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Final Report

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1. PREAMBLE

This Railway Strategy Study is the first step in developing and implementing a seamlessly integrated railway system in the GMS. The need for the study is born out of the fact that there is much more to cross-border traffic than building infrastructure. Integration requires that cross-border procedures such as immigration, customs and health clearance are in place and technical and operational standards are compatible and mutually recognized or, if that is not possible, that procedures and facilities (such axle change at borders) are in place to overcome remaining differences.

The railways in the GMS have developed over the last 100 years and are today, with the exception of Viet Nam and PRC, a collection of national railway networks that do not interconnect with other GMS railways. As a result, each national railway has developed into a unique system with its own standards and procedures. Apart from constructing the necessary interconnections between these railways, successful interconnection will require that the multitude of existing technical standards and operational procedures converge towards common standards to enable trains to flow seamlessly between the national railway systems. Interconnection will also require that entirely new procedures are introduced in some countries, such as ticketing for international passenger travel where effective interconnection requires that, say, a traveler starting in Hanoi, can buy one ticket that is valid for transport through to Bangkok. For this to work, the national railways along the route must recognize the ticket issued in Viet Nam and procedures must be in place for sharing the payment for that ticket between the railways that jointly perform the transport.

In a diverse environment such as the GMS, integration must start with identifying an initial common framework for interconnection that would enable all national railways to join the GMS railway network at reasonable cost and within a reasonable time. The GMS Railway Strategy Study is intended to deliver such a starting point. Once the initial framework is agreed between the GMS countries, the next steps would be conducting national studies to determine how each national railway most efficiently can move towards meeting the agreed initial framework and thereby be brought into the common GMS railway network; implementing the required physical interconnections and establishing effective cooperation at many levels between the national railways to enable increasing integration in the future.

The agenda for railway integration is huge but the GMS countries have certain advantages that can ease and speed-up the process. Some of the GMS railways (in PRC, Thailand and Viet Nam) already operate international connections, which provide a useful starting point for establishing international connections within the GMS. The GMS economies are developing rapidly and all countries have plans for upgrading their transport infrastructure. The additional costs of adapting such plans to a regime of common railway standards would be relatively low compared with the cost of integrating mature railway systems. Most of the national railways are already undergoing modernization which ease introduction of institutional and operational integration and,

finally, many of the agreements that are required for cross-border traffic are common for all modes and have already been established under the GMS Cross Border Transport Agreement. Adapting these agreements to railway traffic would be relatively easy and could give integration of railway traffic in the GMS a head start.

2. INTRODUCTION

The countries of the Greater Mekong Subregion (GMS)—Cambodia, People's Republic of China (PRC), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam—have expressed their desire, through the GMS Economic Cooperation Program, for better transport connectivity to improve the environment for trade. The GMS Transport Sector Strategy Study (TSSS), approved on 20 October 2004, developed a strategy and plan for further integration of transport in the GMS until 2015; these were endorsed by the GMS governments at the summit meeting of heads of government on 4–5 July 2005.

One of the key recommendations of the TSSS was to widen the GMS transport strategy to include not only roads, but also railways and other modes of transport. The TSSS performed a subregional traffic demand study, which confirmed that there is significant demand for subregional railway services. The report also noted that, beyond preparing the Singapore–Kunming Rail Link (SKRL) plan, which was formulated in the early 1990s, no comprehensive subregional railway planning has been undertaken. At the third GMS summit in March 2008, the GMS heads of government noted the need to look into developing the GMS railway network to enhance connectivity between the six countries and to include railways in the scope of GMS cooperation.

The railways in the GMS have developed independently over the course of a century and are today, with the exception of the PRC and Viet Nam, and beyond GMS, Thailand and Malaysia, a collection of national railway networks that do not interconnect. Each national railway has developed into a unique system with its own standards and procedures (Figure 2.1). In view of escalating subregional trade, growing concerns over climate change, and, more recently, sharply fluctuating fuel costs, the GMS countries have accelerated their plans for upgrading their national railway networks and for interconnecting these by constructing new railway connections.

The TSSS recommended that a comprehensive and detailed railway study be undertaken to consider the medium-to-long-term requirement for a GMS railway system beyond the scope of the SKRL plan. The proposed study would consider route structure, quality of service, operating parameters, and financial and economic viability, and take into account technological developments since preparing the SKRL plan. The study would provide the GMS countries with a strategic framework based on a comprehensive analysis of options to integrate their railways by interconnecting and integrating the national railway systems, and an assessment of the resources required.

This study was carried out in 2009; the first draft report was discussed at the 13th Meeting of the Subregional Transport Forum in October 2009, after which further consultations with GMS countries were conducted and this document constitutes the final report.

Successful interconnection will require that the multitude of national technical standards and operational procedures converge toward common standards to enable trains to flow seamlessly between the national railway systems. Interconnection will also require that entirely new procedures are introduced in most countries, such as ticketing and sharing the payment for international passenger travel among the national railways along the route.

In a diverse environment such as the GMS, integration must start with identifying an initial common framework for interconnection that would enable all national railways to join the GMS railway network at reasonable cost and within a reasonable time. The agenda for railway integration is huge but the GMS countries have some advantages that can ease and speed-up the process. Some of the national railways (in the PRC, Thailand, and Viet Nam) already operate international connections, which provide a useful starting point for establishing international connections within the GMS.

The GMS economies are developing rapidly and all countries have plans for upgrading their transport infrastructure. The additional costs of adapting such plans to a regime of common railway standards would be relatively low compared with the cost of integrating mature railway systems. Most of the national railways are already undergoing modernization, which could ease the introduction of institutional and operational integration; many of the agreements that are required for cross-border traffic are common for all modes and have already been established under the GMS Cross Border Transport Agreement (CBTA). Adapting these agreements to railway traffic would be relatively easy and could give impetus to integrating railway traffic in the GMS.

This strategic framework for connecting GMS railways is the first step in developing and implementing a seamlessly integrated railway system in the subregion. The following chapters provide information on the present status and planned developments of national railways in the GMS and the actions needed to enable them to become more efficient and reliable. The economic and trade outlook for the GMS countries is described next, which provides the basis for projections and an economic analysis of freight and passenger traffic on four potential routes to link the GMS countries. Finally, a strategic framework is presented that will help make connecting GMS railways a reality.

The next steps will be (i) conducting national studies to determine how each national railway can move most efficiently toward meeting the requirements set out in the strategic framework and thereby be brought into the common GMS railway network, (ii) implementing the required physical interconnections, and (iii) establishing effective cooperation at many levels between the national railways to enable increasing integration in the future.

Figure 2.1 – Map of present and planned railway lines in the Greater Mekong Subregion

3. STATUS OF GMS RAILWAYS

3.1 INTRODUCTION

How should development of the GMS railway network be undertaken? What needs to be done to ensure an efficient interconnected network that is attractive to shippers and passengers?

The first step in answering these questions is to understand the current status of GMS railways. Following a review of studies and reports on GMS railways, study missions were held in all GMS countries (except Lao PDR). During the missions, meetings were held with representatives of the national railways and with the Ministries or government entities responsible for rail transportation. Meetings were also held with rail freight shippers, shipper organizations and other rail user organizations in order to gain their perspectives on the performance of the railway and opinions on the direction for the development of a GMS rail network. All full list of the stakeholders consulted is provided in Appendix A. Train trips were taken as below:

- Nanning to Hanoi (Gia Lam);
- Hanoi to Lao Cai;
- Hanoi to Ho Chi Minh City;
- Phnom Penh to Sihanoukville;
- Bangkok to Nakhon Ratchasima.

Following the presentation of the draft report at the 13th Meeting of the Subregional Transport Forum in October 2009, further consultations were held with GMS countries from December 2009 to January 2010 to discuss the initial study findings

It is not the intention here to provide a statistical and organizational overview of each of the GMS railways as this information is available from other sources - rather what follows are summaries of the current situation in each country of relevance to the development of GMS rail strategy. This is followed by an assessment of the issues that we think will need to be addressed to achieve an integrated and efficient rail network in the GMS.

It is also important to note that, with the exception of PRC and Viet Nam, GMS countries do not have coherent national rail sector strategies. This does not mean that the countries do not have plans. However the overall objectives, investment priorities and strategies for development have not been clearly defined and approved by governments as agreed policy. This has made it very difficult to achieve a subregional consensus on rail network priorities, as a result the concept of a connected regional network has languished.

3.2 CURRENT DEVELOPMENTS IN GMS RAILWAYS

All GMS countries are considering ambitious railway development plans, and Myanmar, PRC, Thailand and Viet Nam, are already making huge investments in new lines or in the upgrading of existing lines. PRC, Thailand and Viet Nam are also embracing investment in high-speed rail. However, in comparison to the considerable amounts of infrastructure investments committed or proposed, much less attention is being paid to addressing, for example, rolling stock needs and the operational, organizational and institutional barriers to improving the performance of the national railway systems - issues raised by many current users and potential investors in the railway systems, which will be addressed later in this report. In effect, as eloquently expressed by one country representative for Thailand[1], the focus has been tilted towards "hardware" (primarily infrastructure development) rather than on "software" – improving the operational and organizational performance of GMS railways – measures that could be implemented with less capital investment.

3.2.1 Cambodia

With the signing of a Concession Agreement on June 12, 2009, Cambodia completed the concessioning of its railway to Toll (Cambodia) Ltd. The process is currently in a transition period and Toll took over responsibility for railway operations in October 2009.

Railway infrastructure is being rehabilitated at a cost of $142.1 million, $117.3 million of which is funded through loan agreements between the ADB, OFID and the Government of Cambodia. The Governments of Australia and Malaysia are providing grants of $21.5 million and $2.8 million (in kind), respectively.

Construction and rehabilitation is to be completed according to the planned schedule below.

Southern Line:

- Phnom Penh-Touk Meas : October 2010
- Touk Meas-Sihanoukville May 2011

Northern Line:

- "Missing link" Sisophon-Poipet: March 2012
- Sisaphon-Battambang March 2012
- Battambang-Phnom Penh: June 2012

Samrong Terminal Development: March 2013

[1] At GMS Senior Officials Meeting (SOM), Hanoi January 2010.

A feasibility study, (financed by a grant from PRC), for a line connecting Phnom Penh to the Viet Nam border is in progress and is expected to be completed in June 2010. Cambodia will need to decide how infrastructure and operations will be provided on this planned new line.

To complete the process of restructuring its railway, a new Railway Department has been created in the Ministry of Public Works and Transport. The Department will be responsible for managing the concession agreement and for future railway development in Cambodia. With concessioning of the railway to Toll, Royal Railways of Cambodia, the former operator of the railway, ceased to exist and responsibility for assets and staff (surplus to the concessionaire's needs) will be transferred to the new Department.

3.2.2 Lao PDR

A new train service operating from Bangkok over the Friendship Bridge to Thanalaeng opened in March 2009. Trains are operated by SRT under control of the Lao Railway Authority.

A feasibility study for the completion of a 9-kilometre link from Thanalaeng to Vientiane was recently completed. The estimated cost of construction is approximately $25 million.

Lao PDR is considering the feasibility and sequence of development of other railway connections, including:

- To Viet Nam, by construction of lines from Vientiane to Tha Khaek and from Tha Khaek to Mu Gia. (Part of a priority route as adopted in the Vientiane Action Plan of the 10th ASEAN Summit.);
- To PRC, by constructing a line from Vientiane through Luang Prabang to Boten on the PRC border;
- To Thailand, through either Tha Khaek, Savannakhet or Pakse;
- To Viet Nam, via a route from Savannakhet-Lao Bao.

The private sector is promoting the development of new rail lines to service several mines and industries. The first stage involves the construction of a 20-kilometre rail extension from Thanalaeng to Lak Sao-et and construction of an Inland Container Depot (ICD). Two other extensions of 50 and 90 kilometres are also proposed. Private investors appear to be interested in developing and investing in the construction of the proposed infrastructure. These potential developments will put considerable financial demands on Lao PDR and on the Lao Railway Authority, which has limited capacity and resources .

3.2.3 Myanmar

Myanmar is undertaking a major program of new line construction to enhance its national rail network. This will involve the addition of 2100 kilometres of new tracks to the existing 6,942-kilometre network, some of which are double-tracked.

Feasibility studies for international links to PRC (Lashio-Muse-Ruili) and Thailand (Thanbyuzayat-Three Pagoda Pass) were completed in 2007 and 2005 respectively. Sources of funding for these projects have not yet been identified.

The feasibility study for the line from Thanbyuzayat to Three Pagoda Pass (and thence to Nam Tok, Thailand) will need to be updated should the two countries agree to consider the rail connection.

3.2.4 PRC

PRC is planning to invest about 600 billion RMB ($171.5 billion) in railways each year from 2010 to 2012. The total investment in railways in the 11th five-year plan will be 1,870 billion RMB, or $267.1 billion. As part of this investment, PRC has started a $11.8 billion program to expand the capacity of the railway line between Kunming and Nanning. (An ADB loan of $300 million to contribute to this program is under consideration.)

Construction of the following standard gauge, dual track and electrified lines is underway:

- Yuxi-Mengzi ($662 million, to be completed in 2011);
- Menghzi-Hekou link to the Viet Nam border ($1.2 billion, to be completed in 2-3 years); and
- Dali-Ruili line to the Myanmar border ($2.2 billion, to be completed in 2013).

PRC is also considering construction of a line from Yuxi to Mohan in order to connect to Lao PDR. Construction has not yet started.

3.2.5 Thailand

On November 17, 2009, the Cabinet of the Government of Thailand decided to restructure SRT into three main business units: Traffic (operations), Asset management, and Maintenance and one wholly-owned subsidiary, the Airport Rail Link. In December 2009, the Cabinet also approved an investment of 153,053 million Baht in railways for the period 2010-2014.

Thailand's rail net work consists of 4,052 kilometres of which 289 kilometres are double-tracked. To expand its network capacity, as part of the investment program approved in

December 2009, Thailand plans to invest 66,110 Million Baht to double-track another 767 kilometres. Some of the other components of the investment plan are:

	Baht (million)
Track and infrastructure upgrading:	51,125
Signalling & telecomm	19,014
Locomotives and passenger train sets:	16,025

State Railway of Thailand (SRT) has also completed a track strengthening and upgrading program on 1,539 kilometres of track. This involved the installation of heavier rail and concrete sleepers, which has increased axle loads from 15 to 20 tons and maximum speeds from 80k/hr to 120 km/hr on the rehabilitated lines. Another 586 kilometres are scheduled to be upgraded in the next phase.

Thailand is studying the feasibility of high-speed trains on routes from Bangkok to Rayong and between Bangkok and Nakhon Ratchasima. Thailand is also studying the development of rail lines from Bua Yai to Mukdahan and from Nakorn Phanon to Tha Khek to link with Lao PDR. Thailand has not yet approved a budget for the upgrading of the eastern line to Aranyaprathet or to re-construct the 6 kilometres needed to link with Cambodia.

In November 2009, the Cabinet approved the restructuring of SRT into three main business units: traffic (operations), asset management, and maintenance and one wholly-owned subsidiary, the Airport Rail Link.

3.2.6 Viet Nam

In 2002 Vietnam's Prime Minister approved a Master Plan for the development and modernization of the railway network. The objective of the plan is to significantly increase the railway's share of the transport market - to 25% of freight tons and 20% of passengers. The plan calls for approximately $7 Billion to be invested by 2020.

The Master Plan recognized that railways in Vietnam have deteriorated and that significant investment is needed. Major components of the Master Plan include:

- Extensive rehabilitation and upgrading of the Hanoi to Ho Chi Minh City line.
- Upgrading of the line from Hanoi to Dong Dang, which links to Nanning, PRC.
- Electrification of the Hanoi – Haiphong rail line. Developing international links to Lao PDR and Cambodia.

- Modernizing locomotives and rolling stock and constructing new repair facilities.
- Building facilities for the manufacture of locomotives, wagons and passenger coaches – with the intent of also developing export capacity.
- Renewing fibre optic telecommunication systems and modernizing signalling systems.
- Developing of capacity for production of spare parts.
- Upgrading passenger and freight stations.
- Developing interchange hubs in order to integrate modes of transport.
- Introducing the use of information technology to railway operations and management.
- Re-organizing VNR and investing in training and human resource development.

Upgrading of the track and infrastructure between Yen Vien and Lao Cai on the Haiphong-Hanoi-Lao Cai line is expected to start shortly and will be financed through an ADB loan.

Concurrently, Viet Nam is planning the to develop high-speed railway system between Hanoi and Ho Chi Minh City, based on Japan's Shinkansen technology. This project is expected to cost between $33 and $57 Billion. Feasibility studies are being carried out, with assistance from Japan, that will enable the refinement of the system. Concurrently, Vietnam is undertaking a feasibility assessment of the potential for developing a high-speed (standard gauge) railway system between Hanoi and Ho Chi Minh City. According to Viet Nam Railways (VNR) and Ministry of Transport officials, since a high-speed system will take almost a decade to complete, the intent is to maintain the metre gauge network in parallel for freight train operations and to use the high-speed system for passenger trains.

Viet Nam is planning to construct two important GMS links – from Ho Chi Minh City to Loc Ninh to connect to Cambodia and from Vung Anh to Lao PDR through Mu Gia. A feasibility study for the connection to Cambodia is underway and the study the Vung-Anh-Mu Gia line has been completed.

The process of corporatizing VNR is proceeding. Infrastructure is now fully separated from operations and a new accounting system to facilitate this separation (among other things) is partially operational.

Several private passenger train companies have been established, and they are now providing services. Several joint stock companies have also been established to manage rail freight forwarding.

3.3 ASSESSMENT OF GMS RAILWAYS

3.3.1 Capacity Expansion

Based on the preceding summaries, it is clear that GMS railways are investing (or plan to invest) heavily in track upgrading and in the construction of new lines. Whether this investment is directed at real (or projected) capacity constraints or to the achievement of national social, economic or environmental objectives is unclear. What is clear however, is that infrastructure construction has been given much more attention than other important investment components, which can also expand capacity such as: investment in rolling stock and signalling, telecommunications and train control.

Many of the locomotives and other types of rolling stock in service in the railways of Viet Nam, Thailand, Myanmar and Cambodia are nearing the end of their useful life and need to be replaced or upgraded.

Most of the locomotives in service are not fuel-efficient, as they have not been upgraded with new technology. Funds have not been available for routine maintenance, resulting in breakdowns and low rates of availability. Traction motors are in short supply, as are bogies.

Similarly, wagons (except for those recently acquired) are generally in poor condition and standard. Wagon parts are in short supply. The condition of coaches is basic, except for upper class travel coaches and some refurbished coaches used in Viet Nam on premium services.

Locomotive and rolling stock maintenance facilities also need to be upgraded and modernized.

These problems will need to be addressed just to service current demands, not to mention the additional locomotives, wagons and coaches that will be needed to meet the demands of planned new lines and the projected freight and passenger demands. The inadequacy of locomotives and rolling stock, specifically low levels of availability and reliability was a major concern expressed by freight shippers interviewed during this study. Shortages are already occurring in Myanmar, Thailand and Viet Nam. Major rail shippers in Thailand stated that the State Railway of Thailand (SRT) simply could not deliver the required locomotive power when needed.

Investments required will be considerable, yet in many railway planning exercises and feasibility studies, there appears to be a disproportional emphasis on track construction, compared to the significant investments required in locomotives, rolling stock and related facilities that will be needed to service the traffic which will emerge from an interconnected GMS rail network.

It would be unfortunate if, after countries invested in the construction of new railway lines, a shortage of locomotives and rolling stock continued to constrain capacity. To

support effective investment planning, an assessment of the need for locomotives and rolling stock and related maintenance facilities is critical to ensure that the GMS rail network will have the capacity to meet future freight traffic and passenger travel demands.

Locomotive and rolling stock needs assessments need to be undertaken

Investments in new communications and signalling systems and automated train control have a huge potential to eliminate bottlenecks. In some instances, the introduction of a modern communication technology, combined with the construction of more (or longer) passing loops is a viable alternative to extensive double tracking (as proposed in Thailand for example) and would ultimately be less costly.

Similarly, centralized or automated train control systems provide the means to manage capacity more effectively and even to expand it. Europe is in the process of implementing a region-wide Rail Traffic Management System (ETMS) and North America is embracing Positive Train Control, both wireless based systems using GPS tracking. These types of systems should be given careful consideration in the identification and evaluation of investments needed to build and upgrade GMS railway lines. It is much more practical to build these systems into new lines and operations now rather than later.

Furthermore, good signalling/telecommunications and train control systems are prerequisites for safe rail operations. In the GMS, the quantum of uncontrolled railway level crossings is enormous and the degree of encroachment on railway rights of way is frightening. ,More attention needs to directed to developing modern standards for rail safety and taking action to enforce rules. The focus of this should be regional in the interest of promoting interconnectivity and interoperability. Poor enforcement of rules, regulations and encroachment are factors that have diminished the interest of the private sector in undertaking railway operations – the insurance risk is simply too high.

3.3.2 Human Resource Development

It is axiomatic that any organization is only as good as its people. The majority of staff in GMS railways (and the staff of supporting ministries) are dedicated and committed and they work long hours for low pay. However, the need for pay reform, skills upgrading and training in modern railway practices and on the use and application of the latest technology has been neglected. Assessments of the training needs for the GMS railways or government railway departments need to be undertaken.

Human Resources development and training has been neglected.

3.3.3 Management Information Systems

GMS railways collect vast amounts of data. However is this data being used to create more efficient railways? Data and information are often incorrectly referred to

interchangeably but they are not the same. Collecting data is a difficult task itself but the key is to turn this data into useful information in order to manage railways more efficiently.

GMS railways have not yet embraced information technology (IT), neither as a management tool nor as a means of expanding capacity. Management information systems in GMS railways, where they exist (predominantly in PRC and in other GMS railways mainly in financial management departments), do not provide managers with the timely (up to the minute) information necessary to manage capacity and, perhaps more importantly, to run a business. There have been significant developments in railway performance monitoring systems, involving the use of devices to monitor track and equipment. These systems have been implemented in North America and Europe and the potential for their application in GMS railway operations should be explored.

Similarly, cost accounting systems for setting tariffs and fares and in the assessment of profitability of services are clearly lacking in all GMS railways. While this is understandable, since governments largely set tariffs, proper pricing knowledge is an essential ingredient for efficient railway network operations. Similarly, infrastructure and rolling stock repair and maintenance histories are generally not automated, making it difficult to plan and schedule appropriate maintenance activities. Under conditions of scarce financial resources and difficult cash management this information is critical.

Other areas where IT improvements could be beneficial, especially in regard to enhancing the potential for interconnectivity include automated regional ticketing systems, shipment tracing and electronic data interchange (EDI).

3.3.4 GMS Railway Organizations, Institutions and Regulations

With the exception of the railway in Cambodia, which has now been concessioned to a private operator, all of the railways in the GMS are state-owned enterprises[2]. GMS railways are dependant on the state or on donor funding for most of the investment in infrastructure, locomotives and rolling stock and the state also covers operating losses.

There is nothing inherently wrong with state ownership of railways, or countries supporting their railways financially in order to achieve important national social and economic objectives. The problem is that GMS countries are now considering massive investments to restore and/or develop their railway networks and, with the exception of PRC, GMS countries do not have the required financial resources. Making matters worse, investments will be made in railways that are, (again except for PRC), in need of upgrading, are inefficient and for the most part, unprofitable and into railway sectors where regulatory regimes are not conducive to fostering successful railway operations.

From the 1980's until 2004, due to scarce financial resources, investment in railways by governments declined, resulting in a decline in the quality of railway infrastructure and other assets. Inevitably, railways were not able to meet the fierce competition that arose

[2] Infrastructure and operating assets remain state-owned.

from the road sector and therefore lost significant business to trucks. This created a "vicious circle" as governments became less willing to make investments in unprofitable railways and directed their investment to the development of the road network. As a result today, GMS railway's share of the transport market except in PRC is insignificant relative to other modes, as shown in Table 3.1.[3]

Table 3.1 – Traffic Modal Split Rail Vs Other Modes

Country	Passengers	Freight
Vietnam	6.5%	1.6%
Cambodia	0%	0%
Lao PDR	0%	0%
Thailand	5.7%	1.7%
Myanmar	N.A	N.A
PRC	34.8%	51.5%

2007 for Vietnam; 2005 for Thailand PRC
Sources: UNESCAP, World Bank

Governments often blame their railway organizations for the poor financial results and inefficiency. This criticism ignores the fact that governments have not adjusted the regulatory and legislative environments that their railways to operate in and therefore railways are unable to become more competitive and efficient. GMS railways are burdened with:

- Outdated railway sector legislation
- Outdated operating rules and procedures
- Too many employees
- Limited flexibility on tariffs and fares
- Limited freedom to manage and develop assets

Governments need to modernize their railway regulatory and legislative environments to enable their railways to become more competitive and efficient.

In Europe, the preferred restructuring strategy has been to separate infrastructure from operations and to encourage the development of potentially more efficient private train operations on public infrastructure. This has met with mixed success. Often, private operators compete directly with state-supported operating companies, which have different financial objectives. Private operators have experienced difficulties in negotiating infrastructure access charges and complain that access regimes are not transparent or that the infrastructure operator does not act independently. Perhaps most importantly, the "separation" approach underestimated the efficiencies that could be gained by simply restructuring vertically integrated state companies rather than from separating out infrastructure from operations.

[3] No data available for Myanmar.

In North America, freight railways are autonomous commercial enterprises and shares in major Class 1 railway companies are traded on public stock exchanges. Economic regulation of freight is minimal. Today, U.S. and Canadian freight railways are among the most productive (along with PRC) and profitable in the world and freight traffic moves seamlessly throughout the rail network. Governments are involved in ensuring safety and in the provision of capital and subsidies for the operation of rail passenger services. Passenger services are operated by state owned companies – AMTRAK in the U.S and VIA in Canada. These services are operated on the tracks of private freight railways.

In the GMS, only the PRC and Viet Nam have coherent national rail sector strategies. The other countries have plans for their railways but the overall objectives, investment priorities, and strategies are not clearly defined and approved by the respective governments.

Cambodia's rail sector has been significantly restructured as a result of concessioning to a private operating company. Cambodia has formed a Railway Department in the Ministry of Public Works and Transport, to oversee the concession and manage future railway development policy. Cambodia will need to decide how infrastructure and operations will be provided on the planned new line from Phnom Penh to the Viet Nam border. If the line is completed, regulation will be needed to address the interchange of traffic with the existing concession.

In Vietnam, corporatization of VNR began in 1994 and today the operation and maintenance of infrastructure is separate from passenger and freight train operations. The Vietnam Railway Administration (VNRA) is responsible for planning development of the sector, for construction of new lines and for securing financial resources for infrastructure maintenance. VNR pays 10 percent of its gross revenues to VNRA as a track access charge. These funds are generally used toward infrastructure maintenance.

New systems are being introduced to improve financial management and to improve the foundation for setting infrastructure access charges. However, Vietnam's Railway Reform Law, introduced in 2005, has not yet become the catalyst for attracting investment by the private sector in the construction of infrastructure, operation of freight trains or in the maintenance of infrastructure.

Planned investment in railways by Vietnam will require considerable funding – as much as $64 Billion depending on the cost of high-speed rail. Since VNR is a state-owned company the burden of funding this investment will fall mainly on the state.

It is unlikely that the Vietnam's Railway Master Plan can be fully implemented without significant participation by donors (bi-laterally and through multi-lateral institutions) and the private sector, since VNR is unable to generate its own funds for capital investment. The Master Plan has clearly identified the investment needs, yet has not addressed the

need to increase the pace of structural reform or re-organization of the rail sector – reforms that could attract investors and reduce the burden on the state,

In Thailand, despite government policies supporting the restructuring of SRT, promoting private participation in the rail sector and promoting the shift of freight from road to rail, little progress has been made, mainly due to the resistance of railway staff unions. Shippers report that the railway's marketing department is of little value to them because tariffs are not negotiable and the railway is unable to supply the required equipment in any event. The government is planning to separate infrastructure from operations; this will however require the development of an infrastructure access regime.

Lao PDR, which is considering major investments in railways has neither a regulatory regimen or a railway operator.

PRC is not considering structural reform; however, efforts have been made by the Ministry of Railways to encourage the formation of joint venture local railways, to reduce operating losses through more appropriate pricing of services and by encouraging non-government investment in infrastructure and in the provision of services.

Despite the progress made in the GMS on improving railway organizations to date, customer responsiveness of railway organizations remains weak. Commercial departments cannot respond to customer needs because they have little or no control over pricing and there is little they can do to modify services because the organization's orientation is to provide trains, not to serve the needs of customers or to generate profits.

To become financially viable, the railways must generate sufficient profit to sustain their operations and investments, and private investment must be encouraged. But GMS railways have limited capacity to increase revenue or to raise capital and the private sector is not interested in investing without reforms enabling more transparent and responsive regulatory regimes. These changes cannot take place in the GMS without restructuring the railway sector, which would provide a means to expand capacity and competitiveness, both of which help improving financial performance.

Change, not stasis is the solution. To be clear, we are not proposing that GMS railways immediately embrace a program of railway restructuring and regulatory reform. Nonetheless, in order to ensure the emergence of an efficient GMS railway network, planning needs to start now to avoid painful restructuring in the future. Otherwise, history will repeat itself and governments (and donors) will decide to target investment in other sectors. GMS railways will eventually need to stand on their own and become financially self-sufficient – or enter into another spiral of asset deterioration.

A dialogue to chart the best course for the future, involving all stakeholders—GMS railways, responsible ministries, donors, unions, users, and potential investors—should begin as soon as possible.

This dialogue could be accomplished through a series of regional forums or workshops on best practices. Convergence of opinion may be difficult to achieve, but at least the dialogue will have started, and if a consensus emerges it will reflect the national objectives of the GMS countries.

Regulatory and legislative reforms must be implemented before the restructuring of the sector or it will fail. New institutional arrangements will be needed to address such matters as: railway autonomy, tariff de-regulation, subsidies for imposed public service obligations, and operating and safety standards.

Support should be made available to VNR and to the Government of Viet Nam to continue the railway reform process. Viet Nam's achievements in corporatizing VNR and separating infrastructure from operations are significant – and this is reflected in an improved operating ratio – but more assistance is needed to support the continuation of the restructuring effort and to promote private freight operations.

Similarly, the Government of Thailand needs assistance to advance its restructuring of its rail sector. At this point it is difficult to even to discuss the topic given the extent of trade union resistance. The first step might be to convene a series of workshops to explain the rationale for restructuring and to identify the key union concerns.

One option may be to use Lao PDR to develop a model regime. Significant investments in rail infrastructure are contemplated, but Lao PDR presently has only limited rail infrastructure and minimal institutions for rail regulation. In effect, Lao PDR is a "green field" and presents an opportunity to develop a regional best practice.

3.3.5 Interoperability

Adoption of a common set of minimal technical and operating standards is crucial to network operation and interconnectivity. One need look no further than to the phone networks operating in each GMS country. Without common standards no inter-company calls would connect!

Adoption of common standards would also foster the ability to use the same locomotives and rolling stock on any GMS railway, except for PRC where there is a different gauge. Should regional facilities emerge to build or supply locomotives and other rolling stock, common standards would reduce the number of product lines.

Technical standards vary throughout GMS railways. GMS railways need to agree on the minimal technical standards for the following:

- Outline (or structure and vehicle gauge);
- Maximum permissible axle loads ;
- Operating speeds.

A working group should be set up to define and agree on a set of minimum technical standards.

Such a working group would, for example, define dimensions of containers that could be carried on the network, the maximum weight of locomotives, the maximum gross weight of wagons, and the structural gauge for tunnels and bridges. The results would help facilitate cross-border movements and reduce construction costs. Eventually, it is possible that entire trains from one country could run over another country's railway network if common operating and safety standards are developed and implemented.

PRC is constructing standard gauge lines to the borders of Viet Nam, Myanmar and Lao PDR. This should not be problematic. A of technical solutions exist to offset the need to re-construct lines to standard gauge, while maintaining the flow of traffic. The solutions include: trans-shipment facilities, bogie changing and the use of wagons with 'variable-gauge' bogies[4]. Another solution, (already used in Viet Nam on the line connecting Nanning to Dong Dang), involves a dual gauge track (two different track gauges on a single track foundation through the insertion of a third rail.) Another solution is to build (or to upgrade) the track foundation of lines to standard gauge, so that gauge change can be accommodated at future date.

While a consistent gauge throughout the GMS railway network would be ideal, the consultant believes that gauge does not constitute a major problem. Break-of-gauge occurs mostly at border points where trains are required to stop for customs inspections and for a number of reasons related to rail operations, such as, for example, changing locomotives or changing crews. If trans-shipment and bogie exchange facilities are well designed and operated, the processes can be completed during a train's scheduled stop. In addition, the majority of time-sensitive traffic is containerized cargo, which is oriented to trans-shipment.

3.3.6 Facilitation of Cross-Border Traffic and Passenger Travel

Implementation of the Cross Border Transport Agreement (CBTA) has been instrumental in improving cross border truck movements throughout the GMS. Freight forwarders in the GMS (and their umbrella organizations) are generally pleased with efforts to facilitate cross border truck traffic, but are concerned about rail movements because they have less experience in rail since there is no connected network. Except for PRC, Viet Nam and Thailand, GMS counties have little experience in the handling, inspecting and clearing of freight transported cross borders by rail or in handling the movement of passengers across international borders.

The frustration of crossing the PRC-Viet Nam border by rail on a train from Nanning. was experienced first-hand. Five hours out of a total rail journey of twelve hours were spent sitting at stations awaiting entry and exit clearance - and only 20 passengers were on-board. Similarly, despite joint efforts by PRC and Viet Nam to streamline the clearance of goods, freight forwarders on both sides of the border frequently raised the

[4] The use of wagons with 'variable-gauge' bogies enables wagons to be pulled along a special transition track at reduced speed. During the process, the distance between wheels is adjusted from one track gauge to another.

amount of time needed to complete border processing documentation as an important matter.

To be truly interconnected, GMS railways will first need to agree on technical protocols and then proceed to harmonize cross border procedures bi-laterally. Conceivably, bi-lateral cross-border procedures for rail will need to be established between the following countries before the network is completed.

- Viet Nam and Cambodia;
- Thailand and Cambodia;
- Viet Nam and Lao PDR;
- PRC and Lao PDR; and
- PRC and Myanmar.

The CBTA framework exists to accommodate this. However, the focus has clearly been on facilitating movements of trucks and passengers. With plans for building rail infrastructure proceeding rapidly, the focus now needs to shift to rail. There is no reason that rail should not be able to achieve Protocol 2.3.5.1.6 of the Vientiane Action Programme, 2004 wherein direction was given to reduce the target time for release of any container to 30 minutes.

Technical assistance for the GMS railways to develop and implement CBTA protocols specific to rail is needed.

This technical assistance needs to have a particular focus on expanding the use of electronic data interchange.

Technical assistance should also be made available to countries to assist in concluding bilateral cross-border rail transport agreements and in harmonizing customs procedures specific to rail. In this regard, the China-Vietnam border crossing could serve as a useful starting point for the development of develop a model for GMS border-crossing by rail.

3.3.7 Connections with other Modes

To be fully interconnected, the GMS railway network needs efficient connections with other modes, especially road and inland waterways. In fact, the GMS railway network should be viewed as part of a larger seamless multi-modal logistics network.

Careful consideration should be given to investment in efficient rail–road and rail–port interchanges and to identifying optimal locations for these interconnection points.

This implies the need for rail planners to consult with public and private developers of inland container depots (ICD) and other transfer facilities and port developers so that their plans and needs are included in plans for the development of the rail network.

A recent development in Sweden may provide a useful modal for network planning. Sweden plans to merge the planning, management and regulation of its national rail and road networks into one entity.

3.3.8 Information Exchange

Access to timely and relevant information is critical to evaluating the performance of GMS railways. Government. donors and users need this information to evaluate options and to monitor progress. However, operating statistics, train performance, commodity statistics, financial information and a variety of other comparative information on GMS railways are very difficult to obtain or not readily available. Further, the raw data that is available normally requires significant additional processing in order to derive performance and output indicators.

A GMS rail database and information network should be established, based on a common statistical reporting framework agreed on by GMS railways and responsible ministries.

The key output of this would be a set of annual statistics that would be made available to all stakeholders in the form of an annual statistical report on GMS railways. To further enhance cooperation among GMS railways, the detailed source data would be accessible by all GMS railways, and responsible ministries.

It is conceivable such an exchange of data could lead to the establishment (in the future) of a GMS regional railway association, which could develop into an entity which responsibilities similar to the Association of American Railways (AAR).

3.4 PRIVATE SECTOR PARTICIPATION

Many rail customers are unaware of the plans for the development of a GMS rail network. They are obviously focused on dealing with the railway in their country on day-to-day issues. There is however great interest in being consulted on the strategy for its development – from both a business and societal perspective. Of note, those who are aware of the plans for the GMS railway network, (or the Singapore - Kunming Rail Link) referred to it as a “dream”, considering that there has been little progress on completing the network. The following is a general overview of private sector perspectives.

- The private sector is interested in investing in railways. It sees scope for investing in:,
    - Operating rail freight and passenger services;
    - Leasing locomotives and rolling stock;
    - Maintaining track and infrastructure;
    - Providing locomotive and rolling stock repair facilities.

- That said, it will hold off on investing significantly until rail sectors are reformed. Private investors want to see transparent rules, regulations and tendering procedures rooted in solid legislation. Those interested in providing rail operations want the freedom to structure operations and price services to enable them to compete with trucks. They also want governments to develop and enforce safety regulations and take action to reduce encroachments on tracks. Should reform processes be initiated, private investors are willing to participate as key stakeholders.
- Freight shippers and forwarders view the potential GMS railway network as part of a broader logistics chain. They are concerned primarily with finding the lowest cost routing for their goods. It is important to them that the rail network be price and time competitive It is also important to them that the GMS network link smoothly with other modes and with the Trans Asian Network (TAR).

The private sector should be involved in future planning and development of GMS railways.

- There is interest in the private sector in the development of ICDs, in particular in Viet Nam, Thailand and Lao PDR. This offers opportunities for PPP's and their potential should be followed up.
- Private investors are examining the feasibility of new railway lines in Lao PDR to service several mines and industries. The first stage involves the construction of a 20-kilometre rail extension from Thanalaeng.
- One aspect of railway operations that could potentially be attractive to the private sector is the leasing of rolling stock. In North America many wagons used by railways or by shippers are leased from private companies. In the UK leasing companies (ROSCO's) provide the rolling stock for private passenger and freight train operators. This potential should be explored within the GMS railways as a solution to the large capital investments needed for rolling stock upgrading and acquisition. Similarly, the private sector could play a role in providing facilities for the maintenance of rolling stock on a contract basis.
- Most financial institutions (banks) now have environmental and social safeguard policies in place that are consistent with those of the ADB and other major international financing institutions. These policies need to be satisfied before banks will lend to large infrastructure projects. If private investment is to be mobilized in the development of the GMS railway network, it will be important to ensure that investment projects comply with ADB safeguards.

Clearly it would be in the interests of both GMS railways and the private sector if the latter were to take part in future discussion on railway development to voice their concerns and expectations.

3.5 PERSPECTIVES ON THE ADB'S ROLE IN GMS RAILWAY DEVELOPMENT

Representatives of the Ministry of Railways, PRC (MoR), Ministry of Transport, Thailand, Ministry of Transport, Viet Nam and Myanmar Railways all expressed concern that the ADB has not focused on rail to the extent that it has on road development. It was noted that there have only been four Technical Assistance Projects (TAP) specific to rail in the GMS subregion and two loans for railway upgrading - Cambodia and Viet Nam. This pales in comparison to the considerable investments made in road construction and maintenance.

MoR also expressed concern that the ADB was not serious about investing in the construction of railways - rather only in studying the issues. MoR representatives also stated that Lao PDR and Myanmar need the ADB's assistance in building the railway links to PRC.

4. ECONOMIC OUTLOOK AND PERSPECTIVES FOR THE GMS COUNTRIES

In the past thirty years, the GMS has seen rapid economic change. Today, it is one of the fastest growing regions in the world. The seven GMS economies grew 8.3% on average during 1992-2006. All the economies, except that of Thailand, expanded at an average annual rate of at least 6.5%.

The main economic indicators are presented in Table 4.1.

Table 4.1 – Economic indicators

Country	GDP growth (annual Ave, 1992-2006, %)	GDP ($ million) 2006	Population (million) 2006	GDP per capita ($) 2006
Cambodia	8.4	7,264	14.2	512
PRC				
Guangzi Province	11.7	50,190	49.4	1,016
Yunnan Province	9.5	60,224	44.7	1,347
Lao PDR	6.5	3,433	5.7	602
Myanmar	9.6	13,002	56.2	231
Thailand	4.5	206,247	65.2	3,163
Viet Nam	7.7	60,883	84.2	723
GMS Economies	8.3	401,243	319.6	1,255
PRC	10.3	2,626,304	1,311	2,003

Sources: ADB (SDBS), National Bureau of Statistics of PRC, IMF

The economic outlook for the GMS and especially Viet Nam, Cambodia and Lao PDR has a number of favourable aspects. In the case of Lao PDR, proximity to high growth economies also helps to offset some of the disadvantages of being landlocked. At the same time, all three countries benefit from an abundance of natural resources, including oil and gas in Viet Nam, minerals in Lao PDR and minerals in Cambodia.

The degree of openness to trade measured by the ratio of trade (exports + imports) to GDP has grown faster in GMS countries than in other Asian countries. Table 4.2 shows this growth in trade openness between 1990 and 2005:

Table 4.2 – Trade Openness, 1990-2005

Country	1990	1995	2000	2005	% Growth (1990-2005)
Cambodia	29.8	65.2	100.3	125.2	420.1%
PRC	26.8	38.8	44.2	70.0	261.2%
India	16.6	24.6	29.0	45.5	274.1%
Indonesia	48.4	49.4	76.0	72.6	150.0%
Lao PDR	36.9	59.6	73.5	76.3	206.8%
Malaysia	147.2	191.8	228.9	217.4	147.7%
Philippines	57.4	79.6	106.9	98.3	171.3%
Thailand	81.8	90.9	125.0	154.5	188.9%
Viet Nam	63.6	87.8	110.8	147.4	231.8%

Source: IMF, World Economic Outlook (2006)

These positive attributes are reflected in the medium-term growth outlook for the GMS economies forecast by the IMF between 2010 and 2014.

Cambodia: Economic growth is expected to average 6%, underpinned by garment exports, construction and tourism, and supported by improved agricultural productivity. In addition, the exploitation of large recently discovered offshore oil reserves is also likely to significantly boost the economy over the longer term. The main challenge will be to broaden the base for economic growth by creating an environment that is favourable to private sector investment.

Lao PDR: Economic growth is projected to remain at around 6-7%, with large natural resource projects (in the mining and hydropower sectors) expected to contribute around 1.5% per year. Underlying growth should be sustained at 5%, driven by agriculture, tourism and small-scale manufacturing. The main challenge, however, will be to accelerate structural reforms. In addition to maintaining sound macroeconomic policies, stepped up efforts to mobilize fiscal revenues and reform the state-owned commercial banks are needed to ensure macroeconomic stability over the medium term.

Viet Nam: Viet Nam is well placed for industrialization, given its sizeable and well-educated labour force, low labour costs and large domestic market. Economic growth is expected to remain robust in the range of 6-6.5%, sustained by the continued expansion of investment in infrastructure, labour-intensive manufacturing and service activities (including in the tourism sector), as well as a sustained increase in commodity and raw material exports. The main challenges will be to maintain macroeconomic discipline and accelerate market-oriented structural reforms. Such reforms will also be important to enable protected sectors to deal effectively with increased foreign competition, as prohibitive tariffs, industrial subsidies, and barriers to the entry of foreign firms are removed following WTO accession.

Thailand: Economic growth is expected to average 4.4%. Over the medium-term, a gradual recovery led by exports and government investment is projected, with private investment following. Public investment is expected to make a major contribution to GDP growth over the next few years, as much-needed infrastructure projects are undertaken. Over time private investment will increase and private consumption will recover in line with rising income. The investment-to-GDP ratio should rise substantially over the medium-term, while remaining well below historical highs.

Myanmar: Economic growth is expected to average 4%. Further liberalization of agriculture, domestic trade, and state enterprises would promote growth and help strengthen the government's fiscal position, paving the way for an increase in spending on poverty reduction, health and education. Improvements in the environment for private-sector development would lift investment, including non-energy sectors, and so stimulate growth and employment.

Table 4.3 summarizes the IMF's real GDP growth forecast for the GMS countries:

Table 4.3 – Real GDP Growth forecast

Country	2009	2010	2011	2012	2013	2014
Cambodia	-0.5%	3%	7.2%	7%	7.3%	7.5%
PRC	6.5%	7.5%	10.2%	10.7%	10.3%	10%
Lao PDR	4.4%	4.7%	7.5%	6.6%	6.6%	7%
Myanmar	5%	4%	4%	4%	4%	4%
Thailand	-3%	1%	4%	5%	6%	6%
Viet Nam	3.3%	4%	5.5%	6.5%	7%	7%

Source: IMF, World Economic Outlook Database, April 2009

Taking the sub-region as a whole, the growth rates shown in Table 4.3 result in a weighted average annual rate of 5.6% over the period 2009-2014.

5. ANALYSIS OF TRADE BETWEEN GMS COUNTRIES

5.1 TRENDS IN TRADE BETWEEN THE GMS COUNTRIES

This section addresses overall trends in trade, changing patterns of export commodities, and relative shares of trade with different regions of the world for the seven GMS economies, from the early 1990s to the mid-2000s.

Officials in customs departments were contacted to obtain official statistics but at the time of preparing this draft report only Thailand and Cambodia had sent data. Therefore, we examined other sources and databases to gain a complete understanding of trade flows between GMS countries and to establish the railway traffic forecast:

- The United Nation's global commodity trade (COMTRADE) database: the data available are for the year 2004;
- The Statistical Database System (SDBS) of the ADB;

- The World Economic Outlook Database of the International Monetary Fund. This database was mainly used for forecasting GDP growth;
- Various other studies and documents concerning the Greater Mekong Subregion.

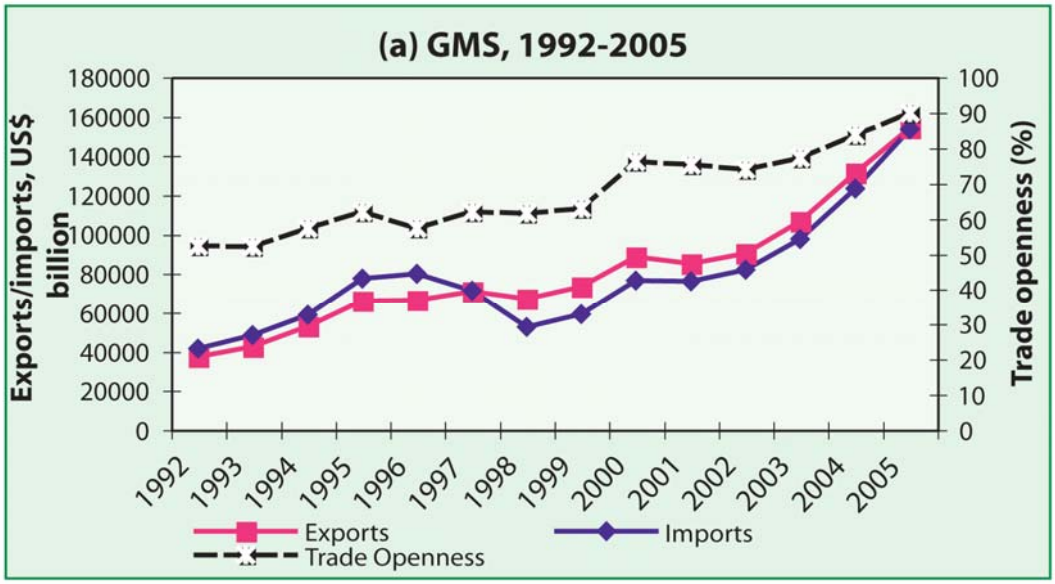
5.1.1 Trends in trade levels

Thailand is by far the biggest trading economy among the GMS countries, although its relative share of combined trade for all GMS economies declined from a highly dominant share of 87% in the early 1990s to 71% as of 2005. Viet Nam is the next largest GMS trading economy; it tripled its share from 7% to 21% over the period. Thailand and Viet Nam thus account for over nine-tenths of all trade involving GMS economies. For the remaining five GMS economies, which account for the balance of 8% of trade to, from and within the region, trade levels are similar for Cambodia, Myanmar and Guangxi Zhuang AR (Guangzi), somewhat smaller for Lao PDR, and negligible for Yunnan Province.

In addition to Viet Nam tripling its share of GMS total trade, Cambodia more than doubled its share over the 1992 to 2005 period. Myanmar's trade generally increased during the 1990s for both exports and imports, but overall trade for Myanmar has generally flattened in recent years. Myanmar's exports did increase significantly in 2005 on the strength of higher prices for natural gas. Lao PDR has seen more fluctuation both upwards and downwards over the period, compared to other GMS economies. External trade does not command a large proportion of the overall economy for Yunnan Province or Guangxi Autonomous Region, consistent with their tighter trade links with other regions of PRC. Although exports grew rapidly (albeit from a small base) for Yunnan and Guangxi , their growth rates lagged behind growth for the PRC as a whole.

Combined trade data (exports, imports and trade openness) for the GMS economies from 1992 to 2005 is shown in Figure 5.1.

Figure 5.1 - Exports, Imports, and Trade Openness



Sources: Asian Development Bank, Statistical Database System (SDBS) Key Indicator Series; National Bureau of Statistics of China, China Statistical Yearbook, IMF World Economic Outlook

With a compound annual growth rate (CAGR) of 11.6% from 1992 to 2005, combined exports from the seven GMS economies outpaced the average growth in exports for the world economy, which averaged 8.4% compound average growth. Export growth rates were especially strong in Viet Nam and Cambodia, with CAGR of 22% and 21%, respectively. In absolute terms, GMS exports rose over the 1992 to 2005 period from $37 billion to $154 billion. In addition to the recorded trade flows cited here, informal (unrecorded) trade among the GMS economies is also substantial, potentially accounting for some 20% to 30% of the total cross-border trade in the region.

GMS economies' trade grew impressively during the 1992 to 2005 period. However, it should be noted that they remain small as a portion of world markets: The GMS economies' share of world trade was just 1.5% in 2005.

Several common factors contributed to the export growth across the GMS region. The dominance of state-owned enterprises declined as many GMS economies transitioned to market-based economies beginning in the second part of the 1980s; policies governing prices and trade were liberalized; and restrictions on the private sector were lessened.

The development of market-oriented strategies within the GMS economies was underpinned by development of the private sector through local initiatives, and by encouragement of foreign direct investment (FDI). It is now common within the GMS to find full foreign ownership permitted in most industries and equal treatment of foreign

and domestic investors. Administrative procedures have been streamlined, although inefficiencies remain.

Another factor contributing to growth in GMS trade is membership in the Association of Southeast Asian Nations (ASEAN) and in the World Trade Organization (WTO). This has helped to move along reforms and to increase access to world markets. Bilateral agreements with developed countries, especially the U.S. and those of the European Union (EU) have also helped to increase trade for GMS economies. Several GMS countries have received or are eligible for Most Favoured Nation status in the U.S. and General System of Preferences or Everything-But-Arms status in the EU and other developed countries.

FDI has been an important factor in advancing trade in all GMS economies, although the sectoral focus of FDI has varied by GMS economy. For example, in Cambodia, FDI has had a particularly important effect on garment exports, as investment in the garment industry shifted away from Northeast Asia. In the Lao PDR, FDI emphasis has been on agriculture and forestry as well as mining and hydroelectric development, which have all been major contributors to growth in exports. In Viet Nam, the focus of FDI has been shifting from crude petroleum and gas extraction towards manufacturing, as Viet Nam becomes more integrated into regional supply chains. While most foreign-invested enterprises so far have been small or medium sized facilities, especially for the assembly of electrical and electronic products, very large multinationals such as Fujitsu, Hitachi and Intel are also investing large sums in major assembly plants.

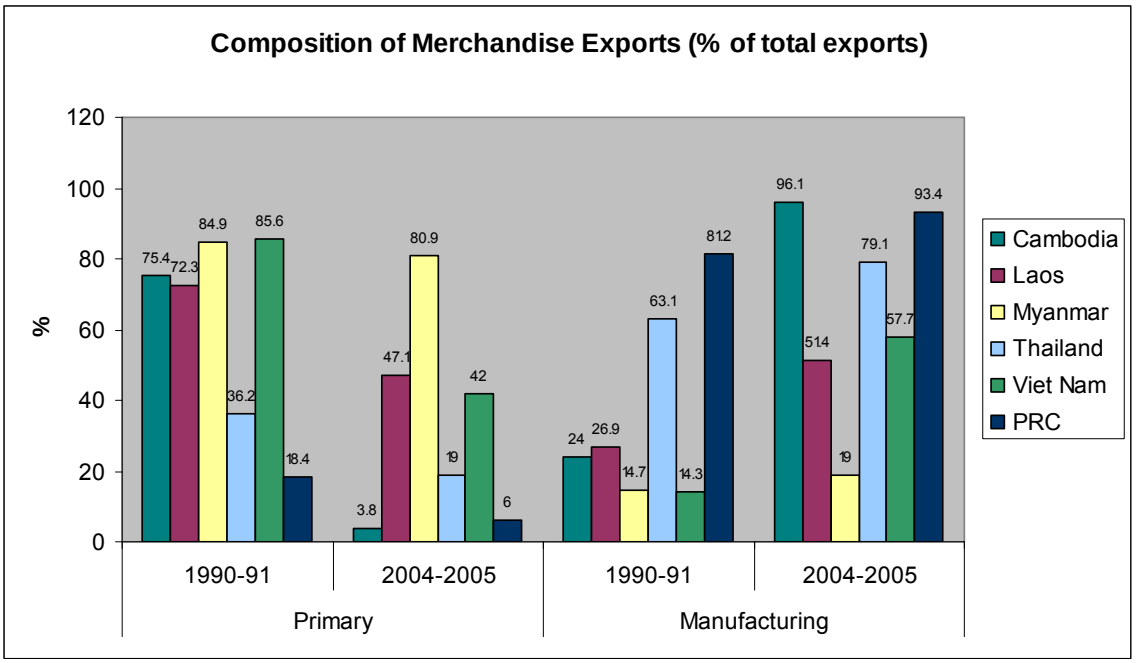
While the overall trend for external trade among GMS economies was upwards over the past decade and more, several events have adversely affected trade at different points during this time. The East Asian financial crisis of the mid-1990s slowed the rate of expansion, while the 2001 contraction of the information technology and communications sector also slowed GMS trade. Afterwards, GMS trade rebounded strongly at least until the current global slowdown. Recent growth was abetted by the recovery in regional markets, the PRC's increasing importance to trade, the boom in export prices for many commodities, continued efforts by Cambodia, Lao PDR and Viet Nam to enhance their environment for doing business, and benefits from trade agreements and membership in trade blocs or international organizations.

5.1.2 Changes in Composition of Exports

While the GMS economies' trade has increased in recent years, it has also undergone a pronounced change in the relative importance of different commodity groups. The commodity structure for exports has evolved differently in different countries, according to each country's comparative advantages. GMS economies are blessed in agricultural and natural resources. In addition, their lower labour costs compared to other countries have provided an increasingly important competitive edge in labour-intensive manufactured goods. The liberalization of policies governing trade and investment noted earlier, combined with infrastructure improvements and expanded access to

external markets have contributed to this shift in export structure, as shown in Figure 5.2.

Figure 5.2 – Composition of Merchandise Exports (% of total exports)



Source: Compiled from partner country data in U.N. COMTRADE database. The sum of shares for primary products, manufactured products and products not classified (SITC 9) add up to 100. Products not classified (SITC 9) are not included in the charts.

Although the increasing importance of labour-intensive manufacturing is evident in all GMS economies, is has been particularly evident in Cambodia, where clothing exports benefited from earlier access to markets in developed countries. Exports of manufactured goods have also risen significantly in Lao PDR and Viet Nam and now comprise more than half of all exports from these countries. Clothing is the most important manufactured export commodity group, accounting for some 80% of the Lao PDR' manufactured exports. While light consumer goods also account for a large share of Viet Nam's manufactured exports, Viet Nam has a more diversified range of export commodities. Processed food, wood products, leather goods and machinery and equipment have all grown in size, in addition to the main export commodity groups of clothing and footwear.

Electrical and electronic products recently accounted for over 5% of total exports from Viet Nam. This is evidence of that country's growing importance in labour-intensive assembly activities for the high-tech industry. It also reflects the structural change which Thailand and the PRC both went through earlier.

Within the GMS economies, the breakdown of imported commodities has remained relatively stable. In all GMS countries, imports are dominated by manufactured products, especially machinery and equipment and resource-based manufactures. This is consistent with the GMS economies' general need to import capital goods, and the

high level of imports which go into many of the products which the GMS countries export (e.g., imports of textile for clothing exports; imports of electronic products to be assembled and exported).

5.1.3 Trends in GMS Trade with Different Regions of the World

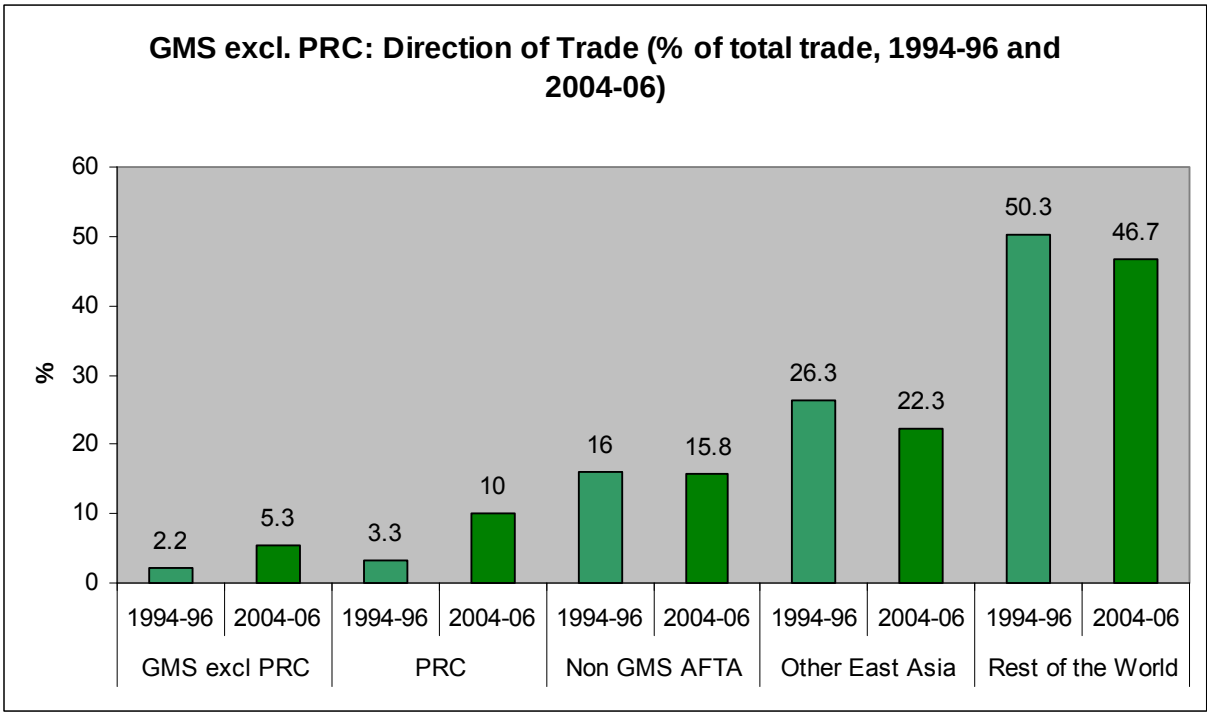
GMS countries' trade grew at impressive rates both within the GMS region itself, and with the rest of the world. Trade with the PRC experienced the most rapid expansion during 1994-2006. GMS exports to the PRC grew at a CAGR of 22%. Intra-GMS exports (excluding the PRC) grew by 19% over the same time period, while exports to all other countries averaged a CAGR of 11% for the period. Breaking down the "rest of the world" further, exports to non-GMS members of the ASEAN Free Trade Area (AFTA) and to other East Asia economies rose by 9% to both regions, while exports to the U.S. and EU actually outpaced this rate of growth.

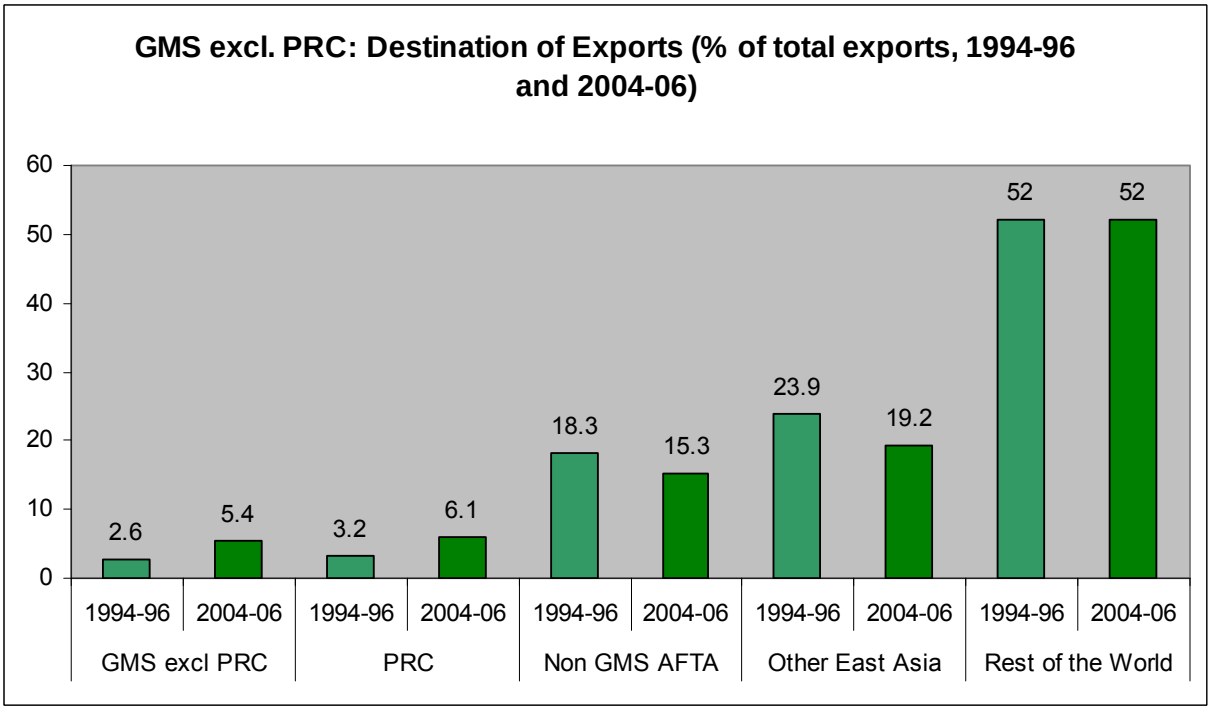
The overall pattern for GMS imports was similar to the pattern for exports, as imports from all regions grew at healthy rates. In the case of imports, those originating from the AFTA actually outpaced the rest of the world, which was not the case for exports. These export and import trends are generally consistent for all GMS countries (excepting Myanmar's trade with the "rest of the world") and match the outward-oriented trade strategies of GMS economies. As imports have grown from all regions, this suggests that AFTA and other regional trade agreements have not had the effect of diverting GMS trade away from other countries outside of the AFTA participants.

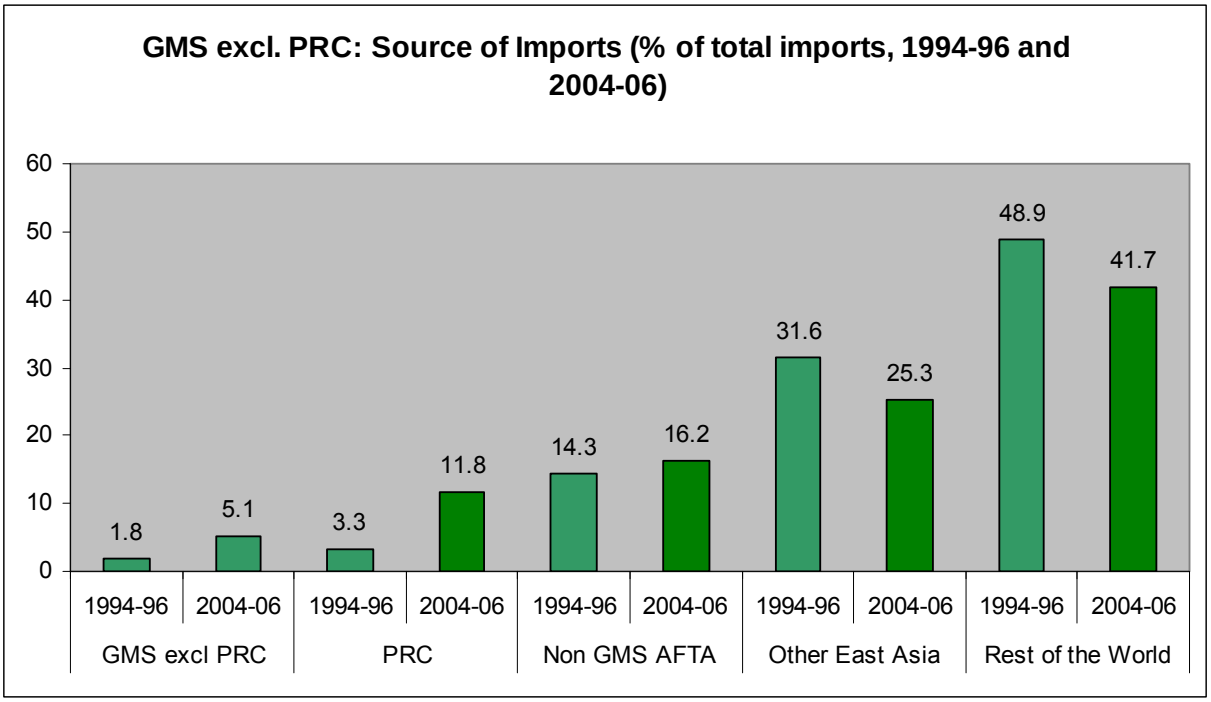
Figure 5.3 below shows how GMS countries' combined trade with different country/regional groupings has evolved, by contrasting the trade shares between 1994-1996 and 2004-2006. Countries outside the ASEAN region are the GMS countries largest trading partners, due to the size of their economies and the high levels of their per capita incomes. The proportion of total GMS trade accounted for by other East Asian (non-AFTA) countries and by countries in the rest of the world actually declined somewhat between these two time frames. Meanwhile, the proportion of intra-GMS trade (GMS countries' trade with other GMS countries) rose sharply, although from a comparatively small base. The rise in intra-GMS trade was especially pronounced for trade with the PRC.

The share of GMS trade accounted for by non-GMS AFTA countries was relatively unchanged. Although GMS exports to other AFTA countries fell, the decline was offset by a rise in the share of imports from non-GMS AFTA countries.

Figure 5.3. – Direction of Trade, Destination of Exports, and Source of Imports







Source: IMF Direction of Trade Statistics.

Note: "GMS excluding PRC" = Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam; "Non-GMS AFTA" = Indonesia, Malaysia, Philippines, Singapore; "Other East Asia" = Hong Kong, PRC; Republic of Korea; Japan.

Trends in the direction of trade experienced by Thailand have had a strong impact on the overall evolution of direction of trade for GMS economies as a whole. This is due to Thailand's trade dominance compared to other GMS countries. Changes in regional trade shares experienced by other GMS economies were varied. For example, the share of trade with other GMS countries (excluding PRC) and with non-GMS AFTA countries fell sharply in the case of Cambodia, as it increasingly specialized in the garment trade and increased its trade with the U.S. and the EU. The Lao PDR' landlocked status at least partly explains the fact that Lao PDR is the most dependent on the GMS for its trade.

5.2 ORIGIN/DESTINATION MATRICES

We used the COMTRADE database as the main source to build an origin/destination (OD) matrix for intra-GMS trade. The first step was to build a 2004[5] matrix; the second was to use certain assumptions to construct a matrix for 2008.

In the COMTRADE database the commodities are classified according to the Harmonized System (HS) codification by chapter (97 chapters). The detailed HS classification is presented in Appendix A.

[5] 2004 is the last year for which a complete set of data is available

Table 5.1 shows the main commodities exported by each GMS country. It should be noted that the data for PRC is for the entire country rather than just the GMS economies of Yunnan Province and Guangxi Zhuang AR.

Table 5.1 – Main Commodities Exported Between GMS Economics

Country	Main Commodities	Main Destinations
Cambodia	Iron and steel, Cereals Rubber and articles thereof	Thailand, Viet Nam
PRC	Mineral fuels and oil products Fertilisers Iron and steel Inorganic chemicals	Viet Nam, Thailand
Lao PDR	Mineral fuels and oil products Salt; sulphur; earths and stone; plastering materials, lime and cement Wood and articles of wood Oil seeds and oleaginous fruits ; industrial or medicinal plants	Thailand, PRC
Myanmar	Mineral fuels and oil products Ores, slag and ash Fish and crustaceans Iron and steel	Thailand, PRC
Thailand	Salt; sulphur; earths and stone; plastering materials, lime and cement Vegetables Mineral fuels and oil products Plastics and articles thereof	Viet Nam, PRC, Cambodia
Viet Nam	Mineral fuels and oil products Ores, slag and ash Vegetables	PRC ,Thailand, Cambodia

Due to the excessive detail of 97 chapters, the HS classification is not useful in establishing an OD matrix. For this reason we grouped the commodities into 5 categories or groups:

- Dry Bulk (minerals, wood, cement, cereals, iron and steel etc…);
- Liquid bulk (fuels, mineral oils, petroleum products);
- Reefer (meat, fish and crustaceans, fruits, vegetables);
- Special: Special trade is trade not handled in containers or bulk, such as live animals, vehicles, running stock, vessels and airplanes,
- Container: Various commodities, including those not specified above.

Tables 5.2 through 5.7 present the 2004 OD matrices for the five categories and for the total.

Table 5.2 – Estimated Dry Bulk Trade Flows in the GMS 2004 (tons)[6]

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		584	0	0	95,673	2,888
PRC	39,205		11,541	452,174	2,867,779	3,734,203
Lao PDR	0	50,557			145,499	36,062
Myanmar	0	316,351	0		95,728	276
Thailand	1,281,413	1,593,583	370,444	282,729		3,491,079
Viet Nam	152,902	1,337,684	14,917	8,076	31,271	
Total	1,473,519	3,298,759	396,903	742,979	3,235,951	7,264,507

Table 5.3 – Estimated Container Trade Flows in the GMS 2004 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		18,546	66	32	11,436	60,327
PRC	153,750		15,067	227,768	1,299,361	716,259
Lao PDR	904	1,708		0	63,473	2,609
Myanmar	18	57,062	0		78,799	6,194
Thailand	328,254	3,313,315	285,544	383,403		816,449
Viet Nam	49,963	655,922	9,735	3,469	61,098	
Total	532,888	4,046,553	310,412	614,672	1,514,167	1,601,838

Table 5.4 – Estimated Liquid Bulk Trade Flows in the GMS 2004 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		0	0	0	58,236	
PRC	2,838		163	145,069	379,770	1,958,822
Lao PDR	38	0			332,845	34
Myanmar	0	3,198	0		8,483,410	0
Thailand	605,555	2,087,086	261,571	78,773		855,011
Viet Nam	355,711	6,653,413	36,632	55	586,202	
Total	964,141	8,743,697	298,365	223,897	9,840,462	2,813,866

Table 5.5 – Estimated Reefer Trade Flows in the GMS 2004 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		194	3	126	3,423	2,705
PRC	4,878		1,828	46,871	219,163	262,658
Lao PDR		23			21,135	227
Myanmar	1,314	13,494			157,150	920
Thailand	18,865	3,051,650	20,651	29,999		5,280
Viet Nam	6,386	478,728	2,466	13	9,953	
Total	31,443	3,544,089	24,949	77,010	410,823	271,789

[6] "Ton" means one metric ton (1,000 kilograms) throughout.

Table 5.6 – Estimated Special Trade Flows in the GMS 2004 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		1	12	1	1,158	63
PRC	5,216		1,327	11,896	30,498	50,455
Lao PDR	0	0		0	834	73
Myanmar	0	0	0		5,458	0
Thailand	12,527	11,333	13,156	8,734		8,633
Viet Nam	3,042	1,013	181	45	1,468	
Total	20,785	12,348	14,676	20,676	39,416	59,223

Table 5.7 – Estimated Total Trade Flows in the GMS 2004 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		19,326	82	159	169,926	65,983
PRC	205,886		29,926	883,778	4,796,570	6,722,397
Lao PDR	942	52,288		0	563,786	39,003
Myanmar	1,332	390,105	0		8,820,544	7,389
Thailand	2,246,614	10,056,967	951,366	783,638		5,176,451
Viet Nam	568,004	9,126,761	63,931	11,659	689,992	
Total	3,022,778	19,645,446	1,045,304	1,679,235	15,040,819	12,011,223

The total internal trade in 2004 is estimated at 52.5 million tons.

Taking into account the average GDP growth between 2004 and 2007, and the economic deceleration observed in 2008 we assume that the internal GMS trade grew at 10% per year between 2004-2007 and then -5% in 2008. Tables 5.8 through 5.13 present the resulting 2008 OD matrices.

Table 5.8 – Estimated Dry Bulk Trade Flows in the GMS 2008 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		748	0	0	122,558	3,700
PRC	50,221		14,784	579,235	3,673,625	4,783,514
Lao PDR	0	64,763		0	186,385	46,195
Myanmar	0	405,246	0		122,628	353
Thailand	1,641,490	2,041,380	474,539	362,176		4,472,072
Viet Nam	195,868	1,713,573	19,109	10,345	40,058	
Total	1,887,578	4,225,710	508,432	951,756	4,145,253	9,305,834

Table 5.9 - Estimated Container Trade Flows in the GMS 2008(tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		23,758	85	41	14,649	77,279
PRC	196,953		19,301	291,770	1,664,482	917,528
Lao PDR	1,157	2,188		0	81,309	3,342
Myanmar	23	73,096	0		100,941	7,934
Thailand	420,493	4,244,356	365,782	491,140		1,045,871
Viet Nam	64,003	840,237	12,470	4,444	78,267	
Total	682,629	5,183,635	397,638	787,395	1,939,648	2,051,954

Table 5.10 – Estimated Liquid Bulk Trade Flows in the GMS 2008 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		0	0	0	74,600	0
PRC	3,635		208	185,834	486,485	2,509,251
Lao PDR	49	0		0	426,375	43
Myanmar	0	4,097	0		10,867,248	0
Thailand	775,716	2,673,557	335,072	100,908		1,095,269
Viet Nam	455,665	8,523,023	46,925	71	750,924	
Total	1,235,065	11,200,676	382,205	286,812	12,605,631	3,604,563

Table 5.11 – Estimated Reefer Trade Flows in the GMS 2008 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		249	4	162	4,385	3,465
PRC	6,249		2,342	60,042	280,747	336,465
Lao PDR	0	29		0	27,073	290
Myanmar	1,684	17,285	0		201,309	1,178
Thailand	24,166	3,909,164	26,454	38,429		6,764
Viet Nam	8,180	613,250	3,160	17	12,750	
Total	40,279	4,539,978	31,960	98,649	526,264	348,162

Table 5.12 – Estimated Special Trade Flows in the GMS 2008 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		2	16	2	1,484	80
PRC	6,681		1,700	15,239	39,068	64,633
Lao PDR	0	0		0	1,069	93
Myanmar	0	0	0		6,991	0
Thailand	16,047	14,517	16,852	11,188		11,058
Viet Nam	3,897	1,298	231	58	1,881	
Total	26,626	15,817	18,800	26,486	50,492	75,865

Table 5.13 – Estimated Total Trade Flows in the GMS 2008 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		24,757	105	204	217,675	84,524
PRC	263,740		38,335	1,132,120	6,144,407	8,611,391
Lao PDR	1,206	66,980		0	722,210	49,963
Myanmar	1,706	499,724	0		11,299,117	9,465
Thailand	2,877,912	12,882,975	1,218,700	1,003,840		6,631,034
Viet Nam	727,614	11,691,380	81,895	14,935	883,880	
Total	3,872,178	25,165,816	1,339,035	2,151,100	19,267,289	15,386,377

The total internal trade in 2008 is estimated at 67.2 million tons.

Table 5.14 summarizes the estimated trade in 2008 by commodity group.

Table 5.14 – GMS Internal Trade by Commodity – 2008 (tons)

Commodity	Tonnage	%
Dry Bulk	21,024,565	31.3%
Containers	11,042,900	16.4%
Liquid Bulk	29,314,953	43.6%
Reefer	5,585,292	8.3%
Special	214,086	0.3%
TOTAL	**67,181,795**	**100%**

5.3 TRADE FORECAST

Our trade forecast extends until 2025. However we distinguish two periods:

- Between 2008 and 2014: The real GDP is expected to grow (on average) at 5.6% in the GMS countries (see Section 4). Our assumption is that trade will grow at the same rate;
- After 2014: Section 4 does not contain projections of GDP growth for this period so to be conservative we assume a trade growth rate of 4%;

With these assumptions we built two sets of matrices (2014, 2025). Tables 5.15 through 5.20 present the 2025 matrices:

Table 5.15 – Estimated Dry Bulk Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		1,598	0	0	261,632	7,898
PRC	107,210		31,561	1,236,532	7,842,330	10,211,683
Lao PDR	0	138,254		0	397,887	98,615
Myanmar	0	865,105	0		261,781	753
Thailand	3,504,196	4,357,869	1,013,030	773,160		9,546,827
Viet Nam	418,132	3,658,077	40,793	22,085	85,515	
Total	4,029,538	9,020,902	1,085,384	2,031,777	8,849,145	19,865,776

Table 5.16 – Estimated Container Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		50,717	181	87	31,272	164,972
PRC	420,449		41,203	622,861	3,553,278	1,958,708
Lao PDR	2,471	4,671		0	173,577	7,135
Myanmar	49	156,044	0		215,486	16,938
Thailand	897,654	9,060,706	780,859	1,048,468		2,232,689
Viet Nam	136,632	1,793,709	26,621	9,487	167,082	
Total	1,457,254	11,065,846	848,864	1,680,904	4,140,695	4,380,442

Table 5.17 – Estimated Liquid Bulk Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		0	0	0	159,253	0
PRC	7,761		444	396,712	1,038,531	5,356,663
Lao PDR	104	0		0	910,210	93
Myanmar	0	8,745	0		23,199,029	0
Thailand	1,655,971	5,707,418	715,301	215,415		2,338,142
Viet Nam	972,739	18,194,657	100,174	151	1,603,048	
Total	2,636,575	23,910,821	815,919	612,277	26,910,071	7,694,897

Table 5.18 – Estimated Reefer Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		531	9	345	9,360	7,396
PRC	13,340		4,999	128,176	599,330	718,274
Lao PDR	0	63		0	57,795	620
Myanmar	3,594	36,900	0		429,747	2,515
Thailand	51,589	8,345,150	56,474	82,037		14,439
Viet Nam	17,463	1,309,145	6,745	36	27,218	
Total	85,986	9,691,790	68,227	210,593	1,123,450	743,244

Table 5.19 - Estimated Special Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		4	34	3	3,168	172
PRC	14,263		3,629	32,531	83,400	137,976
Lao PDR	0	0		0	2,281	198
Myanmar	0	0	0		14,924	0
Thailand	34,257	30,991	35,976	23,884		23,607
Viet Nam	8,320	2,771	494	124	4,015	
Total	56,841	33,766	40,133	56,542	107,789	161,953

Table 5.20 - Estimated Total Trade Flows in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR.**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		52,850	224	436	464,685	180,439
PRC	563,023		81,836	2,416,811	13,116,870	18,383,303
Lao PDR	2,575	142,988		0	1,541,750	106,660
Myanmar	3,643	1,066,794	0		24,120,968	20,206
Thailand	6,143,668	27,502,134	2,601,639	2,142,964		14,155,704
Viet Nam	1,553,285	24,958,359	174,827	31,883	1,886,877	
Total	8,266,193	53,723,125	2,858,526	4,592,094	41,131,150	32,846,312

Total internal trade in 2025 is estimated at 143.4 million tons. Table 5.21 summarizes this estimated trade by commodity group.

Table 5.21 – GMS internal trade by commodity – 2025 (tons)

Commodity	Tonnage	%
Dry Bulk	44,882,522	31.3%
Containers	23,574,005	16.4%
Liquid Bulk	62,580,560	43.6%
Reefer	11,923,290	8.3%
Special	457,023	0.3%
TOTAL	**143,417,400**	**100%**

6. GMS RAIL FREIGHT TRAFFIC FORECAST

This report section sets out the data collected, methodology used and key results of the freight forecasting exercise to estimate potential future cross-border railway traffic within the GMS countries.

Forecasting freight traffic demand for a potential new railway linking the GMS countries is a particularly challenging exercise. The approach adopted is a normative one consisting of three main steps:

- Reviewing and analysing trade flows within the GMS countries for the last five years;
- Assessing what proportion of each of these traffic flows could move by rail. Assumptions on modal split were made to establish the potential railway cross-border traffic. Since we do not have any cost comparison between modes (ships, trucks, rail) the modal split approach based on our experience in the region is probably the best approach in this context;
- Determining the future growth in railway traffic considering the future economic growth (GDP) in the GMS countries.

The Freight traffic forecast was developed taking as the initial point the forecast trade flows presented in Section 5.

The main assumptions underlying the forecasts are:

- That the construction of the missing links to interconnect and integrate the national railway systems in the GMS countries is undertaken;
- That the modernization and efficiency of the national railway systems is based on commercial practices;
- That the private sector will participate in the investment and operation of railways.

Recent studies[7] on the region were examined to estimate the potential share of rail freight traffic that could be obtained. Some cost comparisons are indicated in these studies and it is clearly stated that when the railway has a marked comparative cost advantage, its share usually ranges from 50% to 80%, and when its comparative cost is more marginal, the railway's share varies between 20% and 30%. Transport cost is the dominant parameter for dry and liquid bulk.

The other important factor that should be taken into account is the transfer time which is most important for most containerized and reefer traffic. Providing that the above issues are respected, rail will be competitive compared to ships or even trucks for some origins/destinations.

Given these considerations we assumed conservatively. Accordingly, the rail shares by type of commodity used to develop the forecasts are:

- Dry bulk: 25%
- Containers: 35%
- Liquid bulk: 10%
- Reefers: 35%
- Special: 15%

[7] Restructuring of the Railway in Cambodia – Traffic Forecast and Financial Analysis Report, Canarail April 2006
Nong Khai – Vientiane Railway Link Project, Final Report, Canarail August 2008
Rehabilitation of the Railway in Cambodia – Investment options note, May 2009

To take into account the ramp-up effect for new lines we have also assumed that traffic would develop gradually, not reaching full forecast levels until 2025. In 2014 we have assumed that 40% of forecast levels will be reached.

Tables 6.1 through 6.6 present rail traffic flows in 2025 by origin/destination and by commodity group.

Table 6.1 - Bulk Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		399	0	0	65,408	1,975
PRC	26,803		7,890	309,133	1,960,582	2,552,921
Lao PDR	0	34,563		0	99,472	24,654
Myanmar	0	216,276	0		65,445	188
Thailand	876,049	1,089,467	253,257	193,290		2,386,707
Viet Nam	104,533	914,519	10,198	5,521	21,379	
Total	1,007,384	2,255,225	271,346	507,944	2,212,286	4,966,444

Table 6.2 - Container Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		17,751	63	31	10,945	57,740
PRC	147,157		14,421	218,001	1,243,647	685,548
Lao PDR	865	1,635		0	60,752	2,497
Myanmar	17	54,615	0		75,420	5,928
Thailand	314,179	3,171,247	273,301	366,964		781,441
Viet Nam	47,821	627,798	9,317	3,321	58,479	
Total	510,039	3,873,046	297,102	588,316	1,449,243	1,533,155

Table 6.3 - Liquid Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		0	0	0	15,925	0
PRC	776		44	39,671	103,853	535,666
Lao PDR	10	0		0	91,021	9
Myanmar	0	875	0		2,319,903	0
Thailand	165,597	570,742	71,530	21,541		233,814
Viet Nam	97,274	1,819,466	10,017	15	160,305	
Total	263,657	2,391,082	81,592	61,228	2,691,007	769,490

Table 6.4 - Reefer Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		186	3	121	3,276	2,589
PRC	4,669		1,750	44,862	209,765	251,396
Lao PDR	0	22		0	20,228	217
Myanmar	1,258	12,915	0		150,412	880
Thailand	18,056	2,920,803	19,766	28,713		5,054
Viet Nam	6,112	458,201	2,361	12	9,526	
Total	30,095	3,392,126	23,879	73,708	393,208	260,135

Table 6.5 - Special Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		1	5	0	475	26
PRC	2,139		544	4,880	12,510	20,696
Lao PDR	0	0		0	342	30
Myanmar	0	0	0		2,239	0
Thailand	5,139	4,649	5,396	3,583		3,541
Viet Nam	1,248	416	74	19	602	
Total	8,526	5,065	6,020	8,481	16,168	24,293

Table 6.6 - Total Traffic by Rail in the GMS 2025 (tons)

	Destination					
Origin	**Cambodia**	**PRC**	**Lao PDR**	**Myanmar**	**Thailand**	**Viet Nam**
Cambodia		18,337	72	152	96,030	62,329
PRC	181,544		24,650	616,547	3,530,359	4,046,227
Lao PDR	875	36,220		0	271,815	27,407
Myanmar	1,275	284,681	0		2,613,419	6,997
Thailand	1,379,020	7,756,907	623,250	614,091		3,410,557
Viet Nam	256,988	3,820,400	31,968	8,888	250,291	
Total	1,819,702	11,916,545	679,939	1,239,677	6,761,913	7,553,517

Table 6.7 summarizes rail freight traffic projected for 2014 and 2025; for goods moving between the GMS economies.

Table 6.7 - Summary of GMS Rail traffic projections (tons)

Commodity	2014	2025
Bulk	2,915,483	11,220,630
Containers	2,143,851	8,250,902
Liquid	1,626,046	6,258,056
Reefer	1,084,320	4,173,152
Special	17,812	68,553
TOTAL	7,787,512	29,971,293

7. BUILDING AN INTERCONNECTED GMS RAILWAY – EVALUATION OF CONNECTING ROUTES

A network consists of nodes and links. The efficiency of any network is determined by the degree to which the nodes are connected, by the capacity of the links and the extent of barriers to entry and movement over them – in effect, by the overall efficiency of the connections. As we have seen, GMS countries are addressing some aspects of their "connections", by investing in construction and upgrading of national railway infrastructure. But they are not yet part of a rail network; although major centres in the GMS are well-connected by road, air and by inland waterways, only PRC and Viet Nam are connected by rail (see Figure 2.1). The following sections address the alternatives for linking the unconnected railways to form a network and provide an evaluation of the alternatives.

7.1 ROUTES CONSIDERED

Table 7.1 summarizes possible alternatives for connecting GMS countries by rail and provides estimates of the cost of constructing most of the "missing links".

From the available options, four primary GMS rail routes were identified for analysis:

Route 1: Bangkok-Phnom Penh-Ho Chi Minh City-Hanoi-Kunming-Nanning

Route 2: Bangkok-Vientiane-Kunming (via Boten/Mohan)-Nanning-Hanoi/Ho Chi Minh City

Route 3: Bangkok-Vientiane-Hanoi/Ho Chi Minh City-(via Tha Khaek-Mu Gia-Vung Anh)-Kunming-Nanning

Route 4: Bangkok-Kunming (via Chiang Rai-Boten-Mohan)-Nanning-Hanoi/Ho Chi Minh City

These routes are shown in Figure 7.1.

Routes 1 and 3 were selected because they were defined in the Vientiane Action Plan 2004–2010 as priority routes in the Singapore–Kunming Rail Link (SKRL). Routes 2 and 4 were selected because they have often been identified as other potential SKRL routes. There are, of course, other routes that could be considered, such as a route connecting the PRC and Thailand through Myanmar. However, planning is most advanced on the four routes considered here.

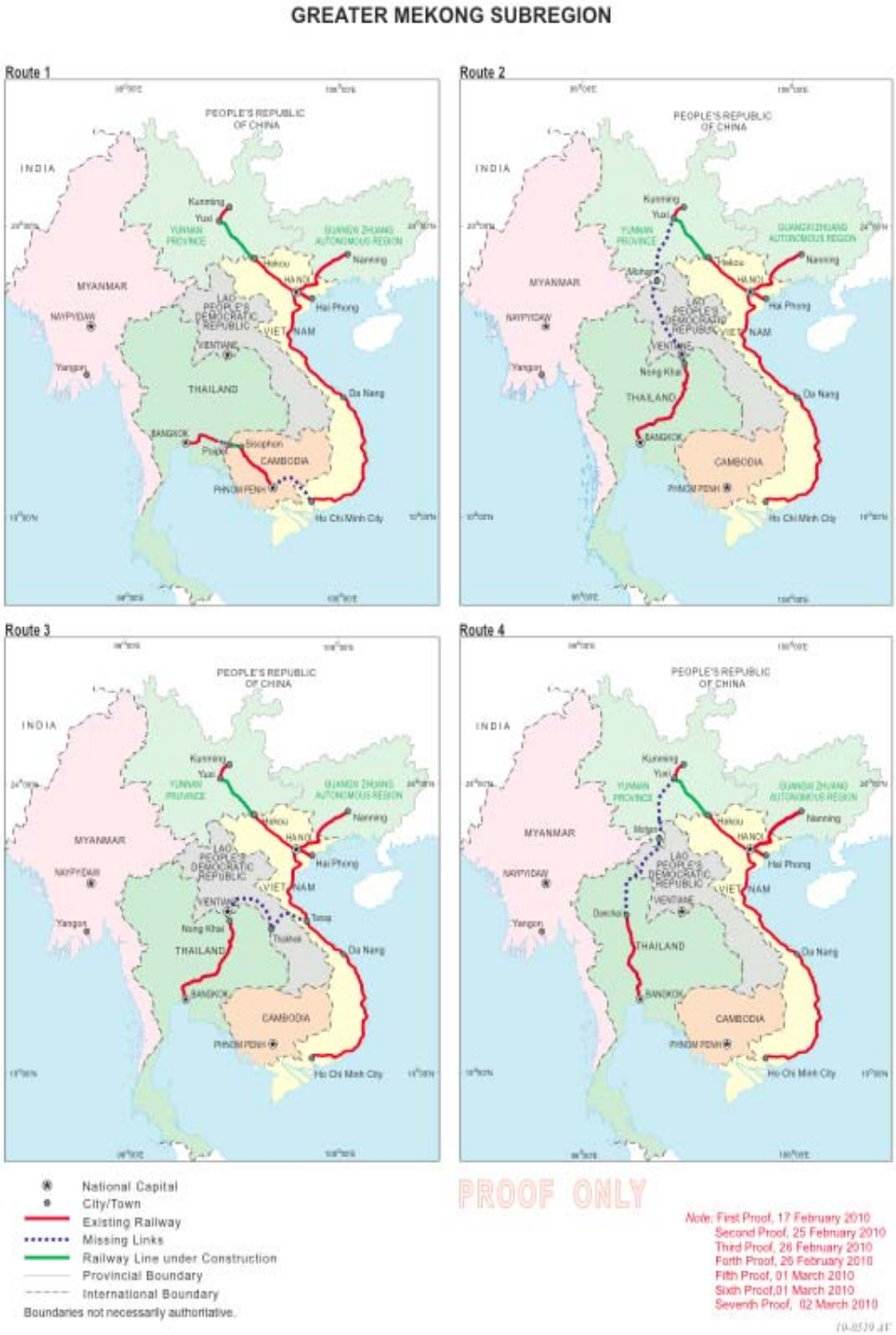
Table 7.1 - Options for Connecting GMS Countries by Rail

Country To / From	Nodes	Links / Options Needed for Connecting	Estimated Construction Cost ($M)*
Cambodia			
Thailand	Phnom Penh-Bangkok	**Sisophon to Poipet.** Construction to start in January 2010 (ADB Loan 2288). Requires re-connection of Aranyaprathet-Poipet by Thailand.	
Vietnam/PRC	Phnom Penh-Ho Chi Minh City/Hanoi-Kunming	**Phnom Penh (Bat Doeung) to Loc Ninh.** Feasibility study in progress. Requires construction from Loc Ninh-Ho Chi Minh City by Vietnam.	600
Other lines under consideration		Sisophon-Siem Reap	n/a
Lao PDR			
Thailand	Vientiane-Bangkok	**Thanalaeng to Vientiane.** Feasibility Study completed.	25
PR China	Vientiane-Kunming	**1) Vientiane-Boten-Mohan.** Requires construction of Yuxi-Mohan by PRC.	2315
		2) Vientiane-Tha Khaek-Mu Gia. Requires construction from Mu Gia-Vung Anh by Vietnam.	1845
Vietnam	Vientiane-Hanoi-Ho Chi Minh City	See Vientiane-Kunming	
Other lines under consideration		Tha Khaek-Savannakhet-Pakse	1380
		Savannakhet-Lao Bao	880
		Pakse-Chong Mek	115
		Salaphounkhoun-Vietnam border	955
Myanmar			
PRC	Mandalay-Kunming	**Lashio to Muse / Ruili**. Feasibility study completed. Requires completion of Dali-Ruili line by PRC	480
Thailand	Yangon-Mandalay-Bangkok	**Thanbyuzayat to Three Pagoda Pass.** Feasibility study complete. Requires construction of Nam Tok-Three Pagoda Pass by Thailand.	250
Other lines under consideration		Kalay-Tamu	100
		Mawlamyine-Mae Sod	n/a
PRC			
Vietnam	Kunming-Hanoi-Ho Chi-Minh	**Yuxi-Mengzi.** Construction of a standard gauge, double track and electrified line to be completed in 2011.	662
		Mengzi-Hekou. Construction is to be completed in 2 to 3 years. Vietnam is upgrading line from Hanoi (Yen Vien) to Lao Cai under ADB Loan 2302.	1210
	Nanning-Hanoi-Ho Chi-Minh	Operational	
Lao PDR	Kunming-Vientiane	**Yuxi-Mohan.** Construction of a standard gauge, double track and electrified line from Yuxi-Mohan is planned. Requires construction from Boten-Vientiane by Lao PDR.	2980
Myanmar	Kunming-Mandalay	**Dali-Ruili.** Construction of a standard gauge, double track and electrified line to be completed by 2013. Requires construction from Lashio-Muse by Myanmar.	2200

Country To / From	Nodes	Links / Options Needed for Connecting	Estimated Construction Cost ($M)*
Thailand			
PRC	Bangkok-Kunming-Nanning	**1) Aranyaprathet-Poipet.** Requires construction of Phnom Penh-Ho Chi Minh City by Cambodia and Vietnam.	5
		2) Connect through Thanalaeng. Requires construction of Thanalaeng-Vientiane-Boten by Lao PDR and Yuxi-Mohan by PRC.	
		3) Den Chai-Chiang Rai-Chiang Khong. Requires construction from Lao Border to Boten in Lao PDR and from Yuxi-Mohan by PRC.	1500
		4) Bua Yai-Mukdahan. Requires construction from Mukdahan-Savannakhet-Dong Ha by Lao PDR and Vietnam	n/a
		5) Udon Thani-Nakorn Phanom. Requires construction from Tha Khaek-Mu Gia-Vung Anh by Lao PDR and Vietnam.	n/a
Cambodia	Bangkok-Phnom Penh	See Bangkok-Kunming-Nanning	
Vietnam	Bangkok-Ho Chi Minh City-Hanoi	See Bangkok-Kunming-Nanning	
Myanmar	Bangkok-Yangon-Mandal	**Nam Tok to Three Pagoda Pass.** Requires construction from Three Pagoda Pass-Thanbyuzayat by Myanmar.	280
Other lines under consideration		Bua Yai-Mukdahan-Nakorn Phanom	n/a
		Nakorn Phanom-Phitsanulok-Mae Sod	n/a
		Ubon Ratachathani-Chong Mek	n/a
Vietnam			
Cambodia	Hanoi-Ho Chi Minh City-Phnom Penh	**Ho Chi Minh City to Loc Ninh.** Requires construction from Loc Ninh-Phnom Penh by Cambodia.	480
Thailand	Hanoi-Ho Chi Minh City-Bangkok	**1) Ho Chi Minh City-Loc Ninh.** Requires construction from Loc Ninh-Phnom Penh by Cambodia and Aranyaprathet-Poipet by Thailand	See above
		2) Vung Anh-Mu Gia. Requires construction of Mu Gia-Tha Khaek-Vientiane-Thanalaeng by Lao PDR.	425
		3) Dong Ha-Lao Bao. Requires construction of Lao Bao-Savannakhet-Thailand border by Lao PDR and from Mukdahan-Bua Yai by Thailand.	n/a
		4) Vung Anh-Mu Gia. Requires construction of Mu Gia-Tha Khaek by Lao PDR and Udon Thani-Nakorn Phanom by Thailand.	See 2) above
Lao PDR	Hanoi-Ho Chi Minh City-Vientiane	**Vung Anh-Mu Gia.**	See 2) above
PR China	Ho Chi Minh-Hanoi-Kunming-Nanning	**Yen Vien-Lao Cai.** To be upgraded 2010 (ADB Loan 2302). Metre gauge line Kunming-Hekou (PR China border point at Lao Cai, Vietnam) is no longer operated by PR China. Requires completion of Yuxi-Mengzi-Hekou by PRC.	
Other lines under consideration		Dong Ha-Lao Bao	

* All amounts are based on metre gauge construction. Exclusive of locomotives and rolling stock.

Figure 7.1 - Four Primary GMS Rail Routes



7.2 EVALUATION OF THE ROUTES

Does any route "stand out" over the others? To answer this, routes were evaluated on the basis of:

- Projected passengers and freight to be transported by rail
- Economic feasibility (EIRR)

There are, of course, other factors that should be considered in evaluating the routes. Since all routes require the construction of at least three "missing links" cooperation among GMS countries will be essential if completion of any route is to be realized. Given the limited progress in building the network to date, it is important that a route can be implemented in a reasonable time frame (at least by the end of the decade) and that a degree of support and interest in the route exists – to the extent that the route would be attractive to users and its development supported by GMS Governments and investors. Evaluating the routes by these factors is by nature, based on judgement and perception.

7.3 PROJECTED RAIL PASSENGER TRAFFIC

In order to evaluate the economic feasibility of each of the four routes it was necessary to estimate the additional passenger traffic which could be made possible by the construction of the missing links required for each route. Projections of rail passenger traffic were developed for each missing link. These were then aggregated to the route level to provide inputs to the economic analysis. Projections were developed for the period 2011-2025.

7.3.1 Aranyaprathet - Poipet

Passenger traffic levels for completion of the link between Bangkok and Phnom Penh were developed in a previous CANARAIL study.[8] This study covered the rehabilitation of the rail line in Thailand leading up to Aranyaprathet, as well as the construction of the link between Aranyaprathet and Poipet, and some passenger traffic on the SRT up to Aranyaprathet was included in the estimates derived by the study, which consisted of:

- Passengers on the line between Bangkok and Aranyaprathet diverted from road due to the rehabilitation of this line;
- Passengers between Bangkok and Sisophon and Phnom Penh diverted from road;
- Passengers between Bangkok and Sisophon and Phnom Penh diverted from air;
- Generated traffic.

Estimated traffic levels as of 2011 were 771,000 passengers and 246,000 passenger-kilometres. The CANARAIL forecast extended to 2031 only. The growth rate applied

[8] CANARAIL "Economic Benefits to Thailand from Re-Establishing the Rail Link with Cambodia" June 2006.

during the last few years of the CANARAIL forecast series (5%) was used to extend the results to 2025.

7.3.2 Phnom Penh – Ho Chi Minh City

Estimated traffic for the link between Phnom Penh and Ho Chi Minh City was derived from a study by the Second Railway Survey and Design Institute.[9] This study estimated the number of passengers for the Cambodia portion of this link as per table below.

Table 7.2 – Estimated Number of Passengers for Cambodia Portion

	2020	2030
Local traffic	400,000	600,000
Transit traffic	400,000	800,000
Total traffic	800,000	1,200,000

The number of "local" passengers (in country) on the portion of the Viet Nam portion of this line were assumed equal to the local Cambodian passengers, i.e., 400,000 in 2020 and 600,000 in 2030. Annual growth rates calculated from the above figures were 4.14 % for local traffic and 7.18 % for transit traffic. These rates were used to extrapolate and interpolate results over the period 2011-2025.

From this, passenger-kilometres were developed as follows. Local passengers in both Cambodia and Viet Nam were assumed to travel, on average, half the distance between Phnom Penh or Ho Chi Minh City and the border. Transit passengers were assumed to travel the whole distance between these two cities.

7.3.3 Nong Khai – Vientiane

Passenger traffic for the Nong Khai – Vientiane missing link was developed from a study by CANARAIL and SYSTRA.[10] This study estimated total passengers on this line in 2010 at 268,834, and passenger-kilometres at 2,419,506. Growth rates used in this study were very low, about 1% per year. Higher growth rates were therefore substituted in projecting the traffic over the period 2011-2040. An annual rate of 5.6 %, based on average GDP growth for the subregion, as developed in Section 4, above was used up to 2014 and 4.0 % was used thereafter.

[9] The Second Railway Survey and Design Institute "Preliminary Technical Study Report of New Railway Bat Deung to Snual Line in Cambodia".
[10] CANARAIL and SYSTRA "Nongkhai-Vientiane Railway Link Project, Final Report" August 2008

7.3.4 Vientiane – Vung Anh

Passenger traffic for the Vientiane – Vung Anh missing link was developed using factors from two studies. The East-West Corridor Project[11] studied a road route connecting Lao PDR and Viet Nam in the vicinity of the proposed Vientiane – Vung Anh rail line. Bus traffic on the roads along this route was estimated at 64 buses per day on the Laotian side and 65 on Viet Nam's side as of 2000. The Nong Khai – Vientiane study cited above used an average load of 50 passengers per bus and a bus-to-rail diversion factor of 50 %. These were applied to the number of buses from the East-West Corridor Project to estimate rail ridership. Annual growth rates cited in the preceding subsection (5.6% up to 2014 and 4.0% thereafter) were used to project ridership for the period 2011-2040.

Passenger-kilometres were calculated as follows. Passengers in Lao PDR were split 50/50 between local and those traveling to or from Viet Nam. This resulted in a 49/51 split for passengers in Viet Nam. Local passengers in both countries were assumed to travel one half the length of the segment located in their own country, while passengers travelling between the two countries were assumed to travel the whole length of the line from Vientiane to Vung Anh.

7.3.5 Vientiane – Yuxi

Traffic on the Vientiane – Yuxi missing link was estimated on the basis of factors from the various studies cited above. Sixty-four buses per day were assumed on the roads as of 2000. A 50-passenger load per bus and a diversion rate of 50% were applied to derive total ridership as of 2000. Ridership was split into 67% local and 33% transit, with the same number of local passengers (i.e., 33% of the total) assumed for Lao PDR and the People's Republic of China. Annual growth rates of 5.6% up to 2014 and 4.0% thereafter were applied to forecast traffic over the period 2011-2040.

In applying distances, the traffic was assumed to be oriented to Kunming, rather than Yuxi,[12] Local traffic was assumed to travel, on average, one half the length of the local (Laotian or Chinese) segment, while passengers travelling between the two countries were assumed to make the entire journey between Vientiane and Kunming.

7.3.6 Den Chai – Yuxi

Traffic on the Chiang Rai – Yuxi missing line was estimated separately for two segments: Den Chai to Chiang Rai and Chiang Rai to Yuxi.

[11] Asian Development Bank "Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Technical Assistance Grant to the Lao People's Democratic Republic and a Proposed Loan to the Socialist Republic of Viet Nam for the Greater Mekong Subregion : East-West Corridor Project" November 1999

[12] Projections to Nanning were not developed.

Traffic on the Den Chai – Chiang Rai segment was estimated from ridership data for the State Railway of Thailand (SRT). The SRT's Northern Line runs from Bangkok to Chiang Mai via Den Chai. (See Figure 1.1). Table 7.3 shows ridership on this line as of 2007.

Table 7.3 - Ridership on SRT's Northern Line

Type of Service	Passengers
Social Railway	
Ordinary Train	3,178,313
Bangkok Commuter Train	2,385,097
Rural Commuter Train	1,312,677
Subtotal, Social	6,876,087
Commercial Railway	
Express Train	402,437
Air-Conditioned Diesel Train	382,578
Rapid Train	1,939844
Special Express Train	441,138
Excursion Train	4,285
Subtotal, Commercial	3,170,282
Total	10,046,369

Source: Commercial Section, State Railway of Thailand, November 2008.Figures supplied by Thailand Development Research Institute

Ridership on the Bangkok commuter trains was disregarded. The remaining trains were sorted into express and local services as per table below.

Table 7.4 – Express vs Local Train Services

Express Trains	Local Trains
Express Train	Ordinary Train
Rapid Train	Rural Commuter Train
Special Express Train	Air-Conditioned Diesel Train
Excursion Train	

Passengers on the express trains were assumed to make the entire journey from Bangkok to Chiang Rai. Total ridership of this type was 2,787,704 in 2007. Ridership on a possible Bangkok – Chiang Rai express service was derived from this by adjusting for the population of the two northern cities, Chiang Mai's being approximately one million and Chiang Rai's around 62,000. The resulting ridership would be 172,838.

Ridership on the local trains was assumed to be a function of kilometres of line. Dividing the local ridership by distance between Bangkok and Chiang Mai resulted in a factor of 6,447 passengers per kilometre. Applying this to the 220 kilometre distance between Den Chai and Chiang Rai resulted in a ridership of 1,418,234. (Since the stations between Bangkok and Den Chai are already served by local trains, it was assumed that adding Den Chai –Chiang Rai would not add any traffic on this segment.)

Growth rates from the Aranyaprathet – Poipet study cited above were use to project ridership over the period 2011-2040.

Passenger-kilometres were developed on the assumption that passengers on the express trains would make the entire journey between Bangkok and Chiang Rai and that passengers on the local trains would travel, on average, half the distance between Den Chai and Chiang Rai.

The Chiang Rai – Yuxi segment of this line was assumed to resemble the lines in Lao PDR. The factors used there (64 buses per day, 50 passengers per bus, a 50% diversion rate) were applied, resulting in an estimated 584,000 rail passengers in 2000. Transit, or express, passengers were assumed to travel between Bangkok and Kunming. Given the long distance involved, the percent of transit passengers was set lower than for other links under study, at 25%. Half of the remaining 75% of passengers were assumed to travel on the Chiang Rai – Mohan segment (i.e., within Thailand and Lao PDR), and the other half on the Mohan – Yuxi segment (i.e. within the People's Republic of China).

Annual growth rates of 5.6% up to 2014 and 4.0% thereafter were applied to project traffic over the period 2011-2040.

As with other links under study, the transit (or express) passengers were assumed to make the entire journey between Bangkok and Kunming, while local passengers were assumed to travel, on average, one half the length of the segment to which they were assigned (Chiang Rai – Mohan or Mohan – Yuxi).

7.3.7 Rail Passenger Projections by Route

The missing links were grouped into the four routes described in Section 7.1 as shown in Table 7.5.

Table 7.5 – Links and Routes

ROUTES	MISSING LINKS					
	Aranyaprathet - Poipet	Phnom Penh - Ho Chi Minh City	Nong Khai - Vientiane	Vientiane - Yuxi	Vientiane - Vung Ang	Den Chai - Yuxi
Route 1	√	√				
Route 2			√	√		
Route 3			√		√	
Route 4						√

Tables 7.6 and 7.7 show the estimated passengers and passenger-kilometres by link and route for the period 2011-2025.

Table 7.6 -- Passenger Forecasts by Link

	2011	2012	2013	2014	2015	2016	2017	2018
Aranyaprathet-Poipet								
Passengers	770,538	815,402	863,144	913,970	968,104	1,025,788	1,083,202	1,143,976
Passenger-Kms	246,089,877	260,197,471	275,190,755	291,132,044	308,088,573	326,132,920	344,181,913	363,272,743
Phnom Penh-Ho Chi Minh City								
Passengers	769,757	808,125	848,547	891,144	936,040	983,370	1,033,275	1,085,907
Passenger-Kms	138,103,282	146,365,340	155,152,113	164,498,438	174,441,533	185,021,166	196,279,833	208,262,947
Nong Khai-Vientiane								
Passengers	283,889	299,786	316,575	334,303	347,675	361,582	376,045	391,087
Passenger-Kms	2,554,998	2,698,078	2,849,171	3,008,724	3,129,073	3,254,236	3,384,406	3,519,782
Vientiane-Yuxi								
Passengers	1,063,447	1,123,000	1,185,888	1,252,298	1,302,390	1,354,486	1,408,665	1,465,012
Passenger-Kms	633,282,830	668,746,668	706,196,482	745,743,485	775,573,224	806,596,153	838,859,999	872,414,399
Vientiane-Vung Ang								
Passengers	2,143,511	2,263,547	2,390,306	2,524,163	2,625,130	2,730,135	2,839,340	2,952,914
Passenger-Kms	484,325,443	511,447,668	540,088,737	570,333,706	593,147,055	616,872,937	641,547,854	667,209,768
Den Chai-Yuxi								
Passengers	3,099,574	3,277,681	3,466,726	3,667,442	3,860,582	4,065,107	4,271,000	4,487,941
Passenger-Kms	999,566,322	1,056,357,366	1,116,502,085	1,180,210,212	1,235,776,260	1,294,223,516	1,353,782,705	1,416,230,265

	2019	2020	2021	2022	2023	2024	2025
Aranyaprathet-Poipet							
Passengers	1,208,318	1,276,449	1,348,604	1,416,034	1,486,835	1,561,177	1,639,236
Passenger-Kms	383,468,653	404,836,941	427,449,231	448,821,693	471,262,777	494,825,916	519,567,212
Phnom Penh-Ho Chi Minh City							
Passengers	1,141,425	1,200,000	1,261,813	1,327,057	1,395,935	1,468,666	1,545,481
Passenger-Kms	221,019,044	234,600,000	249,061,266	264,462,115	280,865,917	298,340,417	316,958,050
Nong Khai-Vientiane							
Passengers	406,730	423,000	439,920	457,516	475,817	494,850	514,644
Passenger-Kms	3,660,573	3,806,996	3,959,276	4,117,647	4,282,353	4,453,647	4,631,793
Vientiane-Yuxi							
Passengers	1,523,612	1,584,557	1,647,939	1,713,856	1,782,411	1,853,707	1,927,855
Passenger-Kms	907,310,975	943,603,414	981,347,551	1,020,601,453	1,061,425,511	1,103,882,531	1,148,037,832
Vientiane-Vung Ang							
Passengers	3,071,031	3,193,872	3,321,627	3,454,492	3,592,671	3,736,378	3,885,833
Passenger-Kms	693,898,159	721,654,086	750,520,249	780,541,059	811,762,701	844,233,209	878,002,538
Den Chai-Yuxi							
Passengers	4,716,564	4,957,543	5,211,591	5,455,691	5,711,337	5,979,080	6,259,497
Passenger-Kms	1,481,716,350	1,550,399,598	1,622,447,652	1,693,758,619	1,768,242,677	1,846,042,784	1,927,308,415

Table 7.7 – Passenger Forecasts by Route

	2011	2012	2013	2014	2015	2016	2017	2018
Route 1								
Passengers	1,540,295	1,623,527	1,711,691	1,805,114	1,904,144	2,009,158	2,116,477	2,229,883
Passenger-Kms	384,193,159	406,562,811	430,342,868	455,630,482	482,530,106	511,154,086	540,461,746	571,535,690
Route 2								
Passengers	1,347,336	1,422,787	1,502,463	1,586,601	1,650,065	1,716,067	1,784,710	1,856,098
Passenger-Kms	635,837,828	671,444,746	709,045,652	748,752,209	778,702,297	809,850,389	842,244,405	875,934,181
Route 3								
Passengers	2,427,400	2,563,334	2,706,881	2,858,466	2,972,805	3,091,717	3,215,385	3,344,001
Passenger-Kms	486,880,441	514,145,746	542,937,908	573,342,431	596,276,128	620,127,173	644,932,260	670,729,550
Route 4								
Passengers	3,099,574	3,277,681	3,466,726	3,667,442	3,860,582	4,065,107	4,271,000	4,487,941
Passenger-Kms	999,566,322	1,056,357,366	1,116,502,085	1,180,210,212	1,235,776,260	1,294,223,516	1,353,782,705	1,416,230,265

	2019	2020	2021	2022	2023	2024	2025
Route 1							
Passengers	2,349,743	2,476,449	2,610,417	2,743,091	2,882,771	3,029,844	3,184,717
Passenger-Kms	604,487,697	639,436,941	676,510,497	713,283,808	752,128,694	793,166,333	836,525,262
Route 2							
Passengers	1,930,342	2,007,556	2,087,858	2,171,373	2,258,228	2,348,557	2,442,499
Passenger-Kms	910,971,548	947,410,410	985,306,826	1,024,719,099	1,065,707,863	1,108,336,178	1,152,669,625
Route 3							
Passengers	3,477,761	3,616,871	3,761,546	3,912,008	4,068,488	4,231,228	4,400,477
Passenger-Kms	697,558,732	725,461,081	754,479,525	784,658,706	816,045,054	848,686,856	882,634,330
Route 4							
Passengers	4,716,564	4,957,543	5,211,591	5,455,691	5,711,337	5,979,080	6,259,497
Passenger-Kms	1,481,716,350	1,550,399,598	1,622,447,652	1,693,758,619	1,768,242,677	1,846,042,784	1,927,308,415

Table 7.8 - Summary of Projected Rail Passengers by Route – 2014, 2025 (millions)

Route	Projected Rail Passengers	
	2014	2025
1	1.805	3.185
2	1.587	2.443
3	2.858	4.400
4	3.667	6.260

7.4 FREIGHT TRAFFIC PROJECTIONS

Freight projections are based on the global forecasts presented in Section 5 and Section 6, modified as follows.

Table 7.9 - Summary of Projected Rail Freight Traffic by Route – 2014, 2025 (Thousand Tons):

Route	Freight traffic 2014	Freight traffic 2025
Route	Projected Freight Tonnages	
	2014	2025
1	6,797	25,704
2	6,274	23,830
3	6,274	23,830
4	6,274	23,830

For each route, countries whose rail network was not part of the route were excluded. Thus, for example, traffic between Thailand and Lao PDR was not included in the analysis of Route 1.

Traffic between the two countries already linked by rail (PRC and Viet Nam) was excluded from the analysis. It was assumed that this traffic would not be affected by the construction of the various links under consideration. For example, connecting Cambodia and Viet Nam under Route 1 was assumed not to increase or decrease traffic between PRC and Viet Nam.

For each route, the forecast rail freight traffic was summed over the countries involved to arrive at total tons and ton-kilometres for the route. For example, for Route 1, the sum Thailand-Cambodia, Thailand-Viet Nam and Cambodia-Viet Nam traffic was used in the analysis.

7.5 ECONOMIC ANALYSIS

The objective of the economic analysis is to compare the different route options at a strategic level. We are not doing a feasibility study or a pre-feasibility study, which would require more thorough investigation and more data. This is the reason why we

did not take into account additional rolling stock and system upgrading costs in our calculations.

In the economic analysis we usually apply an adjustment for the costs (shadow pricing) to eliminate taxes, import duties and other transfer payments. It is a lengthy process to compute shadow process for each country, and for this study we did not apply such adjustment.

7.5.1 Construction Costs

Table 7.10 presents the estimated construction costs for each route. These costs were based on various existing reports and feasibility studies. We spread out the total amount over three years (2011-2013).

Table 7.10 - Construction costs (millions US $)

	2011	2012	2013	Total
Route 1	358	358	369	1,085
Route 2	1,755	1,755	1,808	5,318
Route 3	756	756	779	2,292
Route 4*	2,073	2,073	2,136	6,282

* For Route 4 the cost of Chiang Rai – Chiang Khong – Boten link (330 km) was not available; we assumed that the cost per km is the same as the other links.

7.5.2 Operating Costs

For railway operating costs we used a variable operating cost factor from a previous study,[13] which indicate 0.8 cents per tonne-km. Our experience in developing countries shows that the portion of variable cost is more or less 65% of total cost which allows us to calculate a factor for total operating cost: 1.2 cents per tonne-km. We then apply this factor to the total tonne-kilometres for each route to obtain the year by year operating costs.

7.5.3 Benefits Calculations

7.5.3.1 Cost savings

We used unit factors to estimate cost savings resulting from the use of railway instead of trucks for freight traffic, and bus for passenger traffic. The studies indicated in Section 5 were used. For freight, the factor was adjusted to reflect the distribution of the GMS traffic by commodity. In the Nongkhai-Vientiane study we have the following factors:

[13] Nongkhai – Vientiane railway link project – Final Report, Systra – Canarail, August 2008

	per tonne	per tonne-km
Oil	$ 34.80	$ 0.0544
Containers	$ 70.60	$ 0.1103
Other	$ 13.20	$ 0.0206

The distribution of the projected GMS traffic in 2025 is:

- Oil : 20.9%
- Containers : 27.5%
- Others : 51.6%

We calculated a weighted factor using the above percentages.

The factors used in the economic model are the following:

- 0.54 cents per passenger-km
- 5.24 cents per tonne-km

7.5.3.2 Externalities

The benefits and costs of rail service are first calculated in terms of the interests and behaviour of the various parties directly involved in providing and using rail service. However, the provision of rail service involves a number of externalities or spill-over effects which are not adequately captured by this means. Some of these effects could be considered as benefits and some as costs, a distinction not made in the present model. For each externality, the net effect is calculated and carried to the cash flows with an appropriate sign (positive or negative, as the case may be). These effects are quantified and monetized as follows.

a) Noise, Air Pollution and Greenhouse Gases

All transportation modes contribute to pollution (noise pollution, air pollution, greenhouse gases) to a greater or lesser extent. No factors specific to the GMS countries which could be used to estimate these effects were found. International factors were therefore used. These are shown in Table 7.11, expressed in US dollars.

Table 7.11 - Pollution by Mode – US$

PASSENGER MODES				
Type of Pollution	**Cost per Thousand Passenger-Km**			
	Car	**Bus**	**Rail**	**Air**
Noise	$8.34	$1.90	$5.71	$5.26
Air	$25.38	$28.70	$7.18	$2.39
Greenhouse gases	$23.30	$13.00	$7.80	$51.58
Total	$57.01	$43.61	$20.69	$59.24

FREIGHT MODES		
Type of Pollution	**Cost per Thousand Tonne-Km**	
	Truck	**Rail**
Noise	$7.49	$5.10
Air pollution	$47.42	$5.82
Greenhouse gases	$22.15	$6.86
Total	$77.06	$17.78

Source: External Costs of Transport – Accident, Environmental and Congestion Costs in Western Europe, INFRS – IWW, March 2000

For diverted passenger traffic, the coefficient for all pollution effects taken together is multiplied by thousand passenger-kilometres for each mode from which the passengers are diverted, with the result being considered a benefit. For rail passenger traffic, the coefficient for all types of pollution taken together for the rail mode is multiplied by total passenger kilometres, with the result being considered a "disbenefit". The disbenefits are subtracted from the benefits, and the result is carried to the cash flows.

For freight traffic, the disbenefit (rail-related pollution cost) is subtracted from the benefit (truck-related pollution cost), and the resulting net benefit is carried to the cash flows.

b) Safety

The data necessary to calculate accident rates is difficult to obtain for the GMS countries. However, some international factors are available and were used to compare different modes. Cost-of-accident factors for the European Union are

available from the source cited above for pollution. Stated in 2008 US dollars, these are:

Table 7.12 – Cost-of-Accident Factors for the European Union

PASSENGER MODES – COST PER 1,000 PASSENGER-KMS			
Car	**Bus**	**Rail**	**Air**
$52.72	$4.54	$1.45	$0.88
FREIGHT MODES – COST PER 1,000 TONNE-KMS			
Truck	**Rail**		
$9.96	$1.30		

7.5.4 Economic Evaluation Results

Table 7.13 summarizes the results for the base case and for the sensitivity test for the four routes; results are shown for rate of return and Net Present Value (NPV) in the same table. The sensitivity was tested for four variables: passenger traffic, freight traffic, operating costs and construction costs. Eighty per cent and hundred and twenty per cent means respectively a decrease and an increase by twenty per cent of a variable compared to the base case.

Table 7.13 - Results of Economic Analysis

ECONOMIC ANALYSIS RESULTS - Route 1

		NPV (millions US $)		
		@ 12%	@ 10%	IRR
Base Case		$19,294	$25,203	74.88%
Sensitivity Analysis				
Passenger Traffic	80%	$19,266	$25,168	74.80%
	120%	$19,322	$25,238	74.96%
Freight Traffic	80%	$14,809	$19,405	65.00%
	120%	$23,779	$31,001	83.71%
Operating Costs	80%	$19,754	$25,797	75.83%
	120%	$18,834	$24,609	73.92%
Construction Costs	80%	$19,488	$25,401	84.81%
	120%	$19,100	$25,005	67.54%

ECONOMIC ANALYSIS RESULTS - Route 2

		NPV (millions US $)		
		@ 12%	@ 10%	IRR
Base Case		$9,555	$13,657	24.32%
Sensitivity Analysis				
Passenger Traffic	80%	$9,515	$13,606	24.27%
	120%	$9,596	$13,707	24.37%
Freight Traffic	80%	$6,410	$9,590	20.96%
	120%	$12,701	$17,723	27.34%
Operating Costs	80%	$9,878	$14,073	24.64%
	120%	$9,233	$13,240	23.99%
Construction Costs	80%	$10,508	$14,625	27.75%
	120%	$8,603	$12,688	21.80%

ECONOMIC ANALYSIS RESULTS - Route 3

		NPV (millions US $)		
		@ 12%	@ 10%	IRR
Base Case		$15,283	$20,317	44.52%
Sensitivity Analysis				
Passenger Traffic	80%	$15,252	$20,278	44.45%
	120%	$15,314	$20,355	44.59%
Freight Traffic	80%	$11,455	$15,367	38.51%
	120%	$19,112	$25,266	49.98%
Operating Costs	80%	$15,676	$20,824	45.10%
	120%	$14,891	$19,809	43.93%
Construction Costs	80%	$15,694	$20,734	50.69%
	120%	$14,873	$19,899	40.03%

ECONOMIC ANALYSIS RESULTS - Route 4

		NPV (millions US $)		
		@ 12%	@ 10%	IRR
Base Case		$9,156	$13,374	22.45%
Sensitivity Analysis				
Passenger Traffic	80%	$9,089	$13,290	22.38%
	120%	$9,223	$13,458	22.52%
Freight Traffic	80%	$5,936	$9,212	19.34%
	120%	$12,376	$17,537	25.24%
Operating Costs	80%	$9,486	$13,801	22.75%
	120%	$8,826	$12,947	22.15%
Construction Costs	80%	$10,281	$14,519	25.65%
	120%	$8,030	$12,229	20.10%

The IRR results are very high, especially for Routes 1 and 3, but the objective of this analysis is to compare the four routes and to give indications for further steps such as

detailed studies. It should also be noted that the cost of locomotives and rolling stock and system upgrading elsewhere in the national systems were not considered in this analysis, and adding this cost would reduce the IRR.

7.6 SUMMARY AND EVALUATION

Table 7.14 summarizes projected rail freight and passenger demands for 2014 and 2025.

Table 7.14 - Estimated GMS Rail Passenger and Freight Demand Projections and Cost of Construction, by Route

Route	Traffic Forecast				Cost Estimate ($ billion)
	Passengers (million)		Freight (million tons)		
	2014	2025	2014	2025	
1	1.8	3.2	6.8	25.7	1.09
2	1.6	2.4	6.3	23.8	5.32
3	2.9	4.4	6.3	23.8	2.29
4*	3.7	6.3	6.3	23.8	6.28

* For Route 4, the cost of Chiang Rai–Chiang Khong–Boten link (330 kilometers) was not available; it was assumed that the cost per kilometer is the same as the other links.

Table 7.15 summarizes the results of economic analysis of the four proposed routes and sensitivity testing. As noted previously, the results were tested for sensitivity to four variables — passenger traffic, freight traffic, operating costs, and construction costs —and a decrease and an increase by 20% of each variable compared to the base case. Note that investments in rolling stock and system upgrading elsewhere in the national systems are not included and would reduce the internal rates of return if taken into account.

Table 7.15 - Estimated Economic Internal Rate of Return of GMS Railway Routes(%)

Case	Level (%)	Route			
		1	2	3	4
Base Case	100	75	24	45	22
Sensitivity Analysis					
Passenger Traffic	80	75	24	44	22
	120	75	24	45	23
Freight Traffic	80	65	21	39	19
	120	84	27	50	25
Operating Costs	80	76	25	45	23
	120	74	24	44	22
Construction Costs	80	85	28	51	26
	120	68	22	40	20

7.7 PRELIMINARY CONCLUSION

The projections on freight and passenger demand and on internal rates of return shown in Tables 7.14 and 7.15 suggest that priority should be given to constructing route 1. Relative to the other routes, route1:

- Has the largest potential traffic volume,
- Connects all GMS countries except Myanmar,
- Has the lowest construction cost,
- Has the highest projected economic internal rate of return,
- Has attracted the interest of the private sector as investors and operators, and
- Can be implemented quickly because a detailed feasibility is currently under preparation.

Table 7.16 - Comparison of Principal Route Options

	Route/Principal Nodes	Projected Rail Traffic		Lines to be Constructed		Investment Required		Perceived Level of Marketability	Time Needed to Implement
		Freight 2025 (million tonnes)	Passengers 2025 (millions)	Nodes	Total Kilometers	Estimated Construction Cost ($ Billion)	EIRR Base Case (%)		
1	Bangkok-Phnom Penh-Ho Chi Minh City/Hanoi-Kunming-Nanning	25.70	3.2	Aranyaprathet-Poipet Phnom Penh-Loc Ninh Loc Ninh-Ho Chi Minh City	397	$1.09	75	High	**Short** - Feasibility studies for Phnom Penh - Loc Ninh and Loc Ninh-Ho Chi Minh City nearing completion. Connection of Cambodia and Thailand requires priority intervention.
2	Bangkok-Vientiane-Kunming (via Boten/Mohan)-Nanning-Hanoi/Ho Chi Minh City	23.83	2.4	Thanalaeng-Vientiane Vientiane-Boten Yuxi-Mohan-Boten	1092	$5.32	24	Low	**Moderate** - Feasibility studies completed. High investment.
3	Bangkok-Vientiane-Hanoi/Ho Chi Minh (via Tha Khaek-Mu Gia-Vung Anh)-Kunming-Nanning	23.83	4.4	Thanalaeng-Vientiane Vientiane-Tha Khaek-Mu Gia Mu Gia-Vung Anh	615	$2.29	45	Medium	**Moderate -** Feasibility Studies completed.
4	Bangkok-Kunming (via Chiang Rai-Boten-Mohan)-Nanning-Hanoi/Ho Chi Minh City	23.83	6.3	Den Chai-Chiang Rai-Chiang Khong Chiang Khong-Boten* Yuxi-Mohan-Boten	1150	$6.28	22	Low	**Long** - Need feasibility studies: Den Chai-Chiang Rai-Chiang Khong and Chiang Khong-Boten. High investment.

8. STRATEGIC FRAMEWORK

8.1 GOALS AND PRIORITY ACTIONS

The goal for the GMS countries in rail transport is an efficient and interconnected railway network. This section provides the strategic framework to begin the development of such a network.

Toward that goal, five sets of priority actions are required:

1. Ensuring that all GMS countries are connected to a GMS rail network by 2020.
2. Promoting the development of a seamless rail network in the GMS by:
   - agreeing on common technical standards of interoperability,
   - streamlining and harmonizing procedures for cross-border movement of goods and people,
   - agreeing on regional operating rules and safety standards and
   - fostering cooperation between GMS railways, and ensuring connection to other modes of transport.
3. Ensuring that railway infrastructure and equipment in the GMS is modern and sufficient to meet the demand for rail services, and operated and regulated according to best practices in the operation and regulation of railways.
4. Developing GMS railway organizations to support the development of the rail network
5. Involving the private sector in the planning and development of the GMS railway network.

The strategic framework has four components to support these priority actions: completing at least one connecting route before 2020, complementary investments in upgrading the national railway networks constituting the selected route, technical assistance projects to prepare national strategies and investment studies and to develop information networks, and establishing the GMS railway coordination office. These components are described below.

Component 1: Identify and Complete at Least One Connecting Route by 2020

Despite years of discussions and widespread support within the GMS on the concept of building a GMS rail network and linking Singapore to Kunming by rail, it has not happened.

Thus, the first component is to enable sufficient investment to ensure that at least one GMS rail route is completed by 2020. This decision will act as a catalyst both for governments – getting them to understand what is needed to make the decision and what is required to support the decision – and the private sector, to attract interest in the railway sector. The analysis herein recommends that the priority route be Route 1.

However, selection of a priority route for initial investments does not preclude construction of other routes.

Inherent in deciding on the route is the commitment to complete it. Without at least one complete GMS rail route, there will be no network. In that case, complementary efforts to expand the capacity of GMS railways (components 2 and 3) will not support the development of a network, but rather individual national railway systems, which should, however, be undertaken concurrently.

Component 2: Complementary Investments

The second component is providing the supporting investments needed to upgrade the capacity of the existing railway lines on the selected route. Constructing missing links will be of little use if they connect to lines that have not been upgraded or are already experiencing capacity constraints.

Thus, once the priority route has been selected, studies on the upgrading requirements of the supporting lines should be completed or updated so that upgrading existing lines of the GMS priority route may proceed in parallel with constructing the missing links.

Table 8.1 provides estimates of the investments required to support the development of the existing lines of Route 1 and the indicative timing of the investments.

Table 8.1 - Indicative Investment Requirements – Route 1 Existing Lines

	Indicative Project Description	Country	Estimated Construction or Line Upgrading Cost* ($ million)	Suggested Timing					
				10	11	12	13	14	15
Existing Lines of GMS Route 1	Completion of construction: Mengzi-Hekou	PRC	1210						
	Upgrading of supporting line: Aranyaprathet-Klong Sip Kao Junction	Thailand	100						
	Upgrading of supporting line: Ho Chi Minh City-Hanoi	Vietnam	925						
	Upgrading of supporting line: Hanoi-Haiphong	Vietnam	105						
	Upgrading of supporting line: Hanoi-Dong Dang	Vietnam	1665						
	Upgrading of supporting line: Kunming-Nanning	PRC	11765						

* Excludes cost of locomotives & rolling stock. Infrastructure only.

Component 3: Technical Assistance Projects

The third component is support for the many subsidiary but vital investments to address issues that are presently barriers to building an interconnected and efficient GMS rail network. They include adopting common technical standards; building appropriate regulatory regimes; fostering cooperation and agreements between countries on cross-border transport and exchange of information; and studies on developing national railway strategies and assessing the investments required in other aspects of railway operations, such as locomotives and rolling stock and human resources.

Some of the required investments might be attractive to the private sector. However, for others, the countries will require technical assistance. Appendix E contains a list of proposed technical assistance projects and indicates their estimated cost and potential benefits toward resolving these issues.

Component 4: Greater Mekong Subregion Rail Coordination Office

Developing an interconnected and efficient GMS rail network is a massive and complex undertaking, and it is important that it succeed. The rail development initiative needs to be well-coordinated, and, perhaps most importantly, will need to establish a profile in the GMS with all stakeholders. To achieve those aims, a GMS rail coordination office should be established in the subregion with a small staff—three specialists and perhaps a staff member from each of the GMS countries.

The function of the coordination office would be:

- To coordinate the large amount of technical work to be undertaken by various working groups and external consultants.
- To liaise with railway and government officials to address issues related to progress on the completion of the priority route and the various supporting initiatives.
- To serve as a point of contact with the private sector to mobilize its interest and participation in the development of the GMS railway network.
- To support the raising of financing for the priority route and other initiatives.
- To monitor and report on progress in achieving the objectives of the GMS railway development initiative.
- To serve as a resource centre for distribution of information to the public on the status of the network and the progress of its development.
- To serve as the focal point for developing the GMS railway information network and database.

8.2 NEXT STEPS

This strategic framework provides a platform for further dialogue, discussion, and agreement on prioritizing and carrying out the actions necessary to bring the individual national railways together into a truly seamless subregional network. There are many identified constraints to implementing the identified priority actions. Key constraints are shown in Appendix F, which also suggests ways to resolve them, primarily through the parallel and sequenced technical assistance projects (described in Appendix E).

The GMS Economic Cooperation Program is fortunate in having many opportunities, such as the GMS Subregional Transport Forum and Economic Corridor Forum, for discussion and decision making on priority actions and their implementation. Taking advantage of these opportunities should ensure that the desire of the GMS countries for an efficient GMS railway system could be fulfilled within the decade.

APPENDIX A

LIST OF CONSULTATIONS

Ministry of Railways, PRC

China International Freight Forwarders Association (CIFA)

COFCO, Beijing

SINOTRANS, Beijing

Yunnan Chamber of Commerce

Ministry of Transport, Socialist Republic of Viet Nam

Transport Development and Strategy Institute, Hanoi

Appatit Co., Lao Cai

Lien Viet Joint Stock Company, Hanoi

RATRACO Joint Stock Company, Hanoi

Viet Nam Chamber of Commerce and Industry, Hanoi

Viet Nam Railways Corporation, Hanoi

TRACO Joint Stock Company, Haiphong

Haiphong Railway Service Joint Stock Company, Haiphong

Viet Nam International Freight Forwarders Association, Ho Chi Minh City

Ministry of Public Works and Transport, Kingdom of Cambodia

Toll Holdings (Cambodia) Ltd.

SOKIMEX, Phnom Penh

Myanmar Ministry of Railway Transportation, Transport Planning Department, Nay Pyi Taw

Myanmar Railways, Nay Pyi Taw

Ministry of Transport, Office of Transport and Traffic Policy, Kingdom of Thailand, Bangkok

State Railway of Thailand, Bangkok

Toll Global Logistics, Bangkok

PTT (plc), Bangkok

Shell Company of Thailand, Bangkok

Office of the National Economic and Social Development Board, Office of the Prime Minister, Kingdom of Thailand

Thailand International Freight Forwarders Association

Royal Group, Cambodia

Mandarin Equity Group, Bangkok

Corporate Risk Control Ltd., Bangkok

APPENDIX B

HARMONIZED SYSTEM CLASSIFICATION – SECTIONS AND CHAPTERS

Section	Chapter	Description
I		***Live Animals ; Animal Products***
	1	Live Animals
	2	Meat and edible meat offal
	3	Fish and crustaceans, molluscs
	4	Dairy produce : birds eggs, natural honey
	5	Other product of animal origin
II		***Vegetable Products***
	6	Live trees and other plants ; bulbs ; cut flowers
	7	Edible vegetables and certain roots and tubers
	8	Edible fruit and nuts ; peel of citrus fruit or melons
	9	Coffee, tea, mate and spices
	10	Cereals
	11	Products of the milling industry ; malt ; starches ; inulin ; wheat gluten
	12	oil seeds and oleaginous fruits ; misc. grains seeds and fruits ; industrial
	13	Lac ; gum ; resins and other vegetable saps and extracts
	14	Vegetable plaiting materials, vegetable products elsewhere specified
III		***Animal or vegetable fats and oils and their cleavage products***
	15	Animal or vegetable fats and oils and their cleavage products ; prepared edible fats ; animal or vegetable waxes
IV		***Prepared food stuffs ; beverages, spirits and vinigar ; tobacco***
	16	Preparations of meat, of fish or of crustaceans, molluscs
	17	Sugar and sugar confectionary
	18	Cocoa and cocoa preparations
	19	Preparations of cereals, flour, starch or milk
	20	Preparations of vegetables, fruit, nuts or other parts of plants
	21	Miscellaneous edible preparations
	22	Beverages, spirits and vinigar
	23	Residues and waste from the food industries ; prepared animal fodder
	24	Tobacco and manufactured tobacco substitutes
V		***Mineral Products***
	25	Salt ; sulphure ; earths and stone ; plastering materials, lime and cement
	26	Ores, slag and ash
	27	Mineral fuels, mineral oils and products of their distillation ; bituminous substances ; mineral waxes
VI		***Products of the chemical or allied industries***
	28	Inorganic chemicals ; organic or inorganic compounds of precious metals
	29	Organic chemicals
	30	Pharmaceutical products
	31	Fertilisers
	32	Tanning of dyeing extracts ; tannins and their derivates ; dyes, pigments ; paints and varnishes ; inks
	33	Essential oils and resinoids ; perfumery, cosmetic or toilet preparations
	34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artifical waxes
	35	Albuminoidal substances, glues, enzymes
	36	Explosives ; pyrotechnic product ; matches ; pyrohoric alloys ; certain cumbustible preparations
	37	Photographic or cinematographic goods
	38	Miscellaneous chemical products
VII		***Plastics and articles thereof ; Rubbers and articles thereof***
	39	Plastics and articles thereof
	40	Rubbers and articles thereof
VIII		***Raw Hides and Skins, Leather, Furskins and articles thereof ; Saddlery and Harness ; Travel Goods, Handbags and similar containers***
	41	Raw Hides and Skins(excluding furskin) & Leather
	42	Articles of leather; Saddlery and Harness ; Travel Goods, Handbags and similar containers
	43	Furskins and artificial fur ; manufactures thereof
IX		***Wood and articles of wood ; wood charcoal ; cork and articles of cork ; manufactures of straw, of esparto or of other plainting materials ; Basket ware and wickerwork***
	44	Wood and articles of wood ; wood charcoal
	45	Cork and articles of cork
	46	Manufactures of straw, of esparto or of other plainting materials ; Basket ware and wickerwork
X		***Pulp of wood or of other fibrous cellulosic material ; waste and scrap of paper or paperboard, paper and paperboard and articles thereof***
	47	Pulp of wood or of other fibrous cellulosic material ; waste and scrap of paper or paperboard
	48	Paper and paperboard ; articles of paper pulp, of paper or of paperboard
	49	Printed books, newspapers, pictures and other products of the printing industry ; manuscripts and plans

APPENDIX C

Projected Freight Tonnage by Route (2014)

Projected Freight Tonnage Flows (thousand tonnes)

Bangkok-Phnom Penh-Ho Chi Minh City / Hanoi-Kunming-Nanning

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia		0.02		5	25	16	47
Lao PDR					72		72
Myanmar							0
PRC	48				929	1065	2042
Thailand	363	164		2042		898	3467
Vietnam	68			1006	66		1139
	478	164	0	3053	1092	1980	6767

Bangkok-Vientiane-Kunming (via Boten / Mohan)-Nanning-Hanoi / Ho Chi Minh City

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				10	72	7	88
Myanmar							0
PRC		6			929	1065	2001
Thailand		164		2042		898	3104
Vietnam		8		1006	66		1080
		179	0	3057	1067	1970	6274

Bangkok-Vientiane-Tha Khaek-Mu Gia-Vung Anh-Ho Chi Minh City / Hanoi-Kunming-Nanning

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							
Lao PDR				10	72	7	88
Myanmar							
PRC		6			929	1065	2001
Thailand		164		2042		898	3104
Vietnam		8		1006	66		1080
		179		3057	1067	1970	6274

Bangkok-Kunming (via Chiang Rai-Chiang Khong-Boten-Mohan)-Nanning-Hanoi / Ho Chi Minh City

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				10	72	7	88
Myanmar							0
PRC		6			929	1065	2001
Thailand		164		2042		898	3104
Vietnam		8		1006	66		1080
	0	179	0	3048	1067	1970	6274

Projected Route miles

Estimated Construction Cost	KM to be Developed	Route kilometres					
($ Billion)		**Route 1**					
$ 1.09	397						
			Phnom Penh	Vientiane	Myanmar	Kunming	Bangkok	HCMC/Hanoi
		Phnom Penh		1313	2823	646	1254
		Vientiane	1313			667	
		Myanmar					
		Kunming	2823			3469	1569
		Bangkok	646	667	3469		1900
		HCMC/Hano	1254		1569	1900	
($ Billion)		**Route 2**					
$ 5.32	1092						
			Phnom Penh	Vientiane	Myanmar	Kunming	Bangkok	HCMC/Hanoi
		Phnom Penh					
		Vientiane			1191	667	2652
		Myanmar					
		Kunming		1191		1858	1569
		Bangkok		667	1858		3211
		HCMC/Hanoi		2652	1569	3211	
($ Billion)		**Route 3**					
$ 2.29	615						
			Phnom Penh	Vientiane	Myanmar	Kunming	Bangkok	HCMC/Hanoi
		Phnom Penh					
		Vientiane			2175	667	1469
		Myanmar					
		Kunming		2175		2842	1569
		Bangkok		667	2842		2136
		HCMC/Hanoi		1469	1569	2136	
($ Billion)		**Route 4 ***					
$ 6.28	1150						
			Phnom Penh	Lao PDR	Myanmar	Kunming	Bangkok	HCMC/Hanoi
		Phnom Penh					
		Lao PDR			708	667	2061
		Myanmar					
		Kunming		708		1792	1569
		Bangkok		667	1792		3145
		HCMC/Hanoi		2061	1569	3145	

* Construction cost for Chiang Khong-Boten estimated.

Projected Tonne-kilometres by Route (2014)

Estimated Net Tonne-km (thousands)

Route1

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia		25		13628	16332	20577	50561
Lao PDR	0				47694		47694
Myanmar							0
PRC	134922				3224137	1671335	5030393
Thailand	234527	109359		7084075		1705961	9133922
Vietnam	84840			1578055	125196		1788090
	454289	109383	0	8675757	3413358	3397873	16050661

Route2

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				11357	47694	19135	66829
Myanmar							0
PRC		7729			1726386	1671335	3405450
Thailand		109359		3793217		2882626	6785201
Vietnam		22319		1578055	211548		1811922
	0	139407	0	5382628	1985628	4573095	12069401

Route3

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				20739	47694	10599	79033
Myanmar							0
PRC		14115			2640929	1671335	4326379
Thailand		109359		5802652		1917411	7829421
Vietnam		12363		1578055	140713		1731131
		135836	0	7401446	2829337	3599345	13965963

Route4

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				6751	47694	14871	69316
Myanmar							0
PRC		4595			1665510	1671335	3341439
Thailand		109359		3659459		2823815	6592632
Vietnam		17345		1578055	207232		1802632
	0	131298	0	5244264	1920435	4510020	11806018

APPENDIX D

Projected Freight Tonnage by Route (2025)

Projected Freight Tonnage Flows (thousand tonnes)

Bangkok-Phnom Penh-Ho Chi Minh City / Hanoi-Kunming-Nanning

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia		0.1		18	96	62	177
Lao PDR					272		272
Myanmar							0
PRC	182				3530	4046	7758
Thailand	1379	623		7757		3411	13170
Vietnam	257			3820	250		4328
	1818	623	0	11596	4149	7519	25704

Bangkok-Vientiane-Kunming (via Boten / Mohan)-Nanning-Hanoi / Ho Chi Minh City

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				36	272	27	335
Myanmar							0
PRC		25			3530	4046	7601
Thailand		623		7757		3411	11791
Vietnam		32		3820	250		4103
		680	0	11614	4052	7484	23830

Bangkok-Vientiane-Tha Khaek-Mu Gia-Vung Anh-Ho Chi Minh City / Hanoi-Kunming-Nanning

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				36	272	27	335
Myanmar							0
PRC		25			3530	4046	7601
Thailand		623		7757		3411	11791
Vietnam		32		3820	250		4103
		680		11614	4052	7484	23830

Bangkok-Kunming (via Chiang Rai-Chiang Khong-Boten-Mohan)-Nanning-Hanoi / Ho Chi Minh City

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				36	272	27	335
Myanmar							0
PRC		25			3530	4046	7601
Thailand		623		7757		3411	11791
Vietnam		32		3820	250		4103
	0	680	0	11614	4052	7484	23830

Projected Tonne-kilometres by Route (2025)

Estimated Net Tonne-km (thousands)

Route 1

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia		95		51774	62035	78162	192066
Lao PDR	0				181168		181168
Myanmar							0
PRC	512487				12246819	6348535	19107841
Thailand	890847	415396		26908721		6480064	34695028
Vietnam	322265			5994208	475553		6792026
	1725600	415491	0	32954702	12965575	12906761	60968128

Route 2

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				43138	181168	72691	253859
Myanmar							0
PRC		29358			6557644	6348535	12935537
Thailand		415396		14408460		10949731	25773588
Vietnam		84784		5994208	803588		6882580
	0	529539	0	20445806	7542400	17370957	45845564

Route 3

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				78779	181168	40265	300212
Myanmar							0
PRC		53614			10031518	6348535	16433667
Thailand		415396		22041260		7283336	29739992
Vietnam		46964		5994208	534516		6575687
		515974	0	28114246	10747202	13672136	53049558

Route 4

From / To	Cambodia	Lao PDR	Myanmar	PRC	Thailand	Vietnam	Total
Cambodia							0
Lao PDR				25644	181168	56492	263304
Myanmar							0
PRC		17452			6326405	6348535	12692392
Thailand		415396		13900383		10726211	25041990
Vietnam		65890		5994208	787225		6847323
	0	498738	0	19920234	7294798	17131238	44845009

APPENDIX E

LIST OF PROPOSED TECHNICAL ASSISTANCE PROJECTS

No.	Project	Key Outputs	Benefits	Cost and Countries Involved ($ million)
1	Facilitation of agreement to connect railway networks of Thailand and Cambodia.	Bilateral agreement to connect	Essential for development of GMS priority route (Route 1).	0.125 All GMS countries
2	Determination of Investment Needs: Upgrading of Supporting Lines of GMS Rail Route 1	Investment plan for Route 1 supporting lines	Establishes investment required to support GMS priority rail route (Route 1) and determines sources of financing.	0.250 All GMS countries
3	Ranking Study: Priorities for Investment in other GMS Rail Routes	Sequence of development of other GMS rail routes and component lines	Sets priorities for next phase of investments in GMS routes. Can be derived (in part) from national railway strategies.	0.250 All GMS countries
4	Cambodia Railway Sector Development Strategy	Railway Sector Strategic Plan	Determines national rail sector objectives and strategy.	0.125 Cambodia
5	Lao PDR Railway Sector Development Strategy	Railway Sector Strategic Plan	Determines national rail sector objectives and strategy.	0.500 Lao PDR
6	Thailand Railway Sector Development Strategy	Railway Sector Strategic Plan	Determines national rail sector objectives and strategy.	0.750 Thailand
7	Myanmar Railway Sector Development Strategy	Railway Sector Strategic Plan	Determines national rail sector objectives and strategy. Embraces participation of Myanmar in development of GMS rail network.	0.500 Myanmar
8	GMS Railway Minimum Technical Standards	Regional working group to agree on common GMS railway technical standards	Common technical standards are essential for network connectivity and interoperability.	0.500 All GMS countries
9	GMS Railway Rolling Stock Investment Needs	Long-term investment needs and strategy for funding	Will aid in investment planning. Significant investment in new locomotives and rolling stock will be necessary, especially in fuel-efficient locomotives.	0.500 All GMS countries
10	GMS Railway Investment Needs: Telecommunications, Train Control, and MIS	Long-term investment needs and strategy for funding.	Will aid in investment planning. Significant investment in telecommunications, train control, and MIS will be required.	0.500 All GMS countries
11	Training Needs Assessment of GMS Railways	Long-term investment needs and strategy for funding.	Will identify GMS railways need for skills upgrading to embrace new technologies	0.750 All GMS countries
12	Rolling Stock Leasing: GMS Market Potential Study	Identification of potential for development of private equipment-leasing companies to meet locomotive and rolling stock needs	Requires participation of private sector.	0.250 All GMS countries (Private sector contribution 0.125)

No.	Project	Key Outputs	Benefits	Cost and Countries Involved ($ million)
13	GMS Railway Transshipment Exchange Facility Needs Assessment	Evaluation of efficiency of current transfer facilities and identification of options for improvements, and development of guidelines for investment by other GMS railways, if and when required.	Addresses rail gauge issue; meter gauge will remain for some time. Facilitates logistics chains and smooth functioning of network.	0.250 PRC and Viet Nam
14	GMS Cross-Border Rail Technical Protocols	Regional working group to identify technical issues specific to rail and to develop agreed guidelines and protocols for handling cross-border inspections.	Facilitates logistics chains and smooth functioning of rail network.	0.500 All GMS countries
15	Implementation of Agreed GMS Cross-Border Protocols for Rail	Bilateral agreements for implementation of either agreed cross-border rail protocols or mutually modified protocols.	Facilitates logistics chains and smooth functioning of rail network.	0.600 All GMS countries
16	Development of Electronic Data Interchange in GMS Railways	Plan for electronic integration of GMS railways.	Involves private sector. Can aid in development of logistics chains, tracking by customers, online ticketing, etc. May solve some cross-border movement issues.	0.500 All GMS countries
17	Assessment of Multimodal Connectivity of GMS Railways	Evaluation of investments needed to ensure connection of GMS railways to other modes.	Essential for achieving an interconnected multimodal transport network.	0.500 All GMS countries
18	GMS Rail Database and Information Network	Regional working group to develop framework, define needs and reporting and sharing protocols, and to implement data network.	Will establish database of GMS rail statistics necessary for planning and evaluation. Fosters cooperation among GMS railways. Could be foundation for a GMS railway association.	1.000 All GMS countries
19	Assessment of Need for Restructuring of GMS Railways and Rail Sectors	Evaluation of the financial and operational performance of GMS railways; identification of options for changes in organization and sector to improve performance; development of consensus on strategy.	Sector restructuring in some form will likely be required to enable railways to generate capital to sustain (some) operations and meet future investment requirements. Reforms are needed to promote private sector investment. Involves extensive regional consultation with all stakeholders, public and private.	1.000 All GMS countries

No.	Project	Key Outputs	Benefits	Cost and Countries Involved ($ million)
20	Assessment of Safety in GMS Railways	Risk assessment of railway operational and workplace safety. Guidelines for safety management plans.	Action to eliminate unsafe practices and prevent incidents and accidents is important to general public.	0.750 All GMS Countries
21	General Appraisal of Compliance with ADB Environmental and Social Safeguards in New Rail Construction Projects in GMS	Determination of degree of compliance with ADB safeguards. Recommendations for modification of ADB safeguards.	Difficult to finance investments without compliance with safeguards.	0.500 All GMS Countries

APPENDIX F

Priority Actions, Constraints, and Responses

Priority Action toward Completing the GMS Rail Network	Observed Key Constraint	Recommended Response*
Ensuring that all GMS countries are connected to a rail network by 2020	1. Lack of consensus on where (and when) to start has delayed implementation of SKRL so far	Identify and complete at least one connecting route by 2020 (component 1).
	2. All GMS routes and secondary lines are considered important for national economic development of GMS countries; considerable investment ($1.0 billion–$1.5 billion minimum) will be needed to construct lines needed for the priority route alone; how to secure and structure financing for investment?	Technical assistance to support necessary agreements, studies, and assessments (TA projects 1,19, 21).
	3. National railways and railway sectors in GMS countries are in various stages of development; strategy not yet been set out in Cambodia, Lao PDR, Myanmar, and Thailand	Technical assistance to support development of national rail sector strategies, where lacking (TA projects 4–7).
Promoting development of a seamless rail network by: - agreeing on technical standards of interoperability - streamlining and harmonizing procedures for cross-border movement of goods and people - agreeing on regional operating rules and safety standards - fostering cooperation between GMS railways - ensuring connection to other modes of transport	1. Technical standards and operating rules vary from country to country	Technical assistance on technical standards, rail gauge issues, cross-border protocols, data interchange, multimodal connectivity, database development, and safety assessments (TA projects 8, 13–18, 20).
	2. Decisions needed on use of standard- versus meter-gauge rail	
	3. Cross-border rail protocols in place between the PRC and Viet Nam and between Thailand and Malaysia only; rail procedures different from those on road	
	4. Extensive encroachment and trespassing on railway rights of way inhibits safe operations; greater potential for accident/incidents due to increased traffic (and increased speeds)	
	5. Connections to road and waterways need to be developed to ensure seamless network	
	6. Shippers and passengers not participants in the development process	

Priority Action toward Completing the GMS Rail Network	Observed Key Constraint	Recommended Response*
Ensuring that railway infrastructure and equipment are modern and sufficient to meet the demand for rail services	1. Investment needed for locomotives, rolling stock, telecommunications, information technology, and human resources is substantial and not yet clearly identified	Provision of supporting investments (component 2).
	2. National railways (and railway sectors) in GMS countries are in various stages of development	Technical assistance to assess needs in rolling stock (buy/lease), telecommunications, train control, management information systems, and restructuring needs assessment (TA projects 8–13, 19).
	3. Financing limited	
Supporting the development of GMS railway organizations and the implementation of best practice in the operation and regulation of GMS railways	1. National railways and railway sectors in GMS countries are in various stages of development; agreed strategy not set out in Cambodia, Lao PDR, Myanmar, and Thailand	Technical assistance on national railway strategies, training needs assessment, and electronic data interchange (TA projects 4–7,11,16, 18–20); establish a GMS rail coordination office (component 4).
	2. GMS railways not viable from a purely economic and financial perspective; but there is a need to balance national economic and social development objectives with long-term need for efficient rail operations	
	3. Staff in most GMS railways need skills development and exposure to modern railway technologies	
Involving the private sector in the planning and development of the GMS railway network	1. Regulatory and legislative environment not conducive	Technical assistance projects to study rolling stock leasing, transshipment exchange facility, data interchange, multimodal connectivity, restructuring, and compliance with safeguards (TA projects 12,13,16,17,19, 21).
	2. Railway organizations not commercially responsive	
	3. Private sector currently not participating	
	4. Environmental and social safeguards must be followed to ensure ADB investment in capital projects and to attract private lending institutions	