Towards Greener Transport

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and
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Prologue

The Author has a very wide experience not only in the railways but other important sectors of the economy like energy, steel and infrastructure.

In this in-depth analysis the Author highlights the inherent characteristics and strengths of the various mechanised transportation modes like railways, roads, civil aviation, inland water transport and urban transport, amongst others. The advantages of rail-based transportation (greener transport) vis-à-vis the other systems have been brought out.

With his wide experience he has suggested a course of action for accelerating the development of rail transportation. This includes, amongst others, expeditious setting up of Dedicated Freight Corridors and speedy construction of 10,000 km of new railway lines @1000 km per year. Suggestions for financing mechanisms for such massive projects have also been indicated. Apart from others, formations of a National Transport Authority and a centralised Metro Rail Transport Authority, have also been recommended.

With his abiding interest in governance issues, this is a very comprehensive ‘rail’-map from one who has been at the helm of it all.

- Editor

Introduction

The mechanized modes of transport, consisting of the transport sector in the country, comprise Railways, Highways/Roads, Coastal Shipping, Airlines, Pipelines, and Inland Water Transport.

Demand for transport is directly connected to GDP growth. For a developing economy like ours, the elasticity of transport to GDP can be taken as about 1.25. GDP growth of 9% would, therefore, translate into increase in demand for transport to the tune of 11%. The traffic is very likely to double in next 7-10 years.

Our existing transport infrastructure is already under severe strain with congestions visible everywhere. Paucity of necessary resources came in the way of
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infrastructure development and the lower GDP growth in the earlier periods also made us complacent towards the need for such a development. However, booming economy now necessitates that the transport infrastructure develops at an accelerated pace and that too in a coordinated and integrated manner. Development of necessary transport infrastructure is a pre-requisite to sustain the current levels of GDP growth and if timely action is not taken growth may get stifled.

To compound the problem of accelerated growth of transport infrastructure, the issue of environment has assumed paramount importance in the recent years, needing cuts in emissions of greenhouse gases (GHGs). Growth of transport infrastructure has to consciously keep in view the need for using a mode which is least polluting and hence more environment-friendly in addition to planned efforts to reduce transport demand to the extent possible.

Growth of Traffic

No centralised monitoring authority/institution for regulating coordinated operation and integrated growth of different modes of transport exists in the country. To give an example, while Railways are centrally administered as a department of the government, for the highways, infrastructure is provided by the Central and State governments, and the operation of vehicles is by private sector/owners. Some States also have State Transport Undertakings for the passenger transport. Easy availability of authentic data is, therefore, a problem.

The data regarding ‘Originating Inter Regional Freight Traffic Growth and Changing Modal Split in India’ can be seen in Table No.1. This data has been taken from the White Paper on Indian Railways, December 2009 (Ref.:19) and is based on a recent Study. It will be seen from it that currently about 91% of the Inter Regional Freight Traffic is carried by Rail (30%) and Road (61%), and the balance by Coastal Shipping (2.3%), Pipelines (4.5%) and Inland Water Transport (2.2%), the share of Airlines being very small (0.3 million tonne). The share of Rail in freight traffic has come down from 89% to 30% since 1950-51 and for the passenger traffic it has reduced from 69% to 15%. (Ref.:1,7&19)

It will be interesting to examine the pattern of *intra-regional* freight traffic carried by Road. The inter-regional freight traffic mentioned in the above para basically takes a ‘District’ as a ‘Region’ for evaluating the traffic while for the intra-regional traffic the movements within the Region/District are considered. The pattern of traffic for the year 2007-08 as per the Study referred to in above para is as under:

<table>
<thead>
<tr>
<th>Volume</th>
<th>Average Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter-regional freight traffic</td>
<td>1558 Mt</td>
</tr>
<tr>
<td>Intra-regional freight traffic</td>
<td>4640 Mt</td>
</tr>
</tbody>
</table>

(x3) (x1/30)
It will be seen that the volume of Intra-Regional freight traffic is three times the inter-regional traffic but in terms of ton-km it is about 10% only.

**Transport – Pollution & Social Costs**

A European Study gives details of carbon dioxide (CO\textsubscript{2}) emissions from various transport modes, both for the passenger and the freight traffic (see Table No. 2). Such emissions may even be higher for Indian conditions with less stringent fuel quality and vehicle maintenance norms. It will be seen from it that Rail is more environment-friendly with lower CO\textsubscript{2} emissions. On the other hand Table No.1 indicates that while the volume of freight traffic is increasing, the proportionate volume of traffic carried by Rail, which is greener and so more environment-friendly, is declining.

Transport accounts for approximately 25% of global carbon dioxide (CO\textsubscript{2}) emissions, and is the sector with the highest growth in emissions, and the second largest contributor overall (after electricity and heat supply sector). Railways and their energy efficiency are crucial to reducing greenhouse gas emissions. Incidentally, a shift of 3% from road to rail transport corresponds to 10% decrease in GHG emissions (Ref.:14).

In 2005, India’s transport sector consumed about 17% of the commercial energy supply, and 78% of this was used by Road Transport, 11% by Aviation, 10% by Rail Transport and 1% by Inland Water Transport. Of the total energy consumed in the transport sector 98.5% is met through petroleum products and the rest by electric power. Transport sector consumed 27% of the total oil and oil products in India during 2006-07 (Ref.:15).

Transport pricing does not tell the environmental truths because social costs are not factored in. The social costs of transport operation chiefly encompass costs arising from accidents, atmospheric pollution, damage to the climate and to public health, noise, impairment of natural resources and the landscape, and damage to buildings. In the absence of any such authentic data for our country the data from a European Study (Ref.:16) can be taken as a broad guide (see Table No. 3) which indicates that Rail has the lowest social costs.

The approaches that need to be adopted to reduce green-house gas (GHG) emissions in the transport sector can be classified into the following groups (Ref.:2&8):

- Reducing transport demand by suitable relocation of production and consumption activities; use of Information and Communication Technology (ICT) including the use of Geographic Information Systems (GIS) and the Global Positioning Systems (GPS) to reduce movements or to make them more efficient;

- **Planned Shift to Non-Motorised Transport (NMT)** e.g., for low lead intra-regional freight traffic and for passenger traffic in busy metropolitan areas;
• Fuel efficiency improvements – A European Study (Ref.:16) indicated that upto 25% of fuel consumption could be saved through the use of efficient driving methods (Ecodriving);

• System efficiency improvements through traffic engineering and management measures;

• Encouraging a shift of commuters from use of road to rail and from personalized road vehicles to public mass transport;

• Modal shift of freight traffic towards more environment friendly modes like Rail and IWT;

• Behavioural changes by moving towards an optimum utilization of seating space and load factor; and

• Technological and fuel changes through upgrading automobile technology and fuel quality and promoting alternative fuels.

Table No. 1 : Freight Traffic Growth and Changing Modal Split in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Originating inter Regional Traffic (MT)</th>
<th>Railways</th>
<th>Highways</th>
<th>Coastal Shipping</th>
<th>Airlines</th>
<th>Pipelines</th>
<th>Inland Water Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950-51</td>
<td>82.2</td>
<td>73.2</td>
<td>9.0</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(89%)</td>
<td>(11%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978-79</td>
<td>283.4</td>
<td>184.7</td>
<td>95.6</td>
<td>3.1</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(65%)</td>
<td>(34%)</td>
<td>(1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1986-87</td>
<td>484.9</td>
<td>255.4</td>
<td>224.0</td>
<td>5.5</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(53%)</td>
<td>(46%)</td>
<td>(1%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007-08</td>
<td>2555.4</td>
<td>768.7</td>
<td>1558.9</td>
<td>59.1</td>
<td>0.3</td>
<td>113.5</td>
<td>54.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(30%)</td>
<td>(61%)</td>
<td>(2.3%)</td>
<td>(4.5%)</td>
<td>(2.2%)</td>
<td></td>
</tr>
</tbody>
</table>

Table No.2 : Carbon-Dioxide (CO$_2$) Emissions

<table>
<thead>
<tr>
<th>CO$_2$ Emissions from Freight Transport (gms/tonne-km)</th>
<th>CO$_2$ Emissions from Passenger Transport (gms/passenger-km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road 158</td>
<td>Air 229</td>
</tr>
<tr>
<td>Water Transport 31</td>
<td>Road (Car) 175</td>
</tr>
<tr>
<td>Rail 29</td>
<td>Rail 75</td>
</tr>
</tbody>
</table>


Table No. 3
Social Costs of Various Transport Modes

(Euros per 1000 tonne-km)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>271.3</td>
</tr>
<tr>
<td>Road (Light Lorries)</td>
<td>250.2</td>
</tr>
<tr>
<td>Road (Heavy Vehicles)</td>
<td>71.2</td>
</tr>
<tr>
<td>IWT</td>
<td>22.5</td>
</tr>
<tr>
<td>Rail</td>
<td>17.9</td>
</tr>
</tbody>
</table>

(B) Average Social Costs – Passenger Transport (2000)
(Euros per 1000 passenger-km)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road (Car)</td>
<td>76.0</td>
</tr>
<tr>
<td>Air</td>
<td>52.5</td>
</tr>
<tr>
<td>Road (Bus)</td>
<td>37.7</td>
</tr>
<tr>
<td>Rail</td>
<td>22.9</td>
</tr>
</tbody>
</table>


Road Sector – An Overview (Ref.:7)

- In our country, Roads carry around 85% of the passenger and 61% of the freight traffic.
- The category-wise breakup of road network is as under :

<table>
<thead>
<tr>
<th></th>
<th>Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Highways</td>
<td>70,548</td>
</tr>
<tr>
<td>State Highways</td>
<td>131,899</td>
</tr>
<tr>
<td>Major District Roads</td>
<td>467,763</td>
</tr>
<tr>
<td>Rural Roads</td>
<td>2,650,000</td>
</tr>
<tr>
<td></td>
<td>3,320,210</td>
</tr>
</tbody>
</table>
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- The road network although spanning 3.3 million Km is grossly inadequate as is evident from the following:

<table>
<thead>
<tr>
<th></th>
<th>India</th>
<th>World Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road density per 1000 Km Area</td>
<td>700 Km</td>
<td>840 Km</td>
</tr>
<tr>
<td>Road density per 1000 People</td>
<td>2.75 Km</td>
<td>6.7 Km</td>
</tr>
</tbody>
</table>

This is inspite of fact that growth of network has been significant since 1951:

(i) Road network grew from 0.4 Million Km to 3.3 Million Km, i.e., by about 8 times.

(ii) National Highways grew from 21,000 Km to 70,000 Km, i.e., by about 3.5 times.

- National Highways although constituting about 2% of the road network carry about 40% of the traffic. Further, about 15% of the network (National Highways, State Highways and Major District Roads) carries about 80% of the traffic.

- The National Highways Development Programme (NHDP) launched a decade ago in 1999 by the Central Government aims to upgrade 55,000 Km of roads with an investment of more than Rs. 3,30,000 crore. This will augment the capacity of busy routes.

The recent announcement by the Ministry of Road Transport to accelerate the pace of construction of National Highways from the existing level of 3-4 Km/day to 20 Km/day (7,200 Km/yr) is not only a welcome step but an essential need to ease congestion and meeting at least partly the burgeoning growth needs of the economy/traffic.

- To improve rural connectivity another programme has also been launched called the Pradhan Mantri Gram Sadak Yojana (PMGSY) in Dec. 2000. It is a 100 per cent centrally sponsored scheme and aims at developing 369,386 Km of rural roads at an estimated cost of over Rs. 1,32,000 crore.

- The road sector receives funding from various sources. These include budgetary allocations by the Central and State Governments, assistance from multilateral agencies, the CRF (Rs. 2 cess on diesel and petrol) and public-private partnerships (PPPs). The PPPs, especially on toll format, are increasingly being used to develop road projects.

Some of the schemes are fully funded by governments, like the PMGSY. The NHAI also provides support upto 40% in the form of viability gap (VG) fund for its projects.
On an overall basis, budgetary resources account for 50% of the total funding in the road sector.

**Inland Water Transport** (Ref.: 3, 17)

Inland waterways have played an important role in the Indian Transport System since ancient times. However, in decades after independence, the importance of this mode of transport has declined considerably with the expansion of road and rail transport. Nevertheless, there is a growing realization that Inland Water Transport (IWT) has to be an integral component of the overall transport system since it is a transport mode, having least impact on environment, the lowest cost for domestic and international transport, enormous capacity reserves and the least energy consumption.

There are 14,500 km of navigable inland waterways in India. Based on the recommendation of several Committees the main being NTPC (1980), the Inland Waterways Authority of India (IWAI) was set up under the IWAI Act of 1985. Under the aegis of IWAI some important waterways have been declared as National Waterways, their total length currently being 4434 Km (Ref.: 17). It may not be out of place to mention that only National Waterways come under the purview of the Central Government/IWAI while other waterways are in the domain of the respective State Governments.

Cargo movement by the inland water mode in India in 2007-08 was 54.9 million tonnes, i.e., about 2.2% of the Total Originating Inter Regional Freight Traffic. However, in terms of tonne-km this just constituted about 0.34% of the total inland cargo movement of about 1000 billion tonne-km. The IWAI has proposed a target of 2% (as compared to 0.34%) of the total inland surface movement by 2025, i.e., an increase by about six times. Several policy measures need to be adopted to reach this target. If the project of linking all major Indian rivers by navigable canals which is at a conceptual stage fructifies, then IWT movements may get a real boost.

**Civil Aviation** (Ref.: 6)

In the past 10 years, the aviation sector has witnessed phenomenal growth. The passenger traffic has grown from 37 million in 1988-89 to 117 million in 2007-08 – a growth of almost 200 per cent and a compounded annual growth rate (CAGR) of 13.64 per cent. The six metro airports (Mumbai, Delhi, Chennai, Kolkata, Hyderabad and Bangalore) handle 75 per cent of the total passenger traffic, while Delhi and Mumbai airports alone handle 45 per cent of the total traffic.

It may be interesting to compare the volume of passenger traffic handled by Air with that of Rail as they are seen as competitors in this area. While about one crore passengers travel by Air in a month, the Indian Railways (IR) carries 1.8 crore passengers per day. The Air passenger traffic is thus about 1.8% of the Rail traffic. On
the other hand Rail carries about 15% of the total passenger traffic (the balance 85% being carried by Road) and the Air passenger traffic will thus be about 0.3% of the total passenger traffic. However, in terms of passenger-kms the volume of air traffic will be much larger.

**Urban Transport** (Ref.:6)

Currently, India has the second largest urban system in the world. As per the 2001 census, over 285 million people, constituting nearly 29% of the total population, reside in urban areas. The share of urban population is expected to increase to 40% by 2021, against the earlier projection of 2030.

The government has brought in various reforms and policy initiatives to streamline the urban infrastructure. The biggest reform initiative was the launch of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) under which the Union Government incentivises urban local bodies (ULBs) to undertake mandatory reforms like full cost recovery, accrual-based accounting, e-governance, etc., in return for grants to improve service levels in a financially sustainable manner. The JNNURM covers water supply and sanitation, sewerage and solid waste management, urban transport, etc.

For the urban transport, the National Urban Transport Policy was introduced in April 2006 (Ref.:12) with the objective of providing a unified framework. The policy lays emphasis on the need to increase the efficiency of the use of road space by giving preference to public transport, by using traffic management instruments and by restraining the growth of private vehicular traffic. It also proposes the integration of land use and transport planning, and the setting up of urban metropolitan transport authorities as a means to integrate the sector.

City authorities are now increasingly conscious about the need to have a modern and efficient public transport system. The success of rail-based transit system like the Delhi Metro has encouraged Bangalore, Chennai, Mumbai and Kolkata to implement similar projects. Several bus-based transit system projects are lined up to be implemented under the JNNURM.

The exponential growth of urban transport, growing visible traffic congestions, and the need to reduce green house gas emissions necessitate coordinated and integrated planning, and massive system inputs. The systems should support/encourage shift from (a) Personalised vehicles to Public transport and (b) from Road to Rail modes. In this regard mention could be made of the following:

(i) **Bus Rapid Transit (BRT) System**: Of all the mass transport modes, BRT offers the highest return on investment and the shortest implementation time. It provides equal road space to all types of commuters and offers safety to cyclists and pedestrians.
(ii) **Rail Transport**: Rail based urban transport is more reliable, comfortable and safer than road based systems and reduces journey time by 50-75 per cent. **One train carries the same amount of traffic as nine bus lanes or 33 private car lanes.** Further, it does not occupy any road space, if underground, and only about 2 m width of the road, if elevated.

A typical Bus Rapid Transit (BRT) system, with single lane each way, may provide a carrying capacity of 10,000 passengers per peak hour per direction (pphpd). On the other hand a Monorail or Elevated Light Rail Transit (ELRT) system will be able to cater to 10,000 to 30,000 pphpd and a Heavy Metro Rail System 70,000 pphpd or more.

The Rail systems mostly use steel rail to steel wheel contact (some systems also use rubber tyred wheels for lesser noise) which provides a system with low friction and so a lower fuel consumption. Further, use of electric power makes such systems more environment friendly because of better energy efficiency (in generation and in the use of electric power) as also in avoiding polluting emissions in busy city areas where such rail systems operate. In cities having comparatively lesser traffic, resurgence of ‘Trams’ is now seen on these very considerations.

While setting up of urban metropolitan transport authorities has been/is being done **there is also a need to give a boost to more environment-friendly rail mode which, inter alia, can also carry much larger volumes of traffic faster and with greater safety.** Growth of metro rail systems in our country has been extremely slow but the success of Delhi Metro Rail Project clearly points towards the need for having many more such systems especially in the major cities.

**Railways – Some Points to Ponder**

I. **Savings in Fuel : Rail vs Road**

Planning Commission’s Integrated Energy Policy (August 2006 – Ref:11) mentions that carriage of 3000 BTKM of freight traffic by Rail instead of by Trucks (in the year 2030) will save 50 million tonne of diesel oil. Thus saving in the cost of diesel oil for each net ton-km (NTKM) of freight carried by rail vis-à-vis road works out to Rs. 0.60 (one ton of diesel = 1.2 kilolitres; cost of diesel Rs. 30 per litre).

A study by Deutsche Bank (7th April 2006 – Ref.:5) indicates that cost of carriage of freight by Road per NTKM is Rs. 1.10 out of which 58% is fuel cost. On the other hand the cost of carriage by Rail is Rs. 0.50 per NTKM out of which fuel cost is 14%. This translates into the following:

(a) Fuel cost per NTKM-Road = Rs. 0.58x1.1 = Rs. 0.638
(b) Fuel cost per NTKM-Rail = Rs. 0.14x0.5 = Rs. 0.070
(c) Difference in Fuel costs per NTKM = Rs. 0.568
This also brings out that the road transport consumes nine times more fuel in carrying one NTKM of freight vis-à-vis Rail.

This cost data (fuel cost per NTKM for Road Rs. 0.638; cost of carriage by Rail per NTKM Rs. 0.50) further indicates that carriage of trucks on rail wagons (similar to RO-RO service in operation on the Konkan Railway) will not only be a financially viable option for the truckers but will also benefit the national economy by reducing the fuel consumption. However, this can be a practical reality only when adequate rail capacity to allow free flow of traffic exists, to ensure fast movements in guaranteed time, by the Railways.

II. Level Playing Field to Rail vis-à-vis Road

In our country 91% of the traffic is carried by Rail (31%) and Road (60%). For carriage of freight traffic, Rail is nine times fuel efficient vis-à-vis road but is loosing its market share (from 89% in 1950-51 to 30% as of now) resulting in enhanced pollution for the transport sector as a whole. Efforts to contain this decline in Rail’s market share have not succeeded but the environmental concerns now necessitate urgent action to rectify the situation. The main reason for the Rail to loose vis-à-vis Road is that ‘social costs’ are not suitably factored in. While authentic data in this regard is not available for our conditions, a recourse to other international studies clearly highlights that its impact is substantial. Table No. 3 gives data from a European Study with regard to social costs. The findings of the Balance Research Institute, Melbourne (Ref.:4 – 1999) indicated below further testify this fact:

"Including all known costs and revenues perhaps rail freight is 80% commercial at present, whereas road freight is perhaps 50%. If they both had to pay 100% of the economical and societal costs then the modal split would change towards rail."

This also highlights the need for a detailed Study and evaluation of the Social Costs for our conditions and till this is done to provide inputs to Rail on the same pattern as being done for the Road very much like the National Highways Development Programme (NHDP) and the Pradahan Mantri Gram Sadak Yojana (PMGSY). As a matter of fact Rail should be given some additional inputs so that the skew already created could be rectified with speed.

III. Low Passenger Fares on the IR – Tariff Ratio

On the Indian Railways (IR) passenger fares were deliberately kept low (Ref.:1) as will be evident from the following (Court of Directors – East India Company – 1845):

"According to the experience of this country (Great Britain) by far the largest returns are procured from passengers; the least from the traffic of goods. The condition of India is in this respect directly the
reverse of that of England. Instead of a dense and wealthy population, the people of India are poor and in many parts thinly scattered over extensive tracts of the country. But, on the other hand, India abounds in valuable produce of nature which are in a great measure deprived of a profitable market by want of cheap and expeditious means of transport. It may, therefore, be assured that remuneration for railroads in India, must for the present, be drawn chiefly from the conveyance of merchandise, and not from passengers.”

Tariff ratio is defined as the ratio between the average passenger fare per km to the average freight rate per tonne km. The financially desirable value for the Tariff ratio is around 1.0 while the Chinese Railways have adopted a value which is greater than 1.0. The values of Tariff Ratio for some selected countries are given below:

<table>
<thead>
<tr>
<th>Country</th>
<th>Tariff Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>1.4</td>
</tr>
<tr>
<td>France</td>
<td>1.3</td>
</tr>
<tr>
<td>China</td>
<td>1.2</td>
</tr>
<tr>
<td>Austria</td>
<td>1.1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.9</td>
</tr>
<tr>
<td>Greece</td>
<td>0.4</td>
</tr>
<tr>
<td>India</td>
<td>0.3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>0.2</td>
</tr>
</tbody>
</table>


In the year 1950-51 the value of Tariff Ratio on the IR was around 0.5 which has since come down to 0.3. The IR’s passenger earnings for the year 2008-09 were about Rs. 21,000 crore and the loss on passenger segment about Rs. 14,000 crore. (Ref.:19) If the Tariff Ratio was maintained at 0.5 then at least this loss in passenger segment would have been wiped out making the passenger segment break even. It may not be out of place to mention that the total earnings on IR for the year 2008-09 were as under:

<table>
<thead>
<tr>
<th></th>
<th>(In thousand crore of Rupees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Traffic</td>
<td>53.5 (67.0%)</td>
</tr>
<tr>
<td>Passenger Traffic</td>
<td>21.9 (27.4%)</td>
</tr>
<tr>
<td>Other Earnings</td>
<td>4.4 (5.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>79.8 (100.0%)</td>
</tr>
</tbody>
</table>

For a system already having a policy of keeping passenger fares low (Tariff Ratio as 0.5 earlier) this further lowering of passenger fares (Tariff ratio 0.3 at present) is resulting in a loss of Rs. 14 thousand crore in the passenger segment. This is partly responsible for the higher freight rates on the IR (see Table No.4) as also for the paucity of adequate funds for maintenance, modernization, and growth. The problem got further compounded due to the non-availability of level playing field to Rail vis-à-vis Road, the two primary transport modes carrying about 91% of the traffic. The solution
lies in having a Policy which ensures a level playing field to Rail vis-à-vis Road; and the Rail correcting its Tariff ratio to 0.5 (from the existing value of 0.3) so that the Passenger traffic does not remain a loss-making segment.

### Table No. 4
Average Freight Revenue : World Scenario

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Freight Revenue per ton-km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>751</td>
</tr>
<tr>
<td>India</td>
<td>395</td>
</tr>
<tr>
<td>South Africa</td>
<td>281</td>
</tr>
<tr>
<td>France</td>
<td>218</td>
</tr>
<tr>
<td>Japan</td>
<td>207</td>
</tr>
<tr>
<td>China</td>
<td>185</td>
</tr>
<tr>
<td>Russia</td>
<td>122</td>
</tr>
<tr>
<td>USA*</td>
<td>100</td>
</tr>
</tbody>
</table>

*Freight charges for countries are benchmarked as a comparison to the US (taken as 100) and calculated as freight revenue/tonne-km.


### IV. Planning Commission Endorses Modal Shift Towards Rail

Modal shift in favour of rail will not only reduce emissions (due to reduced diesel consumption) but will also save considerable amount of foreign exchange (about 80% of crude is imported) and has also been endorsed by the Planning Commission as detailed below :

(a) **Integrated Transport Policy - Planning Commission - Oct 2001 - Para 11.9** (Ref.:10)

“...the Railways may attempt to increase its share in total traffic from the present level of 40% to 50% by 2010, leading to a saving in diesel, which at the present level of traffic would amount to around Rs. 2500 crore of foreign exchange per annum. ...”

(b) **Integrated Energy Policy – Planning Commission – Aug. 2006** (Ref.:11)

(i) **Para 4.3.1(c)**

“...The share of railways in total tonne kilometer (t-km) of goods traffic has come down from 70% in 1970-71 to 39% in 2003-04. If the railway carried 70% of the goods traffic today, it would carry 300 Bt-km of additional traffic. Assuming that all of this goods traffic would
have been carried by Railways using diesel, the diesel saved in the year 2003-04 would have been around 5 Mt out of a total consumption of 40 Mt. ""

(ii) Chapter VI – page 86

"… Carrying 3000 billion tonne kilometers (Bt-km) of freight (half of projected freight traffic in 2031) by rail instead of trucks can save approximately 50 Mt of diesel per year. ""

Note: Cost of one million tonne (Mt) of diesel will be about Rs. 2,500 crore including transport, refining costs, etc., but excluding duties & taxes (one barrel costs 60 US dollars; one tonne = 7.4 barrel).

Indian Railways have Severe Capacity Constraints

Indian Railways (IR) is an efficient organization and has well-tuned systems. The “Input vs Output” (Table No.5) indices indicate that with very little inputs (e.g., only 18% increase in Route Kms since 1950-51) about ten times more traffic is being carried currently. The “Select Data – Indian Railways” (Table No.6) shows how in the last fifteen years ‘Wagon Turnround’ and ‘Number of Accidents’ have reduced. However, lack of timely investments in maintenance and capacity building and heavy burden of Social Service Obligations have adversely affected the system.

The argument, that capacity constraints and adequate inputs are not the IR’s problem but it is basically the inefficient operation and lack of focus, does not cut much ice. Following may elucidate the point further:

- In early 1980s, problem of lack of capacity was solved in an adhoc manner by permitting running of only “rake loads” of traffic thereby making movements faster but in the process loosing high rated piecemeal traffic. Planned inputs for ‘capacity generation’ and ‘containerisation’ in time could have avoided such a situation.

- Asset rehabilitation arrears had to be wiped out through a Special Railway Safety Fund of Rs. 17,000 crore (year 2001-02 onwards) indicating inadequate investments in maintenance and upkeep of the system.

- Currently also, the capacity constraints have largely been overcome by an adhoc increase in axle loads from 20.3 tonne to 22.9 tonne. This can be broadly translated into an annual traffic increase of 90 Mt and a corresponding extra yearly income of Rs. 6,000 cr. (Ref.:18).
Towards Greener Transport

There is severe congestion on the Golden Quadrilateral (connecting four metro cities of Delhi, Kolkata, Chennai and Mumbai) and its two diagonals which constitute about 16% of Route Kms but carry more than 55% of the IR’s traffic. Large number of sections falling on these routes are having line capacity utilization exceeding 100% (Ref.:19).

Capacity of a transport system can basically be seen in two ways. Firstly, whether the required levels of traffic can be carried by it, and secondly, whether the system provides for a free flow to traffic wherein unscheduled delays do not occur. Unscheduled delays to movements deter the users as the movements not only take more time but there is also a large amount of uncertainty involved. Studies carried out on sections like Vadodara-Surat, a busy double line section, using the Long Range Decision Support System (LRDSS), have indicated that beyond 61 trains in each direction, the unscheduled delays exceed 50% of the bare running time. On the IR many mainline sections are congested with some of them running 90-100 trains in each direction.

**Table No. 5: Input vs Output : Indian Railways**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Route Kms</td>
<td>100</td>
<td>118</td>
</tr>
<tr>
<td>Running Track Kms</td>
<td>100</td>
<td>144</td>
</tr>
<tr>
<td>Wagon capacity</td>
<td>100</td>
<td>247</td>
</tr>
<tr>
<td>Coaches - Passengers</td>
<td>100</td>
<td>311</td>
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</tbody>
</table>

**Output Indices**

<table>
<thead>
<tr>
<th></th>
<th>100</th>
<th>1185</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Traffic – NT Kms (Rev. + Non Rev.)</td>
<td>100</td>
<td>1185</td>
</tr>
<tr>
<td>Passenger Traffic – Pass Kms (Non-Sub)</td>
<td>100</td>
<td>1084</td>
</tr>
</tbody>
</table>


**Table No. 6**

Select Data – Indian Railways

<table>
<thead>
<tr>
<th>Year</th>
<th>Track Renewals (Kms)</th>
<th>Number of Accidents</th>
<th>Wagon Turnaround (days)</th>
<th>Operating Ratio (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-95</td>
<td>2,763</td>
<td>501</td>
<td>9.5</td>
<td>82.6</td>
</tr>
<tr>
<td>1995-96</td>
<td>2,893</td>
<td>398</td>
<td>9.1</td>
<td>82.5</td>
</tr>
<tr>
<td>1996-97</td>
<td>2,795</td>
<td>381</td>
<td>8.5</td>
<td>86.2</td>
</tr>
<tr>
<td>1997-98</td>
<td>2,950</td>
<td>396</td>
<td>8.1</td>
<td>90.9</td>
</tr>
</tbody>
</table>

Contd.
### Need for Accelerated Development of Rail Capacity

For efficient and effective performance of a transport system, on a sustainable basis, following three areas need proper attention and inputs:

(i) Maintenance of existing assets – Fixed, Moving, and Others.
(ii) Expansion of the Network – As for example, New lines and additional parallel lines (Doubling; Three Lines; Quadrupling) on a Railway System, along with necessary support facilities.
(iii) Modernisation.

On the Indian Railways (IR), all the three areas have suffered primarily due to paucity of resources and policy of advantage Road vis-à-vis Rail. However, extreme concerns for Rail safety, voiced by media and public, have resulted in investments in Maintenance and Modernisation to a large extent but the Expansion of Network has lagged far behind.

Planners have to consciously realize that booming economy will necessitate doubling of traffic capacity in next 7 to 10 years and both the Rail and the Road, which carry about 91% of the traffic, will have to be given suitable inputs for capacity augmentation. Both the modes will have to complement/supplement each other to take on this galloping transport demand.

The congestions on roads already visible with the existing levels of traffic, cost of road service growing faster than the cost of rail especially because of sharply rising fuel costs, concerns for environment (road being much more polluting than rail) etc., will necessitate that rail not only carries the traffic on the existing pattern but improves it further.

This clearly highlights the **need for accelerated capacity generation on the IR both on the existing routes (Doubling/Third Line/Quadrupling) and in the new growth areas (New Line Construction).**
Financing of various Projects/Schemes through Public Private Partnership (PPP) or other means should not be a problem for the IR. However, basic features of Rail/Road infrastructures needing Government support still remain and the Government of India (GOI) will need to support the accelerated pace of building of fixed infrastructure on the IR on the same pattern as is being done for Roads. Once such inputs are given to improve the capacity of the fixed infrastructure, the IR should be able to garner adequate resources for the ‘moving assets’ and ‘other facilities’.

Financing of Projects

Indian Railways in the Pre-independence era (1845-1947) experimented with several financing methods as briefly outlined in Box No.1 and with aggregate rate of construction of new lines about three times faster vis-à-vis that after Independence, one can argue that these methods could provide much better financing towards the development of IR network.

Poulose (Ref.:13) while discussing the various methods of project funding like Build Operate Transfer (BOT), Public Private Partnership (PPP), Foreign Direct Investment (FDI), Foreign Aid, Loans, etc. observes that to meet the massive resource requirements for bridging the infrastructure investment gaps, and the inability of any sector by itself to raise the resources, there is no escape from joint efforts by all the sectors. In this background, no method of funding can be rejected out of hand. All the methods would need to be adopted, by the Public and Private sectors together, for implementing projects, for the benefit of society.

Funding of transport infrastructure projects has to keep in mind the following features:

(a) Governments will always need to subsidise transport in some way, the extent and need of support varying with the mode type and the location. To give example, rural roads in our country are being executed through government funds and even the national highway projects are being provided viability gap (VG) funding to the extent of 40% of the project cost.

(b) Indian economy which was earlier growing at a slow pace is now growing at a much faster rate. With a GDP growth of about 9%, the demand for transport is likely to grow by about 11% and the traffic is very likely to double in the next 7-10 years. Adequate transport infrastructure is a necessary pre-requisite to sustain this growth rate. Accelerated development of transport infrastructure becomes inescapable needing inputs in the form of accelerated development funds.

(c) Further, the current environmental concerns the world over need that emissions be minimized in the interest of our very survival and so transport modes which are environment friendly have to be
preferred. Therefore, the economic and social costs have to be considered to decide upon the most suitable transport mode. For super-accelerated growth of such transport modes, additional inputs by way of environment mitigation funds have to be provided.

Fund generation for accelerated/super-accelerated growth of transport sector will need special and directed efforts on all fronts (Public Private People Partnership) and may, *inter alia*, include divestment of transport and allied PSUs, cess on diesel/petrol, cess on passengers/freight, service tax on related transport services, government support, FDI, Foreign Aid, loans, etc., in addition to government grants.

Box No. 1

Financing of Railway Projects in the Pre-Independence Era (1845-1947) (Ref.:1)

(a) Guaranteed Returns

In this system, the Government of India guaranteed to provide the owner (a Joint Stock Company) a minimum rate of return on the capital deployed. The rate of interest to be guaranteed was generally in the range of 4% to 5%; period of lease was 25 or 50 years or 99 years; the land was given free; the Government prescribed standards for construction and supervised the working and had the flexibility to purchase the line after 25 or 50 years. In case of surplus profits, half of them were to go to the Government and the other half to the share holders. In this system, the tendency on the part of the companies was to inflate the cost of construction as it provided more interest payments. An official report submitted to the House of Commons in 1872-73 indicated as under:-

“There are now open in India 5872 miles of railway which should cost about (pounds) 97 million, giving an average expenditure of 16,536 (pounds) per mile. The exorbitance of the expenditure becomes evident when it is realised that in Australia, the cost per mile for railway construction was 12,000 (pounds) and in Canada only 8,500 (Pounds).”

(b) Provision of ‘subsidy’

In this case, payments were made to secure the construction of railways in India on comparatively more favourable terms and instead of guaranteed return, a subsidy per kilometer was to be given. The system however failed to attract capital and was given up.

*Contd.*
(c) **Government Funding**

In view of high cost of construction obtained in the system of ‘guaranteed returns’ and failure of the ‘subsidy’ approach, the system of Government funding was suggested from 1869 onwards. This funding was provided by classifying the works into three categories as under:

- **Productive works**
  These were the works which could give adequate returns after meeting of liabilities and so could be financed with borrowed money.

- **Protective works**
  These were not remunerative but provided a safeguard against future outlay in the relief of population and were to be financed with revenue surplus and not with borrowed money.

- **Provincial works**
  These were to be undertaken as per the requirements and the Local Governments were to guarantee interest on the capital raised.

In this way from 1880 onwards, the construction of Government lines as also the Company lines started side by side.

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**Dedicated Freight Corridors on the Indian Railways**

The Golden Quadrilateral (connecting four metro cities of Delhi, Kolkata, Chennai and Mumbai) and its two diagonals, which constitute about 16% of Route Kms or 25% of Running Track Kms carry more than 55% of the traffic of the Indian Railways (IR).

Dedicated Freight Corridors (DFCs) are being planned for the entire Golden Quadrilateral and its two diagonals by laying two new parallel double lines exclusively for freight traffic thereby making the existing system a passenger corridor. The approximate length of six DFCs (Four sides of the quadrilateral plus two diagonals) will be 11,500 km of double line (23,000 km of rail track). The DFCs will mostly run parallel to the existing system but in busy areas and yards detours will be necessary.

Existing network is mostly a double line section (except for some stretches where 3rd or 4th lines exist) and the construction of DFCs will virtually mean quadrupling (Two Passenger lines + Two Freight lines) of the sections. With four lines, increasing traffic, and improving average speeds of trains (due to enhanced mobility) the operation of existing level crossing (surface crossings of road and rail) will not be practically possible and so grade separation becomes an essential prerequisite, needing provision of Road Over Bridges (ROBs) or Road Under Bridges (RUBs) in lieu of existing level crossings.
Cost of construction of DFCs is likely to be Rs. 1,20,000 crore in addition to the investment of Rs. 30,000 crore needed for upgrading the Feeder Routes (30,000 km) for carriage of higher axle load wagons (25.0t instead of 22.9t).

Construction of DFCs will greatly enhance capacity and mobility, mainly due to the following:

(a) Slow moving goods trains (75 kmph/100 kmph) will not come in the way of passenger trains (100 kmph/140kmph) nor the slow moving freight trains will have to wait for giving precedence to faster moving passenger trains. This will reduce congestion and improve average speeds of both the passenger and the freight trains. The sectional capacity will also markedly improve.

(b) Higher axle load wagons plying on DFCs will carry more load per train.

(c) Existing corridors (passenger corridors) will be relieved of freight trains, which are heavier thus giving relief in maintenance especially to old existing bridges.

(d) Since level crossings will not be existing (complete grade separation), the existing passenger corridors could run normal trains at 160 kmph speeds as also tilt body High Speed passenger trains upto speeds of 200 kmph (similar to Swedish X2000) by suitably fencing the existing tracks and providing cab signalling. This will also enhance safety of travel.

Completion of DFC project, in a period of about ten years is essential to meet the growing traffic demands (traffic is likely to double in next 7-10 years). However, it will be a difficult and challenging task involving construction of about 2300 km of rail lines every year. (currently IR executes about 300 km of double lines in a year).

Completion of all the six DFC lines (Quadrilateral and two diagonals) in about ten years will not be possible unless adequate funds are assured. In this regard, Government of India should consider providing 40% of the Project Cost as a Grant in the form of Viability Gap cum Accelerated Development cum Environment Mitigation Fund. A Grant of about Rs. 6,000 crore per year for the DFC Project will be required and the balance funds could be organised by the IR through their internal resources/borrowings/PPP, etc. A ten year action plan along with a MOU could be drawn up with the IR accordingly.

It will be desirable to execute the DFC Project as a National Project in view of its importance to the country’s economy. A special purpose vehicle (SPV) viz., Dedicated Freight Corridor Corporation of India Limited (DFCCIL) of the Indian Railways is already in place and work on the Eastern and Western DFC corridors is currently in progress.
Construction of New Railway Lines

New Railway Lines are being constructed at a very slow pace, primarily because of fund constraints and their financial non-viability. Since 1950-51, only 18% addition has been done to the Route Kms which indicates that the pace of New Line construction has been about one third of what it was in the 100 year period prior to Independence (1947).

Such lines open the system to traffic from new markets and are also needed to develop rural areas including the vulnerable ‘border’ areas. In addition to generation of employment during construction and subsequently for the maintenance and operation, such lines generate considerable amount of employment in the related non-railway sectors. Environmental consideration also necessitate improved transport share for Rail clearly pointing towards the need for expeditious growth of the Rail network.

Some may argue that such lines are not necessary for the IR but more than 11,000 km long New Line projects already sanctioned (Ref.:9 – Dec. 2009) and waiting to be executed tell a different story. The progress of New Line construction in the pre-Independence era was more than 500 km/yr which reduced to about one third (about 180 km/yr.) after the Independence (1947). The last five years (2004-05 to 2008-09) have seen a construction rate of about 230 km/yr. (Ref.:19).

The need for a major thrust towards this vital area of Network Expansion has been recognized and the IR’s Vision 2020 document (Ref.:9 – Dec. 2009) suggests a growth rate of 2500 km/yr which has been scaled down to 1000 km/yr in the Rail Budget (24th Feb. 2010). The target of 1000 km/yr appears more pragmatic for a system which hitherto has been executing New lines @ 200 km/yr or so. It is suggested that construction of New Railway Lines should be considered in the same light as the Pradhan Mantri Gram Sadak Yojana (PMGSY) and the Government of India (GOI) should consider a support of Rs. 5000 cr/yr for this vital need in the form of viability gap cum accelerated development cum environment mitigation fund. Other inputs like the rolling stock, operation and maintenance costs, and the allied losses for such lines could be borne by the IR.

Suggest Action Plan

Shift to Environment-friendly Transport Modes

The broad approaches that need to be adopted to reduce green house gas (GHG) emissions in the transport sector have been discussed earlier. It is felt that following need urgent and directed attention/inputs:

- Modal shift of inter-regional freight traffic to more environment-friendly modes like Rail and IWT.
For urban passenger traffic (a) shift from personalised vehicles to public mass transport; and (b) on busy corridors from road to rail; in addition to encouraging non-motorised transport (NMT) to the extent possible.

For low lead intra-regional freight traffic (4640 Million tonne with average lead of 15km) planned shift to non-motorised transport to the extent possible.

Two Rail Projects as National Projects

Expeditious development of Rail transport capacity on busy routes and development of rail network in the country are being suggested. The IR is taking action in this regard and have also developed a Vision 2020 document and an Action plan (Ref.:9). However, to ensure timely availability of adequate rail infrastructure it will be desirable to undertake the following two rail projects as National Projects by the Government of India.

(i) Dedicated Freight Corridors (DFCs)

As discussed earlier, the following could be the broad action plan:

- The Golden Quadrilateral (connecting four metro cities of Delhi, Kolkata, Chennai & Mumbai) and its two diagonals constitute about 16% of Route Kms but carry 55% of IR’s traffic.

- The DFCs on the four sides of the Quadrilateral and its two diagonals have an approximate length of 11,500 Km of double line (about 23,000 Km of rail track) and will cost Rs. 1,50,000 crore. These be executed with speed say in a period of about 10 years.

- About 40% of the cost be borne by the Government of India (GOI) by way of viability gap cum accelerated development cum environment mitigation fund, i.e., about Rs. 6,000 cr./year for 10 years.

- IR to ensure balance funds through its own resources/loans/PPP, etc.

- With complete grade separation (no level crossings) the two passenger tracks (as the freight trains will now be running on the parallel DFC tracks) could be fenced and with the provision of cab signaling passenger safety concerns could be adequately addressed. The existing passenger train speeds could be raised to 160 kmph and on the same track some High Speed Tilt Body trains (at 200 kmph) could also be run.
Towards Greener Transport

• The DFCs could run freight train upto 100 kmph speed. The Ro-Ro service should be introduced in a big way to benefit the truckers, reduce road congestion, and to reduce environmental pollution. Such a service finds a mention in the Rail Budget (2000) as also in current Rail Budget (24th Feb., 2010) but will now need accelerated thrust according to a well defined action plan.

(ii) **Construction of 10,000 Km of New Railway Lines @ 1,000 Km/yr.:**

As detailed earlier these are essentially needed and the Government of India (GOI) should consider a support of Rs. 5000 cr/yr for this vital need (on the same pattern as for the PMGSY). Detailed yearly action plan could be developed by the IR accordingly.

⇒ **Formation of a Centralised Metro Rail Transport Authority**

Metro Rail projects are not only essential to carry heavy urban traffic but also considerably reduce environmental pollution. The Integrated Energy Policy of the Planning Commission, August 2006 (Ref.:11) lays special emphasis towards development of rail-based urban transport systems in major cities to conserve fuel/energy. Construction of metro rail projects in our country has far lagged behind. Even though urban transport is a State subject but the Metro Rail projects need highly specialized knowledge and inputs. To give a boost and direction to this activity constitution of ‘Centralised Metro Rail Transport Authority’ appears necessary. This will ensure faster and effective coordination between the Ministry of Urban Development, Ministry of Railways, concerned State Governments, Urban Local Bodies (ULBs) and other Stake holders.

⇒ **Need for a National Transport Authority**

There is no centralized monitoring authority/institution for regulating coordinated operation and integrated growth of different transport modes in our country. Authentic relevant data is also not available for our conditions. The current environmental scene necessitates much greater weightage towards ‘social costs’ and it has to be duly reflected in the optimization process in addition to the usual ‘economic costs’. There is an urgent need to have a National Transport Authority for the purpose.

It is heartening to note that a ‘National Transport Development Policy Committee’ has been constituted by the Government of India (GOI) under the chairmanship of Dr. Rakesh Mohan, former Deputy Governor, Reserve Bank of India, and a renowned Infrastructure Expert (Feb. 11, 2010). The Committee includes several other experts as also the Secretaries in the ministries of
coal, petroleum & natural gas, civil aviation, road transport & highways, finance, urban development, and power, besides the Chairman of the Railway Board. The Committee has been asked to submit its report in a period of 18 months and is to assess the investment needs of the transport sector and identify the role of state and the private sector in meeting these. It will also compare the cost advantages of various modes of transport while addressing the issues of rural connectivity and the problems of remote and difficult areas on the one hand and of the urban and metropolitan areas on the other.

References


*****

Modern technology Owes ecology
An apology.
- Alan M. Eddison

Everywhere is walking distance if you have the time.
- Steven Wright

I have two doctors, my left leg and my right.
- G.M. Trevelyan