development. This will help in enhancing the productivity. Apart from this, expenses on fuel consists on an average 23% of total operating expenses, hence it is important to control this. One of the ways is to spend more on R&D in this regard. Exploring other modes of traction like hydrogen mobility can be thought of. The speed at which the trains are run can be optimized for better efficiency. Suburban traffic if 57% of total traffic in terms of passengers carried, but consists only 7% of total passenger earnings. Hence one way to improve revenue is to explore increasing fare of Sub-Urban traffic.

ABSTRACT

INTRODUCTION: Indian Railways (IR) is a statutory body under the ownership of Ministry of Railways, Government of India that operates India's national railway system. It crosses the entire nation, providing the connectivity and integration needed growth that is both balanced and coordinated. The system never stops; for the past so many decades, it has been operating continuously. It is one of the basic and most important infrastructure foundations of the country. The scope and magnitude are enormous. The nations with longer railway distances than Indian Railway are United States, China, and Russia. It is important that IR functions properly and efficiently so that this enormous organisation can flourish properly and can contribute to the country in its overall growth. Recently the operating ratio (OR) of the railways has remained on a higher side which is a cause of concern.

OBJECTIVES: This dissertation tries to analyse the OR and factors responsible for high OR and suggest measures for improvement.

METHODS: This has been done by analyzing the expenditure and revenue data from 2000 to 2021 from different sources like Indian Railway Statistical Statements, Annual Year Books etc. The data has been analysed based on percentages, ratios, CAGR etc.

CONCLUSION: Results show that cost of staff is the biggest contributor of expenses followed by expenditure in fuel. In revenue area the freight is the major contributor of revenues followed by passenger traffic. In freight sector coal is the major contributor. In case of passenger traffic suburban passengers are more as compared to urban passengers but revenue contribution by suburban passenger is very less.

RECOMMENDATIONS: The study suggests measures like increasing productivity of staff by up-skilling, monitoring and deploying them in areas where more revenues are coming. To employ latest technologies like AL, ML in predictive maintenance, investing more in R&D, controlling expenses in fuel and exploring other means of traction and increasing fares of suburban traffic.

Chapter 1
INTRODUCTION

1.0 Introduction

Indian Railways is the lifeline of India. Indian Railways (IR) is a statutory body under the ownership of Ministry of Railways, Government of India that operates India's national railway system. It crosses the entire nation, providing the connectivity and integration needed for regional growth that is both balanced and coordinated. The system never stops; for the past so many decades, it has been operating continuously. It is an essential component of every Indian's identity. It is one of the basic and most important infrastructure foundations of the country.

The Indian Railways is sometimes referred to as a "imperium in imperio," or empire within an empire. The scope and magnitude are enormous. The only nations with longer railway distances in kilometres are the United States, China, and Russia. It is the only government agency in India that fully covers salaries, pensions, and benefits for its entire staff through its own resources.

Starting in 1853, from the year in which railroads were first brought to India, it has grown to be a very big organisation in all aspects. On April 16 1853, the first passenger train service ran between Bori Bunder (Bombay) and Thane, spanning a distance of 34 km. With 14 railway carriages carrying about 400 guests, left Boribunder at 3.30 pm "amidst the loud applause of a vast multitude and to the salute of 21 guns." Within a year it got extended to Kalyan. In Eastern Indian the first passenger train from Howrah station to Hooghly ran a distance of 24 miles, on 15th August, 1854. In south, the first train ran from Vyasarpadi Jeeva Nilayam (Veyasarpandy) and Walajah Road (Arcot), for a distance of 63 miles on 1st July, 1856 by the Madras Railway Company. In North a line of 119 miles was laid and from Allahabad to Kanpur on 3rd march 1859

(Railway Board Web Site, 2022). Since then the growth has been tremendous in major indices and it has grown tremendously in all aspects.

From this humble beginning the Indian Railway has become a very big organisation and became a very important part of life of India. So much so that it has been called as life line of India. It has grown to become the fourth largest international network in the world which manages total 1,26,611 track kilometres and 68,103 route kilometers (Indian Railway Year Book 2020-2021). It carried 1250 million passengers, which is more than population of year 2020 of countries like USA, Indonesia, Pakistan, Brazil, Russia, Japan, Mexico (Population by Country (2023) - Worldometer, n.d.).

As per year book of 2020-21 of Ministry of Railways, Indian Railway transported 1,233 million tonnes of goods and merchandise in 2020-2021. It ran 2,140 passenger trains and 8,021 goods trains daily. It employed 1.25 million employees and their wage bill for them was Rs 1,56,730 crores Hence average salary of one employee was around Rs 12.5 lakhs. It earned Rs 15,248 crores in passenger earnings and Rs 1,15,738 crores from freight transportation.

Railway has become one of the preferred modes of transportation for both people and freight. It is an integrating force in India, connecting people and economy. Railway transport is cost effective, has capacity to move people and goods efficiently, and it is more safe and cheap as compared to road transport. It is also more environment friendly and energy efficient than road transport. It is capable of hauling large loads as compared to trucks.

Railway plays an important role in integrating people and connecting remote places of the country. It helps people to explore employment opportunities in other areas.

Also, railway is important from strategic point of view as it helps to connect border areas and helps in transporting troops and ammunition in case of war. It helps in growth of industry and agriculture. It is contributing approximately 1% to Indian GDP (Indian Railways, Year Book 2011-12).

It works as an integrating force to the society and it is a bulk transporter of food and other important ingredients which are indispensable in nation building. It has its own importance from strategic point of view.

1.1 Statement of the Problem

Due to the rapid increase in population, the movement of people has increased tremendously. This has put pressure on transport sector as a whole and people are asking for better, faster and safe travel. Travel inside the city and intercity travel by bus has become very difficult and is mostly overcrowded. Road infrastructure is also in dilapidated condition. The travel inside the city has been helped by the upcoming metros in different cities. But metros are not there in all the cities. However, for long distance, rail transport is still more convenient and reliable. Railway helps in movement of people in an unprecedented scale, in a fast manner and with a very low cost to its passengers. It is also the first choice of movement of various types of cargo, such as freight, containers, automobiles and bulk commodities such as grains, coal, minerals and metals etc. But due to inadequate investment in Railway's infrastructure, their condition has not improved as needed.

In spite of the advantages and importance of Indian Railways, its operating ratio has deteriorated over time. The operating ratio here is the amount spent by Indian Railway to earn every 100 rupees. The lower it is the better. It is used to measure the

operational efficiency of any organisation. Higher the operating ratio, lower the financial resources available for expansion and growth.

Table 1.1: Operating ratio of Indian Railways.

Year	Operating Ratio
2010-11	94.59
2011-12	94.85
2012-13	90.19
2013-14	93.6
2014-15	91.3
2015-16	90.5
2016-17	96.5
2017-18	98.8
2018-19	97.3
2019-20	98.4
2020-21	97.45
2021-22	107.39

(**Source:** Statistical Summary-Indian Railways)

It can be seen from the above table 1.1 that the operating ratio had remained more than 97% for the past five years. Various studies indicate that its expenditure on staff and pension has been increasing. It is evident that the pressure is mounting on railways. Every year Indian Railway allocates a certain amount of funds for catering to current and future pension liabilities. In the Financial year 2020-21 due to COVID-19, fewer funds were allocated to Pension Fund in 2020-21. If the required level of appropriation to the

Pension Fund would have been done in FY 2020-21, then net revenue would be very less and the Operating Ratio would have been 131.55%.

It is also evident from the Economic Survey (2017-2018) that the freight movement has slowly dropped due to non competitive tariff structure (PTI, 2018).

As per CMIE article "Transportation in fast lane (2022)": " the government is exploring the possibility of transporting coal for domestic consumption through waterways from the eastern coast to the western coast. Traditionally, coal is transported by railways within the country." If the coal will get shifted to waterways then further stress is going to come on IR. Moreover, after COVID people now prefer their own vehicles for travel of 7-8 hrs.

Apart from this, as per the same CMIE article, air passenger traffic increased manifolds to 51.2 million during April-May 2022 from 16.9 million during April-May 2021. Yet, it was lower than its corresponding pre-Covid level of 55.6 million. This shows that air traffic has gone to 92% of its pre COVID levels. Whereas, passenger booking on Indian Railways, both suburban and non-suburban, increased to 1.3 billion during April 1-June 20, 2022 from 388.7 million. This shows that the passenger bookings on railways were about 70 per cent corresponding pre-Covid level which were above 2 billion in April-June 2019 (Saha, 2022). From above it is seen that while air passenger traffic has picked up, railway passenger traffic has not picked up compared to the pre-Covid level. Upper class fares are facing competition from low cost airlines and AC bus fares. So moving traffic from railways to airways is yet another challenge faced by IR. Similarly, it is also difficult to increase the fares of second class passenger traffic which contributes to 67% of the total passenger revenue. Keeping all these challenges faced by Indian Railways, it is pertinent and important to analyse the OR performance of IR and

suggest measures for improvement, if IR is to remain competitive and survive. And based on the analysis, the objective will be to suggest measures for improvement for overall Indian Railways.

1.2 Research Objectives

The objectives for the study will be as under:

1. To study the changes in the operating ratio of Indian railway from 2000-01 to 2020-21.
2. To analyse the factors affecting the operating ratio of Indian Railways.
3. To compare different zones of the Indian Railway based on operating efficiency.
4. To explore the areas of improvement in operating efficiency for Indian Railway.

1.3 Rationale

Undoubtedly, the contribution of Indian Railway to the nation building is significant. Starting from income and employment generation, movement of people to transportation of goods and promoting geographical and cultural integration. It acts as a lifeline to the nation, like the blood flowing in the body or rivers flowing in the country. It is also a great contributor to the economy. Hence the effective and efficient functioning of Indian Railway is important for the country. The continuous increase in operating ratio of Indian Railway is a cause for concern. The Operating ratio as elaborated earlier is the amounts spend to earn Rs 100. It is important that Indian Railway should play an important role in achieving the Government of India target of becoming an economic superpower in the near future and a high income country by 2047 as per competitive roadmap for India @100. If the operating ratio keeps on increasing it will not only impact the railway itself but the economy as a whole. Because of this, the cascading effect may come and may

affect the economic development of the nation. The High operating ratio also hampers the Indian Railways capability of investing in itself. The growing importance of railways will require more technology infusion but a high operating ratio prevents it from doing so. Hence it is important to study the factors responsible for an increase in the operating ratio and suggest areas for improvement so that the operating ratio may be controlled. Hence studying the Indian Railway and suggesting improvements will help not only the Indian Railway but the country, its economy and people also.

1.4 Research Questions

Q. 1. What is the performance of Indian Railway in terms the operating ratio (OR) from 2000-01 to 2020-21?

Q. 2. What are the factors affecting the operating ratio of Indian Railway?

Q.3. Which zone is best among the zones in terms of operating ratio?

Q.4. What are the areas of improvement which can help Indian Railways to improve its operating ratio?

1.5 Research Strategy and Research Design

The research strategy of the study is quantitative and the research design is exploratory and descriptive. **The study is based primarily on the secondary data.** In this case, the available literature on the performance of Indian Railways has been studied to derive an assessment. Various railway reports, planning papers and expert committee reports has been studied and analysed for the study. An archival study of historical records and analysis of media articles has also been carried out to complete the objectives.

1.6 Research Methodology

The study is an empirical research based on secondary data. Different quantitative methods have been used to analyse the data. Initially the whole Indian Railway has been studied from operations point of view. That is operating ratio of the whole Indian Railway has been analysed. That is based on analysis of expenditure and earnings of Indian Railways. Thereafter zones have been studied to see which zone is best in performance and which zone is worst.

Research methods mainly consist of measuring the data over timeline, percentages, ratios, Compounded Annual Growth of Return (CAGR) etc. A systematic description of data has also been taken to understand the trends of the performance of IR. The study is based on the data of IR from published statistical statements of Indian Railways, Year Books, etc., various journals, books published on Railways. Various data has been collected from the Annual Statistical Statements published by Indian Railway. Data on revenue & expenditure, no. of employees, wages, passengers travelled & freight carried, revenue generation, fuel consumed, length of track, investment done, gauge, electrified & non electrified track lengths, etc., has been extracted from the Statistical Statements for the study. Apart from published sources of IR, information has also been collected and analysed from many other sources like – budgetary speeches, Indian Railway websites, Indian govt. press releases, reports of auditing agencies, reports by various expert committees, news papers, magazines, papers submitted by various academicians at various universities, books published by various authors/retired employees, etc.

1.7 Literature Review

The following literature in has been reviewed:-

Reeti Agarwal (2008) in her paper "Public transportation and customer satisfaction: The case of Indian Railways", emphasis has been laid on the importance of customer satisfaction and relationship with customers. It was tried to find the factors which impact customer satisfaction. The paper finds that out of various factors, employee behavior has the maximum impact on satisfaction level of customers.

Sopan Kasinath (2015) has analysed the performance of IR from the perspective of brief history of IR, its organisational structure, its physical performance, financial performance, productivity of IR and human resource capital of Indian Railways. The study was descriptive in nature and was based on secondary data. It was based on period from 1950-51 to 2013-14. He has talked about the autonomy as the need of the hour and enhancing the route kilometres in potential arenas. It was suggested to control the operating ratio by reducing the human resource. He also talks about the enhancement of the rates of freight and passenger sector. Apart from this, he also suggested to meticulously utilize the empty land.

Hafiz Wasim Akram, Alam Ahmad and Souvik Sanyal (2022) in their paper "An analysis of performance of Indian Railways" consider that performance of IR is at the low ebb for couple of years and gradually deteriorated. The performance was analysed on the basis of "operating ratios(OR)", "Capital output ratio (COR)" and "Return on logistics asset ratio (ROLAR)". It lays emphasis on doing away with subsidies and ending of archaic pricing policies.

N.L. Dhameja and M. Dhameja (2020) in the paper titled “Indian Railways: Restructuring: Private sector involvement, A Beginning” have highlighted the problem of “chronic under investment, low capacity augmentation, congestion, over-utilisation, safety problems and poor quality service, poor morale” etc. The paper discusses the recommendations of Bibek Debroy Committee which suggested measures for improvement in Indian Railways.

G. Alivelu (2010) in his working paper “Salient aspects of the growth story of Indian railways 1981 through 2007-08” has tried to study Indian railways from three sub periods. First from 1981-82 to 1991-92, second period from 1992-93 to 2002-03 and third from 2003-04 to 2007-08. He has brought out that freight NTKMs (Net tonne kilometres) has declined in second period as compared to first period but high growth rate registered for third period. The rate of PKMs (passenger kilometres) has registered growth for all the periods. It also showed that percentage of Gr A and B officers remained same, Gr C staff increased and Gr D staff decreased.

S.A.George and N.Rangaraj (2008) in their paper “A performance benchmarking study of Indian Railway zones” have carried out performance benchmarking study of zones as an alternate approach for measuring their performances and to envisage its operation in supply chain perspective. They identified the central and western zones as the best performing railway zones over the years and after the restructuring also.

N Bhanot and H Singh (2012) in their paper “Benchmarking the performance indicators of Indian Railway container business using data envelopment analysis” carried out the benchmarking of the performance indicators in Indian Railway container business and select private players. On the basis of Data Envelopment Analysis(DEA) they found

that efficiency trends for CONCOR fluctuated from 87.5% to 100% from 1995-96 till 2010-2011 and 38.31% to 77.59% for private players due to fluctuations due to licensing policy.

G. Raghuram and R Gangwar (2008) in their working paper "Indian Railways in the Past Twenty Years Issues, Performance and Challenges" have highlighted the issues of market segment perspective, capacity growth, employee costs, pricing ,departmental structure etc.

U.S.Jha (2018) in his paper "Indian Railways-contribution to Indian Economy" has dealt with the growth of Indian Railways. He compared the railway transport sector with road transport sector and delineates different freight items. Further it goes on to discuss the contribution by railways to the GDP. He discusses how modernisation, up gradation, capacity creation and expansion help the railways.

V.V.S.B.B.Raju (2017) in his research "Analysis on Growth and performance on Indian Railways (With special reference to East Cost Railway Zone)" has studied origin and growth of IR, reviewed the performance from 2000-01 to 2013-2014, compared the performance of East Coast Railway(ECoR) with IR, passenger opinions of ECoR, reviewed the policies, problems and made suggestions for improvements of IR. It was found that the gross revenue and expenditure grew steadily over the period 2000-01 to 2013-2014. The revenue grew at 11 to 15 per cent between 2004-05 and 2008-09 but from the year 2008-09 to 2009-10 there was a slight dip (11.35 to 8.89 per cent) in Gross receipts resulting in a decline in net revenue receipts. In 2012-13 the situation improved due to fare hike and growth in passenger and freight traffic.

Ministry of Railways (2015) in its paper Indian Railways-Lifeline of the Nation (White paper) discusses about congestion in network and difficulties in coming of resources. “Stress is there on resources for development and replacement of railway. Even covering its operating costs has become a proving challenge. Nonetheless, the spirit is still present. Indian Railways has created an ambitious five-year action plan to try to revive itself. There is an understanding that support crutches must be given up if the vicious cycle of underinvestment is to be changed into a virtuous cycle of prosperity. In order to develop, Indian Railways will need to produce its own resources.” It discusses about the importance of faster and modern trains, better stations, and skilled staff as a future of railways. It emphasizes the importance of becoming self sustainable and giving a affordable, happy and reliable travel experience. The paper says about Indian Railway looking forward in becoming nation’s carrier and multi-modal integrator.

Vivek SahaiI and Ameya Pimpalkhare (2019) in their paper “Improving Asset Productivity: The Key to Revitalising the Indian Railways” discusses about the financial health of Indian Railways and its dismal condition. It expresses the difficulty in analyzing the railway finances after the merging of railway budget with general budget. It examines the falling asset productivity of Indian Railways. “The analysis finds similarities with the historical data of ‘falling asset productivity’ which had in the past led to poor financial performance of the railways. The paper offers recommendations to ameliorate the decline in productivity.” It concludes by recommending actions such as reintroducing the productivity test review, redrawing inter-station running time, preparing of freight working timetable, revamping the train control mechanism, auditing of asset usage, training of operating staff to improve productivity etc.

Ashwini Deshpande and Thomas E. Weisskopf (2014) in their paper “ Does Affirmative Action Reduce Productivity? A Case Study of the Indian Railways" with an "objective is to shed empirical light on a claim that increasing the representation of members of marginalized communities in jobs comes at the cost of reduced productive efficiency" undertook a "systematic empirical analysis of productivity in the Indian Railways—the world’s largest employer subject to affirmative action—in order to assess whether higher proportions of affirmative action beneficiaries in employment have reduced efficiency in the railway system." In the study the researchers found that that there is no evidence for such an effect on the other hand they found that opposite to be true.

Vinod Bhatia and Seema Sharma (2021) in their paper "Expense based performance analysis and resource rationalization: Case of Indian Railways" evaluated the efficiency performance of different zones and suggested cost saving strategies for the zones. They used Constant Return to Scale (CRS) and Variable Return to Scale (VRS) data-envelopment as methods. Apart from this they performed sensitivity analysis with different set of variables. It uses the data published by Indian Railway Annual Statistical Statements. They emphasised the importance of operating and working expenses as input parameters in benchmarking. And output in terms of passenger-kilometer and net ton-kilometers. The outcome for measures for cost reduction as became evident from the study was technological innovation and staff management as important factors. The paper further highlights the important issues for consideration of different stakeholders in railway sector i.e. rail operators, policy makers, customers and infrastructure managers.

Aditya Saxena and Ankit Kumar Yadav (2022) in their paper "Examining the Effect of COVID-19 on Rail Freight Volume and Revenue" using the ARIMA forecasting model and assessing the resilience of Indian railways during the pandemic have tried to see the effect of COVID-19 in freight transport. Based on the analysis, they have found that due to the pandemic, the rail freight volume and rail freight revenge suffered a loss of 149.08 million tonnes and INR 16,712.6 crores. Apart from this several measures for post COVID recovery were also suggested like shifting ocean cargo to air, converting empty passenger aircraft to passenger-freighters by including belly cargo, freight consolidation, warehousing close to point-of origin or destination, converting stores into distribution and fulfilment hubs, and strategically using ocean freight as floating storage through careful timing.

Sabyasachi S. Roy and Mukul Kulshrestha (2021) in their paper "Performance Assessment Study of Indian Railways – Case of Low Efficiencies in Large Government Monopoly" tried to carry out efficiency analyses of mid- and micro-levels by adopting data envelopment analysis (DEA)-based approach to evaluate the performance efficiencies of the 69 divisions of Indian Railways. Six models that deploy a range of performance indicators like operating expenditures, numbers of staff employed or passengers carried, freight carried, rail network length, and revenues generated were employed to assess efficiencies. Several inefficiencies were detected which can be attributed due to proper management, planning policies, and mis-governance, resulting in significant financial losses. The paper discusses these issues and the policy reforms needed in the developing country context, while suggesting some reforms that may lead to improved sector performances.

Manpreet Kaur and Anjali Mehra (2017) in their paper "Inter-Zonal Variations In The Growth Story Of Indian Railways" tried to analyse the growth performance of 16 zonal railways. This was done in terms of physical, financial and asset utilization in railways from 1991-91 to 2010-11. The study periods were 1991-92 to 2010-11. Further divided into two groups from 1991-92 to 2002-03 and from 2003-04 to 2010-11 (post reforms). It was found that performance in the post reform time was on the rising trend. “The study found that performance of growth in many of the zones in IR was not up to the mark. There were indications of less expansion of network, slow electrification, low development of rolling stock and higher costs. It was also observed that infrastructure was obsolete, freight traffic was lost to roadways, overstaffing and poor financial condition.”

Nevil Gandhi , Ravi Kant and Jitesh Thakkar (2022) in their paper "Sustainable performance assessment of rail freight transportation using triple bottom line approach: An application to Indian Railways" tried "to access the performance of sustainable freight transportation" by using twelve sustainability indicators. Data was collected from multiple secondary resources like IR's annual reports, yearbooks, and annual statistical statements between the financial year 2007–08 and 2020–21. It was concluded that on the front of environmental and social performance, railways performed well but economic indicators were not conclusive and were mixed. In terms of energy efficiency, emission factor, mean load factor, average unit cost, net tonne-km per wagon per day, accident rate, and average annual wage per employee IR performed better. But poor in terms of land usage, freight market share, the average speed of freight trains, and employment

generated during the assessment period. It also concludes that IR needs to revamp freight transportation policies.

Lauren McMillan and Liz Varga (2022) in their paper "A review of the use of artificial intelligence methods in infrastructure systems" have discussed about the opportunities that AI offers for infrastructure systems, extent to which the methods of AI has been applied in the field of infrastructure. They found that machine learning has dominated the field. The main purpose for which AI has been used are network provision, forecasting, routing, maintenance and security, and network quality management. They emphasised that to reap ample benefits the research has move from departmental perspective to include all perspective.

In research article "A literature review of Artificial Intelligence applications in railway systems" (Tang et al., 2022) authors tried to undertake a systematic review of current AI applications in railways. Papers from various areas of application of AIs like maintenance and inspection, planning and management, safety and security, autonomous driving and control, revenue management, transport policy, and passenger mobility were discussed. They have found that more research efforts are for maintenance and inspection and less for rail transport policy and revenue management. They came to conclusion that AI research is at a nascent stage and future research is expected in the direction combined with optimisation etc.

Oksana Timchuka, Yuliya Veselovab, Irina Dodorinab, Mariya Vikhorevac (2023) in their paper "Improving the Competitiveness of the Railway Industry Organization Using Innovative Economic Models" have said regarding the necessity of establishing key areas in order to increase the productivity of the Russian railways (JSC).

They also pointed out that there are many controversial issues which require deeper study. They also found that there is an enormous complexity in the mechanism of organisational and economic relations. By defining set of measures which help in improving competitiveness is required and should be the main purpose. They concluded that JSC railway responds “in a timely manner to market changes, internal and external economic situations, with customers they use flexible methods, production technologies are constantly improved, innovation and scientific data is used for any work.”

Alice Lunardon , Doroteya Vladimirova and Benedikt Boucsein (2023) in their paper "How railway stations can transform urban mobility and the public realm: The stakeholders’ perspective" have tried to highlight the importance of stations in the society. They provide a wide range of services. They have large potential in reshaping the cities in a sustainable manner. This can be done by intermodal transportation, green transportation, active modes of transport and logistics. But this required the involvement of all stakeholders. They suggested measures to better harnesh the potential of railway stations. This requires analysis of the station‘s role as a public space at the service of citizens. They emphasized to develop unique solutions in station’s energy efficiency. Apart from this, to have understanding of resources moving in and around station is important for better logistics management.

In the research paper "Africa's railway renaissance and sustainability: Current Knowledge, Challenges, and Prospects"(Bouraima et al., 2023) the researchers tried to identify research and policy gaps that African railway transportation planners and their development partners should take into account by reviewing the body of existing literature.

African railway-related articles were examined to ascertain current understanding of the network, difficulties, economic potential and environmental sustainability. Review included two recent World Bank publications on rail transport in Africa, as well as 49 peer-reviewed papers published between January 2000 and June 2022.Low penetration of electric-powered trains, technology integration, and shuttle services were observed. The analysis revealed that previous research had shunned discussions of planning, regulations, policies, and the opportunities and difficulties that come with implementing policy.

Melody Khadem Sameni and Arash Moradi (2022) in their paper "Railway capacity: A review of analysis methods" tried to summarise significant studies over the past two decades in railway capacity and its utilization, with a focus on those that have been published since 2010 amounting to total papers over 60 in numbers. The three subcategories of capacity assessment techniques mentioned were analytical, optimization and simulation. The timetable is compressed using two basic analytical techniques UIC 406 and CUI to determine how much capacity is used.

In their paper "Analytical Procedures for the Evaluation of Infrastructural Measures for Increasing the Capacity of Railway Lines" (Bulková et al., 2022), the authors tried to suggest methods that will quickly and precisely quantify the advantages of improving the line's throughput performance. Analytical techniques are beneficial for determining the throughput performance for the first estimations and assessments of investment measures. Different proposals were submitted to increase the line capacity of Prešov–Ličartovce track section. The authors claim that procedures mentioned are advantageous in from the view of administration in assessing infrastructural measures.

They also emphasised the importance of adaptaion of optimisation and simulation methods.

1.8 Chaptersation Scheme:

The Dissertation consists of following chapters:

Chapter 1: Introduction

Chapter 2: Origin of Indian Railways and Organisational Structure

Chapter 3 Overall Operating Performance of Indian Railways

Chapter 4 Comparative Study of Zones of Indian Railway

Chapter 5 Challenges and Opportunities of Indian Railway

Chapter 6 Conclusion and Recommendations

Referrences

1.9 Limitations and Scope

The study has been done based on secondary sources like data of IR from published statistical statements of Indian Railways, Year Books, various journals, books published on Railways. Hence the study is based on secondary data only and no primary data has been collected. Since the topic of Indian Railway is vast, scope still remains to go at a deeper level i.e., to divisional level and to access the performance at that level.

Chapter 2

Origin of Indian Railway and Organisational Structure

2.0 Origin of Indian Railways

2.0.1 Introduction

In this chapter “Growth of Indian Railways and Organisational Structure, " we will be dealing with a short history and evolution of Indian Railways, its various zonal railways, different Production Units, PSUs, the organisational structure of the Railway Board, functions of various board members etc.

Railways started in India for the first time in 1853 when the first train ran between Mumbai and Thane. After independence, the railway systems were nationalized in 1951 which resulted in the formation of Indian Railways. Thus Indian Railways become one of the largest networks in the world. Long distance trains, suburban rail systems, different mountain railways like Nilgiri mountain railways and Darjeeling Mountain Railways are operated by Indian Railways. Indian Railway mostly uses broad gauge but it also has a small network of meter and narrow gauge. There are number of PUs and PSUs under the Railway Board engaged in the production of coaches and locomotives and other specialized functions. Passenger trains are common form of long distance transport in most parts of the country. A passenger train mainly consists of ICF or LHB coaches. The bulk of India's main-line trains use the Integral Coach Factory (ICF) coach, a typical passenger carriage. In the 1950s, the Integral Coach Factory, Perambur, Chennai, India, and the Swiss Car & Elevator Manufacturing Co, Schlieren, Switzerland, jointly created the coach's design. Whereas, Linke Hofmann Busch (LHB) coach is a passenger coach of Indian Railways that is developed by Linke-Hofmann-Busch of Germany.

A passenger train may consist of eighteen to twenty four coaches. One coach of Indian railway can carry different number of passengers based on its class. But during the

holiday seasons or on busy routes, a lot more passengers usually travel in a coach. Reserved coaches are connected through vestibules but unreserved coaches are not.

During 2020-21, it carried 1,250 million passengers and 231 billion passenger kilometres. Passenger Kilometres is the product of number of journeys and mean kilometric distance for a class. The passenger kilometres in 2020-2021 were 231 billion. (Indian Railway Year Book, 2020-2021).

It has operated passenger trains amounting to 245 Million Train kilometres and 8,114 Million Vehicle kilometres in 2020-21. For freight traffic, it clocked 418 Million Train Kms and 19,020 Million Vehicle kilometres in 2020-21. In terms of Volume of traffic, passenger traffic was 1,250 Millions and 2,31,126 Million passenger kilometres. In terms of revenue earning traffic it hauled 1230.94 million tonnes of traffic and total traffic was 1233.85 million tonnes. Net Tonne kilometres is payload of one tonne carried over one Km and for revenue earning traffic it was 7,19,762 and for total traffic (incl. non-revenue) Net Tonne kilometres was 7,20,054 (Indian Railway year Book 2020-2021).

Indian Railway had 12,52,000 regular employees on roll and wage bill for regular employees was 1,56,730.39 Crores. Average Annual Wage per Regular Employee was Rs 12,49,755. As far as financial results are concerned its revenue was Rs 1,40,570.52 crore and Expenses were 1,36,567.51 crores. Miscellaneous Transactions was Rs.1,455.63 in crore. Net Revenue (before dividend) was Rs.2,547.48 crores. Which amounted to an excess of Rs.2,547.48 crore. The Rate of Return on Capital was 0.66% (Indian Railway Year Book 2020-2021). It had 64,403 BG route kilo-meters and total 68,103 kilometres of the rail network. Total 44,802 kilometres were electrified route. IR

had total 12,734 locomotives, 3,02,624 wagons, 79,835 coaches. 2140 passenger trains and 8021 good strains were run daily. Average speed of goods train was 43.2 KMPH and mail exp trains was 53.8K MPH. The maximum speed of passenger trains varies, with the Vande Bharat Express running at a peak speed of 180 km/h (110 mph). IR owns locomotive and coach-production facilities at several locations in India. The government has committed to electrifying India's entire rail network by 2023–24, and become a "net zero (carbon emissions) railway" by 2030. (Indian Railway Year Book 2020-2021).

2.0.2 Idea of Railways in India:

The first idea of Railways in India was conceived in 1831-32 in the Presidency of Madras. This was during a Parliamentary Select Committee meeting on the affairs of East India Company to improve communication and commerce. A.P.Cotton who was a civil engineer in erstwhile Madras in 1836 and R. M. Stephenson who was a bridge engineer in 1844 emphasised the importance of the railways in India. The then secretary Halliday felt the importance of railways in the movement of troops and its other advantages. The Chamber of Commerce of Manchester was of the view that the railways would help in the movement of cotton from India and compete with America. Hence it was proposed that railway companies will construct the lines and East Indian Railways will give the guarantee of a specific return (Rao, 1978).

In 1853, Lord Dalhousie insisted the introduction of Railways in India by connecting ports and various presidencies by trunk lines. Initially, it was the movement of troops and improvement of commerce was the main objective for the British for initiation of the railway system (Rao, 1978). Initially, there was less control of the government on these companies which lead to some issues. But as the construction of

railway lines progressed, to the issue with the railway companies the government tightened its contractual conditions and financial conditions so that they can function properly and efficiently (Rao, 1978).

2.0.3 Introduction of Railway in India:

The World's first train successfully ran from Stockton and Darlington in England in 1825. Subsequently, the first train in India ran from Bombay to Thane on April 16, 1853, transporting 400 people for 34 kilometres. Within a year the line was extended to Kalyan. Mr George Clark played a major role in visualizing and thinking of railways in India. It was only his idea to connect Bombay with Thane, Kalyan and the Thal and Bhore Ghats when he was chief engineer of Bombay government in 1843.

The history of railway companies in British India dates back to the 19th century when the British East India Company began to construct railways to facilitate the transportation of goods and people across the vast and diverse landscape of the Indian subcontinent. Over the next several decades, the British government and various private companies continued to build more railways, eventually creating a vast network of lines that connected major cities, ports, and industrial centres throughout India.

During this time, several railway companies were established in British India, including the Great Indian Peninsula Railway, the East Indian Railway Company, and the Bombay, Baroda, and Central India Railway. These companies were responsible for the construction and operation of the railways, and they were granted exclusive rights to operate in specific regions of the country.

As the railway network grew, it played a crucial role in the development of the British Raj, allowing for the efficient transportation of troops, goods, and raw materials.

It also facilitated the growth of trade and commerce, as well as the movement of people across the region. In the early 20th century, the British government began to nationalize the railway companies in India, taking over their assets and operations in order to better regulate and manage the railway system. This process was completed in the 1920s, and the Indian Railway Service was established to oversee the operation of the railways.

First track for IR was constructed by The Great Indian Peninsula Railway (GIPR) a predecessor of the Central Railway (and by extension, the current state-owned Indian Railways). It's headquarters was established at the Boree Bunder in Mumbai. Later on it was known as the Victoria Terminus and presently it is called the Chhatrapati Shivaji Maharaj Terminus. GIPR was incorporated on 1 August 1849 by the Great Indian Peninsula Railway Company Act 1849 (12 & 13 Vict. c.83) of the Parliament of the United Kingdom. It had a share capital of 50,000 pounds." (Wikimedia Foundation, 2022).

The first passenger train in eastern India ran from Howrah station to Hoogly on 5th August, 1854. It ran on 1st September, 1854 for a length of 39 KMs and further it was extended to Pundooah. The distance between Pundooah to Howrah is 61 KMs. On 3rd February, 1855 the line was further extended to Raniganj. (Ministry of Railways (Railway Board), n.d.)

Madras Railway Company played a very important role in the development of the rail network in South India. The credit for opening the first line on Its July, 1856 from Vyasarpadi Jeeva Nilayam (Veyasarpandy) and Walajah Road (Arcot) goes to this railway company. The distance between Vyasarpadi Jeeva Nilayam (Veyasarpandy) and

Walajah Road (Arcot) these two stations was 101 kms. (Ministry of Railways (Railway Board), n.d.).

In the North, a length of 192 Kms of railway track was laid from Allahabad to Kanpur on 3rd March 1859. The first section from Hathras Road to Mathura Cantonment was opened to traffic on 19th October, 1875. After this in 1889 Delhi-Ambala-Kalka line followed (Northern Railways / Indian Railways Portal. (n.d.)).

In the extreme East, from Brahmaputra River Steamer Ghats near Dibrugarh eastward, 15 miles (24km) line from Dibrugarh Town to Dinjan was opened on 15th August 1882. It was further extended to Makum Junction in 1883, a further 23½ miles(38km). Reaching Talap in 1885 giving a total 54½ miles (88km). It was owned by 'Assam Railways and Trading Company' (AR&TC). It was opened in stages and from 1882 it went up to a total of 140km by 1910. (Dibru-Sadiya Railway - FIBISwiki, n.d.)

2.0.4 Early Railway Companies

Initially, railway systems were built and operated by private companies. They were ensured for a fixed rate of exchange and their return was specified on the capital invested by them. Initially the contracts were entered by East India Company and later by the Secretary of State for India with the East Indian Railways Company and other railway companies. Because of these contracts, the railway companies undertook to construct and manage lines. The East India Company and later the Secretary of State for India provided land free of cost and also guaranteed return of capital up to specified rates of return. The rates of return were fixed at 5%, 4.75% and 4.5%. And this was same as the prevailing rates in the market at that time. Also, the currency rate used to transfer interest charges

was set. The government was to be reimbursed for any monies spent to supplement net earnings in any prior period to make up for the fixed rate of interest, and the remaining amount belonged to the shareholders, with the other half going to the government. These contracts included a number of requirements, including construction details, the provision of rolling stock, and the quantity. In addition, the schedule and speed of the trains, the fares, the costs, the maintenance requirements, and the accounting system were covered in depth. The firms had a 99-year lease on the railways. In the contract, there was provision for the purchase of railways by the government after 25 or 30 years on payment of Companies Capital at par. (Indian Railways Administration & Finance, n.d.). State guarantees of profits were not greatly opined both in India and England. In 1862 construction of Railways was more on terms favorable to government than to private players. Private players were required to build lines at their own expense and risk and agree to agreements that allowed for free land to be allocated to them. Private investment is not attracted by this. Just two unguaranteed businesses—the Indian Branch Railway Company and the Indian Tramway Company—were able to continue operating and either went out of business or were absorbed by another business. (Indian Railways Administration & Finance, n.d.).

2.0.5 Government ownership of Railways

After 1869, the Government incurred direct capital expenditure on railways and no fresh contracts were awarded apart from exceptions. However, after the severe famine of 1878 necessity for railway expansion was felt and private players were to be used. This helped in getting investment without involving Government in different types of liabilities. “As a result, between 1881 and 1892, several companies were founded. In comparison to

corporations founded before 1896, several of these companies had guarantees that were far more beneficial to the government. The government's goal in dealing with guaranteed companies formed before 1869 and those formed in 1881 and later were to obtain, as soon as possible, in cases where it had the right to terminate the original contract after a certain amount of time, either better terms under new contracts or ownerships by purchasing the company in accordance with the contract. As a result, numerous railway companies' contract expiration dates fell between 1879 and 1907." (Indian Railways Administration & Finance, n.d.)

2.0.6 Management of Early Railways

After the purchase of some of the Company Railways, the management of these lines was transferred to the government. However, the other purchased lines were managed by existing companies that were established under contracts. There were certain conditions to that contract. The working companies' contracts were terminated, and the management of these entities was taken over by the government (Indian Railways Administration & Finance, n.d.).

The East Indian Railway was taken over on 1st January 1925,The Great Indian Peninsula Railway on 1st July,1925,The Bombay Boroda and Central India Railway on 1stJanuary,1942,The Assam Bangal Railway on 1st January,1942.

Further Oudh and Tirhut Railway was taken over on 1st January, 1943, the Madras and Southern Maharastra Railway on 1st April, 1944, The South Indian Railway on 1st April 1944 and The Bengal Nagpur Railway 1st October 1944. In the development of railways in India four landmarks may be identified. First, the development of railway from 1850-1868 under an early guarantee system. Second, It

followed by state construction of railways from 1869 onwards. Third, the emergence of new guarantee system along with a systematic takeover of lines whenever the options arose of earlier contracts. Fourth, the integration of Indian states into Indian union, the government of India acquiring all railways owned by states under direct management to Indian railways. (Rao, 1978).

2.0.7 Effect of Partition

After independence and partition on 15 August 1947, there were two railway systems, the North Western Railway in western India and the Bengal Assam Railway in eastern India were split into two. The remaining parts of these systems falling in India were either added to the other existing lines or developed as separate units. This resulted in the formation two separate units as Eastern Punjab Railway and the Assam Railway Administrations. This necessitated an administrative re-organisation to monitor efficiency in operation and economy in management.

2.0.8 **Taking over of the ex-States Railway**

After the integration of the Indian States with the Union of India, the railway companies which were owned and managed by states were taken over by the Union of India. Gaekwar's Baroda State Railway was taken over on 1st August, 1949. Bikaner State Railway, Cutch State Railway, Dholpur State Railway, Jaipur State Railway, Jodhpur Railway, Mysore State Railway, Nizam's State Railway, Rajasthan Railway, Saurashtra Railway and Scindia State Railway were taken on 1st August, 1950.

2.0.9 Re-organization and Regrouping of Railway:

In 1944, all arterial Indian Railway Systems were nationalized. A need for reorganizing was felt to improve efficiency in operation and management. With this objective Indian

Railway System was grouped into six major Zonal Administrative Units. The dates and with the mileage noted against each is mentioned below:—

(1) Southern Railway (route mileage 6,017/Km. 9,687) constituted on.... 14th April 1951.

(2) Central Railway (route mileage 5,423/Kms.8,739/Kms.) on..... 5th November, 1951.

(3) Western Railway (route mileage 5,461/Kms. 8,793) on..... 5th November, 1951.

(4) Eastern Railway (route mileage 5,667/Kms. 9,123) on.....14th April, 1952.

(5) Northern Railway (route mileage 6,007/Kms. 9,672) on..... 14th April, 1952.

(6) North Eastern Railway (route mileage 4,767/Kms. 7,675) on..... 14th April, 1952.

2.0.10. Formation of new Zonal Administrative Units—

(a) As the work load increased, Eastern Railway was bifurcated on 1st August, 1955 into two Zonal Administrative Units —

(i) Eastern Railway:

It included the old East Indian Railway and was spread up to Mughalsarai and some portion of ex-Bengal Assam Railway was also included so that to have better management .

(ii) South Eastern Railway:

It included ex-Bengal-Nagpur Railway and some adjustment was made in the jurisdiction of the Adra District.

(b) Further, in from 15th January, 1958 North Eastern Railway was bifurcated into two Zonal Administrative Units as under:

(i) Northeast Frontier Railway— It consisted Pandu region of the former North Eastern Railway but Purnea was not included. From Purnea to Murliganj and then from

Banmankhi—Behariganj Sections were included in this railway to have a better management of the railway system.

(ii) North Eastern Railway—remaining portion was called North Eastern Railway.

2.0.11 The Indian Railways Act 1890

As the railway infrastructure progressed in India, it became important to have regulatory guidelines which can define the rules and regulations as to how the railways will be governed. An act was considered with this objective in mind and to provide for sufficient legislation for directing and regulating the operation of the different railway system. Therefore, on March 21st, 1890, the Indian Railways Act, 1890 (Act No. 9 of 1890) was passed, and it became effective on May 1st, 1890. The Act is a thorough and fundamental piece of legislation that establishes guidelines for the building and upkeep of infrastructure, the opening of railroads, the duties of railway administrations as carrier, the handling of railroad accidents, and a number of other issues related to railroad working. It helps the Indian Railway system in guiding through operation and expansion.

It has provisions for formation of zonal railways, commissioners of railway safety (CRS) which do safety check of lines and carriages before opening line to traffic, opening of railways for public, fixation of rates, railway rates tribunal, carriage of passengers, carriage of goods, responsibilities of railway administration as carriers, etc (Indian Railways Act 1989).

As the time has passed the Central Government has become the owner of the entire railway system. This led to direct superintendence and management of the railways by the Central Government. (Indian Railways Administration & Finance. (n.d.))

2.1 The Organisational structure of Indian Railways

2.1.1 Zonal Railways

Indian Railway is headed by Ministry of Railways which is also called as Railway Board. It is the apex organisation in Indian Railway. Under Railway Board there are seventeen zonal railways. The 17 zonal railways are mentioned below in table 2.1:-

Table 2.1: Zones of Indian Railways

Sl.No.	Name	Abbr.	Headquarters
1	Central Railway	CR	Mumbai
2	Eastern Railway	ER	Kolkata
3	East Central Railway	ECR	Hajipur
4	East Coast Railway	ECoR	Bhubaneswar
5	Northern Railway	NR	Delhi
6	North Central Railway	NCR	Prayagraj
7	North Western Railway	NWR	Jaipur
8	North Eastern Railway	NER	Gorakhpur
9	Northeast Frontier Railway	NFR	Maligaon (Guwahati)
10	Southern Railway	SR	Chennai
11	South Central Railway	SCR	Secunderabad (Hyderabad)
12	South Eastern Railway	SER	Kolkata
13	South East Central Railway	SECR	Bilaspur, CG
14	South Western Railway	SWR	Hubballi
15	Western Railway	WR	Mumbai
16	West Central Railway	WCR	Jabalpur
17	Metro Railway	MTP	Kolkata

Source:https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,533,1007,1012

2.1.2 Divisions

Further each zonal railway is divided into divisions. The divisions in each Zonal Railway are as mentioned below in table 2.2:-

Table 2.2 : Divisions of Indian Railway

S/No.	Name of the Railway Zone	Zonal Headquarter	Division
1	Central Railway	Mumbai	1) Mumbai 2) Nagpur 3) Bhusawal 4) Pune 5) Sholapur
2	Eastern Railway	Kolkata	1) Howrah 2) Sealdah 3) Malda 4) Asansol
3	East Central Railway	Hajipur	1) Danapur 2) Pt. Deen Dayal Upadhyaya (Mugalsarai) 3) Dhanbad 4) Sonpur 5) Samastipur
4	East Coast Railway	Bhubaneshwar	1) Khurda Road 2) Waltair 3) Sambhalpur
5	Northern Railway	Baroda House, New Delhi	1) Delhi 2) Firozpur 3) Ambala 4) Moradabad 5) Lucknow
6	North Central Railway	Allahabad	1) Allahabad 2) Jhansi

			3) Agra
7	North Eastern Railway	Gorakhpur	1) Izzatnagar 2) Lucknow 3) Varanasi
8	North Frontier Railway	Maligaon, Guwahati	1) Katihar 2) Alipurduar 3) Rangiya 4) Lumding 5) Tinsukhia
9	North Western Railway	Jaipur	1) Jaipur 2) Jodhpur 3) Bikaner 4) Ajmer
10	Southern Railway	Chennai	1) Chennai 2) Madurai 3) Palghat 4) Trichy 5) Trivendrum 6) Salem
11	South Central Railway	Secunderabad	1) Secunderabad 2) Hyderabad 3) Guntakal 4) Vijaywada 5) Nanded 6) Guntur
12	South Eastern Railway	Garden Reach, Kolkata	1) Kharagpur 2) Adra 3) Chakradharpur 4) Ranchi
13	South East Central Railway	Bilaspur	1) Bilaspur 2) Nagpur 3) Raipur

14	South Western Railway	Hubli	1) Bangalore 2) Mysore 3) Hubli
15	Western Railway	Churchgate	1) Mumbai 2) Vadodara 3) Ahemdabad 4) Ratlam 5) Rajkot 6) Bhavnagar
16	West Central Railway	Jabalpur	1) Jabalpur 2) Bhopal 3) Kota
17	Metro Railway	Kolkata	

Source: https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,533,1007,1012

2.1.3 Production Units

Apart from 17 Zonal Railways there are 8 production units, first six are headed by GMs and next two are headed by CAO (Chief administrative Officers)

1. Chittaranjan Locomotive Works 2. Diesel Locomotive Works, Varanasi

3. Integral Coach Factory, Chennai 4. Rail Coach Factory, Kapurthala

5. Rail Wheel Factory, Yelahanka 6. Modern Coach Factory, Rae Bareli

7. Diesel Loco Modernization Works/Patiala 8. Rail Wheel Plant, Bela

2.1.4 Other Units

(i) There are other units which are headed by General Managers are:-

1. Central organization for railway electrification, Prayagraj (CORE)

2. NF Railway (Construction) CAO

(ii) Other units which are headed by CAOs are:-

Central Organization For Modernisation Of Workshops (COFMOW)

(iii) Other units which are headed by Director Generals are:-

1. **National Academy Of Indian Railways, Vadodara** – The Academy was founded on 1930 at Dehradun after recommendation by Indian Railway Committee under the chairmanship of Sir William Mitchell Acworth (famous Acworth Committee). After that it was shifted to Vadodara in 1952. It is the place for major and important training for railway officers and probationers. Some of the trainings conducted are Training under 'Strategic Leadership Programme', 'Strategic Management Programme' and 'Strategic Action Leadership Programmes' Advanced Management Programme (AMP) for senior-level in-service Railway officers and Management Development Programme (MDP). It also organises training for Gr-B officers of Indian Railway, foreign officers, seminars, conferences etc.

2. **Research Designs and Standards Organization (RDSO), Lucknow** : - The only R&D organisation for Indian Railways is the Research Designs and Standards Organization (RDSO), which is part of the Ministry of Railways. It serves as a technical advisor to the Railway Board, Zonal Railways, and Production Units. The main responsibilities of RDSO include: developing, implementing, and absorbing new technology for use by Indian Railways, creation of updated and improved equipment and system designs.• Establishing adoption criteria for the Indian Railways, creating specifications for the goods and materials Indian Railways needs, technical inquiry, obtaining necessary permits, conducting tests, and offering consulting services, examining crucial and safety-related components of the track, locomotives, signaling and telecommunications systems, and rolling stock (including metro stock), vendor development for RDSO-controlled safety and critical products, moreover, RDSO provides global consulting services in areas related to the design, testing, and inspection

of railroad equipment as well as surveying for new line construction. RDSO is a centre of research and development for systems and equipment used in the railroad industry.

2.1.5 Other Central Public Sector Enterprises /Corp & Autonomous Bodies/ Authorities:

As many as 14 Public Sector Undertakings and other Organizations are functioning under the Ministry of Railways, as detailed in table 2.3.

Table 2.3: CPSU, Corporations, Autonomous Bodies and Authorities, Indian Railways

Sl.No.	Name	Name Year of Incorporation/ Inception	Core competence
1	RITES	1974	To design, establish, provide, operate, maintain and perform engineering, technical and consultancy services for development of projects/systems of all types and descriptions pertaining to Railways and Other Sectors/ Industries in India and outside India
2	IRCON	1976	To undertake construction activities in India and abroad on turnkey basis or otherwise in various fields of infrastructure like Railways, Bridges, Roads, Highways, Industrial and Residential Complexes, Airports, etc.
3	CRIS	1986	CRIS is the IT arm of Indian Railways. It designs, develops, implements and maintains centralized IT system for all departments of

			Indian Railways
4	IRFC	1986	To raise funds from the market to part finance the Plan Outlay of IR
5	CONCOR	1988	To develop multi-modal logistics support for India's international and domestic containerized cargo and trade
6	KRCL	1990	To construct and operate railway lines, construct Road Over Bridges and rail line projects.
7	RCIL (RailTel)	2000	To utilize the surplus telecom capacity and right of way available with the IR to build nationwide optical fiber cable based broadband telecom and multimedia network.
8	IRCTC	2001	To undertake catering and tourism activities of the Railways. Also facilitates internet ticketing through its website.
9	PRCL (Pipavav Railway Corporation Limited)	2001	To construct, maintain and operate 271 kilometers BG railway line connecting Port of Pipavav to Surendranagar Junction
10	RVNL	2003	Creating and augmenting the Rail Infrastructure. Mobilizing resources from

			multiple agencies for successful implementation of projects.
11	RLDA	2005	Developing vacant railway land for commercial use. To generate revenue from such development. Revenue from non tariff sources.
12	DFCCIL	2006	Planning and constructing Dedicated Rail Freight Corridors (DFCs) which will help in movement of freight trains at a faster pace.
13	MRVC	1999	Planning and implementing rail projects in the Mumbai area.
14	BCL	1976 (In Ministry Of Railways from 2010)	Manufacturing wagons, undertaking structural fabrication jobs and manufacturing, retrofitting of EOT crane.

Source: Indian Railway Year Book 2021-22, page 123

2.1.6 Railway Board

The ministry is headed by Minister of Railways and assisted by two Ministers of state of Railways. Further at executive level it is headed by one Chairman Railway board and chief executive officer (CEO)-CRB. Below CRB and four members: (i) Member (infrastructure), Railway Board- M/lnfra,

(i) Member (Traction & Rolling Stock (T&RS)), Railway Board -M/TRS,

(ii) Member (Operations & Business Development (O&BD)), Railway Board - M/O&BD, and

(iii) Member (Finance), Railway Board- MF

Further the duties of officers at board's level are mentioned below:-

1. **Chairman Railway Board & Chief Executive Officer(CEO)-CRB** : HR, Safety, Security, Health, Planning including-PSU, Infrastructure, Vigilance, Efficiency and Research, Public Relations, Information and Publicity, Heritage, Transformation Cell, Corporate Co-ordination, Secretary's Branches (dealing with Intra-Board Co-ordination and Administrative matters and Parliamentary affairs), Any other matter at the discretion of the Chairman & CEO/RB.

2. **Member (Traction & Rolling Stock(T&RS), Railway Board**: Production Units, Mechanical Workshops, Coaches & Wagons, Locomotives, Train Sets, EMUs/MEMUs, Environment & House Keeping, Disaster Management Equipments (Trains, ARTs etc.), Electrical Maintenance of Coaching Stock, Traction Distribution, Power Supply & Renewable Energy, Power Cars, TL&AC, Materials Management.

3. **Member (Infrastructure), Railway Board-M/Infra**:

   Works and Civil Engineering including Track, Bridges, Signal & Telecom, Land & Amenities and Station Development, Railway Electrification.

4. **Member (Operations & Business Development (O&BD), Railway Board M/TRS:**

   Traffic Transportation, Coaching, Catering and Tourism, Traffic Commercial, Non-Fare Revenue, Marketing & Business Development, Information Technology.

2.1.7 Zonal Management:

Each zone is controlled by General Manager (GM) of the zone. It is his overall responsibility for safe and efficient train operation. GM is assisted by an Additional

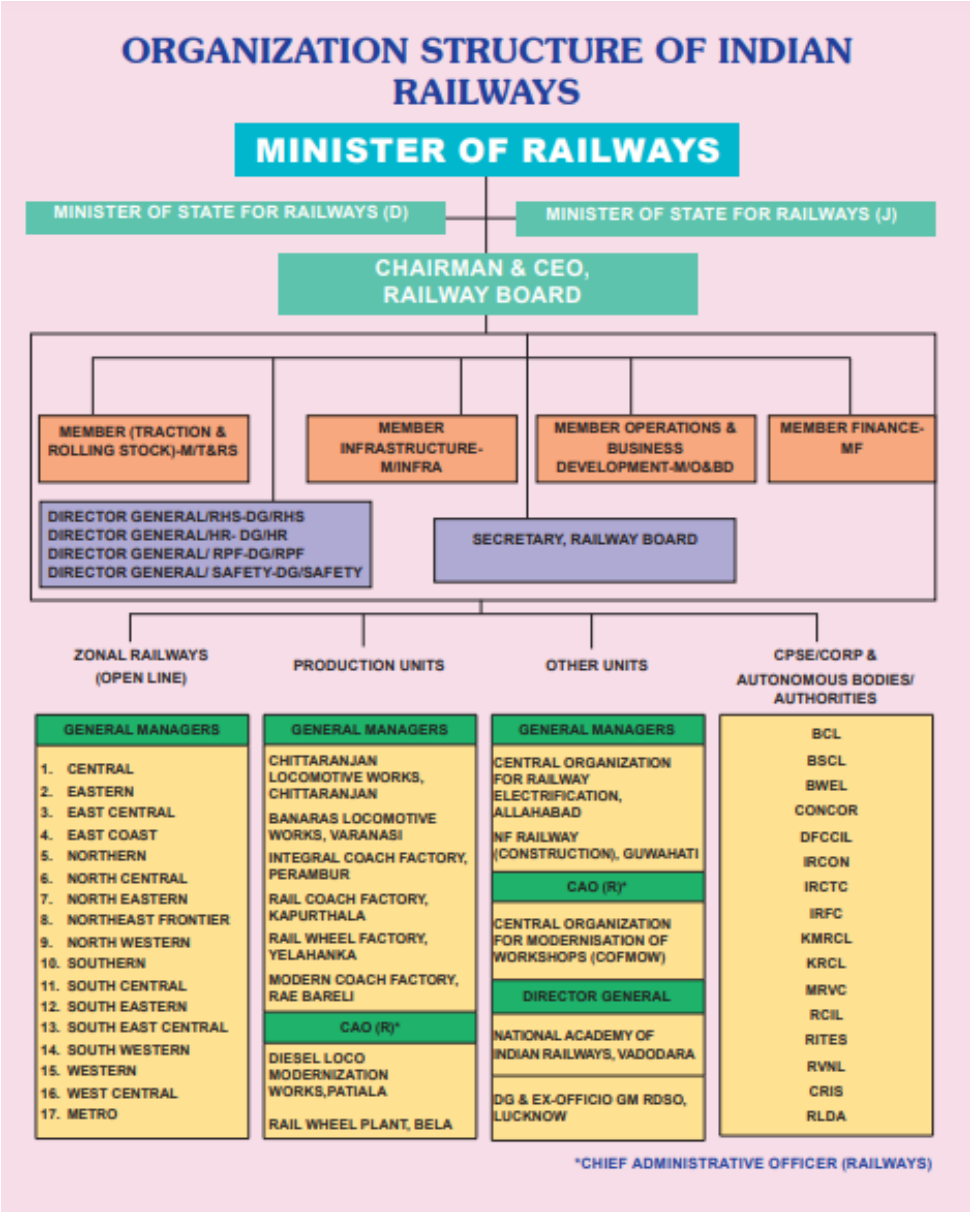

Figure 2.1: Organizational Structure of Railway Board (Source: https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/pdf/2022/Org_Str_22.pdf)

General Manager (AGM) and Heads of Department (HoD) for various Departments i.e., Traffic, Commercial, Accounts, Personnel, Civil Engineering, Mechanical Engineering, Electrical Engineering, Signal & Telecommunications, Stores, Medical and Security. Each department is headed by Principal Head of the departments (PHoD). Below PHoD there are head of departments.

2.1.8 Divisional Management:

Each zone is further divided into Divisions. Divisions are the basic unit of operation. Division is headed by a Divisional Railway Manager (DRM) who is in the rank of senior administrative grade officer. They may be of different cadres in railways. At present there are 68 Divisions in Indian Railways. A Railway Division is the smallest administrative Unit of Railways. After DRM, next in command is Additional DRM and below that there are branch officers of different department. There is divisional control centre in the division which controls the movement of train operation.

Chapter 3

Overall Operating Performance Of Indian Railways

3.0 Introduction

Indian Railway is such a huge organisation that collecting and analysing its data is a herculean task. It becomes more challenging when the study period is spanning from 2000-01 to 2020-21, a period of more than 21 years. Lots of technical, operational and financial changes have taken place during this period. But it is difficult to quantify the impact each and every change has brought. The analysis has been done on the basis of secondary data collected from various data sources like Indian Railway statistical statements, Indian railway year books, data bank of Indian railways etc. Various data like overall operating ratio, total working expenses, total ordinary working expenses, appropriation to depreciation reserve fund, appropriation to pension fund, total expenditure of staff, other important cost, total revenue, goods earnings, transportation of coal, food grains, iron ore, mineral oils, cement, iron and steel, fertilizers, limestone and dolomite, stones, passenger earnings, passenger kilometres, lead, average rate per passenger per kilo metres were analysed based on data from above sources. In this regard, it has been studied and analysed to have a basic idea and not in depth study of particular point.

Operating Ratio

One of the research objectives of the study is to analyse the operating ratio of Indian Railways for the past 20 years. But, What is the operating ratio? Operating ratio is the ratio of Total Working expenses (excluding suspense but including appropriation to depreciation reserve fund (DRF) and pension fund (PF)) to gross traffic earnings.

In other words, the cost incurred to generate every 100 rupees in revenue may be used to define operating ratio. It is calculated using the following formula and represented in percentage: -

$$\frac{\textbf{Total Working expenses (excl. suspense but incl. App.To DRF \& pension fund)}}{\textbf{Gross traffic earnings}}$$

The results are exhibited in the annual statistical statements No 1 Zone-wise and for Indian Railways in Indian Railways annual publications named Annual Statistical Statement. It is a significant number for estimating the effectiveness of the railways. Low operation ratio will produce a beneficial outcome. The ratio is based on both working expenditures and gross income. Overall working expenditures include the costs associated with managing, running, maintaining, and making repairs to lines that are open to traffic, passenger carriages, wagons, signaling equipments etc. Amounts appropriated to the pension fund and contributions paid to the Depreciation Reserve Fund (DRF) to cover replacement and renewal costs are also included. The genuine earnings in an accounting period, whether or not they were actually realised, are referred to as gross traffic earnings. The income consists from passenger services, goods transportation and other sundry income. The difference between working expenses in an accounting period, whether or not they were really paid (disbursed) and working expenditures that were actually paid, is represented by suspense expenditure in the formula above. The effectiveness of the operational crew can frequently reduce working expenditures to a certain level. Yet, there are still certain variables that the operations crew cannot influence, such as: -

(a) Improvements to the facilities available to rail customers,

(b) Adoption of consistent rates and tariffs across all geographic regions without taking operational costs into account,

(c) Funding unprofitable projects in order to coordinate the development of previously underdeveloped regions with the rest of the nation,

(d) The ongoing increase in the cost of staff,

(e) Mass protests, bandhs and strikes.

The organisation should strive to keep this ratio low. The organisation should also strive to make it consistent with efficient working and good maintenance and by efficient working, increase in all kinds of traffic and with fall in expenditure the ratio may fall. This will require contribution from each and every employee of the organisation.

3.1 Analysis of Operating Ratio Of Indian Railways for the past 21 years

Table 3.1 Operating Ratio of Indian Railways

Year	Operating Ratio	Year	Operating Ratio	Year	Operating Ratio
2000-01	98.34	2007-08	75.94	2014-15	91.3
2001-02	96.02	2008-09	90.46	2015-16	90.5
2002-03	92.34	2009-10	95.48	2016-17	96.5
2003-04	92.19	2010-11	94.59	2017-18	98.8
2004-05	90.98	2011-12	94.85	2018-19	97.3
2005-06	83.72	2012-13	90.19	2019-20	98.4
2006-07	78.68	2013-14	93.6	2020-21	97.45

Source : Indian Railway Statistical Summary

Starting from peak of 98.34 in year 2000-2001 operating ratio started declining till 2007-2008 and came to 75.94, but after 2007-2008 again it started rising steadily remaining above 90. As can be seen from above in recent years it remained on higher side i.e., more than 95. In 2016-17 it was 96.5, 2017-18 it came to 98.8, again in 2018-19 it declined slightly to 97.3 but again rose to 98.4 and in F.Y. 2020-2021 it was on higher side i.e.,

97.45(Table3.1). In recently released year book by railways for year 2021-22 the OR has reached 107.39. ***The average operating ratio from 2000-01 to 2020-21 is 92.268***. ***The median operating ratio from 2000-01 to 2020-21 is 93.6. From here it is clearly visible that OR of Indian Railways is on a higher side which is not good for the organisation. Apart from this in recent years it is increasing at a faster rate which is a cause of concern.*** Hence we will try to analyse the situation.

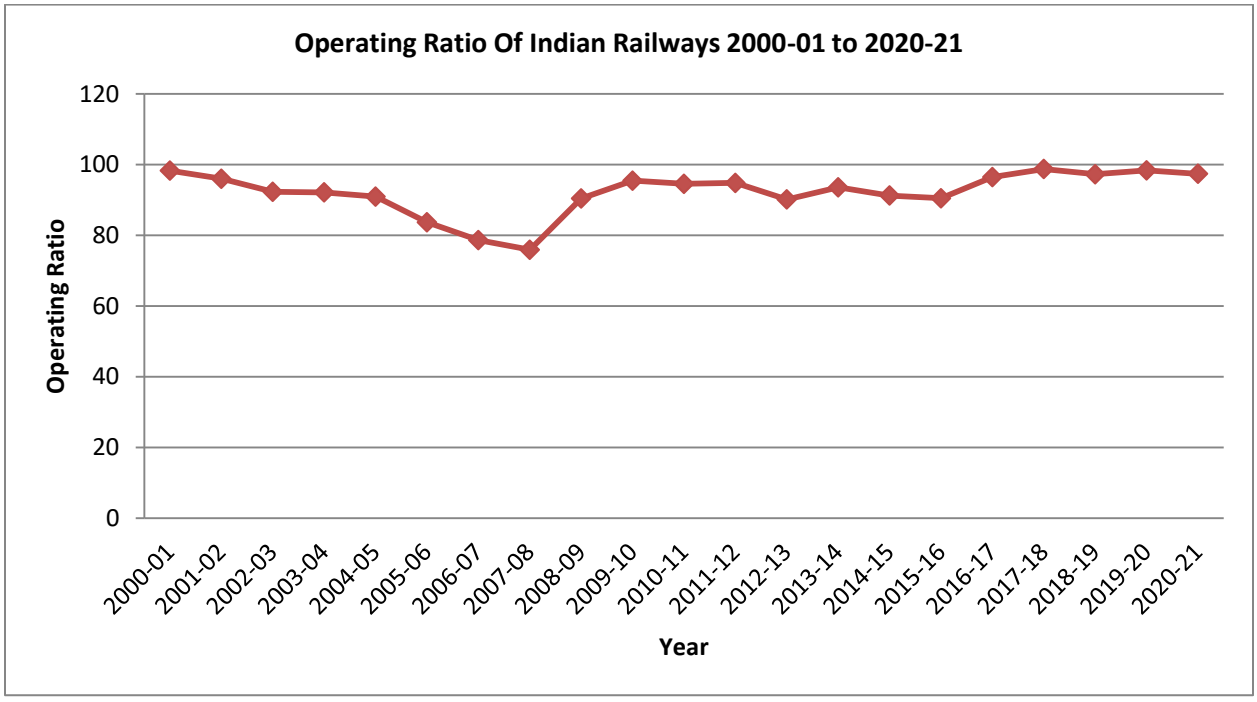

Figure 3.1: Operating Ratio of Indian Railway from 2000-01 to 2020-01.(Source: Indian Railway Year Books, Various Years)

As operating ratio is the ratio of Total Working Expenses (excluding suspense) and Gross Earnings. Total working expenses is the sum of total ordinary working expenses, Appropriation to Depreciation Reserve Fund and Appropriation to Pension Fund. Let's find out the reasons of high OR by analyzing Total Working Expenses and Gross Traffic Earnings.

Table 3.2 shows the Gross Earnings, Total Ordinary Working Expenses, Appropriation to DRF, Appropriation to Pension Fund, Total Working Expenses and

Operating Ratio. If we plot the gross earnings and total working expenses one on one, we will find that one of the reasons for increase of OR of Indian Railway is the closing gap of gross earnings and total working expenses as depicted in fig. 3.2. Hence the aim is to increase the gap between these two. This can be done by increasing the earnings and reducing the expenditure.

Table 3.2 Earnings, Expenditure and Operating Ratio of Indian Railways

year	Gross Earnings (In thousands)	Total Ordinary Working Expenses(In thousands)	Appropriation to DRF(In thousands)	Appropriation to Pension Fund(In thousands)	Total Working Expenses(In thousands)	Operating Ratio
2000-01	352875788	275683050	23010700	48318500	347012250	98.34
2001-02	378585000	287610200	20004000	55900000	363514600	96.02
2002-03	411477000	296554500	24014000	59400000	379968600	92.34
2003-04	428421600	306365700	25925500	62530900	394822100	92.19
2004-05	470382500	333888800	27000000	66700000	427588800	90.98
2005-06	544045625	350023053	36040000	69400000	455463053	83.72
2006-07	623704948	374575396	41980000	74160000	490715396	78.68
2007-08	716646600	410331700	54500000	79790000	544621700	75.94
2008-09	798370705	547320385	70000000	104900000	722220385	90.46
2009-10	871046474	658880744	21870000	149180000	829930744	95.48
2010-11	945254615	680797515	55150000	158200000	894147515	94.59
2011-12	1041535510	746603327	65200000	176100000	987903327	94.85
2012-13	1239010083	841842291	68500000	207100000	1117442291	90.19
2013-14	1398377037	981350274	79000000	248500000	1308850274	93.6
2014-15	1570715746	1063311067	77750000	292250000	1433311067	91.3
2015-16	1637909467	1081055052	56000000	345000000	1482055052	90.5
2016-17	1652990371	1193119835	52000000	350000000	1595119835	96.5
2017-18	1787011483	1285835445	15400000	457977100	1759212545	98.8
2018-19	1899700646	1402500232	3000000	442800000	1848300232	97.3
2019-20	1746605114	1506948533	4000000	207080000	1718028533	98.4
2020-21	1405156591	1362084055	2000000	5230000	1369314055	97.45

Source : Indian Railway Year Books, from 2000-01 to 2020-21

3.1.1 Total Working Expenses includes Total ordinary working expenses, Appropriation to Depreciation Reserve Fund and Appropriation to Pension Fund. These three expenses are covered in Demand No. 3 to 14 of budget of Indian Railways.

Total Working Expenses = Total ordinary working expenses + Appropriation to Depreciation Reserve Fund + Appropriation to Pension Fund

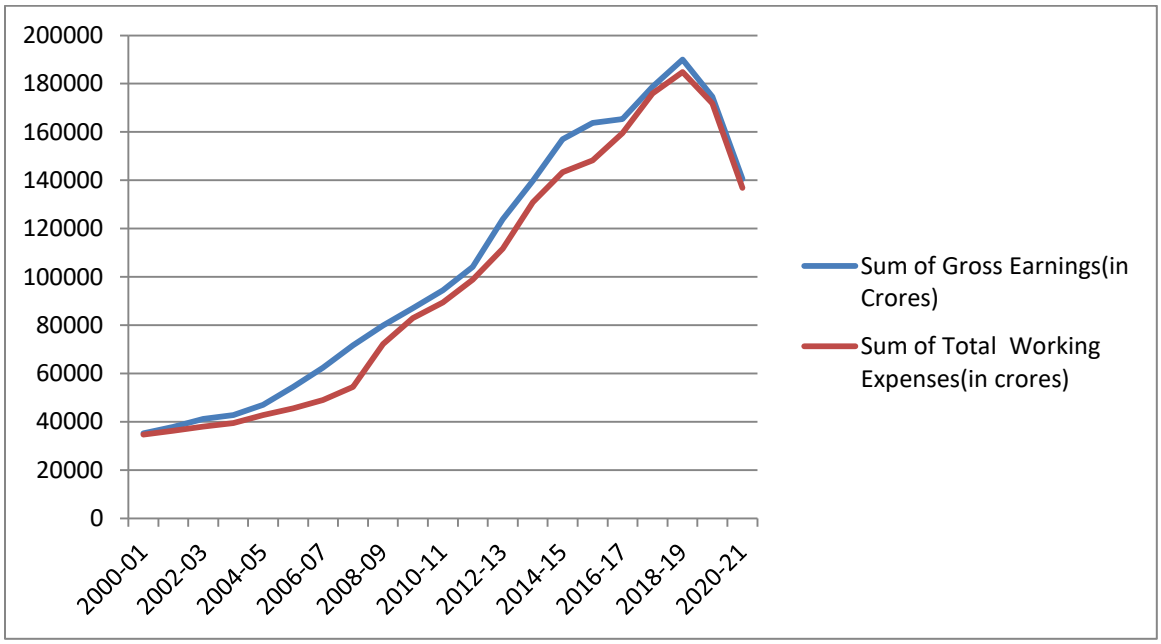

Figure 3.2: Gross earnings and total working expenses (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

Total Working expenses can be grouped under five major groups as depicted in table 3.3. The expenses are put on the table of parliament comprised in 12 demand heads. Previous year's actual values and current year's revised estimates are also tabled. Total Working Expenses (in crores of rupees) from year 2000-01 to 2020-21 is shown in table 3.4.

Table 3.3: Expenditure Heads in Indian Railways and their Demand Numbers

Sr. No.	Name of the Group	Demand No.
1	General Superintendence of service on Railways	3
2	Repairs & Maintenance	4,5,6,7
3	Operation	8,9,10
4	Staff Welfare, Retirements benefits & misc	11,12,13
5	Railway Funds	14

Source: Indian Railway Finance Code, Appendix I

Table 3.4: Total Working Expenses

Year	Total Working Expenses (in Cr)	Year	Total Working Expenses (in Cr)	Year	Total Working Expenses (in Cr)
2000-01	34701.23	2007-08	54462.17	2014-15	143331.11
2001-02	36351.46	2008-09	72222.04	2015-16	148205.51
2002-03	37996.86	2009-10	82993.07	2016-17	159511.98
2003-04	39482.21	2010-11	89414.75	2017-18	175921.25
2004-05	42758.88	2011-12	98790.33	2018-19	184830.02
2005-06	45546.31	2012-13	111744.23	2019-20	171802.85
2006-07	49071.54	2013-14	130885.03	2020-21	136931.41

Source: Indian Railway Year Books, from 2000-01 to 2020-21

If we plot total working expenses year-on-year we will see that it is increasing consistently on a yearly basis but decreased slightly 2018-19 onwards, as depicted in fig 3.3. But it didn't affect the operating ratio in similar manner. Analysis of Total Ordinary Working Expenses, Appropriation to DRF, Appropriation to Pension Fund, as part of Total Working Expenses shows us that total ordinary working expenses is the major chunk of operating expenses. Hence more focus should be on total ordinary working expenses. If that is tackled, then the total working expenses can be monitored and controlled.

General Superintendence and Services include expenditure on General Management including General Management Services, Financial Management, Personnel Management, Materials Management, Way &Works Management, and Rolling Stock Management. Electrical Management, Signal & Telecommunication Management, Traffic Management. Repairs and Maintenance include repairs and maintenance of Permanent Way and Works, Motive Power, Carriages and Wagons and Plant and Equipment. Operating Expenses include expenses in Rolling Stock and Equipment, Traffic and fuel.

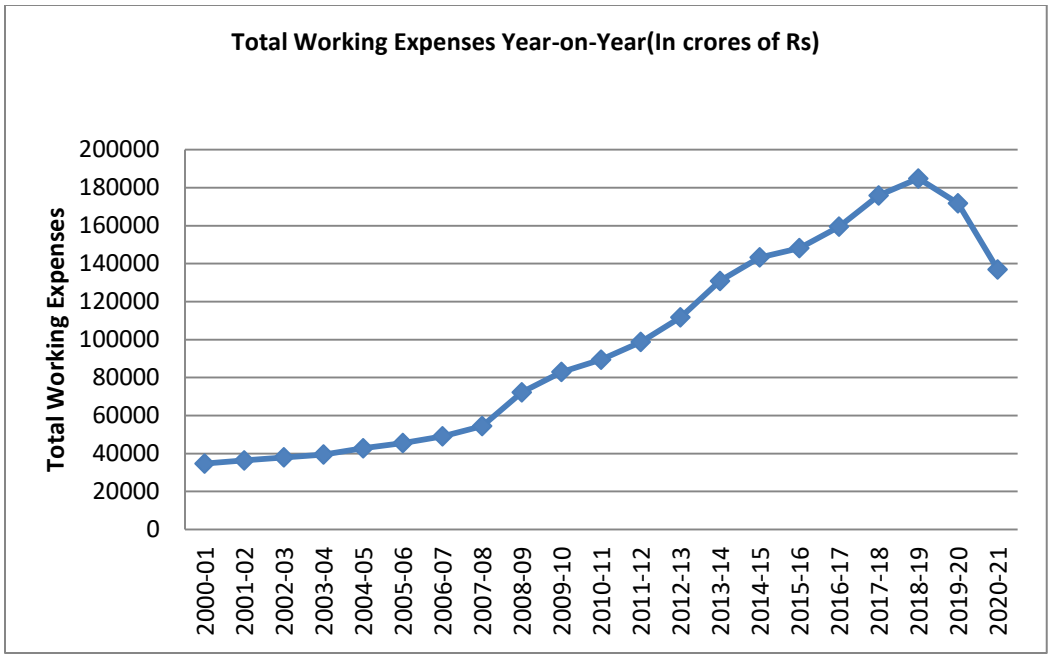

Figure 3.3: Total Working expenses from 2000-01 to 2020-21. (Source: Indian Railway Year Books, From 2000-01 to 2020-21)

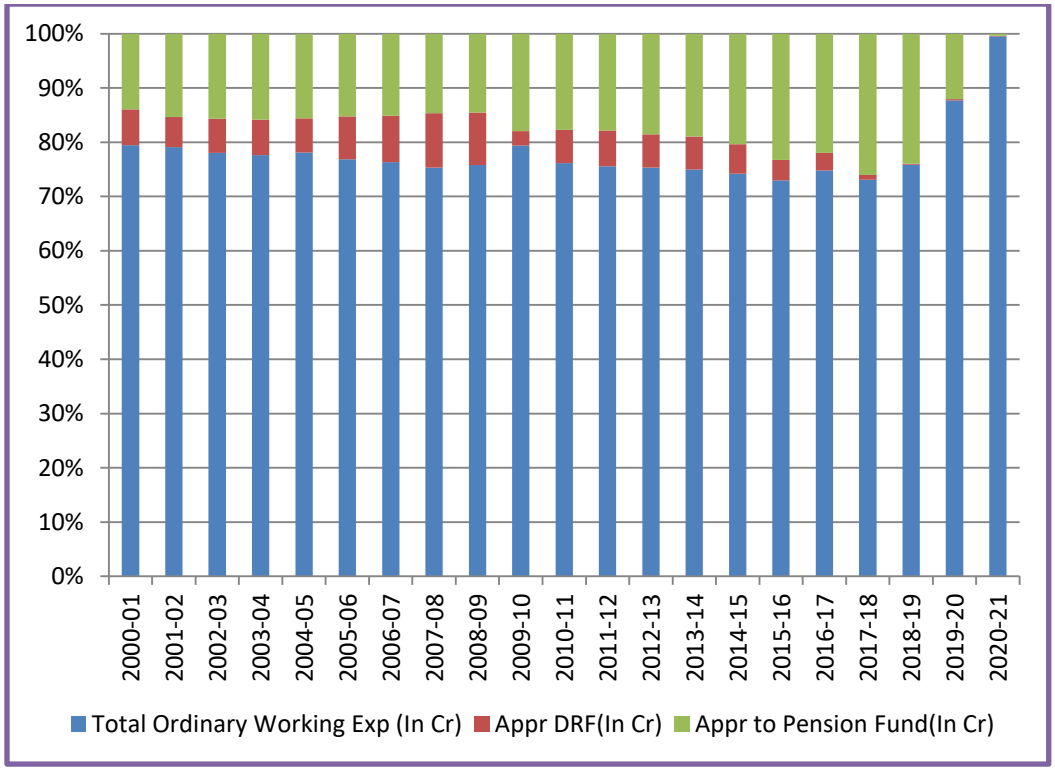

Figure 3.4: Distribution of Total Working Expenses.
(Source: Indian Railway Year Books, from 2000-01 to 2020-21)

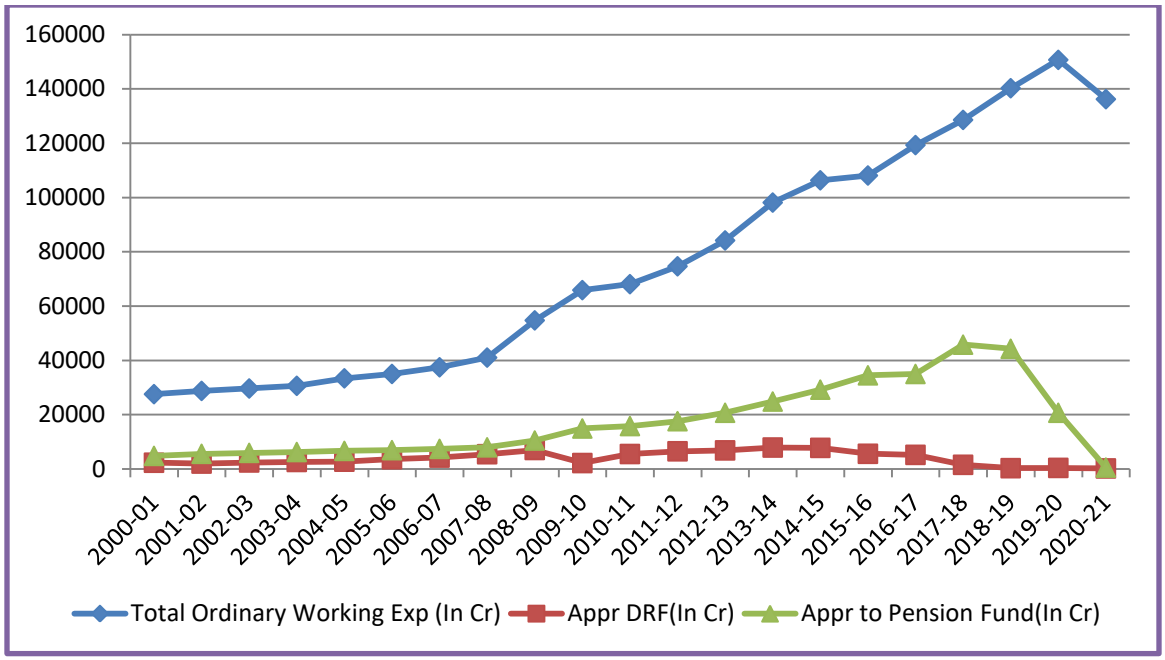

Figure 3.5: Total Ordinary Expenses, Appr to DRF, Appr to Pension Fund from 2000-to 2021.
(Source: Indian Railway Year Books, from 2000-01 to 2020-21)

An analysis of Total ordinary working expenses, Appropriation to Depreciation Reserve Fund and Appropriation to Pension Fund shows that Appropriation to Depreciation Reserve Fund is declining which will put pressure on renewal of assets which are getting old. On the other hand there is drastic increase in total ordinary working expenses. Apart from this Appropriation to Pension Fund has also declined sharply from 2017-18. This will lead to increase in amount which is to be kept aside for pension purposes.

3.1.2 <u>Total Ordinary Working Expenses:</u> Total ordinary working expenses forms a major part of total working expenses and it includes revenue expenditure incurred on General Administration, Operation of trains, Repairs and Maintenance of different assets and other miscellaneous expenses by the Zonal Railway Administrations. From Demand Nos. 3 to 13 Abstracts A to L), whether actually disbursed or not.

Total ordinary working expenses (in thousands) for the years from year 2000-01 to 2020-21 are shown in table 3.5.

Table 3.5 : Total Ordinary Working Expenses

year	Total Ordinary Working Expenses (In Cr)	year	Total Ordinary Working Expenses (In Cr)	year	Total Ordinary Working Expenses (In Cr)
2000-01	27568.31	2007-08	41033.17	2014-15	106331.11
2001-02	28761.02	2008-09	54732.04	2015-16	108105.51
2002-03	29655.45	2009-10	65888.07	2016-17	119311.98
2003-04	30636.57	2010-11	68079.75	2017-18	128583.54
2004-05	33388.88	2011-12	74660.33	2018-19	140250.02
2005-06	35002.31	2012-13	84184.23	2019-20	150694.85
2006-07	37457.54	2013-14	98135.03	2020-21	136208.41

Source: Indian Railway Year Books, from 2000-01 to 2020-21

From the figure 3.6 it is clear that the total ordinary expenses of Indian Railways have only risen except in 2020-21. It is significantly evident that the total ordinary working expenditure has risen very sharply after 2006-07.

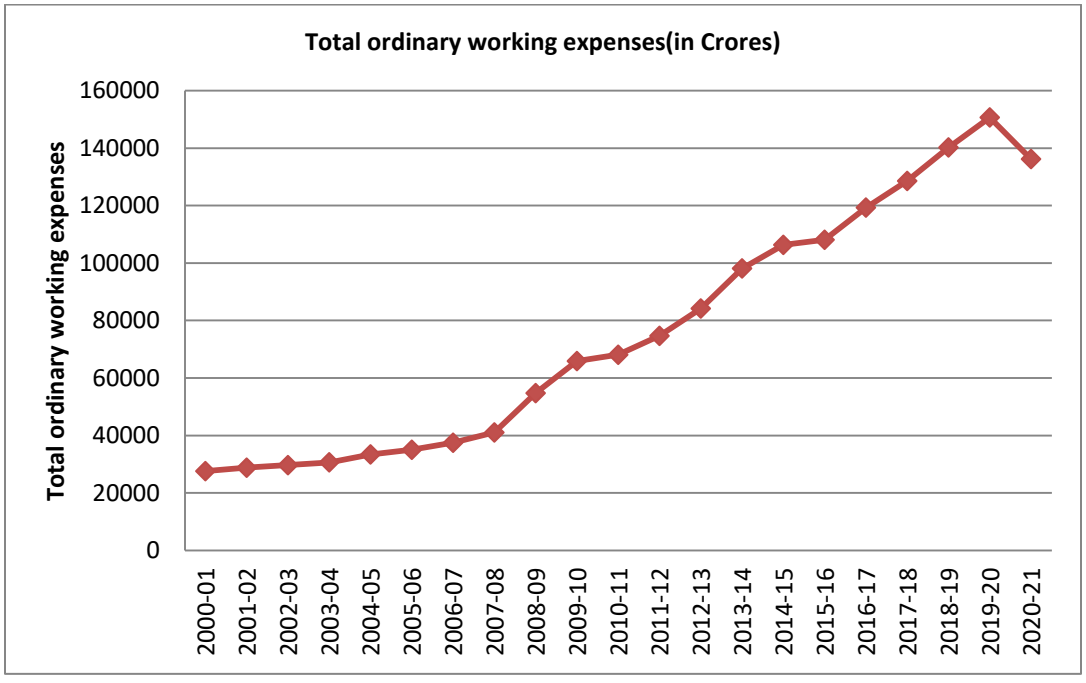

Figure 3.6 Total ordinary working expenses. (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

3.1.3 Appropriation to Depreciation Reserve Fund:

On April 1, 1924, the Depreciation Reserve Fund was established with the goal of financing the cost of new assets and replacements of old assets as and when they are required, as well as the cost of any upgraded features that such new assets may have. It appears in demand number 14 under abstract M. Just the cases listed below will be charged to DRF(a) Investments made with capital-at-charge (b) Assets built using the development fund (DRF) c) Assets created using the OLWR, but only if the total cost of replacement exceeds Rs. 10 lakhs.

The DRF is yearly appropriated from railways revenue, based on projections for five-year periods and the suggestions of the Railway Convention Committee. Appropriation to DRF (in crores of Rs) from year 2000-01 to 2020-21 is tabulated in table 3.6

Table 3.6 : Appropriation to Depreciation Reserve Fund

year	Appropriation to DRF	year	Appropriation to DRF	year	Appropriation to DRF
2000-01	2301.07	2007-08	5450.00	2014-15	7775.00
2001-02	2000.40	2008-09	7000.00	2015-16	5600.00
2002-03	2401.40	2009-10	2187.00	2016-17	5200.00
2003-04	2592.55	2010-11	5515.00	2017-18	1540.00
2004-05	2700.00	2011-12	6520.00	2018-19	300.00
2005-06	3604.00	2012-13	6850.00	2019-20	400.00
2006-07	4198.00	2013-14	7900.00	2020-21	200.00

Source: Indian Railway Year Books, from 2000-01 to 2020-21

Fund balance interest will be credited to the fund. After deductions and incidentals, the sale value of the released assets that are replaced at DRF's expense will likewise be credited to DRF itself.

Since the contribution is from revenues of the railways, it will become part of working expenses for that particular year.

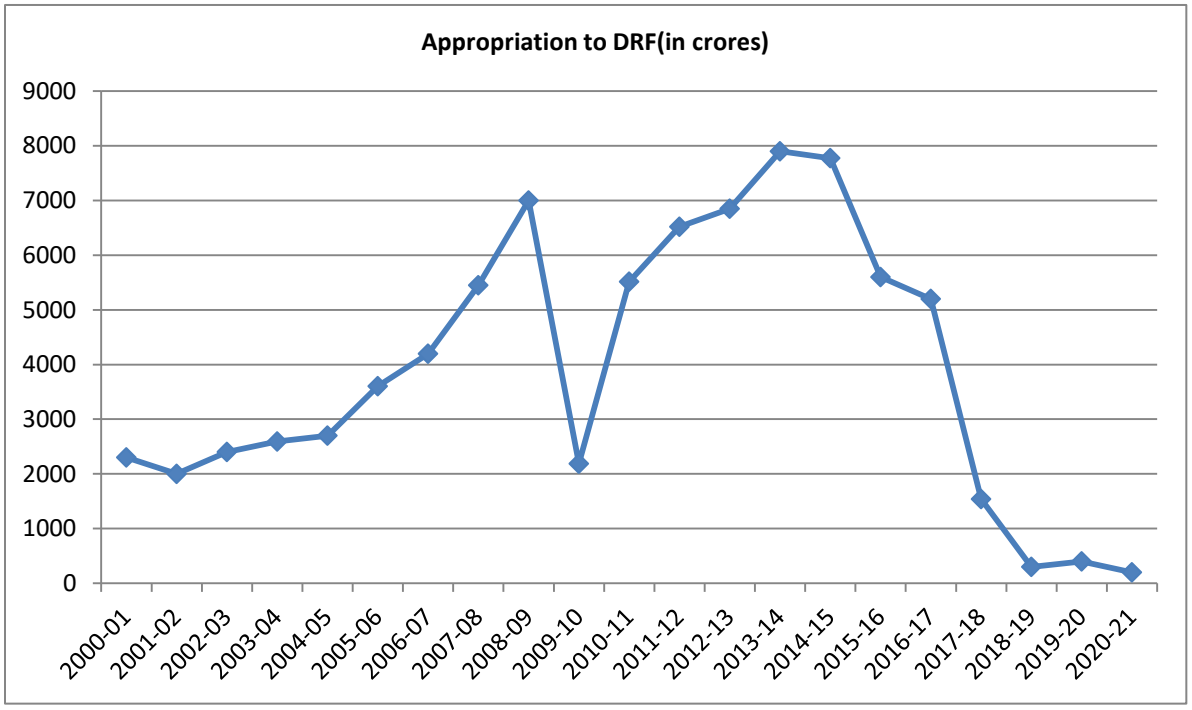

Figure 3.7 Appropriation to DRF (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

From the figure 3.7, it is clear that appropriation to DRF has decreased in recent years which indicates that railway is contributing less money which are required to renew the depreciating assets.

3.1.4 Appropriation to Pension Fund

With effect from April 1, 1964, a pension fund was established with the goal of covering the costs associated with paying pensions, family pensions, and death-cumulative-retirement gratuities (DCRG) to employees who retire or pass away under a pension plan.

A certain amount will be allocated from railway income to this fund each year while taking its financial situation into consideration. Each year, the fund will additionally receive interest on its remaining amount. When a worker covered by the provident fund plan chooses the pension option, the money that was previously held as bonus credit in his PF account will be transferred with interest to the pension fund. The amount that is appropriated from fund receipts in a given year will be counted against that year's operating costs. The Pension Fund will be appropriated in accordance with rules in Demand No. 14 under Abstract M (M-200) in railway accounts.

Table 3.7: Appropriation to Pension Fund

year	Appropriation to Pension Fund(in crores)	year	Appropriation to Pension Fund(in crores)	year	Appropriation to Pension Fund(in crores)
2000-01	4832	2007-08	7979	2014-15	29225
2001-02	5590	2008-09	10490	2015-16	34500
2002-03	5940	2009-10	14918	2016-17	35000
2003-04	6253	2010-11	15820	2017-18	45798
2004-05	6670	2011-12	17610	2018-19	44280
2005-06	6940	2012-13	20710	2019-20	20708
2006-07	7416	2013-14	24850	2020-21	523

Source : Indian Railway Year Books, from 2000-01 to 2020-21

From the table 3.7 table it is clear that appropriation to Pension fund has increased steadily 2017-2018 but after that it has decreased very steeply.

From the figure 3.8, it is clear that appropriation to Pension fund has increased steadily 2017-2018 but after that it has decreased very steeply.

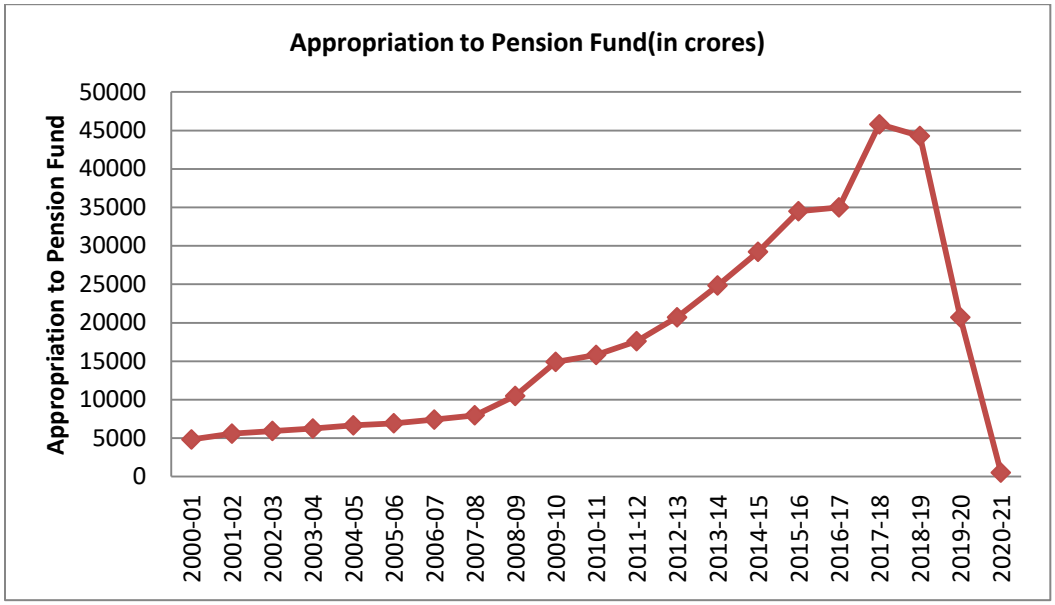

Figure 3.8 Appropriation to Pension Fund (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

3.1.5 Analysis of Total Ordinary Working Expenses

Total working expenses and include revenue expenditure incurred on General Administration, Operation, Repairs and Maintenance and other miscellaneous expenses by the Zonal Railway Administrations under Demand Nos. 3 to 13 , whether actually disbursed or not. Various demand numbers under which expenditure is booked is shown in table 3.8.

Table 3.8: Classification of Revenue Expenditure

Sr.No.	Group	Demand Number	Name of demand
I.	Policy Formulation and Services Common to all Railways	1.	Railway Board
		2.	Miscellaneous Expenditure (General)

II.	General Superintendence & Services on railways	3.	General Superintendence and Services on Railways.
III.	Repairs and Maintenance	4.	Repairs and Maintenance of Permanent Way and Works.
		5.	Repairs and Maintenance of Motive Power.
		6.	Repairs and Maintenance of Carriages and Wagons.
		7.	Repairs and Maintenance of plant and Equipment
IV.	Operation	8.	Operating Expenses-Rolling Stock and Equipment.
		9.	Operating Expenses-Traffic.
		10.	Operating Expenses-Fuel.
V.	Staff Welfare, Retirement Benefits and Miscellaneous	11.	Staff Welfare and Amenities.
		12	Miscellaneous Working Expenses.
		13.	Provident Fund, Pension and other Retirement Benefits.
VI.	Railway Funds and payment to General Revenues.	14.	Appropriation to Funds.
		15.	Dividend to General Revenues, Repayment of loans taken from General Revenues and Amortization of over Capitalisation.

Note: Reprinted from Indian Railway Finance Code (n.d.), Appendix I, https://indianrailways.gov.in/railwayboard/uploads/codesmanual/FINANCECODE/appn-1.htm

Total ordinary working expenses under different demand numbers is mentioned in table 3.9. Demand no.11 includes educational facilities, medical services, health and welfare services, canteen etc to staff. Educational facilities included are reimbursement of tuition fees and subsidy, educational assistance to Railway employee etc.

Table 3.9: Expenditure under Different Demand Number(In Cr)

Year	Repair and Maintenance					Operating Expenses						Total Ordinary Working Expenses
	D.No.3	D.No.4	D.No.5	D.No.6	D.No.7	D.No.8	D.No.9	D.No.10	D.No.11	D.No.12	D.No.13	
2000-01	1420	2864	1539	2924	1530	2525	5977	6443	1143	1184	17	27568
2001-02	1475	2946	1526	2971	1568	2543	6320	6864	1195	1333	22	28761
2002-03	1517	2955	1574	3054	1618	2524	6438	7382	1244	1321	28	29655
2003-04	1629	3016	1581	3215	1681	2606	6346	7928	1276	1306	41	30625
2004-05	1792	3296	1663	3425	1802	2691	7148	8781	1397	1396	35	33426
2005-06	1920	3622	1804	3850	1981	2846	5644	10229	1541	1526	41	35002
2006-07	2080	3824	1941	4212	2102	2979	6087	11284	1668	1224	57	37458
2007-08	2292	4163	2078	4431	2310	3249	6602	12150	1845	1754	105	40977
2008-09	3543	5891	2861	6236	3318	4566	9397	13888	2582	2274	177	54732
2009-10	4522	7419	3413	7698	4279	5817	11603	14555	3354	2939	288	65888
2010-11	4323	7307	3350	7587	4130	5975	11740	16748	3552	3056	312	68080
2011-12	4610	7723	3491	8155	4381	6670	12961	18809	3842	3626	391	74660
2012-13	5172	8164	3838	9031	4766	7676	14611	22327	4064	4023	511	84184
2013-14	5585	9104	4369	10125	5361	8575	16213	29235	4502	4325	740	98134
2014-15	6023	10127	4660	11023	5933	9851	18828	28766	4994	5140	966	106311
2015-16	6116	10734	5120	11649	6175	10051	20378	25783	5296	5612	31571	138485
2016-17	7093	12244	5737	13462	7015	10965	23187	26181	5772	5903	1752	119311
2017-18	7523	13500	6052	14469	7379	12225	24862	27775	6228	6552	46742	173307
2018-19	7898	14559	6605	15286	8041	13771	27084	30394	7199	7091	48495	186423
2019-20	8292	15824	6687	16399	8384	17468	29662	2900	7866	7480	52229	173191
2020-21	8117	15766	5720	15671	8157	14447	29526	19509	7922	7317	51863	184015

Source: INDIAN RAILWAYS, KEY STATISTICS,(1970-71 TO 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

3.1.6 Total Expenditure on Staff

If we compare the percentage of staff cost on open line (excluding payment towards pensions and gratuity) to ordinary working expenses, we find that the staff cost is one of the major contributor to operating ratio.

Table 3.10: Percentage of staff cost on open line (excluding payment towards pensions and gratuity) to ordinary working expenses.

Year	Percentage of staff cost on open line(excluding payment towards pensions and gratuity) to ordinary working expenses	Year	Percentage of staff cost on open line(excluding payment towards pensions and gratuity) to ordinary working expenses
2010-11	54.74%	2016-17	60.00%
2011-12	55.41%	2017-18	61.00%
2012-13	53.01%	2018-19	59.00%
2013-14	51.19%	2019-20	55.00%
2014-15	51.69%	2020-21	68.00%
2015-16	50.90%		

Source: Indian Railway Year Books, from 2000-01 to 2020-21

On further examination of this, we come to the conclusion that slowly it has risen from the ranges of 50% to 68%. Hence a great deal is required to be done in this regard, if the railway is to remain competitive and sustainable in the transport business. On an average the staff expenditure has been 56% from 2010-11 to 2020-21.

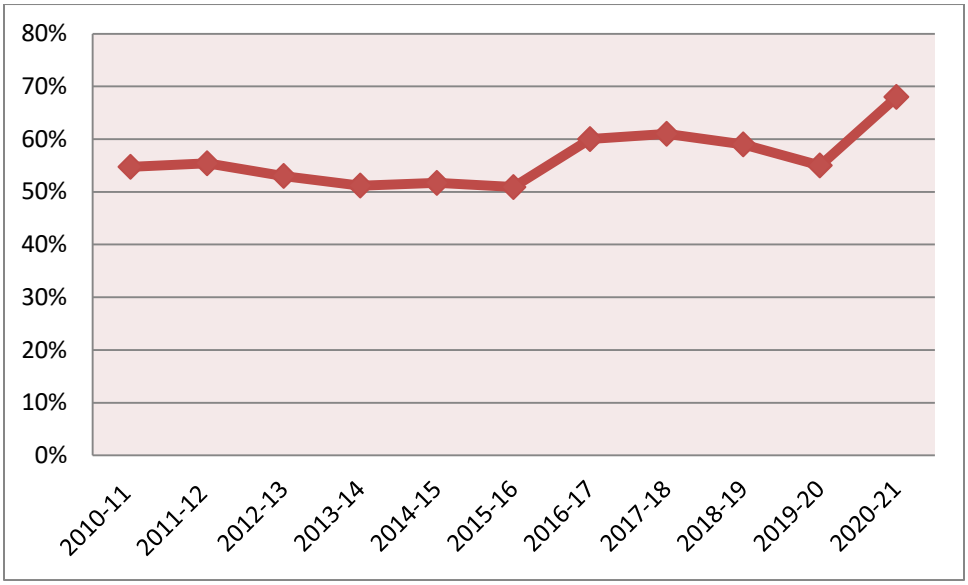

Figure 3.9 : Percentage of staff cost on open line (excluding payment towards pensions and gratuity) to ordinary working expenses.
(Source: Indian Railway Year Books, from 2010-11 to 2020-21)

3.1.7 Other Important Costs

If we analyse the further total cost we find that demand No.10 and Demand No. 9 are next big contributor to the operating cost. Demand no. 10 is Operating Expenses-Fuel and Demand No. 9 is Operating Expenses-traffic. On an average Operating cost of Fuel is 23% of the total operating cost. Hence it is important to concentrate on this area.

Operating expenses on fuel consists of expenses on the basis of traction for example, steam traction, diesel traction and electric traction.

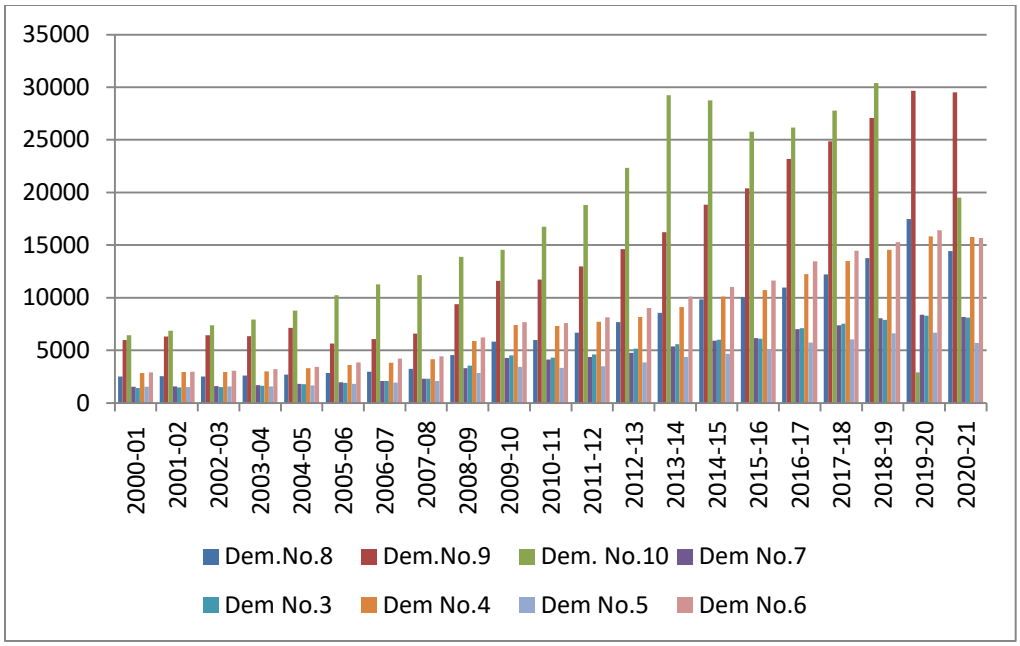

Figure 3.10 Expenditure (in crores) under different plan heads in Indian Railways. Source: Indian Railway Year Books, from 2000-01 to 2020-21)

3.2 Revenue

Revenue in railways is generated from passenger traffic, goods loading and sundry earnings. Gross Earnings from 2000-01 to 2020-21 is tabulated in table 3.11.

Table 3.11: Gross Earnings

Year	Gross Earnings (in Crores)	Year	Gross Earnings (in Crores)	Year	Gross Earnings (in Crores)
2000-01	35287.579	**2007-08**	71664.660	**2014-15**	157071.575
2001-02	37858.500	**2008-09**	79837.071	**2015-16**	163790.947
2002-03	41147.700	**2009-10**	87104.647	**2016-17**	165299.037
2003-04	42842.160	**2010-11**	94525.462	**2017-18**	178701.148
2004-05	47038.250	**2011-12**	104153.551	**2018-19**	189970.065
2005-06	54404.563	**2012-13**	123901.008	**2019-20**	174660.511
2006-07	62370.495	**2013-14**	139837.704	**2020-21**	140515.659

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

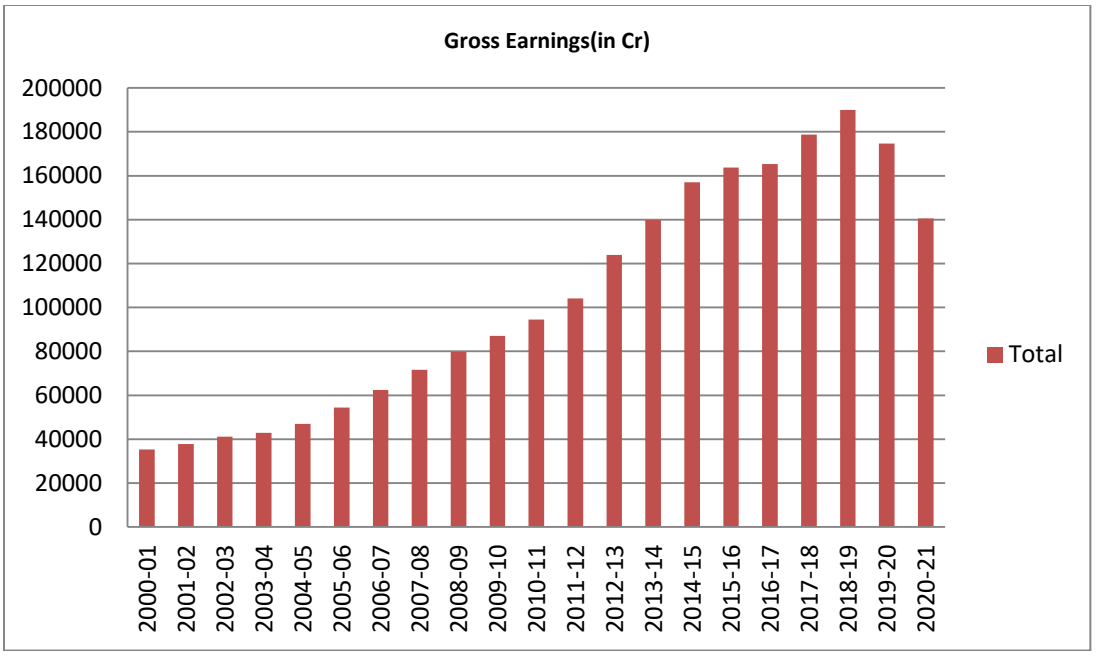

Figure 3.11 Gross Earnings of Indian Railways. Source: Indian Railway Year Books, from 2000-01 to 2020-21)

As is evident from the table 3.11 and figure 3.11 that from 2000-01 onwards revenue has risen till 2018-19, but and after 2018-19, there is a dip in revenue generation. This can be attributed to COVID-19 which affected all the sectors badly.

Earnings in railways are classified as earnings from coaching traffic, earnings from goods traffic and sundry earnings. Earnings from coaching traffic or passenger earnings can be further classified as earnings from suburban services and urban services, which are long distance trains. Almost all commodities including bulk commodities like Coal, Iron ore, Iron & Steel, Food grains, Cement, Petroleum products, Fertilizer and other commodities carried in containers are transported by railways. Parcel is another coaching business apart from Passenger business. Small commodities – households or of business purposes are carried in coaching stock, which is attached in passenger carrying trains, Mail/Exp. or Passenger. Consignments are loaded in SLRs, where Guard cabin is housed and in Parcel vans, popularly known as VPUs. Sundry earnings are rent and tolls from residential buildings, retiring rooms, rest houses, leasing of land, right of way for

OFC by/for RailTel, Receipts from car/scooter/cycle parking at stations/Railway premises, registration fees for construction of private sidings, Receipts from Catering Department, Advertisement fees & Non-Fare Revenue activities like advertisements in coaches, wagons. Further break up of earnings (in crores) can be done as shown below in table 3.12.

Table 3.12: Different Earnings

Year	Passenger earnings	Other coaching earnings	Goods earnings	Sundry earnings	Total gross traffic earnings	Suspense	Gross traffic receipts
2000-01	10515.1	764.2	23305.1	703.2	35287.6	-407.1	34880.5
2001-02	11196.4	872.2	24845.4	944.5	37858.5	-20.9	37837.6
2002-03	12575.4	988.0	26504.8	1079.5	41147.7	-79.5	41068.2
2003-04	13298.3	922.3	27618.0	1003.6	42842.2	62.7	42904.9
2004-05	14112.5	990.3	30778.4	1157.1	47038.3	331.9	47370.2
2005-06	15126.0	1152.6	36287.0	1839.1	54404.6	86.8	54491.4
2006-07	17224.5	1717.7	41716.5	1711.7	62370.5	361.0	62731.5
2007-08	19783.3	1800.3	47434.9	2550.9	71644.7	75.4	71720.1
2008-09	21866.5	1971.7	53433.4	2491.4	79837.1	24.7	79861.8
2009-10	23414.4	2235.1	58501.7	2864.7	87104.6	-140.7	86963.9
2010-11	25705.6	2469.8	62844.7	3402.1	94525.5	10.1	94535.6
2011-12	28246.4	2716.5	69547.6	3643.0	104153.6	-43.2	104110.4
2012-13	31322.8	3054.2	85262.6	4261.4	123901.0	-168.4	123732.6
2013-14	36532.3	3678.5	93905.6	5721.3	139837.7	-279.5	139558.2
2014-15	42189.6	3997.9	105791.3	5092.7	157071.6	-361.0	156710.5
2015-16	44283.3	4371.5	109207.7	5928.6	163791.0	542.6	164333.5
2016-17	46280.5	4312.0	104338.5	10368.0	165299.0	-6.8	165292.2
2017-18	48643.1	4314.4	117055.4	8688.2	178701.2	24.2	178725.3
2018-19	51066.7	4474.5	127432.5	6996.2	189970.1	-63.5	189906.6
2019-20	50669.1	4640.8	113487.9	5862.8	174660.5	303.9	174356.6
2020-21	15248.5	2096.7	117231.8	5938.6	140515.7	54.9	140570.5

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

On analysis of the distribution of revenues it is evidently clear from figure 3.12 that most of the earnings are from goods transportation and next is from coaching earnings.

From the figure 3.13 it is clear that the goods earnings has risen constantly year on year but has dipped slightly in the year 2019-20 and 2020-21. But for passenger traffic growth is there but in the year 2019-20 and 2020-21 there is more dip as compared to freight business. COVID-19 is one of the major reasons for the dip in passenger and goods earnings.

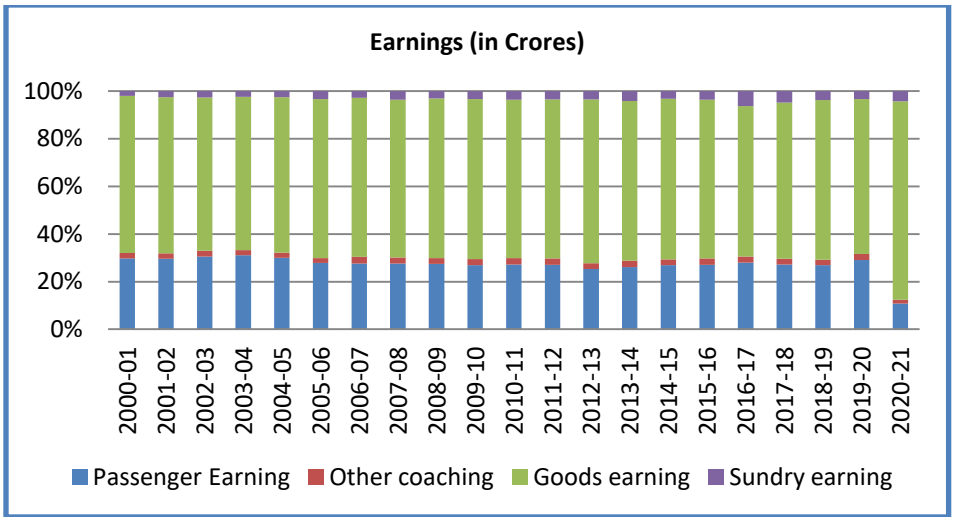

Figure 3.12 Different types of earnings in Indian railways. (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

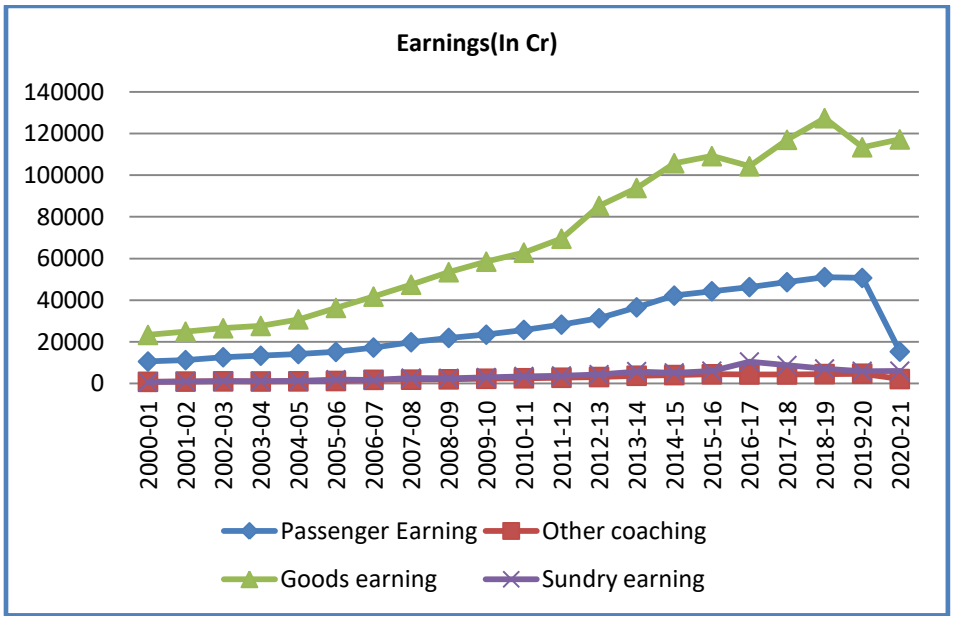

Figure 3.13 Different types of earnings as graph. (Source: Indian Railway Year Books, from 2000-01 to 2020-21)

3.2.1 Goods Earnings

In the freight segment, IR transports various commodities and fuels for various segments like industries, consumer and agricultural segments across the length and breadth of India. IR has historically subsidised the passenger segment with income from the freight business. Goods earnings are a major contributor to the total gross traffic earnings. From year 2000-01 to 2020-21, on an average goods earning was 67 % to total gross traffic earnings. Goods transport is the bread and butter of railways. Hence more attention and R&D should go in developing better transportation infrastructure in wagons and how they can carry more and more load. It is also important to study critical infrastructure more deeply and see that if it is being utilized properly or not. For that a committee may be formed which can look into that.

Table 3.13: Goods Earnings as percentage to total traffic earnings.

Year	goods earnings % to total gross traffic earnings	Year	goods earnings % to total gross traffic earnings	Year	goods earnings % to total gross traffic earnings
2000-01	66.04%	2007-08	66.21%	2014-15	67.35%
2001-02	65.63%	2008-09	66.93%	2015-16	66.68%
2002-03	64.41%	2009-10	67.16%	2016-17	63.12%
2003-04	64.46%	2010-11	66.48%	2017-18	65.50%
2004-05	65.43%	2011-12	66.77%	2018-19	67.08%
2005-06	66.70%	2012-13	68.82%	2019-20	64.98%
2006-07	66.88%	2013-14	67.15%	2020-21	83.43%

Source : Data from Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

Table 3.14: Details of freight loading from 2001-02 to 2020-21

Sl. No.	Commodity group	2001-02		2002-03		2003-04		2004-05		2005-06	
		Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age
1	Coal	229.82	46.67	235.85	45.47	251.75	45.16	271.40	45.07	294.25	44.15
2	Food grains	32.82	6.66	45.60	8.79	44.32	7.95	16.52	7.73	41.64	6.25
3	Iron &Steel	14.50	2.94	16.06	3.10	19.32	3.47	18.36	3.05	21.76	3.27
4	Iron ore	64.46	13.09	70.83	13.65	85.05	15.26	96.26	15.99	113.45	17.02
5	Cement	44.04	8.94	46.25	8.92	49.25	8.83	53.77	8.93	61.20	9.18
6	POL (Mineral oils)	35.62	7.23	34.05	6.56	32.02'	5.65	32.00	5.31	33.45	5.02
7	Fertilizers (Chemical manures)	27.20	5.52	26.46	5.10	23.73	4.26	28.75	4.78	32.65	4.90
8	Limestone and Dolomite	9.23	1.88	9.09	1.75	10.90	1.96	9.97	1.66	11.95	1.79
9	Stones	5.21	1.06	6.07	117	7.29	1.31	10.24	1.70	12.80	1.92
10	Salt	5.20	1.06	3.18	0.61	3.80	0.68	4.17	0.69	4.69	0.70
11	Sugar	2.32	0.47	2.32	0.45	2.81	0.50	2.10	0.35	2.81	0.42
	Total	470.42	95.52	495.76	95.57	529.69	95.03	573.54	95.26	630.65	94.62
12	Commodities other than above	22.08	4.48	22.98	4.43	27.70	4.97	28.56	4.74	35.86	5.38
	Grand Total	492.50	100	518.74	100	557.39	100	602.10	100	666.51	100

s. No.	Commodity group	2006-07		2007-08		2008-09		2009-10		2010-11	
		Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age
1	Coal	313.33	43.06	336.83	42.43	369.63	44.35	396.15	44.62	420.37	45.61
2	Food grains	41.84	5.75	38.23	4.82	35.51	4.26	38.69	4.36	43.45	4.71
3	Iron &Steel	27.04	3.72	25.79	3.25	28.58	3.43	31.85	3.59	32.82	3.56
4	Iron ore	121.74	16.73	136.69	17.22	130.58	15.67	132.74	14.95	118.46	12.85
5	Cement	73.13	10.05	78.99	9.95	86.24	10.35	93.15	10.49	99.08	10.75
6	POL (Mineral oils)	35.23	4.84	35.88	4.52	38.08	4.57	38.88	4.38	39.29	4.26
7	Fertilizers	34.27	4.71	35.83	4.51	41.35	4.96	43.68	4.92	48.22	5.23
8	Limestone and Dolomite	12.70	1.74	14.14	1.78	13.34	1.60	14.77	1.66	16.37	1.78
9	Stones	13.22	1.82	10.67	1.34	6.88	0.83	11.44	1.29	11.66	1.27
10	Salt	4.63	0.64	4.62	0.58	4.83	0.58	4.76	0.54	4.64	0.50
11	Sugar	3.68	0.51	5.98	0.75	4.36	0.52	3.97	0.45	3.76	0.41
	Total	680.81	93.55	723.65	91.15	759.38	91.12	810.08	91.25	838.12	90.93
12	Commodities other than above	46.94	6.45	70.24	8.85	74.01	8.88	77.71	8.75	83.61	9.07
	Grand Total	727.75	100.00	793.89	100.00	833.39	100	887.79	100.00	921.73	100.00

s. No.	Commodity group	2011-12		2012-13		2013-14		2014-15		2015-16	
		Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age	Million Tonnes	%age
1	Coal	455.81	47.04	496.42	49.24	508.06	48.31	545.81	49.83	551.83	50.1
2	Food grains	46.40	4.79	49.03	4.86	55.10	5.24	55.47	5.06	45.73	4.15
3	Iron &Steel	35.15	3.63	35.31	3.50	38.95	3.70	42.84	3.91	44.79	4.07
4	Iron ore	104.70	10.80	111.41	11.05	124.27	11.82	112.77	10.30	116.94	10.62
5	Cement	107.66	11.11	105.87	10.50	109.80	10.44	109.80	10.03	105.35	9.56
6	POL (Mineral oils)	39.77	4.10	40.61	4.03	41.16	3.91	41.10	3.75	43.24	3.93
7	Fertilizers	52.69	5.44	46.21	4.58	44.70	4.25	47.41	4.33	52.23	4.74
8	Limestone and Dolomite	17.66	1.82	19.64	1.95	20.71	1.97	21.20	1.94	23.53	2.14
9	Stones	12.96	1.34	11.77	1.17	11.61	1.10	14.98	1.37	15.04	1.37
10	Salt	5.14	0.53	4.77	0.47	4.65	0.44	4.99	0.46	5.02	0.46
11	Sugar	4.56	0.47	2.95	0.29	3.00	0.29	2.69	0.25	3.39	0.31
	Total	882.50	91.07	923.99	91.66	962.01	91.48	999.06	91.23	1007.09	91.43
12	Others	86.55	8.93	84.10	8.34	89.63	8.52	96.20	8.77	94.42	8.57
	Grand Total	969.05	100.00	1,008.09	100.00	1051.64	100.00	1,095.26	100.00	1101.51	100.00
s. No.	Commodity group	2016-17		2017-18		2018-19		2019-20		2020-21	
1	Coal	532.83	48.17	555.20	47.88	605.84	49.60	586.87	48.56	541.82	44.02
2	Food grains	44.86	4.06	43.79	3.78	39.31	3.22	37.53	3.10	62.82	5.10
3	Iron &Steel	52.41	4.74	54.36	4.69	53.99	4.42	53.13	4.40	60.06	4.88
4	Iron ore	137.55	12.43	139.80	12.06	137.34	11.24	153.37	12.69	159.13	12.93
5	Cement	103.29	9.34	112.96	9.74	117.34	9.61	110.10	9.11	120.4	9.78
6	POL	42.42	3.83	43.11	3.72	43.01	3.52	44.68	3.70	42.48	3.45
7	Fertilizers	48.34	4.37	48.53	4.18	51.83	4.24	51.39	4.25	53.79	4.37
8	Limestone and Dolomite	25.53	2.31	27.7	2.39	30.35	2.48	2.48	2.54	30.84	2.51
9	Stones	14.78	1.34	19.57	1.68	21.58	1.77	18.24	1.51	27.3	2.22
10	Salt	4.97	0.45	4.95	0.43	4.86	0.40	4.30	0.36	5.88	0.48
11	Sugar	2.35	0.21	2.47	0.21	3.02	0.25	2.89	0.24	3.81	0.31
	Total	1009.33	91.25	1052.44	90.76	1108.47	90.75	1093.13	90.46	1108.33	90.04
12	Others	96.82	8.75	107.11	9.24	113.01	9.25	115.28	9.54	122.61	9.96
	Grand Total	1106.15	100.00	1159.55	100.00	1221.48	100.00	1208.41	100.00	1230.94	100

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

As we can see from the table 3.15 that coal is major contributor of freight basket and does constitute more than 46% of the total freight loading.

Table 3.15: Percentage of Different commodities

Commodity	%age	Commodity	%age	Commodity	%age
Coal	46.25	Fertilizers (Chemical manures)	4.75	POL (Mineral oils)	4.22
Food grains	4.86	Limestone and Dolomite	1.51	Salt	0.53
Iron &Steel	4.01	Stones (including gypsum) other than marble	1.49	Sugar	0.37
Iron ore	13.41	Cement	10.13	Commodities other than above	8.47

Source : Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

Next to coal, Iron ore is next major commodity railway is transporting which is constitutes 13.41% of total loading. After that comes cement loading with 10.13% and other commodities with 8.47%. Fertilizers consist of 4.75% on an average and POL consists of 4.22% in total.

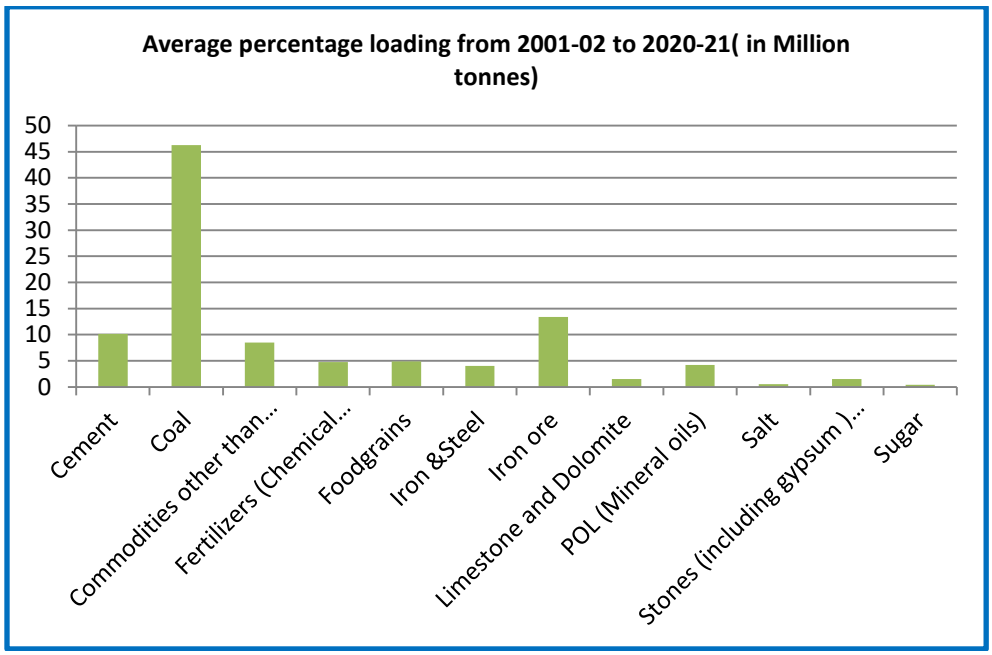

Figure 3.14 Average percentages loading of different commodities. (Source: Indian Railway Year Books, from 2001 to 2021)

3.2.1.1 Transportation of Coal

From the figure 3.15 it is clear that the freight loading of coal has remained more or less same year on year but declined slightly recently. The slight decline is from 2018-19 onwards and in subsequent years. In 2018-19 it was 605.84 million tonnes which reduced to 586.87 million tonnes and then subsequently it further went down to 541.82 million tonnes. In terms of percentage, there is heavy dependence on coal as far as freight loading is concerned and in an average it has constituted 46.67% of all freight loading.

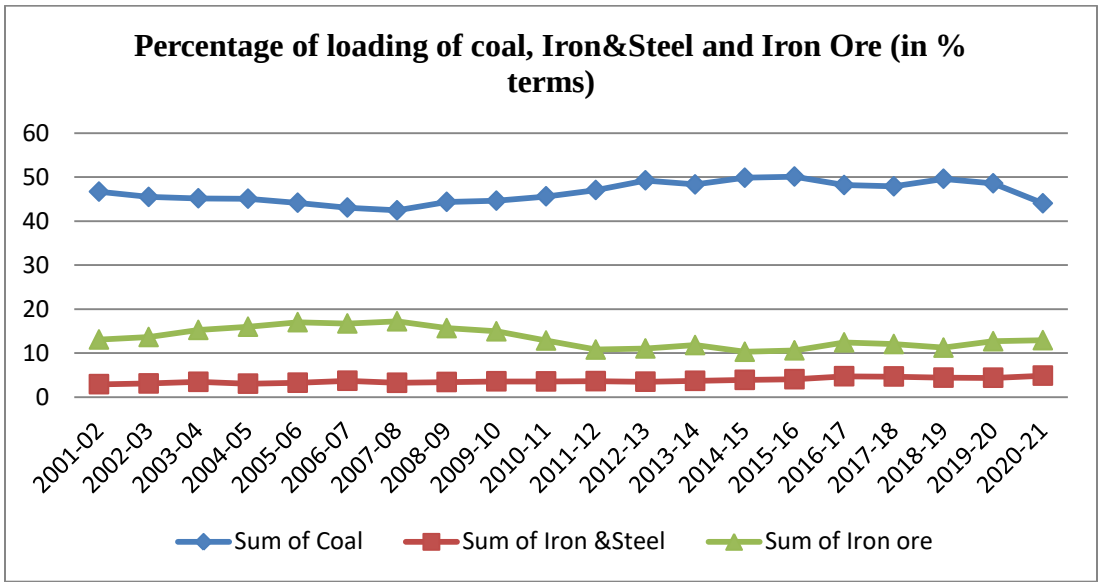

Figure 3.15 Percentage loading of coal, Iron and Steel and Iron Ore. (Source: Indian Railway Year Books, from 2001 to 2021)

From the figure 3.16 is can be seen that from 2001-02 to 2007-08 the coal loading percentage to total loading was on decreasing trend. From 2008-09 onwards 2013-14 it has increased from 42.3% to 48.31%, and after that it followed zig zag path. As of now, in the year 2020-21 it has decreased to 44%. Since there is heavy dependency on coal, Railways must find some other avenues of freight transportation so that if it coal loading decreases there is some way to counter its effects. This becomes more important in the

light of various water transport modes opening up in India. For these 20 years, coal loading has grown by 4% CAGR while total freight loading has grown by 22% by CAGR.

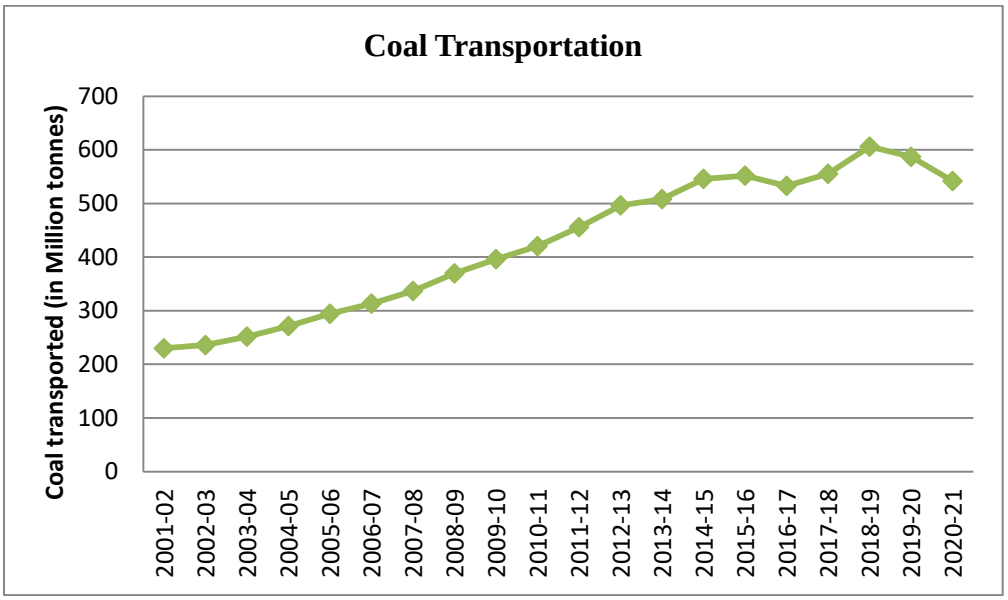

Figure 3.16: Coal transportation (Source: Indian Railway Year Books, from 2001 to 2021)

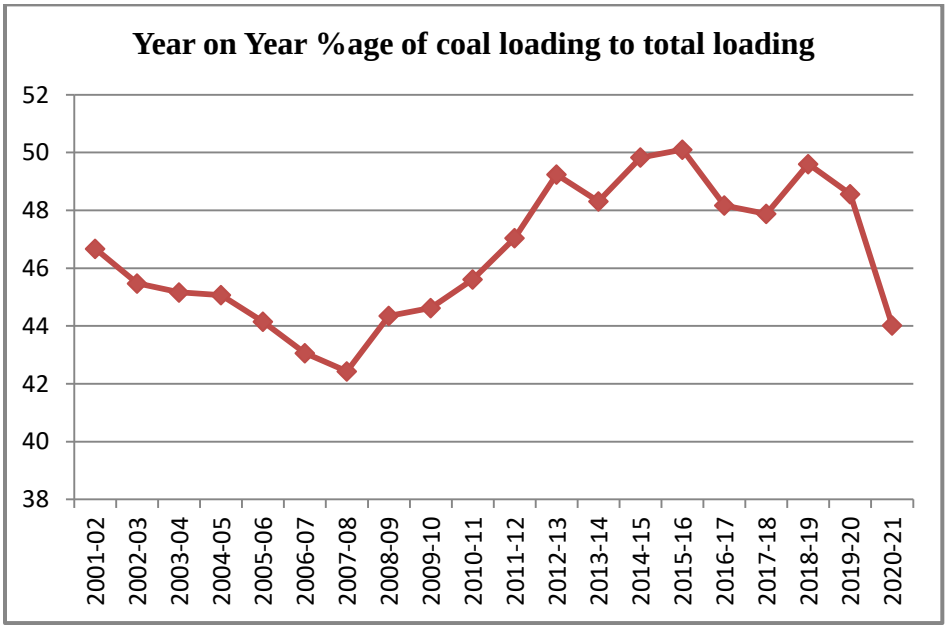

Figure 3.17 year on year coal loading as percentage to total loading. (Source: Indian Railway Year Books, from 2001 to 2021)

3.2.1.2 Transportation of Food Grains

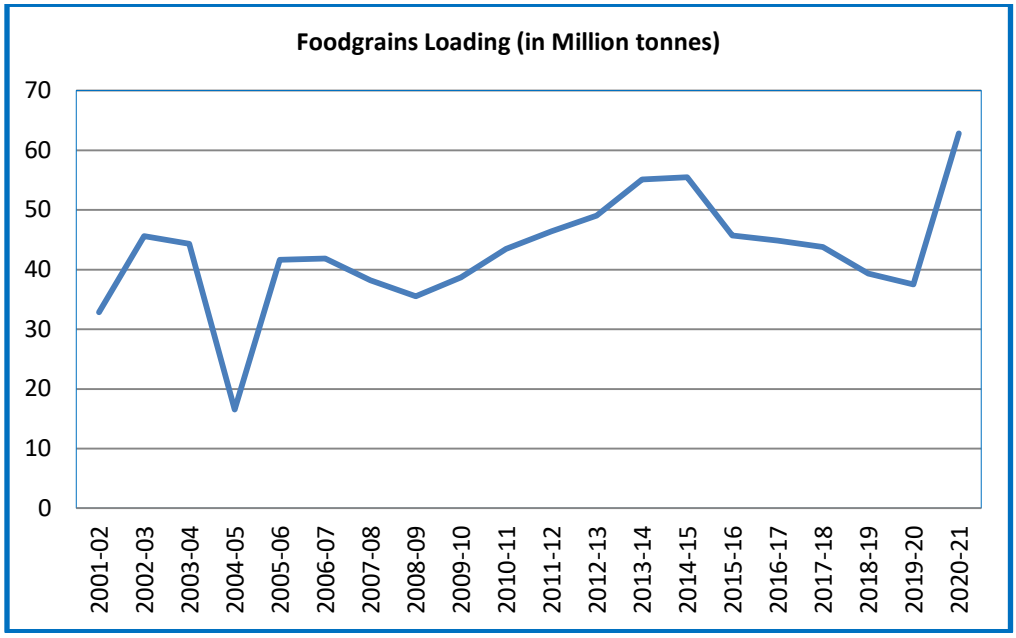

Figure 3.18 Food-grain Loading. (Source: Indian Railway Year Books, from 2001 to 2021)

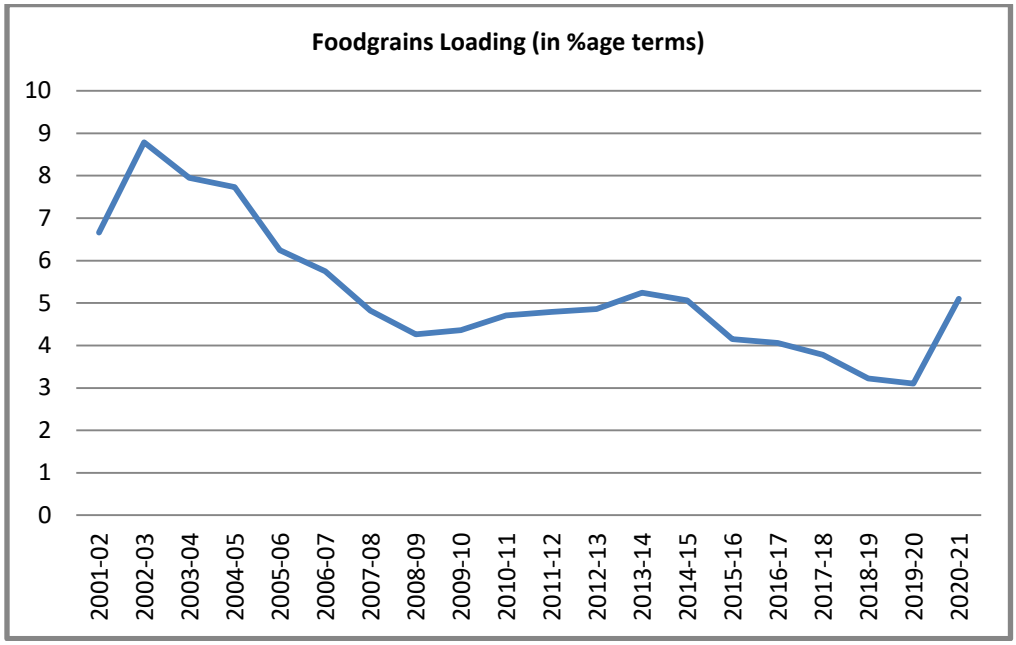

Figure 3.19 Food-grain loading as percentage. (Source: Indian Railway Year Books, from 2001 to 2021)

In percentage terms, transportation of food grains has decreased from an all time high of around 9% to as low as 3%. It is also important to investigate the reasons for the same. Food-grains transportation has grown by CAGR 3% only.

3.2.1.3 Transportation of Iron and Steel

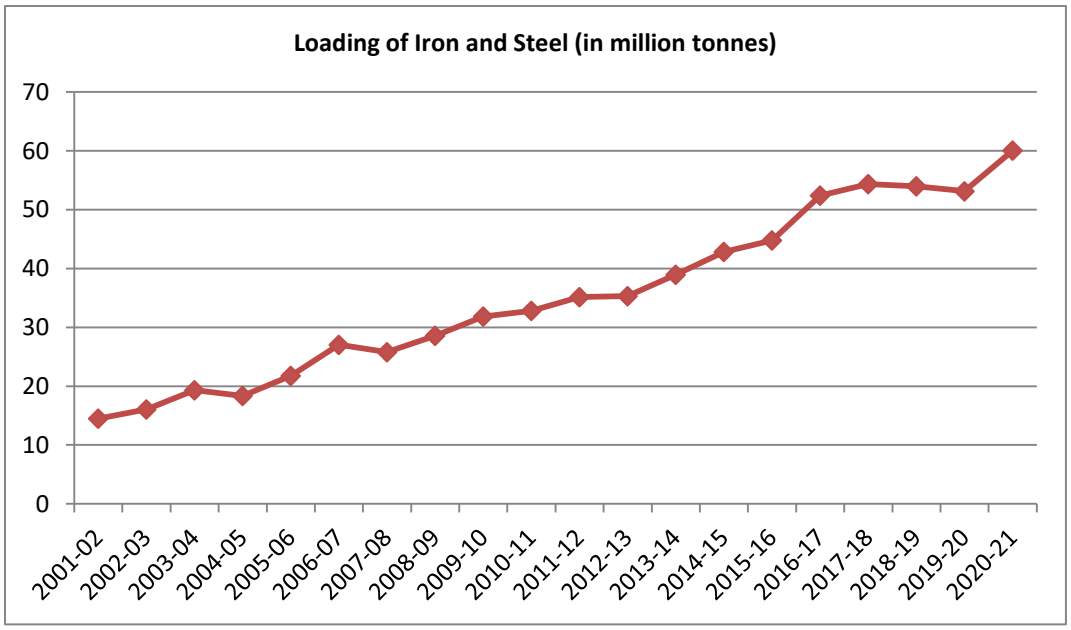

Figure 3.20 Loading of Iron & Steel. (Source: Indian Railway Year Books, from 2001 to 2021)

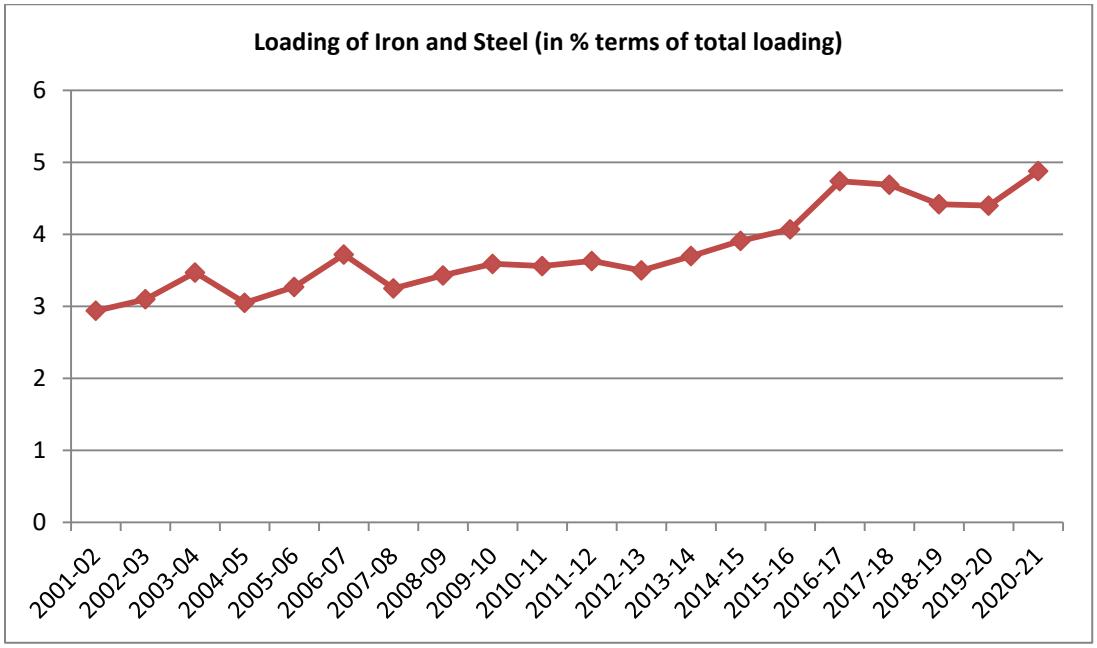

Figure 3.21 Loading of Iron & Steel as percentage. (Source: Indian Railway Year Books, from 2001 to 2021)

From the figure 3.21 is clear that transportation of Iron and steel has increased at a fast pace. It is also clearly evident from the percentage share of the same. Iron and Steel has grown by a CAGR of 7%.

3.2.1.4 Transportation of Iron Ore

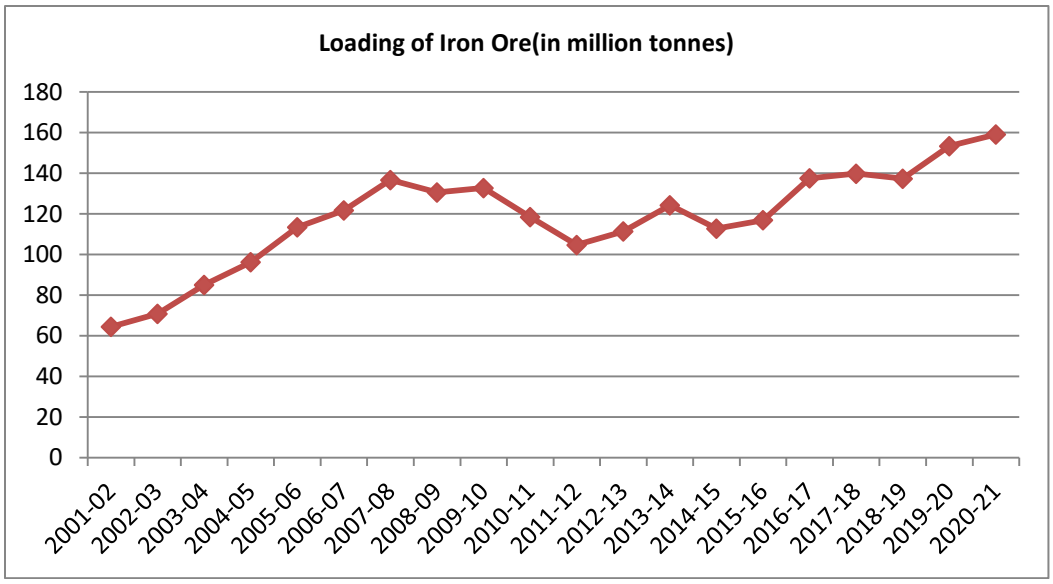

Figure 3.22 Loading of Iron Ore. (Source: Indian Railway Year Books, from 2001 to 2021)

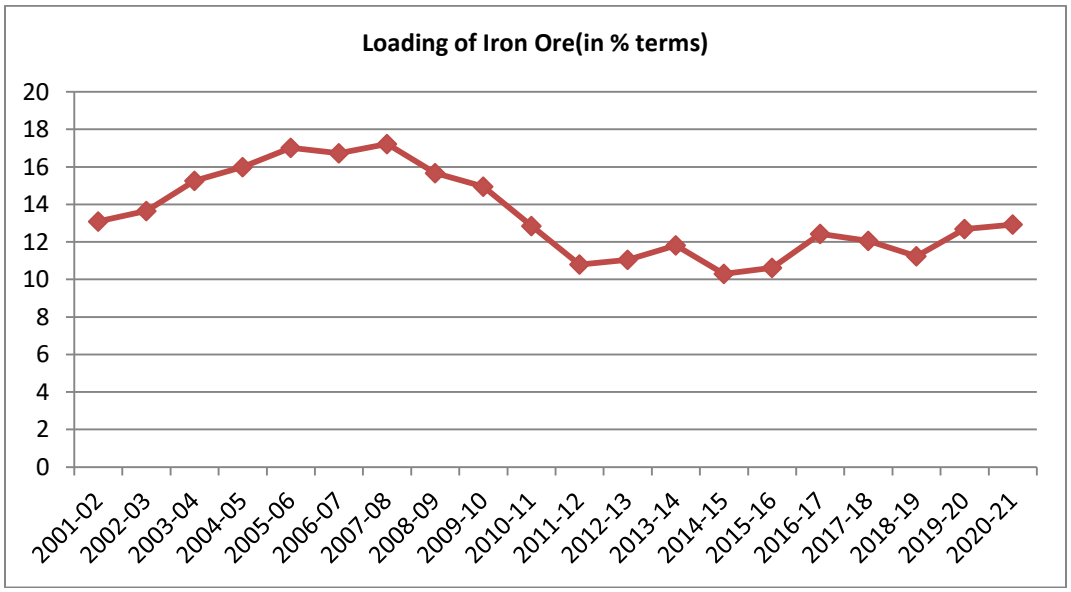

Figure 3.23 Loading of Iron Ore as percentage. (Source: Indian Railway Year Books, from 2001 to 2021)

Loading of Iron Ore has grown from 60 million tonnes in 2001-01 to around 160 million tonnes in 2020-21. It has grown with a CAGR of 5%. Next to coal, iron ore transportation is the second largest commodity in the basket of railways.

3.2.1.5 Loading of cement

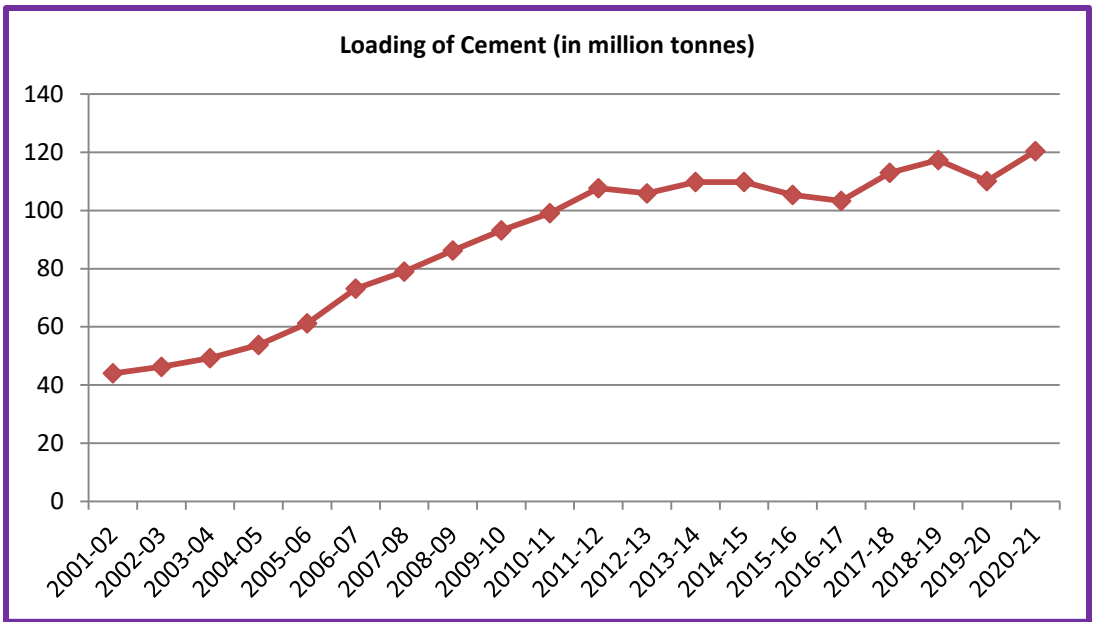

Figure 3.24 Loading of cement. (Source: Indian Railway Year Books, from 2001 to 2021)

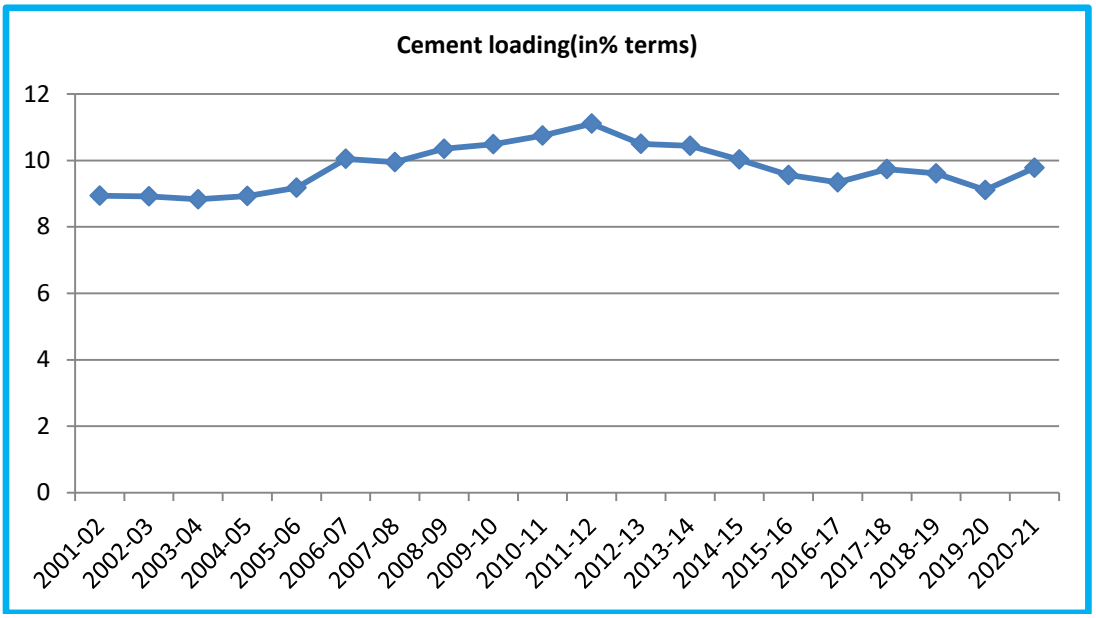

Figure 3.25 Loading of cement as percentage(Source: Indian Railway Year Books, from 2001 to 2021)

Loading of cement has risen consistently over the years and with a CAGR of 5% from 2001-02 to 2020-21.The percentage share also has remained more or less same over the years.

3.2.1.6 Loading of Mineral Oils

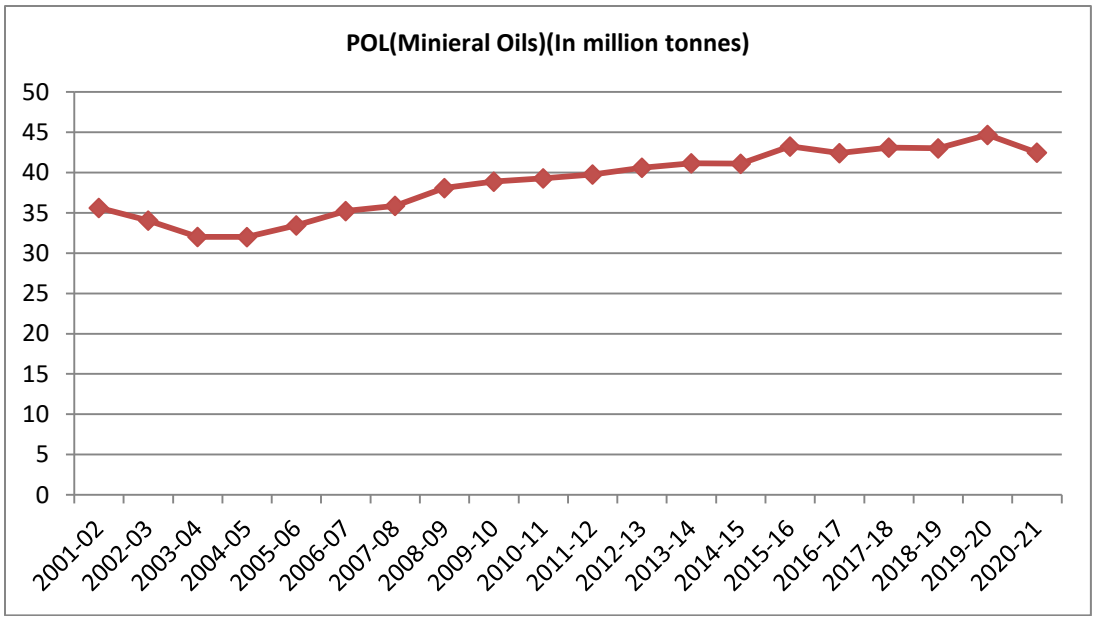

Figure 3.26 Loading of POL (Mineral Oils). (Source: Indian Railway Year Books, from 2001 to 2021)

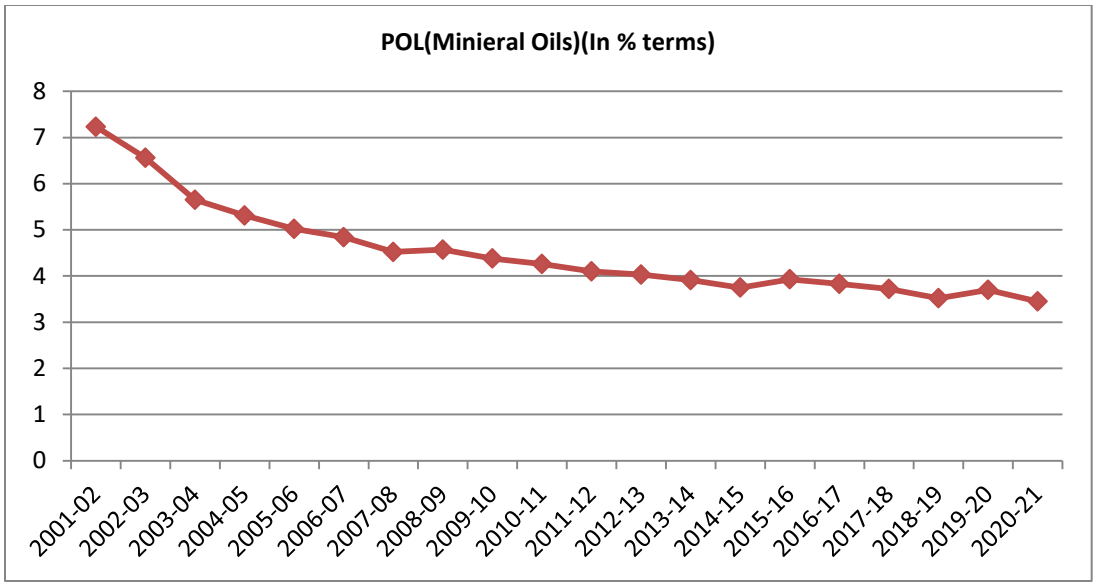

Figure 3.27 Loading of POL mineral oils as percentage to total loading. (Source: Indian Railway Year Books, from 2001 to 2021)

Over the years the loading of POL has remained in the range of 30-45 million tonnes. Over the years it has grown merely 1% of CAGR. Apart from this, over the years its percentage contribution to total loading also has declined from 7% to 3%.

3.2.1.7 Loading of Fertilizers

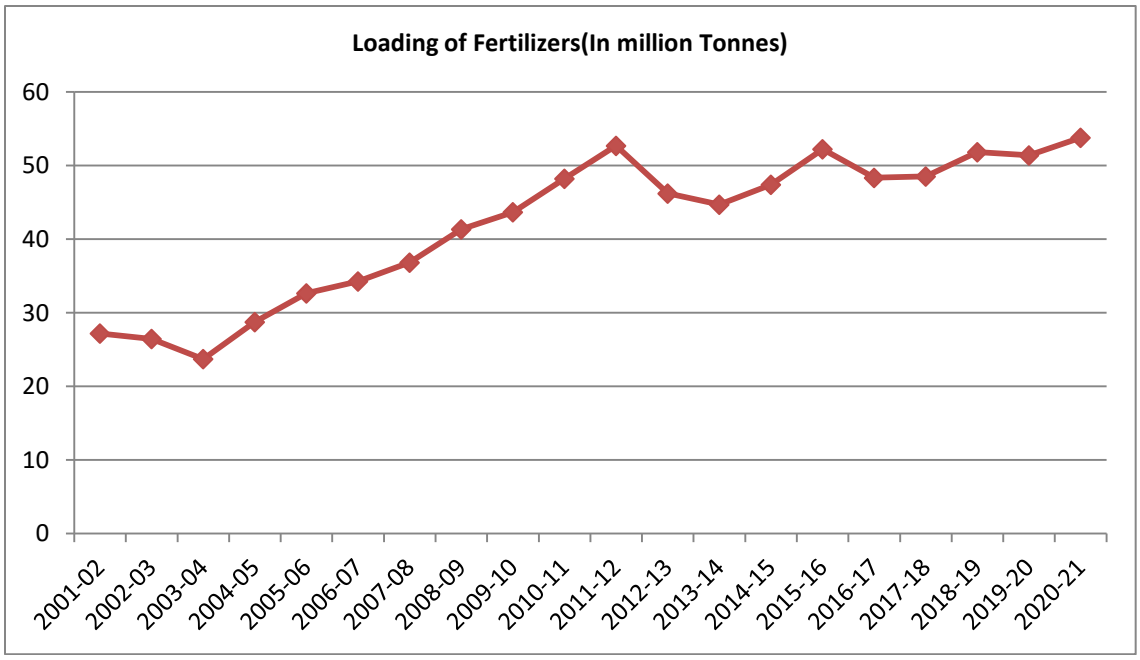

Figure 3.28 Loading of fertilizers. (Source: Indian Railway Year Books, from 2001 to 2021)

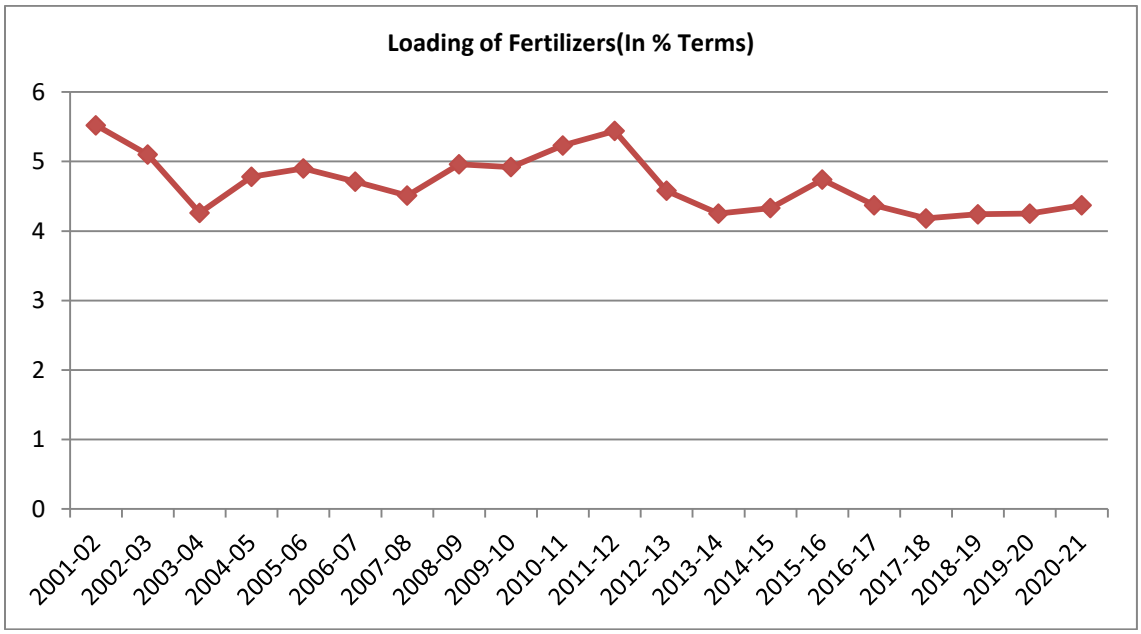

Figure 3.29 Loading of fertilizers as percentage to total loading. (Source: Indian Railway Year Books, from 2001 to 2021)

Loading of fertilizers have grown from around 27 million tonnes to 53 million tonnes over the years. It has grown with CAGR of 3% from 2001-02 to 2020-21.

3.2.1.8 Loading of Limestone and Dolomite

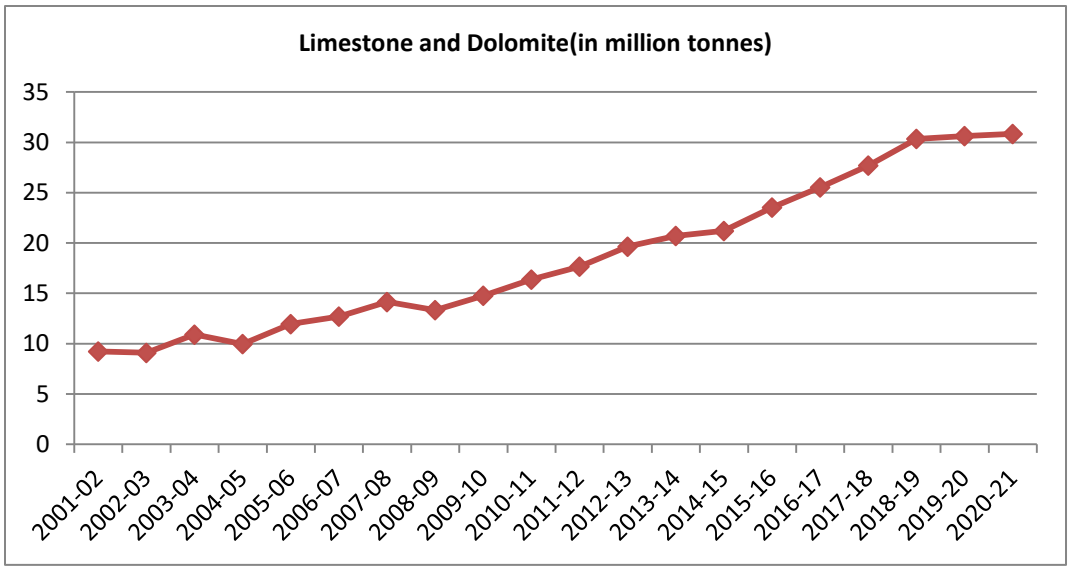

Figure 3.30 Loading of Limestone and Dolomite. (Source: Indian Railway Year Books, from 2001 to 2021)

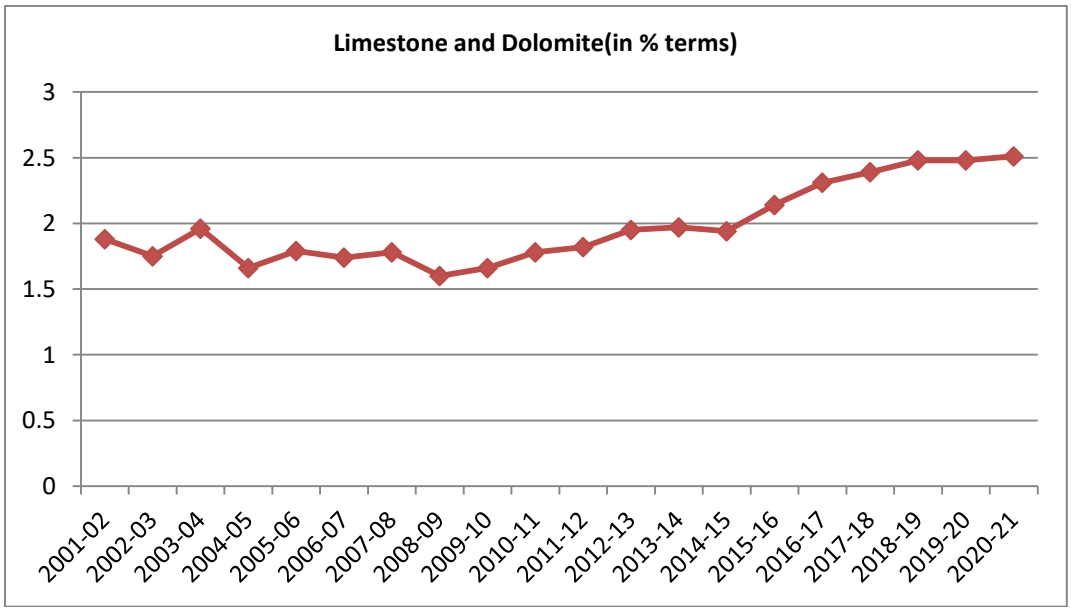

Figure 3.31 Loading of limestone and dolomite as percentage of total loading. (Source: Indian Railway Year Books, from 2001 to 2021)

Loading of limestone and dolomite has grown exponentially over the years. For example, it has grown from 9 million tonnes initially to around 30 million tonnes in 2020-21. It has registered a CAGR of 6%.

3.2.1.9 Loading of Stones

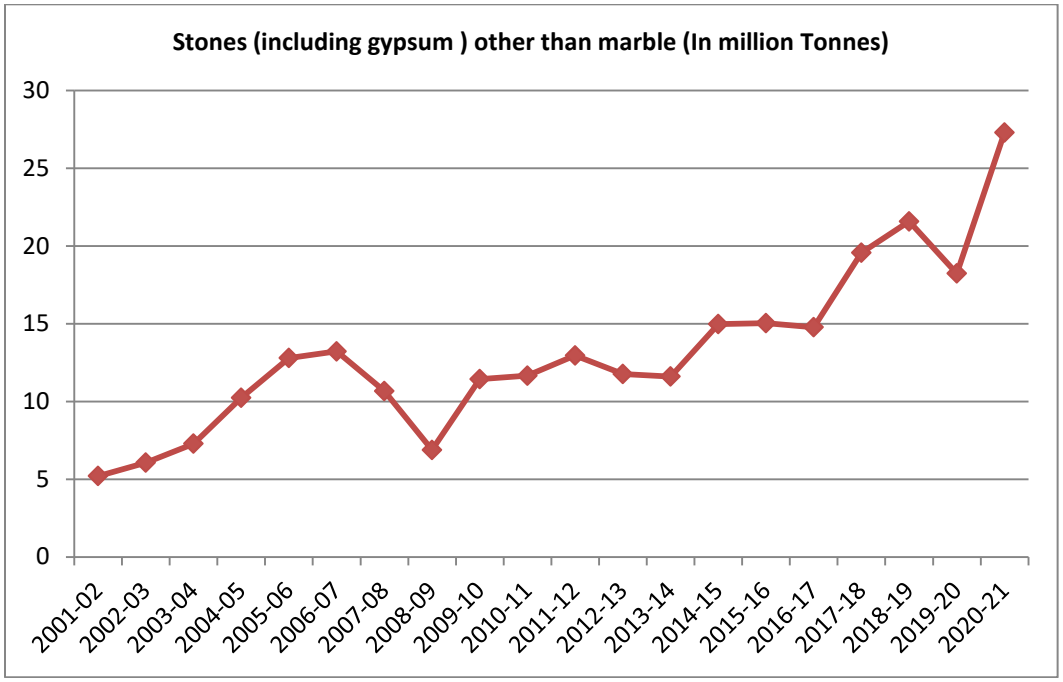

Figure 3.32 Loading of stones(including gypsum) other than marble. (Source: Indian Railway Year Books, from 2001 to 2021)

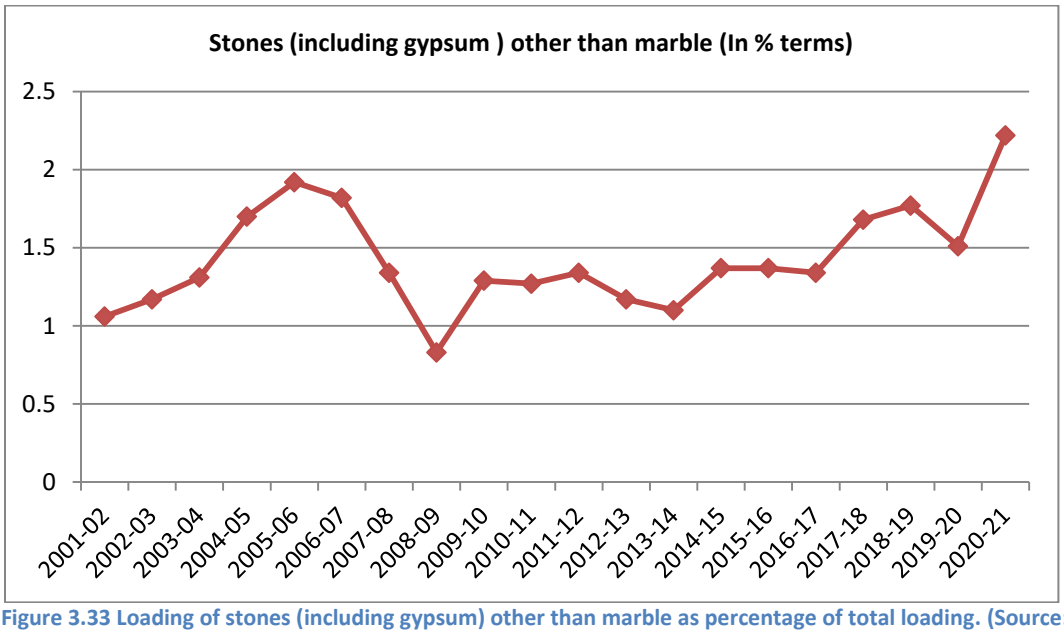

Figure 3.33 Loading of stones (including gypsum) other than marble as percentage of total loading. (Source: Indian Railway Year Books, from 2001 to 2021)

Loading of stones has gone from around 5 million tonnes to 27 million tonnes. It has registered highest growth of CAGR of 9%.

3.2.2 Passenger Earnings

Passenger earnings constitute on an average 27% of total gross traffic earnings. Next to goods earnings, passenger earning is the second most important sector to concentrate upon. But this is getting competition from aviation sector. As the income of the people has increased and the airfare has reduced, more and more people are preferring to travel by air rather than travelling long distance travel by train.

Table 3.16: Passenger Earnings and year-on-year growth

Year	Earnings (Rupees in crores)	Year-On-Year growth	Year	Earnings (Rupees in crores)	Year-On-Year growth	Year	Earnings (Rupees in crores)	Year-On-Year growth
2000-01	10483.20	--	2007-08	19783.30	15.2%	2014-15	42189.61	15.5%
2001-02	11162.20	6.5%	2008-09	21866.50	10.5%	2015-16	44283.26	5.0%
2002-03	12540.80	12.4%	2009-10	23414.40	7.1%	2016-17	46280.46	4.5%
2003-04	13259.80	5.7%	2010-11	25705.60	9.8%	2017-18	48643.14	5.1%
2004-05	14072.50	6.1%	2011-12	28246.40	9.9%	2018-19	51066.65	5.0%
2005-06	15080.80	7.2%	2012-13	31322.80	10.9%	2019-20	50669.09	-0.8%
2006-07	17176.00	13.9%	2013-14	36532.25	16.6%	2020-21	15248.49	-69.9%

Source : Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

Figure 3.34 Passenger Earnings. (Source: Indian Railway Year Books, from 2001 to 2021)

Figure 3.35 Year on Year growth of passenger earnings. (Source: Indian Railway Year Books, from 2000 to 2021)

Table 3.17: Passenger Earnings as percentage to Total Earnings

Year	Passenger earnings % to total gross traffic earnings	Year	Passenger earnings % to total gross traffic earnings	Year	Passenger earnings % to total gross traffic earnings
2000-01	29.80%	2007-08	27.61%	2014-15	26.86%
2001-02	29.57%	2008-09	27.39%	2015-16	27.04%
2002-03	30.56%	2009-10	26.88%	2016-17	28.00%
2003-04	31.04%	2010-11	27.19%	2017-18	27.22%
2004-05	30.00%	2011-12	27.12%	2018-19	26.88%
2005-06	27.80%	2012-13	25.28%	2019-20	29.01%
2006-07	27.62%	2013-14	26.12%	2020-21	10.85%

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

As we can see from the variation of percentage it is clear that after 2004-05 the percentage of passenger earnings to total earnings has slightly decreased and came down from 30%. This may be due to shifting of passengers towards airways as fare in that area also was getting reduced. By analyzing trend it is also suggested that freight is contributing more towards earnings hence Indian Railways should concentrate on how to enhance freight loading and how to optimize it.

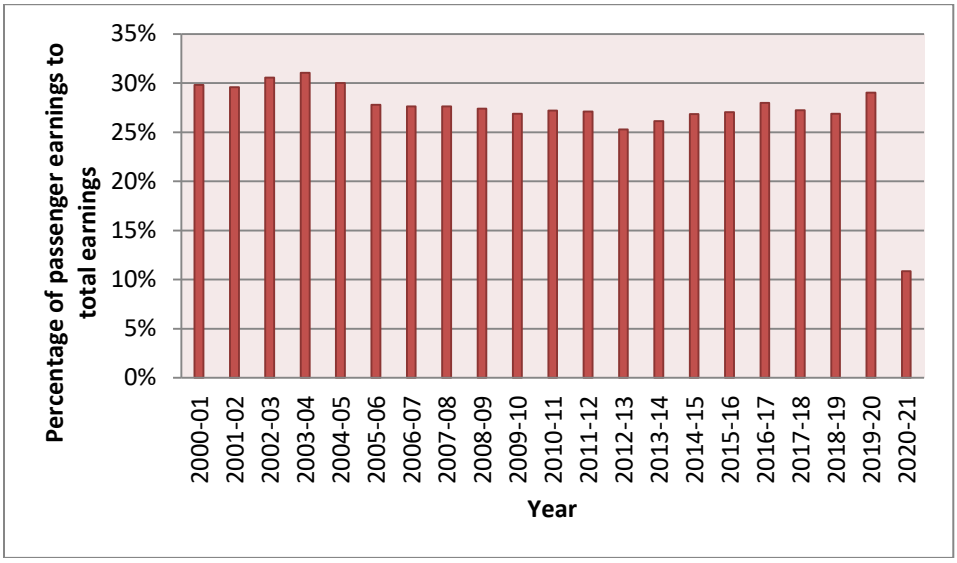

Figure 3.36 Percentage of passenger earnings to total earnings. (Source: Indian Railway Year Books, from 2000 to 2021)

3.2.2.1 Suburban and Non-Suburban Earnings

Passenger services of the Indian Railways are available on both Suburban and Non suburban sections. While the non-suburban trains cover long distance trains, the suburban services are meant for short distances, normally up to 150 Km to facilitate rapid movement of passengers within the cities, suburbs and extended suburbs. In India suburban services were introduced in Mumbai on 3.2.1925, Chennai on 1.5.1931 and Kolkata on 1.12.1957 being the port cities and easily accessible by sea were the first to become centers of trade and industry and therefore Electrical Multiple Units (EMUs) were introduced in these cities to cater to mass passenger transport need.

Table 3.18: Earnings from suburban and non-suburban passengers

Year	Earnings from passenger carried (non-suburban)(In Cr)	Earnings from passenger carried (suburban)(In Cr)	% non suburban	% suburban
2000-01	9392.02	1091.14	89.59%	10.41%
2001-02	10006.25	1156.00	89.64%	10.36%
2002-03	11309.19	1231.60	90.18%	9.82%
2003-04	12004.32	1255.52	90.53%	9.47%
2004-05	12731.65	1340.88	90.47%	9.53%
2005-06	13709.24	1371.53	90.91%	9.09%
2006-07	15748.58	1427.43	91.69%	8.31%
2007-08	18213.69	1569.56	92.07%	7.93%
2008-09	20251.72	1614.76	92.62%	7.38%
2009-10	21745.40	1669.04	92.87%	7.13%
2010-11	23953.34	1752.29	93.18%	6.82%
2011-12	26320.79	1925.65	93.18%	6.82%
2012-13	29312.40	2010.44	93.58%	6.42%
2013-14	34271.59	2260.66	93.81%	6.19%
2014-15	39696.38	2493.22	94.09%	5.91%
2015-16	41708.04	2575.22	94.18%	5.82%
2016-17	43591.02	2689.44	94.19%	5.81%
2017-18	45839.35	2803.79	94.24%	5.76%
2018-19	48253.90	2812.75	94.49%	5.51%
2019-20	47826.00	2843.09	94.39%	5.61%
2020-21	14659.18	589.31	96.14%	3.86%

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

This has now become the lifeline of all the above three metropolitan cities. From the table 3.18 it is clear that non suburban traffic is the primary contributor to the passenger earnings. Suburban passengers constitute around 7% of total earnings.

3.2.2.2 Passenger Originating

As we can see from the table 3.19 and figure 3.37 that total passenger on originating basis has increased from around 4833 millions in 2000-01 to around 8000 millions in 2010-11 and remained more or less around at that level. Sharp reduction in 2020-21 may be attributed to COVID-19.

Table 3.19 : Passenger Originating

Year	Passengers Originating(In Millions)		
	Suburban	Non-Suburban	Total
2000-01	2861	1972	4833
2001-02	2999	2094	5093
2002-03	2934	2037	4971
2003-04	2986	2126	5112
2004-05	3178	2200	5378
2005-06	3329	2396	5725
2006-07	3514	2705	6219
2007-08	3689	2835	6524
2008-09	3802	3118	6920
2009-10	3876	3370	7246
2010-11	4061	3590	7651
2011-12	4377	3847	8224
2012-13	4477	3944	8421
2013-14	4552	3845	8397
2014-15	4505	3719	8224
2015-16	4459	3648	8107
2016-17	4566	3550	8116
2017-18	4665	3621	8286
2018-19	4784	3655	8439
2019-20	4597	3489	8086
2020-21	917	333	1250

Source: Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

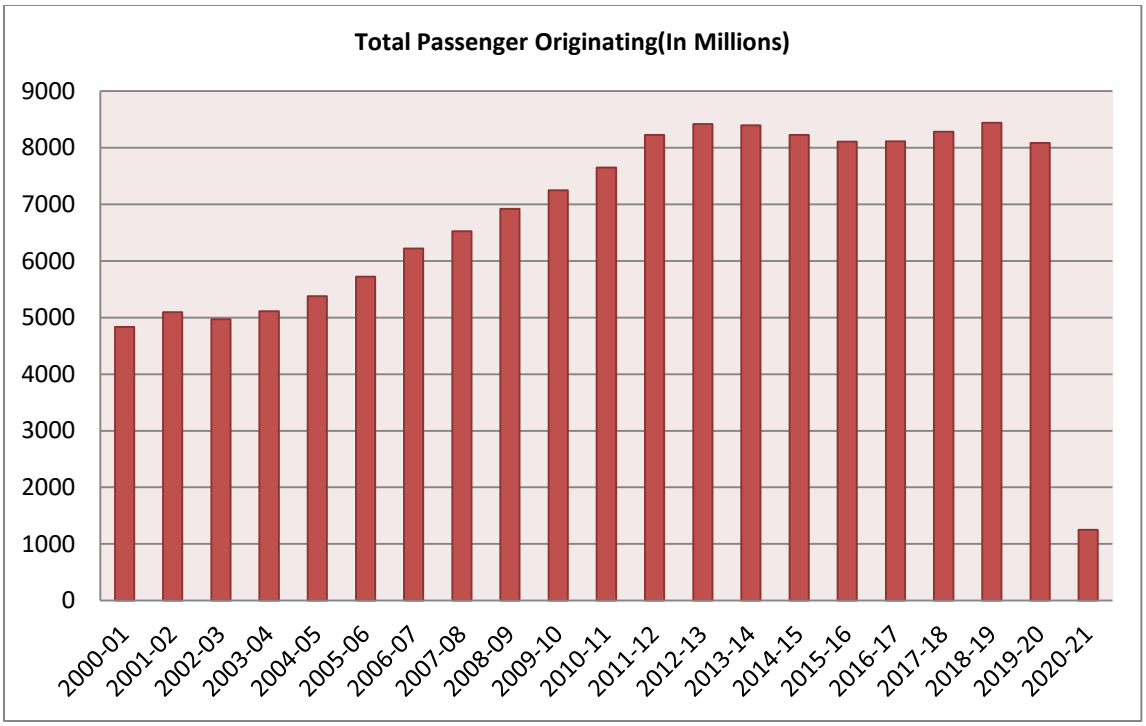

Figure 3.37 Total passengers originating. (Source: Indian Railway Year Books, from 2000 to 2021)

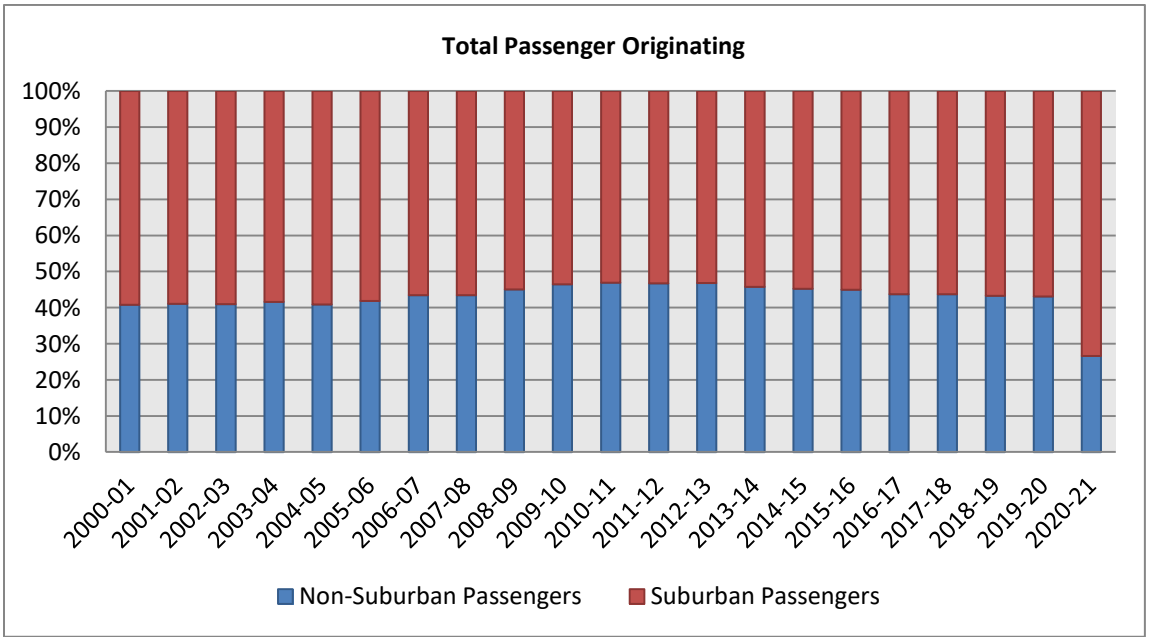

Figure 3.38 Total passengers originating suburban and non suburban. (Source: Indian Railway Year Books, from 2000 to 2021)

Average 57% passengers are suburban passengers and rests are non suburban passengers.

But suburban passengers contribute just around 7% of total passenger earnings.

3.2.2.3 Passenger Kilometers

Passenger kilometres, is calculated by multiplying the number of journeys by mean kilometric distance in case of each class.

Table 3.20 : Passenger Kilometres

Year	Sub.	Non-Sub.	Total(in Millions)
2000-01	88872	368150	457022
2001-02	92868	398044	490912
2002-03	90266	424778	515044
2003-04	95981	445227	541208
2004-05	103759	471943	575702
2005-06	106419	509195	615614
2006-07	111897	582867	694764
2007-08	119842	650114	769956
2008-09	124836	713196	838032
2009-10	130917	772548	903465
2010-11	137127	841381	978508
2011-12	144057	902465	1046522
2012-13	145654	952449	1098103
2013-14	150259	990153	1140412
2014-15	151775	995415	1147190
2015-16	145253	997786	1143039
2016-17	145417	1004418	1149835
2017-18	149465	1028234	1177699
2018-19	146678	1010496	1157174
2019-20	137130	913608	1050738
2020-21	30075	201051	231126

Source Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

Average 57% passengers are suburban passengers and rests are non suburban passengers. But as far as kilometres travelled are considered more than 80% kilometres are travelled non suburban passengers. Hence one way of increasing revenue is to increase some fare of suburban passengers as compared to suburban passengers.

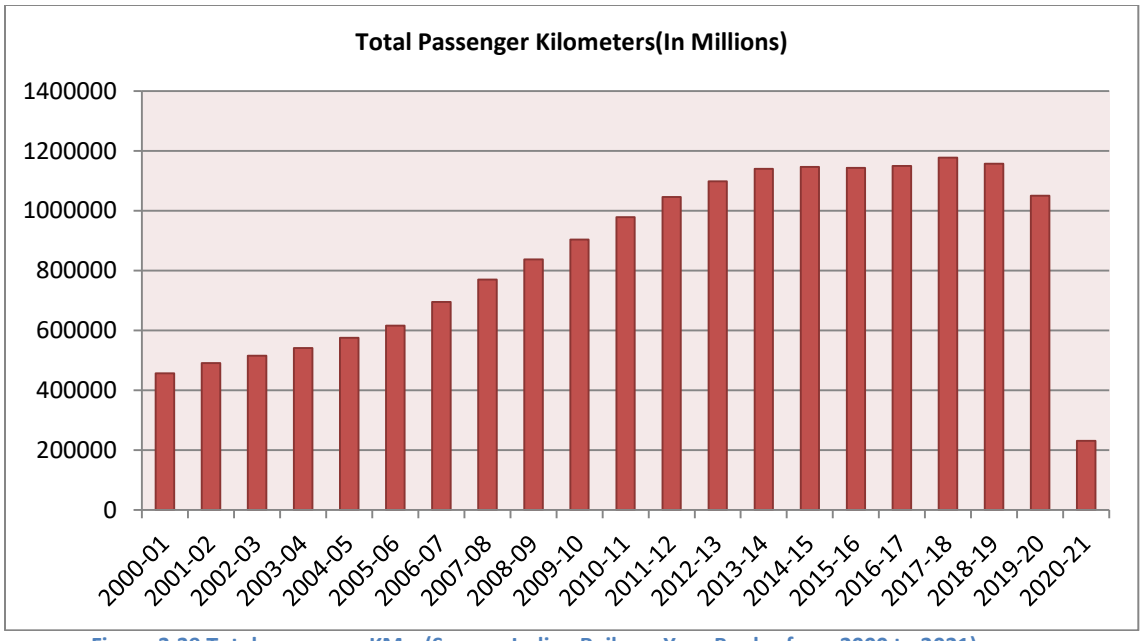

Figure 3.39 Total passenger KMs. (Source: Indian Railway Year Books, from 2000 to 2021)

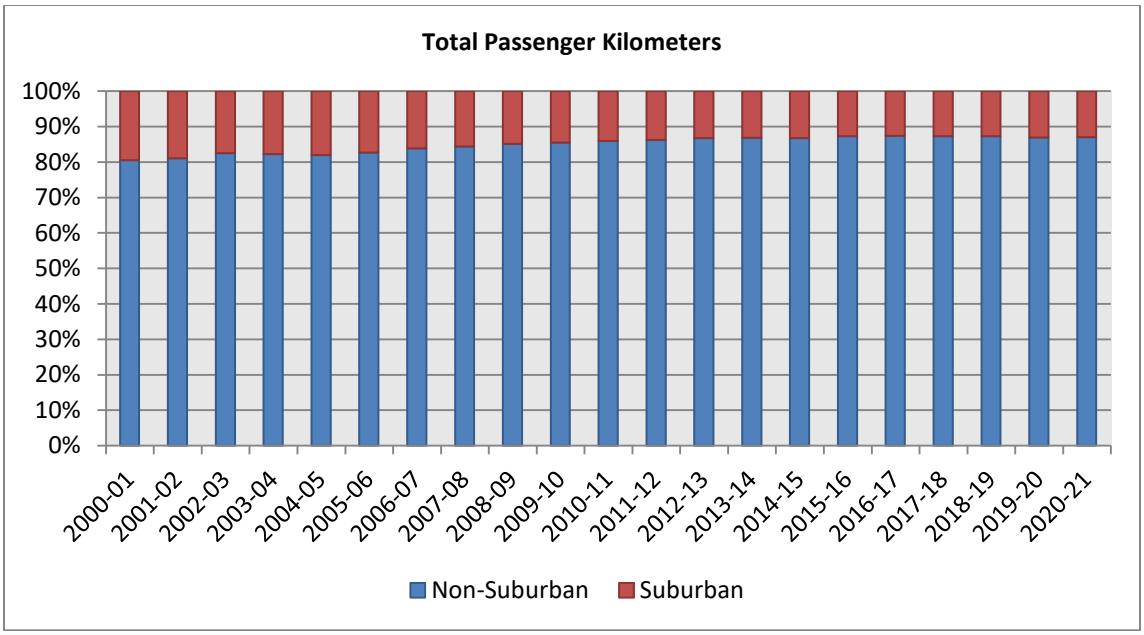

Figure 3.40 Total passenger KMs Non Suburban and Suburban. (Source: Indian Railway Year Books, from 2000 to 2021)

3.2.2.4 LEAD

Lead represents the average distance each passenger is transported. Average lead of suburban traffic was 32.2 KMs and for non urban passengers average lead was 254 KMs.

Table 3.21: Lead of Suburban and Non Suburban Passengers

Year	Lead (In kilometres) (Av. distance travelled by a pass.)		
	Sub.	Non-Sub.	Total
2000-01	31.1	186.70	94.6
2001-02	31.0	190.10	96.4
2002-03	30.8	208.60	103.6
2003-04	32.1	209.40	105.9
2004-05	32.7	214.50	107.0
2005-06	32.0	212.60	107.5
2006-07	31.8	215.50	111.7
2007-08	32.5	229.30	118.0
2008-09	32.8	228.70	121.1
2009-10	33.8	229.20	124.7
2010-11	33.8	234.40	127.9
2011-12	32.9	234.60	127.2
2012-13	32.5	241.50	130.4
2013-14	33.0	257.50	135.8
2014-15	33.7	267.70	139.5
2015-16	32.6	273.50	141.0
2016-17	31.8	283.00	141.7
2017-18	32.0	284.00	142.1
2018-19	30.7	276.50	137.1
2019-20	29.8	261.90	129.9
2020-21	32.8	603.50	184.8

Source: Indian Railways, Key Statistics, (1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

From table 3.21 it is evident that lead has not at all increased for suburban traffic from 2000-01 to 2020-21 but whereas lead for urban traffic has increased from 186.7 KMs in 2020-21 to 603.5 in 2020-21. It is also evident that total lead has increased from 94.6 KMs to 184.8 KMs. From the figure 3.42 it is clear that the lead of Non-Suburban traffic is highest. And the lead for Suburban travel is the least, which is natural.

For these twenty one years, suburban traffic lead has grown with a CAGR of only 0.25% while urban traffic lead has grown by 5.75% and average growth on lead is 3.24%.

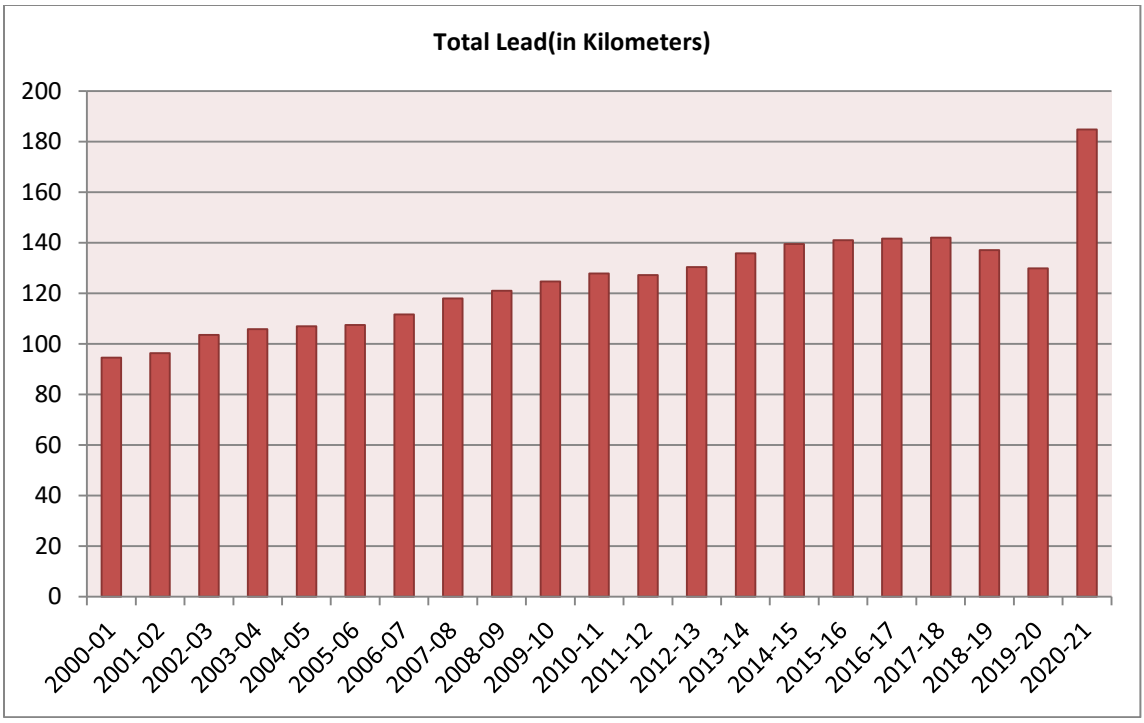

Figure 3.41 Total lead in KMs. (Source: Indian Railway Year Books, from 2000 to 2021)

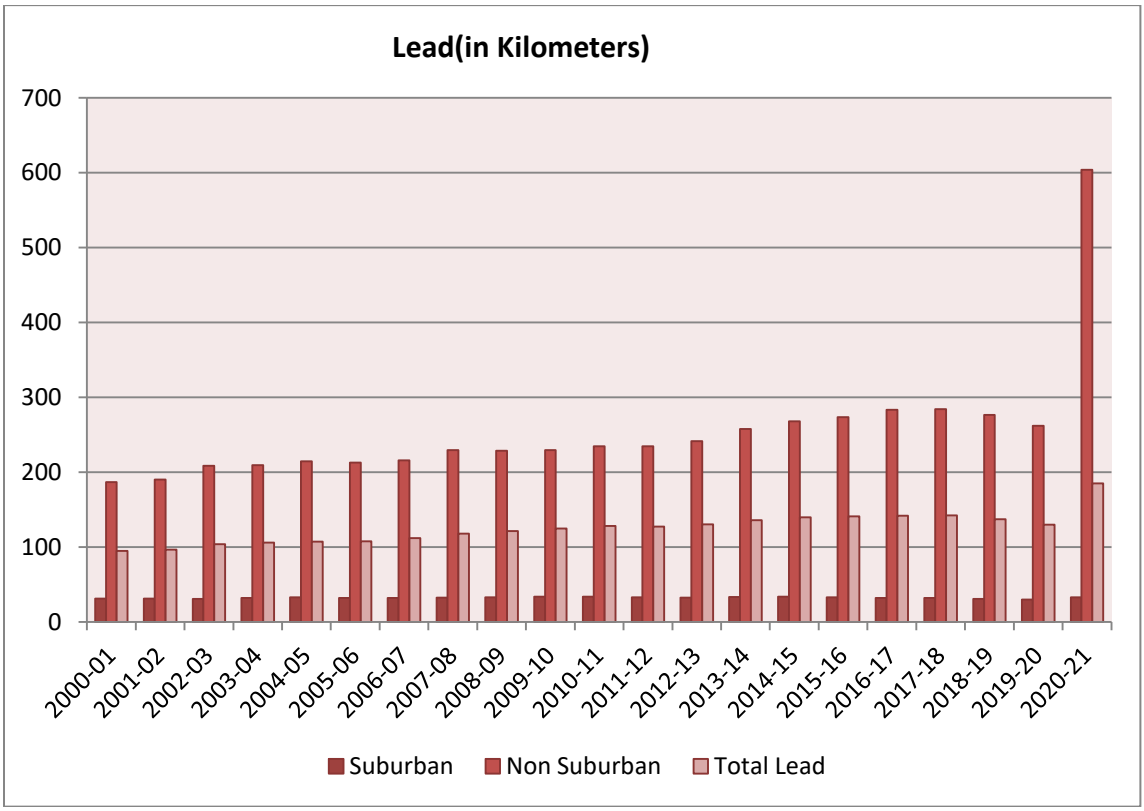

Figure 3.42 Lead of Suburban and non suburban traffic. (Source: Indian Railway Year Books, from 2000 to 2021)

3.2.2.5 Average Rate per passenger per kilometer

Table 3.22 : Average rate per passenger per kilometres

Year	Average rate per passenger km. (in paise)	Year	Average rate per passenger km. (in paise)	Year	Average rate per passenger km. (in paise)
2000-01	22.90	2007-08	25.70	2014-15	36.78
2001-02	23.00	2008-09	26.10	2015-16	38.74
2002-03	24.30	2009-10	25.90	2016-17	40.25
2003-04	24.50	2010-11	26.30	2017-18	41.30
2004-05	24.40	2011-12	27.00	2018-19	44.13
2005-06	24.50	2012-13	28.50	2019-20	48.22
2006-07	24.70	2013-14	31.53	2020-21	65.97

Source Indian Railways, Key Statistics,(1970-71 to 2012-13) and Indian Railway Year Books, from 2000-01 to 2020-21

Average rate per passenger per kilometer is the rate at which a passenger is charged for travelling for one kilometer. From the table 3.22 it can be seen that the average rate has increased from approx 22.9 paise per passenger per kilometres to 65.97 paise per passenger per kilometres.

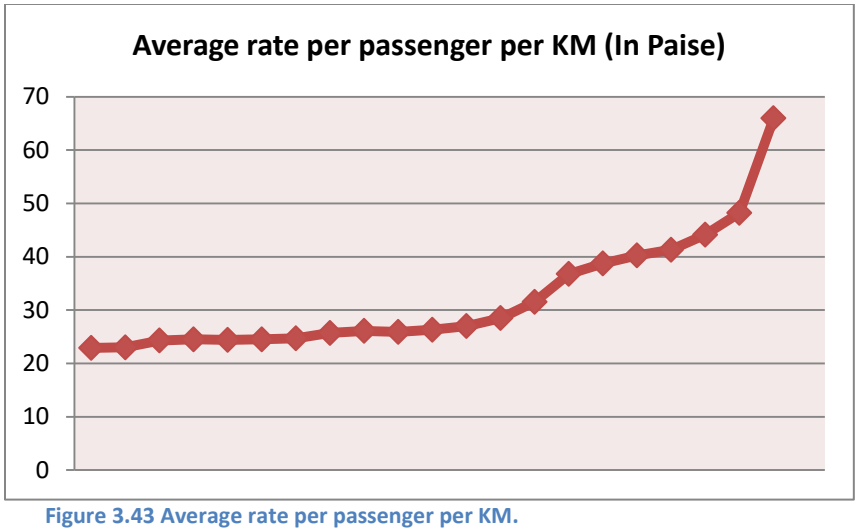

Figure 3.43 Average rate per passenger per KM.
(Source: Indian Railway Year Books, from 2000 to 2021)

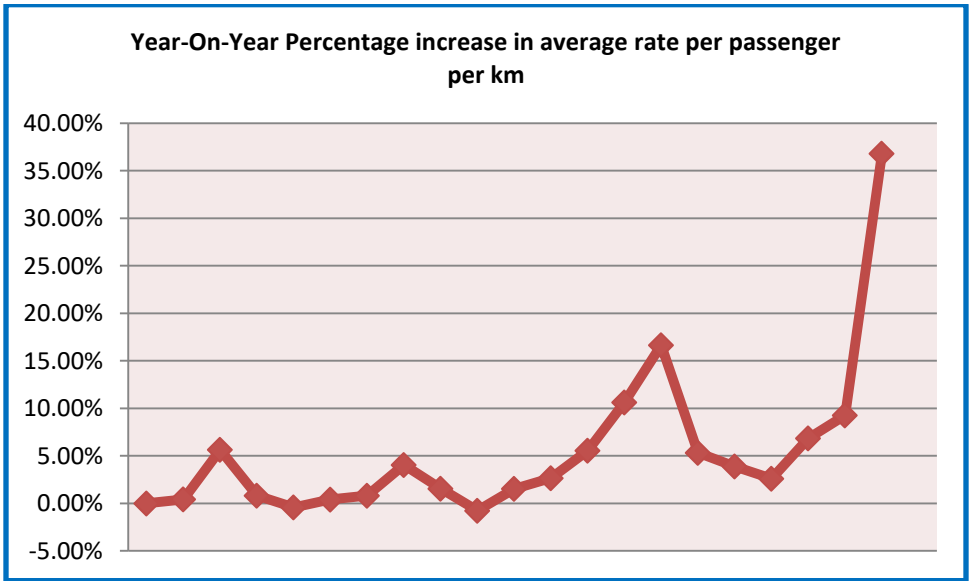

Figure 3.44 Year on Year percentage increase in average rate per passenger. (Source: Indian Railway Year Books, from 2000 to 2021)

Chapter 4

Comparative Study Of The Zones Of Indian Railways

4.0 Introduction

Indian Railway is divided into zones and zones are further divided into divisions. Further, the zonal and divisional boundaries are decided by operational/administrative requirements of Railway and not on considerations of State boundaries and as such there are some States which have railway lines under jurisdictional control of more than one Zonal Railway/Division. Until 2003, there were 9 zones, and this system remained for four decades. In 2002-03, 7 new zones were created, giving a total of 16. In 2010 only, Kolkata Metro was given the status of the 17th zone of Indian Railways. Out of various zonal railways, metro railway Kolkata is the only railway specifically serving to metro (suburban) traffic at Kolkata only. Hence for our analysis we will exclude Metro Railway. Additionally, Konkan Railway and RDSO have the administrative status of a zone of IR, but are not normally considered a zone for operational purposes. The operating ratio of each zonal railway from 2003 to 2021 has been analysed to find out the best performing zone on the basis of operating efficiency.

4.1 Various Zones if Indian Railways

The nine older railway zones were:

- Northern Railway (NR) North Eastern Railway (NER)
- Northeast Frontier Railway (NFR, sometimes NEFR)
- Western Railway (WR) Southern Railway (SR)
- South Central Railway (SCR) South Eastern Railway (SER)
- Eastern Railway (ER) Central Railway (CR)

The eight newer zones are:

- South Western Railway (SWR) , North Western Railway (NWR)
- West Central Railway (WCR), North Central Railway (NCR)
- South East Central Railway (SECR), East Coast Railway (ECoR)
- East Central Railway (ECR) Kolkata Metro

4.2 Analysis of Operating Ratio

Since this change happed after 2003 onwards, there is a need to analyse the performance of zonal railways after 2003. In terms of Operating ratio, the OR of zonal Railways from 2003-04 onwards is mentioned in table 4.1 for all railways except metro railway Kolkata.

Table 4.1 Operating ratio of Zonal Railways-I.

Year	Central (CR)	Eastern (ER)	East Central (ECR)	East Coast (ECoR)	Northern (NR)	North Central (NCR)	North Eastern (NER)	North Frontier (NFR)
2003-04	80.29	161.3	93.65	66.64	91.08	76.33	151.93	147.98
2004-05	82.48	152.84	98.9	61.75	92.89	66.71	160.88	159.45
2005-06	84.82	145.42	82.89	54.01	83.93	61.06	144.72	128.85
2006-07	79.34	150.53	85.23	53.03	88.32	58.22	132.64	108.07
2007-08	75.92	143.61	87.46	48.22	92.42	53.44	131.74	119.89
2008-09	97.64	173.45	99.48	49.3	115.57	60.59	197.32	199.08
2009-10	106.47	186.25	107.94	48.25	112.7	61.55	216.19	178.03
2010-11	107.31	178.52	109.06	42.82	111.96	63.12	201.78	207.29
2011-12	105.68	182.1	103.58	44.68	121.25	61.81	202.06	184.74
2012-13	97.82	178.86	92.19	44.5	113.3	59.68	200.01	190.37
2013-14	100.23	176.76	99.58	48.34	110.27	64.04	207.49	206.01
2014-15	101.85	177.27	95.24	51.55	117.72	64.13	193.47	193.83
2015-16	98.13	180.56	90.28	50.53	115.09	61.98	196.52	172.11
2016-17	105	165.27	101.83	53.78	119.45	70.5	197.01	211.09
2017-18	111.1	181.3	97.5	51.98	116.9	66.9	201.8	199.73
2018-19	105.44	185.98	98.46	52.39	132.18	204.55	192.6	94.15
2019-20	104.67	169.75	102.37	51.49	155.25	74.38	188.17	189.82
2020-21	126.24	175.29	88.58	47.34	154.34	79.22	202.99	193.27

(Source: Indian Railway Year Books, from 2003 to 2021)

Table 4.2: Operating ratio of Zonal Railways-II

Year	North Western (NWR)	Southern (SR)	South Central (SCR)	South Eastern (SER)	South East Central (SECR)	South Western (SWR)	Western (WR)	West Central (WCR)
2003-04	106.26	118.55	85.72	81.24	62.8	91.35	93.21	80.99
2004-05	104.98	120.79	83.62	83.51	56.1	86.15	90.85	84.08
2005-06	91.78	114.46	79.7	67.54	49.97	80.97	85.11	82.67
2006-07	86.91	105.85	71.83	58.39	47.2	74	79.2	67.8
2007-08	88.65	105.07	66.99	53.84	45.74	69.24	76.91	66.33
2008-09	122.2	126.06	77.23	62.24	53.23	77.11	93.25	73.95
2009-10	108.88	137.47	80.66	69.18	60.43	88.42	97.9	74.07
2010-11	104.48	135.55	85.76	66.98	58.01	98.69	97.96	74.94
2011-12	98.13	122.58	85.9	72.74	55.24	109.01	94.6	70.13
2012-13	87.1	130.59	79.63	70.5	49.14	104.85	89.84	68.18
2013-14	96.52	132.18	84.13	72.54	52.53	115.41	91.74	71.06
2014-15	88.35	128.98	76.03	73.62	50.83	98.72	86.51	63.56
2015-16	88.05	134.89	78.71	71.15	50.52	102.6	88.72	64.38
2016-17	104.2	147.83	86.24	73.46	56.24	119.56	103	73.9
2017-18	108.62	161.2	82.94	75.9	55.8	129.5	107.9	74.9
2018-19	89.71	152.62	79.54	73.08	56.24	132	102.1	67.83
2019-20	114.6	146.46	87.55	64.86	53.66	124.37	114.9	70.6
2020-21	110.15	218.65	101.23	57.31	46.07	137.68	128.3	68.03

(Source: Indian Railway Year Books, from 2003 to 2021)

As we have discussed earlier that Operating Ratio is:

the ratio of **Total Working expenses** (excl. suspense but incl. Appropriation to Depreciation Reserve Fund (DRF) and Pension Fund) to Gross traffic earnings expressed in percentage and is worked out by the following formula: -

Total Working expenses (excl. suspense but incl. Appro To DRF & pension fund)

Gross traffic earnings

If we calculate the average of operating ratio for the period from 2003-04 to 2020-21 we will find the average OR of the Zonal Railways as mentioned below in table 4.3:

Table 4.3 Average operating ratio of Zonal Railways.

Zonal Railway	Average OR	Zonal Railway	Average OR
Central (CR)	98.36	North Western (NWR)	99.98
Eastern (ER)	170.28	Southern (SR)	135.54
East Central (ECR)	96.35	South Central (SCR)	81.86
East Coast (ECoR)	51.14	South Eastern (SER)	69.34
Northern(NR)	113.59	South East Central (SECR)	53.32
North Central(NCR)	72.68	South Western (SWR)	102.20
North Eastern (NER)	184.41	Western (WR)	95.67
North Frontier (NFR)	171.32	West Central (WCR)	72.08

(Source: Indian Railway Year Books, from 2003 to 2021)

Out of the 16 zonal railways, East Coast Railway (ECoR) is the best railway in terms of average operating ratio, which is 51.14% for the period from 2003-04 to 2020-21(Table 4.3). Apart from this, North Eastern Railway is the worst performing railway in terms of average operating ratio (Table 4.3). The average operating ratio of NER for the period from 2003-04 to 2020-21 is pegged at 184.41% (Table 4.3). We can see the average operating ratio of different zonal railways in fig 4.1.

Ranking of Zonal Railways in terms of average operating ratio is depicted in table 4.4. If we see fig 4.2, the yearly variation of operating ratio of East Coast Railway we find that year on year the OR of ECoR has improved and even remained below 50% in 2020-21.

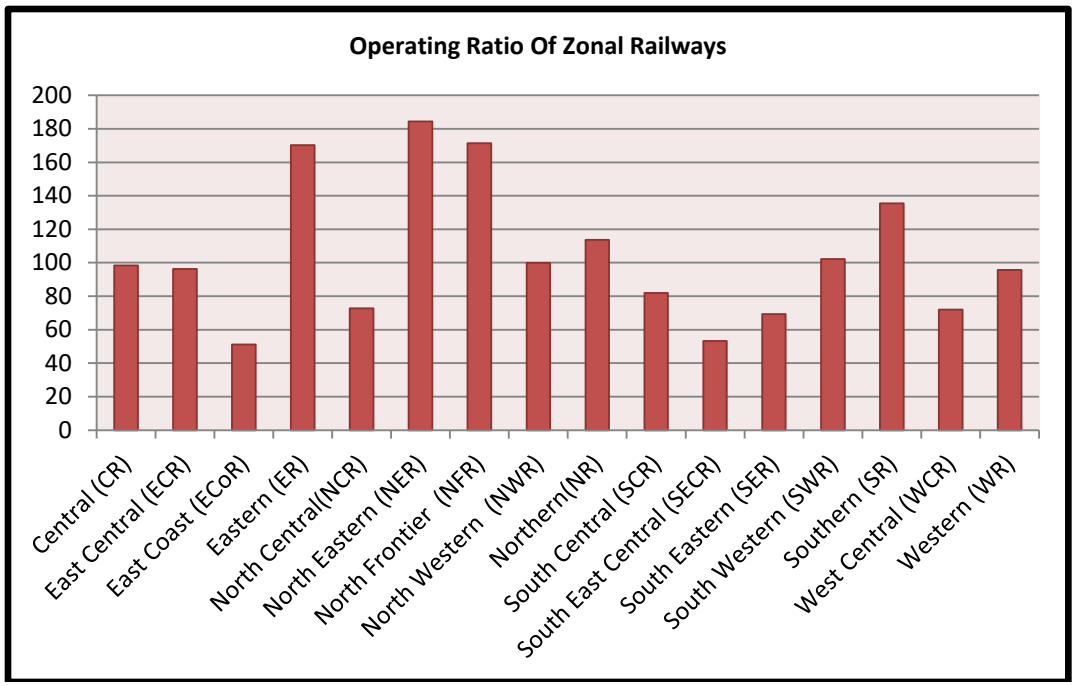

Figure 4.1: Operating ratio of zonal railways. (Source: Indian Railway Year Books, from 2003 to 2021)

Table 4.4 Ranking of Zonal Railways.

Rank	Zonal Railway	Average OR	Rank	Zonal Railway	Average OR
1	East Coast (ECoR)	51.14	9	Central (CR)	98.36
2	South East Central (SECR)	53.32	10	North Western (NWR)	99.98
3	South Eastern (SER)	69.34	11	South Western (SWR)	102.20
4	West Central (WCR)	72.08	12	Northern(NR)	113.59
5	North Central(NCR)	72.68	13	Southern (SR)	135.54
6	South Central (SCR)	81.86	14	Eastern (ER)	170.28
7	Western (WR)	95.67	15	North Frontier (NFR)	171.32
8	East Central (ECR)	96.35	16	North Eastern (NER)	184.41

(Source: Indian Railway Year Books, from 2003 to 2021)

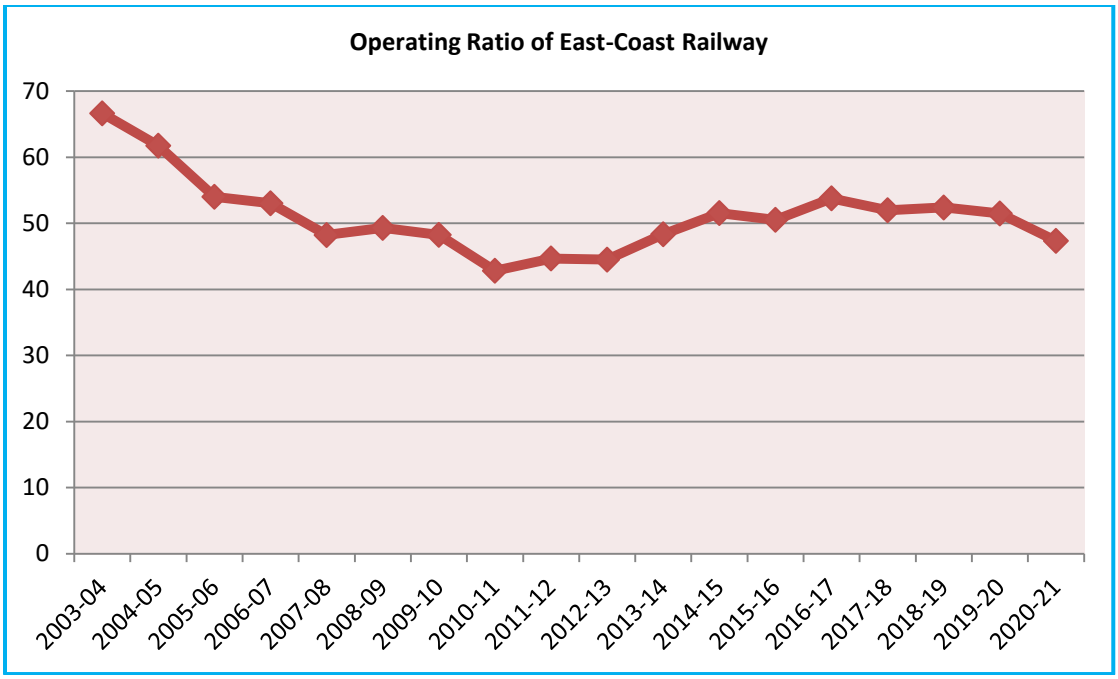

Figure 4.2: Operating ratio of East Coast Railway. (Source: Indian Railway Year Books, from 2003 to 2021)

Chapter 5

Challenges And Opportunities of Indian Railways

5.0 Introduction

Being one of the biggest government organisations in the world and in India itself, Indian Railway has not only many challenges but also ample opportunities for development. The major challenge is high operating ratio. Over the years the operating ratio has remained on the higher side which is almost close to 100%. But at the end of year 2022 it has gone beyond 100% and was at 107.39%, .It is now becoming one of the major challenge for Indian Railway. The other major challenge is maintaining and ensuring the productivity of its huge work force. Apart from this, Indian Railways consumes huge amount of energy for different sectors like traction and general uses, it is also a cause of concern. Since India is moving towards more sustainable development goals, it is a great challenge to reduce the consumption of fossil fuels and move towards more green sources. Apart from this, Indian Railway has to play dual roles in transportation sector.

Apart from these challenges, there are many areas where Railways can contribute to Indian economic and social development. The railway can work as a major growth engine for Indian economy. Apart from transporting people and materials from one place to another, it can make a major contribution to GDP through employment, tourism, infrastructure development and social development. Another area where a lot of opportunities exist for railway is digitalisation. In the new era, railways can optimise its system by using IT systems. Modern systems can be used in predictive maintenance, real time analytics, safety, enhancing passenger experience etc. Lot of possibilities exist for railways for exploring in green energy area and reducing its carbon footprint. Apart from this, improvements can be done in freight loading.

5.1 Challenges

5.1.1 High Operating Ratio

The Indian Railways is the fourth-largest railway network in the world and serves as a lifeline for the country's economy. With its extensive network, the Indian Railways has been able to connect even the remotest parts of the country to the rest of the world. However, despite its impressive reach, the Indian Railways has been plagued with a high operating ratio, which has become a significant concern for policymakers and stakeholders.

In the case of the Indian Railways, the operating ratio has been persistently high for several years. In 2021-22, the operating ratio was 107.39%, which means that the Indian Railways spent Rs. 107.39 for every Rs. 100 it earned. This indicates that the Indian Railways was operating at a loss and was not generating enough revenue to cover its expenses.

The high operating ratio of the Indian Railways can be attributed to several factors. One of the primary reasons is the low fare structure. The fares for the Indian Railways have not been increased in many years, which has led to a decline in revenue. Additionally, the Indian Railways has to provide concessions and subsidies to various categories of passengers which further reduce its revenue.

Another significant factor contributing to the high operating ratio is the high operational cost of the Indian Railways. The organization has to bear the cost of maintaining and upgrading its vast network of tracks, stations, and trains. Huge workforce adds to its operational costs. For example, if we see table 3.9, we find that on

an average the total cost on repair and maintenance is 35% of total ordinary working expenses while operating cost is 49%.

The high operating ratio of the Indian Railways has several implications. It means that the organization is not generating enough revenue to cover its expenses, which is not sustainable in the long run. The Indian Railways has to rely on loans and grants from the government to finance its operations, which puts a strain on the country's finances. Additionally, the high operating ratio has led to a decline in the quality of services provided by the Indian Railways, which has resulted in dissatisfaction among passengers.

To address the issue of the high operating ratio, the Indian Railways needs to take several measures. One of the primary steps is to increase the fares for its services. This would increase the revenue generated by the Indian Railways and help it cover its expenses. The organization could also explore alternative sources of revenue, such as advertising and commercializing its assets.

The Indian Railways also needs to focus on reducing its operational costs. The organization should explore ways to optimize its operations and reduce its workforce to cut down on its expenses. The Indian Railways should also invest in technology and modernize its infrastructure to improve the efficiency of its operations.

In conclusion, the high operating ratio of the Indian Railways is a cause for concern, and it requires urgent attention from policymakers and stakeholders. The Indian Railways needs to take several measures to address the issue, such as increasing fares, exploring alternative sources of revenue, and reducing its operational costs. By taking these steps, the Indian Railways can improve its financial health and provide better services to its passengers.

5.1.2 Maintaining productivity of Staff

Staff productivity is an essential aspect of any organization. It refers to the amount of work done by an employee in a specific period. The higher the productivity better the performance of an organization. However, staff productivity challenges have become a significant concern for organizations, and they need to address them to remain competitive.

As such IR has 1,21,300 total employees as of 2021-22 from summary sheet of 2021-2022.It is important to effectively utilize these staff by properly training them and monitoring them. There are different aspects which may lead to improved staff productivity. Some of them are listed below:-

One of the main challenges in staff productivity is the lack of motivation. Employees who are not motivated are less likely to work hard, which affects their productivity. To overcome this challenge, organizations need to provide their employees with a supportive work environment, opportunities for career development, and fair compensation. It will be good if some survey etc can be done for checking the level of motivation in employees and corrective measures can be taken.

Another challenge in staff productivity is poor time management. Organizations can help their employees improve their time management skills by providing them with training and tools such as project management software.

Communication is also a critical factor in staff productivity. Employees who do not communicate effectively are less likely to work efficiently. Effective communication involves clear instructions, active listening, and feedback. Organizations need to provide their employees with communication training to improve their productivity.

Technology can also pose a challenge to staff productivity. While technology has made work more accessible and efficient, it can also be a source of distraction. Social media, email, and other online platforms can distract employees from their work, reducing their productivity. IR may try to inculcate the use of latest technology like AI, ML etc to enhance staff productivity.

Lastly, a lack of skills and knowledge can be a significant challenge to staff productivity. Employees who lack the necessary skills and knowledge are less likely to perform well, affecting their productivity. Audit can be done to check the level of technical abilities required vis-a-vis staff possessing those requirements. IR can overcome this challenge by providing their employees with training and development programs to enhance their skills and knowledge.

In conclusion, staff productivity challenges are a significant concern for IR, and it needs to be addressed to remain competitive. The challenges include lack of motivation, poor time management, poor communication, technology, and lack of skills and knowledge. To overcome these challenges, IR needs to provide their employees with training and development programs to enhance their skills and knowledge. By addressing these challenges, IR can improve their productivity and remain competitive in today's business environment.

5.1.3 Energy Consumption

The Indian Railways is the largest rail network in Asia and the second-largest in the world, covering over 67,000 km of track and carrying millions of passengers and tons of freight every day. As a result, the energy consumption of the Indian Railways is significant and has become a concern for policymakers and stakeholders.

The Indian Railways is one of the largest energy consumers in India, accounting for around 2% of the country's total energy consumption. The primary source of energy for the Indian Railways is diesel and electricity, which is used to power its locomotives. The organization also uses electricity for its signaling and other infrastructure needs.

Indian Railways (IR) is an Indian state-owned enterprise, operated by the Government of The Indian Railways consumes over 20 billion kWh (As per IR Annual Environmental Sustainability Report 2018-19) of electricity annually, which is around 2% of the country's total power consumption, in addition to primary energy usage, mainly in the form of diesel. Indian Railways consumes approximately 2.5 Billion units of electricity for non-traction usage, spending about INR 1,700 crores per annum.

The high energy consumption of the Indian Railways has several implications. It contributes significantly to the organization's operating costs, which affects its financial health. The use of diesel also has an adverse impact on the environment, as it emits greenhouse gases and other pollutants that contribute to climate change and air pollution.

5.1.4 Catering to public service obligation simultaneously with commercial interests

The Indian Railways is a massive organization that serves both public service obligations and commercial interests. It is a vital part of India's transportation infrastructure, providing affordable and accessible transport services to millions of passengers and businesses across the country. The organization faces a unique challenge of balancing its public service obligations with its commercial interests to remain financially viable and continue providing quality services.

Passenger Services: The Indian Railways is primarily a passenger transport service, serving both long and short distances across the country. The organization has a public service obligation to provide affordable and accessible transport services to the public. To cater to this obligation, Indian Railways offers different classes of travel, including the general class, sleeper class, and air-conditioned coaches, to suit different budgetary needs.

Freight Services: Indian Railways also serves commercial interests by transporting goods and raw materials across the country. The organization's freight services are essential for businesses that rely on the rail network to transport their products to different parts of the country. The organization has a public service obligation to provide reliable and cost-effective freight services, which it achieves by offering competitive rates and value-added services such as parcel services and container services.

Modernization: Indian Railways has invested significantly in modernizing its infrastructure and rolling stock, which benefits both its public service obligation and commercial interests. The organization has introduced new technology, such as the use of GPS to track trains and the installation of automated signaling systems to improve safety and reliability. The introduction of high-speed trains, such as the Gatimaan Express, improves the quality of passenger services and supports commercial interests by reducing travel times.

Corporate Social Responsibility: Indian Railways is also committed to social responsibility, which supports its public service obligation. The organization has initiated several social welfare programs such as providing safe drinking water, building schools, and donating to disaster relief funds, to support local communities. These programs not

only help the public but also help create a positive image for the organization, which benefits its commercial interests.

5.1.5 Safety

Safety concerns are a significant challenge faced by the Indian Railways, which is one of the largest railway networks in the world. Despite being one of the safest modes of transportation in India, the Indian Railways still faces several safety concerns that affect its passengers, staff, and infrastructure.

Train Accidents: Train accidents, such as derailments, collisions, and other mishaps, pose a significant safety risk to passengers and staff. These accidents can be caused by a variety of factors, such as equipment failure, track defects, human error, and natural disasters.

Level Crossing Accidents: Level crossing accidents, where vehicles or pedestrians are struck by trains, are another safety concern for the Indian Railways. These accidents can be caused by inadequate safety measures, driver or pedestrian error, and insufficient visibility.

Fire Accidents: Fire accidents can occur on trains or in stations, leading to injury, loss of life, and damage to infrastructure. These accidents can be caused by electrical faults, equipment failure, and other factors.

Security Concerns: Security concerns, such as theft, vandalism, and terrorism, pose a significant safety risk to passengers and staff. The Indian Railways needs to ensure that its stations and trains are secure and that its staff is trained to handle security-related incidents.

Overcrowding: Overcrowding on trains and stations is a safety concern for the railways. It can lead to accidents, stampedes, and other incidents that put passengers at risk.

Natural Disasters: Natural disasters, such as floods, landslides, and earthquakes, can damage the infrastructure of the Indian Railways, leading to accidents and service disruptions.

In conclusion, safety concerns are a significant challenge faced by the Indian Railways, which is one of the largest railway networks in the world. The organization needs to ensure that its infrastructure and operations are safe for its passengers and staff. It must continue to invest in modern technology, equipment, and training to improve safety and address the challenges posed by natural disasters, security concerns, and overcrowding.

5.2 Opportunities

5.2.1 Growth Engine for Indian economy

Indian Railways has been a key contributor to the growth of the Indian economy, and has the potential to continue to be a growth engine in the future. Here are some ways in which Indian Railways can drive economic growth:

i. **Transportation of Goods**: Indian Railways is a major transporter of goods in the country. The efficient movement of goods is vital for the growth of industries and businesses, and Indian Railways plays a critical role in this. By providing affordable and reliable freight transportation services, Indian Railways can help to reduce transportation costs and improve supply chain efficiency.

ii. **Employment Generation**: Indian Railways is one of the largest employers in the country, providing jobs to a large number of people. The expansion and modernization of Indian Railways can generate new employment opportunities, both directly and indirectly.

iii. **Tourism:** Indian Railways plays an important role in promoting tourism in the country. By offering special tourist trains and improving the passenger experience, Indian Railways can attract more tourists, which can have a positive impact on the tourism industry.

iv. **Infrastructure Development:** Indian Railways can invest in infrastructure development, which can have a multiplier effect on the economy. The development of new railway lines, stations, and modernization of existing infrastructure can lead to the growth of other industries, such as real estate and construction.

v. **Social Development:** Indian Railways also plays an important role in the social development of the country. By providing affordable and accessible transportation services to people from all walks of life, Indian Railways can help to reduce economic disparities and promote social inclusion.

In summary, Indian Railways can be a growth engine for the Indian economy by providing efficient transportation services, generating employment opportunities, promoting tourism, investing in infrastructure development, and contributing to social development.

5.2.2 Digitalization

Indian Railways can leverage digital technologies to improve the customer experience and increase efficiency. This can include using artificial intelligence (AI), machine learning (ML) and data science for business decisions. These technologies can be used in the railway industry to improve operations, safety, and the passenger experience. They can be used in predictive maintenance thus saving time, cost and wastage of resources by avoiding breakdown. Real time data analytics such as train speeds, passenger volumes, and weather conditions can be used for enhancing operational efficiency and optimizing train operation. New technologies can also help in improving safety by identifying potential hazards thus avoiding accidents. Immense opportunities are there for railways to explore this area. Improving the passenger experience is another field in which new technologies can help. For example, AI-powered chat-bots can answer passenger inquiries and provide real-time information on train schedules and delays. Artificial intelligence (AI) is increasingly being used in the railway industry to improve operations, safety, and the passenger experience. Here are some ways AI is being used in railways:

i. **Predictive Maintenance:** AI can help to predict when equipment, such as locomotives, track switches, and signals, are likely to fail. By monitoring sensor data and using machine learning algorithms, AI can identify patterns and anomalies that indicate impending failures. This enables maintenance crews to schedule repairs and replacements before a breakdown occurs, reducing delays and improving safety.

ii. **Real-Time Analytics:** AI can also help railways to monitor real-time data, such as train speeds, passenger volumes, and weather conditions, to optimize operations. By using AI algorithms to analyze this data, railways can identify

bottlenecks and optimize routes, which can improve the overall efficiency of the system.

iii. **Safety:** AI & ML can help railways to improve safety by identifying potential hazards and alerting operators. For example, AI can be used to detect objects on the track or monitor for signs of driver fatigue.

iv. **Passenger Experience:** AI can also be used to improve the passenger experience. For example, AI-powered chat-bots can answer passenger inquiries and provide real-time information on train schedules and delays. AI can also be used to analyze passenger feedback and identify areas where improvements can be made.

v. **Automated Train Control:** AI & ML can be used to automate train control, reducing the need for human operators. By using AI to monitor train speeds and locations, trains can be automatically controlled to ensure optimal performance and safety.

Overall, AI and ML have the potential to revolutionize the railway industry, improving efficiency, safety, and the passenger experience. As AI technology continues to develop, we can expect to see more widespread adoption of AI in railways.

5.2.3 Green Energy: India's railway system is one of the largest in the world, and it is also one of the largest consumers of energy in the country. Indian Railways can invest in renewable energy sources to power their operations and reduce their carbon footprint. This can include solar power for stations and trains, as well as energy-efficient lighting and cooling systems. Solar Power: Indian Railways has set a target of installing 20 GW of solar power capacity by 2030. So far, it has installed solar panels on the rooftops of railway stations, railway offices, and other railway buildings. In addition, Indian

Railways has also set up solar power plants on unused land and along railway tracks. But still lot of opportunities exists for tapping the solar power in Indian Railways. Apart from this there are immense opportunities in tapping the wind power. Indian Railways can also explore the use of biofuels such as biodiesel and bioethanol. It can help to reduce carbon emissions. Apart from this in the area of saving energy LED lights, regenerative braking systems, and energy-efficient motors in trains can be optimized to reduce energy consumption.

5.2.4 Freight Loading Improvements:

Indian Railways has immense opportunities for businesses and industries across the country for enhancing transportation of freight. Here are some of the ways in which businesses can take advantage of Indian Railways' freight services. Indian Railways can expand in multiple fronts like parcel services, particularly for e-commerce and small industries. Great opportunities exist in container traffic for businesses that need to transport large quantities of goods. This service is particularly useful for industries such as automobiles, steel, cement, and other heavy industries. Transportation can increase by innovative methods like rake sharing, special parcel trains and tapping automobile traffic.

(i) **Less than Container Load (LCL):** For businesses that do not require a full container, Indian Railways also offers LCL services. This allows businesses to share a container with other businesses, reducing transportation costs.

(ii) **Special Parcel Train**: Indian Railways operates special parcel trains for businesses that need to transport perishable goods such as fruits, vegetables, and other food products. These trains have refrigerated compartments to ensure that the goods remain fresh during transportation.

(iii) **Open Wagon**: Indian Railways also offers open wagon services for businesses that need to transport bulk goods such as coal, iron ore, and other raw materials.

Overall, Indian Railways offers a wide range of freight loading opportunities for businesses across various industries. By leveraging these services, businesses can reduce transportation costs and improve their supply chain efficiency.

Chapter 6

Conclusion And Recommendations

6.0 Introduction

Indian Railways is the lifeline of India, a statutory body under the ownership of Ministry of Railways, Government of India. With a modest beginning from first train from Boribunder (Bombay) to Thane on 16th April 1853, Indian Railways has grown to be the fourth largest international network in the world which managing total 1,26,611 track kilometres, 68,103 route kilometres, carried 1250 million passengers, transported 1,233 million tonnes of goods and merchandise in 2020-2021. It ran 2,140 passenger trains and 8,021 goods trains daily and employed 1.25 million employees. (Indian Railway Year Book 2020-2021).

It is empire within an empire. Only United States, China, and Russia have longer railway routes in kilometres than India. It is the only government agency in India that fully covers salaries, pensions, and benefits for its entire staff through its own resources.

Railway is the preferred modes of transportation and acts as an integrating force, is cost effective, has less impact on environment, efficient than road transport and capable of hauling large loads.

6.1 Conclusion

Operating ratio (OR) is used to measure the operational efficiency of any organisation. The operating ratio is the amount spent to earn every 100 rupees. The lower it is the better. Higher the operating ratio, lower the financial resources available for expansion and growth.

The OR of the Indian Railways was analysed from different yearbooks and other data published by Ministry of Railways from 2000-01 to 2020-21 and it was found that the

over time it has deteriorated drastically. For last five years it increased and remained more than 97%.

Starting from peak of 98.34 in year 2000-2001 operating ratio started declining till 2007-2008 and came to 75.94, but after 2007-2008 again it started rising steadily remaining above 90. In recent years it has remained on higher side and more than 95. In 2016-17 it was 96.5, 2017-18 it came to 98.8, again in 2018-19 it declined slightly to 97.3 but again rose to 98.4, in F.Y. 2020-2021 it was 97.45. In recently released year book by railways for year 2021-22 the OR has reached 107.39.

Operating ratio is the ratio of Total working expenses (excl. suspense but incl. Appropriation to Depreciation Reserve Fund (DRF) and Pension Fund) to Gross traffic earnings expressed in percentage. Total working expenses is the sum of total ordinary working expenses, Appropriation to DRF and Appropriation to Pension Fund. Total Working expenses can be grouped under five major groups. These five major groups are General Superintendence of service on Railways (Demand No. 3), Repairs & Maintenance(Demand No.4,5,6,7), Operation (Demand No. 8,9,10), Staff Welfare, Retirements benefits & misc(Demand No.11,12,13) and Railway Funds (Demand No.14). The expenditure on various demand heads were analysed and was found that cost on staff is the highest and it consists more than 50% of total ordinary expenses. On analyzing the trend of total ordinary working expenses, Appropriation to DRF and Appropriation to Pension Fund, it was found that while the total ordinary working expense has increased over time, appropriation to DRF and appropriation to Pension Fund has decreased. After that it was found that demand No.10 and Demand No. 9 are next big contributor to the operating cost. Demand no. 10 is Operating Expenses-Fuel and Demand No. 9 is

Operating Expenses-traffic. On an average Operating cost of Fuel is 23% of the total operating cost. Hence it is important to concentrate on this area.

The revenue of railways comes from freight transportation; passenger services, other coaching earnings and sundry earnings. Majority of earnings come from freight earnings and next is passenger earnings. As far as revenue generation is considered, it was seen that it has risen consistently from 2000-01 onwards but decreased after 2018-19. From year 2000-01 to 2020-21, on an average goods earning was 67 % to total gross traffic earnings. Coal is the major commodity of freight basket and constitutes on an average 46% of the total freight loading. Freight loading of coal has increased year on year, and railway has transported more and more coal. But there is slight decline in 2018-19 onwards and in subsequent years. In 2018-19 it was 605.84 million tonnes which reduced to 586.87 million tonnes and then subsequently it further went down to 541.82 million tonnes. Next to coal, Iron ore is next major commodity railway is transporting which is constitutes 13.41% of total loading. After that comes cement loading with 10.13% and other commodities with 8.47%.

In case of passenger earnings, it constitutes about 27% of total earnings and in recent years its growth has stagnated. Passenger services of the Indian Railways are available on both Suburban and Non suburban sections. Non suburban traffic is the primary contributor to the passenger earnings. On passenger originating basis 57% passenger are suburban passengers but revenue wise suburban passengers constitute only around 7% of total earnings. While 80% passenger kilometres are travelled by non suburban passengers. Lead represents the average distance each passenger is transported. Average lead of suburban traffic was 32.2 KMs and for non urban passengers average

lead was 254 KMs. Average rate per passenger per kilometer is the rate at which a passenger is charged for travelling for one kilometer. Average rate has increased from approx 22.9 paise per passenger per kilometres to 65.97 paise per passenger per kilometres. On analyzing the performance of different zonal railways in terms of operating ratio we find that East Coast railway is the best performing railway which has maintained an average OR of 51.14% for the period from 2003-04 to 2020-21. While the worst performing railway in terms of average operating ratio is NER for the period from 2003-04 to 2020-21 is pegged at 184.41%

6.2 Recommendations

1. Review of Staff Cost:-

Staff cost is the highest of the revenue expenditure incurred by the Indian Railway. It is about 50 percent of the total expenditure. That's why, it becomes necessary to keep an eye on this expenditure. A committee may be constituted by the Railways to review and reduce the expenditure on staff. Staff productivity is the key now; therefore, Railways should develop such a system which helps in increasing the productivity of the employees. There is a need for up-skilling, multi-skilling. There should be an emphasis on technology adoption. New technology can be used to do many jobs people were doing earlier.

2. Measurement of staff effectiveness: Measurement of staff effectiveness needs to be done on priority basis. A new system can be developed that links employee performance directly to revenue generation. Based on this effectiveness, the employees should be closely monitored and appropriate action taken.

3. Deployment of staff in revenue generating area: Freight sector is the most important sector and generates maximum revenue hence manpower and human resources can be deployed in this sector so as to achieve maximum productivity.

4. Up skilling of Staff: Indian Railways should invest more in enhancing the skills of its employees. Thus it will help in increasing the productivity of the system. Today's world is changing rapidly and technology is advancing rapidly. It is necessary to stay updated in every field.

5. Use of Advanced Technology: Use of advanced technologies like Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), Data Science etc. in day to day operations and other tasks should be explored. Artificial intelligence (AI), machine learning (ML), and data science have a wide range of applications in railways. Some examples are:

Predictive Maintenance: Railway systems require regular maintenance to ensure smooth operations and avoid accidents. AI and ML can help analyze data from sensors and other sources to predict when maintenance is needed, allowing timely repairs and replacements.

Safety and Security: AI and ML can be used to monitor train movements and identify potential safety hazards. Data Science can help detect anomalies and flag them for further investigation, while AI can be used to analyze CCTV footage to identify potential security risks. It can also be used to check rolling in-rolling out examinations.

Passenger Experience: AI and ML can be used to personalize the passenger experience by analyzing data on their travel history and preferences. This information can be used to provide customized recommendations and services, such as seat upgrades or

meal choices.

Traffic Management: AI and ML can be used to optimize train schedules and routes, reducing congestion and improving efficiency. These technologies can also help predict delays and adjust schedules accordingly, improving overall system performance.

Asset Management: Data Science can help manage railway assets, such as rolling stock and tracks, by analyzing data on their usage and performance. This information can be used to optimize asset usage and reduce maintenance costs. Overall, the use of AI, ML, and Data Science in railways can help improve safety, efficiency, and customer satisfaction while reducing costs and improving asset management.

6. Investment in Research and Development (R&D):

Research and Development (R&D) is a crucial component of innovation and economic growth. Indian railway must invest more in Research and Development (R&D) activities and collaborating with top educational and academic institutions in Railway Research. R&D is important in:

Innovation: R&D is essential for the development of new products, services, technologies and maintenance regimes etc. It will enable Indian Railway to innovate and stay ahead of its competitors by creating new, improved and effective transport services that meet changing customer needs.

Growth: R&D is a key driver of economic growth and development not only of the Railways but also of the nation as a whole. By creating new products, services, and technologies, R&D can stimulate the Railways which can improve operating ratio in the long run which can boost economic activity.

Improved efficiency: R&D can help Indian Railway to identify and implement

more efficient production processes, reduce waste and costs, and improve productivity. **Improved quality:** R&D can help improve the quality of transportation and reduce claims and wastages which can enhance customer satisfaction and loyalty.

7. Controlling operating expenses in fuel:

Expenses in fuel consists on an average 23% of the total operating expenses, hence it is important to control and explore the other modes of fuel sources. It is also important the existing systems to be smart to save cost on fuel. Railways can achieve fuel cost savings in a number of ways, including: Energy-efficient trains: Indian Railways should invest more in energy-efficient trains that consume less fuel per passenger or freight ton transported. This is one of those areas where more and more expenditure is required in R&D.

Optimized speed and acceleration: Adjusting train speed and acceleration to the optimal levels can also save fuel. Fast speed and rapid acceleration consume more fuel, so optimizing train speed and acceleration can help reduce fuel consumption. Loco pilots should be trained more in this regard so that they can run trains at optimum level.

Route optimization: Planning the most efficient routes for trains can also reduce fuel consumption. By avoiding hilly or windy terrain, trains can run more efficiently and consume less fuel.

In addition to these measures, Indian railways can invest more in alternative fuels such as biodiesel, fuel cell propelled trains etc. These alternative fuels can be more expensive initially, but they can lead to long-term fuel cost savings and reduced emissions.

8. Reviewing the fare of Sub-Urban Traffic

As far as the total passengers carried is concerned, the suburban traffic accounts for 57% of the total passenger traffic. But suburban traffic accounts for only 7% of total passenger earnings. Therefore, one way to increase revenue is that Indian Railways can explore the possibility of increasing the fare of sub-urban traffic.

References:

Agarwal, R.(2008). Public Transportation and Customer Satisfaction: The Case of Indian Railways. *Global Business Review*. 9(2), 257-272.

Akram, H.,Ahmad, A., & Sanyal, S. (2022). An analysis of performance of Indian railways. International Journal of Logistics Systems and Management.

Alivelu,G.(2010). Salient Aspects of the growth story of Indian Railways 1981-82 through 2007-08, Centre for Economic and Social Studies. Working Paper No.86.

Bhanot, Neeraj & Singh, Harwinder. (2014). Benchmarking the Performance Indicators of Indian Railway Container Business using Data Envelopment Analysis. Benchmarking An International Journal. 21. 10.1108/BIJ-05-2012-0031.

Bhatia, V., & Sharma, S. (2021). Expense based performance analysis and resource rationalization: Case of Indian Railways. Socio-Economic Planning Sciences, 76, 100975. https://doi.org/10.1016/j.seps.2020.100975

Bouraima, M. B., Alimo, P. K., Agyeman, S., Sumo, P. D., Lartey-Young, G., Ehebrecht, D., & Qiu, Y. (2023). Africa's railway renaissance and sustainability: Current knowledge, challenges, and prospects. Journal of Transport Geography, 106, 103487. https://doi.org/10.1016/j.jtrangeo.2022.103487

Bulková, Z., Gašparík, J., Mašek, J., & Zitrický, V. (2022). Analytical Procedures for the Evaluation of Infrastructural Measures for Increasing the Capacity of Railway Lines. *Sustainability*, *14*(21), 14430. https://doi.org/10.3390/su142114430

Department of Expenditure. (2022). Annual Report on Pay and Allowances for the Year 2020-21.Department of Expenditure, Govt of India.(https://doe.gov.in/annual-report-pay-and-allowances)(Accessed 17 March. 2023).

Debroy B. (2022). A 5 point Reform Template for Indian Railways.[Online]. https://economictimes.indiatimes.com/industry/transportation/railways/a-5-point-reform-template-for-indian-railways/articleshow/89208095.cms. (Accessed 17 March. 2023).

Deshpande, A., & Weisskopf, T. E. (2014). Does Affirmative Action Reduce Productivity? A Case Study of the Indian Railways. World Development, 64, 169–180. https://doi.org/10.1016/j.worlddev.2014.05.024

Dhameja, N. L., Dhameja., M.(2020). Indian Railways Restructuring: Private Sector Involvement, A Beginning. Indian Journal of Public Administration. 66(4),492-512

Dibru-Sadiya Railway – FIBIS-wiki. (n.d.). https://wiki.fibis.org/w/Dibru-Sadiya_Railway (Accessed 14 March. 2023).

Gandhi, N., Kant, R., & Thakkar, J. (2022). Sustainable performance assessment of rail freight transportation using triple bottom line approach: An application to Indian Railways. *Transport Policy*, *128*, 254–273. https://doi.org/10.1016/j.tranpol.2022.08.023

George, S. A. and Rangaraj, N. (2008). "A performance benchmarking study of Indian Railway zones".*Benchmarking: An International Journal*,15(5),599-617.

Gupta R. P. (2022) Reduce logistics cost via Railway Reforms. [Online]. https://www.dailypioneer.com/2022/columnists/reduce-logistics-cost-via-railway-reforms.html. (Accessed 17 March 2023).

Indian Railways Administration & Finance. (n.d.) https://indianrailways.gov.in/railwayboard/uploads/codesmanual/ADMIN_FINANCE/AdminFinanceCh1_Data.htm (Accessed 17 March 2023).

Indian Railways Act 1989. (n.d.). https://indianrailways.gov.in/railwayboard/uploads/codesmanual/Railway_Act.PDF (Accessed 17 March 2023).

Indian Railway. (2021). Year Book 2020-2021.

Indian Railways. (2013). Corrigendum Year Book 2011-12. Page 8.

Indian Railway.(2022).Expenditure Profile 2022-2023 statement 1

Indian Railway. (2022).Statistical summary-Indian Railways.

Indian Railway. 2021. Annual Statistical Statement 2020-2021.

Jha, U.S., (2018). Indian Railways Contribution to Indian Economy. SANKALPA: Journal of Management and Research.8 (1).122-130.

Kasinath,S. (2015). Performance Analysis Of Indian Railways (1950–51 And 2013–14). Journal of Commerce and Management Thought. 6. 693.

Kaur M., & Mehra A. (2017). Inter-Zonal Variations in the Growth Story of Indian Railways. Amity Journal of Strategic Management, 1(1), pp. 38–54.

Khadem Sameni, M., & Moradi, A. (2022). Railway capacity: A review of analysis methods. *Journal of Rail Transport Planning & Management*, *24*, 100357. https://doi.org/10.1016/j.jrtpm.2022.100357

Lunardon, A., Vladimirova, D., & Boucsein, B. (2023). How railway stations can transform urban mobility and the public realm: The stakeholders'

perspective. *Journal of Urban Mobility*, *3*, 100047. https://doi.org/10.1016/j.urbmob.2023.100047

McMillan, L., & Varga, L. (2022). A review of the use of artificial intelligence methods in Infrastructure Systems. Engineering Applications of Artificial Intelligence, 116, 105472. https://doi.org/10.1016/j.engappai.2022.105472

Ministry of Railways (Railway Board). (n.d.). https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1 (Accessed 17 March 2023).

Ministry of Railways (2015) Indian railways lifeline of the nation (A White Paper), no. February, pp 1–66, 2015, [Online].Available: https://indianrailways.gov.in/railwayboard/uploads/directorate/finance_budget/Budget_2015-16/White_Paper-_English.pdf (Accessed 17 March 2023).

Ministry of Railways. (2022). Indian Railways Year Book 2020-21. n.d.

Northern Railways / Indian Railways Portal. (n.d.). https://nr.indianrailways.gov.in/view_section.jsp?fontColor=black&backgroundColor=LIGHTSTEELBLUE&lang=0&id=0%2C1%2C283 (Accessed 17 March 2023).

PTI.(2018). Railways Freight Traffic Declining on non competitive tariff:survey. https://economictimes.indiatimes.com/industry/transportation/railways/railways-freight-traffic-declining-on-non-competitive-tariff survey/articleshow/62696638.cms?from=mdr.(Accessed 17 March 2023).

Population by Country (2023) - Worldometer. (n.d.). https://www.worldometers.info/world-population/population-by-country/ (Accessed 17 March 2023).

Railway Board (2022). Evolution. (online). https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,261 (Accessed 17 March 2023).

Raghuram, G. & Gangwar R., (2008). "Indian Railways in the Past Twenty Years Issues, Performance and Challenges," IIMA Working Papers WP2008-07-05, Indian Institute of Management Ahmedabad, Research and Publication Department.

Raju,V.V.S.B.B.,(2017).“Analysis on Growth and performance on Indian Railways (With special reference to East Cost Railway Zone)”

Rao, Y. S. (1978). The Railway Board: A study in administration. S. Chand.

Roy, S. S., & Kulshrestha, M. (2021). Performance Assessment Study of Indian Railways – Case of Low Efficiencies in Large Government Monopoly. Transportation Research Record, 2675(11), 1272–1284. https://doi.org/10.1177/03611981211025516

Saha, D. (2022, August 4). *Rail passenger mobility at 70% of pre-Covid levels still shy of target*. Business Standard. https://www.business-standard.com/article/indian-railways/rail-passenger-mobility-at-70-of-pre-covid-levels-still-shy-of-target-122080401326_1.html . (Accessed 17 March 2023).

Sahai, V., and Pimpalkhare, A., (2019). “Improving Asset Productivity: The Key to Revitalising the Indian Railways, ORF Occasional Paper, ORF.

Saxena, A., & Yadav, A. K. (2022). Examining the Effect of COVID-19 on rail freight volume and revenue using the ARIMA forecasting model and assessing the resilience of Indian railways during the pandemic. *Innovative Infrastructure Solutions*, *7*(6). https://doi.org/10.1007/s41062-022-00929-2

Swamy M. (2022).Transportation in Fast Lame. [online]. www.cmie.com/kommon/bin/sr.php?kall=warticle&dt=20220709154601&msec=636. (Accessed 17 March 2023).

Tang, R., De Donato, L., BešinovićN., Flammini, F., Goverde, R. M. P., Lin, Z., Liu, R., Tang, T., Vittorini, V., & Wang, Z. (2022). A literature review of Artificial Intelligence applications in railway systems. Transportation Research Part C: Emerging Technologies, 140, 103679. https://doi.org/10.1016/j.trc.2022.103679

Timchuk, O., Veselova, Y., Dodorina, I., & Vikhoreva, M. (2023). Improving the Competitiveness of the Railway Industry Organization Using Innovative Economic Models. *Transportation Research Procedia*, *68*, 120–125. https://doi.org/10.1016/j.trpro.2023.02.015

Wikimedia Foundation. (2022, December 2). Great Indian Peninsula Railway. Wikipedia. https://en.wikipedia.org/wiki/Great_Indian_Peninsula_Railway. (Accessed 17 March 2023).