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*****

INTERNATIONAL COMPARISON OF PAKISTAN RAILWAYS

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C O N T E N T S

LIST OF TABLES

APPENDICIES

SUMMARY

S U M M A R Y

Among the inland means of transportation, Railway occupies a primary role as far as personal mobility and movement/carriage of goods are concerned. It is not a denying fact that rail transport is best suited for the carriage of bulk cargo over long distance. Notwithstanding with the introduction of large speed train together with managerial techniques the rail freight traffic performance deteriorated worldwide. The railway professionals and managers are making efforts to improve the operational efficiency of the railway system.

The present study is designed to compare the performance of Pakistan Railways viz-a-viz the World's Railways. The comparative analysis have been carried on the basis of physical and manpower resources of World's Railways, their utilization to achieve the operational and financial targets. It is important to note that the railway systems of the world are invariably different from each other because of regulations and practices. Even the terminology of operating statistics differs from each other. As such the comparison among them has been developed through interpretation of the results obtained from the

analysis. The data of 1986-87 or the latest available has been used for the purpose of comparison. The salient findings of the study are outlined below:-

1. Physical Resources

a) Route Length: American Rail-Roads (ARR) of USA had maximum route kilometerage (234,584 kms) while Taiwan had minimum (1075 kms). Pakistan Railways (PR) possessed 8775 route kms while the Indian Railway (IR), being the largest in Asia, had 61,836 kms.

b) Locomotives: ARR had largest locomotive fleet (22932 locomotives) while Tunis had minimum (45 diesel locomotives). PR's locomotive fleet was 873 and IR had 9920.

c) Coaches and Wagons: IR owned largest number of coaching vehicles (31,317) and freight wagons by ARR (1,421,686). PR had 2877 coaches and 35237 wagons.

d) Ratio between Locomotives, Coaches and Wagons: The size of the locomotive fleet with respect to number of coaches and wagons owned by 44 railway system has been studied. It was

found that among the developing countries (excluding India, China and Poland because of large number of locomotive), one locomotive, on the average was matched with 2 coaches and 34 wagons. For PR, this ratio was 3 and 40.

2. Productivity:

a) Traffic: All the world's railways use passenger kms & ton kms for estimating the traffic. Most of the railways in Europe and Asia (excluding China & to some extent India) have become pre-dominantly passenger careers while ARR, Canada Brazil including African countries (Algeria, Moroco, Zaire, Tunis etc.) were main freight haulers.

b) Average Passenger Lead: The analysis revealed that most of the European Railways, Japan, India and Korea etc. had average passenger journey ranged between 28-80 kms. This may be due to greater railway commuters traffic. In comparison Pakistan, China, Zaire and Middle East countries showed higher average passenger lead due to large proportion of long distance traffic (200-500 kms).

c) Average Freight Lead: Average distance travelled by a tone on ARR was the highest followed by Rusia, India and

Pakistan. It may be pointed out that Pakistan freight traffic in terms of tone km has declined sharply to the lowest ever figure of 5709 million in 1990-91.

c) Model Split: It was found that road freight traffic was dominated in about 18 countries where it captured more than 2/3rd of the total traffic. Generally the rail freight traffic all over the world declined while the passenger traffic increased at a much faster rate. PR's modal split ratio reduced from 24:76 in 1986-87 to 15:85 in 1990-91.

3) Performance/Efficiency Indicators:

a) Wagon Turn Around Time: PR had the highest average wagon turn around time (16.5 days) while China had the lowest (3.3 days) in the world.

b) Annual Wagon Loading: It indicates the wagon utilization on the entire railway system. The data analysis for a number of countries revealed that the wagon km operted by PR was the lowest. With only 52% loaded wagon km. This implied that empty haulage on PR was the highest (about 50%) as compared with railway in India, Japan, Turkey and some European countries.

c) Net Tone Km (NTKm) per Wagon: China had the highest usage of wagons with 2.78 million NTKm per wagon. Bangladesh had the lowest figure (.23 NTKm per wagon). Pakistan, France and Nigeria had at almost same average figure (.23 NTKm per wagon).

d) Traffic Units per Locomotive: Traffic Units in million (MTU) per locomotive have been worked out by simple addition of MPKm and MTKm. Railways in Japan, Korea, India had significantly more traffic unit per locomotive (average 63 MTU per loco.) than France, UK, Sweden and Netherland (average 24 MTU per loco). PR's performance was also better than these European railways with 27.9 MTU per Locomotive.

e) Locomotive Availability: The data for this parameter was available only for 7 countries Turkey had the lowest percentage of locomotive availability (65%) while Pakistan and Hunghry both had about 83% Locomtive availability which was significantly lower than India & Japan.

f) Traffic Density: Traffic Density providing the measures of the track utilization on the entire system is the ratio of

total traffic unit per km of line per year. China had the highest Traffic density of annual 22 MTU per km while Algeria had the lowest with 1.32 MTU per Km per year. The analysis revealed that railway system with higher freight density was more productive in terms of track utilization than predominently passenger service system. The traffic density on PR system (3.0 million TU per km per annum) was comparable with UK, France and Germany (average 2.2 MTU per km per year).

g) Number of Employees pr Km of Line: PR's having about 15 employees per km of line ranked 24 among 44 railways. This was 57% of the ratio of Indian railways and about twice that of Turkish railways having equvailent length of route km.

h) Staff Productivity (No. of Traffic Units per Employee): The out put of the staff is directly proportional to freight traffic. The variations in ratio of staff productivity were quite significant among different railways. ARR and Canadian Railways had the highest staff productivity ratios (average 3.9 MTU per employee) while Sri Lanka and Bangladesh had the lowest (about 0.11 MTU per employee). PR had 0.196 MTU per employee which was lower than Turkey and India.

4. Financial Performance

a) Operating Ratio: Operating Ratio is defined as ratio of ordinary operating/working expenses to the operating revenues. China had the lowest operating ratio (0.724) and Uruguay had the highest (2.996%). PR's operating ratio was also higher than 1 (1.16, in 1990-91 decreasing to 0.95 in 1991-92).

b) Rate of Return: It is ratio of net profit or net loss over the fixed assets. U.K. had the highest profitability (11.3%). while 9 railways had suffered from losses with Uruguay had the highest percentage (-) 36.6% followed by Tunis, Pakistan and Germany (-11.0%), and -5.58% respectively).

5. Conclusions:The following conclusion emerged from the study...

1) Performance of Railways all over world have been on the decline and Pakistan Railway is no exception.

2) Although freight traffic is growing but the declining trend in rail freight traffic suggests that world's railways have not been able to capture its due share.

3) Operating Ratios of most of the railways either stand at 1. or near to one - a reflection of uneconomical railway operation and consequent loss to railway system.

CHAPTER - I

INTRODUCTION

CHAPTER - 1

INTRODUCTION

Transportation is regarded as an index of economic, social and commercial progress of a country. The adequate transport facilities constitute the essential component of the modern economy and influence to a large extent the commercial/economic activities of a country. Land, Water and Air have been used to develop the various transport modes.

The two important modes of land transportation are railways and highways. Railways are the significant and potential means of transporting men and materials over large distances. the first rail link came into being in 1825 when the line between Stockton and Darlington in U.K. was opened for the general carriage of goods. This railway was of the length of 61 kms (38 miles) and George Stephenson drove the first steam engine. Five years later, the Liverpool and Manchester railways was opened for the carriage of fare-paying passengers as well as goods in steam-hauled trains. This was the first railway of the world as far as public carriage of passengers was concerned.

In India, the first railway line was constructed in 1855 between Madras and Bangalore. In the areas now in Pakistan, the first Railway line was opened on 13th May, 1861 for the public traffic between Karachi and Kotri covering a distance of 169 kilometers. Since 1947, Pakistan Railway have managed to add only about 250 kilometers to the system which was inherited at the time of independence.

The railways, all over the world, since its inception was a dominant mode of transportation. It began to grow slowly in the initial period. By the start of 20th Century, the railway network was so developed that it was the only fast mean of transportation available both for long and short distance traffic. As such it enjoyed monoplistic situation in the movement of goods and passengers and its performance reached at peak level prior to World War-I. With the rapid motorization, especially after the World War II, the strong hold of the railway gradually weakened. There was widespread change in the trend of traffic because of competition from roads. Nevertheless, the railway's share is declining, it continued to be considered as cheaper and best suited mode for long distance traffic. With the growing competition from road and to keep pace with the advancement in science and technology as well as with the economy the need has been felt to modernize the railway facilities/network particularly in the field of motive power, rolling stock, tracks, signalling etc. to reduce the

operational and maintenance cost. In certain countries such as France, Japan etc., the new technology was adopted to improve the entire railway system together with improved management techniques and institutional development. As a consequence the railway in these countries have been able to utilize the assets/capacity to the maximum extent possible and thus achieve the highest speed particularly in passenger services.

Pakistan Railways (PR) have a route length of 8775 kms. Since 1947, it has managed to add only 250 kms to the system inherited at the time of independence. The condition of rail assets, particularly track and rolling stock has deteriorated over the years. The PR's performance has never been consistent. During First, and Second Five Year Plans the railway was the primary mode of transportation especially as a freight carrier. However, this trend was changed during the 3rd Five Year Plan when the traffic started shifting from railway to road due to improved road conditions. As a consequence, the share of the rail traffic continued to decline to 22% in 1986-87 (the period under review for the study) which further reduced to 15% in 1990-91. This was not confined to Pakistan alone, but was a universal phenomenon being experienced also by the other railways all over the world.

In the back drop of such a situation, a need was felt to study the short comings of the Pakistan Railway viz-a-viz the other railways of the world. The study is an attempt to find out whether the performance of Pakistan Railways is at par with that of the other railways. If not, how far does it lag behined and in what areas. The detailed objectives are outlined below.

1.1 Objectives

In a broad context, the purpose underlying the study is to make comparison of Pakistan Railway with other railways on the basis of physical, operational and financial indicators. The physical indicators cover the inventory of railway assets and their utilization while efficiency of a railway network is examined by operational and financial performance. More precisely the objective of the study is to identify a number of issues being faced by the various railway systems all over the world and thus highlight the performance on the basis of the data as it existed in the year 1986-87. The study would, therefore, present compilation of comparable data which would be useful to learn more about Pakistan Railway and its performance viz-a-viz the other railways of the world.

1.2 Methodology

The study covers railway system of 44 countries; 12 from Asia, 22 from Europe, 6 from Africa, 2 from North America and one each from Latin America and Australia. The data in respect of resources/assets owned by a railway system, operating statistics and efficiency indicators was collected by using the following methods:-

i) Through Correspondence: Originally 28 railways of different countries were requested to provide the data for the study. Out of these data received from 10 countries.

ii) Through Visits: A number of national and international libraries located in Islamabad including National Library, Central Secretariat Library, Libraries of U.S. Aid, British Council, World Bank and American Centre were visited for the collection of data regarding other railways of the world.

iii) Through Publications: The data pertaining to Indian Railway and Pakistan Railway have been collected from their published document called "Railway Year Book". In addition, the publication of International Union of Railways for the year 1989 has also been consulted.

Using the above sources as data base comparison for operating statistics and other performance indicators particularly in terms of the productivities of rolling stock, track etc. has been made between Pakistan Railway and the other railways of the world. The railway statistics alongwith their comparison developed in the study were indicative of general conditions of rail transportation and economic activities prevailed in different countries.

Chapter II gives brief information regarding history and development of rail system for 10 out of 44 railways of the world. Chapter III presents the analysis of comparable operating statistics including performance/efficiency indicators. Finally, financial performance in terms of operating, liquidity ratios etc. of different railways are highlighted in Chapter IV of the study.

CHAPTER-II

BRIEF DESCRIPTION OF WORLD'S RAILWAYS

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2.1. Pakistan Railways

Pakistan Railway (PR) has completed 132 years of its existance. On the 13th of May, 1861 the first railway line in Pakistan (the then India) was opened for public traffic between Karachi and Kotri covering a distance of 169 kilometers. The route length at the time of independence in 1947 was 8554 kms. Before independence the railway was known as North Western Railway. In February, 1961 it was renamed as Pakistan Western Railway. Later in May, 1974, it was called by the name of Pakistan Railway (PR).

PR is a Public Sector Organization and presently operating 8775 route kms ranging from Karachi in the South to Peshawar in the North. The route length has only been increased by 221 kms since 1947. PR is under obligation to provide a basic Public utility service. The fares regulated by the government are not in accordance with the requirements of changing/expanding economy and also with the operational cost. PR is, therefore, not being run purely on commercial consideration. Though the PRs development programmes/plans are being financed through government's

budgetory allocations, but unlike other transport modes, it has to maintain an extensive network and huge infrastructure. Out of 8775 kms of route length, PR had 7718.37 kilometers (88%) of broad-guage, 445.40 kilometers (5%) of meter-guage and 611.10 kilometers (7%) of narrow-guage in the year 1986-87. Pakistan has an area of 796,095 sq.kms. Of the total route km the double track length was 1037 kms with electrified track of 293 km.

A brief data in respect of operating statistics and resources owned by PR (as of the year 1986-87) is enumerated below:-

Area of the country (Sq. Km.)	796,095
Population of the country (000)	105,409
Route Length (kms)	8,775
Rail Staff	133,214
No. of Locomotives	837
Steam	261
Diesel	547
Electric	29
No. of Coaches including Railcars and Trailers	3,178
Total No. of Wagons	34,867
No. of Passenger carried (thousand)	78,141
Passenger Km (Million)	16,920
Average lead (Kms)	217

Tonnes carried (Thousand)	11,639
Tonne Kilometres (Million)	8,033
Average lead (Kms)	644
Revenue (Thousand)	4,710,517
Expenditure (Thousand)	4,073,378
Operating Ratio(%)	86.5

Pakistan Railway is faced with a situation of depleted infrastructure facilities. Due to huge back-log of rail and sleeper renewals, speed restrictions are quite frequent especially on the main line between Karachi and Lalamusa resulting in a loss of track capacity. The condition of bridges and culverts is also deplorable. Nearly half of the rail bridges are more than 100 years old.

The problem is more aggravated as the motive power and rolling stock has become overage and worn out. Most of the steam locomotives are more than 60 years old against the normal life of 45 years. Also 1/3rd of diesel electric locomotives are more than 25 years old as against their normal life of 20 years. This is making adverse affect on the haulage capacity as well as availability of locomotives.

The worn out assets and infrastructure facilities resulted in the deterioration of PR's performance, which has been showing a surplus upto 1971-72. The position changed thereafter. The factors include among others the emergence of roads as a competitive mode of transport.

The investment in the road sector has increased from Rs.220 million (27.9% of total investment) in the First Five Year Plan to Rs.23,420 million in the sixth plan (50.3%) of total investment). The investment by the Government in the Railways has, however, shown reverse trend. Although, the plan allocations have increased in absolute terms (from Rs.478 million in the first plan to Rs.10,000 million in the sixth plan) but the share with respect to total investment in T&C Sector has reduced from 78.5% in the first plan to 21.5% in the sixth plan. As a result the railway share in the freight sector fell from 50% in 1971-72 to 22% in 1986-87 and in the passenger sector it reduced from 21% to 14%. In absolute terms while freight traffic almost remained constant the passenger traffic grew at an annual compound growth rate of 4.1%.

2.2 Indian Railways

Indian Railway (IR) at present is the Asia's largest and the world's second largest railway system as far as the route length is concerned which constitutes the main artery of the country's inland

transport. The rail operation was started off with a line of 34 kms length laid in April, 1853 between Bombay and Thana. The network has now spread over throughout the country having route length of 61,850 kms as existed in 1986-87.

The main trunk lines consisted of 33553 kms of Broad guage (54.46%), Metre-guage of 24051 kms (38.88%) and narrow guage of 4246 kms (6.86%). The total route km was about 61850% while the total area of the country is 3,166,829 sq. km. The length of double and multiple track (route kms) was 13397 km while that of electrified track was 8880 km. IR is Government controlled organization. However, it is free to persue its own financial policies subject to obligation to pay dividend to the Government.

Operating Statistics and other data of Indian Railway (as existed in 1986) is given as under:-

Area (Sq. Km.)	3,166,829
Population (000)	807,062
Route Length (km)	61,850
Staff	1,613,280
No. of Locomotives	9,920
Steam	5,571
Diesel	3,047

Electric	1,302
No. of Coaches including Railcars and Trailers	31,317
Total No. of seats including Sleeping Accommodation	2,746,009
Total No. of Wagons	347,748
Total Capacity (Tonnes)	10,957,966
Average Capacity of a Wagon (Tonnes)	31.5
No. of Passengers (In thousand)	3,433,459
Passenger Kms (In million)	240,614
Average Lead Kms	70
Tonnes Carried (In thousand)	258,548
Tonnes Kms (In million)	196,601
Average Lead Kms	760
Revenue (Rs. in Crores)	7,505.66
Expenditure (Rs. in Crores)	6,900.56

Over the years there has been significant increase both in passenger and freight traffic. In 1986-87, the MPKm has risen by 285.6% and MTKm by 469.9% since 1950-51. The growth in the traffic has been steady inspite of the severe competition from road and lesser expenditure on railways i.e. 6.9% in the Seventh Plan as compared to previous plans.

2.3 Chinese People's Republic Railways

Chinese Railway (CR) is state owned organization. The Ministry of Railway at present administers 20 railway bureaus and 16 sub-bureaus throughout China. Local authorities are also encouraged to build and operate their own railways upto the length of 200 kms. In 1985, the total route length is 53,187 km including 12528 double track and 6372 km electrified track. China has area of 9,597,000 sq. km. CR is predominantly a freight carrier. However, it carried 57.4% of the total passenger in 1985-86. The other data and operating statistics (as of 1986) is as under:-

Area (Sq. Km.)	9,597,000
Population (000)	1,106,000
Route Length (Km.)	53,187
Staff	1,860,786
No. of Locomotive	12,266
Steam	7,542
Diesel	4,017
Electric	707
No. of Coaches including Railcars and Trailers	22,138
Total No. seats including Sleeping Accommodation	N. A.
Total No. of Wagons	314,537
No. of Passengers (In thousand)	1,073,580

Passenger Kms (In million)	258,311
Average Lead Kms	241
Tonnes Carried (In thousand)	1,073,580
Tonnes Kms (In million)	875,009
Average Lead Kms	662

2.4 Korean National Rail Road (KNRR)

The route length of Korean National Rail Road, as existed in 1985, was 3113.4 kms. The length of double track which formed the back bone of the rail network and run mostly between the main cities was of 809.5 km long while electrified track was 525 kms in length. The total area of the country is 98,913 sq. km.

Though the rail passenger traffic in terms of MPKm handled in 1985 by the KNRR was 65% of the total rail traffic units, the modal split of freight traffic was in favour of rail transport as it carried 40% of the total country's freight traffic. The operating statistics and other data as of 1986 is given below:-

Area (Sq. km)	98,913
Population (000)	40,845
Route Length (Km)	3,113
Staff	38,854
No. of Locomotives	571
Diesel	480

Electric	91
No. of Coaches including Railcars and Trailers	2,913
Total No. of seats including	152,914
Sleeping Accommodation	
Total No. of Wagons	15,858
Total Capacity (Tonnes)	731,320
Average Capacity of a Wagon (Tonnes)	46.1
No. of Passengers (In thousand)	518,956
Passenger Kms (In million)	23,563
Average Lead Kms	45
Tonnes Carried (In thousand)	56,645
Tonnes Kms (In million)	12,657
Average Lead Kms	223
Revenue (won million)	563,959
Expenditure (Won million)	593,836

2.5 Japanese National Railways (JNR)

The railway in Japan was opened between Shimbashi (Tokyo) and Yokohama with initial length of 29 kms. Since then the State Railways had grown as a Governmental Organization until 1949, when the present Japanese National Railways (JNR) was established as a public corporation. JNR is one of the most advanced and modernized railway in the world. It has done

poineering work of introducing advance technology and equipment in all the disciplines of railway operations. The new innovations and technology together with restructuring the JNR achieved the fast speed train operations called as "Shinkansen train" with speed of 240 Kms per hour.

The total route length of JNR as existed in 1986 was 19,949 kms. This included 44% of electrified track and 28% of double and multi tracked sections. The total area of the country is 372,313 sq. km. The operating statistics as of 1986 are detailed below:-

Area (Sq. Km)	372,313
Population (000)	122,918
Route Length (Km)	19,949
Staff	223,947
No. of Locomotives	1,801
Steam	5
Diesel	822
Electric	974
No. of Coaches including Railcars and Trailers	24,049
Total No. of Wagons	33,204
No. of Passengers (In thousand)	7,103,957
Passenger Kms (In million)	198,299

Average Lead Kms	28
Tonnes Carried (In thousand)	59,831
Tonnes Kms (In million)	19,945
Average Lead Kms	333
Revenue (Yen million)	3,552,800
Expenditure (Yen Million)	5,572,800

In addition to JNR, the other rail services having limited operations include conventional lines with ordinary express and local trains. The total passenger traffic in terms of MPKm have been registering steady growth. However, the traffic on local lines has been on the decrease. The JNR traffic (MPKm) has been growing steadily. As regards the freight traffic, JNR's MTKm have been declining since 1975. The decrease in 1985 was 54%.

Equiped with high technology qualified staff and experience of fast train operation the JNR's engineering capabilities are highly valued abroad. It provides technical assistance and sends experts all over the world to introduce new technology.

2.6 Turkish Railways

The first railway in Turkey was constructed in 1856 having length of 130 kms. The railway in Turkey is a state railway operating under the

name of "Turkish Republic State Railways Administration (TCDD). It has a route length of 8170 kms, out of which 291 lines were electrified while double track was 270. The total area of the country is 780,576 sq. km. The operating statistics as of the year 1986 is given as under:-

Area (Sq. Km)	780,576
Population (000)	50,932
Route Length (Km)	8,170
Staff	65,927
No. of Locomotives	1,028
Steam	380
Diesel	630
Electric	18
No. of Coaches including Railcars and Trailers	1,574
Total No. of seats including Sleeping Accommodation	100,190
Total No. of Wagons	21,966
Total Capacity (Tonnes)	733,588
Average Capacity of a Wagon (Tonnes)	33.4
No. of Passengers carried (In thousand)	152,352
Passenger Kms (In million)	6,052
Average Lead Kms	526

Tonnes Carried (In thousand)	13,656
Tonnes Kms (In million)	7,396
Revenue (Turkish Lira million)	255.106
Expenditure (TL million)	285,672

Though, the TCDD passenger traffic has not been growing significantly yet the passenger business expanded steadily. Due to rapid highways development in the country, the freight traffic has been on the slight decrease which was casual. Nevertheless, the freight traffic increased from 5.17 billion TKm in 1980 to 7.4 billion TKm in 1987, indicating an increase of 43%.

2.7 British Rail (BR)

Britian is pioneer in railway as the first line was built there in 1825 and first passenger train worked by steam power was operated between Stockton and Danlington stations. The poineering experience enabled the BR's engineeer to construct railways in many countries such as India, Malaysia, Canada and Brazil.

BR is being run under British Railway Board set up in 1963. Upto 1986, the railway network comprised of 16,737 route-Kms while the total area of the country is 244,755 sq. km. The electrified track and double track formed 24% and 70% of the total route Kms respectively. The operating statistics and other details pertaining to year 1986 are given as under:-

Area (Sq. Km)	244,755
Population (000)	58,194
Route (Km)	16,737
Staff	171,400
No. of Locomotives	2,642
Steam	N.A
Diesel	2,398
Electric	244
No. of Coaches including Railcars and Trailers	13,713
Total No. of seats including Sleeping Accommodation	896,729
Total No. of Wagons	47,730
Total Capacity (Tonnes)	1,621,395
Average Capacity of a Wagon (Tonnes)	34.0
No. of Passengers (In thousand)	689,400
Passenger Kms (In million)	30,819
Average Lead Kms	45
Tonnes Carried (In thousand)	138,369
Tonnes Kms (In million)	16,565
Average Lead Kms	120
Revenue (TL Million)	226,784
Expenditure (TL Million)	216,384

BR continued to achieve high rate of progress in railway development as evident from the intercity traffic where high speed trains are designed to reduce the journey time. These trains run at a speed of 200 Kms per hour. In addition to this, BR run more services at speeds of 160 KPH.

BR also runs non-commercial passenger services as a Public Service Obligation (PSO) which are financially supported by the Government. The operation of these services include among other many branch lines in rural areas. BR is concentrating on freight traffic which is considered suitable for rail especially long distance bulk traffic with entire train loads. For the small loads BR provides scheduled freight services running at speeds upto 120 KPH and offering next day delivery. For carrying commodities of a particular customer, company trains on long term contract basis are generally operated. About 3500 company trains run each week. BR is one of the least subsidized railways in the world and is working to achieve the Government financial targets. High standards of safety are maintained on the BR network.

2.8 Sweden's State Railways

Sweden's public railway company (SJ) have been operating since 1856 under Ministry of Transport. Though, most of the Sweden's population

lines in southern part of the country, but the rail network is spread relatively evenly throughout the country. Almost the entire Sweedish rail network was constructed in the 19th century to cope with the transport needs of the major industries which were introduced at that time. Initially most of the railways were privately funded but in 1930's & 1940's SJ took over (about 80) of these privately owned railway organisation.

SJ has a route length of 11,236 kms with two thirds account for un profitable lines. The area of the country is 449,964 sq. kms. SJ since its inception continued to develop and expand rail network. It invested about 25% of its income in various projects every year for modernizing railway system. The average speed of the conventional trains was normally 160 KPH, expected to increase to 200 KPH in future. The operating statistics and other information is given as under:-

Area (Sq. Km)	449,964
Population (000)	8,564
Route Length (Km)	11,236
Staff	35,826
No. of Locomotives	1,234
Steam	N.A.
Diesel	540
Electric	694

No. of Coaches including Railcars and Trailers	1,982
Total No. of seats including Sleeping Accommodation	119,799
Total No. of Wagons	36,298
Total Capacity (Tonnes)	1,094,884
Average Capacity of a Wagon (Tonnes)	30.2
No. of Passengers (In thousand)	72,996
Passenger Kms (In million)	6,152
Average Lead Kms	84
Tonnes Carried (In thousand)	53,309
Tonnes Kms (In million)	17,754
Average Lead Kms	333

SJ, other than railway operation also provides for all forms of transport services through its subsidiary companies. SJ's nation wide network accounts for 99% of aggregate passenger traffic including passenger traffic carried by non-commercial lines having length of about 7500 kms which are subsidized by the Government. The Swedish rail network is predominant with passenger services. However, there exist some sections in the rail network devoted exclusively to the freight traffic which had a share of 46% in 1986-87. Like BR, trains are considered safest mode of transport in Sweden. The system of Automatic Train Control (ATC), a computer-based monitoring system, has been installed on almost all the main line network.

2.9 American Rail-Road (ARR) of USA

Railway operation in USA was first started in 1830. The main stay of rail transportation rests with American Rail Road (ARR) which is exclusively running freight service operations. Upto 1986, 16 individual systems, designated as class I rail-road were operating. In addition, there were approximately 484 regional, local rail road working in the country. All the freight rail road companies are part of the private sector and are running affairs of management independent of US Government. Regarding passenger service National Railroad Passenger Corporation (AMTRAK), established in 1971 with the Federal Government assistance/ subsidy provides inter-city and commuter services. Efforts were underway to transfer rail passenger service to the private sector.

At the end of 1986, the total route kms owned by rail roads were 225,406. The route length has been gradually decreasing since 1929. The total area of the country is 9,372,570 sq. km. The other information and relevant operating statistics as existed in 1986 are given as under:-

Area (Sq. Km)	9,372,570
Population (000)	241,657
Route Length (Km)	225,406
Staff	323,946
No. of Locomotives	23,932

Steam	2
Diesel	22,869
Electric	61
No. of Coaches including Railcars and Trailers	5,806
Total No. of seats including Sleeping Accommodation	521,300
Total No. of Wagons	1,421,686
Total Capacity (Tonnes)	107,067,500
Average Capacity of a Wagon (Tonnes)	75.3
No. of Passengers (In thousand)	20,157
Passenger Kms (In million)	8,064
Average Lead Kms	400.10
Tonnes Carried (In thousand)	1,372,262
Tonnes Kms (In million)	1,396,460
Average Lead Kms	1,069
Revenue ($ million)	26,204
Expenditure ($ million)	24,896

The passenger traffic indicated above has been carried by AMTRAK only during 1986. The passenger kms handled by all class of rail roads stood 18,990 million which was 3.4% of the total passenger traffic carried in 1986. With respect to freight traffic, the rail share was 35.5%. The

passenger traffic declined sharply after World War-II and its share was only 4.5% in 1980 as compared to 28.6% in 1960. On the other hand, the freight share of rail roads was reduced from 44.1% in 1960 to 37.5% in 1980. The downward trend in freight traffic was not as sharp as witnessed by passenger traffic.

2.10 AUSTRALIAN NATIONAL RAILWAYS

Australian National Railway (ANR) is managed by the Federal Government as a business organization. ANR was formed of three railway systems operated by the Common Wealth, Tasmanian and South-Australian Railway in 1978. In 1986 ANR had a route length of 7450 kms which consistedof standard guage, Broad Guage and Narrow guage. ANR partially operates in South Australian (in Adelaide metropolitan area) under an agreement with State Transport Authority (STA) of South Australia. It operates freight service only in Tasmania. Under an Act in 1983, a commission was set up to look into the matters of ANR. The commission empowered ANR to undertake non rail services (rental & leasing of property) and to provide consultancy (technical engineering & other services) to the Commenwealth within & outside Australia. It also conducts Road Service in small area. However, ANR's principal business pertains to the provision of passenger and freight transport by rail. The other statistics as of 1986 are given as under:-

Area (Sq. Km)	7,692,300
Population (000)	16,079
Route Length (Km)	7,450
Staff	70,675
No. of Locomotives	1,223
Steam	17
Diesel	498
Electric	708
No. of Coaches including Railcars and Trailers	3,788
Total No. of seats including Sleeping Accommodation	243,833
Total No. of Wagons	36,862
Total Capacity (Tonnes)	254,180
Average Capacity of a Wagon (Tonnes)	33.2
No. of Passengers (In thousand)	322
Passenger Kms (In million)	2.486
Average Lead Kms	46
Tonnes Carried (In thousand)	13,049
Tonnes Kms (In million)	7,081
Average Lead Kms	205
Revenue ($ million)	283.317
Expenditure ($ million)	352,766

Source: Annual Report 1985-86.

Passenger trains are operated by ANR jointly with one or two State railway systems. No commuter service is provided with metropolitan areas. Like PR and other railways ANR's passenger services run into deficits, however, the revenues showed an increase of 22% in 1986 over the previous year. Regarding the freight services, the ANR share in the total country's freight was 26% in 1986.

CHAPTER-III

ANALYSIS OF DATA

CHAPTER III

ANALYSIS OF DATA

The objective of the study is to examine the performance of different Railways of the World and draw comparison with each other particularly the Pakistan Railway's performance viz-a-viz the other Railways. The comparative analysis has been carried out in terms of physical and manpower resources, operational and financial performance based on the utilization of assets and achievement of other operational efficiency/financial targets pertaining to the different railway system of the world. It may be pertinent to point out that the railway systems all over the world are invariably different from each other because of the requirements of national regulations and practices. Even the terminology of operating statistics and other indicators varies from one country to another. As such the comparison among different railway systems have been developed on the basis of interpretation of the results obtained from the analysis of data which led to the general conclusion. However, specific conclusions can only be drawn after the detailed analysis of individual railways. The data as existed in the year 1986-87 (or pertained to the latest available) has been used for the purpose of comparison between world's railways. The detailed data pertaining to assets/resources and

other operating statistics/parameters of 44 railways of the world are appended at the end of the report. For the sake of comparisons, the analysis concerning important variables/parameters of some of the railway system of the world including Pakistan Railways have been tabulated in the main text of the study which followed the explanation and the summary of the results. Efforts have been made to include the countries like Pakistan, India, Turkey, Bangladesh, Algeria, Tunis, etc. developed economies of Japan & Europe and countries of Planned/Socialist economies such as Poland, Hungary etc. In this sample the railway systems, though appear to be representation of different economic conditions, but have indicated explicitly the achievements of performance targets/parameters regarding different railways.

The variables covering various statistics in respect of physical assets and operating performance and financial indicators are enumerated below:

Assets & Resources

- Route length
- Locomotive fleet
- Passenger and Freight rolling stock

Operating Statistics & Staff

- Passenger Traffic
- Goods Traffic
- Modal split
- Staff & its productivity (in terms of traffic unit per employee)

Performance and Efficiency Indicators

- Productivity of locomotives and other rolling stock
- Availability of diesel locomotives
- Average wagon turn around time
- Freight train kilometers
- Annual wagon kilometers
- Density of traffic

Financial Indicators

- Liquidity ratio
- Operating ratio
- Rate of Return (Net profit or loss)
- Wages, cost/revenues and fares ratios

The data for the above parameters have been obtained/compiled from the annual reports, statistics and year books of different railways of the world. Also the data for certain parameters (as indicated beneath the table) have been obtained from the publication of International Union of Statistics (UIC) 1989. The comparative analysis for each of the above parameters/variables are enumerated in detail in the following paragraphs.

3.1 Physicals Assets

The comparative statements indicating population area, route kilometerage staff and other physical assets owned by different railways of 44 countries are appended at the end (Appendix I to VIII).

3.1.1 Route Length

The World's largest railway in terms of having maximum route kilometerage was owned by American Rail Road (ARR) of U.S.A. kms followed by former USSR (145,576 kms) and India, which had the highest route length in Asia. Pakistan Railway (PR) possessed route length of 8775 kms which was about 1/8th of the length of Indian Railway (IR) and half that of British Rail (16,068 kms). The data pertaining to track composition including length of double track, electrified track for some of the railways including Pakistan Railway has been summarized as under:-

Table 3.1
ROUTE KILOMETERAGE INCLUDING DOUBLE & ELECTRIFIED TRACK

Name of the country	Composition of Track (Kms)				
	Route Length	Double Track	Electrified Track	Double Track %	Electrified Track %
*					
Pakistan	8775	1037	293	11.8	3.3
India	61985	13997	8880	22.6	14.3
Iran	4567	-	149	-	3.3
Turkey	10369	270	567	2.6	5.5
U.K.	16588	11633	4546	70.1	27.4
Hungary	7619	1192	2129	15.6	27.9
Japan	20341	7982	11586	39.2	57.0
Sweden	11022	1183	6995	10.7	63.5
France	34322	15685	12430	45.7	36.2
Korea	3121	846	525	27.1	16.8
China	53187	12528	6372	23.6	11.9

Source: International Railways Statistics 1989
*
Pakistan Railways Year Book 1988-89

There are variations in the track resources as shown in the above table. PR's double track length was more than that of Korea and Turkish Railways. However, the length of PR's electrified track was significantly low as compared to other countries except Iran and Turkey. There is a room for the extension of electrification over its track particularly on the main line sections. Such projects can be under-taken by the Pakistan Railways if the resources are made available.

3.1.2 Motive Power & Rolling Stock

The resources owned by a railway system includes inter alia the motive power and rolling stock constituting the capital assets of a railway system. The motive power pertains to locomotives while rolling stock includes stock of passenger and freight transport i.e. coaching vehicles, freight wagons etc.

The locomotives operated on different railways of the world are generally classified as Steam, Diesel and Electric. The passenger coaches are generally of 2 or 3 types, such as A.C. coaches, 1st class and lower class carriages, each including sleeping accommodation while the freight wagons are 4 wheelers and 8 wheelers which are called as bogie wagons covering also container wagons.

The locomotives and other rolling stock owned by different railway systems are tabulated as under:-

Table 3.2
NO. OF LOCOMOTIVES, COACHES AND WAGONS

Name of the country	No. of Locomotives				No. of Coaches i/c Railway Trailer	No. of Seats i/c Sleeping Accommodations	No.of Wagons	Average Capacity per wagon
	Steam	Diesel	Elec.	Total				
Pakistan	338	512	23	873	2877	220000 *	35237	24.8
India	5571	3047	1302	9920	31317	2746009	347748	31.5
China	7542	4017	707	12266	22138	1660350	353041	25.0 *
Turkey	380	630	18	1028	1574	100190	21966	33.4
Japan	5	822	974	1801	24989 *	2365700 *	33204	30.0 *
Korea	-	480	91	571	2913	152914	15858	46.1
Bangladesh	N.A.	293	-	290	1410	91497	15908	20.9
U.S.A.	2	22869	61	22932	5806	521300	1421686	75.3
Canada	-	1262	-	1262	-	-	53488	75.5
Brazil	27	1515	40	1582	959	43023	46397	57.4
U.K.	-	2398	244	2642	13713	896729	47730	34.0
France	-	3444	2363	5807	15609	1185166	200015	42.5
Sweeden	-	540	694	1234	1982	119799	36298	30.2
Netherland	-	419	150	569	2190	148888	8233	33.2
Poland	761	4205	2294	7260	12876	627320 *	238507	43.0
Algeria	-	207	25	232	493	32342	14291	31.1
Tunisia	-	45	-	45	302	14108	5578	25.6
Morocco	-	128	100	228	481	39529	8865	39.3
Uruguay	4	52	-	56	73	70000 *	2462 *	25.0 *

* Data obtained from UIC (International Union of Railways) Statistics 1989.

As of the 1986-87 data relating to locomotives fleet maximum number of locomotives were owned by American Rail Road with 22869 diesel, 61 electric and 2 steam locomotives and minimum by Tunisia with 45 diesel locomotives only. Over the years, the steam locomotives had been gradually phased out by almost all the railways of the world. Among the countries under consideration more than half of the Japan's locomotives fleet were electric which was the maximum number commensurating with the length of electrified track (i.e. 57% of the total kilometers). Most of the European countries including U.K. France, Sweeden etc. had more diesel locomotives than electric locomotives indicating that even the most developed railways of the European countries have yet to extend electrification all over the track which is capital intensive project as compared with diesel traction costing more on maintenance than electric traction. PR's locomotive fleet stood at 873 in 1986-87 reducing to 753 locos including 160 steam in 560 Diesel Electric and 29 Electric locomotive 1990-91. The steam locos were being used mostly for shunting purpose and for narrow guage/meter guage operations. As regards the coaching vehicles and freight wagons, Japan had the maximum number of passenger carriages including coaches and railcars and ARR of U.S.A. had maximum number of freight wagons including covered flat and bogie wagons. This is because of the reason that Japanese Railway's operation has become passenger oriented while USA is a basically a freight carrier. Nevertheless, most of the railways in European and Asian

countries normally have focussed more on passenger services, yet they own more wagons than passenger carriages as evident from the above table. In case of American rail roads the ratio of coaches to freight wagons was 1:245 and was the maximum in the world for freight rolling stock. PR's ratio of coaches to freight wagons stood at 1:12 and Japan had almost 1:1 ratio.

From the available data, the size of the locomotive fleet of different 44 railway systems has also been studied in relation to their fleet of coaches and wagons. Among the developing countries India, China and Poland had large fleet of locomotives and thus excluded from this analysis. Excluding also the railways of developed countries, the ratio between size of locomotive fleet and the number of coaches and the number of wagons for the developing countries has been calculated as one locomotive matched on the average with 2 coaches and 34 wagons. The ratios of other railways are shown as under:-

Table 3.3
LOCOMOTIVES FLEET IN PROPORTION TO NO. OF COACHES AND WAGONS

Name of Country	One Locomotive matched with	
	No. of Coaches	No. of Wagons
Pakistan	3	40
Turkey	2	21
Korea	5	28
Japan	14	18
Brazil	1	29
U.K.	5	18
France	3	34
Sweden	2	29
Netherland	4	15
U.S.A.	-	62
Tuinsia	7	124
Algeria	2	62
Uruguay	1	44

The above analysis led to conclude that except for U.S.A., the passenger coaches in almost all the countries have more motive power than the freight wagons fleet.

3.2 Traffic

Rail Traffic measures the commercial output of a railway system. It is the product of passenger and distance (in kms) in case of passenger traffic i.e. Pass-kms and ton and distance (in kms) for freight traffic i.e. Ton kms. The traffic performance of different railways is compared with each other in terms of total traffic units achieved, which is worked

out by simple addition of passenger Kms & Ton Kms, notwithstanding the different nature of both the traffic and variation in their cost. The combination of the passenger-kms and ton-kms through simple addition without assigning any weight provided relatively a crude measure as traffic units are not the same product. Presumably, Ton km equivalent can be worked out by multiplying the passenger traffic with two and through this rough weighting/approximation, the two traffic can be lumped together. However, there is no generally and universally agreed principle/basis for lumping together the passenger and freight traffic. In this study, the passenger km and ton-kms have simply been added together for calculating the traffic units.

3.2.1 Passenger and Goods Traffic

Almost all the railways of the world use pass-km and ton-kms for estimating the traffic. A comparison of both passenger traffic and freight traffic handled by certain rail system is tabulated as under while comparative traffic figures in respect of all the 44 Railways selected for the study is indicated at the end of the study in the Appendices VI-VIII.

Table 3.4
RAIL PASSENGER AND GOODS TRAFFIC

Name of Country	Pkm (In million)	Tkm (In million)	Total Traffic Units	Share in Total Rail Traffic (%) Pkm	Tkm
Pakistan	16850	8269	25119	67.08	32.92
India	240614	196601	437215	55.03	44.97
China	258311	875009	1133320	22.79	77.21
Turkey	6052	17189	23241	26.04	73.96
Japan	198299	19945	218244	90.86	9.14
Korea	23563	12657	36220	65.06	34.94
Bangladesh	6005	567	6572	91.37	8.63
U.S.A.	17649	1352508	1370157	1.29	98.71
Canada	-	92770	92770	-	100.00
Brazil	1742	39956	41698	4.18	95.82
U.K.	30819	16565	47384	65.04	34.96
France	59618	51016	110634	53.89	46.11
Sweeden	6152	17754	23906	25.73	74.27
Netherland	8919	3107	12026	74.16	25.84
Poland	48526	120043	168569	28.79	71.21
Algeria	2011	3049	5060	39.74	60.26
Tunisia	893	1417	2310	38.66	61.34
Moroco	1958	4503	6461	30.30	69.70

It is clear from the above table as well as from the appendices that though railways all over the world were handling both ton-kms and pass-kms most of the system's operations were invariably dominated by passenger traffic. With the exception of China and to some extent India, majority of Asian railways including Japan, Korea, Pakistan, Bangladesh, Sri Lanka had become mainly the passenger traffic. On the other hand, the American rail road, Brazil had very insignificant movement of passengers.

In African countries like Algeria, Morocco, Zaire, Zimbabawe Mozambique, Tunisia having freight traffic share more than the passenger and can thus be termed as main freight hauler. In Europe, railways had focussed more on passenger services than freight as the passenger traffic exceeded the freight traffic in U.K., France, Netherland, Spain, Italy, Turkey while in the countries with Planned economies such as then Yogoslavia, Czechosalovakia, Poland etc. the freight traffic was higher than passenger traffic.

Another aspect of passenger traffic is the average length of passenger journeys called as average lead. In most of the European countries Germany, U.K., France & Turkey and also in Asian countries like Japan, India and Korea this average was significantly less (ranged 28-80 kms). This was apparently due to a large of proportion of rail commuter traffic in these countries as compared with long distance passenger traffic on long intensity routes. In comparison to this, Pakistan, China, Zaire and railways in Middle East countries registered higher average passenger lead due to greater proportion of long distance passenger traffic which has been continuing to increase particularly on PR.

As for the distance travelled by a tonne (the average lead for freight traffic), American rail road has the highest average followed by

Russia, India and Pakistan. China had average lead lesser than Pakistan inpite of the freight traffic performance of Chinese railways in terms of tonnes carried and ton-kms were far better than Pakistan. However, Pakistan Railway's freight traffic of ton-kms has fallen sharply to the lowest ever figure of 5709 million in 1990-91. The tonnes carried have not declined with the same rate as of ton-kms which led to conclude that Pakistan Railway is not only losing its freight traffic but it has also not been able to capture the long lead freight traffic.

Generally the trend of railway service in the developing and developed countries of the world (particulary in Asia and Europe excluding the countries with planned economies) seemed invariably to be more passenger oriented and as such Pakistan Railway was no exception. The reason for the poor freight traffic performance was mainly attributed to the higher priority assigned to passenger services by most of the railways particularly the railways of Asian and European countries. This was obvious from the ratios between locomotive to coaches and locomotive to wagons which indicated that passenger services were more power intensive than freight operations.

3.2.2 Modal Split

Most of the World's railways particularly of the developing countries have been facing increasing competition of the road sector especially for freight. This may be the other reason contributed toward the declining trend of freight traffic as evident from the modal split between rail and road freight traffic in respect of some of the developing and developed countries shown as under:-

Table 3.5
MODAL SHARES, FREIGHT TRAFFIC

Sl. No.	Name of Country	SHARE (%) Rail	Road
1	2	3	4
1.	Pakistan	24.00	76.00
2.	India	66.20	33.80
3.	Bangladesh	3.30	96.70
4.	China	80.60	19.40
5.	Japan	9.10	90.90
6.	Hong-Kong	31.20	68.80
7.	Mongolia	28.30	71.70
8.	Republic of Korea	25.20	74.80
9.	Thailand	20.60	79.40
10.	United Kingdom	14.70	85.30
11.	Belgium	25.93	74.07
12.	Denmark	9.09	90.91
13.	F. R. Germany	30.65	69.35
14.	France	30.38	69.62
15.	Italy	11.24	88.76
16.	Netherlands	13.64	86.76
17.	Spain	10.00	90.00
18.	Austria	57.14	42.86
19.	Czechoslovakia	77.32	22.68
20.	Finland	25.93	74.07
21.	German DR	79.73	20.27
22.	Hungary	65.71	34.29
23.	Norway	22.22	77.78
24.	Sweden	46.15	53.85
25.	Switzerland	53.33	46.67
26.	Yugoslavia	55.77	44.23
27.	USA	59.18	40.82
28.	USSR	88.71	11.29

SOURCE: i) Transport Statistics Great Britian 1977-1987
ii) Review of Developments in T&C in ESCAP Region 1990.

It is clear from the above table that road freight traffic was dominant in about 18 countries where the road shared more than two third of the total traffic. However, there existed a reverse trend being experienced by few railways with freight traffic share on the average, of more than 50%.

The traffic analysis and modal split evinced that railways all over the world particularly the Asian and European systems have lost substantial volume of their freight traffic which was diverted towards other competitive transport modes mostly the roads. This widespread deterioration continued unabated. Pakistan Railway's freight traffic performance also seemed to be in line with the trend prevailing the world over.

3.3 Performance and Efficiency Indicators

The performance of railways is usually measured in terms of rate of utilization of equipment which is the indices of efficiency and productivity. This includes mainly rolling stock productivity particularly the locomotive productivity and availability, wagon turn around time, track & staff productivity. The productivity indicators wereanalysed and the comparative performance of different railways has been described in the following paragraphs.

3.3.1 Rolling Stock Productivity

Productivity of rolling stock depends upon their utilization. The carriage of traffic is greatly effected by the timely supply/availability of locomotives, coaches and wagons. The average pass.Km per coach, ton-kms per wagon and traffic units per locomotive are the measures of utilizing the rolling stock resources and thus form the operational efficiency indicators of a railway system. The table underneath indicates the productivity ratios of certain railways.

Table 3.6
PRODUCTIVITY OF COACHES, WAGONS AND LOCOMOTIVES

Name of Country	PKm per Coach (In Mill.)	Average No. of Passenger per Coach Per Annum (000)	TKm per Wagon per Annum (In Mill.)	Traffic Unit Per Locomotive Per Annum (In Mill.)
Pakistan	5.86	28.82	0.23	28.8
India	7.68	109.64	0.57	44.1
China	11.67	48.50	2.78	92.4
Turkey	3.84	82.18	0.33	12.9
Japan	8.25	295.40	0.60	121.2
Korea	8.09	178.15	0.80	63.4
Bagladesh	4.26	58.16	0.04	22.7
U.S.A.	3.04	48.50	0.95	59.7
Canada	-	-	1.73	73.5
Brazil	1.82	47.87	0.86	26.4
U.K.	2.25	50.27	0.35	17.9
France	3.82	49.27	0.25	19.1
Sweeden	3.10	36.83	0.49	19.4
Netherland	4.07	96.11	0.38	21.1
Poland	N.A.	N.A.	N.A.	23.6
Algeria	4.08	96.61	0.21	21.8
Tunsia	2.48	84.43	0.33	51.3
Moroco	4.07	24.12	0.51	28.3

The table revealed that China had the highest passenger and freight productivity with 11.67 million Pkm per coach and 2.78 million Tkm per wagon. India, Japan and Korea had almost same passenger productivity i.e. 8 million Pkm per coach, while Pakistan had 5.86 million Pkm per coach. The lower productivity per coach was found mostly in other European and African countries. Among these countries i.e. France, Sweden, Netherland in Europe and Algeria and Morocco in Africa had this ratio in the range of 3-4 million Pkm per coach.

On freight side, after China, Canada had 1.73 MTKms carried annually by one wagon. All the other railways of Europe, Asia and African including ARR of USA had wagon productivity lesser than 1 MTKm per wagon per annum. It may be noted that the predominantly freight railways like ARR, Brazil and some railways of Europe, Asia and Africa having attained little balance between two traffic outputs had wagon productivity lesser than coach productivity. Comparing annual PKm per coach and annual TKm per wagon for the railways listed in the above table, the productivity of coaches, on the average, was about 7 times that of wagons which reflected better utilization of coaching stock. However, it did not seem to have made any impact on the financial performance of the railway system as the increase in productivity of coaches may be offset by the higher cost of passenger traffic and lesser income on this account.

3.3.2 Productivity and availability of a Locomotives

Efficiency of utilization of locomotives can be assessed by the indices of engine kilometerage per locomotive, traffic handled per locomotive and locomotive availability. Based on the annual average of Engine kilometer per locomotive the average work done by a locomotive per day has been estimated - for some of the railways as under:

Table 3.7
DAILY ENGINE KILOMETERAGE PER LOCOMOTIVE

Sl. No.	Name of Country	Figures in Million 1980	1981	1982	1983	1984	1985	1986	1987	Daily Average Kms
1.	Pakistan	62	59	61	63	66	87	68	78	179
2.	India	67	72	87	77	82	88	0	87	299
3.	China	0	92	95	97	98	99	99	0	318
4.	Korea	139	149	156	190	166	192	162	170	453
5.	Japan	0	1213	1224	0	1578	1770	2041	-	2680
6.	Turkey	94	106	107	82	103	118	109	90	277
7.	Spain	111	108	109	100	95	87	90	90	270
8.	Sweden	100	133	123	102	132	121	119	122	326
9.	U.K.	236	262	246	266	345	198	206	252	689
10.	West Germany	114	112	109	112	114	100	101	118	301
11.	France	119	115	117	114	111	113	108	107	309

Among the railways listed above, Japan had the best usage of locomotive with average kilometerage per locomotive per day at 2680 kms. This may be because of large fleet of electric locomotives operated with the very fast speed. The other railways lagged far behind Japan. Both India

and Pakistan had lesser average as far as daily usage of locomotive was concerned while there were insignificant variation among European countries except for UK with average daily kilometerage of 689 kms per locomotive.

Traffic units per locomotives is another important performance indicators representing the utilization of the locomotives on entire railway network. The above table showed that China had the highest number of traffic units (84 million per locomotive). It may be noted that other railways in Asia i.e. Japan, Korea, India have significantly more traffic units per locomotive than the European railways of France, U.K., Sweden and Netherland. Pakistan Railway's performance in this regard was also better than these European railways. The ARR of USA had lagged behind the Korean & Japanese railways. The locomotive utilization was also low in the African countries. The analysis indicated that higher locomotive productivity was found mostly in the predominantly passenger oriented system except ARR, Canada and China.

The rolling stock productivity is largely affected by its extensive use. The availability of rolling stock particularly the locomotive is one of the essential factors contributing towards the productivity and is influenced relatively by the speed. As decline in speed adversely affects the availability thereby increase locomotive turn arround

time and consequently locomotive and its crew. In addition, the lower availability is a reflection of inefficient maintenance system/schedule. D.E. locomotive availability has been worked out in terms of percentage of in-affective locomotives on the basis of the UIC Statistics 1989 for some of the railways as under:

Table 3.8
AVERAGE LOCOMOTIVE AVAILABILITY

		Name of Country						
Item	Unit	Pakistan*	India	Turkey	Hungary	Japan	France	Canada
Annual average of D.E. Locomotive	(No)	565	3339	678	1078	717	3338	1241
Annual average of out of service D.E. Locomotive	(No)	96	354	239	194	89	216	44
Availability of D.E. Locomotives	%	83	89	65	82	88	94	96

* Actual: No. of D.E. Locomotives taken from PR Year Book 1988-89.

It may be noted that locomotive availability in these countries was in the range of 65-96%. Pakistan performance was better than Turkey but significantly lower than India which exceeded Japan. Canada, however was on the top among these countries.

3.3.3 Wagon Time Around Time and Wagon Loading

Wagon turn around time is another important efficiency/ performance indicator providing the extent of utilization and availability of a wagon. The lesser the turn around time, the greater would be the tunnage handled by a railway network. The turn around time depends interalia upon the speed, wagon detentions in yards/terminals, cargo disposal and wagon placement. The improvement in wagon operation through elimination of detentions and increase in speed results in reducing the wagon turn around time. The data in this regard for some of the railways system is indicated as under:

Table 3.9
AVERAGE WAGON TURN AROUND TIME
(No. of Days)

Name of country	1980	1981	1982	1983	1984	1985	1986	1987	Average
Pakistan	16.4	17.2	17.5	17.4	17.2	16.2	16.5	13.7	16.5
India	8.2	7.1	6.5	6.1	5.8	5.6	0.0	11.5	7.0
China	3.0	3.2	3.2	3.3	3.4	3.5	3.5	-	3.3
Korea	4.9	4.9	5.0	4.6	4.4	4.3	4.2	3.9	4.5
Japan	5.3	5.9	6.0	4.4	3.7	2.7	-	-	4.2
Turkey	8.8	11.3	10.8	8.0	11.9	11.9	13.2	13.2	11.1
Spain	6.8	4.9	5.8	8.5	5.8	5.9	4.7	7.1	6.2
Sweden	5.8	4.2	4.7	6.9	4.2	3.3	3.2	4.7	4.6
U.K.	7.0	4.6	4.0	4.7	4.1	4.2	3.9	-	4.6
West Germany	5.4	3.7	4.2	6.3	3.9	3.8	3.8	5.6	4.6
France	8.3	5.4	5.8	5.8	5.7	5.4	5.9	5.8	6.0

It is evident from the above table that Pakistan had the highest period for average wagon turn time around time (i.e. 16.5 days) while China has the lowest i.e. 3.3 days in the world. European countries did not differ except for France and Spain which had slightly higher. Indian average was much better than Pakistan and Turkey showed improvement with the passage of time. In case of PR, there has been no improvement in wagon turn around time. The reason may include inter-alia, the extensive delays caused in loading/unloading and in shunting the wagons in marshalling yards/terminals. Also the delay may be attributed to the old age wagon stock owned by Pakistan Railway, which needs to be replaced immediately so as to improve wagon turn around time which in turn would not only result in quicker movement of goods but will increase the freight carrying capacity of Pakistan Railways.

The other indices pertaining to efficiency of wagon utilization include delay wagon kilometerage, net ton kilometerage per wagon day, daily wagon loading over the entire system, empty haulage and loaded wagon kms. The data in respect of freight train kilometers including loaded wagon kms was available from International Railway Union (UIC) Statistics 1989. Based on the data, freight train kms including loaded wagons kms have been worked out as follows:

Table 3.10
WAGON USAGE IN TERMS OF FREIGHT TRAIN/LOADED WAGON KMS

Name of Railways	Freight Trains Kms (000) (All type of Traction)	Wagons Kms (000) Total	Loaded	(%)
Pakistan Railways	14,443	748,321	389,127	52
Indian Railways	239,521	18,090,739	11,183,093	62
Japanese Railways	91,164	1,655,103	1,366,811	83
Canadian Pacific Railways	40,934	2,645,402	1,633,355	62
Turkish Railways	16,690	447,761	285,424	64
Germany Federal Railways	196,029	5,539,275	3,665,892	66
French Railways	167,964	3,415,000	2,079,000	61

The above table indicates that Pakistan Railway's freight train kilometer was the lowest. Similarly the loaded wagon km was only 52% of the total which was far less than the other Railways listed in the above table. In other words, the ratio of loaded and empty haulage on Pakistan Railway was almost 50:50 which was the maximum as compared with other railways. This is understandable in view of the heavy dependency of Pakistan's economy on imports for which empty wagons have to be despatched to the ports. However, a decline in empty haulage is expected to be achieved through management information system and computerized wagon operation which project has been under PR's consideration for implementation.

3.3.4 Density of Traffic

Traffic density is the ratio of total number of traffic units per km of route track per year. It provides broad measure of the track utilization on the entire system. Traffic units are estimated by combining the passenger and freight (Pass km + Ton Km). However, passenger traffic density and freight traffic density has been calculated separately to indicate the tendency of the railway system towards a particular type of traffic. The ratios thus estimated for some railway systems have been revealed in the table.

Table 3.11
TRAFFIC DENSITIES

Name of Country	PKM (Million)	TKM (Million)	Total Traffic Units Million	Route Kilometerage (Kms)	Traffic Density (Traffic Units per KM of Rout per Year in Million)	MPKM per Route per Year	MTKM per KM of Route per Year
Pakistan	16850	8269	25119	8775	2.86	1.92	0.94
India	240614	196601	437215	61836	7.07	3.89	3.18
China	258311	875009	1133320	52487	21.59	4.92	16.67
Turkey	6052	7189	13241	8170	1.62	0.74	0.88
Japan	198299	19945	218244	19949	10.94	9.94	1.00
Korea	23563	12657	36220	3113	11.64	7.57	4.07
Bangladesh	6005	567	6572	2818	2.33	2.13	0.20
U.S.A.	17649	1352508	1370157	234584	5.84	0.08	5.77
Canada	-	92770	92770	25266	3.67	-	3.67
Brazil	1742	39956	41698	22057	1.89	0.08	1.81
U.K.	30819	16565	47384	16670	2.84	1.85	0.99
France	59618	51016	110634	34639	3.19	1.72	1.47
Sweeden	6152	17754	23906	11236	2.13	0.55	1.58
Netherland	8919	3107	12026	2817	4.27	3.17	1.10
Poland	48526	120043	168569	24333	6.93	1.99	4.93
Algeria	2011	3049	5060	3841	1.32	0.52	0.79
Tunisia	893	1417	2310	1484	1.56	0.60	0.95
Moroco	1958	4503	6461	1779	3.63	1.10	2.53
W.Germany	41397	59581	100978	27490	3.67	1.51	2.17
Spain	15646	13994	29640	12721	2.33	1.23	1.10

It may be noted from the above that China had the highest total traffic density, though its passenger traffic density was the third best. From the analysis it is apparent that the density of traffic on Pakistan Railway system can be comparable with that of certain European Railway such as U.K., France and Germany. It may be pertinent to point out that railway system with higher freight traffic density was more productive in terms of usage of track than the predominantly passenger service systems. The low traffic densities envisage the under utilization of the line capacity depending upon different factors need to investigated separately.

3.4 Staff & Labour Productivity

There is no criteria or yardstick followed for the number of personnels employed by a railway. This depends upon the requirement of a particular railway system. However, automation and modernization including Management Information System (MIS), computerization etc. introduced on many railways of the world have gradually replaced the manual operation and thereby resulted in reducing the manpower requirement. For the purpose of comparison, the ratios relating to staff per km of line, staff productivity i.e. Traffic units (Pass km + Tonne km) per employee and their relationship with other operating statistics are tabulated below:

Table 3.12
STAFF PRODUCTIVITY/LABOUR OUTPUT

Name of the country	Staff Strength	No. of Employees per km of line	Staff Productivity (Traffic Units per Employee in 000)	Passenger Traffic Density (Pass-km per km in 000)	Freight Traffic Density (Ton-km per km in 000)
Pakistan	128047	14.59	196	1920	942
Turkey	65927	8.07	201	741	880
India	1613280	26.09	271	3891	3179
Hungary	133718	17.56	233	1241	2855
Japan	223947	11.23	975	9940	1000
U.K.	171400	10.28	276	1849	994
U.S.A.	323946	1.38	4230	75	5766
France	233404	6.74	474	1721	1473
Canada	25953	1.03	3575	-	3672 *
Iran	38963	8.53	326	206	1744
Korea	38854	12.48	932	7569	4066
China	1860786	35.45	609	4921	16671
Bagladesh	59822	21.23	110	2131	201
Sri Lanka	21150	15.17	112	1514	177
Algeria	19604	5.10	258	524	794
Poland	373639	15.39	451	1994	4933

Note: Based on data as existed in 1986-87.

* Data obtained from UIC statistics 1989

The size of the system in terms of staff cannot be compared because of the reason indicated above. However, the system size can be measured by the labour intensity i.e. number of employees per km of line (a ratio which is a normalized to compare size of the system). Though the different railway systems were at variance with each other as far as the ratios of employees per km of line are concerned but as evident from the above table there was no much difference between the ratios of the railways which are predominantly passenger carrier such as Pakistan, Bangladesh and Sri Lanka as compared with Japan, Korea and U.K. Out of 44 Railways considered for the study, Pakistan Railways ranked 24th among the countries having about 15 employees per km. This was 57% of the ratio of Indian Railway which is the largest railway in Asia. It may be noted that Turkish Railways had route kms almost equal to Pakistan Railways but their staff per km of line was about half that of PR.

The staff productivity or the labour productivity is a measure of number of traffic units per employee of a railway system. This is comparative ratio used to explain the output of the staff/labour in the railway system's performance. The above table reveals that significant variations existed in the traffic units per employee among different railways. USA and Canada had the highest productivity ratios while Sri Lanka and Bangladesh have the lowest figures. It may be pointed out that

American and Canadian Railways are basically freight haulers. Among the Asian countries Japan and Korea had almost equal level of the ratio which was significantly higher than India, Turkey, Pakistan etc. In the European countries such as France, Germany, Sweden, Poland, etc. the labour productivity was found in the range of 370-667 million traffic units (MTUs) but U.K. fell far short of this range with figure of 276 MTUs per employee.

An interaction is found between the labour output and passenger and freight traffic. In overall terms, the staff productivity is directly proportional to freight traffic and inversely proportional to passenger traffic. It increases with the increase in ton-kms. while the traffic units per employee was low in the countries where the share of passenger traffic carried by railways was as high as more than 70%. The ratio of no. of employees per km of line has also been studied with in relation with traffic density including freight or passenger traffic density. The analysis evinced that some of the railway system with relatively higher passenger traffic density did not have much variations in the ratios of employees per km of line as compared to much larger railways as evident from the labour productivities of Pakistan, Bangladesh, Sri Lanka (having relatively higher passenger traffic density) as compared with that of Japan, Korea, U.K. (termed as mainly passenger oriented carriers). This analysis led to conclude that the smaller railways focusing mainly on

passenger services had labour intensity equivalent to that of much larger railways also having much higher passenger traffic densities. As against this, the system with higher freight traffic densities such as ARR of USA, Canada had low level of employees per km of line, which implied that such system had affected by the economies of scale achieved by these countries. One interesting finding of the analysis was that Chinese railways had freight traffic density almost 3 times higher than USA but its labour productivity was much lower than that of USA (14% of USA's 4.23 MTUs per employee).

CHAPTER-IV

FINANCIAL ANALYSIS

CHAPTER - IV

FINANCIAL ANALYSIS

Financial performance of a railway system is judged in terms of assets and liabilities, revenues and expenses and the profitability. The data and figures pertaining to balance sheets or profit & loss accounts of different railways were available in different currencies which could not be converted into a common denominator (U.S.Dollar or Pak. rupee) due to the non-availability of a common conversion factor/exchange rate. Owing to this problem, the ratios including liquidity ratio, operating ratio, rate of return etc. have been used to measure and compare, the financial performance of various railways which are shown in the following table. It may be pointed out that except for the Pakistan and Indian Railways, data pertaining to assets, liabilities, operating expenses and revenues for the railways listed in the table were taken from the International Union of Railway Statistics (UIC) 1989 to work out the ratios. The relevant data for Pakistan Railways (PR) and Indian Railways (IR) were obtained from the P.R. year work/Appropriation accounts for 1990-91 & I.R. Year book 1986-87.

Table 4.1
FINANCIAL RATIOS

Name of Country	Liquidity Ratio (Current Assets Stock/ (Current Liabilities)	Operating Ratio (Operating Expenses/ Operating Revenues)	Turn Over Fixed Assets (Operating Revenue/ Fixed Assets) (%)	Turn Over Total Assets (Operating Revenue/ Total Assets) (%)	Ratio of Fixed Assets to Total Assets (Total Assets: (Net Fixed Assets/ Total Assets) (%)	Ratio of Earnings on capital Employed (Net profit or Net Loss Over Total Assets) (%)	Rate of Return on fixed total Assets (Net profit or (Net Loss Over Fixed Assets) (%)
1	2	3	4	5	6	7	8
Pakistan	(1) 0.54	(2) 1.16	75	30	40	(-3)	(-8)
India	(3) 0.51	0.930	52	42	80	0.62	0.82
Turkey	0.86	1.152	31	24	77	(-3.58)	(-4.67)
China	-	0.724	24	-	-	-	6.71
Japan	0.53	0.925	57	52	91	1.94	2.14
Korea	0.60	1.028	22	20	95	(-0.06)	(-0.07)
U.K.	0.95	0.930	162	94	58	6.57	11.30
France	0.48	1.061	36	55	67	0.07	0.11
Germany	0.53	1.129	43	36	82	(-4.58)	(-5.58)
Sweden	0.80	0.997	157	107	67	0.35	0.52
Belgium	0.64	0.992	45	39	88	0.38	0.38
Bulgaria	-	0.923	-	-	-	-	-
Algeria	0.54	1.296	9	7	77	(-1.41)	(-1.85)
Tunis	0.40	1.235	18	14	77	(-1.51)	(-11.0)
Keneya	1.88	0.976	57	30	53	(-3.28)	(- 6.23)
Morocco	0.52	1.123	21	14	67	(-1.56)	(- 2.34)
Brazil	0.19	0.991	3	3	98	(0.03)	(0.03)
Uruguay	0.47	2.996	19	12	66	(-24.23)	(-36.60)

Source: UIC Statistics 1989

Note :

i) Excluding the Balance account with the Government and inventories from current assets (Appropriation Accounts of Pakistan Railways 1990-91 Vol. V)

ii) Based on 1990-91 figure which has increased to 0.95 in 1991-92

iii) Current liabilities excluding the dividend which if included, the ratio stood at 0.52

4.1 Liquidity Ratio: It is the ratio of current assets owned by a firm to the current liabilities. The current assets excluded the inventories/Stock. The value of the ratio higher than one means that the current assets are more than the liabilities. The highest current ratio estimated for some railways in the above table was pertained to Railway of Kenya (1.88:1) followed by U.K. (0.95:1) and Turkey (0.86:1). Brazil had the lowest ratio (0.19:1). The current assets of Pakistan, India and Japan were half of the current liabilities.

4.2 Operating Ratio: Operating Ratio is defined as ratio of ordinary operating/working expenses to the operating revenues. The expenses included depreciation funds and interest charges and the operating revenues consisted of gross traffic receipts, luggage, parcels, mail and miscellaneous earnings. The operating ratio of value less than one is an index of profitability of a railway operation whereas the its value higher than one is an indicator of the uneconomical and inefficiency of the railway operation and consequent loss to the railway system.

Among the countries listed in the above table, China had the lowest operating ratio (0.724) followed by Bulgaria and Japan (0.923 and 0.925 respectively). The highest operating ratio was shown by Uruguay (2.996). PR's operating ratio was also higher than one (1.16, in 1990-91)

but in the year 1991-92, it has reduced to 0.95 indicating residual amount available to meet the over-head expenses. Among European Countries France (1.061) and Germany (1.129) had higher operating ratios. It may be noted that despite higher operating ratio, French Railway managed to earn profit (though nominal) on the capital employed (col 7 & 8 of the above table). On the other hand Kenyan Railway with operating ratio of 0.976 and highest liquidity ratio had incurred losses of 26.23% on the capital employed during 1989. India and U.K had same figure of operating ratio (0.930 which implied that they had enough surplus available for distribution to other head of accounts. However, U.K had the highest profitability (11.3%) while China which having least operating ratio of 0.72 in the above table was the second highest as for as rate of return was concerned (6.71%) and Japan with 2.14% was the third. Out of the 18 railways listed above, 9 railways had suffered from losses while Uruguay had the highest percentage (-)36.6% followed by Tunis and Pakistan (-11.0% and -8% respectively). Among European railways, Germany incurred losses of the level of 5.58%. The position of Indian Railways seemed to be sound among developing as well as Asian countries with rate of return at 0.82% which was based on 1986/87 statistics.

4.3 Ratios of wages, cost, revenues and fares

In the data analysis various productivities were discussed which included among others, the staff/labour productivity. It was considered important to determine proportion of the wage bill in the total cost and revenues of a railway system. In addition, the railways in developing countries and also some European railways placed emphasis of passenger services than the freight services. On the contrary, the developing countries normally charge less fares for the passenger services which contribute less to the revenues as compared to freight services. This aspect was also studied. The ratios of wages in relation to total cost and revenues and the ratios of passenger revenues and fares with respect to that of freight revenues and fares estimated for some of the railway systems of the World are given as under:-

Table 4.2
WAGES, COST, REVENUES AND FARES PROPORTIONS

Railways	Proportions of Staff Cost to Total Cost %	Proportions of Staff Cost to Total Revenue %	Ratio of Pass. Revenue to Freight Revenue	Ratio of Pass. Fares to Freight Rates %
1	2	3	4	5
Pakistan	37 *	37.35	0.25	39.6
India	51 **	47.38	0.30	29.6
Turkey	42	48.90	0.23	34.4
China	-	-	1.10	163.8
Japan	32	28.91	1.50	173.4
Korea	37	0.05	0.75	-
UK	50	47.02	1.15	122.3
France	51	53.88	1.20	119.3
Germany	60	68.10	1.40	143.4
Sweden	53	53.27	1.73	211.9
Belgium	69	68.37	2.36	228.6
Bulgaria	40	36.81	-	-
Algeria	54	70.27	0.61	63.9
Tunis	41	49.31	0.75	76.5
Kenya	54	52.66	0.35	28.9
Morocco	34	37.70	0.76	96.5
Brazil	10	9.93	0.38	15.6
Uruguay	55	163.80	0.40	-

Source:
UIC Statistics 1989
Estimated from Figure 16 of World Bank Survey
(Data 1980-89)

Note

* Figure of 37% pertained to 1990-91 however this increased to 40% in 1991-92 (PR Year Book 1991-92)

** Indian Railway Year Book (1986-87)

It may be noted that among Asian Railways for which the data was available, Indian Railway had the highest cost of wages which constituted 51% of the expenses. It may be due to the largest number of employees owned by Indian Railways. PR's staff cost was little more than one third of the total expenses and was at par with Korea. However, this ratio had increased to 40% in 1991-92. Japanese Railways spent about one third of their total expenditure on the wages. Brazil had the lowest figure (10%) while Belgium had the highest (69%). The wages cost on the average, more than 50% of the expenditure incurred by the most of the European Railways. This may be due to the higher labour charges paid in European countries. Similarly corresponding to the proportion of staff cost in the total expenses, the ratio of staff cost to the total revenues was also calculated. The railways of Uruguay had the highest percentage (163.8%) while Korean Railways had the lowest (0.05%). For Pakistan Railway, this ratio was same as of the ratio of wages to the total expenditure (37.35%). Generally, the cost of wages in proportion to revenues for about all the railways listed above followed the same trend as the ratio of staff cost to the total expenses of the railway operation with the exception Railways of Uruguay & Korea where in very high variations between the two ratios are extraordinary.

Other two ratios in Column 4 & 5 of above table indicates the proportion of passenger revenues and fares in relation to that of freight

services. It may be noted that except for European countries and for China and Japan, the revenues earned by rail passenger services were less than the freight revenues. In case of Pakistan India & Turkey the passenger earning was even less than 0.5% of the freight earnings. This was due to the reason that developing countries have the tendency to charge less for passenger services than freight charges as evident from column 5 of the above table. On the other hand, the European railways together with China and Japan charge more for passenger services than freight services and it was for this reason the revenue on this account were higher than freight earnings. It may, however, be clarified that freight charges in these countries may not be on lower side. They appeared to be less compared with the passenger fares.

A P P E N D I C I E S

Appendix-I

Relationship of Population, Area for Staff & Route Length of Different Railways

Sl. No.	Name of Country	Population (000) Of the Country	Area (Sq.Km.) Of the Country	Route Kilometreage Of the Railway	Staff Of the Railway	Employees per (000) Population	Route Kilometreage per (000) Population	Employees per (Sq.Km.) of Area	Route Kilometreage per (Sq.Km.) of Area
1	2	3	4	5	6	7	8	9	10
1.	Pakistan	105,409	796,095	8,775	128,047	1.215	0.083	0.161	0.011
2.	India	807,062	3,166,829	61,836	1,613,280	1.999	0.077	0.509	0.020
3.	U.S.A.	241,657	9,372,570	234,584	323,946	1.341	0.971	0.035	0.025
4.	U.S.S.R.	283,215	22,402,076	145,576	N.A.	N.A.	0.514	N.A.	0.006
5.	China	1,106,000	9,597,000	52,487	1,860,786	1.682	0.047	0.194	0.005
6.	France	56,145	547,014	34,639	233,404	4.157	0.617	0.427	0.063
7.	German (West)	64,480	248,577	27,490	272,790	4.231	0.426	1.097	0.111
8.	Canada	25,781	9,976,139	25,266	25,953	1.007	0.980	0.003	0.003
9.	Poland	37,822	312,677	24,333	373,639	9.879	0.643	1.195	0.078
10.	Brazil	136,963	8,511,965	22,057	64,766	0.473	0.161	0.008	0.003
11.	Japan	122,918	372,313	19,949	223,947	1.822	0.162	0.602	0.054
12.	U.K.	58,194	244,755	16,670	171,400	2.945	0.286	0.700	0.068
13.	Italy	58,422	301,825	16,068	214,947	3.679	0.275	0.712	0.053
14.	German. East.	64,408	248,577	14,005	246,007	3.820	0.217	0.990	0.056
15.	Spain	38,922	5,047,509	12,721	66,509	1.709	0.327	0.013	0.003
16.	Czechoslovakia	15,537	127,899	13,116	208,207	13.315	0.839	1.628	0.103
17.	Sweden	8,564	449,964	11,236	35,826	4.183	1.312	0.080	0.025
18.	Yugoslavia	23,715	255,804	9,246	156,198	6.586	0.390	0.611	0.036
19.	Turkey	50,732	780,576	8,170	65,927	1.300	0.161	0.084	0.010
20.	Hungary	10,990	93,030	7,616	133,718	12.167	0.693	1.437	0.082
21.	Finland	4,824	338,145	5,899	25,621	5.311	1.223	0.076	0.017
22.	Austria	7,815	83,854	5,745	70,675	4.395	0.357	0.009	0.001
23.	Australia	16,079	7,692,300	5,488	18,997	N.A.	N.A.	N.A.	N.A.
24.	Zaire	N.A.	N.A.	4,772	N.A.	N.A.	N.A.	N.A.	N.A.
25.	Iran	44,444	1,648,000	4,567	38,963	0.877	0.103	0.024	0.003
26.	Norway	4,385	324,219	4,216	15,832	3.610	0.961	0.049	0.013
27.	Algeria	21,351	2,381,741	3,841	19,604	0.918	0.180	0.008	0.002
28.	Belgium	9,958	30,540	3,618	55,193	5.543	0.363	1.807	0.118
29.	Portugal	10,451	92,082	3,603	21,433	2.051	0.345	0.233	0.039
30.	Zimbabwe	8,325	391,090	3,394	18,935	2.274	0.407	0.048	0.009
31.	Mozambique	N.A.	N.A.	3,131	18,915	N.A.	N.A.	N.A.	N.A.
32.	Korea	40,845	98,913	3,113	38,854	0.951	0.076	0.393	0.031
33.	Switzerland	6,601	41,228	2,986	37,010	5.607	0.452	0.898	0.072
34.	Bangladesh	102,065	143,998	2,818	59,822	0.586	0.028	0.415	0.020
35.	Netherlands	14,860	41,160	2,817	27,474	1.849	0.190	0.667	0.068
36.	Denmark	5,218	43,076	2,471	21,437	4.108	0.474	0.498	0.057
37.	Greece	10,512	131,957	2,461	14,596	1.389	0.234	0.111	0.019
38.	Iraq	15,107	434,925	2,029	16,534	1.094	0.134	0.038	0.005
39.	Ireland	3,700	70,282	1,944	15,000	4.054	0.525	0.213	0.028
40.	Morocco	16,265	329,749	1,779	12,899	0.793	0.109	0.039	0.005
41.	Syria	10,260	185,180	1,525	9,658	0.941	0.149	0.052	0.008
42.	Tunis	21,893	939,652	1,484	8,168	0.373	0.068	0.009	0.002
43.	Saudi Arabia	11,564	2,150,000	1,401	1,912	0.165	0.121	0.001	0.001
44.	Taiwan	18,604	36,000	1,075	21,360	1.148	0.058	0.593	0.030

Appendix-II

Relationship of Population, Area for Locomotives Coaches & Wagons of Different Railways

Sl. No.	Name of Country	Population (000) Of the Country	Area (Sq.Km.) Of the Country	Locomotive Of the Railways	Coach Of the Railways	Wagon Of the Railways	Locomotive Per(000) Population	Coach Per(000) Population	Wagon Per(000) Population	Locomotive Per(Sq.Km.) of Area	Coach Per(Sq.Km.) of Area	Wagon Per(Sq.Km.) of Area
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Pakistan	105,409	796,095	873	2,877	35,237	0.008	0.027	0.334	0.001	0.004	0.044
2.	India	807,062	3,166,829	9,920	31,317	347,748	0.012	0.039	0.431	0.003	0.010	0.110
3.	U.S.A.	241,657	9,372,570	22,932	5,806	1,421,686	0.095	0.024	5.883	0.002	0.001	0.152
4.	U.S.S.R.	283,215	22,402,076	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5.	China	1,106,000	9,597,000	12,266	22,138	314,537	0.011	0.020	0.284	0.001	0.002	0.033
6.	France	56,145	547,014	5,807	15,609	200,015	0.103	0.278	3.562	0.011	0.029	0.366
7.	Germany(West)	64,480	248,577	6,481	15,957	299,043	0.101	0.247	4.638	0.026	0.064	1.203
8.	Canada	25,781	9,976,139	1,262	N.A.	53,488	0.049	N.A.	2.075	0.0001	N.A.	0.005
9.	Poland	37,822	312,677	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
10.	Brazil	136,963	8,511,965	1,582	959	46,397	0.012	0.007	0.339	0.0001	0.0001	0.005
11.	Japan	122,918	372,313	1,801	24,049	33,204	0.015	0.196	0.270	0.005	0.065	0.089
12.	U.K.	58,194	244,755	2,642	13,713	47,730	0.045	0.236	0.820	0.011	0.056	0.195
13.	Italy	58,422	301,825	3,276	14,649	110,871	0.056	0.251	1.898	0.011	0.049	0.367
14.	German (East)	64,408	248,577	N.A.	10,151	169,619	N.A.	0.158	2.634	N.A.	0.041	0.682
15.	Spain	38,922	5,047,509	1,398	4,066	41,225	0.036	0.104	1.059	0.0003	0.001	0.008
16.	Czechoslovakia	15,637	127,899	4,729	9,670	151,731	0.302	0.618	9.703	0.037	0.076	1.186
17.	Sweden	8,564	449,964	1,234	1,932	36,298	0.144	0.231	4.238	0.003	0.004	0.081
18.	Yugoslavia	23,715	255,804	1,411	3,847	53,180	0.059	0.162	2.242	0.006	0.015	0.208
19.	Turkey	50,732	780,576	1,028	1,574	21,966	0.020	0.031	0.433	0.001	0.002	0.028
20.	Hungary	10,990	93,030	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
21.	Finland	4,824	338,145	737	1,051	16,176	0.153	0.218	3.768	0.002	0.003	0.054
22.	Austria	16,079	7,692,300	1,223	3,788	36,862	0.076	0.236	2.293	0.0001	0.001	0.005
23.	Australia	N.A.	N.A.	322	215	4,641	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
24.	Zaire	N.A.	N.A.	N.A.	N.A.	8,239	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
25.	Iran	44,444	1,648,000	522	967	12,420	0.012	0.022	0.279	0.0003	0.001	0.008
26.	Norway	4,385	324,219	370	976	7,233	0.084	0.223	1.649	0.001	0.003	0.022
27.	Algeria	21,351	2,381,741	232	493	14,291	0.011	0.023	0.669	0.0001	0.0002	0.006
28.	Belgium	9,958	30,540	1,124	3,521	37,645	0.113	0.354	3.780	0.037	0.115	1.233
29.	Portugal	10,451	92,082	315	1,232	5,462	0.030	0.118	0.523	0.003	0.013	0.059
30.	Zimbabwe	8,325	391,090	433	372	12,998	0.052	0.045	1.561	0.001	0.001	0.033
31.	Mozambique	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
32.	Korea	40,845	98,913	571	2,913	15,658	0.014	0.071	0.388	0.006	0.029	0.160
33.	Switzerland	6,601	41,228	1,419	3,956	23,784	0.215	0.600	3.603	0.034	0.096	0.577
34.	Bangladesh	102,085	143,998	290	1,410	15,908	0.003	0.014	0.156	0.002	0.010	0.110
35.	Netherlands	14,860	41,160	569	2,190	8,233	0.038	0.147	0.554	0.014	0.053	0.200
36.	Denmark	5,218	43,076	400	1,615	5,431	0.077	0.310	1.041	0.009	0.037	0.126
37.	Greece	10,512	131,957	214	692	10,588	0.020	0.066	1.007	0.002	0.005	0.080
38.	Iraq	15,107	434,925	430	646	14,914	0.028	0.043	0.987	0.001	0.001	0.034
39.	Ireland	3,700	70,282	130	326	1,959	0.035	0.088	0.529	0.002	0.005	0.028
40.	Morocco	16,265	329,749	228	481	8,865	0.014	0.030	0.545	0.001	0.001	0.027
41.	Syria	10,260	185,180	192	488	5,267	0.019	0.048	0.513	0.001	0.003	0.028
42.	Tunis	21,893	939,652	45	302	5,578	0.002	0.014	0.254	0.0000	0.0003	0.006
43.	Saudi Arabia	11,584	2,150,000	49	58	2,329	0.004	0.005	0.201	0.0000	0.0000	0.001
44.	Taiwan	18,604	36,000	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Appendix-III

Comparative Statistics of Locomotives and Their Relationship with Route Kms. Employees

Sl. No.	Name of Railways	Route Kilometrage (Kms.)	Staff	NUMBER OF LOCOMOTIVES				Number of Employees per Kilometre of Line.	Number of Employees per Locomotives	Route Length per Locomotve
				Steam	Diesel	Electric	Total			
1	2	3	4	5	6	7	8	9	10	11
1.	Pakistan Railways	8,775	128,047	338	512	23	873	14.59	146.67	10.05
2.	Indian State Railways	61,836	1,613,280	5,571	3,047	1,302	9,920	26.09	162.63	6.23
3.	American Rail-Roads	234,584	323,946	2	22,869	61	22,932	1.38	14.13	10.23
4.	Soviet Union Railways	145,576	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5.	Chinese Railways	52,487	1,860,786	7,542	4,017	707	12,266	35.45	151.70	4.28
6.	French National Railways	34,639	233,404	N.A.	3,444	2,363	5,807	6.74	40.19	5.97
7.	German Federal Railways	27,490	272,790	N.A.	3,884	2,597	6,481	9.92	42.09	4.24
8.	Canadian Pacific Railways	25,266	25,953	N.A.	1,262	N.A.	1,262	1.03	20.56	20.02
9.	Polish State Railways	24,333	373,639	N.A.	N.A.	N.A.	N.A.	15.36	N.A.	N.A.
10.	Brazilian Railways	22,057	64,766	27	1,515	40	1,582	2.94	40.94	13.94
11.	Japanese National Railways	19,949	223,947	5	822	974	1,801	11.23	124.35	11.08
12.	British Railways	16,670	171,400	N.A.	2,398	244	2,642	10.28	64.88	6.31
13.	Italian State Railways	16,068	214,947	48	1,139	2,089	3,276	13.38	65.61	4.90
14.	German State Railways	14,005	246,007	N.A.	N.A.	N.a.	N.A.	17.57	N.A.	N.A.
15.	Spanish National Railways	12,721	66,509	N.A.	775	623	1,398	5.23	47.57	9.10
16.	Czechoslovak State Railways	13,116	208,207	5	3,295	1,429	4,729	15.87	44.03	2.77
17.	Swedish State Railways	11,236	35,826	N.A.	540	694	1,234	3.19	29.03	9.11
18.	Yugoslav Railways Community	9,246	156,198	105	811	495	1,411	16.89	110.70	6.55
19.	Turkish Republic Railways	8,170	65,927	380	630	18	1,028	8.07	64.13	7.95
20.	Hungarian State Railways	7,616	133,718	N.A.	N.A.	N.A.	N.A.	17.56	N.A.	N.A.
21.	Finnish Railways	5,899	25,621	N.A.	627	110	737	4.34	34.76	8.00
22.	Austrian Federal Railways	5,745	70,675	17	498	708	1,223	12.30	57.79	4.70
23.	Victorian Railways(Australia)	5,488	18,997	N.A.	297	25	322	3.46	59.00	17.04
24.	Zaire Railways	4,772	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
25.	Iranian Republic Railways	4,567	38,963	N.A.	514	8	522	8.53	74.64	8.75
26.	Norwegian Railways	4,216	15,832	N.A.	204	166	370	3.76	42.79	11.39
27.	Algerian Railways	3,841	19,604	N.A.	207	25	232	5.10	84.50	16.56
28.	Belgian Railways	3,618	55,193	N.A.	770	354	1,124	15.26	49.10	3.22
29.	Portugese Railways	3,603	21,433	4	267	44	315	5.95	68.04	11.44
30.	Zimbabwe Railways	3,394	18,935	83	320	30	433	5.58	43.73	7.84
31.	Mozambique Railways	3,131	16,915	N.A.	N.A.	N.A.	N.A.	6.04	N.A.	N.A.
32.	Korean National Railways	3,113	38,854	N.A.	480	91	571	12.48	68.05	5.45
33.	Swiss Federal Railways	2,986	37,010	N.A.	271	1,148	1,419	12.39	26.08	2.10
34.	Bangladesh Railways	2,818	59,822	N.A.	290	N.A.	290	21.23	206.28	9.72
35.	Netherlands Railways	2,817	27,474	N.A.	419	150	569	9.75	48.28	4.95
36.	Danish State Railways	2,471	21,437	N.A.	390	10	400	8.68	53.59	6.18
37.	Greece Railways	2,461	14,596	N.A.	214	N.A.	214	5.93	68.21	11.50
38.	Iraqi Republic Railways	2,029	16,534	23	407	N.A.	430	8.15	38.45	4.72
39.	Irish Railways	1,944	15,000	N.A.	130	N.A.	130	7.72	115.38	14.95
40.	Moroccan Railways	1,779	12,899	N.A.	128	100	228	7.25	56.57	7.80
41.	Syrian Railways	1,525	9,658	N.A.	192	N.A.	192	6.33	50.30	7.94
42.	Tunisian Railways	1,484	8,168	N.A.	45	N.A.	45	5.50	181.51	32.98
43.	Saudi Arabian Railways	1,401	1,912	N.A.	49	N.A.	49	1.36	39.02	28.59
44.	Taiwan Railways.	1,075	21,360	N.A.	N.A.	N.A.	N.A.	19.87	N.A.	N.A.

Appendix – IV

Comparative Statistics of Coaches & Their Relationship with Route Kms. & Employees

Sl. No.	Name of Railways	Route Kilometrage (Kms.)	Staff	Number of Coaches including Railcars and Trailers	Total No. of Seats including Sleeping Accommodation	Number of Employees per Coach	Number of Seats per Employee	Number of Coaches per Kilometre of Line.	Number of Seats per Kilometre of Line.
1	2	3	4	5	6	7	8	9	10
1.	Pakistan Railways	8,775	128,047	2,877	N.A.	44.51	N.A.	0.33	N.A.
2.	Indian State Railways	61,836	1,613,280	31,317	2,746,009	51.51	1.70	0.51	44.41
3.	American Rail-Roads	234,584	323,946	5,806	521,300	55.80	1.61	0.02	2.22
4.	Soviet Union Railways	145,576	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5.	Chinese Railways	52,487	1,860,786	22,138	N.A.	84.05	N.A.	0.42	N.A.
6.	French National Railways	34,639	233,404	15,609	1,105,166	14.95	5.08	0.45	34.21
7.	German Federal Railways	27,490	272,790	15,957	1,171,786	17.09	4.30	0.58	12.63
8.	Canadian Pacific Railways	25,266	25,953	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
9.	Polish State Railways	24,333	373,639	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
10.	Brazilian Railways	22,057	64,766	959	43,023	67.53	0.66	0.04	1.95
11.	Japanese National Railways	19,949	223,947	24,049	N.A.	9.31	N.A.	1.21	N.A.
12.	British Railways	16,670	171,400	13,713	896,729	12.50	5.23	0.82	53.79
13.	Italian State Railways	16,068	214,947	14,649	1,067,324	14.67	4.97	0.91	66.43
14.	German State Railways	14,005	246,007	10,151	N.A.	24.23	N.A.	0.72	N.A.
15.	Spanish National Railways	12,721	66,509	4,066	279,428	16.36	4.20	0.32	21.97
16.	Czecnoslovak State Railways	13,116	208,207	9,670	445,668	21.53	2.14	0.74	33.98
17.	Swedish State Railways	11,236	35,326	1,982	119,799	18.08	3.34	0.18	10.66
18.	Yugoslav Railways Community	9,246	156,198	3,847	241,876	40.60	1.55	0.42	26.16
19.	Turkish Republic Railways	8,170	65,927	1,574	100,190	41.89	1.52	0.19	12.26
20.	Hungarian State Railways	7,616	133,718	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
21.	Finnish Railways	5,899	25,621	1,051	70,812	24.38	2.76	0.18	12.00
22.	Austrian Federal Railways	5,745	70,675	3,788	243,833	18.66	3.45	0.66	42.44
23.	Victorian Railways(Australia)	5,488	18,997	215	12,482	88.36	0.66	0.40	2.27
24.	Zaire Railways	4,772	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
25.	Iranian Republic Railways	4,567	38,963	967	55,094	40.29	1.41	0.21	12.06
26.	Norwegian Railways.	4,216	15,832	976	54,967	16.22	3.47	0.23	13.04
27.	Algerian Railways	3,841	19,604	493	32,342	39.76	1.65	0.13	8.42
28.	Belgian Railways	3,618	55,193	3,521	309,329	15.68	5.60	0.97	85.50
29.	Portugese Railways	3,603	21,433	1,232	92,836	17.40	4.33	0.34	25.77
30.	Zimbabwe Railways	3,394	16,935	372	23,809	50.90	1.26	0.11	7.02
31.	Mozambique Railways	3,131	18,915	N.A.	N.A.	N.A.	N.A.	N.A.	N. A.
32.	Korean National Railways	3,113	38,854	2,913	152,914	13.34	3.94	0.94	49.12
33.	Swiss Federal Railways	2,986	37,010	3,958	264,373	9.35	7.14	1.33	88.54
34.	Bangladesh Railways	2,818	59,822	1,410	91,497	42.43	1.53	0.50	32.47
35.	Netherlands Railways	2,817	27,474	2,190	148,686	12.55	5.42	0.78	52.85
36.	Danish State Railways	2,471	21,437	1,615	103,418	13.27	4.82	0.65	41.85
37.	Greece Railways	2,461	14,596	692	41,434	21.09	2.84	0.28	16.84
38.	Iraqi Republic Railways	2,029	16,534	646	N.A.	25.59	N.A.	0.32	N.A.
39.	Irish Railways	1,944	15,000	328	20,768	46.01	1.39	0.17	10.69
40.	Moroccan Railways	1,779	42,899	481	39,529	26.82	3.06	0.27	22.22
41.	Syrian Railways	1,525	9,658	488	30,452	19.79	3.15	0.32	19.97
42.	Tunisian Railways	1,484	8,168	302	14,108	27.05	1.73	0.20	9.51
43.	Saudi Arabian Railways	1,401	1,912	58	2,728	32.97	1.43	0.04	1.95
44.	Taiwan Railways	1,075	21,360	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Appendix-V

Comparative Statistics of Wagons and Their Relationship with Route Kms. and Employees

Sl. No.	Name of Railways	Route Kilometrage (Kms.)	Staff	Total No. of Wagons	Total Capacity (Tonnes)	Average Capacity of a Wagon (Tonnes)	Number of Employees per Wagon	Total Capacity (Tonnes) per Employee	Number of Wagons per Kilometre of Line.	Total Capacity (Tonnes) per Kilometre of Line.
1	2	3	4	5	6	7	8	9	10	11
1.	Pakistan Railways	8,775	128,047	35,237	878,153	24.8	3.63	6.86	4.02	100.07
2.	Indian State Railways	61,836	1,613,280	347,748	10,957,966	31.5	4.64	6.79	5.62	177.20
3.	American Rail Roads	234,584	323,946	1,421,686	107,067,500	75.3	0.23	330.50	6.06	456.40
4.	Soviet Union Railways	145,576	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5.	Chinese Railways	52,487	1,807,786	314,537	N.A.	N.A.	5.92	N.A.	5.10	N.A.
6.	French National Railways	34,639	233,404	200,015	8,498,874	42.5	1.17	36.40	5.77	245.35
7.	German Federal Railways	27,490	272,790	299,043	10,742,942	35.9	0.91	39.40	10.90	390.80
8.	Canadian Pacific Railways	25,266	25,953	53,498	4,036,451	75.5	0.49	155.53	2.12	159.75
9.	Polish State Railways	24,333	373,639	N.A.	N.A.	N.A.	N. A.	N.A.	N.A.	N.A.
10.	Brazilian Railways	22,057	64,766	46,397	2,665,129	57.4	1.40	41.10	2.10	120.83
11.	Japanese National Railways	19,949	223,947	33,204	N.A.	N.A.	6.74	N.A.	1.66	N.A.
12.	British Railways	16,670	171,400	47,730	1,621,395	34.0	3.59	9.50	2.86	97.30
13.	Italian State Railways	16,068	214,947	110,671	3,665,131	33.1	1.94	17.05	6.90	228.10
14.	German State Railways	14,005	246,007	169,619	N.A.	N.A.	1.45	N.A.	12.11	N.A.
15.	Spanish National Railways	12,721	66,509	41,225	1,430,556	34.7	1.61	21.50	3.24	112.46
16.	Czechoslovak State Railways	13,116	208,207	151,731	6,328,774	41.7	1.37	30.40	11.60	482.52
17.	Swedish State Railways	11,236	35,826	36,298	1,094,884	30.2	0.99	30.60	3.23	97.44
18.	Yugoslav Railways Community	9,246	156,198	53,180	2,266,071	42.6	2.94	14.50	5.75	245.08
19.	Turkish Republic Railways	8,170	65,927	21,966	733,568	33.4	3.00	11.13	2.69	89.79
20.	Hungarian State Railways	7,616	133,716	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
21.	Finnish Railways	5,899	25,621	18,176	636,164	35.0	1.41	24.80	3.08	107.84
22.	Austrian Federal Railways	5,745	70,675	36,862	1,225,331	33.2	1.92	17.30	6.42	213.29
23.	Victorian Railways(Australia)	5,488	18,997	4,841	240,616	49.7	3.92	12.70	0.88	43.88
24.	Zaire Railways	4,772	N.A.	8,239	215,454	34.5	N.A.	N.A.	1.73	45.15
25.	Iranian Republic Railways	4,567	38,963	12,420	561,369	45.2	3.14	14.40	2.72	122.92
26.	Norwegian Railways	4,216	15,832	7,233	212,254	29.3	2.19	13.40	1.71	50.34
27.	Algerian Railways	3,841	19,604	14,291	444,737	31.1	1.37	22.70	3.72	115.78
28.	Belgian Railways	3,618	55,193	37,645	1,545,511	41.1	1.47	28.00	10.40	427.17
29.	Portugese Railways	3,603	21,433	5,462	146,864	26.9	3.92	6.80	1.51	40.76
30.	Zimbabwe Railways	3,394	18,935	12,998	530,063	40.8	1.46	27.10	3.83	156.18
31.	Mozambique Railways	3,131	18,915	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
32.	Korean National Railways	3,113	38,654	15,858	731,320	46.1	2.45	18.90	5.09	234.92
33.	Swiss Federal Railways	2,986	37,010	23,784	948,044	39.9	1.56	25.60	7.97	317.50
34.	Bangladesh Railways	2,818	59,322	15,908	332,833	20.9	3.76	5.55	5.64	118.13
35.	Netherlands Railways	2,817	27,474	8,233	273,685	33.2	3.34	9.96	2.92	97.15
36.	Danish State Railways	2,471	21,437	5,421	161,909	29.9	3.95	7.55	2.19	65.52
37.	Greece Railways	2,461	14,596	10,568	253,061	23.9	1.38	17.30	4.30	102.83
38.	Iraqi Republic Railways	2,029	16,534	14,914	N.A.	N.A.	1.11	N.A.	7.35	N.A.
39.	Irish Railways	1,944	15,000	1,959	50,252	25.7	7.66	3.35	1.00	25.85
40.	Moroccan Railways	1,779	12,899	8,865	348,720	39.3	1.46	27.03	4.98	196.02
41.	Syrian Railways	1,525	9,658	5,267	272,362	51.7	1.83	28.20	3.45	178.59
42.	Tunisian Railways	1,484	8,168	5,578	142,878	25.6	1.46	17.50	3.76	96.28
43.	Saudi Arabian Railways	1,401	1,912	2,329	116,450	50.0	0.82	60.90	1.66	83.12
44.	Taiwan Railways.	1,075	21,360	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Comparative Figures of Passenger Traffic, Average Lead and Passenger Traffic Densities

Appendix-VI

Sl. No.	Name of Railways	Route Kilometrage (Kms)	Staff	Revenue Earning Passenger Traffic			Passengers Carried per Employee	Passengers Kilometres per Employee	Passengers Carried per Kilometre of Line	Passengers Kilometres per Kilometre of Line	No. of Passengers per Coach	Passengers Kms. per Coach
				No. of Passengers (in 000)	Passenger Kms. (in Million)	Average Lead Kms.	(in 000)	(In Million)	(in 000)	(in Million)	(in 000)	(In Million)
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Pakistan Railways	8,775	128,047	82,928	16,850	203	0.648	0.132	9.450	1.920	28.82	5.86
2.	Indian State Railways	61,826	1,613,280	3,433,459	240,614	70	2.128	0.149	55.525	3.891	109.64	7.68
3.	American Rail-Roads.	234,584	323,946	281,576	17,649	63	0.869	0.054	1.201	0.075	48.50	3.04
4.	Soviet Union Railways	145,576	N.A.	4,345,000	390,200	90	N.A.	N.A.	29.847	2.680	N.A.	–
5.	Chinese Railways	52,487	1,860,786	1,073,580	258,311	241	0.577	0.139	20.454	4.921	48.50	11.67
6.	French National Railways	34,639	233,404	768,998	59,618	78	3.295	0.255	22.200	1.721	49.27	3.82
7.	German Federal Railways	27,490	272,790	1,023,016	41,397	40	3.750	0.152	37.214	1.506	64.11	2.59
8.	Canadian Pacific Railways	25,266	25,953	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	–
9.	Polish State Railways	24,333	373,639	889,633	48,526	49	2.649	0.130	40.671	1.994	N.A.	–
10.	Brazilian Railways	22,057	64,756	45,859	1,742	38	0.708	0.027	2.079	0.079	47.87	1.82
11.	Japanese National Rlys.	19,949	223,947	7,103,957	198,299	28	31.722	0.885	356.106	9.940	295.40	8.25
12.	British Railways	16,670	171,400	689,400	30,819	45	4.022	0.180	41.356	1.849	50.27	2.25
13.	Italian State Railways	16,068	214,947	397,100	40,500	102	1.847	0.188	24.714	2.521	27.11	2.76
14.	German State Railways	14,005	246,007	608,777	22,395	37	2.475	0.091	43.469	1.599	59.97	2.21
15.	Spanish National Railways	12,721	56,509	193,400	15,646	81	2.908	0.235	15.203	1.230	47.57	3.85
16.	Czechoslovak State Railways	13,116	208,207	422,320	19,935	47	2.028	0.096	32.199	1.520	43.67	2.06
17.	Swedish State Railways	11,236	35,826	72,996	6,152	84	2.038	0.172	6.497	0.548	36.83	3.10
18.	Yugoslav Rlys. Community	9,246	156,198	131,732	12,399	94	0.843	0.079	14.247	1.341	34.24	3.22
19.	Turkish Republic Railways	8,170	65,927	129,352	6,052	47	1.962	0.092	15.833	0.741	82.18	3.84
20.	Hungarian State Railways	7,616	133,718	201,230	9,450	47	1.505	0.071	26.422	1.241	N.A.	–
21.	Finnish Railways	5,899	25,621	34,763	2,676	77	1.357	0.104	5.893	0.454	33.08	2.55
22.	Austrian Federal Railways	5,745	70,675	158,311	7,332	46	2.240	0.104	27.556	1.276	41.79	1.93
23.	Victorian Rlys(Australia)	5,488	18,997	4,463	928	208	0.235	0.049	0.813	0.169	20.76	4.32
24.	Zaire Railways	4,772	N.A.	860	320	372	N.A.	N.A.	0.180	0.067	N.A.	–
25.	Iranian Republic	4,567	38,963	6,336	943	149	0.163	0.024	1.387	0.206	6.55	0.98
26.	Norwegian Railways.	4,216	15,832	35,552	2,225	63	2.246	0.141	8.433	0.528	26.13	2.28
27.	Algerian Railways	3,841	19,604	47,628	2,011	42	2.430	0.103	12.400	0.524	96.61	4.08
28.	Belgian Railways	3,618	55,193	139,113	6,069	44	2.520	0.110	38.450	1.677	39.51	1.72
29.	Portugese Railways	3,603	21,433	224,479	5,803	26	10.473	0.271	62.303	1.611	182.21	4.71
30.	Zimbabwe Railways	3,394	18,935	2,713	N.A.	N.A.	0.143	N.A.	0.799	N.A.	7.29	–
31.	Mozambique Railways	3,131	18,915	6,272	225	36	0.332	0.012	2.003	0.072	N.A.	–
32.	Korean National Railways	3,113	38,854	518,956	23,563	45	13.357	0.606	166.706	7.569	178.15	8.09
33.	Swiss Federal Railways	2,986	37,010	228,467	9,325	41	6.173	0.252	76.513	3.123	57.72	0.42
34.	Bangladesh Railways	2,818	59,822	82,002	6,005	73	1.371	0.100	29.099	2.131	58.16	4.26
35.	Netherlands Railways	2,817	27,474	210,492	8,919	42	7.661	0.325	14.722	3.166	96.11	4.70
36.	Danish State Railways	2,471	21,437	144,320	4,536	31	6.732	0.212	58.406	1.836	69.36	2.81
37.	Greece Railways	2,461	14,596	11,729	1,950	166	0.804	0.134	4.766	0.792	16.95	2.82
38.	Iraqi Republic Railways.	2,029	16,534	213	108	507	0.013	0.007	0.105	0.053	0.33	0.17
39.	Irish Railways	1,944	15,000	21,735	1,075	49	1.449	0.072	11.181	0.553	66.67	3.30
40.	Moroccan Railways	1,779	12,899	11,603	1,958	169	0.899	0.152	6.522	1.101	24.12	4.07
41.	Syrian Railways	1,525	9,658	3,297	893	271	0.341	0.092	2.162	0.586	6.76	1.83
42.	Tunisian Railways	1,484	8,168	25,498	750	29	3.122	0.092	17.182	0.505	84.43	2.48
43.	Saudi Arabian Railways	1,401	1,912	194	76	392	0.101	0.040	0.138	0.054	3.34	1.31
44.	Taiwan Railways	1,075	21,360	131,607	8,305	63	6.161	0.389	122.425	7.726	N.A.	–

Appendix–VII

Comparative Figures of Freight Traffic, Average Lead and Freight Traffic Densities

Sl. No.	Name of Railways	Route Kilometrage (Kms)	Staff	Revenue Earning Freight Traffic			Tonnes Carried per Employee	Tonne Kilometres per Employee	Tonnes Carried per Kilometre of Line	Tonne Kilometres per Kilometre of Line	Tonnes Carried per Wagon	Tonne Kilometres per Wagon
				Tonnes Carried (in 000)	Tonne Kilometrs (in Million)	Average Lead (Kms.)	(in 000)	(in Million)	(in 000)	(in Million)	(in 000)	(in Million)
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Pakistan Railways	8,775	128,047	11,805	8,269	705	0.092	0.065	1.345	0.942	0.34	0.23
2.	Indian State Railways	61,836	1,613,280	258,548	196,601	760	0.160	0.122	4.181	3.179	0.74	0.57
3.	American Rail-Roads	234,584	323,946	1,225,310	1,352,508	1,104	3.782	4.175	5.223	5.766	0.68	0.95
4.	Soviet Union Railways	145,576	N.A.	4,077,600	3,834,500	940	N.A.	N.A.	28.010	26.340	N.A.	N.A.
5.	Chinese Railways	52,487	1,860,786	1,322,195	875,009	662	0.711	0.470	25.191	16.671	4.20	2.78
6.	French National Railways	34,639	233,404	144,518	51,016	353	0.619	0.219	4.172	1.473	0.72	0.25
7.	German Federal railways	27,490	272,790	277,241	59,581	215	1.016	0.218	10.085	2.167	0.93	0.20
8.	Canadian Pacific Railways	25,266	25,953	81,805	92,770	1,134	3.152	3.575	3.238	3.672	1.53	1.73
9.	Polish State Railways	24,333	373,639	419,954	120,043	286	1.124	0.321	17.259	4.933	N.A.	N.A.
10.	Brazilian Railways	22,057	64,766	89,182	39,956	448	1.377	0.617	4.043	1.811	1.92	0.86
11.	Japanese National Railways	19,949	223,947	59,831	19,945	333	0.267	0.089	2.999	1.000	1.80	0.60
12.	British Railways	16,670	171,400	138,369	16,565	120	0.807	0.097	8.300	0.994	2.90	0.35
13.	Italian State Railways	16,068	214,947	51,723	17,476	338	0.241	0.081	3.219	1.088	0.47	0.16
14.	German State Railways	14,005	246,007	328,069	57,916	177	1.334	0.235	23.425	4.135	1.93	0.34
15.	Spanish National Railways	12,721	66,509	37,127	13,994	377	0.558	0.210	2.919	1.100	0.90	0.34
16.	Czechoslovak State Railways	13,116	208,207	295,770	69,315	234	1.421	0.333	22.550	5.285	1.95	0.46
17.	Swedish State Railways	11,236	35,826	53,309	17,754	333	1.488	0.496	4.744	1.580	1.47	0.49
18.	Yugoslav Railways Community	9,246	156,198	89,807	27,573	307	0.575	0.177	9.713	2.982	1.69	0.52
19.	Turkish Republic Railways	8,170	65,927	13,656	17,189	526	0.207	0.109	1.671	0.880	0.62	0.33
20.	Hungarian State Railways	7,616	133,718	144,443	21,741	190	1.080	0.163	18.966	2.855	N.A.	N.A.
21.	Finnish Railways	5,899	25,621	27,677	6,951	251	1.080	0.271	4.692	1.178	1.52	0.38
22.	Austrian Federal Railways	5,745	70,675	55,073	11,273	205	0.779	0.160	9.586	1.962	1.50	0.31
23.	Victorian Railways(Australia)	5,488	18,997	10,512	3,094	294	0.553	0.163	1.915	0.564	2.17	0.64
24.	Zaire Railways	4,772	N.A.	4.039	1,753	434	N.A.	N.A.	0.846	0.367	0.49	0.21
25.	Iranian Republic Railways	4,567	38,963	12,280	N.A.	N.A.	0.315	N.A.	2.689	N.A.	0.99	N.A.
26.	Norwegian Railways	4,216	15,832	25,234	2,954	117	1.594	0.187	5.985	0.701	3.49	0.41
27.	Algerian Railways	3,841	19,604	12,469	3,049	245	0.636	0.156	3.246	0.794	0.87	0.21
28.	Belgian Railways	2,618	55,193	75,433	8,524	113	1.367	0.154	20.849	2.356	2.00	0.23
29.	Portugese Railways	3,603	21,433	5,939	1,443	244	0.277	0.068	1.648	0.402	1.09	0.27
30.	Zimbabwe Railways	3,394	18,935	13,619	6,558	478	0.719	0.344	4.013	1.918	1.05	0.50
31.	Mozambique Railways	3,131	18,915	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
32.	Korean National Railways	3,113	38,854	56,645	12,657	223	1.458	0.326	18.197	4.066	3.57	0.80
33.	Swiss Federal Railways	2,986	37,010	54,127	6,966	154	1.462	0.188	18.127	2.333	2.28	0.29
34.	Bangladesh Railways	2,818	59,822	2,179	567	260	0.036	0.009	0.773	0.201	0.14	0.04
35.	Netherlands Railways	2,817	27,474	19,073	3,107	163	0.694	0.113	6.771	1.103	2.32	0.38
36.	Danish State Railways	2,471	21,437	7,436	1,719	241	0.347	0.080	3.009	0.696	1.37	0.32
37.	Greece Railways	2,461	14,596	4,164	702	169	0.285	0.048	1.692	0.285	0.39	0.07
38.	Iraqi Republic Railways	2,029	16,534	4,155	1,244	299	0.251	0.075	2.048	0.613	0.28	0.08
39.	Irish Railways	1,944	15,000	3,126	574	184	0.208	0.038	1.608	0.295	1.60	0.29
40.	Moroccan Railways	1,779	12,899	27,815	4,503	162	2.156	0.349	15.635	2.531	3.14	0.51
41.	Syrian Railways	1,525	9,658	5,097	1,417	278	0.528	0.147	3.342	0.929	0.99	0.27
42.	Tunisian Railways	1,484	8,168	9,515	1,867	196	1.165	0.229	6.411	1.258	1.71	0.33
43.	Saudi Arabian Railways	1,401	1,912	1,525	675	443	0.798	0.353	1.089	0.482	0.65	0.29
44.	Taiwan Railways.	1,075	21,360	17,034	2,208	130	0.797	0.103	15.846	2.054	N.A.	N.A.

Traffic Units per Employee and Traffic Units per Locomotive of 44 Railways of the World

Sl. No.	Name of Railways	Route Kilometrage (Kms.)	Staff	Passenger Kilometres (in Million)	Tonne Kilometres (in Million)	Traffic Units (in Million)	Traffic Units per Employee (in Million)	Traffic Density (in Million)	Traffic Unit per Locomotive (in Million)
1	2	3	4	5	6	7	8	9	10
1.	Pakistan Railways	8,775	128,047	16,850	8,269	25,119	0.196	2.863	28.77
2.	Indian State Railways	61,836	1,613,280	240,614	196,601	437,215	0.271	7.071	44.07
3.	American Rail-Roads	234,584	323,946	17,649	1,352,508	1,370,157	4.230	5.841	59.75
4.	Soviet Union Railways	145,576	N.A.	390,200	3,834,500	4,224,700	N.A.	29.021	N.A.
5.	Chinese Railways	52,487	1,860,766	258,311	875,009	1,133,320	0.609	21.592	92.40
6.	French National Railways	34,639	233,404	59,619	51,016	110,634	0.474	3.194	19.05
7.	German Federal Railways	27,490	272,790	41,397	59,581	100,978	0.370	3.673	15.58
8.	Canadian Pacific Railways	25,266	25,953	N.A.	92,770	N.A.	N.A.	N.A.	N.A.
9.	Polish State Railways	24,333	373,639	48,526	120,043	168,569	0.451	6.928	N.A.
10.	Brazilian Railways	22,057	64,766	1,742	39,956	41,698	0.644	1.890	26.36
11.	Japanese National Railways	19,949	223,947	198,299	19,945	218,244	0.975	10.940	121.18
12.	British Railways	16,670	171,400	30,819	16,565	47,384	0.276	2.842	17.93
13.	Italian State Railways	16,068	214,947	40,500	17,476	57,976	0.270	3.608	17.70
14.	German State Railways	14,005	246,007	22,395	57,916	80,311	0.326	5.734	N.A.
15.	Spanish National Railways	12,721	66,509	15,646	13,994	29,640	0.446	2.330	21.20
16.	Czechoslovakia State Railways	13,116	208,207	19,935	69,315	89,250	0.429	6.805	18.87
17.	Swedish State Railways	11,236	35,826	6,152	17,754	23,906	0.667	2.128	19.37
18.	Yugoslav Railways Community	9,246	156,198	12,399	27,573	39,972	0.256	4.323	28.33
19.	Turkish Republic Railways	8,170	65,927	6,052	7,189	13,241	0.201	1.621	12.88
20.	Hungarian State Railways	7,616	133,718	9,450	21,741	31,191	0.233	4.095	N.A.
21.	Finnish Railways	5,899	25,621	2,678	6,951	9,627	0.376	1.632	13.06
22.	Austrian Federal Railways	5,745	70,675	7,332	11,273	18,605	0.263	3.238	15.21
23.	Victorian Railways(Australia)	5,488	18,997	928	3,094	4,022	0.212	0.733	12.50
24.	Zaire Railways	4,772	N.A.	320	1,753	2,073	N.A.	0.434	N.A.
25.	Iranian Republic Railways	4,567	38,963	943	N.A.	N.A.	N.A.	N.A.	N.A.
26.	Norwegian Railways	4,216	15,932	2,225	2,954	5,179	0.327	1.228	14.00
27.	Algerian Railways	3,841	19,604	2,011	3,049	5,060	0.258	1.317	21.81
28.	Belgian Railways	3,618	55,193	6,069	8,524	14,593	0.264	4.033	12.98
29.	Portugese Railways	3,603	21,433	5,803	1,448	7,251	0.338	2.012	23.02
30.	Zimbabwe Railways	3,394	18,935	N.A.	6,508	N.A.	N.A.	N.A.	NA.
31.	Mozambique Railways	3,131	18,915	225	N.A.	N.A.	N.A.	N.A.	N.A.
32.	Korean National Railways	3,113	38,854	23,563	12,657	36,220	0.932	11.635	63.43
33.	Swiss Federal Railways	2,986	37,010	9,325	6,966	16,291	0.440	5.456	11.48
34.	Bangladesh Railways	2,818	59,822	6,005	567	6,572	0.110	2.332	22.66
35.	Netherlands Railways	2,817	27,474	8,919	3,107	12,026	0.438	4.269	21.14
36.	Danish State Railways	2,471	21,437	4,536	1,719	6,255	0.292	2.531	15.64
37.	Greece Railways	2,461	14,596	1,950	702	2,652	0.182	1.078	12.39
38.	Iraqi Republic Railways	2,029	16,534	108	1,244	1,352	0.082	0.666	3.14
39.	Irish Railways	1,944	15,000	1,075	574	1,649	0.110	0.848	12.68
40.	Moroccan Railways	1,779	12,899	1,958	4,503	6,461	0.501	3.632	28.34
41.	Syrian Railways	1,525	9,658	893	1,417	2,310	0.239	1.515	12.03
42.	Tunisian Railways	1,484	8,168	750	1,867	2,617	0.320	1.763	58.16
43.	Saudi Arabian Railways	1,401	1,912	76	675	751	0.393	0.536	15.33
44.	Taiwan Railways	1,075	21,360	8,305	2,208	10,513	0.492	9.779	N.A.