III. TRANSPORT INFRASTRUCTURE[1]

A. INTRODUCTION

Transport is so essential in both developing and developed countries that it is often taken for granted. Macroeconomic facts about transport are indeed impressive. The value added by transport and storage accounts for 3 to 8 per cent of the GDP of countries in Asia and the Pacific, according to ESCAP secretariat estimates.[2] Employment in transport, storage and communications ranges between 2.5 and 11.5 per cent of total paid employment. Demand for freight and passenger transport, particularly by road, has typically grown 1.5 to 2 times faster than GDP in most developing and transition countries. Public investment in transport typically accounts for 2.0 to 2.5 per cent of GDP[3] and may rise as high as 4 per cent or more in countries modernizing or building new transport infrastructure.[4] Logistics costs are typically more than 20 per cent of sales, of which transport costs alone can be as much as 13 per cent.[5]

Demand for freight and passenger transport has grown 1.5 to 2 times faster than GDP

Landlocked countries face logistics costs that are, on average, 50 per cent higher than those of countries with access to the sea. Consequently, many Governments have assigned transport an important role as a key to economic development and integration into the world economy.

The logistic costs of landlocked countries are 50 per cent higher than those of countries with access to the sea

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[1] For the purpose of this study, *transport infrastructure* refers to *"hardware"*, including roads, railways, bridges, tunnels, ports (for maritime and inland water transport), airports, urban transport infrastructure (mass transit systems), dry ports and inland container depots (intermodal infrastructure). It also includes signage and traffic management systems. It does not include mobile equipment, except for trains. *"Software"* issues are discussed in the study only to the extent that they create an environment conducive to investment in infrastructure, make more efficient the utilization of existing infrastructure (for example, repairs and maintenance) or facilitate the movement of goods, vehicles and people, thereby supporting trade, growth and mobility objectives. In other words, they have a direct bearing on type or volume of investments for "hardware".

[2] ESCAP, *Statistical Abstract of Transport 2005* (www.unescap.org/ttdw/statabs/index2.asp)

[3] World Bank, *Transport Sector Overview* (http://www.worldbank.org/transport/whytsimp.htm)

[4] Viet Nam government expenditure on transport amounted to 4.9 per cent of GDP in 2003 (see Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005)). Total private and public expenditure on transportation reached 4 per cent in China and Thailand and 6 per cent in Viet Nam in 2003.

[5] ESCAP, *Statistical Abstract of Transport 2005* (www.unescap.org/ttdw/statabs/index2.asp)

This chapter provides a general picture of current trends and possible future developments in transport infrastructure and related regional cooperation in Asia and the Pacific. Section B describes the experience of countries that have successfully leveraged transport infrastructure development for their overall national development. It outlines a vision for a future Asian transport system in 2015 and 2030 and summarizes the deficiencies that need to be addressed in order to achieve it. Section C provides an overview of investment requirements for transport infrastructure in the region. Section D provides a brief overview of regional and subregional cooperation in transport to bridge infrastructure gaps. Section E concludes by identifying potential regional cooperation initiatives in transport.

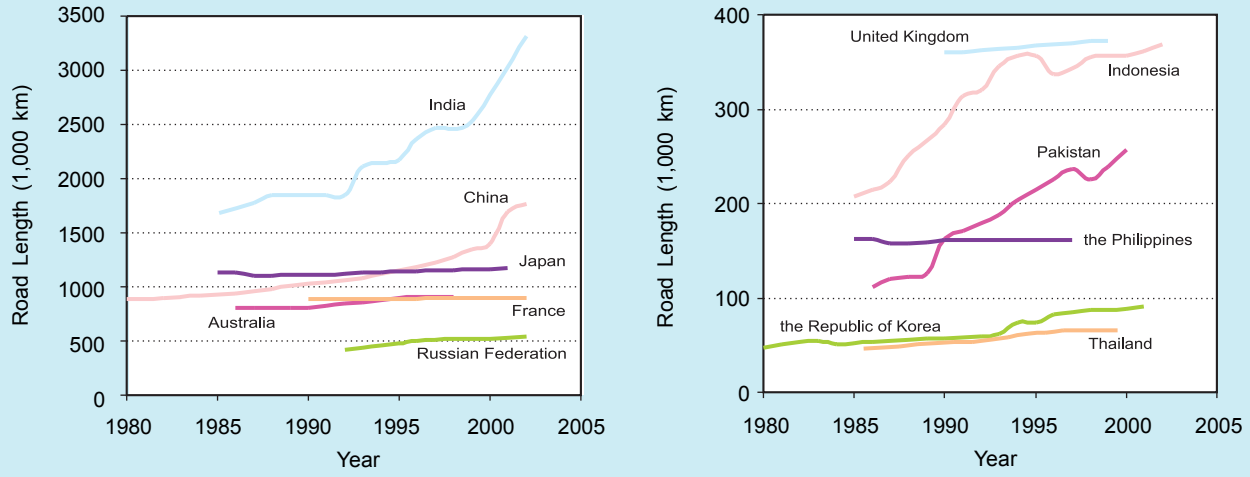
B. REPLICATING SUCCESSFUL TRANSPORT INFRASTRUCTURE DEVELOPMENT THROUGHOUT ASIA

1. EXAMPLES OF SUCCESSFUL TRANSPORT INFRASTRUCTURE DEVELOPMENT

Many East and South-East Asian countries have substantially expanded their transport infrastructure; yet, in most Asian countries transport densities and effective network access levels are still much lower than in Europe or North America

Some Asian countries, particularly in East and South-East Asia, have been very successful in instrumentalizing transport for their overall national economic development. In fact, many East and South-East Asian countries have substantially expanded their transport infrastructure. Some countries have doubled road network length over the past two decades (figure III.1); some invested in road widening schemes which significantly increased capacity through increased total lane length. Yet, in most Asian countries, transport densities and effective network access levels are still much lower than in Europe or North America, implying a potential for further large transport infrastructure development.

Figure III.1. Road length in selected ESCAP member countries (1980-2003)



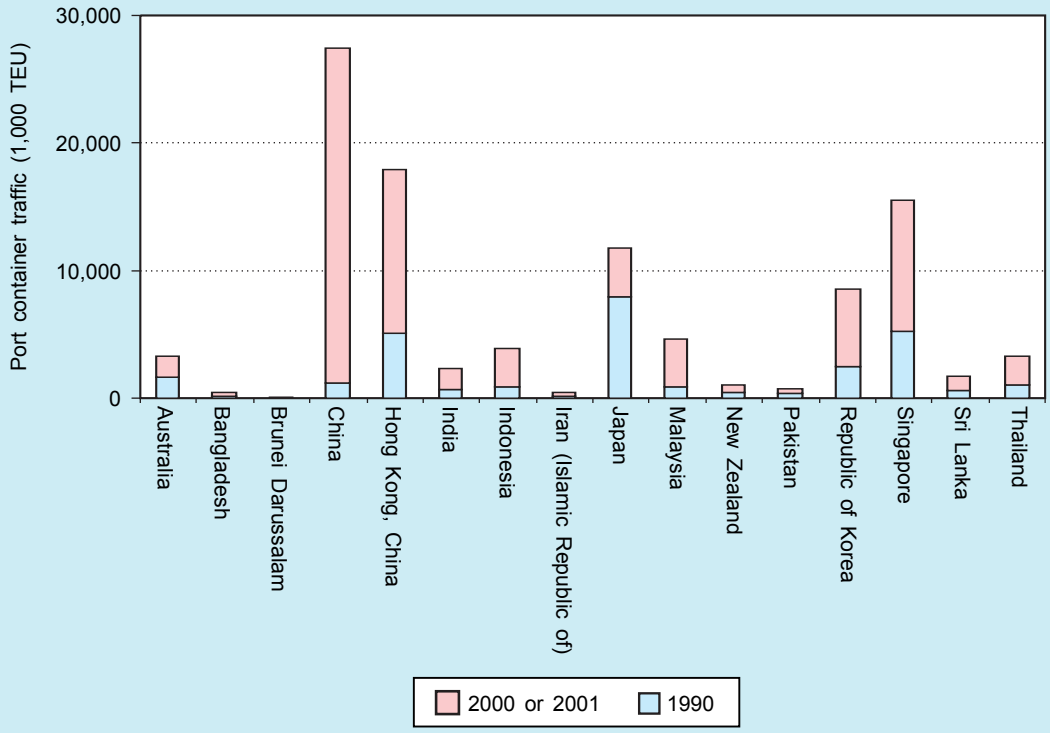
Source: ESCAP, Statistical Abstract of Transport, 2005 <www.unescap.org/ttdw/statabs/index2.asp>

Note: For comparison, some OECD countries are included.

Seaport and airport infrastructures have grown even faster. Port container traffic in the ESCAP region tripled in the 1990s. Today, Asian countries account for 26 per cent of world gross product but 62 per cent of world container throughput. In the 1990s, port container traffic increased 23-fold in China, 5-fold in Malaysia and 4-fold in the Republic of Korea, Indonesia, Bangladesh and India (figure III.2), much faster than in most of the rest of the world.

Today, Asian countries account for 26 per cent of world gross product but 62 per cent of world container throughput

Figure III.2. Port container traffic in select ESCAP members and associate members (1990 and 2000/2001)



Source: ESCAP Statistical Abstract of Transport, 2005 <www.unescap.org/ttdw/statabs/index2.asp>.

Aircraft departures in the region doubled between 1990 and 2000 and have tripled since 1980. In some emerging Asian economies, departures grew even faster, albeit from a low base. Between 1980 and 2000, departures increased 11-fold in China, 6-fold in the Republic of Korea and 4-fold in the Islamic Republic of Iran.

Intercity railway infrastructure has attracted comparatively less investment in Asian countries in recent years. Almost all the increase in Asian railway length occurred in China, with some expansion in Indonesia. India has undertaken a major gauge conversion programme, while the Republic of Korea, Turkey, Malaysia and Japan made significant investments in electrification.[6]

Intercity railway infrastructure has attracted comparatively less investment than roads in Asian countries

[6] ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178).

a. Transport, globalization and regionalization

Transport infrastructure development in East and South-East Asia has played a key part in the phenomenal growth of world trade. The infrastructure backbone for international trade has been the container shipping network and increasingly the airfreight network. World container port traffic, which expanded by 9.2 per cent to 266 million TEUs in 2003, is dominated by Asian countries. They accounted for 46 per cent of container ship operations, 62 per cent of container port throughput, and 83 per cent of container ship building. Twelve major South and East Asian exporters together account for half of the world's containerized exports.

Transport development has been a major factor driving the internationalization of production. The impressive growth of shipping in Asia is in large part due to the formation of regional production networks (RPN),[7] whereby countries specialize in the production of particular components which are shipped from one country to another until final product assembly, a process that is often referred to as "regionalization".[8]

The most important factor contributing to massive productivity and cost savings in transport was the advent of the marine container

The most important factor contributing to massive productivity and cost savings in transport was the advent of the marine container and the container ship. Container ship sizes have increased more than five-fold since the 1970s and, to keep these ships moving, operators have introduced various route networks, including mainline-feeder (hub-and-spoke) and pendulum services. These route structures, combined with increased ship speed and reduced time in port, have reduced transit times, increased service frequency and improved service reliability.

Large investments have been made in seaports to achieve the significant productivity gains from containers and changes in shipping technology. Access provided by these seaports to international and domestic markets has been enhanced by development of industrial estates and special economic zones and attracted FDI from corporations engaged in RPNs. As a result, coastal areas of East and South-East Asia have derived most of the economic benefits, experiencing faster growth that has in turn exacerbated spatial concentration and inequalities in national economies.

By 2025, 58 per cent of the world's population is expected to live in cities

Spatial concentration of economic activities, particularly in large urban clusters, has been a key feature of rapid development in Asia and increases the importance of international transport agreements. Large urban clusters have taken the role that special economic zones played in the past three decades. Bangalore, for example, with some 100,000 workers (or 0.01 per cent of population) accounts for 25 per cent of India's software exports and 3 per cent of India's total exports. A related observation is that by 2025, 58 per cent of the world's population is expected to live in cities: an increase of almost 11 percentage points from 2000. This implies an increase of 1.7 billion in the urban population with their concomitant demand for urban transport infrastructure. Of equal importance is the converse of this observation, namely that 42 per cent (or approximately the same numbers as today) will be living in rural areas with their concomitant demand for access to health, educational and economic opportunities.

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[7] Similar to those in other world regions, such as in Europe.

[8] John Moon and Richard A. Roehrl, "Infrastructure networks to extend regional production networks to inland sites in Asia: strategies, programmes and activities", *Proceedings of the High-level Conference on Asia's Economic Cooperation and Integration*, Manila, June 2004.

International production networks (IPNs) have been of overwhelming importance for the rapid development of East and South-East Asian countries. In fact, three features of these countries have been (i) very little export diversification;[9] (ii) strong sectoral concentration of exports; and (iii) an increasing share of intra-industry trade since 1985 (table III.1). East and South-East Asian trade is dominated by just 30 of over 800 four-digit SITC products (mainly electronic products and other components of manufactures) that in 2001 accounted for just over one half of this exchange.[10] Bulk transport continues to be more important for South Asia and even more so for Central Asia. However, future potential for containerized trade in manufactures is large in these subregions. In addition, bulk transport continues to be more important in domestic transport than in international trade.

East and South-East Asian trade is dominated by just 30 of over 800 four-digit SITC products

Table III.1. Intra-industry trade ratios for East and South-East Asian trade, a simple proxy of participation in international production networks*

	1985 (Percentage)	2001 (Percentage)		
Lao People's Democratic Republic	0	3	Level of integration with IPNs	low
Cambodia	0	6		
Brunei Darussalam	8	8		
Mongolia	..	14		
Viet Nam	3	21		
Hong Kong, China	42	33		
China	32	37		
Philippines	38	48		
Republic of Korea	27	50		
Indonesia	22	51		
Thailand	47	69		
Malaysia	59	74		strong
Singapore	64	75		
Average of above	26	38		

Source: Francis Ng and Alexander Yeats, "Major trade trends in East Asia", World Bank Policy Research Working Paper No. 3084 (Washington D.C., World Bank, June 2003).

Notes:

* Intra-industry trade ratios are the shares of trade within one industry as a percentage of total trade.

b. Access and personal mobility

Passenger transport is equally important for the region's economies. During the rapid catch-up phase of economic growth, the investments of countries of the region have focused on providing international connectivity at the land-sea interface, exacerbating subnational disparities. More recently, their focus has typically included providing access for rural areas and small towns.

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[9] There is surprisingly little overlap in the top product lines of quite similar countries. See Robin Burgess and Anthony J. Venables, "Toward a microeconomics of growth", World Bank Policy Research Working Paper No. 3257, April 2004 (available online at www.worldbank.org).

[10] Francis Ng and Alexander Yeats, "Major trade trends in East Asia: what are their implications for regional cooperation and growth?", World Bank Policy Research Working Paper No. 3084, June 2003 (available online at www.worldbank.org).

Access

The region has made substantial progress in providing universal access to the transport system. As of 2002, more than 90 per cent of rural people in China, and 70 per cent in the Lao People's Democratic Republic, as well as 43 per cent of all Thai rural villages were within 2 kilometres of an all-weather road. India's rural road programme means that half of all villages and towns are now connected by all-weather roads, up from 39 per cent in 1995.[11] India now has almost half as many kilometres of road as the United States.

Mobility

Personal mobility increased sharply in all of the region's faster growing economies

Personal mobility has also increased sharply in all of the region's faster growing economies. Investment in roads has not been able to keep up with the region's rapid pace of motorization, leading to extremely high vehicle densities (vehicles per kilometre of road) in countries such as China, Thailand, Malaysia and Indonesia. Yet, even in ESCAP member countries with a high prevalence of traffic jams, higher personal mobility levels have helped to increase national competitiveness and economic efficiency. Equally important have been improved urban mass-transit schemes.

2. A DESIRABLE VISION OF THE FUTURE TRANSPORT SYSTEM

It is clear that major advances have been made over the past few decades in the provision of transport services in the region. There are, however, indications that further improvements are required to sustain development and to ensure a more equitable distribution of the benefits of globalization. Consequently, questions such as the following need to be asked: what would a desirable future transport system look like? How would the transport system develop in such a desirable future scenario from now to 2030, and what would it take to achieve it? In particular, how can the rest of the region develop transport infrastructure and services that would facilitate the emulation of the spectacularly successful economic development of the newly industrialized countries over the past 25 years?

a. Regional production networks extended to inland sites in Asia

ESCAP supports a phased approach to extending international production networks to hinterlands and landlocked countries an integrated intermodal international transport system

By becoming important nodes in regional production networks, coastal regions of Asia and the Pacific have been the main beneficiaries of the current phase of globalization. ESCAP supports a phased approach to extending international production networks to hinterlands and landlocked countries in Asia through, among others, the development of an integrated intermodal international transport system. The model for such a transport development process starts with unimodal transport links and nodes of international importance. It moves on to integrate the modes into an intermodal network. In parallel, the model envisions developing and connecting nodes that support the increased efficiency of the system, adding value and creating employment in areas that are in danger of being marginalized by globalization. Such nodes may incorporate functions ranging from inland container depots and value added logistics services through to special

[11] Yoginder K. Alagh, "Panchayati Raj and Planning in India: Participatory institutions and rural roads" in ESCAP, *Transport and Communications Bulletin for Asia and the Pacific,* No. 69 (United Nations publication, Sales No. E.00.II.F.23), pp. 1-27.

economic zones. ESCAP is also focusing on developing international transport corridors. Work to date has largely concentrated on the Trans-Asian Railway Network and the Asian Highway, which link countries of the region as well as Asia with Europe.

A desirable vision of the Asian land transport system would see an extension of IPNs to hinterlands and landlocked countries. This process would ideally include a re-emergence of railways. As population densities in East, South-East and South Asia are considerably higher than in North America, and more in line with those in Japan and Europe, there are, for example, signs in China and India that railways might play an increasing role in Asia to complement and substitute for road transport in the backbone network functions. This would also have substantial environmental and safety benefits.

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It appears that strategic investment in transport infrastructure at the regional level could lead to rapid growth in Asian countries that are now at risk of being marginalized. The timeline for this process will vary from country to country, but an ambitious scenario would see all ESCAP member countries participating significantly in international production networks by 2030. The process of engaging inland areas would not come at the expense of coastal development and ports. On the contrary, ESCAP container forecasts foresee a huge expansion of container shipping and berth development.

b. Increased average personal mobility levels

Personal mobility as measured by vehicle ownership will increase but large disparities in mobility levels would remain in the region. By 2030, vehicle ownership could reach the level that the Republic of Korea achieved in 2002 with 270 motor vehicles[12] per 1,000 people. An IMF study suggests that China will reach this level by 2030, but Asian developing countries, excluding China, would reach half this rate. By then, Asia is likely to account for three quarters of all motor vehicles in developing countries, with 571 million motor vehicles, up from 81 million in 2002. Personal mobility could also be enhanced by large investments in conventional and high-speed railway systems in the region, particularly in China, as well as significant improvements in urban transport systems (including integration of subsystems).

c. Cost savings due to a more efficient transport system

More efficient transport can potentially achieve very large cost savings for Asian and Pacific countries. A study by Micco and Perez[13] suggests that upgrading the efficiency of ports could significantly decrease shipping costs (on an order equivalent to the level of many trade tariffs today). A similar study on Asian and Pacific aviation services[14] foresees Asia's share of worldwide international scheduled passenger traffic reaching almost 50 per cent by 2010 and competitive aviation services bringing cost savings to users of $22 billion per year by 2010. Large cost savings are also possible in the

Large cost savings are also possible in the region from improved domestic logistics. It has been estimated that India loses about 20 per cent of total agricultural output and 40 per cent of fruits and vegetables on the journey from farm to consumer as a result of weaknesses in transport and logistics services

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[12] Motor cars seating fewer than eight persons, trucks, buses and tractors.

[13] Alejandro Micco and Natalia Perez, "Maritime transport costs and port efficiency" (New York, Inter-American Development Bank, 2001) (www. iadb.org/res/seminars_events.htm).

[14] Findlay, Hufbauer, and Jaggi, 1996, p. 23; as quoted in T.R. Lakshmanan, "The evolution of transport arrangements" (Paris, OECD, 2005).

region from improved domestic logistics. It has been estimated that India loses about 20 per cent of total agricultural output and 40 per cent of fruits and vegetables on the journey from farm to consumer[15] as a result of weaknesses in transport and logistics services.[16]

Fatal accidents per vehicle in the region are roughly double the world average

d. Safe, reliable and environmentally friendly transport systems

Transport systems will also need to address the negative impacts arising from higher personal mobility and freight traffic. Fatal accidents per vehicle in the region are roughly double the world average of 0.10 per cent per vehicle. Significant road safety measures in ESCAP member countries could cut the fatality rate to 0.16 per cent per vehicle by 2015 and to the current world average by 2030, which could save 400,000 lives annually. It has been proposed that a Declaration be submitted for the consideration of the Ministerial Conference on Transport, to be held in November 2006, setting out clear, time-bound goals that will help to achieve this goal.

Significant reductions in greenhouse gases produced by transport appear to be achievable at relatively low cost

A desirable vision of the future foresees significant reductions in greenhouse gases (GHGs) produced by transport, such as nitrogen oxides and carbon monoxide emissions,[17] by setting standards, and without assuming a major shift in energy fuels. Such reductions are feasible and appear to be achievable at relatively low cost. These could be partially financed through the Clean Development Mechanism (CDM) under the Kyoto Protocol on Climate Change.[18]

Transport-related energy use throughout the ESCAP region will remain highest among light-duty vehicles and road freight transport, World Energy Council estimates show (figure III.3). One way that energy use (that is gasoline, diesel) can be reduced (in total and in terms of its non-renewable fuel portion) is through the promotion of alternative forms of transport, such as intercity railways and urban mass-transit systems.

3. DEFICIENCIES AND GAPS IN TRANSPORT INFRASTRUCTURE DEVELOPMENT

The objectives outlined above still leave a significant number of gaps and deficiencies that need to be addressed by transport policymakers.

Inland container depots need to be developed as a more efficient way to connect inland areas to the coastal production networks

a. Connectivity of hinterlands and landlocked countries

The land transport networks of most ESCAP member countries with maritime coastlines are oriented towards their major seaports. On the whole, internal land transport linkages are not as developed, contributing to the concentration of development in coastal areas. Most general cargo (80 per cent in terms of value, 50 per cent in terms of weight) moves in containers. Therefore, in order to take advantage of this technology, inland container

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[15] "A survey of India's economy: grim reapers", *The Economist*, 2 June 2001, p. 14.

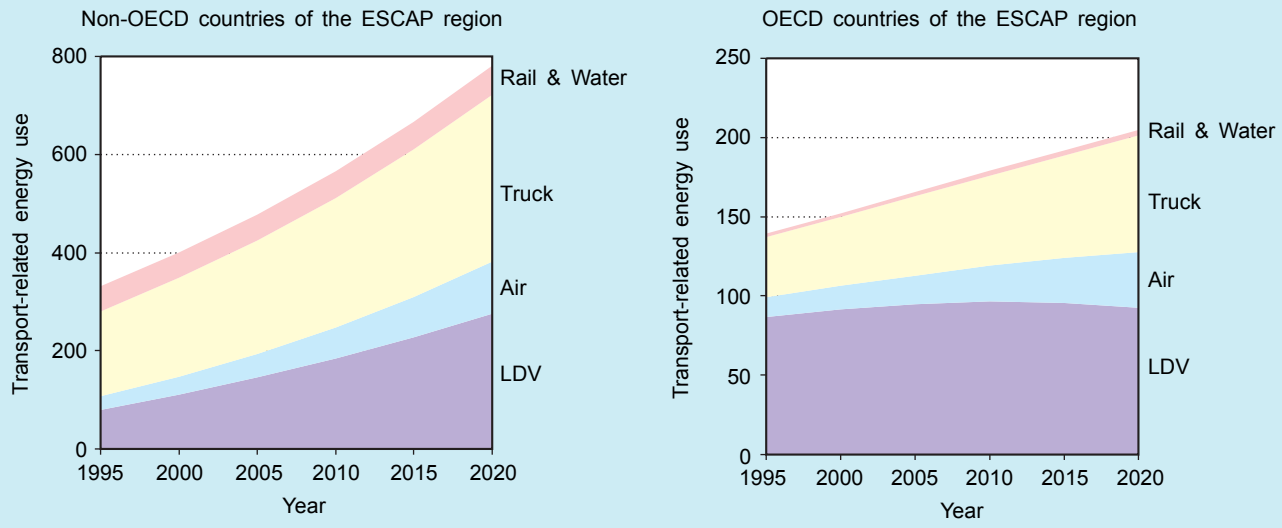
[16] Note that these losses are not included in the logistics costs in terms of the definitions used in the estimate presented on page 1.

[17] Cofala, Amann and Mechler (2005), *Scenarios of World Anthropogenic Emissions of Air Pollutants and Methane up to 2030,* International Institute for Applied Systems Analysis (http://www.iiasa.ac.at/rains/global_emiss/global_emiss.html).

[18] Intergovernmental Panel on Climate Change IPCC, *Third Assessment Report* (Cambridge University Press, 2001).

Figure III.3. Energy use in the transport sector

(Millions of tons of oil equivalents)



Source: World Energy Council (private communications).

Note: LDV: light-duty vehicles.

depots (ICDs) need to be developed in a few countries as a more efficient way to connect inland areas to the coastal production networks. Further, ICD development will require large-scale investments in the medium-term future.

As large urban clusters have become the major nodes in international production systems, many ESCAP member countries also need to tackle issues arising in urban transport.

b. Quality and efficiency of the infrastructure network system

There is a lack of comprehensive policies melding together transport and other networks

Intermodal transport, the process of organizing and moving people and goods across different types of transport, is not well developed in many Asian and Pacific countries. Often, there is a lack of comprehensive policies melding together transport and other networks, including networks for financial payments, banking, information and communication, tracking systems, networks of freight forwarders, multimodal transport operators, customs, security and immigration. Many aspects need to be integrated in order to achieve efficient intermodal transport, which include addressing border-crossing issues, change of railway gauge consistency and ICD development.

The Asian Highway forms a backbone network of about 140,000 kilometres in Asia, but the quality of the Highway varies considerably within and between its 32 member States. In South Asia, roughly 17 per cent or 24,000 kilometres of the Asian Highway network requires upgrading, and 12 per cent does not reach the minimum standard specified in the Intergovernmental Agreement on the Asian Highway Network. In North, Central and South-West Asia, approximately 14 per cent of the network is below the minimum standard. In the ASEAN region, 11 per cent or 2,600 kilometres,

remains below the minimum standard. Of the total 23,594 kilometres of the Asian Highway in the members of ASEAN, over 4,000 kilometres are currently being maintained or rehabilitated and 2,300 kilometres are being upgraded. Similarly, the Trans-Asian Railway has 13 so-called "missing links" totalling 7,060 kilometres.

In some Asian and Pacific countries, there is considerable room for increased port efficiency, which could lead to large cost savings. As many countries have reduced tariff and non-tariff barriers to trade, to promote their integration into the global economy, the relative importance of transport costs has increased. In order to assist integration into the world trading system and competitiveness, countries need to tackle transport costs,[19] by improving access to hinterlands and landlocked countries, increasing port efficiency and liberalizing airline services.

Transport is crucial to tackling the region's poverty

c. The role of transport in tackling rural and urban poverty

Transport is crucial to tackling the region's poverty. Distance is a key factor depriving the rural poor of access to basic services, such as health and education, and to economic opportunities. WHO estimates that 40 to 60 per cent of people in poor countries live more than 8 kilometres away from a health-care facility. As a result, the simplest day-to-day tasks become difficult and the rural poor are left particularly vulnerable to economic crises and natural disasters.

Transportation is also central to tackling urban poverty. The urban poor tend to live in informal settlements, often out of reach of public transport networks. Available motorized transport is often too expensive. Many urban poor depend entirely on non-motorized transport, such as bicycles or walking, but investment in the infrastructure on which such transport relies is often neglected in favour of private motorized transport, particularly cars.[20]

Maintenance is a major issue for all transport modes

d. Infrastructure asset management

Maintenance is a major issue for all transport modes, but particularly the maintenance of roads and bridges. This includes preventative maintenance, such as sealing cracks in road pavements, grading shoulders and cleaning drains to minimize the incidence of wash-aways, as well as planned rehabilitation. Regular road maintenance offers major benefits yet is so neglected in some developing countries that every additional dollar spent on maintenance and rehabilitation saves twice as much in reconstruction costs and reduced wear and tear on vehicles.

Safety standards are low in most subsectors of Asia-Pacific transport modes with the economic cost of road accidents estimated to be in the range of 1 to 3 per cent of the GDP of ESCAP member countries

e. Environmental stress, traffic congestion and traffic accidents

Safety standards are low in most subsectors of Asian and Pacific transport modes. Issues related to the transport of dangerous goods, road safety, maritime transport safety (for example, ferry loading, oil spills from ballast flushing in ports), and even aspects of railway safety and air transport safety remain unresolved in some ESCAP member countries. In 2003, an

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[19] Alejandro Micco and Natalia Perez , "Maritime Transport Costs and Port Efficiency" (New York, Inter-American Development Bank, 2001) (www. iadb.org/res/seminars_events.htm).

[20] World Bank, *Cities on the Move: A World Bank Urban Transport Strategy Review* (Washington D.C., World Bank, 2002).

estimated 430,000 people were killed and more than 2 million injured in accidents on the roads of Asia and the Pacific.[21] The economic cost of road accidents is estimated to be in the range of 1 to 3 per cent of the GDP of ESCAP member countries. Although the region has only 20 per cent of the world's registered motor vehicles, it accounts for about half of global traffic fatalities[22] and the number could rise to two thirds by 2020, the ESCAP secretariat estimates.

Various approaches to tackling safety are possible but infrastructure interventions are one of the key elements. These include addressing issues of road design and conducting "road safety audits." Railway safety can be enhanced by such measures as improving level crossings.

C. TRANSPORT INFRASTRUCTURE INVESTMENT REQUIREMENTS

This section provides indicative answers to the question of the order of magnitude of the anticipated investment "requirements"[23] in the ESCAP region for the period until 2015.

1. CURRENT EXPENDITURE ON TRANSPORT INFRASTRUCTURE

Current investment and maintenance expenditure on transport infrastructure in the ESCAP region[24] is estimated to be at least on the order of $200 billion per year (see table III.4), which was roughly equal to 1.6 per cent of GDP in 2003.[25] Current transport infrastructure investments in many ESCAP member countries are still relatively high, particularly in the East and South-East Asian countries that are participating in international production networks. Indeed, in 2003, investment and maintenance expenditure as a share of GDP reached as high as 6 per cent in Viet Nam and 4 per cent in Thailand and China (see figure III.4).

In 2004, investments in transport in China amounted to a staggering $88 billion

In 2004, investments in transport in China amounted to a staggering $88 billion, more than two thirds of which flowed into the road sector (table III.2). In 2004 alone, more than 46,000 kilometres of new highways were put into operation, a total length of 150,000 kilometres of county and rural highways were reconstructed, and almost 2,000 kilometres of new railway lines were constructed. Yet, there are precedents to this massive construction in history, such as the building of the United States interstate highway system. In fact, from 1948 to 1960, between 32,000 and 53,000 kilometres of new highways were built in the United States each year.

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[21] These are conservative estimates; WHO, for example, estimates that these numbers might be twice as high.

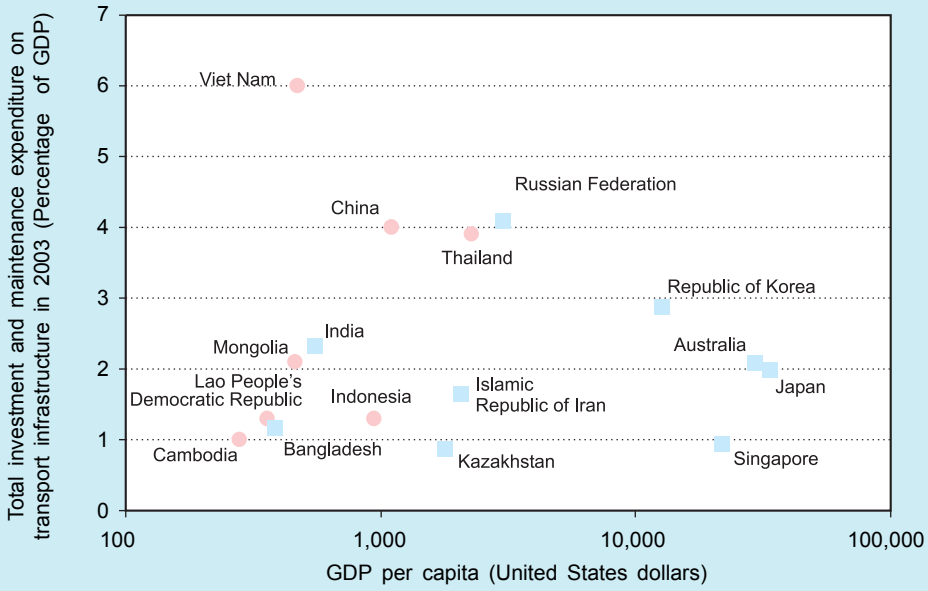
[22] ESCAP, *Transport and Communications Bulletin for Asia and the Pacific: Road Safety*, No. 74 (United Nations publication, Sales No. E.05.II.F.17, 2005).

[23] Investment "requirements", "needs" or "wants" depend on assumptions about the uncertain future, such as economic growth and changing policy targets and priorities of Governments. In other words, there are no absolute investment "needs".

[24] Excluding the extraterritorial members of the Commission.

[25] This is likely to be underestimated; see figure III.4.

Figure III.4. Total investment and maintenance expenditures in transport infrastructure in 2003 as a share of GDP in selected ESCAP member economies



Sources: Asian Development Bank, Japan Bank for International Cooperation and World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington, D.C., World Bank, 2005); *India in Figures, 2004; Iran Statistical Yearbook* 1382; *Statistical Pocketbook Bangladesh* 2003; *Japan Statistical Yearbook 2005; Yearbook of Statistics Singapore, 2005,* and National Statistical Office, Republic of Korea.

Notes: Round circles represent data published in Statistical Appendix of the ADB/JBIC/WB study 2005; squares represent data from statistical yearbooks.

Note that these data do not all follow consistent data definitions. Also, due to data availability, some data are for 2002 or 2004 rather than 2003. As a result, the comparability of these data across countries is limited. For example, the graphed data for Japan, Singapore, the Islamic Republic of Iran, the Republic of Korea and India include only the expenditures of governments, not the private sector.

Table III.2. Investment in the transport sector in urban areas in China, 2004

	Investment (Millions of 2004 United States dollars)	Investment, share of GDP (Percentage)
Transport, storage and post	87 984	5.19
Railway transport	10 500	0.62
Road transport	57 885	3.42
Urban public transport	4 855	0.29
Water transport	6 633	0.39
Air transport	3 380	0.20
Storage	2 319	0.14
Loading, unloading and other transport services	727	0.04
Transport via pipelines	1 328	0.08
Post	357	0.02

Source: China Statistical Yearbook 2005 (China Statistics Press, 2005).

Note: The China Statistical Yearbook was compiled by the National Bureau of Statistics of China.

Table III.3. Examples of new transport infrastructure put into operation in China, 2004

	2004
New trunk railways put into operation [km]	1 433
Double-track railways put into operation [km]	352
Electrified railways put into operation [km]	409
New highways [1 000 km]	46
Reconstructed highways [1 000 km]	150
New berths in major coastal ports (number)	287
New civil airports (number)	7

Source: *China Statistical Yearbook 2005* (China Statistics Press, 2005).

Note: The *China Statistical Yearbook* was compiled by the National Bureau of Statistics of China.

2. ESCAP ESTIMATES OF TRANSPORT INFRASTRUCTURE INVESTMENT REQUIREMENTS

In the theme study for the Commission in 1994,[26] the secretariat presented estimates of infrastructure investment requirements to 2000. The secretariat has carried out a similar estimation of transport infrastructure requirements to 2015 for this study using a modified methodology. In essence, the estimates are based on "dynamics-as-usual" assumptions.

a. Overview of results

Consolidated investment and maintenance requirements in transport infrastructure for the ESCAP region are estimated at $261 billion per year from 2005 to 2015

Consolidated investment and maintenance requirements in transport infrastructure for the ESCAP region are presented in table III.4. They show a rapid increase particularly in South, South-West, East and North-East Asia.

Total annual average requirements are estimated at $261 billion from 2005 to 2015. This represents an increase to $292 billion *per year* by 2010-2015, up from the current $205 billion and the level of $137 billion per year in the early 1990s. Of this, the developing countries of Asia and the Pacific would require an estimated $224 billion annually during 2005-2015. However, in terms of GDP, total requirements for the whole region reflect a reduction from 1.8 per cent of GDP in 2003 to 1.4 per cent in 2013, while for the developing countries of the region that will decline from 2.6 per cent of GDP to 1.8 per cent of GDP.[27]

Roads are expected to continue attracting the largest share of investments, but in selected countries, such as China, upgrading and expansion of railways are also expected to play an important role. Due to the dynamics-as-usual assumptions, requirements for railways are likely to be underestimated. In other words, the "re-emergence" of railways in the form of high-speed passenger trains on routes linking areas with high population densities and dedicated tracks for freight and fast container block-trains may become a policy priority.

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[26] ESCAP, *Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation* (ST/ESCAP/1364).

[27] Based on the IMF GDP forecasts, as contained in the source mentioned in footnote.

Table III.4. Estimates of average annual investment and maintenance requirements in the transport sector from 2005 to 2015

(2004 prices)
(Billions of United States dollars)

		North and Central Asia	South and South-West Asia	South-East Asia	East and North-East Asia	Australia, New Zealand and the Pacific	ESCAP region Total	Developing Asia-Pacific countries
Total	1990-1995	17.0	48.2	15.8	39.9	16.6	137	107
	1995-2000	12.9	49.9	12.1	50.6	11.4	137	112
	2000-2005	18.8	61.8	19.7	88.4	16.2	205	172
	2005-2010	19.7	71.4	22.8	101.1	15.8	231	195
	2010-2015	22.9	86.2	27.4	138.0	18.0	292	253
Roads	1990-1995	13.7	45.6	13.4	33.2	14.7	121	95
	1995-2000	10.0	47.0	10.6	43.5	9.9	121	100
	2000-2005	14.4	57.5	14.2	70.5	13.1	170	145
	2005-2010	14.5	64.8	14.7	78.3	12.2	185	161
	2010-2015	17.5	76.3	17.2	106.7	13.5	231	206
Railways	1990-1995	2.8	1.8	0.5	1.9	0.8	7.8	6.7
	1995-2000	2.6	1.9	0.5	3.2	0.8	9.0	7.9
	2000-2005	2.5	1.9	0.4	2.7	0.8	8.4	4.3
	2005-2010	2.5	2.0	0.5	3.0	0.8	8.8	7.7
	2010-2015	2.5	2.1	0.5	3.5	0.8	9.3	8.2
Airports	1990-1995	0.5	0.8	1.8	4.8	1.0	8.9	5.1
	1995-2000	0.3	0.9	0.9	3.8	0.8	6.7	3.5
	2000-2005	0.9	0.6	0.9	6.5	1.5	10.4	8.0
	2005-2010	1.3	1.1	1.7	8.6	2.0	14.6	8.7
	2010-2015	1.1	1.3	2.0	11.5	2.7	18.5	10.9
Container Ports	1990-1995							
	1995-2000							
	2000-2005	0.002	0.17	0.49	1.15	0.040	1.85	1.71
	2005-2010	0.003	0.24	0.65	1.56	0.049	2.50	2.33
	2010-2015	0.004	0.36	0.92	2.28	0.063	3.62	3.41
Urban mass-transit	1990-1995							
	1995-2000							
	2000-2005	1.0	1.5	3.7	7.5	0.7	14.4	9.9
	2005-2010	1.4	3.3	5.3	9.6	0.9	20.4	15.6
	2010-2015	1.8	6.2	6.8	14.1	1.0	29.8	24.3

Source: ESCAP secretariat.

Notes: ESCAP standardized regional groupings were used, see *ESCAP Review of Developments in Transport* or *ESCAP Economic and Social Survey*. See annex III to this chapter on data sources and methodology.

A doubling of investment requirements in the next 10 years is expected for major coastal container ports

A doubling of investment requirements in the next 10 years is expected for major coastal container ports. Two thirds of the required new container berths in the world are expected to be built in the ESCAP region, translating into a cumulative capital requirement for terminals alone of roughly $31 billion until 2015.[28]

[28] Assuming typical costs to develop new infrastructure and procure the handling equipment required to allow the terminal to operate at a satisfactory level of efficiency, see section C.2.b, on data sources and methodology.

Driven by rising living standards, investment requirements for airports and air navigation services may double in the next 10 years to cater for the growth in both passenger and cargo traffic and to accommodate new large aircraft and emerging budget airlines.[29] This is despite the fact that more than $50 billion has been invested over the past decade in the region in eight major new airports alone.[30]

Investment requirements for mass-transit systems in urban areas of the region are estimated to double over the next decade to almost $30 billion per year to 2015.

The desired vision of an Asian integrated transport system will need balanced investments in the transport backbone and access infrastructures requiring further investment in secondary access systems

b. Investment "needs"

Still, our results are likely to be underestimates of actual absolute "needs" in terms of politically desired goals. For example, in many countries the necessary regular maintenance needs, particularly of roads and railways, are not being met, leading to higher future liabilities.[31] Furthermore, the desired vision of an Asian integrated transport system will need balanced investments in the transport backbone as well as the access infrastructures. This will require further investment in secondary access systems.

The ESCAP expert group meetings in 2004 and 2005[32] on identifying investment needs and priorities for the development of the Asian Highway network and related intermodal connections identified a shortfall of almost $18 billion to upgrade and improve about 26,000 kilometres of the Asian Highway in 26 member countries, for which financing from multilateral or bilateral donors and other sources would be required.[33]

Furthermore, to close the 13 "missing links" of the Trans-Asian Railway would require about $13.5 billion to build single track lines (figure III.5). In order to upgrade high priority parts of the Trans-Asian Railway to double-track would cost tens of billions of dollars more. Finally, as inland sites in Asia are increasingly developed through ICDs and efficient intermodal connections, a similar level of investment as for container ports today might be required for the construction of ICDs in the future.

Extensive rural access programmes, such as those of India and more recently of China, are also likely to increase investment "needs" particularly for roads. For example, India is committed to investing $26 billion to connect all its currently unconnected villages (roughly 50 per cent of the total) to all-weather roads,[34] and China plans to build 400,000 kilometres of new rural roads to connect 80 per cent of all villages in China by 2020.

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[29] This estimate is consistent with the International Civil Aviation Organization's estimate of $300 billion in cumulative investment needs worldwide from 2000 to 2010.

[30] ESCAP, *Transport and Tourism Data for Asia and the Pacific* (http:/www.unescap.org/ttdw/data/index.aspx).

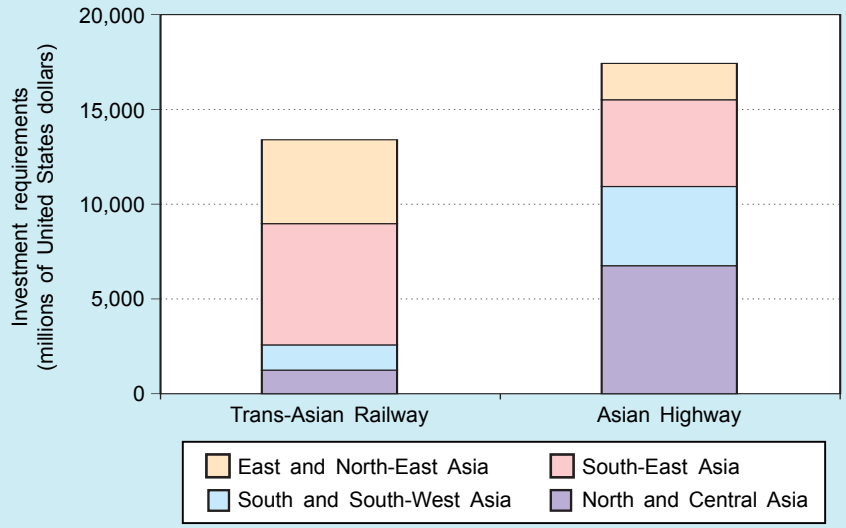
[31] ESCAP, *Transport and Communications Bulletin for Asia and the Pacific*, No. 75, *Road Funds* (ST/ESCAP/SER.E/75), 2005 (http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=181).

[32] For SAARC members (with the participation of Afghanistan and the Islamic Republic of Iran) on 21-23 September 2004 in Islamabad; North, Central and South-West Asia on 23-25 January in Tehran; and for South-East Asia (with participation of Mongolia) on 25-26 April 2005 in Bangkok.

[33] This is in addition to current (or committed) investments of $21 billion in the Asian Highway.

[34] Excluding the cost of major bridges; see Pradhan mantra Gram Sadak Rojana project in India (http://www.pmgsy.nic.in/pmg216.asp).

Figure III.5. Identified investment requirement for identified high-priority projects of the Asian Highway and the Trans-Asian Railway



Source: ESCAP secretariat.

However, to date many Governments and donors have focused mainly on international connectivity, national backbone routes and secondary networks, with the consequence that other access and feeder roads have been neglected.[35] This has become a serious issue in some cases, as the efficiency of the road network depends on the state of *all* its links and nodes.

3. SOURCE OF FUNDS

Chapter VIII discusses sources of funds for infrastructure development in detail. While there are important differences between transport subsectors, the largest share of financing for transport has come from and will continue to come from public sector budgets, particularly in the land transport sector. The large transport investment needs in the region identified in this study means that Governments will need to explore all possible funding options, including traditional and innovative public sector financing, loans provided by development banks, official development assistance, and different types of private sector involvement.

Decentralization presents new institutional challenges in terms of coordination and raising of the necessary funds for financing transport infrastructure

There are changing differences among ESCAP members in terms of the role of local governments and various State enterprises in financing transport infrastructure. Decentralization presents new institutional challenges in terms of coordination and the raising of the necessary funds for financing transport infrastructure. In fact, the responsibility for the development of infrastructure has been or is proposed to be delegated to lower levels of government. However, capacity to plan and implement projects is often weak and in many cases the legal basis for raising the level of funds is lacking.

[35] Note that developing countries typically channel more than half of their public spending on transport into the roads sector. The World Bank allocates 70 per cent of its transport loan portfolio into the roads sector, despite having changed its policy focus in the 1990s from economic growth to poverty alleviation.

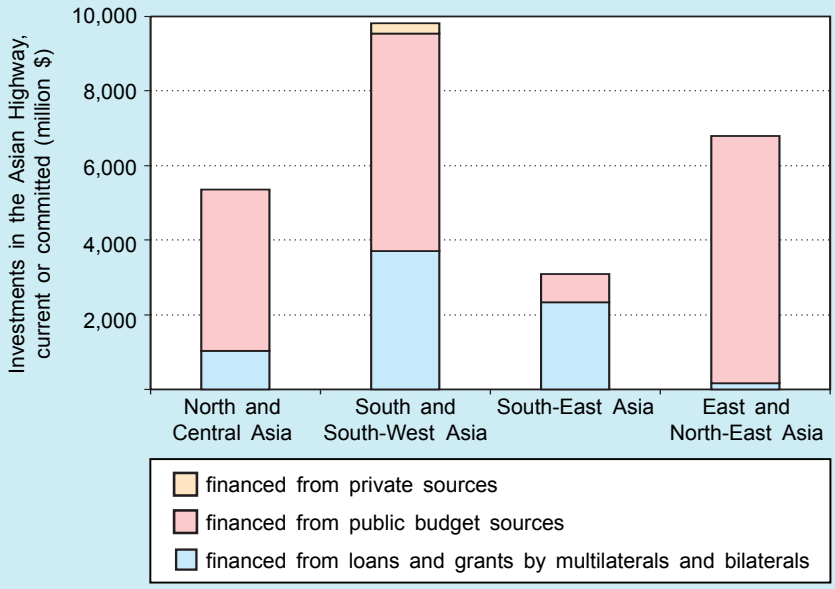
Contributions by the private sector, multilateral or bilateral donors and cross-border financing have been important in certain niches; however, they cover only a small share of the overall total requirements

Contributions by the private sector, multilateral or bilateral donors and cross-border financing have been important in certain niches; however, they cover only a small share of the overall total requirements. For example, from 1990 to 2003, PPI flows in the transport sector have concentrated on a few countries and a few sectors.[36] In fact, almost all transport private participation in infrastructure (PPI) went to five countries (China, Malaysia, Thailand, the Philippines and Indonesia) and there was no such activity in three quarters of all ESCAP members. From 1990 to 2003, *cumulative* PPI investment in roads ($25 billion) accounted for half of the region's PPI transport projects. Of 188 road projects in the region, more than half were in China, which invested $14 billion in such projects. In the same period, cumulative PPI port investments in the region totalled $13.4 billion, railways $10.6 billion (mainly urban mass-transit schemes) and airports $3.5 billion.[37] It should be noted that a lack of seed financing for feasibility studies that take project ideas of Governments to a stage where the private sector becomes interested is a general problem and particularly acute in the smaller ESCAP economies.

Multilateral and bilateral donors play an important role for some least developed countries as well as in the case of transport infrastructure of international importance such as the Asian Highway and the Trans-Asian Railway (figure III.6); yet, they cover only a tiny amount of total regional investment requirements for transport infrastructure.

Figure III.6. Investments in the Asian Highway, current or committed, by types of funds as of 2004/2005

(Millions of United States dollars)



Source: ESCAP secretariat.

[36] The figures are only indicative, however, as the World Bank Private Participation in Infrastructure database from which they are drawn does not cover all projects with PPI investment and the actual share of private sector funding in these projects is unknown.

[37] ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178).

Cross-border financing of transport infrastructure has recently received increased attention as a possible way to deliver benefits across national borders. This is particularly the case where there are large disparities in living standards between neighbouring countries. Such financing is of particular interest in the context of transit transport and landlocked countries, as well as in terms of seed financing. One notable example is a $96 million road project in the Lao People's Democratic Republic, which will link China and Thailand and for which China, Thailand and the Asian Development Bank are providing concessional loans, with maintenance costs being covered by infrastructure usage charges. Other examples of this modality have been reported between China and other neighbouring countries, Afghanistan and its neighbours as well as Myanmar and its neighbours.

D. REGIONAL COOPERATION IN TRANSPORT INFRASTRUCTURE DEVELOPMENT

1. GENERAL TRENDS AND ISSUES

As a step towards deeper regional integration in Asia and the Pacific, international transport-related agreements and programmes have gained increasing importance as a means by which Governments can help economies to participate in international production networks and to mitigate systemic risks.[38]

The proliferation of bilateral and subregional agreements in the transport sector raises concerns over their consistency with regional and global conventions

The number, magnitude and extent of regional and subregional transport cooperation initiatives and organizations in Asia and the Pacific have increased significantly, creating a complex web of cooperation mechanisms and relationships. There has also been a clear trend towards ever more and often overlapping organizations and programmes with fewer members, particularly in the last 20 years.[39] These agreements and programmes take many different legislative and non-legislative forms covering issues related to policy, infrastructure, operations and facilitation.

Most Asian and Pacific Governments recognize the importance of their active participation in the major regional, subregional and bilateral agreements in key sectors related to globalization, such as trade, transport and communications, but some countries have benefited more than others. Countries at the hub of an emerging "hub-and-spoke" system of transport-related agreements have reaped particular benefits, partly due to their geographical location and in part because of their active "transport diplomacy."

The proliferation of bilateral and subregional agreements in the transport sector raises concerns over their consistency with regional and global conventions. ESCAP has promoted openness of agreements and adherence to regional and global standards in order to ensure the efficient operation of the intra- and interregional transport system. One example is in the area of

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[38] Most risks are simple direct risks. For example, the risk that the income of a certain group of rice farmers will increase/decrease due to regional integration is a direct risk. Direct risks can usually be addressed by appropriate policies on the part of national Governments. *Systemic risks* are risks that are inherent in the "system" as it becomes integrated. These types of risks often can only be addressed by *regional cooperation* among most Governments, not by the policies of a single Government.

[39] Smaller groups and groups of a "like mind" can reach a consensus easier, which increases the effective speed of implementation.

cross-border transport facilitation, where ESCAP in its resolution 48/11 of 23 April 1992 recommended that countries in the region consider acceding to a list of key international conventions.

The land transport sector in particular needs policy interventions in order to address the many social, economic and political inter-country challenges. Landlocked countries, such as Tajikistan, Kyrgyzstan, Azerbaijan, Kazakhstan and Uzbekistan, as well as geopolitically important countries, such as the Russian Federation, China, India, Thailand and Turkey, are members of the largest number of agreements and organizations, indicating the level of importance placed by these countries on regional cooperation.

2. REGIONAL INITIATIVES

a. Early forerunners (1959-1992): Asian Highway and Trans-Asian Railway

Until the late 1980s, there were only two significant regional land transport cooperation initiatives that had been launched in Asia: namely, the Asian Highway, which started in 1959, and the Trans-Asian Railway, which started in the 1960s, both initiated by ESCAP. These have played a pivotal role in developing regional transport and by providing models for many cooperation initiatives of the past 15 years.

The Asian Highway and the Trans-Asian Railway, both initiated by ESCAP, have played a pivotal role in developing regional transport

b. Asian Land Transport Infrastructure Development (1992)

The Asian Land Transport Infrastructure Development Project (ALTID)[40] launched by ESCAP in 1992 has been at the core of regional cooperation in transport infrastructure development in Asia and the Pacific. Its major contribution was that it drew together the Asian Highway, Trans-Asian Railway and initiatives that facilitate cross-border land transport. ALTID helps countries to identify and formulate routes, set standards, formalize networks and put the networks into operation. Route selection criteria included: capital-to-capital links; connections to main industrial and agricultural centres; connections to major sea- and river ports; connections to major inland container terminals and depots; and connections to major tourist attractions. Furthermore, the number of lines to be included in the networks were to be minimized, and maximum use made of existing infrastructure.

A refined implementation strategy was adopted by the Commission at its fifty-fourth session, in 1998, and includes the following components:[41] (i) facilitation of land transport at border crossings and maritime transport at ports through the promotion of the relevant international conventions and agreements in Asia, particularly those contained in ESCAP resolution 48/11; (ii) completion of the formulation of Asian Highway and Trans-Asian Railway networks covering the whole of Asia as well as completion of the missing links; (iii) formalization of the Asian Highway and Trans-Asian Railway routes/networks. A legal framework in the form of "ESCAP agreements on Asian Highway and Trans-Asian railway routes/networks" should be developed; (iv) improvement of the operational efficiency of the Asian Highway and Trans-Asian Railway routes, including transport logistics; (v) improvement of transport logistics; (vi) Asian Highway and Trans-Asian Railway promotion.

The major contribution of the Asian Land Transport Infrastructure Development Project has been that it drew together the Asian Highway, Trans-Asian Railway and initiatives that formulate cross-border land transport

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[40] Endorsed by the Commission at its forty-eighth session, in 1992, and extended at its fifty-sixth session, in June 2000.

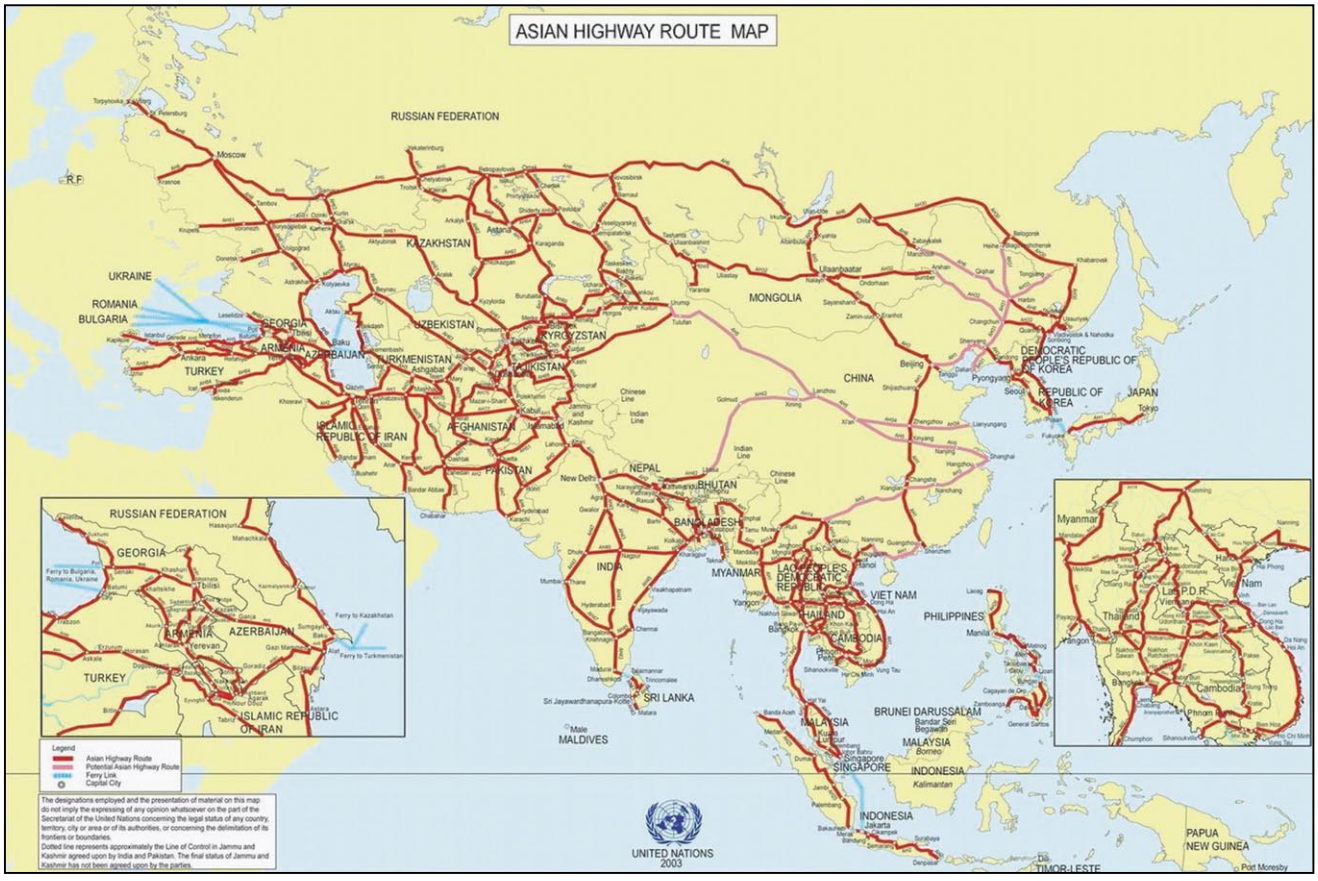
[41] See ESCAP document E/ESCAP/CTC(3)2.

c. The Asian Highway after 1992 and its Intergovernmental Agreement (2005)

The Intergovernmental Agreement on the Asian Highway Network came into force on 4 July 2005

The Asian Highway network now comprises approximately 140,000 kilometres of roads, passing through 32 member States (figure III.7). The Intergovernmental Agreement on the Asian Highway Network was concluded in November 2003 and came into force on 4 July 2005.[42] The contracting parties have agreed to: (i) adopt the Asian Highway network as a coordinated plan for the development of highway routes of international importance; (ii) bring the network into conformity with the Asian Highway classification and design standards; and (iii) place Asian Highway route signs along the network. Members also established the Working Group on the Asian Highway to review its implementation. The ESCAP secretariat acts as the secretariat for the Agreement. The Agreement plays a catalytic role in developing international highways in the Asian and Pacific region.

Figure III.7. Map of the Asian Highway Network, 2003



Source: ESCAP, <http://www.unescap.org/ttdw/common/TIS/AH/maps/AHMapApr04.gif>.

In 2004, ESCAP adopted resolution 60/4 of 28 April 2004 on the Intergovernmental Agreement on the Asian Highway Network, in which it invited (i) all the relevant members of the Commission to become parties to

[42] As of 6 February 2006, 28 member States had signed the Agreement and 16 had ratified, approved or accepted it.

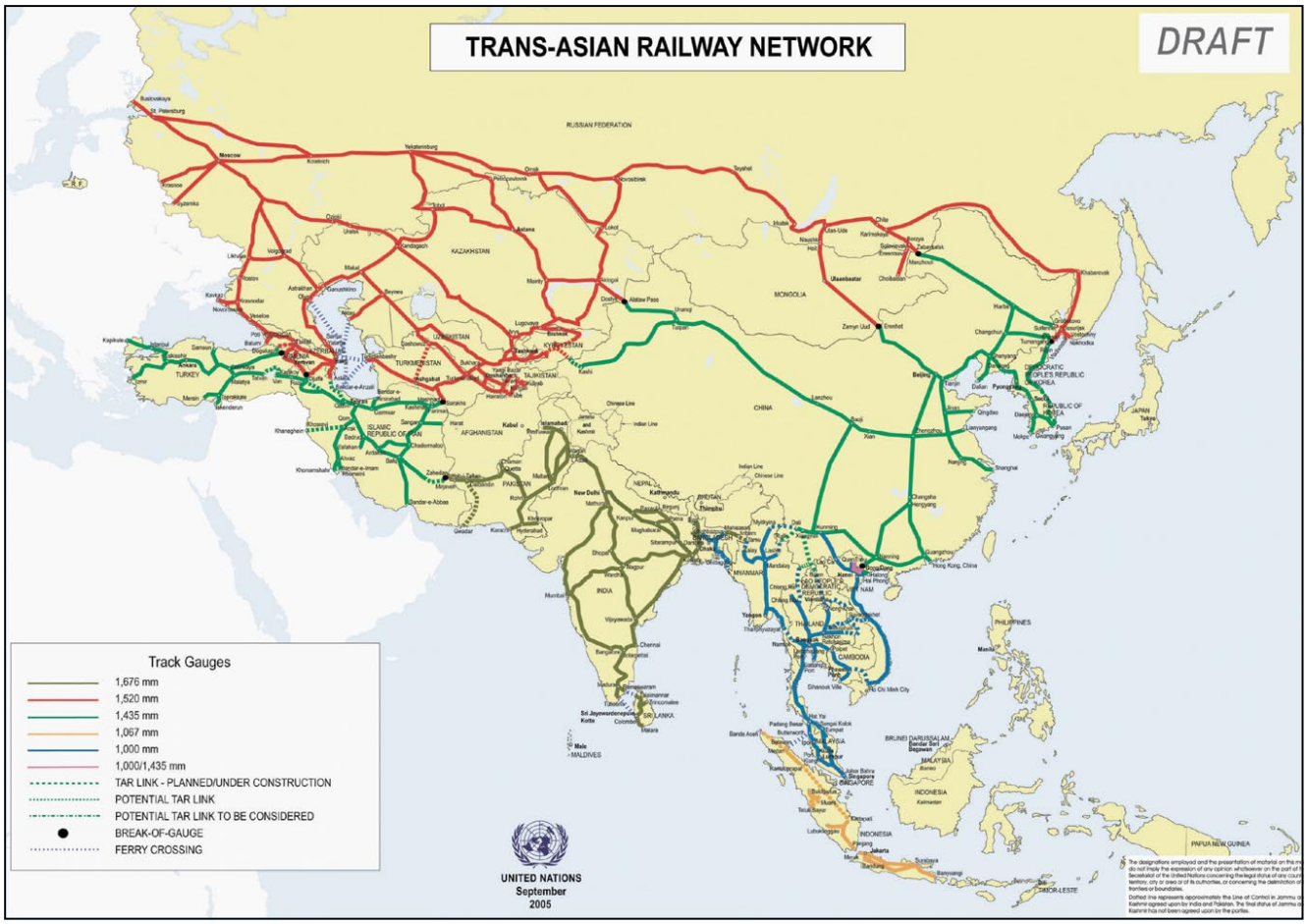
the Agreement; (ii) international and regional financing institutions and multilateral and bilateral donors to provide financial and technical support for the development of the Asian Highway network; and (iii) subregional organizations to promote the Agreement and accord priority to the development of the Asian Highway network.

Through a series of subregional meetings with the participation of the World Bank, the Asian Development Bank, the Islamic Development Bank, the Japan Bank for International Cooperation, and related institutions, member countries have identified a list of priority investment projects and prepared project profiles for potential donors, giving highest priority to upgrading the Asian Highway's substandard sections.[43]

d. The Trans-Asian Railway after 1992

The Trans-Asian Railway Project aims to enhance the efficiency and development of rail transport infrastructure in Asia, thereby promoting international and bilateral trade and regional economic and social development.

Figure III. 8. Map of the Trans-Asian Railway Network, September 2005



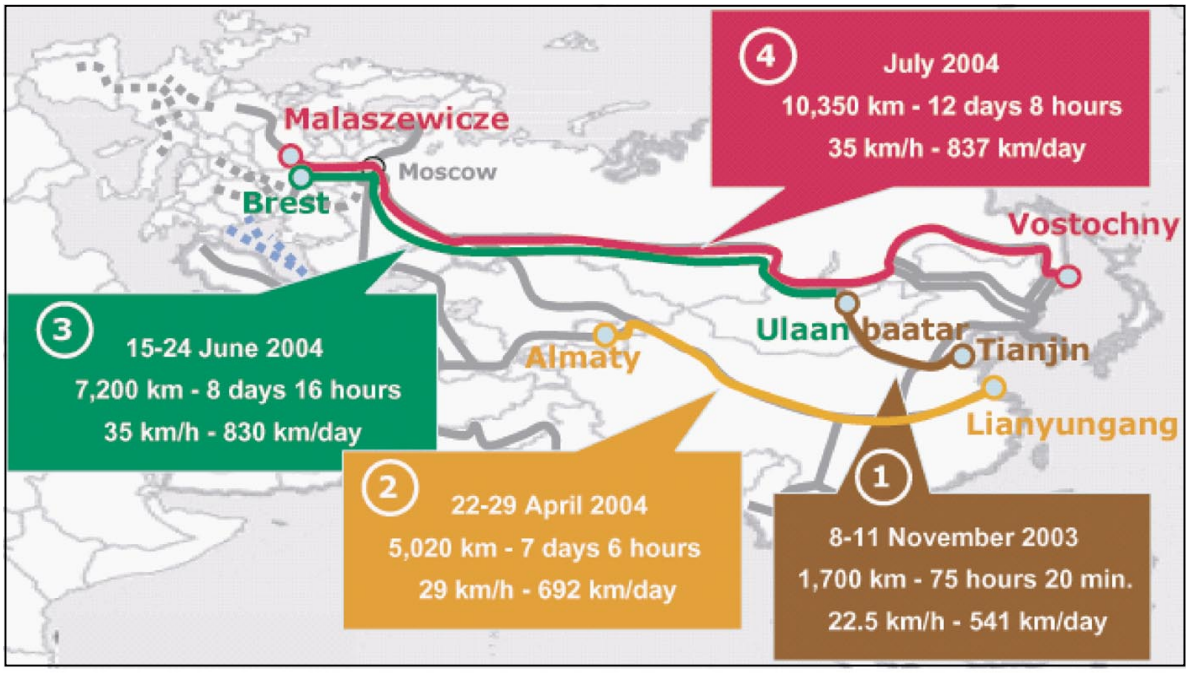
Source: ESCAP, <http://www.unescap.org/ttdw/common/TIS/TAR/images/tarmap_latest.jpg>.

[43] See also the second paragraph under section C.2.b.

Given the extent of the territory covered by the Trans-Asian Railway (figure III.8), the differences in standards between railways in the region and the differences in levels of technical development, a step-by-step approach was adopted to developing the network, starting with four major corridors and focusing on break-of-gauge points and missing links.

Demonstration runs of container block-trains were carried out along different routes of the northern corridor of the Trans-Asian Railway between November 2003 and July 2004 (figure III.9). These were followed by more than 200 commercial container block-train runs between 2004 and 2005. A container block-train travelling between Western Europe and North-East Asia covering about 1,000 kilometres per day takes at least seven days less than sea transport.

Figure III.9. ESCAP-promoted demonstration runs of container block-trains along the Trans-Asian Railway Northern Corridor



Source: ESCAP, <http://www.unescap.org/ttdw/common/TIS/TAR/Container%20Block-trains.asp>.

Transport officials from across the region finalized the draft of the Intergovernmental Agreement on the Trans-Asian Railway Network at an intergovernmental meeting organized by ESCAP and held in Bangkok from 28 to 30 November 2005. The draft will be submitted for adoption by the Commission at its sixty second session[44] and for signature at the Ministerial Conference on Transport to be held later in 2006.

[44] See ESCAP document E/ESCAP/1370.

e. Euro-Asian Transport Linkages since 1997

ESCAP has promoted a number of initiatives to improve Euro-Asian land linkages and open up the relatively untapped potential of land transport

Trade between Europe and East Asia is increasing rapidly and in 2004, in terms of full containers, amounted to 3.1 million TEUs transported from East Asia to Europe and 7.4 million TEUs in the other direction in 2005.[45] Almost all of it was transported by sea. ESCAP has promoted a number of initiatives to improve Euro-Asian land linkages and open up the relatively untapped potential of land transport as well as providing access for the landlocked countries of central and transit for concerned countries. These initiatives, which identified priority transport corridors and routes between Asia and Europe, included those proposed by a series of Euro-Asian conferences on transport[46] held in Saint Petersburg, Russian Federation, since 1998, the OSJD Agreement[47] of 1997 and a project of United Nations regional commissions entitled "Capacity-building in developing interregional land and land-cum-sea transport linkages"[48] launched in 2002. Continuation of these efforts will also improve transport links between Central Asia and Europe and between East Asia and Central Asia.

3. SUBREGIONAL INITIATIVES

Regional cooperation plays an important role in not only developing inter-country linkages but also in promoting access at the subnational level. The Asian Highway and Trans-Asian Railway networks now provide the main framework for trunk corridors for national, as well as interregional and subregional, movement of goods and people and have improved access both to subregional and national hinterlands.

a. Subregional intergovernmental organizations

Most subregional cooperation in transport infrastructure is promoted under the frameworks of subregional, intergovernmental organizations such as the Association of Southeast Asian Nations[49] (ASEAN), the Economic Cooperation Organization[50] (ECO), the Pacific Islands Forum,[51] the South Asian Association for Regional Cooperation[52] (SAARC), and the Shanghai Cooperation Organization[53] (SCO) which cover a multitude of economic

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[45] *Containerization International*, October 2005 (www.ci-online.co.uk).

[46] Four main Euro-Asian transport corridors were identified in 2000: the Trans-Siberian, TRACECA, Southern, and the North-South Corridors.

[47] The OSJD "Agreement on organizational and operational aspects of combined transport between Europe and Asia and related installations" identified and formalized a number of Euro-Asian railway corridors/routes with those in Asia constituting a part of the Trans-Asian Railway.

[48] Both road and railway corridors and routes were identified for transport between Asia, Europe and the Middle East.

[49] ASEAN was founded in 1967. Its current members are Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam (website: www.aseansec.org).

[50] ECO was founded in 1985. Its current members are Afghanistan, Azerbaijan, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan (website: www.ecosecretariat.org).

[51] Current members: Australia, Cook Islands, Micronesia (Federated States of), Fiji, Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu (website: www.forumsec.org.fj).

[52] SAARC was founded in 1985. Its current members are Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka (website: www.saarc-sec.org).

[53] SCO was proclaimed in 2001 by China, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan and Uzbekistan (website: www.sectsco.org).

sectors. The Commonwealth of Independent States[54] (CIS) consisting of countries which formed part of the former Soviet Union, includes some countries located in Asia, as does the Intergovernmental Commission of the Transport Corridor Europe Caucasus Asia[55] (IGC-TRACECA). Yet, there are large differences between these subregional organizations. They pursue different levels of integration and different types of cooperation. These organizations have typically set up one or more technical bodies[56] to deal with transport,[57] concluding international transport agreements[58] and adopting long-term visions that include elements of transport infrastructure development (for example, ASEAN 2020 and the ECO Vision 2015).

b. Other arrangements

An increasing number of programmes, projects and initiatives have been started that include elements of subregional cooperation in transport. ESCAP has promoted these initiatives and collaborated on a number key areas

An increasing number of other programmes, projects and initiatives have been started that include elements of subregional cooperation in transport. ESCAP has promoted these initiatives and collaborated on a number of key areas.

ESCAP has been working closely with ADB, supporting its comprehensive subregional cooperation programmes in Asia and the Pacific, all of which include components related to integrated transport. These include the Greater Mekong Subregion (GMS); the South Asia Subregional Economic Cooperation (SASEC); the Central Asia Regional Economic Cooperation (CAREC); the Brunei Darussalam, Indonesia, Malaysia, Philippines-East ASEAN Growth Area (BIMP-EAGA); the Subregional Economic Cooperation in South and Central Asia (SECSCA); and the Pacific Plan for the small island developing States in the Pacific Ocean.

At the request of, and following consultations with the Central Asian republics, the Economic Commission for Europe (ECE) and ESCAP jointly initiated a programme in 1997 focusing specifically on economic issues of concern to those countries. The United Nations Special Programme for the Economies of Central Asia, or SPECA, assists the participating countries in strengthening cooperation for their economic development through more efficient use of resources and facilitation of their integration into Europe and Asia.

ESCAP has also collaborated with the UNDP-supported Tumen River Area Development Programme, a joint project of the five countries in North-East Asia.

In the railway sector, the Organization for Railways Cooperation (OSJD) concluded an agreement on organizational and operational aspects of combined Euro-Asian transport in 1997. This agreement identified a number of Euro-Asian railway corridors and routes.

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[54] The Commonwealth of Independent States was created in 1991. Its current members are Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

[55] Current members include Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Romania, Tajikistan, Turkey, Ukraine and Uzbekistan (website: http://igc.traceca-org.org).

[56] Examples: 20 transport-related bodies of ASEAN, Transport Coordinating Committee of CIS, and the SAARC Technical Committee on Transport.

[57] Note that IGC-TRACECA is works only on transport issues.

[58] For example, the ECO Transport Transit Framework Agreement of 1998 and the CIS protocol on international roads in 1998.

ESCAP has concluded a number of memorandums of understanding to formalize its collaboration in promoting subregional and regional cooperation in transport with International Union of Railways (UIC), Organization for Railways Cooperation (OSJD), Asian Development Bank (ADB), International Road Federation (IRF), Korea Transport Institute (KOTI), the Korea Maritime Institute (KMI), Asian Institute of Transport Development (AITD), CPD and others.

Other notable subregional cooperation initiatives include:

- The Brunei Darussalam, Indonesia, Malaysia, Philippines East ASEAN Growth Area (BIMP-EAGA);
- Indonesia, Malaysia, Thailand-Growth Triangle (IMT-GT);
- Indonesia, Malaysia, Singapore-Growth Triangle (IMS-GT);
- ASEAN Mekong Basin Development Cooperation (AMBDC);
- The Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS).

4. SMALL ISLAND DEVELOPING STATES IN THE PACIFIC

The ESCAP Pacific Operations Centre (EPOC) provided technical assistance and advisory services to Pacific island countries in various areas including port related issues

Distance and isolation have resulted in relatively high transport costs for many small island developing States. The quality and frequency of international shipping and air services are largely beyond their control. Domestic markets are too small to provide economies of scale and the remoteness of many rural and outer-island communities constrains options and increases costs.

The Programme of Action for the Sustainable Development of Small Island Developing States[59] and its follow-up, the Mauritius Strategy for the Further Implementation of the Programme of Action,[60] form the basis of much of the regional cooperation in the field of transport and communications in the Pacific, focusing on environmental, infrastructure investment and maintenance issues.

The ESCAP Pacific Operations Centre (EPOC) provided technical assistance and advisory services to Pacific island countries at the request of their respective Governments in various socio-economic areas, including port-related issues.

The Pacific Islands Forum, which represents the Heads of Government of all the independent and self-governing Pacific island countries, Australia and New Zealand, conducted a Pacific Regional Transport Study (2004) and drew up the Forum Principles on Regional Transport Services, which addressed aviation and maritime commercial and regulatory issues.

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[59] *Report of the Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, Barbados, 25 April-6 May 1994* (United Nations publication, Sales No. E.94.I.18 and corrigenda), chap. I, resolution 1, annex I.

[60] *Report of the International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, Port Louis, Mauritius, 10-14 January 2005* (United Nations publication, Sales No. E.05.II.A.4 and corrigendum), chapter I, resolution 1, annex II.

E. THE WAY FORWARD IN REGIONAL TRANSPORT COOPERATION

To further promote cooperation and an inclusive approach to development of the region's transport sector, the secretariat will continue to work with subregional intergovernmental bodies and development partners

This chapter has illustrated the importance of transport in the economic and social development of the region, the levels of investment required in order that it can continue to effectively support the development process and the priority that member and associate members of ESCAP have placed on regional cooperation in the sector.

To further promote cooperation and an inclusive approach to development of the region's transport sector, the secretariat will continue to work with subregional intergovernmental bodies and development partners including: ECE, ESCWA, ECA, UNCTAD, UNDP, World Bank, Tumen River Area Development Programme (TRADP), the UNDP Silk Road Area Development Programme, Forum Secretariat, Asian Development Bank (ADB), ASEAN, ECO, SAARC, Shanghai Cooperation Organization (SCO), Commonwealth of Independent States (CIS), ICG-TRACECA, Organization for Railways Cooperation (OSJD), International Union of Railways (UIC), International Road Federation (IRF), International Road Transport Union (IRU), International Coordinating Council of Trans-Siberian Transportation (CCTST), the Korea Maritime Institute (KMI), Korea Railroad Research Institute (KRRI), Korea Transport Institute (KOTI) and Asian Institute of Transport Development (AITD).

While later chapters will consider the general issues of enhancing regional cooperation in infrastructure development, including the sources of funds for such development, the following section considers a number of proposals that are specific to the transport sector.

With respect to the Asian Highway and Trans-Asian Railway, the secretariat will continue to assist member countries in identifying investment requirements and in promoting partnerships with potential donors.

1. STRENGTHENING THE INSTITUTIONAL FRAMEWORK FOR REGIONAL COOPERATION

One mechanism to institutionalize regular (and more frequent) meetings of Asian and Pacific ministers of transport is through the establishment of an institution that would perform functions similar to, although perhaps more limited than, those of the European Conference of Ministers of Transport

In Europe, ECE, the European Union and the European Conference of Ministers of Transport[61] are providing effective mechanism to promote the development of an increasingly efficient and closely integrated transport network. Under the auspices of these organizations, frequent meetings of the highest level policymakers are creating the opportunity to speedily plan, develop and implement strategies responsive to the needs of individual countries and the European region as a whole.

In view of the increasingly rapid development of the transport in the ESCAP region at the national, subregional and regional levels, continuing policy guidance is required at the ministerial level to address emerging issues and promote regional integration. One mechanism to institutionalize regular (and more frequent) meetings of Asian and Pacific ministers of transport is through the establishment of an institution that would perform functions similar to, although perhaps more limited than, those of the European Conference of Ministers of Transport.

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[61] See www.cemt.org.

The functions of such an arrangement, which could meet biennially with ESCAP acting as the secretariat,[62] will be considered at the Ministerial Conference on Transport, to be held in November 2006. The functions could include: (a) identifying and articulating regional transport issues; (b) developing long-term regional policies/strategies; (c) developing and prioritizing regional action plans; (d) reviewing, monitoring, evaluating and coordinating programmes of regional development partners; (e) enhancing the momentum of regional cooperation and integration initiatives in the transport sector; (f) resolving issues that are creating impediments to achieving regional visions and goals; (g) interacting with international financial institutions and bilateral donors; (h) mobilizing resources and promoting public-private partnerships.

Meetings could be held at intervals of two years and could include the convening of sessions of ministers of subregional organizations.

2. DEVELOPING THE REGION'S TRANSPORT NETWORK: INFRASTRUCTURE

In Commission resolution 60/1 of 28 April 2004 (Shanghai Declaration), members and associate members declared that "in the area of managing globalization, we will strive to develop an integrated intermodal transport network in Asia and the Pacific as well as Asia-Europe transport corridors." In so doing, they recognized the importance of the network concept, including connectivity and interoperability both within and between different transport modes.

Any capacity constrained, inefficient or "missing" links or nodes affect the efficiency of movements from origin to destination along individual routes and over the network as a whole. Consequently, in developing an integrated intermodal transport network there is a need to ensure that all of the constituent elements are contributing to the network's overall efficiency. The Commission's work in developing the Asian Highway and Trans-Asian Railway are both supporting this end and the mechanisms for addressing modal issues are being set in place, though the Working Group on the Asian Highway and the Working Group on the Trans-Asian Railway network. As part of the way forward in the transport sector, activities need to be intensified in: (a) upgrading modal infrastructure links and nodes (including substandard and capacity constrained sections, border crossings and break-of-gauge points); (b) promoting the re-emergence of railways in the intermodal system; (c) addressing infrastructure connectivity issues at modal interchange points (including seaports and dryports); and (d) promoting the improvement of infrastructure asset management and maintenance (in particular, the creation of earmarked road funds for maintenance).

3. DEVELOPING THE REGION'S TRANSPORT NETWORK: LOGISTICS AND FACILITATION

There is a need for initiatives to promote the more efficient use of existing infrastructure. Examples include:

There is a need for initiatives to improve cross-border facilitation, moving towards consistency in transport-related agreements

[62] The secretariat of the European Conference of Ministers of Transport is located in the secretariat of OECD.

Increasing attention should be given to enhancing the efficiency of unimodal and intermodal routes and corridors between origins and destinations of trading partners

(a) Improving cross-border facilitation through, among others, the implementation of pilot or demonstration projects based on “single window” or “one-stop shop” concepts for cross-border customs, trade and transport facilitation;

(b) Moving towards consistency in transport related agreements within the ESCAP region as well as between subregions.

To promote the competitiveness of the region within the globalization process, increasing attention should be given to enhancing the efficiency of unimodal and intermodal routes and corridors between origins and destinations of trading partners.

Annex

Data and methodology

Data on transport infrastructure stocks used for the estimates were taken from the *ESCAP Statistical Abstract of Transport in Asia and the Pacific, 2005*[a] as well as *ESCAP's Maritime Policy Planning Model (MPPM)*[b] and the *Asian Highway database*. The economic data was drawn from official statistics contained in the United Nations Common database[c] and the conservative IMF forecasts.[d]

Separate estimates were made for each transport subsector, based on a common dynamics-as-usual assumption. Both investment and maintenance costs are included, except in the case of container ports and urban mass-transit. Mobile equipment (such as railway rolling stock, aircraft, and trucks) is only included in the estimates for railways and urban mass-transit. For most subsectors, the methodologies used are similar to those employed by the 1994 ESCAP theme study[e] as well as for the recent ADB/WB/JBIC study,[f] where scenarios are made for infrastructure stocks which are converted into capital costs using average unit costs (see annex table III.1).

Annex table III.1. Unit costs assumed for the ESCAP estimates, in real 2004 prices

	Unit costs (United States dollars)	
Roads	$ 410,000 per kilometre	everywhere except South Asia
	$ 300,000 per kilometre	in South Asia
Railways	$ 900,000 per kilometre	everywhere
Ports	$ 80 million per berth	world class hub port (500,000 TEU per berth)
	$ 60 million per berth	major port with mainline services (400,000 TEU per berth)
	$ 60 million per berth	important secondary port (350,000 TEU per berth)
	$ 40 million per berth	feeder or regional port (250,000 TEU per berth)
	$ 40 million per berth	minor port using multi-purpose facilities (150,000 TEU per berth)
Airports	$ 300 per 1 passenger capacity	everywhere

Source: ESCAP secretariat.

[a] ESCAP, Transport and tourism data for Asia and the Pacific (http://www.unescap.org/ttdw/data/index.aspx).

[b] ESCAP, *Regional Shipping and Port Development Strategies: Container Traffic Forecast*, Monograph Series on Managing Globalization (ST/ESCAP/2398), 2004 (http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=183).

[c] United Nations, United Nations Common Database (http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp).

[d] Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

[e] ESCAP, *Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation* (ST/ESCAP/1364), 1994.

[f] Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

Future scenarios for road, railway and airport stocks were based on the assumption of continued network growth and upgrading including maintenance costs on the order of 2 per cent of capital stock per year for road and rail and three per cent for airports. Future growth of infrastructure stocks was reduced in some cases where "big-push" development occurred recently. Unit costs for airports are consistent with those implied in International Civil Aviation Organization's estimates for 2000 to 2010.[g] Due to the methodology used and the fact that many countries in the region do not invest sufficient amounts in maintenance, the expected increase in investment needs in the future is likely to be underestimated.

Estimates for major container ports were taken from recent results of the ESCAP MPPM model runs for 2002 to 2015[h] that forecast individual flows between all major container ports in the world and are strongly correlated with expected economic and trade growth. It should be noted that only capacities of major coastal container ports are taken into account. The estimates do not include smaller container and general cargo berths, liquid and dry bulk ports and inland waterway ports. In the case of the Russian Federation, only ports on the Pacific coast were included. Assumed unit costs (see annex table III.1) include only costs to develop new terminals, including handling equipment. Additional costs of dredging, the provision of breakwaters and the establishment of land transport links and intermodal interchanges would easily double the reported investment requirements for container ports.

Investment requirements for mass-transit infrastructure in urban areas are based on national statistics and the lists of major current or proposed projects as published in the *ESCAP Review of Developments in Transport 2005,*[i] *2003*[j] *and 1996-2001.*[k]

Comparison with other estimates

The estimate presented above a comprehensive estimate of transport investment requirements in the ESCAP region for 2005-2015. There are studies by Fay and Yepes (2003)[l] and Yepes (2005)[m] that present investment and maintenance requirements for roads and railways for the world as a whole for 2005 to 2010. Estimates in the latter study for East and South-East Asia were

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[g] ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (http://www.unescap.org/ttdw/PubsDetail.asp?IDNO=178) and *Transport and Tourism Data for Asia and the Pacific* (http://www.unescap.org/ttdw/data/index.aspx).

[h] ESCAP, *Regional Shipping and Port Development Strategies: Container Traffic Forecast*, Monograph Series on Managing Globalization (ST/ESCAP/2398), 2004 (www.unescap.org/ttdw/PubsDetail.asp?IDNO=183).

[i] ESCAP, *Review of Developments in Transport in Asia and the Pacific* (ST/ESCAP/2392), 2005 (www.unescap.org/ttdw/PubsDetail.asp?IDNO=178).

[j] ESCAP, *Review of Developments in Transport in the ESCAP Region* (ST/ESCAP/2307), 2003 (http://ttd_webserver/ttdw/PubsDetail.asp?IDNO=141).

[k] ESCAP, *Review of Developments in Transport and Communications in the ESCAP Region*, 1996-2001 (ST/ESCAP/2157), 2001 (http://ttd_webserver/ttdw/PubsDetail.asp?IDNO=93).

[l] Marianne Fay and Tito Yepes, "Investing in infrastructure: what is needed from 2000 to 2010?", World Bank Policy Research Working Paper No. 3102, July 2003 (available online at www.worldbank.org).

[m] Tito Yepes, "Expenditure on Infrastructure in East Asia Region, 2006-2010", a background paper for Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

also used in the recent joint study by ADB World Bank and JBIC.[n] In absolute terms, the Yepes (2005) estimates are larger than the earlier 2003 estimates. This was due to the use of a different base year that takes into account the recent rapid development in the early twenty-first century.

When expressed *in terms of shares of GDP*, the ESCAP secretariat estimates presented above are roughly in line with those for transport subsectors contained in the Fay and Yepes studies. For example, both foresee annual investment and maintenance needs of roughly 0.1 per cent of GDP for railways and 1 per cent of GDP for roads for the ESCAP region as a whole. In part this is due to the fact that all these studies assume almost identical average unit costs (annex table III.1).

However, the overall *absolute* ESCAP estimate is considerably larger than in the other studies for the following reasons: The ESCAP study (i) comprises more transport subsectors; (ii) uses a more complete dataset, particularly for roads;[o] (iii) includes the three developed countries of the region;[p] (iv) uses a newer base year (2003/2004) and takes into account the renewed dynamism of Asia after the Asian financial crisis; (v) does not include old data for 1960 to 1980 which reflected a transition in the development paradigm to one dominated by IPNs since the 1980s; and (vi) does not include a statistical relationship with GDP per capita, thereby allowing for continued, higher infrastructure investments already at a lower GDP per capita which better reflects the realities of IPN participation.

The ESCAP estimates are line with the reported actual total expenditure on transport infrastructure and are consistent with reported ongoing or planned major infrastructure projects as reported in the ESCAP *Review*. Finally, the results for the latter half of the 1990s are roughly in line with estimates reported in the 1994 ESCAP theme study (annex table III.2), except for roads where lower unit costs were assumed previously.

Annex table III.2. ESCAP theme study 1994 results of expected annual average investments for the ESCAP region for 1993 to 2000

ESCAP theme study 1994 estimates					
Annual average investments per year [billion (2002) United States dollars]					
Total	**Roads**	**Railways**	**Airports**	**Container ports**	**Urban mass-transit**
55	20.6	9.75	8.14	4.64	12.34

Source: ESCAP, *Infrastructure Development as a Key to Economic Growth and Regional Economic Cooperation* (ST/ESCAP/1364) 1994.

Notes:

[a] It should be noted that the definition of ESCAP region has changed since 1994. Country coverage in the 1994 study was smaller, in particular in the case of Central Asia and South-West Asia.

[n] Asian Development Bank, Japan Bank for International Cooperation, World Bank, *Connecting East Asia: A New Framework for Infrastructure* (Washington D.C., World Bank, 2005).

[o] Data available for 42 (of 57) ESCAP members and associate members in the ESCAP region, accounting for 99.1 per cent of the region's GDP.

[p] Even though their share is actually small in terms of investments in new fixed assets.