ON ESTIMATION OF RAIL-ROAD SHARE IN PASSENGER AND FREIGHT TRAFFIC: NEED FOR REALISTIC INVESTMENT STRATEGY FOR TRANSPORT SECTOR IN INDIA

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The objective of this paper is to analyse causal relationship between transport and development, trends of transport development in India, estimate passenger and freight traffic by rail-road transport targetted for the planning horizon extending to the Ninth Plan(1995-2000), additional capacity required to carry targetted traffic, investment required to create capacity, identify sources of financial resources and mobilise them for investment.

TRANSPORT AND DEVELOPMENT

Transport and development are complementary. Transport initiates and accelerates development process which, in turn, generates demand for transport. It carries passenger and freight traffic among far-flung scattered location of regions. In this function, it removes regional barriers, provides linkages and accessibility among them, reduces regional disparities and social distances, extends and widens the scope of markets, promotes social cohesion, trade and commerce, offices, industries, housing colonies and regional balanced development. Transport, thus, improves mobility, employability, productivity, exchange-value, competitiveness and income of resources. These growth-led factors create demand for transport which is highly elastic function of development in developing economies like India. Demand for transport, therefore, far exceeds its supply which is relatively inelastic due to heavy investment involved in transport projects requiring long-gestation period. The supply of transport lagging behind its demand produces transport bottlenecks which retard development process and make resources immobile. Immobility of resources and poverty are positively correlated which characterise the backwardness of an economy.

In view of aforementioned complementary relationship between the two and the overwhelming role that transport plays in the development process, it is imperative to develop capacity in transport sector prior to the emergence of its demand to avoid transport bottlenecks. However, this approach to transport planning is opposed on the ground that heavy investment involved in transport projects might be wasted if targetted demand for transport is not available. This apprehension does not appear convincing as realistic estimation of demand for transport can be made atleast for the plan period because it is a function of planned development objectives which are specified well in advance for a period of five years if it is a Five Year Plan as is the case in India. Besides, inadequacy of its demand might be a short period phenomena. These reinforce the need that capacity development in transport sector should take precedence over its demand. The capacity generation in transport should not only be decided by demand

for traffic but also by equity considerations as it is a public utility. It might cause underutilisation of capacity in transport sector on certain routes for a short period which is likely to be eliminated as development process gets initiated by the availability of transportation thereby generating demand for transportation. Transport and development are causaly related. It is, therefore, imperative to adopt coordinated system approach to transport development.

In India, transport sector has been receiving lower weightage in the development plans as assessed in terms of its declining share in the total outlay during the Five Year Plans. The share of transport in total outlay declined to 12.8 percent in the Sevent Plan (1985-90) from 22.1 per cent in the First Plan (1951-56). The average of Plan outlays comes out to be 17.7 percent. This declining share reflects shift in policies and perception of the Indian planners. Besides, it might be due to resource crunch which is largely attributable to leakages.

As regards share of different modes of transport in total outlay on transport during the Plans, it is observed that on an average, railways, roads and road transport have been receiving 49 percent, 25.7 percent and 5.3 percent respectively. Other sectors of transport, that is, Ports, Shipping, Inland Water Transport, Light House, Air Transport and Tourism have been sharing the remaining outlay of 20 percent during the Plans. However, the Plan outlays allocated to different modes of transport have been increasing in absolute terms.

The highest share of railways is justified on the ground that it is a capital intensive mode of transport. It appears to be a valid argument in favour of railways. But the share of railways in passenger and freight traffic and growth of the economy has been declining. During 1951-85, railways share in passenger traffic declined to 19.8 percent from 62.2 percent whereas proportion of road transport increased to 81.2 percent from 37.8 percent. Also, freight traffic by railways declined to 41.5 per cent from 78.5 percent and that of road transport increased to 58.5 percent from 21.5 percent. The main reasons for the shift of traffic from railways to road transport are (i) railways' policy to discourage short distance traffic, (ii) inadequate growth in railways' capacity to carry enhancing levels of traffic, (iii) advantageous of road transport in terms of door to door transportation of manpower and material. The increasing share of road transport in traffic has led to phenomenal growth of vehicles thereby raising vehicle density, consumption of scarce petroleum products and pollution from vehicles.

The registered motor vehicle density increased to 4.32 vehicles per kilometer of road length in 1983 from 0.76 in 1951. It is likely to increase by 9 to 10 vehicles per kilometer of road length by 2000 AD on account of higher growth of per capita income, freight traffic and working population in the age-group of 15-59 years causing increase in per capita trip rate and trip length. It is estimated that working population would be 60 per cent by 1990, 62 percent by 1996 and 65 percent by 2000. As regards freight traffic, Gross National Product is being targetted to grow by 6 percent to 7 percent growth rate (compound) per annum

during the plans. The growing density of vehicles is being largely contributed by phenomenal growth of personalised vehicles. Such high density of vehicles does not appear desirable in view of limited capacity in roads and availability of petroleum products. The reasonable vehicle density appears to be 6 vehicles per kilometer of road length by 2000 AD. At this density of vehicles,number of vehicles are estimated to grow by 217.26 lakhs if road length turns out to be 36.21 lakh kilimeters. This would mean a net addition of 129.30 lakh vehicles over 87.96 lakh vehicles in 1985.

The road development has been sluggish, assessed in terms of its gross inadequacy to carry explosive growth of vehicles of national life causing higher density of vehicles and clogging of traffic. It is reflected by the fact that 14 percent villages with population of 1500 and above and 37 per cent villages in the population range of 1000-1500 would remain unconnected with all weather roads. Some states are expected to face large shortfall than the above. Among them, Orissa is the State which may not be able to connect 50 per cent villages with population 1000-1500. Other states, namely, Andhra Pradesh, Bihar, West Bengal, Himachal Pradesh, Jammu and Kashmir, Karnataka, Rajasthan and Mizoram may not be able to provide connectivity of villages with population of 1500 and above by the end of the Seventh Plan. There are ninety three identified backward districts having gross inadequacy of transport links. These districts are unconnected with the mainstream of national life. Further the growth of surfaced roads has been inadequate. Their proportion to total road length was only 47.04 per cent in 1983. This is the stage of development of roads which form the backbone of road transport. It is,therefore, imperative to accelerate the development of roads to carry explosive growth of vehicles caused by increasing share of road transport in passenger and freight traffic.

The share of air transport in domestic traffic is also increasing but it is not comparable with railways and road transport as it carries higher income people. Regarding,water transport, it is mainly involved in foreign trade. To develop water transport for domestic traffic, the Govt. of India has constitute Inland Water Transport Authority. Also, electronic, telecommunication and computer technologies have been accorded higher priority in the development plans of the country. All these are likely to accelerate the development process in India.

The role of transport and its different modes in the development of the national economy can further be assessed in terms of their contribution to net domestic product, capital formation and factor incomes. In total net domestic product the share of transport, communication and trade at current prices in the unorganised sector increased to 27.68 percent in 1984-85 from 16.46 percent in 1970-71. In the organised sector, the above three subsectors recorded a decline share from 14.02 per cent in 1970-71 to 11.26 per cent in 1984-85. Railways recorded a decline of its share in total net domestic product to 2.86 per cent in 1984-85 from 5.50 percent in 1970-71. But the road transport registered

an increase from 6.63 per cent in 1970-71 to 8.31 percent in 1984-85. The share of transport, storage and communication in terms of net value added to total net domestic product at current prices in the unorganised sector increased from 2.14 percent in 1970-71 to 4.73 percent in 1984-85. But in the organised sector, it declined from 10.9 percent in 1970-71 to 7.78 percent in 1984-85. As regards factor incomes, the share of railways in total net domestic product declined from 1.51 percent in 1970-71 to 1.08 percent in 1984-85 whereas the share of transport by other means and storage increased to 4.05 percent in 1984-85 from 2.42 percent in 1970-71.

The foregoing analysis highlights that railways which form a major part of the organised sector receive the highest share in outlay but its contributions to the growth of the economy have been sluggish and declining. Road transport has emerged out to be a major mode of transport. In view of these facts, it is imperative to estimate the targetted traffic to be carried by railways and road transport and to determine the capacity required to carry the traffic and the investment required in each mode to create the additional capacity. Besides, it is also important to identify sources of finance and the mobilisation effort required to secure funds.

REVIEW OF LITERATURE

Attempts have been made to estimate rail-road share in passenger and freight traffic by transport professionals and Groups. They have mainly applied regression, time trend, transport coefficient, gravity model,normative approach based on vehicle population and utilisation and income elasticity methods. Besides, shift and share technique[1] has also been applied. This technique has been tried for forecasting value added by industry groups for different states in India. It can also be applied for constructing regional forecast of output, income and employment or any other variable which can be decomposed sectorally and regionally. The objective of shift and share technique is to analyse and forecast regional decomposition of industrial change. However, there are problems of weights and interwoven effects. Attempts have been made to overcome these problems. This technique has been applied for computing changes in State Domestic Product(SDP) for fourteen states for 1960-75 by the UNDP project.

As regards Gravity Model applied by NTPC, it has been tried for estimating freight traffic. This model "determines commodity traffic pattern directly by relating the flow pattern to supply of commodity at the originating region, the demand for it at destination region and cost of transport"[2]. However, in the transport coefficient "production targets are first translated into originating traffic by using transport (mainly rail)coefficient and then into tonne kilimeters by multiplying by the average lead for each commodity observed in the past"[2]. The regression

1. UNDP Transport Policy Planning Project,Planning Commission, Govt.of India, New Delhi(1982)- Transport Planning Model for India.

equations used by NTPC are log linear using (1) intra-city rail passenger traffic, (2) inter-city mail/express rail passenger traffic, (3) inter-city rail passenger traffic, (4) road passenger traffic, (5) total rail plus road freight traffic, (6) urban population, (7) total population and (8) contribution of industry and mineral sector to G.D.P.

The estimates of passenger and freight traffic made by various Groups are presented in Table 1. These estimates can be categorised under High, Medium and Low. It is observed that the share of railways in freight traffic has been estimated as high as 74 percent for 2000AD. The lowest share turns out to be 27.3 percent. In between these two estimates, the medium estimate varies between 40 to 50 percent. In passenger traffic, railways share is as high as 90 percent. The lowest is 48 percent and the medium estimate lies between 50 to 70 percent. These shares when assessed on the basis of their values observed in 1985, it becomes obvious that High and Medium estimates are unlikely to be achieved. In 1985, railways carried 19.8 percent passenger traffic and 41.5 percent freight traffic. Railways would be able to carry 40 to 45 percent freight traffic and 20 to 25 percent passenger traffic by 2000 AD. This assessment is based on the ground that railway rates which form a major portion of administered prices have been increasing. Besides, leakage of revenue and costs, increasing preference of railways to long distance over short distance traffic, under-utilisation of railway capacity, possibility of alternative efficient and cost-effective modes of transportation, improvement in the design of road vehicles and the emerging benefits of road transport are likely to adversely affect the share of railways in passenger and freight traffic.

METHODOLOGY

In this paper, rail-road share in passenger and freight traffic has been estimated for the planning horizon extending to 2000 AD.

The share of railways and road transport in targetted passenger/freight traffic at alternative utilisation factors has been computed by applying following equations:

$$D_{1i} = \frac{C_{1i} \times U_1}{C_{1i} \times U_1 + C_{2i} \times U_2} \times D_i$$

$$D_{2i} = \frac{C_{2i} \times U_2}{C_{2i} \times U_1 + C_{2i} \times U_2} \times D_i$$

where,

D_i = Additional targetted traffic in year i over the previous period.

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2. NTPC Report 1980, page 57.

TABLE-1

COMPARISON OF FREIGHT & PASSENGER TRAFFIC ESTIMATE BY VARIOUS GROUPS FOR 2000 AD

Sl.No.	Name of study	Method	FREIGHT TRAFFIC BTKMS Road	Rail	Total	PASSENGER TRAFFIC BPKMS Road	Rail	Total
1.	A Long-range Perspective for India-Transportation,2000 AD, Opertions Res. Group,Baroda,1975	Regression.	250(40.5) 695(43.5)	368(59.5) 903(56.5)	618 1598	293(56.3) 365(57.0)	227(43.7) 275(43.0)	520 640
2.	Second India Studies Services,H.Ezekiel and M.Pavaskar,Macmillan, New Delhi,1976.	-do-	530(57.0) 600(60.0)	400(43.0) 400(40.0)	930 1000	600(66.7) --	300(33.3) --	900 --
3.	India In Perspective volume 3,C.H.Shah, Arnold Heineman, New Delhi.1978	-do-	250(37.7) 995(52.4)	413(62.3) 903(47.6)	663 1898	527(64.3) 646(63.9)	293(35.7) 365(36.1)	820 1011
4.	Report of the Working Group on Economy Policy Planning Commission,New Delhi,1979.	Time Trend	518(55.8)	410(44.2)	928	1057(66.7)	527(33.3)	1584
5.	Report of the National Transport Policy Committee,Planning Commission New Delhi.	1)Trend Analysis 2)Regression 3)Transport coefficient 4)Gravity Model.	163(27.3) 215(30.6)	435(72.7) 487(69.4)	598 702	465(48.3) 707(58.7)	498(51.7) 498(41.3)	963 1205
6.	Road Development Plan for India (1981-2001) Indian Roads Congress New Delhi,1984.	Normative Approach based on vehicle population and utillsation.	869(56.4) 1004(59.9)	672(43.6) 672(40.1)	1541 1676	1989(73.4) 2152(74.9)	721(26.6) 721(25.1)	2710 2873
7.	Towards a Perspective on Energy Demand and Supply in India in 2004-5,Advisory Board on Energy,New Delhi, 1985.	-do-	199(37.3) 292(40.7)	335(62.7) 425(59.3)	534 717	1606(77.7) 1800(77.8)	461(22.3) 513(22.2)	2067 2313
8.	Estimation of Total Road Transport Freight and Passenger Movement in India for the year 2000 AD, Engineering Consultants Pvt.Ltd. New Delhi,1987.	1)Regression Analysis. 2) Income Elasticity	735(66.5) 1040(73.8)	370(33.5) 370(26.2)	1105 1490	3000(87.2) 4000(90.1)	440(12.8) 440)9.9)	3440 4440

D_{1i} = Additional share of railways in targetted traffic in year i.

D_{2i} = Additional share of road transport in targetted traffic in year i.

C_{1i} = Targetted traffic in railways in year i.

C_{2i} = Targetted traffic in road transport in year i.

U_1 = Capacity utilisation in railways.

U_2 = Capacity utilisation in road transport.

The share of railways in targetted traffic in year i denoted by D^*_{1i} has been computed by adding the additional traffic in year i (D_{1i}) to the share of railways in the previous periods. Besides, capacity required in railways in year 'i' denoted by $C^*_{1i}=D^*_{1i}/U_1$ has also been estimated. In making these estimates, the values of U_1 have been assumed. It has been assumed at 90 percent, 95 percent and 100 percent. The same methodology has been adopted for road transport except different values of U_2 have been assumed at 95 percent,100 percent and 110 percent. These values of utilisation factors have been assumed on the basis that there is a possibility of underutilisation and overutilisation of the capacity. An ideal situation will be at 100 per cent utilisation of capacity.

ANALYSIS OF RESULTS (Passenger Traffic)

In scenario-I, Railway passenger traffic has been estimated for 1995 and 2000 at an annual compound growth rate of 4.75 percent observed during 1971-85. The targetted traffic in 2000 AD over 1995 works out to be 1265 billion passenger kilometers (BPKMS) as evident from Table-2. It is observed that share of railways at this growth rate comes out to be 14.2 percent for 1995 and 11.9 percent for 2000 AD. The remaining share will have to be carried by road transport which has been computed at an average of 9 percent annual compound growth rate. The additional share of railways (D_{1i}) in targetted traffic in year 2000 at utilisation factor of 100 percent in railways and 95 percent in road transport comes out to be 12.5 percent and the share of road transport is 87.5 percent for 2000 AD. When share of railways denoted by D^*_{1i} is computed, it turns out to be 13.6 percent which has been obtained by adding D_{1i} to the estimated traffic in 1995. In absolute terms, it comes out to be 518 BPKMS for 2000 AD. The total capacity required to carry this traffic at 90 percent utilisation factor works out to be 560 BPKMS and additional capacity in 2000 AD over 1995 turns out to be 200 BPKMS. The investment required to create additional capacity works out to be Rs. 10320 crores computed by taking Rs. 43 crores as the cost per BPKMS at 1982-83 prices and inflation rate of 20 percent. Under scenario II, targetted railway passenger traffic has been computed at 4 percent annual compound growth rate. For road transport, 8.5 percent has been considered. The estimates of rail-road share in passenger

TABLE-2

TARGETTED SHARE OF RAIL-ROAD IN PASSENGER TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD

Targetted Traffic			
Year	Rail	Road	Total
1985 (actual)	226.6(19.8)	918.7 (80.2)	1145.3
1995	360 (14.2)	2175 (85.8)	2535
2000	454 (11.9)	3346 (88.1)	3800 D_i=1265 BPKMS

		D_{1i}			D_{2i}		
U_1%	U_2 %	95	100	110	95	100	110
90		144(11.4)	138(10.9)	126(10.0)	1121(88.6)	1127(89.1)	1109(90.0)
95		151 (11.9)	144(11.4)	133(10.5)	1114 (88.1)	1121(88.6)	1132 (89.5)
100		158 (12.5)	151 (11.9)	139 (11.0)	1107(87.5)	1114(88.1)	1126 (89.0)

		D^*_{1i}			D^*_{2i}		
U^*_1%	U^*_2%	95	100	110	95	100	110
90		504 (13.3)	498(13.1)	486 (12.8)	3296(86.7)	3302(86.9)	3314(87.2)
95		511(13.4)	504(13.3)	493(13.0)	3289(86.6)	3296(86.7)	3307(87.0)
100		518(13.6)	511(13.4)	499(13.1)	3282(86.4)	3289(86.6)	3301(86.9)

Note:

1. Targetted rail passenger traffic estimated for 1995 and 2000 at 4.75% CGR (Annual Compound Growth Rate).

2. Targetted road passenger traffic estimated for 1995 and 2000 at an average of 9.0%.

3. Figures in brackets indicate percentage share of rail-road. All other figures are in BPKMS.

4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BPKMS: $C^*_{1i} = D^*_{1i}/U$ where U is the utilisation factor. For example, U = 90% and D^*_{1i}=504 then C^*_{1i} = 504/.9 = 560 BPKMS (Similarly for road transport)

5. Additional capacity required in railways during 1995-2000: $C^*_{ai} = C^*_{1i}$ minus the initial capacity available in year 1995. In the above example, C^*_{ai}= 560-360=200 BPKMS (Similarly for road transport).

6. Investment required in railways during 1995-2000 to carry C^*_{ai}: $I^*_{ai} = C^*_{ai} \times 43 (1+r/100)$ crore rupees where Rs.43 crores is the cost per BPKMS at 1982-83 prices as per the norms of railway ministry and r is the inflation rate. If r =20%, then I^*_{ai} =10320 crore rupees.

traffic are presented in Table-3.

At utilisation factor of 100 percent for railways and 95 percent for road transport, the share turns out to be 12.1 percent for railways and 87.9 percent for road transport. In this case, total additional capacity required in railways will be 508.9 BPKMS and additional capacity required comes out to be 173.9 BPKMS. For this, investment required will be Rs. 8973.2 crores. In scenario-III, rail passenger traffic has been computed at an annual compound growth rate of 4.75 percent for 1995 and for 2000 AD, 7.5 percent growth rate (compound) has been applied. At these rates, additional targetted traffic, that is D_i in year 2000 over 1995, comes out to be 1178 BPKMS as observed from Table-4. It is evident that growth rate for road transport has been taken at 9 percent for 1995 and 8 percent for 2000 AD. At the utilisation factors of 100 percent for railways and 95 percent for road transport, the share of railways comes out to be 14.5 percent. The additional capacity required in railways will be 213 BPKMS and the investment required is estimated to be Rs. 10991 crores.

Freight Traffic

In scenario-I, railways targetted freight traffic has been estimated at 4 percent for 1995 and 2000 AD. For road transport, 11 percent growth rate has been applied. The estimates of this scenario are presented in Table-5. It is obvious that additional targetted billion tonne kilometers comes out to be 146.2 BTKMS and investment required comes out to be Rs. 13333 crores computed at Rs. 76 crores per BTKMS at 1982-83 prices with 20 percent inflation factor. Under scenario-II, 3 percent for railways and 9.2 % for road transport have been considered for estimating freight traffic. Other factors are the same which have been applied under scenario-I. The estimates of this scenario are presented in Table-6. In scenario-III, 4 percent for 1995 and 7.5 percent for 2000AD have been applied for computing railway freight traffic. For road transport, 11 percent for 1995 and 9.5 percent for 2000 AD have been tried. The estimates of this scenario are presented in Table-7. The additional targetted capacity in railways comes out to be 165 BTKMS and investment for this capacity works out to be rupees 15048 crores for 2000 AD.

For railways, higher growth rate for 2000 AD has been applied for passenger and freight traffic for the reason that railways might be able to carry higher levels of traffic by the end of the century. However, railways should be able to carry higher levels of traffic at an annual compound rate of 8 to 10 percent. If it carries this traffic, it would require higher capacity and investment. Railways should have these targets. For financing heavy investment in railways and road transport, it is imperative to estimate leakage of revenue and costs by ensuring completion of transport projects during the original schedule period, avoiding wates and pilferage. Besides, improvement in efficiency by introducing improved technologies, rating system and ensuring highest possible accountability need to be developed. The employ-

TABLE-3

TARGETTED SHARE OF RAIL-ROAD PASSENGER TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD

Targetted Traffic

Year	Rail	Road	Total
1985 (actual)	226.6(19.8)	918.7(802)	1145.3
1995	335(13.9)	2077(86.1)	2412
2000	408(11.6)	3123(88.4)	3531

D_i = 1119 BPKMS

		D_{1i}			D_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		123(11.0)	118(10.5)	108(9.7)	996(89.0)	1001 (89.5)	1011(90.3)
95		129(11.5)	123(11.0)	113(10.1)	990(88.5)	996(89.0)	1006(89.9)
100		135(12.1)	129(11.5)	119(10.6)	984(87.9)	990(88.5)	1000(89.4)

		D^*_{1i}			D^*_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		458(13.0)	453(12.8)	443(12.5)	3073(87.0)	3078(87.2)	3088(87.5)
95		464(13.1)	458(13.0)	448(12.7)	3067(86.9)	3073(87.0)	3083(87.3)
100		470(13.3)	464(13.1)	454(12.9)	3061(86.7)	3067(86.9)	3077(87.1)

Note:

1. Targetted rail passenger traffic estimated for 1995 and 2000 at 4.0% CGR (Annual Compound Growth Rate).

2. Targetted road passenger traffic estimated for 1995 and 2000 at 8.5% CGR.

3. Figures in brackets indicate percentage share of rail-road. All other figures are in BPKMS.

4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BPKMS: $C^*_{1i} = D^*_{1i}/U$ where U is the utilisation factor. For example, U = 90% and D^*_{1i} = 458 then C^*_{1i} = 458/0.9 = 508.9 BPKMS (Similarly for road transport)

5. Additional capacity required in railways during 1995-2000: C^*_{ai} = C^*_{1i} minus the initial capacity available in the year 1995. In the above example C^*_{ai} =508.9 -335 =173.9 BPKMS (Similarly for road transport)

6. Investment required in railways during 1995-2000 to carry C^*_{ai} : I^*_{ai} = C^*_{ai} x43 x(1+r/100) crore rupees wher Rs.43 crores is the cost per BPKMS at 1982-83 prices of railway ministry and r is the inflation rate . If r= 20% then I^*_{ai} = 8973.2 crore rupees.

TABLE-4

TARGETTED SHARE OF RAIL-ROAD IN PASSENGER TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD.

Targetted Traffic

Year	Rail	Road	Total	
1985 (actual	226.6(19.8)	918.7(80.2)	1145.3	
1995	360(14.2)	2175(85.8)	2535	
2000	517(13.9)	3196(86.1)	3713	D_i =1178 BPKMS.

		D_{1i}			D_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		156(13.2)	150(12.7)	138 (11.7)	1022(86.8)	1028(87.3)	1040(88.3)
95		164(13.9)	157(13.3)	144(12.2)	1014(86.1)	1021(86.7)	1034(87.8)
100		171(14.5)	164(13.9)	151(12.8)	1007(85.5)	1014(86.1)	1027(87.2)

		D^*_{1i}			D^*_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		516(13.9)	510(13.7)	498(13.4)	3197(86.1)	3203(86.3)	3215(86.6)
95		524(14.1)	517(13.9)	504(13.6)	3189(85.9)	3196(96.1)	3209(86.4)
100		531(114.3)	524(14.1)	511(13.8)	3182(85.7)	3189(85.9)	3203(86.2)

Note:

1. Targetted rail passenger traffic estimated for 1995 at 4.75% (CGR) and for 2000 over 1995 at 7.5% CGR(Annual Compound Growth)

2. Targetted road passenger traffic estimated 1995 at 9.0% CGR and for 2000 over 1995 at 8.0% CGR.

3. Figures in brackets indicate percentage share of rail-road. All other figures are in BPKMS.

4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BPKMS : $C^*_{1i} = D^*_{1i} / U$ where U is the utilisation Factor. For example if U = 90% and D_{1i} = 516 BPKMS then C^*_{1i} = 516/0.9 = 573 BPKMS (Similarly for road transport).

5. Additional capacity required in railways during 1995-2000: $C^*_{ai} = C^*_{1i}$ minus the initial capacity available in year 1995 .In the above example, C^*_{ai} = 573 -360 = 213 BPKMS (Similarly for road transport).

6. Investment required in railways during 1995-2000: $I^*_{ai} = C^*_{ai}$ x 43 x(1+r/100) crore rupees where Rs.43 crores is the cost per BPKMS at 1982-83 prices as per the norms of railway ministry and r is the inflation rate. If r = 20%, then I^*_{ai} = 10991 crore rupees to carry additional 213 BPKMS in 2000 at U_i = 90% and U_2=95%.

TABLE-5

TARGETTED SHARE OF RAIL-ROAD IN FREIGHT TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD

Targetted Traffic

Year	Rail	Road	Total	
1985(actual)	172.6(41.5)	243.5(58.5)	416.1	
1995	256(29.0)	626(71.4)	882	
2000	311(22.8)	1054(77.2)	1365	D_i = 483 BTKMS

		D_{1i}			D_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		106(21.9)	101(20.9)	94(19.5)	377(78.1)	382(79.1)	389(80.5)
95		110(22.8)	106(21.9)	98(20.3)	373(77.2)	377(78.1)	385(79.7)
100		114(23.6)	110(22.8)	102(21.1)	369(76.4)	373(77.2)	381(78.9)

		D^*_{1i}			D^*_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		362(26.5)	357(26.2)	350(25.6)	1003(73.5)	1008(73.8)	1015(74.4)
95		366(26.8)	362(26.5)	354(25.9)	999(73.2)	1003(73.5)	1011(74.1)
100		370(27.1)	366(26.8)	358(26.2)	995(72.9)	999(73.2)	1007(73.8)

Note:

1. Targetted rail freight traffic estimated for 1995 and 2000 at 4.0% CGR (Annual Compound Growth Rate).
2. Targetted road freight traffic estimated for 1995 and 2000 at 11.0% CGR.
3. Figures in brackets indicate percentage share of rail-road. All other figures are in BTKMS.
4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BTKMS: $C^*_{1i} = D^*_{1i}/U$ where U is the utilisation factor. For example, U = 90% and D^*_{1i} = 362 then C^*_{1i} = 362/0.9 = 402.2 BTKMS (Similarly for road transport).
5. Additional capacity required in railways during 1995-2000: $C^*_{ai} = C^*_{1i}$ minus the initial capacity available in year 1995. In the above example, C^*_{ai} = 402.2-256.0 = 146.2 BTKMS (Similarly for road transport).
6. Investment required in railways during 1995-2000 to carry C^*_{ai} : $I^*_{ai} = C^*_{ai} \times 76 \times (1+r/100)$ where Rs.76 crores is the cost per BTKMS at 1982-83 prices as per the norms of railway ministry and r is the inflation rate. If r = 20% , then I^*_{ai} = 13333 crore rupees.

TABLE-6
TARGETTED SHARE OF RAIL-ROAD IN FREIGHT TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD.

Targetted Traffic

Year	Rail	Road	Total
1985 (actual)	172.6(41.5)	243.5(58.5)	416.9
1995	232(28.3)	587(71.1)	819
2000	269 (22.8)	912(77.2)	1181

D_i = 362 BTKMS.

		D_{1i}			D_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		79(21.8)	76(21.0)	70(19.3)	283(78.2)	286(79.0)	292(80.7)
95		82(22.7)	79(21.8)	73(20.2)	280(77.3)	283(78.2)	289(79.8)
100		86(23.8)	82(22.7)	77(21.3)	276(76.2)	280(77.3)	285(78.7)

		D^*_{1i}			D^*_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		311(26.3)	308(26.1)	302(25.6)	870(73.7)	873(73.9)	879(74.4)
95		314(26.6)	311(26.3)	305(25.8)	867(73.4)	870(73.7)	876(74.2)
100		318(26.9)	314(26.6)	309(26.2)	863(73.1)	867(73.4)	872(73.8)

Note:

1. Targetted rail freight traffic estimated for 1995 and 2000 at 3.0% CGR(Annual Compound Growth Rate).

2. Trargetted road freight traffic estimated for 1995 and 2000 at 9.2% CGR.

3. Figures in brackets indicate percentage share of rail-road. All other figures are in BTKMS.

4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BTKMS: $C^*_{1i} = D^*_{1i}/U$ where U is the utilisation factor .For example, U= 90% and D^*_{1i}=311 then C^*_{1i} = 311/0.9 = 345.6 BTKMS (Similarly for road transport).

5. Additional capacity required in railways during 1995-2000: $C^*_{ai} = C^*_{1i}$ minus the initial capacity available in year 1995. In the above example, C^*_{1i} = 345.6-232 = 113.6 BTKMS (Similarly for road transport).

6. Investment required in railways during 1995-2000 to carry C^*_{ai} : $I^*_{ai} = C^*_{ai} \times 76 \times (1+r/100)$ crore rupees where Rs.76 crores is the cost per BTKMS at 1982-83 prices as per the norms of railway ministry and r is the inflation rate. If r = 20% , then I^*_{ai} = 10360 crore rupees.

TABLE-7

TARGETTED SHARE OF RAIL-ROAD IN FREIGHT TRAFFIC AT ALTERNATIVE UTILISATION FACTORS FOR 2000 AD

Targetted Traffic

Year	Rail	Road	Total	
1985(actual)	172.6(41.5)	243.5(58.5)	416.1	
1995	256(29.0)	626(71.0)	882	
2000	368(27.2)	986(72.8)	1354	D_i= 472 BTKMS.

		D_{1i}			D_{2i}		
U_1%	U_2%	95	100	110	95	100	110
90		123(26.1)	119(25.2)	110(23.3)	349(73.9)	353(74.8)	362(76.7)
95		128(27.1)	124(26.3)	115(24.4)	344(72.9)	348(73.7)	357(75.6)
100		133(28.2)	128(27.1)	120(25.4)	339(71.8)	344(72.9)	352(74.6)

		D^*_{1i}			D^*_{2i}		
U_1%	U_2%	95	100	110 110	95	100	110
90		379(28.0)	375(27.7)	366(27.0)	975(72.0)	979(72.3)	988(73.0)
95		384(28.4)	380(28.1)	371(27.4)	970(71.6)	974(71.9)	983(72.6)
100		389(28.7)	384(28.4)	376(27.8)	965(71.3)	970(71.6)	978(72.2)

Note:

1. Targetted rail freight traffic estimated for 1995 at 4.0% CGR (Annual Compound Growth Rate) and for 2000 over 1995 at 7.5% CGR.

2. Targetted road freight traffic estimated for 1995 at 11.0% CGR and for 2000 over 1995 at 9.5% CGR.

3. Figures in brackets indicate percentage share of rail-road . All other figures are in BTKMS.

4. Total capacity required in railways during 1995-2000 to carry D^*_{1i} BTKMS : $C^*_{1i} = D^*_{1i}/U$ where U is the utiliation factor. For example U=90% and D^*_{1i} =379 then C^*_{1i} = 379/0.9 = 421 BTKMS (Similarly for road transport).

5. Additional capacity required in railways during 1995-2000: $C^*_{ai} = C^*_{1i}$ minus the initial capacity available in year 1995. In the above example, C^*_{ai} = 421 -256 =165 BTKMS (Similariy for road transport).

6. Investment required in railways during 1995-2000 to carry C^*_{ai} : $I^*_{ai} = C^*_{ai}$ x76x (1+r/100) crore rupees where Rs.76 crores is the cost per BTKMS at 1982-83 prices as per the norms of railway ministry and r is the inflation rate. If r=20% , then I^*_{ai} = 15048 crore rupees.

ment and investment policies should be such so that gaps in these variables do not appear. Additional finances need to be mobilised from capital market, preventing people from keeping their money in foreign banks and giving 100 percent tax benefits to investors in transport projects and crediting tax receipts collected from transport sector to a separate transport fund. The Govt. of India can raise funds from the capital market only by securing public participation in the Govt. bonds etc.

CONCLUSION

Railways and road transport are the two principal modes of mass transportation in India. The share of the former in passenger and freight traffic has been declining and is likely to fall further if corrective measures are not promptly adopted, that is, electrification of all routes, creating additional capacity, modernising the old stock, and providing maximum service to users of railway services. It appears paradoxical that on the one hand, its share in plan outlays is the highest among all modes of transport and on the other, railways share in traffic is declining. Road transport is receiving lower share in plan outlays but it is carrying enhancing levels of traffic. Its major segments is in private sector. Such trends are causing phenomenal growth of personalised vehicles which are raising passenger car unit (PCU), clogging of traffic, consumption of scarce petroleum product, pollution and road accidents. To overcome these problems, road capacity needs to be increased, fuel efficient vehicles need to be developed and modern traffic management measures need to be implemented effectively. Investment in roads requires highest priority in India to carry increasing number of vehicles, provide and improve linkages and accessibility among the different sectors and backward regions of the country. However, system approach to transport planning needs to be adopted in all sincerety and honesty.

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