World Road Association (PIARC)

PRELIMINARY DISCUSSION PAPER ON GUIDANCE FOR THE DEVELOPING COUNTRIES TO BUILD A SUSTAINABLE FREIGHT TRANSPORT SYSTEM

Original Version in English
May 2007

PIARC Committee "Freight Transport and intermodality"

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SUMMARY

The history and pattern of economic growth has been found to be different for different countries. Whether it is a developed country or a developing country, is has its own characteristics of economic growth. Transport system has got a distinct contribution in the overall economic growth of a country. Its elasticity has a quantifiable relation with the growth of GDP. The economic growth can't be maintained to rise unless it is synchronous with the social and political developments also. For maintaining a sustained growth of a transport system, it is, therefore, imperative to pay due attention to the overall growth of a given society. This paper aims to present necessary aspects of a sustainable transport system of the developing countries, and also presents the comparable background information on the transport growth scenario of the developed economies.

1. INTRODUCTION

Transport system is known by the mode of movement adopted to provide the services. Land, sea and air are the broader categories of the transport modes. Roads and rails are the common means of land transport. Oil and gas pipelines are the other significant mode of transport.

Transport system further depends upon the goods being transported. Passenger and freight are carried from one place to another depending upon their destination. For passenger movement roads, rails and air are commonly used.

Depending on the geographical size of the country, destination within the country may be reached by either of the modes. For international movement air provides the quickest means of transport which also depends upon the commodity being transported. The available budget is another factor which influences the option of using the mode of transport.
For passenger movement, if the tourism is the objective, intermodal transport air-road/rail is the common choice. Within a country, the tourism is substantially covered by roads since it provides the convenient option of movement from one place to another.

For freight the common mode is road/rail or sea-road/rail or air-road/rail. The consumer goods mostly have local destinations and their shelf-life is another factor which influences the decision of choosing the mode of transport. Vegetables, green fruits, and food items find road as the favourable mode of transport.

The geographical situation of a country has a greater bearing on the development of the mode of the transport. It has been experienced the sea / river transport is the cheapest among all the modes. Air has been found to be the costliest. However, present trend indicates that air is going to enter into a big way for economical freight transport. The intermediate modes, i.e., rails and roads depend upon the available transport system.

For landlocked countries rail and road are the first choice either for inside country movement as well as for reaching a destination port of transshipment. Whenever an international movement is involved the development and success of a given mode of transport primarily depends upon the prevailing agreement regulations of the countries involved. In the case of two countries bilateral agreement works but for a transit transport movement multilateral agreement need to be implemented.

2. INTERNATIONAL MULTIMODAL TRANSPORT

The opening up of world market driven by the global market forces of supply and demand has caused a great change in the economic scenes of the countries and the continents. Some of the new countries, which haven't been a major player earlier, have started emerging on the world economic scene. They have become manufacturing hub of several consumer goods, industrial goods and energy goods. To send the goods to the place of demand there is an urgent need of international regulation to help facilitate the transport through several countries.

The case of landlocked countries is worth discussing. European countries (Austria, Switzerland, Czech republic and Slovakia), Asian countries (Mongolia, Afghanistan, Kazakhstan, Laos and others), African countries (Ethiopia, Niger, Zambia, Zimbabwe, Botswana), CIS countries (Belarus and others), Bolivia and Paraguay in Latin America have to formulate their multilateral agreement with the neighbouring countries to have an access to either the ports or the targeted market.

Besides the regulation, the development and upkeep of intermodal transport infrastructure are very essential. Once a country has traffic worthy transport network (National and regional roads, rail system) the international business through freight movements become viable. The regional imbalances are thus eliminated by developing a good transport system.

2.1 DEVELOPED COUNTRIES (EU AND NORTH AMERICA)

The case of EU (European Union) is an example. In all respects, the EU countries are cooperating with each other for having a balanced regional market, and an integrated transport system. Another example is of USA, CANADA, and Mexico.

2.2 CENTRAL ASIA COUNTRIES (MONGOLIA, RUSSIA AND CHINA)

The case of Mongolia, Russia and PRC (People Republic of China) demands improvement. The regulations of these countries don't allow the transit of the freight transport coming from one country to move deep inside the other country. They just enter the border, and the commodity is unloaded to be transported by another national carriers. The Mongolian and Chinese border at Zamyn Uud on the one side at the border, Russia on the other side, suffer from several bottlenecks which delay the transshipment due to involvement of intermodal transportation. Varying track gauges of the existing rails calls for adopting a harmonized dimension for the uninterrupted movement of the rail transport. For a sustained rail transport, the technological issues have to be resolved and a compatible infrastructure needs to be developed on a priority basis.

Mongolia has three systems of transport: rail, road and air. The waterway transport is absent. The road and rail has a main trunk route running north south connecting Russian and China borders at Altanbulag and Zamyn Uud respectively. The main population lies along this trunk route. The Millennium highway is under progress which can provide east – west link although the population lying along this route is sparse on the eastern end, contrary to sizeable number on the western side. The country has about 50,000 km of road length out of which about 11,200 km provide the national link, and the balance is for regional connectivity. Only about 15 % of the national link, and 1 % of regional link have paved pavement.

2.3 CIS (COMMONWEALTH OF INDEPENDENT STATES)

The example of Slav countries (Russia, Ukraine, Belarus) has its own remarkable aspects. The availability of the existing infrastructure of railways and pipelines (oil and gas) provides enough technological support to carry out the economic activities related to transport of energy goods. It is worth mentioning that Russian transport is railway and pipeline dominated. The share of the commodities carried (coal and coke 23 %, oil products 18%, ore 10%, building materials 15%, metallurgical products 8%) by rails is

remarkable. The rails have given an economical system of transportation. The share of road transport is limited to local movement of consumer products. The geographical condition and long distance haulage favours the extensive use of the railways in Russia.

Russia is equally conscious towards the development of more new pipelines to help facilitate the transportation of oil with China on the western border. This may affect the existing rail system and therefore a new transportation system is likely to emerge in this zone having an interface with rail and pipeline system. The opening up of the pacific front to develop a better transportation system with Japan is also likely to come up soon. With changing economic activities the transportation system is also being rearranged.

The scenario is different for Kazakhstan, Uzbekistan, and Azerbaijan where the road transport system is in developed form and has its substantial share with respect to the total transportation varying from 78 % to 84 %. The coming up of pipeline connecting Mediterranean sea through Azerbaijan, Georgia and Turkey is likely to change the scene of intermodal transportation effectively. A shift is bound to occur from sea – rail or rail – road to rail / road – pipeline system.

2.4 LATIN AMERICAN COUNTRIES

The road-dominated transportation is proving uneconomical. In Brazil, the transportation cost is about 20 % of the GDP, whereas this figure is just half in the case of USA although both countries have similar extent of land area. In the countries like Brazil, Venezuela, Bolivia the reason for rise in the road transportation cost is because of the far away location of the ports from the production / consumption centres. Such constraint requires a total re-arrangement of the intermodal transportation and then only a sustainable system can be developed.

The road share in Brazil is 63 % whereas for Chile the figure is 91%. The shift from rails to roads in 50s and 70s has created the intermodal imbalances. The old rail tracks having different gauges, needs a fresh technological effort (and substantial investment) to have an integrated and economical transportation infrastructure among the Latin American countries. At present, the use of railways is limited to heavy freight of iron ore in Brazil, and Copper in Chile. A balanced rail – road, and rail – river intermodal transportation has to be explored.

Ports form the core of freight transportation by using sea routes: Chile 90%, Columbia 86%, Peru 74% and Venezuela 70%. The present trend in Latin American countries is of having bi-oceanic routes using both the Atlantic and the Pacific coasts for exports to China. Among Latin American countries, the bi-oceanic routes and short shipping routes using the river ways have also more promising scope to establish the sustainable transport system.

2.5 ASIA – PACIFIC REGION

The ADB, JBIC, and World Bank have recently estimated US $ 1000 billion for the balanced and integrated intermodal growth of transportation in the free-trade-area set up by ASEAN (Association of South East Asian Nations) countries. About 80 % of the estimated amount is for China. Countries like Malaysia and Thailand are facing sever transport competition with the more advanced countries (Singapore, Korea, Hong Kong) of the region. The archipelago countries of Philippines and Indonesia are facing deficient infrastructure in the transportation and thereby they are lagging behind in the integrated economic growth.
The share of rail freight in China is 55% and the growth in the road sector is taken at a faster pace of about 4000 km of motorways every year; this means about 10 km / day. There has been an encouraging development in China for river transport with more than half through the river Yang Tse. Nine container ports have been setup and operating successfully. Sea – rail transport is also working well as the

containers are transferred by rail picked up from Hong Kong port to the mainland destinations. In North China a coal harbour with dedicated railways for carrying coals has been developed.

In Thailand**,** the capacity development of highways (road sector) has been given top priority. It has about 159,000 km of road length compared to 5000 km of rail lines. The flexibility in driving, easy local access, less loading /unloading times are the favourable features of the road sector.
The freight share in the Philippines belongs to marine and road transport. The railways are almost absent.
Indonesia is characterized by large number (about 18000) of islands with 3.2 million km of territorial coastline. Its main transport is through sea routes. The balance is catered by air routes. The growth of roads is being taken up for local connectivity but lot more is to be done yet.
The roads form the major transportation avenues in Vietnam and are supported by the river transport. The country has about 17000 km of navigable waterways. There is an apparent lack of intermodal transportation.

2.6 ASIA – SOUTH REGION

The notable countries of the region are India, Bangladesh, Pakistan, Sri Lanka. The main artery of transportation in this region is road networks. About 70 to 90% of freight is carried by roads in this region.

India is the second largest country of the world in terms of road network length which is about 3.3 billion km. The expressways being developed are called golden quadrangle and they connect four metropolis situated almost on the territorial periphery in four cardinal directions of the country. The expressways cover about 2 % of the road network but cater to about 40 % of freight traffic.

The Indian railways have 108,700 km length of rail lines (about 15 % electrified lines) and are over occupied, mostly in providing cheap passenger traffic. The coverage of freight by railways is confined to heavy goods, cement, coal, ore, fertilizers etc. In last twenty years the share of railways for freight traffic has come down from 65% to 35 % and road has taken the lead. A separate container handling set-up has been created which is called Concor (Container Corporation of India) to facilitate the import and export freight traffic.

Marine and river transport has an appreciable contribution in the Indian transport system. 95 % of foreign trade is conducted through harbours and ports. The freight containerisation takes unduly long time because of inadequate infrastructure. The marine clearance thus takes 3 – 5 days for export and 7 – 14 days for import compared to 18 and 24 hours of the international standards.

About 14,500km long river waterway is operated through Inland Waterways Authority using the main river routes of the Ganga, the Brahmputra, and the East Coast Canal. It is targeted to share about 5 – 8 % of national freight traffic.
The Air transport in India is handling about 40% of the import and export activities and is considered to be an important sector of the economy.

Road transport (network length 250,000 km) in Pakistan covers about 90 % of freight traffic; 4 % of the road network caters to 56 % of the traffic. The principal corridor is Karachi – Lahore trunk link. The railways cover only 7,800 km and there is inadequate intermodal transport. The air transport is mainly for passengers although there are 40 airports in the country. There are two harbours, Old Karachi in the east, Qasim harbour in the southeast. The freight handling capacity needs to be enhanced.
Bangladesh like India has a share of about 70 % of freight traffic to road sector. The railway system has to be strengthened as only two stations Chitagong and Dhaka cover all the freight transports. The river routes and harbours are poorly connected with the supporting intermodal transport system.

3. TRANSPORT DEVELOPMENT POLICIES

3.1 LAND USE PLANNING

In most of the developed economies the emphasis is on maintaining the facilities rather than building new ones. They now concentrate more on capacity enhancement of the existing trunk motorways. For developing countries the density of existing facilities have to be increased. The regional balances have to be properly implemented otherwise the skew growth will fail to serve the society in the longer run.

3.2 CONGESTION FREE SYSTEM

Poor density of the facilities creates congestion in the populated urban surroundings. Such congestions can be eliminated by capacity enhancement of the existing facilities. The single / double lane national trunk routes need widening to four or six lanes. The thickly populated cities / settlements are provided with either by-pass or elevated highways with interchange facilities.

3.3 SAFETY AND QUALITY OF SERVICES

The road, vehicle and the driver form the safety triangle. The deficient functioning of anyone of them invites hazard to the public safety system. Further, safety is also ensured by proper awareness training of the road users and the roadside settlers. The accidents and pollution are controlled by conducting regular and frequent awareness program along the trunk route corridors. The deficiency in road design is covered by avoiding sharp turns, excessive gradients, adequate visibility and proper road signs in the hazardous sections.

3.4 SOCIAL DEVELOPMENT TOOL

Its main role is the economic development and elimination of social isolation. It helps boost the tourism and opens up opportunities for local services. It has been experienced that after construction of the roads number of motels, restaurants, service stations, and cars increase in that area. The development of this tertiary sector is an indicator of the zonal economic growth. In some cases this has been demonstrated that before the construction of the road a given area was den of diseases but after construction of the roads the civic condition in the area has improved. Drainage by the side of the roads is improved and this improves the natural environment.

However, in some of the developed countries the road projects are now taken as a source of nuisance for vitiating the ecological balance. France, Belgium and Japan maintain strong reservation against a new road project. Lot of public participation is invited before a project is adopted for implementation.

3.5 DEVELOPMENT PLAN

Almost all the developed and developing countries have to have their planning for road sector development. Normally it is time dependent, e.g., five year plan in Japan, National road scheme in Cuba, Service schemes in France, Infrastructure plan in Spain, Planning policy directives and a network strategy in UK, and National Highways Development Project (NHDP) in India etc. The planning has to be well knit on the consideration of national and regional integration.

3.6 ASSESSMENT OF ECONOMIC BENEFITS

Although political considerations prevail, but normally, the cost-benefit analysis is the primary tool for giving priority to the development of a given road network. Different countries have different models, and some of them are based on either of the following indicators or their combination.

- Environmental impact and return on investment

- Changes in real state prices, job creation, increase in land-fill area, number of existing commercial bodies and growth in their turnover
- Achieving economic, social and environmental goals
- Estimation of cost and benefits in terms of Internal Rate of Return, Discounted benefits, life cycle cost
- Impact on environment, cultural and tourist heritage, agriculture, urbanization, and human activities (education, health, services), traffic demand in intermodal perspective
- Economic consequences e.g., time savings, vehicle fixed cost and variable cost and project cost; project externalities in the form of noise, traffic jams, safety and accidents, and pollution

The above-enumerated indicators are used to ensure social integration, economic growth and environmental protection. None of the models is complete in itself as each country is unique in its natural environment, social set-up, and economic conditions. An appropriate assessment model has to be therefore developed for a given economy and society.

3.7 PREVALENCE OF MULTI PUBLIC AUTHORITIES

There are several public bodies involved in the planning and implementation of a transportation project, e.g., Local bodies, Central authority, Environmental Ministry, Labour regulation authority etc. Instead of integrated approach, they have their divided and unilateral guidelines. For a sustainable growth of the transportation system each one of them has to be brought together to common minimum program.

3.8 DECENTRALIZATION

For a sustainable growth, after achieving a minimum goal in the field of infrastructure development, the decentralization becomes an important factor. The regional imbalances are eliminated by decentralizing the planning and implementation of transportation programs. The distribution of tasks and responsibilities from central body to the regional and local body is an essential policy for sustained growth of the economy.

3.9 NATIONAL CONSULTATION

The formulation of any transportation project should not be limited to the elected representative. There should be national debate on fixing the priorities of a given model of development. France is an example where National Public Debate Commission was set up in 1997 and it is said to be quite effective.

3.10 ENVIRONMENTAL PROTECTION

The realm of protection includes the air, water and noise abetment.
Air protection indicators are

- Reducing particulate matter (PM) emission, NOx, and SO_2
- Climatic warming control due to green house gas emissions of CO_2

Controls are exercised through various methods. Instead of being trapped in a traffic block it is better to use peripheral roads and avoid driving through the thickly populated settlements.

Reduction of private car participation in the local movement is also one of the useful tools where traffic capacity of a given road network has saturated. The capacity augmentation needs further finance but public voluntary participation by changing the mode of transport also renders a great help in reducing the traffic-generated pollution. The change in type of fuel used by the automobiles is proving very useful. In Delhi, one of the Indian metropolises, the automotive fuel in public transport has been converted from diesel to CNG (compressed natural gas) and this has greatly reduced the pollution level.

Noise abatement from the growth of traffic is an important environmental protection requirement. Schools, colleges, hospitals and other pubic institutions are affected by the growth of traffic in an urban establishment. Several measures are being studied for devising suitable noise screens (e.g., growing vegetation) and other physical noise deviators. The technological improvement for reducing the engine noise has to be taken up on priority.

3.11 BLENDING WITH THE NATURAL ENVIRONMENT

The alignment and profile of a road need to be merged well in the natural environment through which it passes. In Mongolian terrain where the small and medium peaks are the common feature of the topography, excessive cutting or filling has proved to be detrimental to the durability of the road embankment. The horizontal alignment and vertical profile have to be blended into the local natural terrain.

3.12 PRIORITISATION OF PROJECTS

Every sustainable project has its own cost. The increasing cost and decreasing fund is one of the most common features of the economic activities. Suitable parameters have to be developed for quantifying the economic, social and ecological consequences. The weighted evaluation finally provides the priority list of road network.

3.13 RESOURCE MANAGEMENT AND WASTE UTILIZATION

The sustainability is also attained by use of the indigenous materials. The appropriate use of waste product of any industrial activity has a wide scope in the road development works. This, however, requires careful selection of experience-based technique. Taking up of some specific research projects also help in formulating the long-term utilization scheme of the local waste materials.

3.14 SUSTAINABLE ENERGY SOURCE

The tapping of the solar energy can be easily set up with the noise barrier screens. This may help in warming the nearby houses along the road network.

3.15 INTELLIGENT TRANSPORT SYSTEMS (ITS)

This is an expensive system, and requires its careful use in a given network of the road transportation. The installation and maintenance of ITS are cost intensive and this goes against the sustainability of a road project. However, there are compelling situations where its use has enhanced the traffic flow and almost eliminated the loss of road users life, and damage to the vehicles. This is a qualitative measure to ensure a high grade of zero accident and traffic jam free road network.

3.16 INTERMODAL COMPATIBILITY

For a sustainable system inter dependence of various modes of transportation is one of the vital requirements. Various modes of sea-rail-road-air transport have to be made complementary to each other. This aspect is achieved through long-term life cycle cost and benefit analysis. The competition between a given modes of transport also helps in achieving the economic efficiency. For example, heavy freights for long haulage are better handled by railways, whereas door-to-door service for providing consumer goods can be efficiently ensured by roads. Quick disposal of supply in the international market can be achieved by air transport only. Regular supply of commodities at a cheaper transportation cost is normally attained by using the sea and river routes.

3.17 DESIGN AND PLANNING TEAM

For laying the sustainable system of transport, highly knowledgeable team of technical personnel and planners has to be employed. The experience of similar situations in other countries and regions need to be reviewed before finalizing any project.

3.18 SUPPORTING SECONDARY SERVICES

The transshipment of freights requires a punctual and reliable delivery. Some times it has been observed that due to administrative lapses the deliverables are lost by theft or fire break out or due to similar unavoidable situations. To ensure a sustainable system of transport, it is therefore necessary to develop an Insurance Service Scheme which can compensate the physical loss of the commodities in financial terms. The stakes are thus covered, and confidence of the public is maintained by introducing a proper support service for any sort of either demurrage or loss of the commodities being transported.

4. INTERNATIONAL BORDER CROSSING

Asian Development Bank (ADB) has taken up a special program called Regional Cooperation Strategy and Program (RCSP) for bringing about simplification in cross border transport among several central Asia countries. Conventions and meetings with representative countries have been organized to identify the issues. The member countries have been able to familiarize themselves with the prevailing bottlenecks, and a list of time bound action-program have been prepared for further necessary action.

In the first phase of the action program following issues have been identified on which the countries need to concentrate and prepare an acceptable and simple regulations.

- Vehicle emission requirements
- Axle load control
- Dimension of the vehicles
- Tariffs, road user charges, and transit fees
- Traffic safety
- Provision of transport services

4.1 MULTILATERAL AGREEMENTS

It has been observed that different country has different approach to deal with the movement of international freight traffic across the border. If traffic from one country has to pass through another country to reach the third country, the existing regulation is almost non-existent for such transit movement. To facilitate transit movement there is a need for having not only bilateral agreements but also multilateral agreements in which several countries can have a common convenient regulation.

4.2 VEHICLE EMISSION

With a view to protect the environment and cut down the pollution to an acceptable level, it is necessary to have a control on the vehicle emission test at specified locations during the transit or at the entry point. At present, almost all over the world, control on vehicle emission is exercised by using EURO (European) standards and guidelines. EURO standard is being regularly updated as rapid advancement is taking place in the manufacture of automotive engines and environmental control requirements for urban and rural settlements. Coming up soon is the EURO 5 vehicles. For developing countries, EURO 2 may be taken up as the initial standard to begin with which can be upgraded to higher level over a period of time.

Some countries have their own emission control standards (GOST of CIS countries. That can also be reviewed and harmonized with a world standard like EURO. There could be varying control for urban and rural areas.

4.3 AXLE LOAD CONTROL

The allowable axle load is an important requirement to protect the existing pavement structure against damage by the heavily loaded vehicles. The pavement design is carried out using a given standard axle load to assess vehicle damage factor in the designed service life of the facility. To start with a common practical approach can be formulated to have maximum axle load not exceeding 82 kN. However, EU countries of the developed economy is working out on 115 kN axle load. The updating will be a continuum process after the enforcement of a common regulation in the beginning.

4.4 DIMENSION OF THE VEHICLES

Freight vehicles of varying sizes are being used in various countries. The existing highway geometric standard has a greater bearing on the limitations of the maximum dimension of the operating vehicles. The trading counties have to understand and review the requirement for a long-term agreement.

4.5 TARIFFS, ROAD USER CHARGES, AND TRANSIT FEES

This has been found to be a controversial issue. Political background plays a great role in either encouraging or discouraging the passing of the other country's vehicles. Closely coordinated conventions have to be organized for striking a common ground to encourage the sustainable growth of the trading traffic. To simplify the approach following proposal may be adopted after due consideration. There is a need for having one common system for internal or external vehicles. The regional and local authority controls should exempt the international vehicles from local tariff payments. The stopping of vehicles for payment at different places delays their movement.

- Free of charge entry and transit
- Road user charge including all sorts of the following fees to be paid in one consolidated lump sum amount
    - Custom fee
    - Ecological / environmental fee
    - Toll charges for using the facility where such fees are collected separately
    - All other administrative charges

4.6 TRANSPORT SERVICES

When a foreign vehicle is in a given country on a given route, the roadside quality facilities at a reasonable price becomes a necessity.

- For any breakdown, timely service to bring back the vehicle in running condition has to be ensured along the moving corridor.
- Another important issue is of getting return load after disposing the goods at the destination. The availability of return load is quite unpredictable. The return load waiting may be long or it may be eventually an empty return.
- A reliable international brokerage services may be encouraged who can coordinate in advance for the appropriate return load.
- Roadside food, sanitary and medical facilities must be of acceptable standard at a reasonable price.

5. CONCLUSIONS AND RECOMMENDATIONS

For a sustainable transport system there can't be one unified approach for all the countries and the continents. It has to be compatible with the geographical, social and cultural background. There is a need to develop an appropriate approach compatible to a given economy.

Some of the important salient points to help promote the sustainable transportation system are summarized below, provided the regional factors are appropriately applied to them.

- To establish complementary and viable multimodal transport system
- To have regular conventions of the concerned countries for transparent discussion of the related issues
- To constitute an independent body to regularly assess the impact of transport growth
- To utilize the specialized services of a reputed group of international experts to formulate implementation schemes
- To cooperate and interact with the special bodies constituted by international agencies to simplify and harmonize the transport regulations