

CONTAINER TRANSPORTATION BY RAILWAYS IN INDIA: CHALLENGES AND INITIATIVES

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ABSTRACT

The Indian economy is growing at an unprecedented rate. The multi-sectoral growth has posed humongous challenges to the infrastructure sectors, especially transportation. Indian Railways has registered significant growth in both freight and passenger transportation during last three years. Seized of the challenges from different sectors including transportation of containers by railways, Indian Railways has launched some important initiatives including construction of Dedicated Freight Corridors, Public-Private Partnerships in rail infrastructure development, induction of modern rolling stock, technological upgradation, and new experiments for running double stack container trains in electrified sections and triple stack container trains on diesel routes. Due to these initiatives, the years ahead are likely to witness tremendous growth in container transportation by railways in India enabling and sustaining an efficient logistics chain and the much needed support to the growth of international trade.

INTRODUCTION

Many interesting and intriguing shifts in national development policies and priorities are taking place to face the challenges of globalization. National economies are gearing up to face some of the most dramatic changes in the core sectors specifically manufacturing, services and infrastructure. Challenges posed by inter-dependability of countries and a sense of their coherent co-existence largely as a result of economic integration have resulted in some of the most talked about developments in many parts of the world.

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South Asia too has not only witnessed these changes but emerged as one of the fastest growing regions in terms of the GDP growth. The Indian and Chinese economies are in the lead globally with GDP growth rate hovering around 9 per cent per year. The proliferation of markets and relocation of manufacturing activities have also brought significant shifts in regional and international trade to and from the countries in the Asia-Pacific region. The multi-sectoral growth has necessitated development of infrastructure including power, transport, and communication. Transport has now become the core of infrastructure in national priorities in many countries such as India. Huge public sector investments along with public-private partnership arrangements are being planned for strengthening, upgradation and expansion of transport networks. The international trade and to a large extent the domestic trade consider intermodal transportation to be the most suitable and convenient means of ensuring seamless logistics chain.

Containerization of cargo and its transportation by railways is a late development in South Asia compared to container transportation by surface transport in the United States of America and Europe. The growing international and intraregional trade has reinforced the thinking that efficient intermodal transportation of containers is an inescapable requirement to reduce unit cost and transit time. The development of container transportation by railways in India is an interesting story. Great strides have been made in this sector during the last five years. Major challenges have been identified and addressed to by taking major initiatives by the Government and lately by the private sector.

I. RECENT TREND IN TRANSPORT DEVELOPMENT

Asia-Pacific region

A frenzied growth in some of the Asia-Pacific economies has put additional pressure on their infrastructure sectors, the demand for which outpaces the GDP growth. The economic development as a result of centralization of manufacturing activities, services and consumption centres demands an efficient transport system both for passengers and freight. However, the share of surface transport in international trade even today hovers around 5 per cent. This has been largely on account of development of improved maritime connectivity between continents and regions providing efficient and low cost transportation solutions against inadequate and slow development of surface transport systems. In addition, countries with larger geographical spheres and long coast lines, transport sizable volume of goods to

other ports in the same country by coastal shipping. The development of surface transport has, to a large extent, remained restricted on account of huge costs involved in providing fixed infrastructure like construction of roads and rail infrastructure. The lack of surface transport links also affects the seamless movement of freight traffic across the regions rather adversely.

To address this problem, huge investments are being made to develop rail and road networks in the Asia-Pacific region. China and India are rehabilitating, strengthening and expanding their railway networks to cater to the huge transport demands of their economies.

Rail and road networks spanning across regions are being brought together under multilateral agreements like the Asian Highway Agreement and the Trans-Asian Railway Agreement. Globalization alongwith liberalization of national economies has also resulted in sizable increase in international trade that is largely intermodal i.e. movement of containers involving more than two modes of transport such as sea, road and rail. The container transportation by railways in the last few years has acquired new dimensions across the globe especially in the Asia-Pacific region.

Container transportation by railways

It is generally agreed that the first freight containers were used in the United States of America around 1911. However, it took another 50 years for container operations to become a major component in freight transportation. Container movement witnessed manifold increases in the last few decades. Over a period of time and with the development of ISO containers, certain amount of standardization and uniformity could be achieved globally. The container trains and ships could accommodate larger volumes of containers with ISO specifications. Intermodal operations became swift and efficient. The larger container ships with the capacity of upto 8,000 TEU started calling at growing number of ports and carried cargo for not only transshipment by feeder shipping services but also for long-haul transportation of containers by rail to their destinations in hinterlands. With the induction of latest container ships with a capacity of 14,500 TEU (Emma Maersk), the development of rail and road network alongwith longer and heavier trains have become necessary.

According to a forecast by ESCAP¹ the annual average growth rate of world's container traffic would be about 6.5 per cent during the period 2002-2015. China has acquired the leading position in the world container

¹ ESCAP and AITD (2007). *Toward an Asian Integrated Transport Network* (ST/ESCAP/2399).

transport market accounting for 20 per cent of world container handling and about 50 per cent of the Asian total.

The ESCAP forecast also estimates that the port throughput of international cargo will increase from 240.5 million TEU in 2002 to 576.4 million TEU in 2015, representing about 6.9 per cent annual average rate of growth. It is also estimated that during the same period the international container port throughput in Asia and the Pacific will grow from 133 million TEU to 352 million TEU indicating an annual average growth of 7.7 per cent. This would also increase the region's share from 55 per cent to 61 per cent of the total container traffic. Container transshipment will also grow from 30 million TEU in 2002 to 76 million TEU by 2015. The estimate also indicates that about 927 new container berths would be required for the handling of the new container traffic across the world, of which 569 berths would be required in the ESCAP region alone.

The trend of growth of container traffic poses a serious challenge to national infrastructure facilities and equipment. The growth indicators have been well received in countries such as China and India and many initiatives have been launched in the infrastructure sector in the last few years. In the following sections container transportation by rail in India is discussed alongwith the current situation, the challenges posed and initiatives undertaken and planned.

II. INDIAN ECONOMY AND INDIAN RAILWAYS – AN OVERVIEW

India is one of the fastest growing economies in the Asia-Pacific region next only to China, having achieved a growth rate of over 9.2 per cent in 2006-2007. The GDP growth rate of over 9 per cent has been targeted for the XIth Five Year Plan period of 2007-2012. All the core sectors of the economy have shown significant trends of growth resulting in growing demands on the existing infrastructure. Plan outlays for the transport sector have gone up to 14.8 per cent of the total outlay during the Xth Five Year Plan period.

Recent announcements by the Government reiterate that huge investments would be required in this sector. Railways in India has also been declared as the core of infrastructure. Apart from moving a sizable volume of passenger traffic, its freight traffic largely consist of long-haul bulk commodities including coal, iron ore, cement, food grains, fertilizer, and petroleum, oil and lubricant products. The growth in these sectors of the economy directly results in growth of freight traffic on Indian Railways (IR).

IR has one of the largest rail networks in the world with 63,332 route km equivalent to 109,808 track km. It carries over 1.83 million tons of freight and 15.68 million passengers everyday.² It is not only the single largest employer with 1.41 million employees but its operations also account for almost 2.8 per cent of country's GDP directly. In the last few years IR has witnessed an unprecedented growths in both passenger and freight traffic. Although railway operations are undertaken on mixed use basis (passenger and freight trains share the same infrastructure), the freight tonnage which was 557.39 MT in 2003-2004 has gone up over 726 MT in 2006-2007. The freight revenue constitutes two-thirds of IR's total revenue earnings (over US\$ 15 billion in 2006-2007) with passenger revenues contributing for one-third.³ During the last three years IR has achieved a growth rate of over 8 per cent and brought down its operating ratio from 92 per cent in 2003-2004 to 78.7 per cent in 2006-2007.⁴ IR essentially moves a select group of commodities on long hauls (average hauls are over 600 km). In addition to the transportation of bulk commodities, it also undertakes operation of container trains and parcels.

The railway network is spread across the length and breadth of the country connecting resource centres with consumption centres, ports with hinterlands, major cities/population centres, sub-urban areas and even inaccessible and remote areas. Over 50 per cent of its freight and passenger traffic, however, moves on six major routes which connect the four metropolitan cities of Delhi, Mumbai, Kolkata and Chennai. These routes are called the Golden Quadrilateral and its diagonals, which accounts for 25 per cent of the network. Strengthening of these vital rail routes is being accorded high priority.

IR's Five Year development plans are part of the national Five Year Plans. The XIth Five Year Plan (2007-2012) projections indicate that IR would be targeting to achieve a freight traffic of 1,100 MT and passenger traffic of 8,400 million in the year 2012. In order to achieve these targets, IR would be making an unprecedented investment of over US\$ 60 billion, a sizable portion of which will be coming from internal resource generation and public-private partnership arrangements. During this period two Dedicated Freight Corridors planned at a cost of US\$ 8 billion are likely to be completed, connecting Mumbai-Delhi and Kolkata-Delhi. It will also include major feeder routes connecting major production areas with consumption centres and ports with hinterlands. It has also been decided that during the XIth Five Year Plan period

² *Indian Railways Year Book 2005-2006*. Published by the Ministry of Railways, India.

³ *Indian Railways Looking Ahead to Future, 2007*. Monograph, published by Ministry of Railways, India.

⁴ Operating Ratio is the ratio of working expenses to gross earnings.

the main routes of the remaining metre gauge rail sections will be converted to broad gauge in order to increase their connectivity with the main rail network and to provide seamless operations. Modernization of the rolling stock and construction of high speed passenger corridors are also planned.

Rail-port connectivity is another significant area which has been given special attention by the Government. Although all the major ports have already been provided with broad gauge rail connectivity, a few identified sections which are experiencing capacity constraints are being taken up for double tracking and gauge conversion. A number of such projects would be completed through public-private partnership arrangements. The construction of Dedicated Freight Corridors would also facilitate the movement of double stack container trains in a big way.

III. TREND IN INTEGRATED INTERMODAL TRANSPORT DEVELOPMENT IN INDIA

In the global trading system India is fast emerging as a centre for manufacturing goods and services. However, it faces tough competition from other countries in providing seamless logistics services and suffer from capacity constraints in certain sectors. Containerization of cargo and its movement across the country has significantly improved during the last decade. However, the ratio of containerized cargo to general cargo handled at ports is still about 45 per cent, which is much lower than the global figure of about 70 per cent. During 2005-2006, out of 423.4 million tons of total port cargo handled containerized cargo was about 60 million tons.⁵ The trend in terms of cargo projected to be handled at the major ports indicated in the National Maritime Development Programme of the Ministry of Shipping is given in table 1.

The maritime transport is likely to play an ever growing role during the decades ahead. Indian exports crossed US\$ 100 billion in 2005-2006 registering an unprecedented growth of 25 per cent. Imports have also grown significantly to US\$ 140 billion. As 95 per cent of the export and import are done through the ports, this trend of growth in trade can only be sustained if the port and connecting land transport infrastructure are developed at a matching pace. Rail and road connectivity to ports is the key to seamless container operation. Currently 12 major ports in India handle 75 per cent of the total maritime cargo, which has increased from 19.38 MT in 1950-1951 to 415 MT by the end of 2006-2007.

⁵ National Maritime Development Programme, Department of Shipping, Government of India. Available at <<http://shipping/nic.in>>.

**Table 1. Projections for cargo handling at major Indian ports
(in million tons)**

Year	Total cargo handled	General cargo including containers		Containerized cargo	Per cent of total	Per cent of general cargo
		Million tons	Per cent of total			
2000-2001	281.10	75.05	26.70	32.22	11.50	42.90
2001-2002	287.58	83.13	28.90	37.24	12.90	44.80
2002-2003	313.53	96.43	30.80	43.67	13.90	45.30
2003-2004	344.80	105.82	30.70	51.06	14.80	48.20
2004-2005	383.77	118.65	30.90	54.76	14.30	46.20
2005-2006	423.42	130.81	30.90	61.83	14.60	47.30
2006-2007*	415.00	123.45	29.70	61.10	14.70	49.50
2013-2014*	961.55	404.15	42.00	251.40	26.10	62.20

Source: National Maritime Development Programme – Department of Shipping, Government of India – Website: <http://shipping.nic.in/>.

* Projected.

An integrated transport system has become the need of the time to cater to this huge demand for transportation. For this not only various modes have to be placed in position but the systems at change of transportation mode points have to be efficient. For an integrated transportation network containerization of the cargo is a basic requirement.

The growth projections for the containerized traffic in India are extremely positive indicating a huge growth rate of 15-20 per cent on an annual basis during the next 10 years. It is estimated that the Indian ports are likely to handle over 20 million TEU per year by the next 10 years from the present level of 5 million TEU. The transportation of containers to and from the ports would require efficient surface links by both rail and road. According to another estimate about 70 per cent of the containerized cargo is meant for hinterland areas which are located beyond 300 km. Out of this traffic only about 30 per cent is being currently carried by railways. The geographical spread in India with all the ports located in the south and the hinterland markets in the north necessitates that a sizable portion of this traffic is moved by the railways. Ninety per cent of the entire container handling is confined at the ports on the west coast of India with Jawaharlal Nehru Port in Mumbai handling over 50 per cent of the country's container traffic.

IV. CONTAINER OPERATIONS BY RAILWAYS IN INDIA

At present transportation of container by railway in India is being undertaken almost entirely by Container Corporation of India Limited (CONCOR), a public sector undertaking of the Ministry of Railways set up in 1989 with the prime objective of developing intermodal transport and logistics infrastructure.⁶ CONCOR is engaged in the business of setting up and managing a network of rail linked and road-based Inland Container Depots (ICD) and Container Freight Stations (CFS). With its nationwide 56 container terminals and a large fleet of captive rolling stock, it has handled 2.1 million TEU during 2006-2007.

CONCOR's 41 terminals exclusively handle export-import traffic and are fully equipped with rail/road ICDs and port side container terminals. CONCOR not only provides rail services between ICDs and the ports but also between ports and hinterland. As CONCOR is primarily a rail bound service provider, its mainstay is long-haul traffic from ports to the hinterlands. It undertakes operations with a fleet of over 8,000 freight cars (flat container wagons). The normal container trains consist of 45 wagons which carry 90 TEU per train at 100 km/hour. New high speed wagons are being procured alongwith modern equipment for the ICDs. The warehouse space is being extended to 150,000 square metres with facilities for handling bonded cargo, multi-tacking, consolidation of cargo, and air cargo besides conventional transit warehouses.⁷ CONCOR rates are quite competitive and in cases where these are higher than the rates by road, the coordinated transit time and the capacity to handle large volumes offset the higher charges making CONCOR a preferred service provider.

Advance information system along with cargo logistics information system has greatly helped CONCOR in managing the cargo and the terminals. Facilities for e-filing of commercial documents and container and cargo logistics system have also been made available to customers. CONCOR has achieved a cumulative annual rate of growth of over 15 per cent in the last few years. However, an analysis of the existing port traffic indicates that out of the total containerized port traffic, only 30 per cent of the total container traffic is currently being handled by CONCOR, although such traffic requires long-haul movement to the hinterland.

⁶ A separate article on CONCOR in this volume provides more information on its business, operational practices, performance and other matters.

⁷ www.concorindia.com – The official website of Container Corporation of India.

V. CONSTRAINTS AND CHALLENGES TO CONTAINER TRANSPORTATION BY RAIL

Capacity constrains on major rail routes

IR has achieved an unprecedented growth of 9.2 per cent in goods traffic and 7.0 per cent in passenger traffic over the last three years in sharp contrast to the usual growth rates of 3-4 per cent. This could be achieved despite capacity constraints on major routes of its network. The Golden Quadrilateral and its diagonals connecting four metro cities and some of the major ports suffer from acute capacity constraint on most of the sections. The same infrastructure carries mixed traffic i.e. freight, passenger, parcels and container trains. With passenger trains accounting for over 60 per cent of the train runs, the capacity to handle freight trains is limited. Over 50 per cent of the containerized traffic moving by rail is between Delhi and nearby destinations and Mumbai. The rail route, despite being a double line and electrified, suffers from capacity saturation on a number of sections. Apart from Mumbai and Jawaharlal Nehru port, other ports on the West coast including Kandla, Mundra and Pipavav are also connected through feeder sections with this main route. Most of these rail sections are also saturated. Capacity constraints are also significant on the rail route connecting Delhi in the north with Kolkata in the east and Chennai in the south. The projected growth of over 10 per cent in freight traffic and over 15 per cent in container traffic over the next 5-10 years is likely to put additional pressure on the existing rail routes.

Inadequate rail-port connectivity

The cargo handled at the 12 major ports has increased from 19.3 MT in 1950-1951 to 383.6 MT by the end of 2004-2005. With a future GDP growth of over 9 per cent, the development and modernization of port infrastructure would be essential to ensure global competitiveness. The capacity at various ports is likely to increase with the approved expansion programmes and introduction of modern technology. However, the capacity of the ports to handle cargo and thereby reduce the turn around time of vessels is dependent upon its capacity to evacuate the cargo quickly and efficiently. Lack of quick evacuation directly affects the turn around time of ships at major ports in India which is in the range of over 3 days at present. The estimates prepared by the Planning Commission indicate that traffic for all ports in India is likely to grow at an annual rate of 7.5 per cent. The highest rate is expected in container traffic which is likely to be over 17 per cent during the period 2003-2004 to 2013-2014. In this period, the container traffic is likely to grow from 3.90 million

TEU to 20.95 million TEU. The current share of railway in container transportation is about 30 per cent, which is likely to grow from 1.55 million TEU in 2005-2006 to over 6 million TEU by 2013-2014.

Although all the 12 major ports are connected by rail, the rail-port connectivity for some of them is inadequate. In view of the projected growth of traffic at major ports and saturated capacity of exiting routes, the single line rail sections are required to be doubled, meter gauge lines require conversion to broad gauge, and new lines are to be constructed to connect green field ports. A large number of medium and small sized ports including those in the private sector are coming up both on the East and West coasts. These ports also require efficient rail connectivity with the main IR Network for quicker evacuation of cargo.

Capacity constraints at ports

India has a long coast line extended over 7,500 km. Six major ports are located on each of the East and West coasts and handle over 75 per cent of sea borne traffic. The remaining 25 per cent is handled by non-major ports. The growth rate of over 10 per cent of port traffic over last few years demanded that the capacity at ports is expanded. The combined capacity at all the major ports was 456 million tons per annum in 2006 against the actual traffic of 423 MT in 2005-2006, indicating that there was adequate capacity to handle the present level of traffic. However, the growth projections indicate that within the next five years, this traffic is likely to go over 700 MT requiring the handling capacity at ports to be substantially increased by that time. The capacity constraints are already being experienced at not only the major ports but also at the non-major ports. The requirements include development of additional berths, deepening of channels, modernization and induction of latest cargo handling equipment and expeditious completion of port connectivity projects. Other facilities required include development of container terminals and warehouse facilities, construction of dry docks, ship repair facilities and dredging etc. The non-major ports are at different stages of development and therefore also suffer from capacity constraints.

Insufficient terminals and dry ports

Container transportation by railway is being undertaken largely to and from 56 container terminals also known as ICDs managed by CONCOR. A few container terminals are also being operated by private container operators. As the pattern of container transportation by rail is currently region specific (North India to ports), the existing terminals in North India suffer from capacity

constraints. Some of the terminals which were initially located inside the cities and towns also face similar constraints in view of the severe congestion on roads for movement of trucks to and from the terminals. The infrastructure at some of the terminals is also inadequate to handle the projected growth of rail bound containerized cargo.

Technical constraints

Container operations by rail are dependent on an efficient fleet of rail freight cars and modern container handling equipment in the port sidings and also in the terminals. The present fleet of wagons for container operations is bogie low height container flat wagons. These wagons are provided with slackless draw bars, automatic twist locks and load sensing devices along with anti-pilferage devices and are able to run at a speed of 100 km/hour. The length of container train is limited to 45 freight cars which can carry either 90 TEU or 45 FEU. The restriction in the length of train is primarily on account of standard length of loop lines, which is 700 m in length.

The capacity of the trains to carry more containers is also restricted as container flat wagons cannot carry double stack ISO containers in the electrified sections due to the overhead electric lines. Non-availability of specially designed wagons which can carry double stack containers results in running of single stack container trains on the electrified sections. Running of double and triple stack container trains on non-electrified routes also requires removal of height restrictions due to foot over bridges, road over bridges, tunnels and railway bridges.

VI. INITIATIVES AND STRATEGIES

During the annual Budget Speech in February 2007, the Minister of Railways, India announced that container transportation by rail will be increased to 100 million tons by 2011-2012 from its current level of 20 million tons. Infrastructure would be strengthened accordingly to facilitate the movement of containerized cargo by railways. This would involve major investments in the development of container terminals, procurement of rolling stock and improvement of related rail infrastructure.⁸ Some of the major initiatives launched in these regards are discussed in the following sections.

⁸ Minister for Railways, Government of India's Budget Speech on 26 February 2007.

Development of Dedicated Freight Corridors and throughput enhancement projects

The capacity constraints on the existing major rail routes have been identified by the Ministry of Railways and have accorded high priority in removing those constraints. Various measures for the enhancement of throughput by strengthening the existing major rail routes including upgradation of tracks, doubling of single line sections, gauge conversion, replacement of old signaling gears and electrification of sections are being initiated. The identified projects have been assigned to a separate organization called Rail Vikas Nigam Ltd. (RVNL) to ensure their faster completion. RVNL is a special purpose vehicle under the Ministry of Railways. It is currently executing 46 projects at a cost of about US\$ 3 billion to expand the capacity of high density traffic routes. Fourteen of these rail projects are scheduled to be completed by 2006-2007. The construction of another 544 km broad gauge line would be completed by 2007-2008. The rest of the projects are scheduled to be completed by 2009-2010.

In addition to the above mentioned capacity enhancement works, it has been decided by IR to develop Dedicated Freight Corridors along side the major identified routes. This new concept is to ensure that the freight and passenger traffic are segregated on the busy routes and thereby create additional capacity for handling the projected growth of rail freight traffic. Two mega projects for the construction of Dedicated Freight Corridors involving construction of 2,700 route km of railway line equivalent to about 5,000 track km at an approximate cost of US\$ 6 billion have been sanctioned by the Government. The western Dedicated Freight Corridor is to connect Jawaharlal Nehru Port (JNPT), Mumbai with the container terminals in Delhi area. The eastern corridor on the other hand would link the ports on the east coast of India with Delhi and Punjab. The western corridor will primarily cater to container transportation by rail. It is estimated that the Dedicated Freight Corridor will be able to handle not only the projected growth of traffic from JNPT and Mumbai ports but also other ports on the West coast which will also be connected to the corridor through feeder routes. The Dedicated Freight Corridors would be designed to run longer, heavier and double stacked container trains. It is expected that these two corridors will be completed over the next five years. In addition, IR has also decided to develop similar corridors alongside other busy routes. Feasibility studies are being conducted to assess the specific requirements and costs. It is also planned to procure new design of wagons with bigger space envelope and develop mega freight terminals/ logistics parks alongside these corridors.

Intermediate blocks and automatic signaling will also be provided along with bypasses to improve sectional capacity and faster rail movement across busy junctions. These initiatives are likely to take care of the capacity constraints being faced at present and provide additional capacity to deal with the projected growth of rail traffic specially for container transportation by railway. Various options for financing these mega projects are being explored, which include public-private partnership and assistance from multilateral and bilateral financial institutions.

Prioritization of rail-port connectivity projects

The rail-port connectivity projects have been prioritized and specifically assigned for execution by RVNL. RVNL is undertaking feasibility studies and examining the possibility of their implementation by setting up joint ventures with the private sector. Over two dozens of rail-port connectivity projects are assigned to RVNL. The Committee on Infrastructure set up by the Government, prioritized the ongoing rail-port connectivity projects for their expeditious completion. These projects include:

- Doubling of Panskura-Haldia Port railway line;
- New railway line connecting Haridaspur with Paradip Port;
- Gauge conversion of Hasan-Mangalore Port line to broad gauge;
- Gauge conversion of Palanpur-Gandhidham to broad gauge;
- Connecting Ports of Kandla and Mundra on the West coast;
- Doubling of Panvel-Jasai rail section connecting Jawaharlal Nehru Port-Mumbai;
- Doubling of Maduari-Dindigul section to facilitate movement to and from Port of Tuticorin in the south; and
- Gauge conversion of Bhildi-Samdari rail section to broad gauge for additional connectivity to Kandla Port and construction of railbridge over Mahanadi to facilitate movement to and from Paradip Port.⁹

These projects will cost about US\$ 500 million. A number of these projects have already been completed. In addition, rail-port connectivity projects for Kolkata, Goa, Mumbai and Ennore ports are also being developed

⁹ *Road-Rail Connectivity of Major Ports*, report published by the Secretariat for the Committee on Infrastructure, Planning Commission, Government of India.

for providing new rail connectivity and strengthening of the existing rail infrastructure. With these rail-port connectivity projects completed, all the major ports would be able to handle the projected growth of traffic. Non-major ports are also being provided rail connectivity. Some of these projects are being implemented by the special purpose vehicles like Pipavav Railway Corporation Ltd. (PRCL).

The constraints restricting the port operations have also been identified and over 276 projects involving total investment of over US\$ 12 billion have been proposed under the National Maritime Development Programme for implementation by 2011-2012. The Government has also permitted foreign direct investment upto 100 per cent for the construction and maintenance of ports and harbours and it is expected that an investment of about US\$ 7 billion would be made by the private sector for these projects. Apart from augmenting the existing capacity at the ports, some of the larger capacity enhancement plans include an off-shore container terminal at Mumbai port, 2nd container terminal at Tuticorin port, 3rd container terminal at Mormugao port, 4th container terminal at Jawaharlal Nehru Port, multi purpose cargo berth at Kandla port and container terminal at Ennore port.

Development of terminals and logistics parks

IR also plans to develop mega freight terminals. For this, IR has collaborated with the Central Warehousing Corporation. In a recent policy announcement, IR has also asked private operators to develop ICDs and container terminals by providing the available vacant railway land. Various options for developing common user facilities are also being explored. The logistics parks and mega terminals are also planned alongside the Dedicated Freight Corridors.

Container train operations by private operators

As part of the strategy to increase the IR's share of container traffic and to introduce competition in railway container transportation, the Ministry of Railways opened up this sector to private container operators. The private container operators including logistics companies, shipping lines and transport companies may now register with the Ministry and obtain permission to undertake container operations on the IR network at par with CONCOR, which was the only entity to undertake container operations until now. Fourteen container operators have signed a model concession agreement (MCA) on 4 January 2007 with the Ministry to undertake container operations. The entry of 14 operators indicates that the scope for such ventures in view of the

projected growth of container traffic and the preference of the shipping lines to move containers by railways is overwhelming. This decision of the Ministry would not only enable it to achieve the target of 100 MT of container traffic by railways by 2011-2012 but would also result in generation of additional capacity in terms of additional terminals, ICDs, logistics parks, and induction of modern rolling stock.

The private container operators under this agreement have to develop their own ICDs and procure rolling stock which would be operated by IR by levying haulage charges on container operators. This move will greatly encourage competition, improve efficiency and reduce unit cost of operation. The operators would also undertake marketing, collection and aggregation of cargo from the hinterlands to the terminals. Container operators are procuring their own rolling stock through purchase, import, lease or on rent basis. The policy is now open to other potential container operators and it is expected that many more private container operators would join the group of container train operators.

Double stack and triple stack container operations

With the unprecedented growth in India's external trade and specially that of the containerized cargo, it is expected that the number of container trains will increase manifold over the next 5-10 years. Although efforts are being made to develop Dedicated Freight Corridor and augment the capacity of existing rail network, one of the significant short-term measures to augment the capacity to handle the increased volume of traffic would be either to increase the length of container trains or to move containers in double and triple stacks. Double stack container trains also tend to reduce the unit cost of transportation and requirement of rolling stock. Taking into account the experience on the United States of America and Canada where double stack container trains are running on long hauls, incurring savings of almost 40 per cent in operating costs, IR also decided to undertake double stack container running on non-electrified sections.

A feasibility study on running of double stack container trains was undertaken by PRCL, which included detailed survey of the identified route between Gurgaon (near Delhi) to the Port of Pipavav on the West coast of India. This route was specifically selected for being non-electrified. The container trains were running on this single line route on diesel traction carrying a load of 90 TEU or 45 FEU per train in single stack. This rail route of 1,233 km from the Port of Pipavav to Gurgaon was already capacity saturated in sections causing longer transit times for trains. The only solution to increasing the throughput

and quicker evacuation of the port was found to be running of double stack container trains on this route.

Detailed physical survey identified the overhead infringements by structures such as road over bridges, foot over bridges and crossing of high tension electric transmission lines etc. The survey was undertaken with the help of a special prototype structure loaded on a flat container freight car. With the help of this measuring device, all the identified locations of the infringements were physically checked. After the survey, infringements were categorized in Phase I and Phase II. Phase I indicated the infringements required to be removed for moving double stack container trains with container height of 8½ feet each. The Phase II infringements were those which were required to be removed for undertaking movement of double stack container trains with container height of 9½ feet each (High cube).

On directions from the Ministry of Railways the work on removal of infringements was taken up on a priority basis and the first double stack container train was flagged off from an ICD located near Jaipur for Port of Pipavav in March 2006. The arrangement approved for loading container in double stack was with either 2 FEU in double stack or 2 TEU in the lower section with 1 FEU on top. Initially, clearance for running of double stack container trains has been given for a speed of 75 km/hour. The double stack container trains are now successfully running between container terminals at Kanakpura near Jaipur and Port of Pipavav. It is observed that with double stack container operations, the share of container transportation by rail has increased with the same rolling stock and the overall transit time has significantly reduced.

The work of removal of infringements for enabling running of high cube ISO high containers in double stack is currently being undertaken on the Gurgaon and Port of Pipavav rail route.

Double stack container trains on electrified rail routes and triple stack on non-electrified sections

The Ministry of Railways has now decided to run double stack container trains on electrified routes and triple stack container trains with low height containers on diesel hauled route. PRCL has been asked to take up a detailed survey for this purpose. PRCL has designed low height containers matching the length and width of ISO containers but with reduced height. Taking into account the height of the container flat wagons, total height of the trains with the double stack modified container is 4,782 mm and that of triple

stack container 6,691 mm. For the purpose of survey, the electrified Delhi-Pune route was selected keeping in view of the huge requirement of car transportation from the manufacturing plants in Delhi area to Southern India and movement of car from Southern Indian plants to North India. The modified containers were specially designed to carry upto four small sized cars in one container. The height of the contact wire on electrified rail routes of 5.50 m was found to be sufficient for the running of low height double stack container trains in electrified sections. However, under certain fixed structures including tunnels and bridges the height of the contact wire is lower than 5.50 m. During the survey it was also observed that it was possible to not only raise the height of the overhead wire but also lower the track at few locations to obtain the necessary clearance. At present work on providing the necessary clearance are being undertaken. It is estimated that double stack operation in electrified territories would enable movement of 360 cars per train against 120 being currently transported in modified rolling stock. Similarly triple stack container trains on diesel routes would be able to carry 540 cars in specially modified containers. Such transportation of automobiles in containers would also provide complete logistics solutions to car manufacturers. Loaded containers can be brought to the rail terminal by trucks and at the other end they can be further despatched by road to various retail outlets without involving loading and unloading at rail terminals. The project is now in the development stage.

Public-private partnership (PPP) in rail infrastructure projects

IR has a large shelf of infrastructure projects with an investment requirement of over US\$ 10 billion. The public funding required to complete these projects could not be provided through the usual budgetary support. The limited funding available during the last few years resulted in thin spread of resources across many rail infrastructure projects. As a result, completion of these projects took much longer than the targeted and resulted in cost overruns. It was decided that important rail infrastructure projects which were operationally justified and financially viable, including projects for rail-port connectivity, may be taken up through public-private partnership arrangements. The PPP policy was opened to the potential beneficiaries including State Governments, port authorities and trade and industry. Participation of the Ministry of Railways in special purpose vehicle or SPVs formed under this arrangement made the scheme quite attractive. A combination of equity and debt was adopted for the financing of such infrastructure projects. The experiment has been greatly successful and a few important rail infrastructure projects have been completed in record time.

The flagship joint venture in a rail infrastructure project is Pipavav Railway Corporation Limited with an equal participation of the Ministry of Railways and Gujarat Pipavav Port Limited (GPPL), a private port company. PRCL has developed 270 km long rail connectivity to the Port of Pipavav with the Indian Railway network. Significant volumes of container and bulk cargo are being moved to and from the port.

Similar to PRCL, two other SPVs have been formed. The Hasan Mangalore Rail Development Corporation (HMRDC) and Kutch Railway Company Limited (KRCL) are two such ventures, the former connecting the port of Mangalore with Hasan, an important iron ore producing area and the latter connects Palanpur in Western India with the ports of Kandla and Mundra on the West coast. Both of these PPP arrangements involve participation of the State Government, port authorities and the private sector. All the above mentioned three rail infrastructure project companies have been able to complete the ongoing rail port connectivity projects including gauge conversion and construction of new lines in record time. Few more similar SPVs are being considered for other important rail infrastructure projects including new lines connecting ports. The PPPs in port connectivity projects have resulted in a guaranteed flow of containerized and bulk cargo on these lines and are regarded as successful ventures.

Public-private partnership project – a case study of the Pipavav Railway Corporation Limited

Gujarat Pipavav Port Limited (GPPL) a private port company was set up in 1992 to manage the Port of Pipavav. Being the first private sector port in the country located on the west coast of India in the State of Gujarat, the port did not have any rail connectivity with the IR network. The development of this private port largely depended on a broad gauge rail connectivity with the hinterland. A Memorandum of Understanding was signed between GPPL and the Ministry of Railways in 2000 for promoting a joint venture company to undertake construction, operations and maintenance of the Surendra Nagar-Pipavav Rail Project (270 km). The Government of India approved the formation of the first joint venture between the Ministry of Railways and the private sector, and the Pipavav Railway Corporation Limited was established on 30 May 2000. The PPP arrangement was to have equity contribution of 50:50 between the Ministry of Railways and GPPL. Thereafter, PRCL signed various agreements with the Ministry of Railways including Construction Agreement, Concession Agreement, Shareholders Agreement, Lease Agreement, Operations and Maintenance Agreement and Transportation and Traffic Guarantee Agreement. Apart from the equity provided by the Ministry of Railways and GPPL, debt was

raised from financial institutions for undertaking construction of the project line. From the signing of the Construction Agreement in 2001, the work was completed in a record time of two years and the line was commissioned in March 2003. The commercial operation on this line started from April 2003. Since 2003-2004, the movement of cargo to and from the port of Pipavav has been steadily going up both for containers and the bulk cargo. About two-thirds of the cargo being handled on this line is by containers. In addition, other bulk commodities including fertilizer, food grain, salt, cement and coal have been transported by rail to and from the port. The traffic handled during 2006-2007 went up to 2.3 MT.

The project was awarded to PRCL by the Ministry of Railways on a 33-year concession period for operation, maintenance and undertaking of other activities. The total cost of the project was over US\$ 90 million out of which US\$ 50 million was provided by the Ministry of Railways and Gujarat Pipavav Port Limited on a 50:50 basis. The remaining funds were raised from the market (financial institutions/consortium of banks). The concession entitles PRCL to exercise all the rights and authorities vested in the concessionaire under the agreement. PRCL has the rights, obligations and duties of the railway administration on the project section. It has rights to commercial exploitation of the project assets and can develop, design, engineer, finance, market, procure, construct and operate the project railway, market freight services, appoint supervisors and monitor activities of contractors. It also has the rights to develop additional facilities in the project area, can quote special rates in specific cases. It receives its share of the apportioned earnings from the tariff on freight traffic originating, terminating and moving on the project railway. It also has freedom to levy and charge tariffs for container traffic on this section. Various obligations of PRCL alongwith rights and obligations of the Ministry of Railways are detailed in the Concession Agreement.

This concession was granted for a period of 33 years unless terminated earlier in accordance with the terms of the agreement. After the expiry of 33 years, the project assets will be handed over by the concessionaire to the Ministry of Railways with a provision that if the Ministry to grant a fresh concession in respect of the project railway, the concessionaire will have the first right to be awarded the new concession.

PRCL has also entered into a Traffic Guarantee Agreement with Gujarat Pipavav Port Limited and Western Railway (Zonal Railway Administration of Indian Railways). As per the Traffic Guarantee Agreement, GPPL will provide a minimum guaranteed quantity of the cargo. This was to be 1 MT during the 1st year, 2 MT in 2nd year and 3 MT from the 3rd year onwards till the termination

date. Any shortfall against the guaranteed traffic will be converted into revenue and the amount will have to be paid by GPPL to PRCL. This guarantee is deemed to have been fulfilled, once the minimum guaranteed traffic has been met during the financial year.

The Traffic Guarantee Agreement ensures that the guaranteed cargo is made available by the port to PRCL and in case of non-fulfilment, a compensation is to be paid by GPPL to PRCL, which ensure its financial viability. This agreement also includes the provision that Indian Railways will guarantee sufficient rolling stock for evacuation/movement of the minimum guaranteed traffic that originates at the port. The agreement envisages that in case of non-availability of its obligations under the agreement, Western Railway is responsible for paying out compensation to GPPL. This provision ensures that the evacuation of cargo takes place from the port in time.

IR does not provide any incentives/subsidy to PRCL. However, in view of the likely traffic shortfall against the guaranteed traffic during the first four years, IR has deferred the operating and maintenance costs on a request made by PRCL for the first few years which is to be paid along with interest from 2008-2009 onwards.

The revenue sharing arrangement between the Ministry of Railways and Pipavav Railway Corporation Limited is also detailed in the O&M Agreement. The same has been further followed through a Joint Procedure Order signed between the parties wherein detailed procedure has been spelt out for the compilation of necessary data on the traffic moved over the PRCL section and for the calculation of apportioned revenue to PRCL. Bills for operations and maintenance including both the fixed costs i.e. salary and wages of employees and variable cost i.e. fuel and locomotive and wagon hire charges etc. are raised by the IR and adjustments are made out of the PRCL's share of the traffic revenue.

PRCL has obtained license from the Ministry of Railways for running its own container trains. The plan developed by PRCL involves procurement of new rolling stock i.e. freight wagons, containers and setting up of ICD/container terminals. It is expected that the investment required for the expansion of business can be raised from financial institutions and existing consortium of banks.

The management of PRCL is fully independent to manage the day-to-day work. It has to, however, supervise and monitor operations on the project line in close coordination with the local railway authorities and the Ministry of

Railways. The Board of Directors of PRCL, which is headed by the Member (Traffic), Ministry of Railways as its Chairman has equal representation from GPPL and Ministry of Railways. Major investments and policy decisions are taken by the Board of PRCL.

In addition to rail operations and marketing, PRCL also undertakes project consultancy services and transport related feasibility studies. It has conducted a number of feasibility and bankability studies for railway projects over the last three years including for construction of a new line connecting Kathmandu in Nepal with Birganj. PRCL is looking forward to entering the logistics market after acquiring its own rolling stock and setting up of CDs. It plans to provide complete logistics solutions to shipping lines and other customers both for containerized and bulk cargo. It has also taken up research and development activities for the running of double stack container trains from Jaipur to Port of Pipavav and is currently working on models and technical solution to run double stack container trains in the electrified territories and triple stack container trains in non-electrified territories.

VII. INTERNATIONAL AND REGIONAL TRADE – POTENTIAL AND POSSIBILITIES

At present, 95 per cent of India's international cargo moves by sea through the ports. The share of international cargo by surface transport including rail and road is limited to just about 5 per cent. Apart from established road connectivity between India and its neighbours including Bangladesh, Bhutan, Nepal and Pakistan, rail connectivity provides a much better transport mode for trade with the neighbours. Intraregional rail connectivity is, however, restricted by certain types of commodities, specific type of rolling stock and other trade restrictions. As is evident, broad gauge (1,676 mm) railway network is largely confined to the countries of South Asia including Bangladesh, India, Nepal and Pakistan, thereby providing potential for movement of bilateral cargo by rail without involving transshipment and change of rolling stock. India currently has two cross-border points with Pakistan i.e. one in the north (Wagha-Attari) and the other in the west (Munabao-Khokhrapar). Only one of these points i.e. Wagha-Attari is opened for both freight and passenger traffic and the other point i.e. Mumabao-Khokharapa is restricted to only passenger traffic. With Bangladesh, three broad gauge cross-border points on the western side of Bangladesh at Benapole-Petrapole, Gede-Darshana and Singhabad-Rohanpur are operational. All the three border points are exclusively for freight traffic.

Nepal is also connected by a broad gauge link with India. Regular movement of container trains takes place between Kolkata and Birganj. At present, there is no rail connectivity between India and Sri Lanka, India and Bhutan and India and Myanmar. Routes of international significance and various other intraregional corridors have been studied and identified by ESCAP and SAARC. Missing links and various other physical and non-physical barriers hindering the seamless operations have been identified on these routes. It is expected that operationalization of intraregional rail connectivity would not only provide access by the landlocked countries like Bhutan and Nepal to ports and markets but also increase the intraregional trade between the countries of the region. The potential for intermodal operations specially movement of containers by rail is immense.

CONCLUSION

India is emerging as one of the fastest growing countries in the world. It is also becoming the hub of manufacturing and services and developing as a huge consumption centre. The growth of India's international trade is now over 20 per cent annually. Despite 95 per cent of the international trade being undertaken through the sea routes, the geographical expanse of the country and the locations of its ports necessitate long-haul movement of containers from ports to the hinterlands. However, only 30 per cent of the total containers handled at the Indian ports are being transported by rail. The growth projections for the international and domestic containerized traffic and the capacity expansion plans of ports indicate that there is likely to be huge demand for transportation of containers by rail. There are constraints which presently inhibit further growth of container transport by rail. To overcome these constraints, Indian Railways has launched some major initiatives including construction of Dedicated Freight Corridors, encouraging PPPs in rail infrastructure projects, modernization of rolling stock and fixed infrastructure, development of mega logistics parks and opening of containerized transportation sector to private operators. Special efforts are also being made to introduce running of double stack container trains in the electrified territories and triple stack container trains in non-electrified sections. These initiatives are expected to significantly increase the capacity of container transportation by rail.

Rail transportation of containers in India is something worth watching during the next few years in view of the huge growth projections and IR's ambitious plans and initiatives to develop its infrastructure and take on the challenges posed.