

TP 12929E
APEC Transportation Safety and Security Project
Satellite Navigation and Communications

Element 1 - Inventory of Existing and Planned
SN&C Systems in the APEC Economies
Part 1: Trade, Traffic and APEC

Prepared for
Transportation Development Centre
Safety and Security
Transport Canada

by
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in Association with
Econolynx

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This report reflects the views of the authors and not necessarily those of the Transportation Development Centre.

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16. Abstract <p>Canada is a member of the Asia-Pacific Economic Cooperation (APEC) which comprises 18 economies: Australia, Brunei Darussalam, Canada, Chile, the People's Republic of China, Chinese Taipei, Hong Kong, Indonesia, Japan, the Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the Republic of the Philippines, Singapore, Thailand and the United States. In support of APEC, Transport Canada undertook a study of the implementation of satellite navigation and communications (SN&C) for both air and marine. This study consists of the following elements:</p> <ul style="list-style-type: none"> • Element 1 - Inventory of Existing and Planned SN&C Systems in APEC economies; • Element 2 - SN&C Technology and Safety Review; and • Element 3 - Costs and Benefits of SN&C for Air and Marine Transportation. <p>This report presents the results of Part 1: Trade, Traffic and APEC of Element 1, and covers in particular:</p> <ul style="list-style-type: none"> • Air and marine traffic, and marine cargo data for historical and forecast years for the APEC economies. • The demands on air and marine transportation infrastructure along with changes in airports and ports, both those underway and planned ones. 					
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16. Résumé <p>Le Canada est membre de l'APEC (Organisation de la coopération économique Asie-Pacifique), qui comprend les 18 pays suivants : Australie, Brunei Darussalam, Canada, Chili, République populaire de Chine, Chine de Taïpei, Hong Kong, Indonésie, Japon, République de Corée, Malaisie, Mexique, Nouvelle-Zélande, Papouasie-Nouvelle-Guinée, République des Philippines, Singapour, Thaïlande et États-Unis. À l'appui de l'APEC, Transports Canada a entrepris une étude sur la mise en oeuvre de systèmes de navigation et de communications par satellite (NCS) pour l'aviation et la marine. Cette étude comporte les éléments suivants :</p> <ul style="list-style-type: none"> • Élément 1 - Inventaire des systèmes actuels et prévus de NCS dans les pays de l'APEC; • Élément 2 - Examen de la technologie et de la sécurité des systèmes NCS; • Élément 3 - Coûts et avantages des systèmes NCS pour les transports aériens et maritimes. <p>Dans le présent rapport, on retrouve les résultats de la partie 1: Échanges, trafic et APEC, de l'élément 1, notamment :</p> <ul style="list-style-type: none"> • le trafic aérien et maritime et les données sur le fret maritime des années passées et prévues pour les pays de l'APEC. • les demandes imposées à l'infrastructure des transports aériens et maritimes, ainsi que les modifications, en cours et prévues, dans les aéroports et les ports. 					
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- TP 12928** APEC Transportation Safety & Security Project
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Summary Report for Study Elements 1, 2 and 3
- TP 12929E** APEC Transportation Safety & Security Project
Satellite Navigation and Communications
Element 1 - Inventory of Existing and Planned
SN&C Systems in the APEC Economies
Part 1: Trade, Traffic and APEC
- TP 12930E** APEC Transportation Safety & Security Project
Satellite Navigation and Communications
Element 1 - Inventory of Existing and Planned
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Part 1: Technology Review
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Part 2: Safety Review
- TP 12933E** APEC Transportation Safety & Security Project
Satellite Navigation and Communications
Element 3 - SN&C Costs and Benefits Assessment
in the APEC Economies

Executive Summary

INTRODUCTION

APEC Satellite Navigation and Communications Study

The Asia-Pacific Economic Cooperation (APEC) comprises 18 economies: Australia, Brunei Darussalam, Canada, Chile, the People's Republic of China, Chinese Taipei, Hong Kong, Indonesia, Japan, the Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the Republic of the Philippines, Singapore, Thailand, and the United States. These economies have agreed to cooperate in four areas: global and regional economic development, global trade liberalization, and regional cooperation in specific sectors. One of the sectors identified is transportation. The Transportation Working Group (TPT/WG) was created to coordinate that effort.

The ambitious agenda for liberalizing trade in the region will bring about a rapid increase in air and marine traffic and a requirement for higher levels of aircraft and shipping throughput. This demand for increased capacity is driving the application of satellite communications, navigation and surveillance technologies and systems. It is apparent from discussions in the TPT/WG that the economies of APEC share an interest in introducing new technologies and systems in a way that maintains or improves transportation safety.

The Canadian Minister of Transport has made a commitment to APEC Ministers of Transportation to lead the promotion of transport system safety in the APEC region. To that end, Transport Canada proposed a study on the implementation of satellite navigation and communications (SN&C) for both of air and marine. The study is a component of the APEC Action Program in Transportation.

The study consists of the following elements:

- ▶ Element 1 - Inventory of Existing and Planned Satellite Navigation and Communications Systems in the APEC Economies;
- ▶ Element 2 - Satellite Navigation and Communication Technology and Safety Review; and

- ▶ Element 3 - Costs and Benefits of Satellite Navigation and Communications for Air and Marine Transportation.

Hickling Corporation was contracted to carry out the work and detailed reports have been prepared and are available for each of the three elements. This report presents Part 1: Trade and Traffic of the final report for Element 1. A separate report presents the second part, Part 2: Implementation Plans.

Part 1: Trade, Traffic and APEC Report

This report presents the trade and traffic analysis for the marine and aviation sectors for the APEC economies, Element 1 of the Study. In particular this report:

- ▶ Presents air and marine traffic, and marine cargo data for historical and forecast years; and
- ▶ Describes the demands on air and marine transportation infrastructure along with the changes in airports and ports, both those underway and planned ones.

RESULTS

Growth in the Region

At present the Asia-Pacific region boasts the highest level of economic growth in the world. It is transforming itself from the “world’s factory” exporting inexpensive industrial products to a “vast consumer market” in its own right. APEC’s principal role is to create an environment conducive to the sustained growth of the Asian economy, dubbed the world’s growth centre. Many of the economies within this region are currently experiencing Growth Domestic Product (GDP) growth rates exceeding 6.0 percent; GDP will be higher in Asia-Pacific than in North America by 2010. APEC economies currently have 38.9 percent of the world’s population and 51.6 percent of its total GDP. High growth trends and increased per capita income have placed a great strain on transportation infrastructure, both air and marine.

Air Transport

Recent increases in Asia-Pacific international passenger growth reflect strong economic growth in the region as a whole. Passengers have the wherewithal to buy tickets, and real income expansion is fuelled by cargo traffic (export trade) and purchase requirements (import trade). The unique geography of the region has continued to fuel growth as many of the economies are islands making air travel the primary mode of transport. In addition, political stability, relaxation of travel restrictions (primarily Korea and Taiwan) and increased personal disposable income have contributed to the overall growth in air travel.

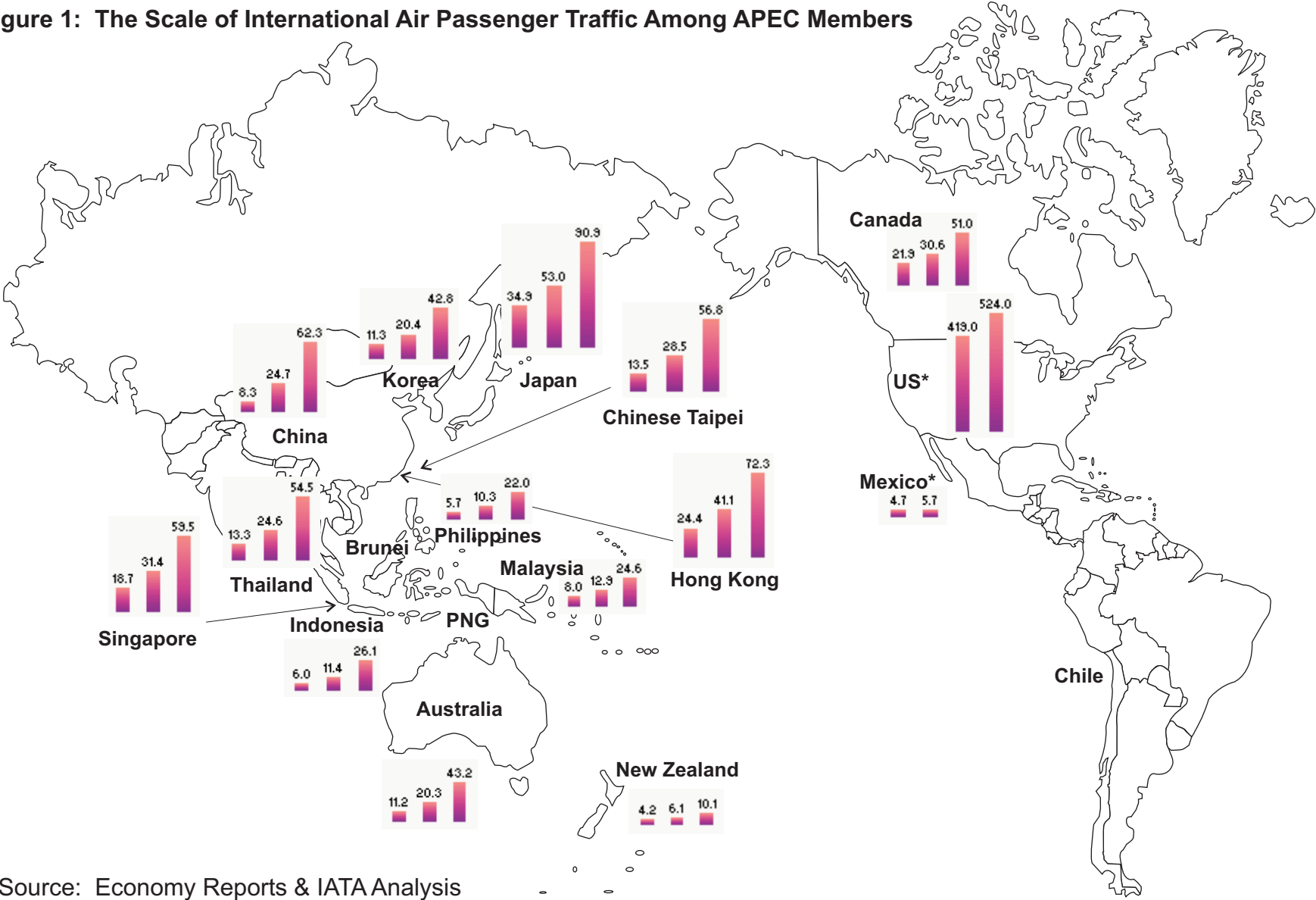
Demand for air transport (typically driven by passenger demand) in the Asia-Pacific region is now growing faster than in any other world region. By 2010, Asia-Pacific will have more international scheduled passengers than the rest of the world, exceeding 50 percent of the world total. Between 1993 and 2000, Asia-Pacific international scheduled passenger traffic will grow by 8.6 percent per annum reaching a new peak of 200 million passengers in 2000. By 2010 this figure will increase to 398 million; 3.5 times higher than in 1993. In comparison, the rest of the world will reach an aggregated 390 million passengers by 2010. Consequently, the global share of Asia-Pacific international passenger traffic will have increased from 26.4 percent in 1985 to 35.3 percent in 1993, and will increase even further to 50.5 percent by the year 2010. Figure 1 presents historical and forecast international passenger traffic for economies in the region.

Japan has been and will remain, the region's dominant traffic market accounting for over 90 million passengers traveling to and from this economy. While it dominates the air traffic market today, Vietnam will achieve the most rapid growth in the future, followed by China. Passenger traffic to and from Vietnam is expected to increase by 18.9 percent annually on average between 1993 and 2000, then by a further 16.0 percent per annum thereafter.

Increased traffic in the APEC region is expected to reflect and follow current trends. That is, scheduled traffic on *long-haul routes* (routes greater than 1 500 nm in length) has been and will continue to remain *dominant*. Not only is long-haul route growth expected to continue, but average travel distances along long-haul routes are expected to increase. Short-haul routes, on the other hand, will achieve lower rates of growth than any other routes. Figure 2 presents 1994 growth in main inter-regional air traffic flows.

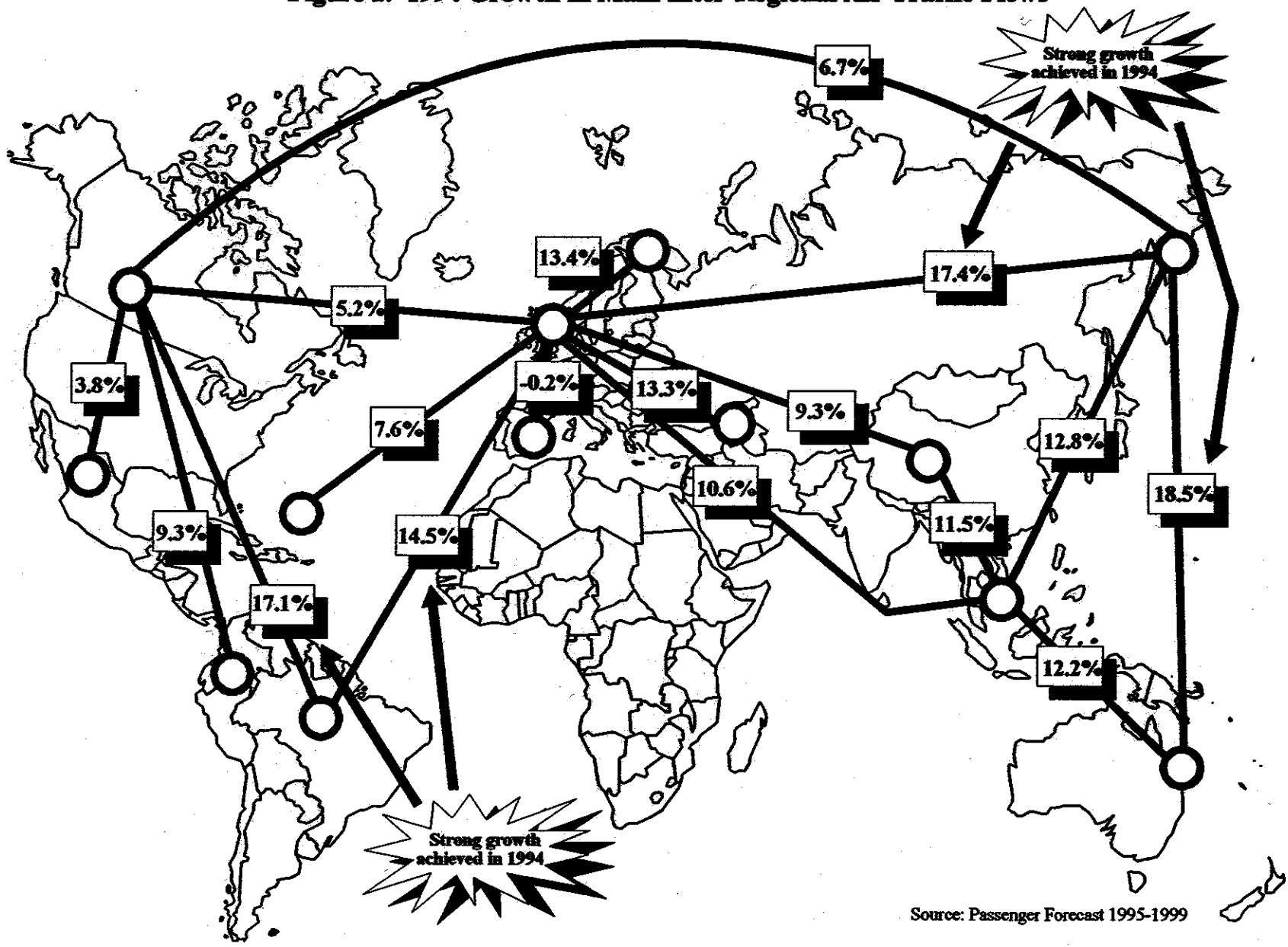
In terms of region pairs, the most dominant pairs are and will remain within the Asia-Pacific area. By 2010 five origin-destination pairs in this region will be showing air traffic exceeding 10 million passengers annually: China-Hong Kong, Japan-U.S. Mainland, China-Taiwan, Japan-Korea and Hong Kong-Taiwan.

Figure 1: The Scale of International Air Passenger Traffic Among APEC Members



Source: Economy Reports & IATA Analysis
 Notes: Passenger traffic in millions for 1993, 2000 and 2010
 * Data for these countries are for 1993 and 1999 only

Figure 2: 1994 Growth in Main Inter-Regional Air Traffic Flows



Source: Passenger Forecast 1995-1999

To cope, economies of the region are investing heavily in new airports. Five new airports have opened since 1980 - Singapore/Changi, Jakarta/Sukarno Hatta, Osaka/Kansai, Macau and Shenzhen, China. In contrast, the U.S. opened only one major international airport in the past 25 years, Denver International Airport, and no airports are under construction. While in the Asia-Pacific region, six more are under construction or planned to be in operation by 2005 - Kuala Lumpur Airport in Malaysia, New Seoul Metropolitan Airport and Chengju, South Korea's two new airports; New Bangkok International Airport in Thailand; Changhai Airport at Pudong, China, and Hong Kong's Chek Lap Kok Airport. By constructing these airports, Asia is preparing the foundation for future economic development.

However, airspace capacity in Asia has been falling behind airport development. Air traffic control systems and procedures in the past have not kept pace with traffic growth. With new airports designed to handle millions of passengers, the primary obstacle to this growth is airspace congestion. The key to removing this obstacle is the implementation of CNS/ATM hardware and the procedures necessary to gain the efficiency and reduced separation needed to accommodate the air traffic growth. As a result, the APEC economies are jumping in to lead the world in the use of satellite navigation and communication for air traffic management.

Marine Transport

The more industrialized economies of the region have succeeded in moving into the production of export items by incorporating high domestic value-added and technological sophistication, and then market diversification. These economies have not only developed inter-regional exports but have also become increasingly important markets for each other's exports. To serve these supply capabilities and external demand for manufactured exports, there has been a rapidly expanding requirement for seaborne traffic. Energy must be shipped in tankers and liquid natural gas (LNG) vessels. Ores must be carried in bulk carriers, as must timber, grains, oilseeds and other commodities. But more importantly, consumer and capital goods need containers and the specialized vessels or cargo ship deck space to carry them. These marine cargo requirements have put great pressure on port capacities and the infrastructure that supports them. Passenger demand does not typically have a significant impact on marine traffic levels.

Total inter-regional seaborne general cargo trade comprising break-bulk and unitized cargoes is estimated to have reached 50 million tons in 1993. About 45 percent of the total cargo from Taiwan, China and from Korea is destined for Hong Kong, a considerable portion which is expected to go to China. The exports of Taiwan are 1.4 times larger than its imports and the Korean exports are almost three times the volume of imports.

Hong Kong and Singapore were ranked as the world's first and second largest ports in container volume in 1993, handling over 9 million TEUs (or 20-foot equivalent units), twice as much as in 1989. Both ports are pouring money into expansion; Hong Kong alone plans to be able to handle 32 million TEUs by 2011. The combined throughput of these two ports alone accounts for 16.7 percent of the world total volume. This large portion reflects both ports' transshipment activities linking feeder services with trunk lines.

The most active ocean route is China to/from Japan; this route is serviced by over 2 000 vessels a year, undertaking over 8 000 voyages in each direction (i.e., 16 000 plus in total). The next most heavily travelled route is Japan to/from Southeast Asia, where there are about 5 000 voyages, in each direction (9 200 in total), using 1 800 vessels a year. The next largest group of voyages are Japan to/from Australia and New Zealand, with about 3 500 voyages in each direction (7 000 in total) using 1 200-1 400 vessels each year. Southeast Asia to/from Australia and New Zealand also has intensive traffic, registering some 2 000 voyages in each direction (4 000 in total), employing some 1 000 vessels. There is also significant marine trade between China and Australia and New Zealand — 1 200 voyages (2 500 in total) and around 600 vessels.

Trans-Pacific marine trade is dominated by the Japan to/from U.S. Southwest and U.S. Northwest traffic. On the U.S. Southwest route around 2 000 voyages in each direction (4 100 in total) are undertaken by around 800 vessels. On the U.S. Northwest route, the indicators are 1 800 voyages (3 700 in total), and 700 vessels. For Western Canada, the Japan route is the most important with about 1 300 voyages (2 650 in total), using some 600 vessels.

The West Coast of the U.S. is the principal origin/destination for trans-Pacific maritime trade. Key ports are Los Angeles, Long Beach, Oakland, Tacoma, Portland and Seattle. These ports recorded growth rates of 3 percent per annum from 1984 to 1994, but the pace has now quickened to 4 percent per annum. Import tonnage has been growing at 4 percent annually, while exports have expanded annually at 2 percent by volume over the past ten years. Of these ports the ports of Los Angeles and Long Beach are the two largest in the U.S. and they expect to **double** their cargo volume by the year 2020. Independently, the ports of Long Beach and Los Angeles are the two largest in the nation. Combined, they *rank third in the world* for container trade.

The Port of Long Beach is the number one container port in the United States. During 1995, 2 843 502 TEUs crossed Long Beach wharves. The total volume of all forms of cargo was 91.3 million metric revenue tons. The value of cargo passing through Long Beach during 1995 was in excess of \$70 billion. Exports through Long Beach are now growing four times as fast as imports. During the first six months of the 1995-96 fiscal year, exports soared by 25 percent, while imports grew by 6 percent. Today, exports account for 43 percent of all containerized cargo passing through Long Beach — up from 28 percent recorded just 10 years ago. Nearly 80 percent of all international cargo crossing Long Beach is moving to or from

Asia with Japan, China, Hong Kong, South Korea and Taiwan being the leading top five trade partners, in order.

The Port of Los Angeles is the number one West Coast port in terms of value. Los Angeles has almost quadrupled the value of cargo handled since 1984 with the total value now passing through the port topping \$73.4 billion, \$2.5 billion more than its closest competitor – the Port of Long Beach.

Despite the overall strength of the Asian market, trade with Latin America also spurred the port's success. Chilean Line moved to Long Beach and imported pitted fruits and grapes to stock grocery store shelves during the California winter season. Container lines reported increased imports of refrigerated fruits, vegetables, fish and meats in their inbound flows, contributing to an overall 200 percent hike in trade between Long Beach and Latin America.

Vancouver is Canada's largest port, and consistently in the top five North American ports in terms of foreign import and export tonnage. It is the largest bulk port on the North American west coast with tonnage throughput in 1995 exceeding 71.5 million t. The Port of Vancouver currently has two container terminals located in the Burrard Inlet – *Centerm* and *Vanterm*. To meet the growth in container volumes projected over the next decade, the Port of Vancouver is planning an additional container facility, *Deltaport*, to be situated at Roberts Bank in the outer harbour, 30 nautical miles (40 km by land) from downtown Vancouver and Burrard Inlet. *Deltaport* will double the Port of Vancouver's overall container capacity to more than one million TEUs per year.

Recent strong growth of inbound TEU (manufactured imports) traffic to the West Coast is resulting in mounting sea-lane and port congestion. Both Long Beach and Los Angeles see their TEU traffic doubling by 2020. For traffic originating from China, Hong Kong, South Korea, and Latin America, the doubling could occur before 2010. The rapid buildup of trans-Pacific maritime trade is pushing ocean carriers to purchase new and larger vessels. For instance, Hyundai Merchant Marine of Korea has introduced six new 4 411 TEU mega-container ships on service to Long Beach. Later in 1996 Hyundai will start developing 5 551 TEU ships on its trans-Pacific routes. The larger vessels yield substantial economies of scale and can operate at up to 25 knots. By travelling faster with more TEU cargo, these mega-ships can lower operating costs and meet the growing demand for speedy, efficient, reliable trans-Pacific container service.

Sommaire

INTRODUCTION

Étude de l'APEC sur les systèmes de navigation et de communications par satellite

L'APEC (Organisation de coopération économique Asie-Pacifique) comprend 18 pays : Australie, Brunei Darussalam, Canada, Chili, République populaire de Chine, Chine de Taïpei, Hong Kong, Indonésie, Japon, République de Corée, Malaisie, Mexique, Nouvelle-Zélande, Papouasie-Nouvelle-Guinée, République des Philippines, Singapour, Thaïlande et États-Unis. Ces pays ont convenu de coopérer dans les quatre domaines suivants : le développement économique mondial et régional, la libéralisation des échanges mondiaux, enfin, la coopération régionale dans certains secteurs, notamment les transports. Le Groupe de travail chargé des transports (TPT/WG) a été créé pour coordonner cette activité.

L'ambitieux programme de libéralisation du commerce dans la région entraînera une augmentation rapide du trafic aérien et maritime; il faudra donc améliorer la capacité des aéronefs et des navires. Cette demande de capacité accrue favorise le recours aux technologies et aux systèmes de communications, de navigation et de surveillance par satellite. Il ressort clairement des entretiens au sein du TPT/WG que les pays membres de l'APEC ont un intérêt commun dans l'introduction de nouvelles technologies et de nouveaux systèmes de façon à maintenir ou à améliorer la sécurité des transports.

Le ministre canadien des Transports s'est engagé envers ses homologues de l'APEC à mener la promotion de la sécurité des systèmes de transport dans la région. À cette fin, Transports Canada a proposé une étude sur la mise en oeuvre de systèmes de navigation et de communications par satellite (NCS) pour l'aviation et la marine. Cette étude fait partie du programme d'action de l'APEC en matière de transports.

Cette étude comporte les éléments suivants :

- ▶ Élément 1 - Inventaire des systèmes actuels et prévus de navigation et de communications par satellite dans les pays de l'APEC;

- ▶ Élément 2 - Examen de la technologie et de sécurité des systèmes de navigation et communications par satellite;
- ▶ Élément 3 - Coûts et avantages des systèmes de navigation et de communications par satellite pour les transports aériens et maritimes.

On a retenu les services de la société Hickling pour l'exécution des travaux. Chacun de ces derniers a fait l'objet d'un rapport détaillé qui est disponible. Dans le présent rapport, on retrouve la partie 1 : Échanges et trafic, du rapport final de l'élément 1. La partie 2 : Plans de mise en oeuvre, est présentée dans un rapport séparé.

Partie 1 : Rapport sur les échanges, le trafic et l'APEC

Le présent rapport contient l'analyse des échanges et du trafic pour les secteurs maritime et aérien des pays de l'APEC, soit l'élément 1 de l'étude. En particulier, ce rapport :

- ▶ présente le trafic aérien et maritime et les données sur le fret maritime des années passées et prévues;
- ▶ décrit les demandes imposées à l'infrastructure des transports aériens et maritimes, ainsi que les modifications, en cours et prévues, dans les aéroports et les ports.

RÉSULTATS

Croissance dans la région

À l'heure actuelle, la région Asie-Pacifique jouit de la plus forte croissance économique au monde. Après avoir été "l'usine du monde" qui exportait des produits industriels bon marché, elle se transforme de son propre chef en un vaste marché de consommation. Le principal rôle de l'APEC est de créer un environnement favorable à la croissance soutenue de l'économie asiatique, véritable centre de croissance du monde. De nombreuses économies dans cette région jouissent à l'heure actuelle d'un taux de croissance de leur produit intérieur brut (PIB) supérieur à 6,0 p. 100; le PIB sera plus élevé en Asie-Pacifique qu'en Amérique du Nord d'ici 2010. Les économies de l'APEC représentent actuellement 38,9 p. 100 de la population mondiale et 51,6 p. 100 du PIB total. Ces tendances de forte croissance et l'augmentation du revenu par habitant soumettent à de fortes contraintes l'infrastructure des transports aériens et maritimes.

Transports aériens

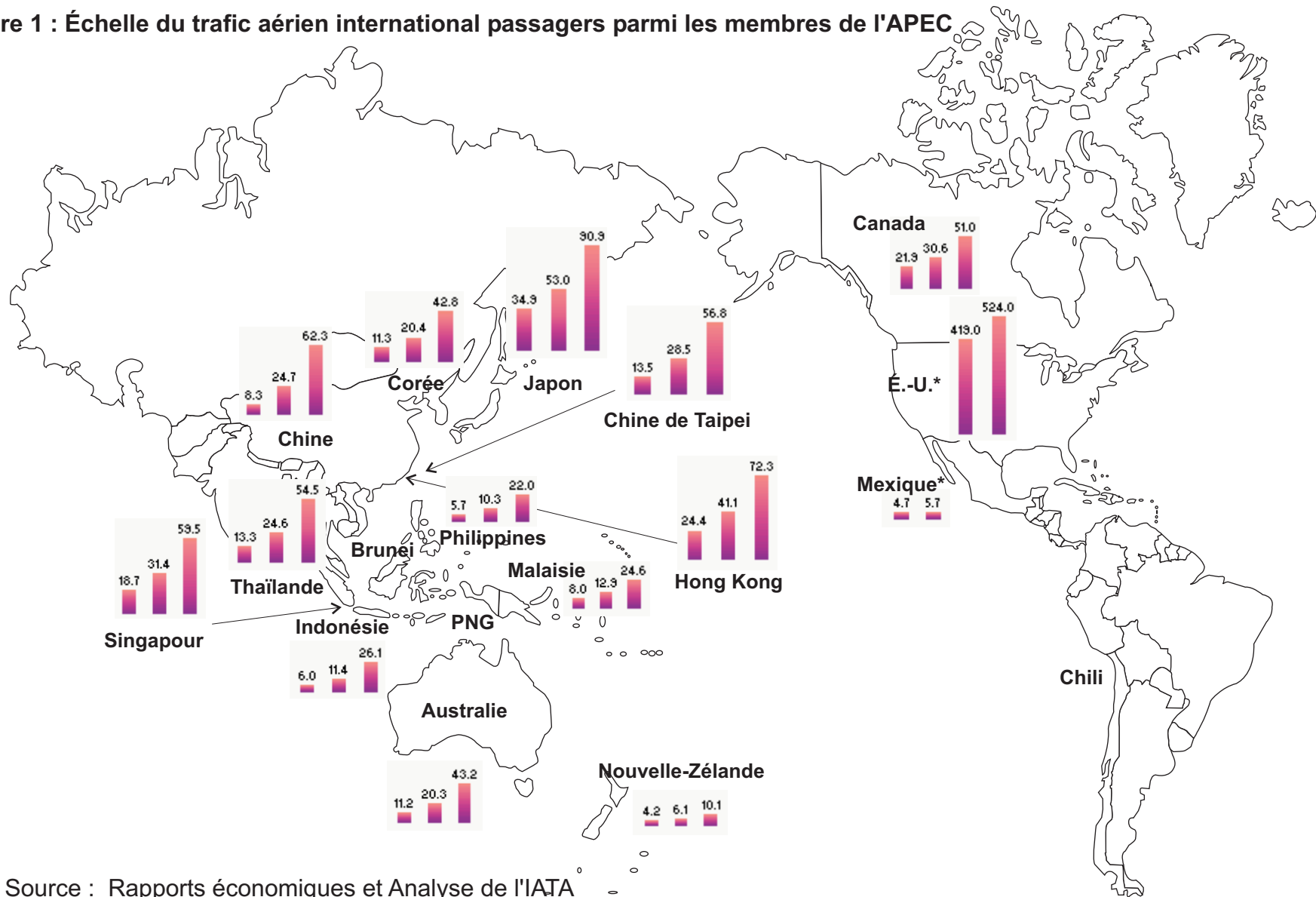
Les récentes augmentations du trafic international passagers en Asie-Pacifique traduisent la forte croissance économique de la région dans son ensemble. Les passagers ont les moyens d'acheter des billets et l'augmentation des revenus est alimentée par le trafic de fret (exportations) et les achats nécessaires (importations). La configuration géographique unique de la région continue de favoriser la croissance, la plupart des pays concernés étant des îles pour lesquelles l'avion est le principal moyen de transport. En outre, la stabilité politique, le relâchement de la réglementation des voyages (principalement en Corée et à Taïwan) et l'augmentation des revenus personnels disponibles ont contribué à la croissance générale des voyages aériens.

La demande de transports aériens (généralement menée par la demande des passagers) dans la région Asie-Pacifique connaît maintenant une croissance plus rapide que dans toute autre région du monde. D'ici 2010, l'Asie-Pacifique comptera plus de passagers réguliers internationaux que le reste du monde, avec plus de 50 p. 100 du total mondial. Entre 1993 et 2000, le trafic régulier international passagers en Asie-Pacifique augmentera de 8,6 p. 100 par an pour atteindre un nouveau pic de 200 millions de passagers en l'an 2000. D'ici 2010, ce chiffre grimpera jusqu'à 398 millions, c'est-à-dire 3,5 fois plus qu'en 1993. À titre de comparaison, le nombre total de passagers pour le reste du monde atteindra 390 millions d'ici 2010. Par conséquent, la part mondiale du trafic international passagers de l'Asie-Pacifique sera passée de 26,4 p. 100 en 1985 à 35,3 p. 100 en 1993, et continuera d'augmenter jusqu'à 50,5 p. 100 d'ici l'an 2010. La figure 1 présente le trafic international passagers passé et prévu pour les pays de la région.

Le Japon a été et va rester le marché dominant du trafic de la région avec plus de 90 millions de passagers entrant au pays et en sortant. Dominant aujourd'hui le marché du trafic aérien, le Viêt-nam connaîtra la croissance la plus rapide et sera suivi par la Chine. On prévoit que le trafic passagers entrant au Viêt-nam et en sortant augmentera de 18,9 p. 100 en moyenne par an entre 1993 et 2000, puis de 16,0 p. 100 par an par la suite.

Il est prévu que le trafic accru dans la région de l'APEC reflète et suive les tendances actuelles. Autrement dit, le trafic régulier sur les *itinéraires long-courrier* (itinéraires de longueur dépassant 1 500 milles marins) est *prédominant* et va le rester. On prévoit non seulement que la croissance des itinéraires long-courrier va se poursuivre, mais aussi qu'il y aura augmentation des voyages de distances moyennes sur les itinéraires long-courrier. Par contre, les itinéraires court-courrier vont connaître les taux de croissance les plus faibles. La figure 2 présente la croissance en 1994 des principaux flux de trafic aérien entre régions.

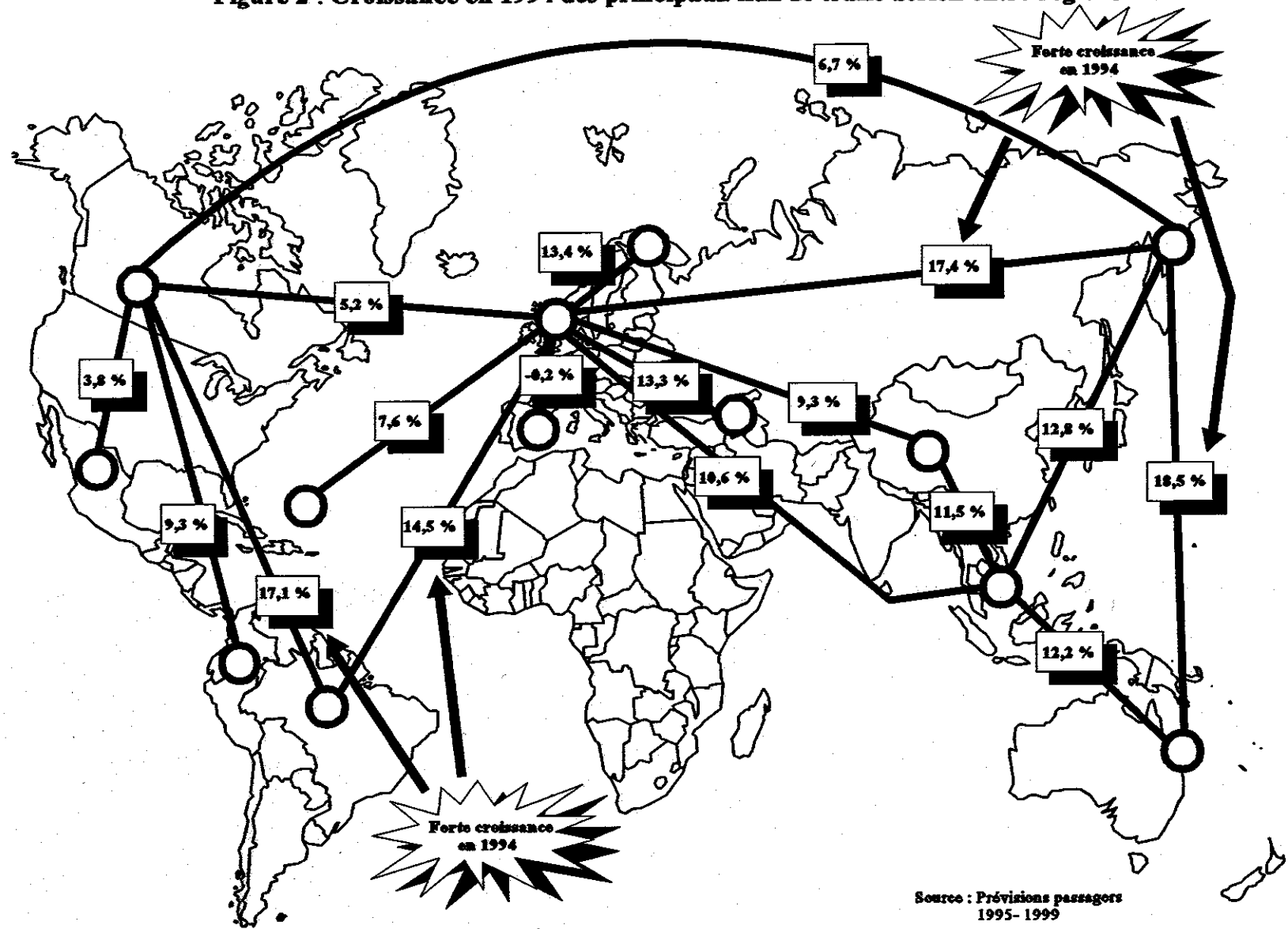
Figure 1 : Échelle du trafic aérien international passagers parmi les membres de l'APEC



Source : Rapports économiques et Analyse de l'IATA
 Notes : trafic passagers en millions pour 1993, 2000 et 2010

* Les données pour ces pays sont uniquement pour 1993 et 1999

Figure 2 : Croissance en 1994 des principaux flux de trafic aérien entre régions



En ce qui concerne les paires de régions, les paires prédominantes sont et vont rester dans la région Asie-Pacifique. D'ici 2010, cinq paires origine-destination dans cette région auront un trafic aérien de plus de 10 millions de passagers par an : Chine-Hong Kong, Japon-continent des É.-U., Chine-Taïwan, Japon-Corée et Hong Kong-Taïwan.

Pour faire face à cette croissance, les pays de la région investissent lourdement dans de nouveaux aéroports. Cinq nouveaux aéroports ont été ouverts depuis 1980 - Singapour/Changi, Djakarta/Sukarno Hatta, Osaka/Kansai, Macau et Shenzhen en Chine, alors qu'aux États-Unis, un seul grand aéroport international a été ouvert au cours des 25 dernières années, l'aéroport international de Denver. De même, tandis qu'il n'y a pas d'aéroport en construction aux États-Unis, la région Asie-Pacifique en compte six de plus dont la construction est en cours ou dont l'exploitation est prévue d'ici 2005 - l'aéroport Kuala Lumpur en Malaisie, deux nouveaux aéroports en République de Corée (le nouvel aéroport de Séoul et celui de Chengju), le nouvel aéroport international de Bangkok en Thaïlande, l'aéroport de Shanghai à Pudong en Chine, et l'aéroport Chek Lap Kok de Hong Kong. Avec la construction de ces aéroports, l'Asie prépare les fondements du futur développement économique.

En revanche, la capacité de l'espace aérien en Asie a pris du retard sur la création d'aéroports. Les systèmes et les procédures de contrôle de la circulation aérienne utilisés jusqu'à présent n'ont pas progressé aussi rapidement que l'augmentation du trafic. Avec ces nouveaux aéroports conçus pour accueillir des millions de passagers, l'encombrement de l'espace aérien est un obstacle majeur à la croissance. Le moyen d'éliminer cet obstacle consiste à mettre en place le matériel CNS/ATM et les procédures nécessaires pour atteindre le niveau de rendement requis et pour réduire l'écart afin de faire face à la croissance du trafic aérien. Les pays de l'APEC vont donc avoir l'occasion de servir d'exemple pour le reste du monde dans l'utilisation des systèmes de navigation et de communications par satellite pour la gestion du trafic aérien.

Transports maritimes

Les pays les plus industrialisés de la région ont réussi à passer à la production d'articles d'exportation en incorporant une forte valeur ajoutée interne et des perfectionnements technologiques, puis en diversifiant leur marché. Ces pays ont non seulement augmenté leurs exportations entre régions mais sont aussi devenus des marchés mutuels d'exportation de plus en plus importants. Pour répondre à ces capacités d'offre et à cette demande externe de produits d'exportation manufacturés, on a de plus en plus recours aux transports maritimes. Le combustible est transporté dans les navires pétroliers et les méthaniers (GNL). Les minerais sont transportés dans les vraquiers, tout comme le bois de construction, les céréales, les graines oléagineuses et autres marchandises. Mais ce qui est plus important, les biens de consommation et de production ont besoin de conteneurs et de navires spécialisés ou d'espaces de pont sur les navires de charge pour être transportés. Ces diverses

exigences de fret maritime ont fait peser de fortes contraintes sur les installations portuaires et sur leur infrastructure. La demande du trafic passagers n'a pas en général une influence considérable sur le trafic maritime.

On estime que le total du fret maritime entre régions comprenant les chargements répartis et les cargaisons regroupées a atteint 50 millions de tonnes en 1993. Près de 45 p. 100 du fret total en provenance de Taïwan, de Chine et de Corée est à destination de Hong Kong, dont une importante partie ira probablement en Chine. Les exportations de Taïwan sont 1,4 fois plus importantes que ses importations et les exportations de la Corée représentent presque le triple de ses importations.

En 1993, les ports de Hong Kong et de Singapour se classaient premier et deuxième ports les plus grands en volume de conteneurs, avec plus de 9 millions de TEU (unité équivalente à un conteneur de 20 pi), soit deux fois plus qu'en 1989. Les deux ports investissent dans des agrandissements; celui de Hong Kong compte pouvoir traiter à lui seul 32 millions de TEU d'ici 2011. La capacité combinée de ces deux ports représente à elle seule 16,7 p. 100 du total mondial. Cette grande proportion traduit les activités de transbordement des deux ports qui relient les services d'apport et les lignes principales.

La route océanique la plus active est celle qui relie la Chine et le Japon; elle est desservie par plus de 2 000 navires par an et plus de 8 000 voyages y sont effectués dans chaque direction (c.-à-d., plus de 16 000 en tout). La deuxième route la plus empruntée est entre le Japon et l'Asie du Sud-Est, avec près de 5 000 voyages dans chaque direction (9 200 en tout) et 1 800 navires par an. Vient ensuite le groupe de voyages entre le Japon et l'Australie/la Nouvelle-Zélande, avec près de 3 500 voyages dans chaque direction (7 000 en tout) et 1 200 à 1 400 navires chaque année. L'itinéraire entre l'Asie du Sud-Est et l'Australie/la Nouvelle-Zélande fait également l'objet d'un intense trafic, avec près de 2 000 voyages dans chaque direction (4 000 en tout) et près de 1 000 navires. Il y a aussi de nombreux échanges maritimes entre la Chine et l'Australie/la Nouvelle-Zélande — 1 200 voyages (2 500 en tout) et environ 600 navires.

Les échanges maritimes transpacifiques sont dominés par le trafic entre le Japon et les états du Nord-Ouest et du Sud-Ouest des États-Unis. Sur l'itinéraire du Sud-Ouest des É.-U., près de 800 navires effectuent 2 000 voyages environ dans chaque direction (4 100 en tout). Sur l'itinéraire Nord-Ouest, les indicateurs sont 1 800 voyages (3 700 en tout) et 700 navires. Pour l'Ouest du Canada, l'itinéraire vers le Japon est le plus important avec près de 1 300 voyages (2 650 en tout) et 600 navires.

La côte Ouest des É.-U. est la principale origine et destination pour les échanges maritimes transpacifiques. Les principaux ports sont ceux de Los Angeles, de Long Beach, d'Oakland, de Tacoma, de Portland et de Seattle. Ces ports ont enregistré des taux de croissance annuelle de 3 p. 100 de 1984 à 1994, mais le rythme s'est maintenant accéléré pour passer à 4 p. 100 par an. Le tonnage des importations a augmenté de 4 p. 100 par an, tandis que le volume des exportations a augmenté de 2 p. 100 par an au cours des dix dernières années. Parmi ces ports, ceux de Los Angeles et de Long Beach sont les deux plus grands des É.-U. et on prévoit que le volume de leur fret va **doubler** d'ici l'année 2020. Indépendamment, les ports de Long Beach et de Los Angeles sont les deux plus grands du pays. Ensemble, ils *occupent le troisième rang mondial* pour les échanges de conteneurs.

Le port de Long Beach est le premier port de conteneurs aux États-Unis. En 1995, 2 843 502 TEU ont traversé les quais de Long Beach. Le volume total de fret de toutes formes était de 91,3 millions de tonnes métriques payantes. La valeur du fret qui a transité par Long Beach en 1995 dépassait 70 milliards de dollars. Les exportations à partir de Long Beach augmentent maintenant quatre fois plus rapidement que les importations. Durant les six premiers mois de l'année financière 1995-96, les exportations ont fait un bond de 25 p. 100, tandis que les importations augmentaient de 6 p. 100. Aujourd'hui, les exportations représentent 43 p. 100 de tout le fret en conteneurs passant par Long Beach – alors qu'elles n'en représentaient que 28 p. 100 il y a à peine dix ans. Près de 80 p. 100 de tout le fret international transitant par Long Beach est à destination ou en provenance de l'Asie, les cinq principaux partenaires commerciaux étant dans l'ordre le Japon, la Chine, Hong Kong, la République de Corée et Taïwan.

Le port de Los Angeles est le numéro un de la côte Ouest en termes de valeur des marchandises. Los Angeles a presque quadruplé le montant de son fret depuis 1984, le montant total du fret passant par le port atteignant maintenant 73,4 milliards de dollars, soit 2,5 milliards de plus que celui de son concurrent le plus près, le port de Long Beach.

Malgré l'importance générale du marché asiatique, les échanges avec l'Amérique latine ont également été un stimulant pour le port de Los Angeles. Chilean Line a emménagé à Long Beach et importe des fruits dénoyautés et des raisins pour approvisionner les magasins d'alimentation durant l'hiver californien. Les lignes de transport par conteneurs ont signalé une augmentation des importations de fruits, de légumes, de poissons et de viandes réfrigérés dans leur flux entrant, laquelle a contribué à une hausse globale de 200 p. 100 des échanges entre Long Beach et l'Amérique latine.

Vancouver est le plus grand port du Canada et se classe constamment dans les cinq premiers ports d'Amérique du Nord en termes de tonnage des importations et exportations avec l'étranger. C'est le plus gros port de marchandises en vrac de la côte Ouest de l'Amérique du Nord avec un tonnage supérieur à 71,5 millions de tonnes en 1995. Le port de Vancouver dispose à l'heure actuelle de deux terminaux d'embarquement de conteneurs situés dans le bras de mer Burrard, *Centerm* et *Vanterm*. Pour faire face à l'augmentation des quantités de

conteneurs prévue au cours de la prochaine décennie, le port de Vancouver prévoit une installation supplémentaire pour les conteneurs, *Deltaport*, qui sera située à Roberts Bank dans le port extérieur, à 30 milles marins (40 km par les terres) du centre-ville de Vancouver et du bras de mer Burrard; le terminal *Deltaport* va doubler la capacité totale en conteneurs du port de Vancouver pour la faire passer à plus d'un million de TEU par an.

La forte augmentation récente du tonnage du trafic entrant (importations de produits manufacturés) sur la côte Ouest crée de longues files d'attente et un encombrement des ports. Les ports de Long Beach et de Los Angeles vont voir leur tonnage doubler d'ici 2020. Pour le trafic provenant de Chine, de Hong Kong, de la République de Corée et d'Amérique latine, le tonnage pourrait doubler avant 2010. La croissance rapide des échanges maritimes transpacifiques pousse les transporteurs océaniques à acquérir de nouveaux navires plus gros. Par exemple, Hyundai Merchant Marine de Corée a mis en service six nouveaux navires de méga-conteneurs de 4 411 TEU pour Long Beach. Plus tard en 1996, Hyundai commencera à déployer des navires de 5 551 TEU sur ses itinéraires transpacifiques. Les navires de plus gros tonnage permettent de réaliser d'importantes économies d'échelle et peuvent atteindre une vitesse de 25 noeuds. Voyageant plus vite et transportant un fret plus important, ces méga-navires permettent de réduire les coûts d'exploitation et de répondre à la demande de services transpacifiques rapides, efficaces et fiables pour le transport des conteneurs.

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1. Introduction

1.1 *Background*

The Asia-Pacific Economic Cooperation (APEC) comprises 18 economies: Australia, Brunei Darussalam, Canada, Chile, the People's Republic of China, Chinese Taipei, Hong Kong, Indonesia, Japan, the Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, the Republic of the Philippines, Singapore, Thailand, and the United States of America. These economies have agreed to cooperate in four areas: global and regional economic development, global trade liberalization, and regional cooperation in specific sectors. One of the sectors identified is transportation. The Transportation Working Group (TPT/WG) was created to coordinate that effort.

The ambitious agenda for liberalizing trade in the region will bring about a rapid increase in air and marine traffic and a requirement for higher levels of aircraft and shipping throughput. This demand for increased capacity is driving the application of satellite communications, navigation and surveillance technologies and systems. It is apparent from discussions in the TPT/WG that the economies of APEC share an interest in introducing new technologies and systems in a way that maintains or improves transportation safety.

The Canadian Minister of Transport has made a commitment to APEC Ministers of Transportation to lead the promotion of transport system safety in the APEC region. To that end, Transport Canada proposed a study on the implementation of satellite navigation and communications (SN&C) for both of air and marine. The study is a component of the APEC Action Program in Transportation.

The study is composed of the following elements:

- ▶ Element 1 - Inventory of Existing and Planned Satellite Navigation and Communications Systems in the APEC Economies;
- ▶ Element 2 - Satellite Navigation and Communication Technology and Safety Review; and

- ▶ Element 3 - Costs and Benefits of Satellite Navigation and Communications for Air and Marine Transportation.

Hickling Corporation was contracted to carry out the work for the three elements and detailed reports have been prepared and are available for each of the elements. This report presents, Part 1: Trade and Traffic of the final report for Element 1. A separate report presents the second part, Part 2: Implementation Plans.

Part 1: Trade, Traffic and APEC Report

This report presents the trade and traffic analysis for the marine and aviation sectors for the APEC economies, Element 1 of the Study. In particular this report:

- ▶ Presents air and marine traffic, and marine cargo data for historical and forecast years; and
- ▶ Describes the demands on air and marine transportation infrastructure along with the changes in airports and ports, both those underway and planned ones.

1.2 Structure of Report

This report has seven chapters. The first four chapters present information on air transportation in the Asia-Pacific region including key growth indicators, infrastructure development and economy reports. The last three chapters discuss marine transportation in the areas of cargo trade, development of shipping, and development of land and sea infrastructure and services. The appendices contain shipping traffic data and a list of acronyms.

2. Air Facts

2.1 *Traffic In and Between Asia-Pacific*

Demand for air transport (typically driven by passenger demand) in the Asia-Pacific region is growing faster than in any other world region. By 2010, Asia-Pacific will have more international scheduled passengers than the rest of the world, exceeding 50 percent of the world total (See Table 2-1). Total international scheduled passenger traffic to, from and within only the Asia-Pacific grew by 10.3 percent per annum between 1985 and 1993, whereas international scheduled traffic to, from and within the rest of the world grew by 4.7 percent per annum during the same period.

Table 2-1: Asia-Pacific International Scheduled Passenger Traffic Compared to Rest of World

Year	<i>Asia-Pacific</i>		<i>Rest of World</i>		Share of World International Scheduled Passengers
	International Scheduled Passengers (in millions)	Average Annual Rates of Growth	International Scheduled Passengers (in millions)	Average Annual Rates of Growth	
1985	51	-	143	-	26.4%
1993	112	10.3%	206	4.7%	35.3%
2000	200	8.6%	285	4.7%	41.2%
2010	398	7.1%	390	3.2%	50.5%

Source: Asia-Pacific Air Transport Forecast 1980 - 2010, IATA.

Between 1993 and 2000, Asia-Pacific international scheduled passenger traffic will grow by 8.6 percent per annum reaching a new peak of 200 million passengers in 2000. By 2010 this figure will increase to 398 million; 3.5 times higher than in 1993. In comparison, the rest of the world will reach an aggregated 390 million passengers by 2010. Consequently, the global share of Asia-Pacific international passenger traffic will have increased from 26.4 percent in 1985 to 35.3 percent in 1993, and will increase even further to 50.5 percent by the year 2010. Much of this increase can be attributed to Japan.

Japan has been and will remain the region's dominant traffic market. By 2010 over 90 million passengers will travel to and from that economy resulting in a 2.6 fold increase over 1993. While Japan may be the dominant leader in the traffic market, it is not the fastest growing market. In fact, Japan's share of total Asia-Pacific scheduled international passengers will decline to less than 23 percent in 2010 from 31 percent in 1993. Vietnam, followed by China will achieve the most rapid growth in the future due mainly to a currently underdeveloped travel market. For instance, total international passenger traffic to and from Vietnam is expected to increase by 18.9 percent per annum on average between 1993 and 2000, then by a further 16.0 percent per annum thereafter. In 1993, this traffic reached 1.2 million passengers but will reach an unprecedented 17.2 million passengers by 2010.

Increased traffic in the APEC region is expected to reflect and follow current trends. That is, scheduled traffic on *long-haul routes* (routes greater than 1500 nm in length) has been and will continue to remain *dominant*. Not only is long-haul route growth expected to continue, but average travel distances along long-haul routes are expected to increase. Short-haul routes, on the other hand, will achieve lower rates of growth than any other routes. Europe has been and will remain the most important world region for long-haul international passenger traffic to and from Asia-Pacific followed by the Transpacific, Africa and lastly, the Middle East.

In terms of region pairs, the most dominant pairs are and will remain within the Asia-Pacific area. By 2010 five of these Origin-Destination pairs will show traffic exceeding 10 million passengers annually and three of these five will be to and from China. These include; China-Hong Kong, Japan-U.S. Mainland, China-Chinese Taipei, Japan-Korea and Hong Kong-Chinese Taipei.

3. Air Traffic in Asia-Pacific

3.1 Key Growth Indicators

3.1.1 *Why did Asia-Pacific international passenger traffic increase so rapidly in the past?*

Recent increases in Asia-Pacific international passenger growth reflect most importantly strong economic growth in the region as a whole. Passengers have the wherewithal to buy tickets, and real income expansion is fuelled by cargo traffic (export trade) and purchase requirements (import trade). Many of the economies within this region are currently experiencing Gross Domestic Product (GDP) growth rates exceeding 6.0 percent; GDP will be higher in Asia-Pacific than in North America by 2010. Not only are regional GDP growth rates high, but one must also keep in mind that APEC member economies currently represent 51.6 percent of the world's total GDP not to mention 56.9 percent of the world's population. Asia-Pacific's population will continue to increase from 3.3 billion inhabitants in 1993 to 3.5 billion by 2010. Its share of total world population will remain fairly stable well into the future; 56.9 percent expected by 2000, and 56.8 percent by 2010.

Another characteristic of passenger growth is reflected in the unique geography of the region. Because many economies are islands, air travel is the primary mode of transport. Travellers in this region have fewer alternatives than elsewhere in the world, particularly compared with Europe. The nature of the landscape and culture has also made this region attractive for tourism. Other reasons contributing to rapid growth in the past include:

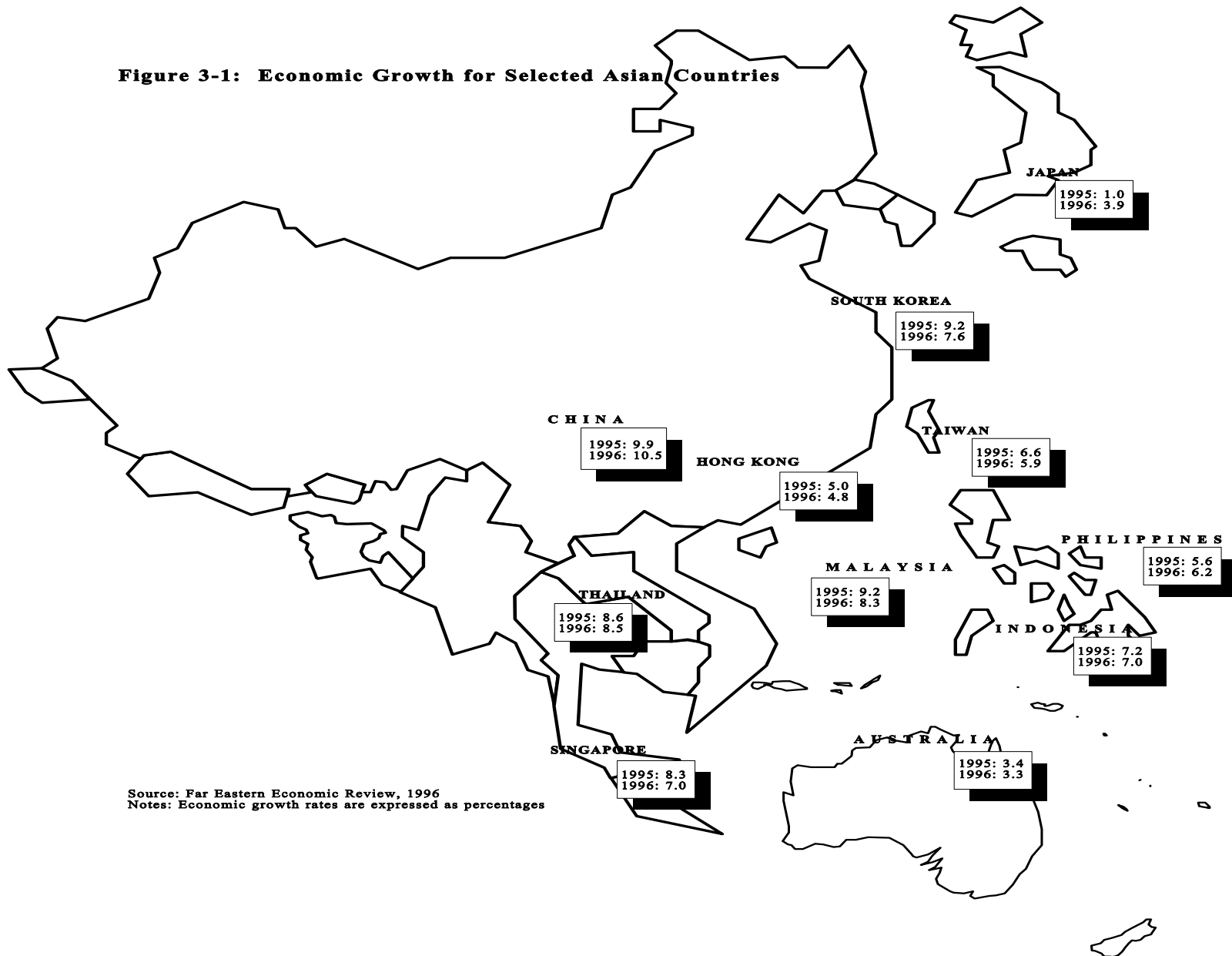
- ▶ Increased personal disposable income;
- ▶ Political stability in many economies;
- ▶ Relaxation of travel restrictions (mainly Korea and Chinese Taipei);
- ▶ Important ethnic and business ties between Asian countries (overseas Chinese, etc.);
- ▶ Important and successful tourism promotion;
- ▶ More frequent, short-duration trips; and
- ▶ Early stages of air transport liberalization.

3.1.2 Why will it continue to grow at a fast rate?

The strong rate of growth in the Asia-Pacific region will undoubtedly continue to be sustained well into the future (See Figure 3-1, Economic Growth for Selected Asian Countries). Estimates to 2010 verify this growth and indicate that international scheduled passengers will grow to 50.5% of the world's share. Again, economic activity is the key factor, along with trade, investment, information and infrastructure explosion in most Asia-Pacific economies. Total GDP for the Asia-Pacific region as a whole is projected to grow by 4.5 percent annually to 2000 and by 4.4 percent annually to 2010. Figure 3-2 illustrates the areas of strong economic growth in Asia Pacific for 1980 and 2010. In terms of dollars, the Asia-Pacific region will represent U.S.(1990) \$ 6 868 billion in GDP by 2010. Other factors contributing to the rapid growth rate include:

- ▶ Intensification of intra Asia-Pacific commercial liberalization (Figure 3-3 presents export and import growth rates for selected APEC economies);
- ▶ Opening of new airports (Macau, Hong Kong, Kuala Lumpur, Bangkok, etc.);
- ▶ Low traffic base at present for several countries with large travel potential (China, Vietnam, etc.);
- ▶ Assumed direct links between China and Chinese Taipei; and
- ▶ Disposable income and propensity to travel will continue to increase.

Figure 3-1: Economic Growth for Selected Asian Countries



Source: Far Eastern Economic Review, 1996
Notes: Economic growth rates are expressed as percentages

Figure 3-2: Areas of Strong Economic Growth in Asia Pacific

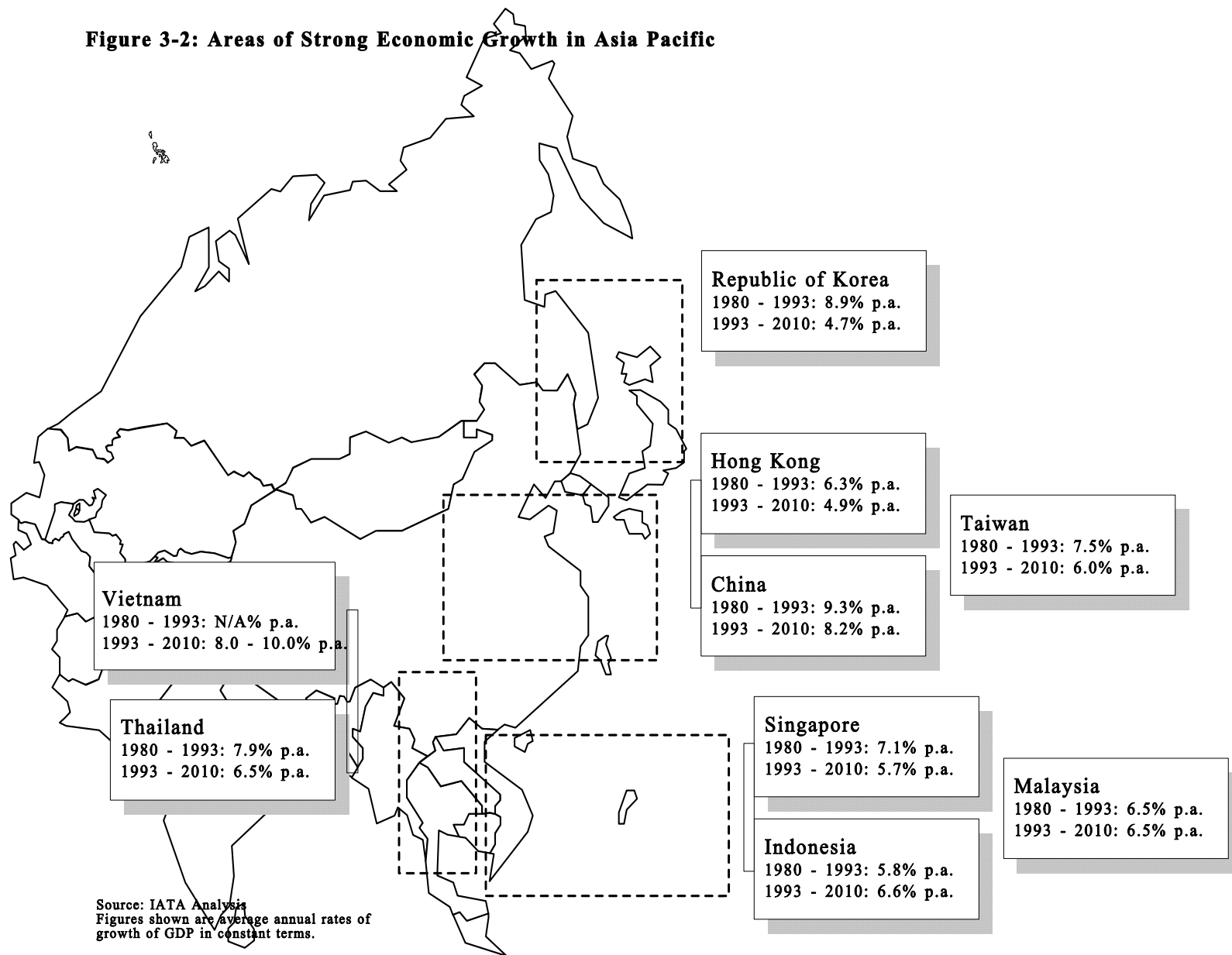
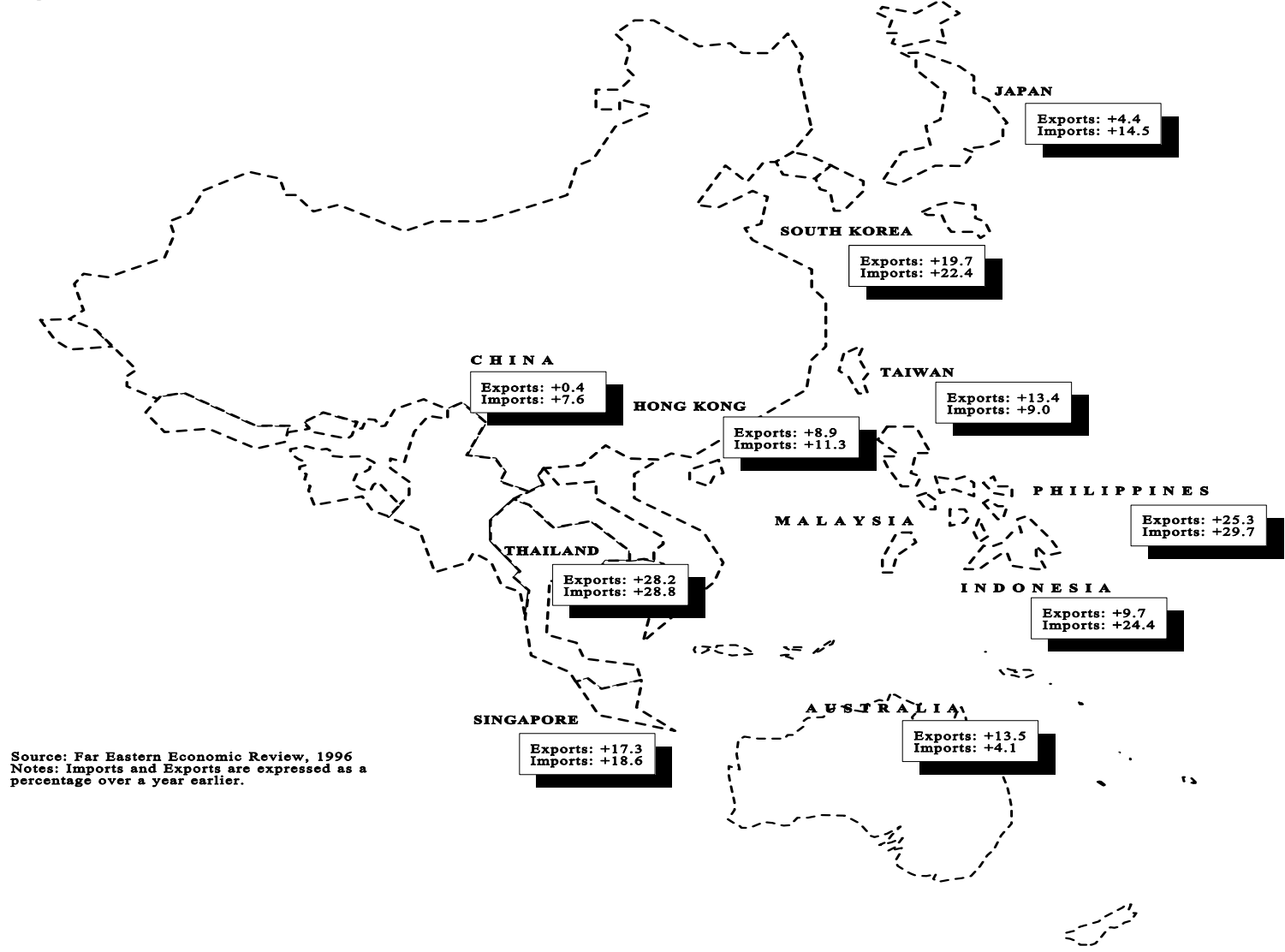


Figure 3-3: Export and Import Growth Rates for Selected APEC Economies



Source: Far Eastern Economic Review, 1996
 Notes: Imports and Exports are expressed as a percentage over a year earlier.

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4. Demands on Infrastructure

Within Asia there is a boom in infrastructure services demand. While many areas are completing cycles of housing and commercial building erection, there is still a need for water sanitation and energy provision. Bottlenecks and choke points impede these services, and their counterparts can be observed in transport and telecom deficiencies. Railroads cannot cope with resources and heavy capital equipment movements. Urban traffic snarls and long distance highway jams impede the movements of goods and commodities. Even access to ports and airports is threatened by traffic congestion. Airports throughout Asia are struggling with overload, leading to a spate of new international and regional airports being constructed to handle massive passenger and cargo throughput. Ocean ports and sea lanes (e.g., Malacca Straits) are similarly congested as hundreds of vessels compete for dock space and struggle to avoid costly demurrage. New channels, new docks and new navigation aids are required throughout the Asia-Pacific region.

4.1 *New Airport Construction*

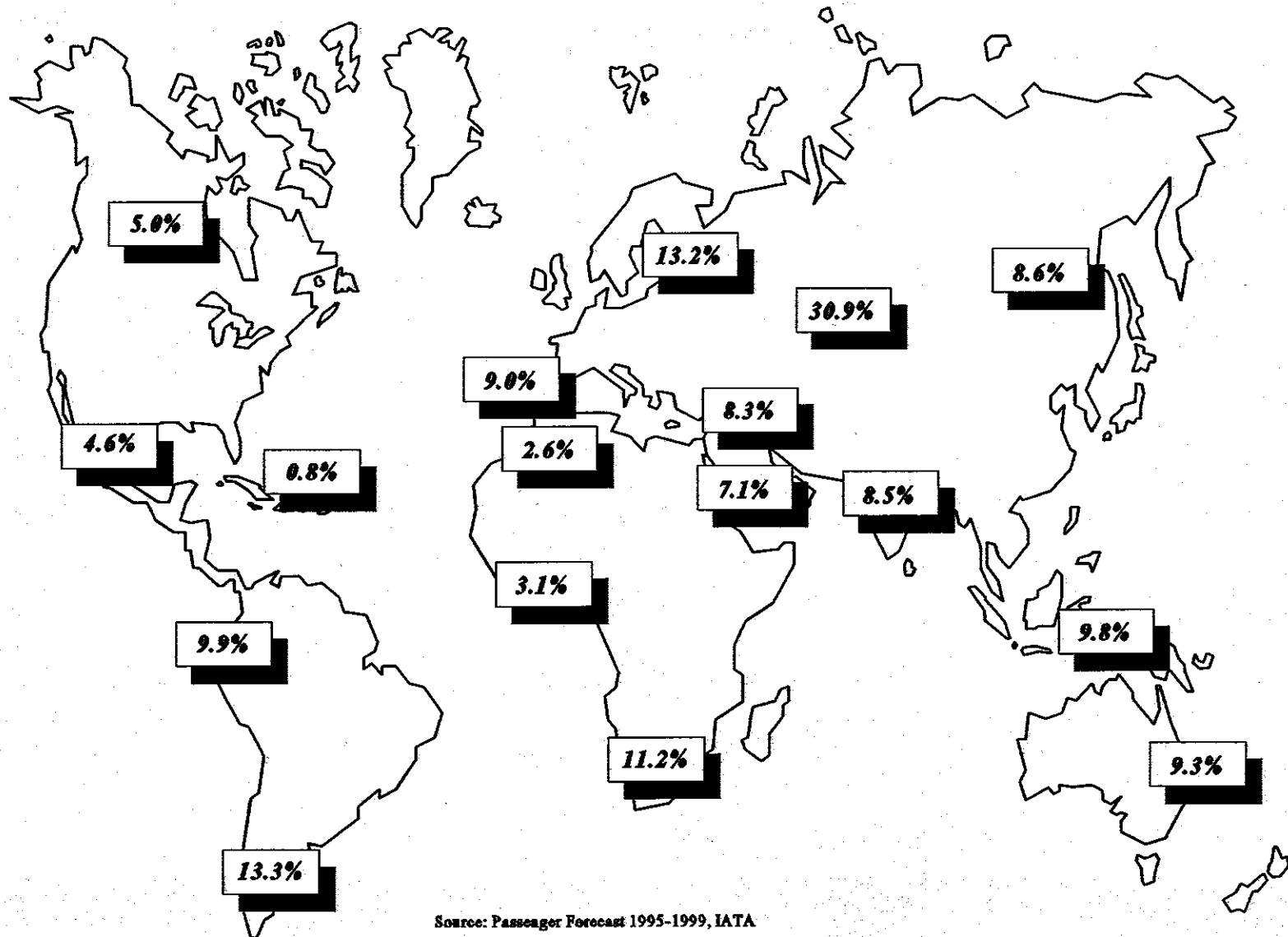
Many governments in Asia are scrambling to establish “superhub airports” in their economies. Nearly all of the new large-scale airports being built for the 21st century are concentrated in this region. By constructing these airports, the economies are preparing the foundation for future economic development.

According to a forecast of the demand for air transport in the Asia-Pacific region, issued in 1993, by the International Air Transport Association (IATA), the average growth for the world as a whole from 1993 to 1997 will be 6-7 percent; for Southeast Asia, 9 percent; and for Northeast Asia (including Japan), 8.7 percent. IATA also predicts that the demand for air transport will be greater in Asia than in any other part of the world (See Figure 4-1 World Regions – Actual Traffic Growth 1994 over 1993 and Figure 4-2 Main Inter-Regional Air Traffic Flows Between Northeast and Southeast Asia). Figure 4-3 presents the 1994 growth achieved in the main inter-regional traffic flows.

For instance, 17 million people annually use Seoul’s *Kimpo International Airport*, but the South Korean Transport Ministry predicts that the number will swell to 60 million by the year 2010. To meet this growing demand, the ministry has come up with a plan to build a new Seoul metropolitan airport off the coast at Incheon, 50 kilometres west of Seoul.

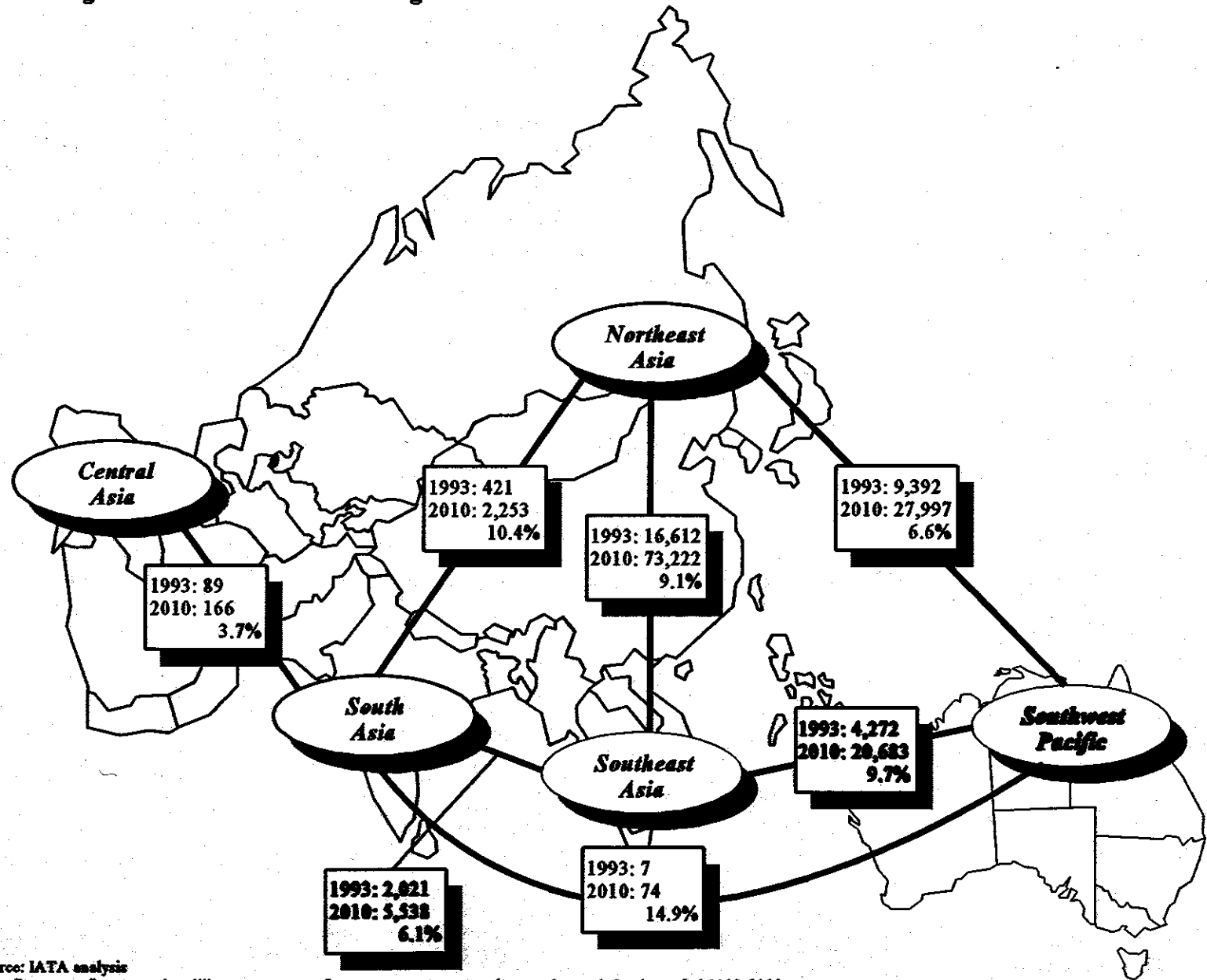
Figure 4-1: World Regions - Actual Traffic Growth for 1994 over 1993

Growth in international scheduled traffic to, from and within each of the main regions.



Source: Passenger Forecast 1995-1999, IATA

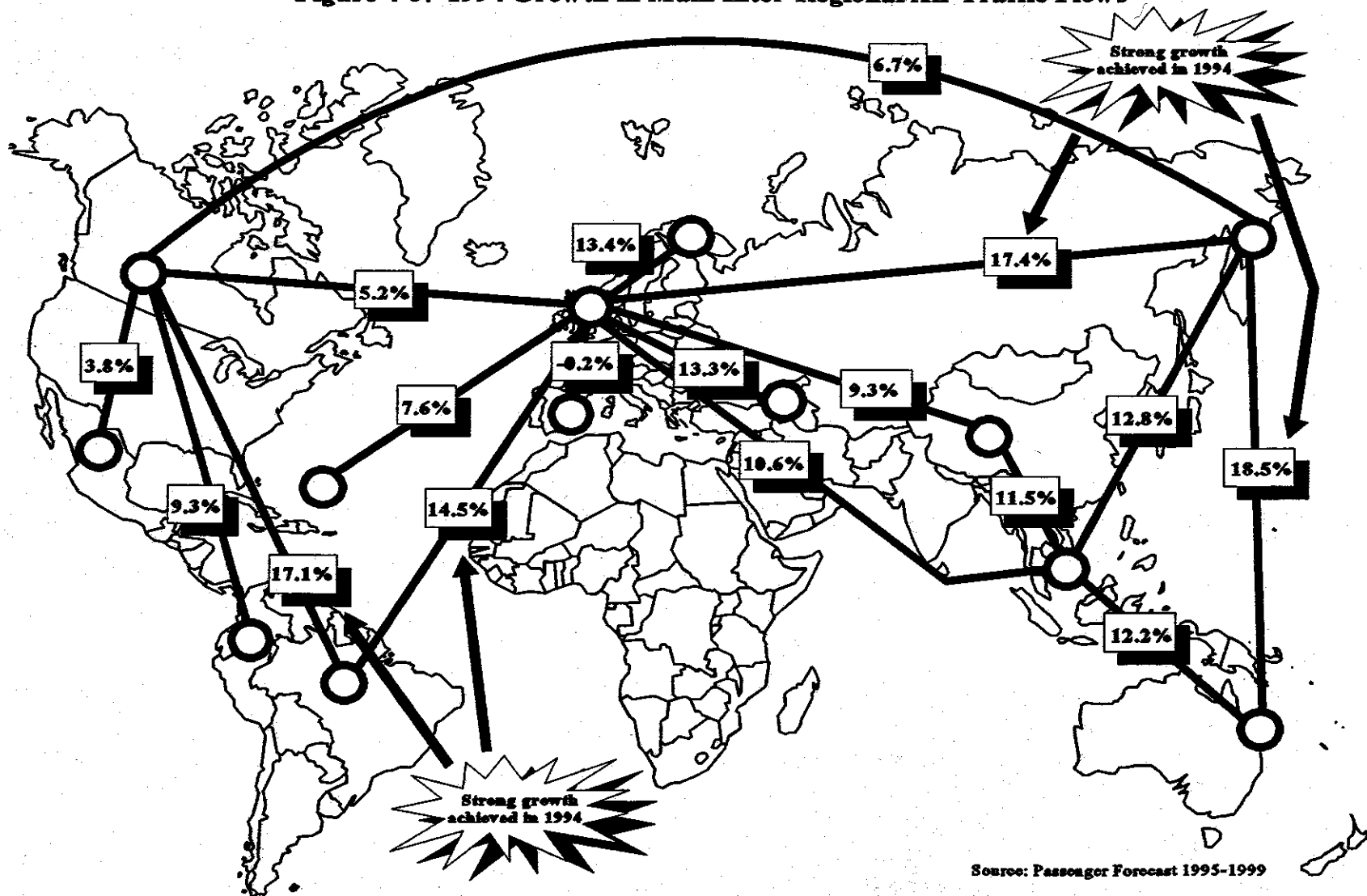
Figure 4-2: The Main Inter-Regional Air Traffic Flows Between Northeast and Southeast Asia



Source: IATA analysis

Note: Passenger figures are in millions, percentage figures are average annual rates of growth for the period 1993-2010.

Figure 4-3: 1994 Growth in Main Inter-Regional Air Traffic Flows



Source: Passenger Forecast 1995-1999

With the opening of Phase I of the new airport in 1999, a 3 700-metre runway and a 250 000-square-metre passenger terminal will go into service. By the year 2020, four additional runways and a 900 000-square-metre passenger terminal will also have been completed. The gigantic new airport will be capable of handling annually 700 000 landings and take-offs, 100 million passengers and seven million tons of cargo.

Meanwhile, Hong Kong isn't idle. At present *Kai Tak* handles more passengers than any other airport in Asia, and the existing facilities are now operating way above capacity. In response to the burgeoning demand and in step with the 1997 revision of Hong Kong to China, a new airport four times larger than *Kai Tak* is being constructed on *Lantau Island* west of Hong Kong Island. It is scheduled to open in 1997 and when eventually completed, hopefully by 2010, will be able to handle 87 million passengers and 8.9 million tons of cargo a year, thus enabling Hong Kong to retain its standing among Asia's air hubs.

Elsewhere, in Bangkok, Thailand, a new airport is being built next to the existing one, with the opening date slated for the turn of the century. *Chiang Kai-Shek Airport* in Taipei, Chinese Taipei, also aspires to become a hub airport for the Asia-Pacific region by the year 2010. Many construction projects are being planned to achieve this goal, including a second terminal building, enlargement of the existing cargo terminal building, enlargement of the existing cargo terminal and a new transport system connecting the airport with downtown Taipei.

One reason for this rush to build airports is the expected shift in long-distance passenger planes from jets to supersonic transport planes in the not-so-distant future. When this is realized, the travel time between, say, Tokyo and New York, will be reduced to five to six hours.

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5. Economy Reports for Aviation

5.1 *Group 1: Australia and New Zealand*

5.1.1 *Australia*

Total international passenger traffic in and out of Australia is forecast to grow by 8.8 percent per annum between 1993 and 2000 and by 7.9 percent between 2000 and 2010. The strongest regional growth is expected to be between Australia and Southeast Asia. In 1985, this region pair represented 27 percent of the total traffic but will increase to almost 40 percent by 2010. This is due in part to the anticipated development of services between Singapore, Malaysia, Indonesia and secondary airports in Australia. In contrast, the highest rates of growth in the past were between Australia and Northeast Asia. The relative importance of Southwest Pacific markets (mainly New Zealand) for Australia will decline in the future, with Singapore emerging as the most important economy of origin-destination for traffic by 2010.

5.1.2 *New Zealand*

Total international passenger traffic to and from New Zealand increased at an average rate of 8.2 percent per annum between 1985 and 1995. This traffic amounted to 4.2 million passengers in 1993. This is forecasted to grow by a moderate 5.6 percent per annum to 2000 and then 5.1 percent thereafter. By 2010, the traffic will amount to 10 million passengers.

The strongest growth was achieved by traffic to and from the Americas, with an average rate of 32 percent per annum between 1985 and 1993, followed by Northeast Asia (26 percent per annum), contrasting with only 4.9 percent per annum growth by traffic to and from the rest of the Southwest Pacific region. Although the strongest growth is forecast for traffic to and from Northeast Asia and the Americas, the Southwest Pacific will remain the most important region for traffic in and out of New Zealand.

5.2 Group 2: People's Republic of China and Hong Kong

5.2.1 China

Total international scheduled passenger traffic to and from China will increase 7.6 times between 1993 and 2010 reaching 62.3 million by the year 2010. The most significant growth will take place to and from Southeast Asia and to and from the Americas. Northeast Asia will remain by far the most important world region for traffic to and from China, but the relative importance of this region will diminish as China-Southeast Asia travel markets expand. Hong Kong will remain the most important economy of origin-destination for China. Japan and Thailand will become the second and third most important economies respectively, in the year 2010.

Current travel restrictions on mainland China for both domestic and international traffic have constrained growth. The gradual relaxation of travel restrictions together with the rapidly increasing propensity to travel of the Chinese population means the building up of a very large potential market which could sustain double-digit growth rates for many years well into the future.

5.2.2 Hong Kong

In Asia-Pacific, the strongest growth was experienced by traffic between Hong Kong and Northeast Asia, essentially Chinese Taipei and China. In particular, the relaxation of travel restriction imposed on Chinese Taipei residents in the mid-1980s has resulted in a large increase in Chinese Taipei visitors to Hong Kong.

Hong Kong has played an active role in channelling traffic between Chinese Taipei and China, since direct services do not exist between these two countries. The opening of direct links between Chinese Taipei and China is expected to have some adverse effects on traffic between Hong Kong and Chinese Taipei, but it is also expected that this would be largely offset by the emergence of a large Chinese outgoing travel market, which as yet is still in its infancy.

Total international passenger traffic to and from Hong Kong is forecast to increase at an average annual rate of 7.8 percent between 1993 and 2000, decreasing slightly to 5.8 percent per annum between 2000 and 2010. The most rapid growth is expected to take place between Hong Kong and the Southwest Pacific as well as the Americas. By 2000, the most important economy of origin-destination will be China, and it is expected that the predominance of China will be even more significant in 2010.

5.3 Group 3: Japan and Korea

5.3.1 Japan

Between 1985 and 1993 nearly 35 million passengers passed through Japan, in and out, at an average annual rate of 9.8 percent per annum with a growing share of this traffic being handled at regional airports (Japanese cities other than Tokyo and Osaka are generating an increasing share of total departing seats out of Japan). Expected passenger traffic will grow to nearly 91 million by 2010. Total international scheduled passenger traffic to and from Japan is forecast to grow by 6.1 percent per annum between 1993 and 2000 decreasing slightly to 5.5 percent per annum between 2000 and 2010. The U.S. mainland will remain the most important origin and destination economy for Japan with almost 14 million passengers by 2010, followed distantly by Korea. Traffic between Japan and the Americas is also forecast to achieve relatively strong rates of growth with the opening of new routes between Japan and Latin America.

In sharp contrast to many of the other economies in the Asia-Pacific region, forecast rates of growth for Japan's international passenger traffic are generally *lower* than for other countries in the region. Much of the reason for this is attributed to the fact that Japan is a mature market with a well established air traffic industry that has existed for many years, while many emerging economies, such as Vietnam, are only beginning to realize their potential for air transport.

5.3.2 Korea

By the year 2010, passenger traffic will grow to 42.8 million passengers. This reflects a significant increase from just over 11 million passengers in 1993. In terms of percentage increase, total international scheduled passenger traffic to and from Korea will increase at an average annual rate of 8.8 percent between 1993 and 2000 and 7.7 percent between 2000 and 2010. Europe will continue to achieve the strongest growth of all world regions to and from Korea, with an average annual rate of 17.4 percent and 11.1 percent for 1993 to 2000 and 2000 to 2010 periods respectively. The second highest growth rate will be sustained by traffic to and from Southeast Asia. Japan will remain the most important economy of origin-destination for Korea with total passenger traffic between the two economies reaching nearly 12 million passengers by 2010.

5.4 Group 4: Malaysia and Singapore

5.4.1 Malaysia

Traffic for most world regions to and from Malaysia has recently achieved double-digit growth with only two exceptions, to and from South Asia and Southeast Asia. The main world traffic region for Malaysia was Southeast Asia with 60.5 percent of total international traffic in 1993. This share has decreased since 1985, when it represented 71 percent of total international traffic. Total international scheduled passenger traffic in and out of Malaysia will increase at an average annual rate of 7.0 percent and 6.7 percent during the 1993 to 2000, and 2000 to 2010 time periods respectively. By the year 2010, this traffic will amount to 24.6 million passengers.

Future regions of growth will point to the Americas followed by Northeast Asia. The recent development of direct services between Malaysia and Latin America on the one hand, and China on the other hand, will contribute significantly to this trend. The most important economy of origin and destination was Singapore, with 43 percent of total international passenger traffic in 1993. This shows a relative decline from 56 percent in 1985. Also, as traffic expands on many routes to and from Malaysia, the share of Singapore-Malaysia is expected to decline even further to just 26.6 percent by 2010.

5.4.2 Singapore

Total international scheduled passenger traffic to and from Singapore will increase at an average annual rate of 7.7 percent between 1993 and 2000, and 6.6 percent to 2010, exceeding 59 million passengers by 2010. Southeast Asia will remain the most important region for Singapore. Its share of the total will account for 40 percent of the total in 2010, an increase from 46 percent in 1993. The most important economy of origin-destination for Singapore will be Australia, with 9.6 million passengers in 2010. The geographical position of Singapore has favoured its role of gateway to Australia and has become a hub for *Qantas*, distributing its European traffic converging on Singapore between the various regional airports in Australia. Its share of the total will increase from 8.5 percent in 1993 to 16 percent in 2010.

A recent air services agreement between Singapore and Indonesia will stimulate regional flights between Singapore and many regional airports in Indonesia. It will make Singapore the alternative choice to Jakarta as the gateway to Indonesia. This will enhance transfer traffic at Singapore. Singapore has also been very successful in its latest bilateral agreement with China in significantly increasing frequencies to many points in China.

5.5 Group 5: Thailand, Indonesia, Philippines and Chinese Taipei

5.5.1 Thailand

The most important traffic-generating economies for Thailand in 1993 were Malaysia and Japan. But among the main traffic generating markets, Chinese Taipei achieved the strongest growth, with 28.9 percent per annum on average during the 1985-1993 period. The most important economy of origin-destination for Thailand will remain Hong Kong, followed closely by Singapore.

Total international scheduled passenger traffic to and from Thailand will increase by 9.2 percent per annum between 1993 and 2000 and 8.2 percent per annum to 2010. This traffic will reach 54.4 million passengers by 2010. Among all Thailand's main traffic generating economies, the one which will experience the strongest growth in the future is Chinese Taipei, followed by Japan.

5.5.2 Indonesia

Total international scheduled traffic to and from Indonesia is forecast to reach 11.4 million and 26.1 million passengers in 2000 and 2010 respectively. This represents an average annual growth rate of 9.4 percent between 1993 and 2000 and 8.7 percent between 2000 and 2010. Contributing the most to this significant traffic growth, to and from Indonesia, will be Northeast Asia and Southwest Pacific with Singapore remaining the most important economy of origin and destination through 2010.

5.5.3 The Philippines

The strongest growth is forecast to take place between the Philippines and Northeast Asia. Traffic to and from South Asia will also experience a strong growth, especially between 2000 and 2010. However, the forecast rates of growth are applied on a very small base which means only 37 000 more South Asian passengers in 2010 than 2000.

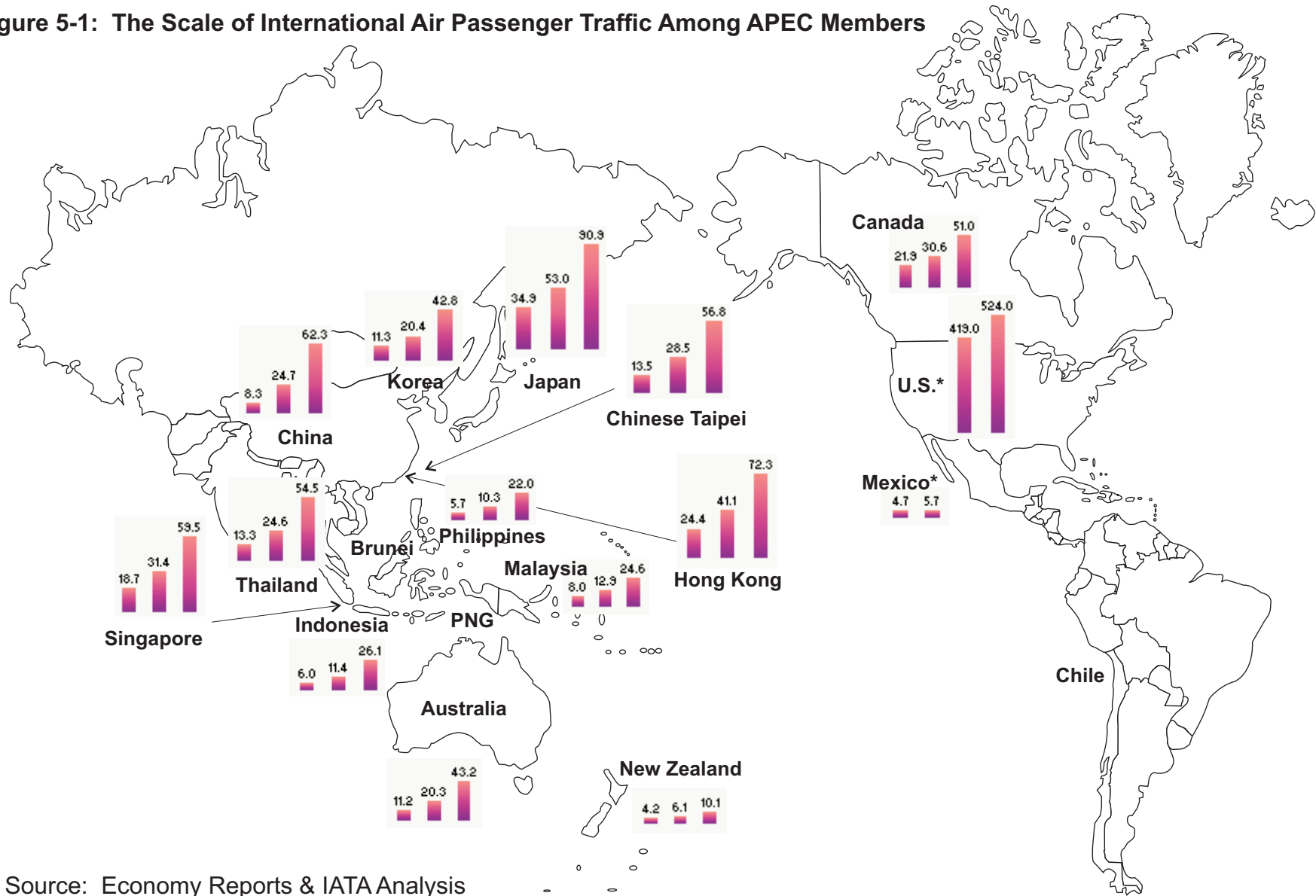
Total international scheduled passenger traffic to and from the Philippines is forecast to grow at 8.9 percent average per annum between 1993 and 2000 and at 7.8 percent per annum thereafter. By 2010 this traffic will amount to 22 million passengers. Northeast Asia will remain the most important region for traffic to and from the Philippines. Its share of the total will increase to 57 percent, from 53 percent in 1993. The most important economy of origin-destination for the Philippines will be Hong Kong with 4.4 million passengers by 2010 (or 20 percent of total international passenger traffic).

5.5.4 Chinese Taipei

Total international scheduled passenger traffic to and from Chinese Taipei will grow by 11.3 percent per annum between 1993 and 2000 and 7.1 percent per annum thereafter to 2010. Northeast Asia will remain the most important region for traffic to and from Chinese Taipei. Its share of the total will be 56 percent in 2010, a significant decrease from 62 percent in 1993 and 80 percent in 1985. The main economy of origin-destination for Chinese Taipei will become Hong Kong in 2000. But by 2010 this is likely to shift to the rest of China. Traffic between China and Chinese Taipei is expected to reach 11.7 million passengers by 2010.

Figure 5-1 presents historical and forecast international passenger traffic for the APEC economies.

Figure 5-1: The Scale of International Air Passenger Traffic Among APEC Members



Source: Economy Reports & IATA Analysis

Notes: Passenger traffic in millions for 1993, 2000 and 2010

* Data for these countries are for 1993 and 1999 only

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6. Marine Facts

6.1 *Growing Cargo Trade*

At present the Asia-Pacific region boasts the highest level of economic growth in the world. It is transforming itself from the “world’s factory” exporting inexpensive industrial products to a “vast consumer market” in its own right. APEC’s principal role is to create an environment conducive to the sustained growth of the Asian economy, dubbed the world’s growth centre. APEC currently represents 38.9 percent of the world’s population and 51.6 percent of its total GDP.

The developing economies in this region – including China – constitute a fast-expanding industrial zone. During the first half of the 1980s, their combined real GDP grew at an annual rate of 7.6 percent, as compared to a world total of 3.0 percent. With a broadly sustained growth rate of 7.8 percent in the second half, the growth in these economies was 4.7 percentage points above the world average. Moreover, during the global recession of the early 1990s, when world output was more or less stagnant, the combined growth in this region even accelerated slightly to 7.9 percent during 1990-1992.

This exceptionally rapid expansion is owed much to exports especially of manufactures. Asia’s share of the total exports of developing economies expanded to 83.1 percent in 1990 from 74.8 percent in 1980. The combined share of the eight major exporting economies increased from 62.0 percent in 1980 to 72.8 percent in 1990. As regards the share of manufactures in exports, the three major export economies (Hong Kong, Korea, and Chinese Taipei) have maintained the highest level – about 90 percent – since the early 1980s. Singapore, Malaysia and Thailand have been expanding their manufacturing industries also. Singapore thus increased its share of manufactures in exports by 66.4 percent, while Malaysia and Thailand more than doubled their shares during the decade from 1980.

The more industrialized economies of the region have succeeded in moving into the production of export items by incorporating high domestic value-added and technological sophistication, and then market diversification. These economies have not only developed inter-regional exports but have also become increasingly important markets for each other’s exports. To serve these supply capabilities and external demand for manufactured exports, there has been a rapidly expanding requirement for seaborne traffic. Energy must be

shipped in tankers and LNG vessels. Ores must be carried in bulk carriers, as must timber, grains, oilseeds and other commodities. But more importantly consumer and capital goods need containers and the specialized vessels or cargo ship deck space to carry them. These marine cargo requirements have put great pressure on port capacities and the infrastructure that supports them.

7. Development of Shipping

Total inter-regional seaborne general cargo trade comprising break-bulk and unitized cargoes is estimated to have reached 50 million tons in 1993. Table 7-1 provides details of estimated intra-Asian containerized cargo movements in 1993. About 45 percent of the total cargo from Chinese Taipei, China and from Korea is destined for Hong Kong, a considerable portion which is expected to go to China. The exports of Chinese Taipei, are 1.4 times larger than its imports and the Korean exports are almost three times the volume of imports.

Table 7-1: Estimated Intra-Asia Containerized Cargo Movements (1993) (TEUs)

Destination Origin	Chinese Taipei	Hong Kong	South Korea	Singapore	Philippines	Thailand	Malaysia	Indonesia	Total
Chinese Taipei		195 500	29 900	58 900	19 000	26 500	47 200	41 400	418 400
Hong Kong	69 000		41 400	46 000	28 800	35 100	21 900	35 700	277 900
Korea, Rep	54 100	166 800		29 900	29 900	27 600	12 900	61 000	382 200
Singapore	51 800	52 900	14 400		15 000	20 700	41 400	26 400	222 600
Thailand	34 500	36 800	11 500	27 600	4 800		5 800	5 500	126 500
Malaysia	34 500	35 700	9 500	33 400	4 000	7 000		10 000	134 100
Indonesia	36 800	21 900	18 400	41 400	2 300	4 100	7 400		132 300
TOTAL	291 100	525 700	130 600	245 300	103 800	122 700	138 300	181 200	1 738 700

Source: Compiled on the basis of data supplied by Kaiun (Shipping), various issues, 1993.

Table 7-2 indicates the container throughput of the ports of eight major economies in east and Southeast Asia. These economies' percentage share of the world total increased very slowly but steadily in the second half of the 1980's, while the pace of growth has accelerated since 1990. Hong Kong and Singapore were ranked as the world's first and second largest ports in container handling in 1993. Their combined throughput accounts for 16.7 percent of the world total volume. This large portion reflects both ports' transshipment activities linking feeder services with trunk lines.

**Table 7-2: Main Intra-Asia Ports Container Throughput Volume, 1986 - 1993
(Thousand TEUs)**

Economy	1986	1987	1988	1989	1990	1991	1992	1993 (estimated)
Hong Kong	2 774	3 457	4 033	4 464	5 101	6 162	7 972	9 300
Singapore	2 203	2 635	3 375	4 364	5 224	6 354	7 560	9 000
Chinese Taipei	4 105	4 772	4 889	5 278	5 451	6 127	6 635	7 190
Republic of Korea	1 533	1 949	2 065	2 159	2 348	2 694	2 860	3 200
Philippines	754	908	1 097	1 160	1 408	1 463	1 594	1 820
Thailand	511	650	795	939	1 078	1 171	1 299	1 530
Indonesia	364	379	618	763	924	1 156	1 868	2 350
Malaysia	402	462	589	740	888	1 074	1 113	1 350
TOTAL	12 646	15 212	17 461	19 876	22 422	26 201	30 901	35 740
WORLD TOTAL	60 877	65 844	73 810	78 471	85 597	93 101	100 734	109 500
%OF WORLD TOTAL	21	23	24	25	26	28	31	33

Source: Containerization International Yearbooks, 1988-1994.

8. Development of Infrastructure

8.1 Asian Ports

There are few better gauges of East Asia's economic boom than the region's crowded docks (See Figure 8-1). In Singapore and Hong Kong, Asia already boasts the world's two busiest ports: last year each handled over 9 million TUEs (or 20-foot equivalent units, the standard container measure), twice as much as in 1989. Both are pouring money into expansion: Hong Kong alone plans to be able to handle a staggering 32 million TEUs by 2011. But other ports in Southeast Asia and China, egged on by local ship owners, are determined to challenge Singapore and Hong Kong for a larger slice of the region's trade.

The two colonial ports start with strong advantages over their two largest rivals (See Table 8-1). South Korea's Pusan is too far away from with of the ports to represent a direct threat; Chinese Taipei's Kaohsiung is handicapped in competing with Hong Kong by, among other things, the ban on direct travel between Chinese Taipei and the mainland. Other ports hope to compete directly.

Table 8-1: Container Port Traffic (TEU millions)

Port	1990	1991	1992	1993	Average Annual Growth Rate Percent, 1990-1993
Hong Kong	5.1	6.16	7.97	9.2	21.8
Singapore	5.22	6.35	7.56	9.04*	20.1
Kaohsiung	3.49	3.91	3.96	4.64	9.8
Pusan	2.35	2.57	2.75	2.95*	7.9

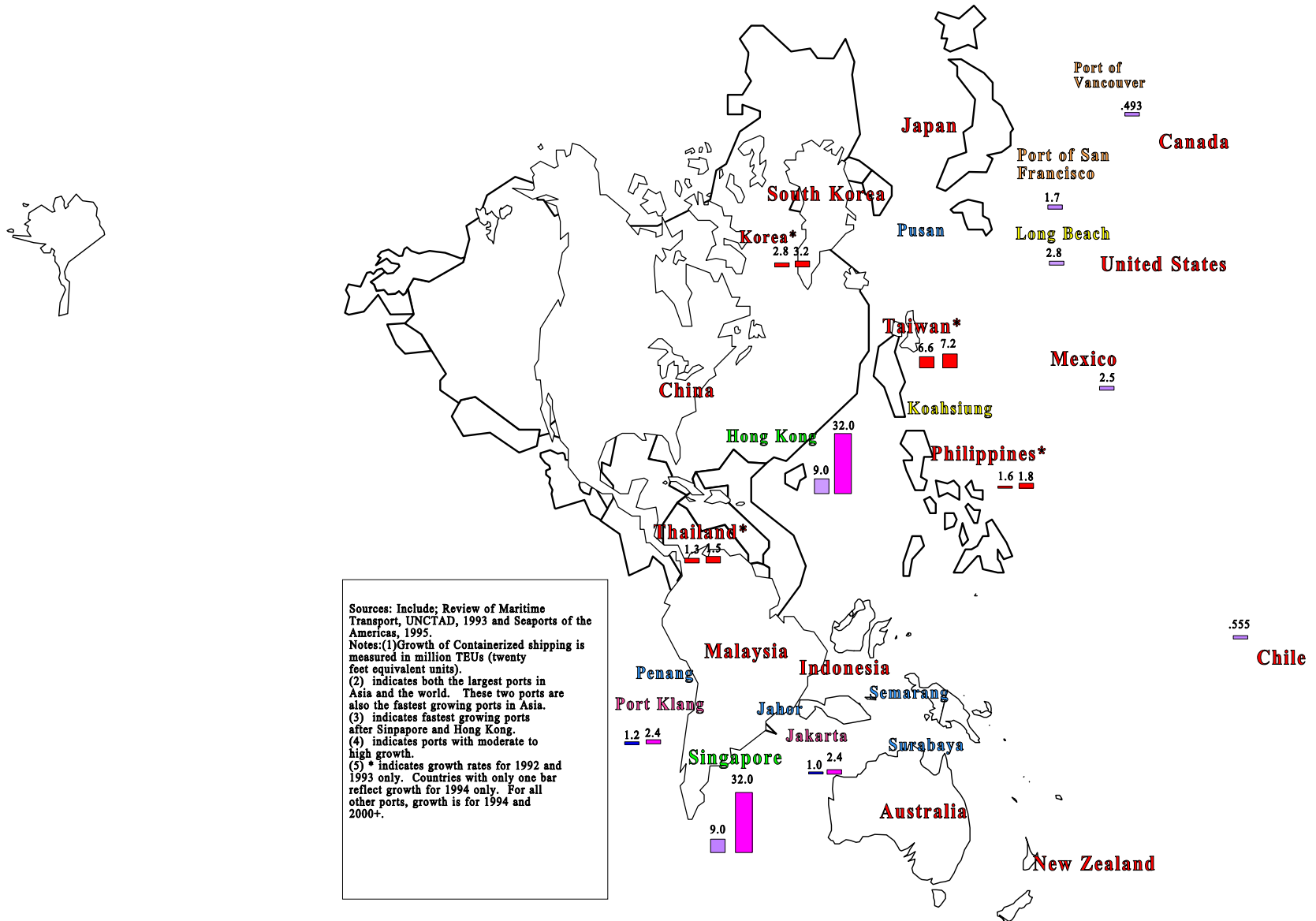
* Preliminary Estimates Only

Source: Containerization International Yearbook.

8.1.1 Malaysia

Malaysia's three big ports – Penang, Port Klang and Johor – are building hard to double capacity from the current level of 1.2 million TEUs. The most ambitious development is taking place at Port Klang, near the Malaysian capital, Kuala Lumpur, where the Malaysians

Figure 8-1: Containerized Traffic Growth in the Asia-Pacific Region



Sources: Include; Review of Maritime Transport, UNCTAD, 1993 and Seaports of the Americas, 1995.

Notes: (1) Growth of Containerized shipping is measured in million TEUs (twenty feet equivalent units).
 (2) indicates both the largest ports in Asia and the world. These two ports are also the fastest growing ports in Asia.
 (3) indicates fastest growing ports after Singapore and Hong Kong.
 (4) indicates ports with moderate to high growth.
 (5) * indicates growth rates for 1992 and 1993 only. Countries with only one bar reflect growth for 1994 only. For all other ports, growth is for 1994 and 2000+.

are planning to invest U.S. \$593 million. The port authority predicts that the amount of cargo going through Port Klang will double by 2000 and has suggested that Malaysia's expansion is aimed at Singapore.

8.1.2 Indonesia

Indonesian ports are also hoping to declare limited independence from Singapore. At present some 70 percent of Indonesian exports go through Singapore. The Indonesian government hopes that it can reduce its dependence on its neighbour by expanding its own ports: hence its enthusiasm for a scheme involving Evergreen, a Chinese Taipei conglomerate and the world's second largest operator of container ships, to build a U.S.\$1 billion container port on Batam Island, 20 Kilometres from Singapore. Plans are also under way to expand Indonesia's three main ports in Jakarta, Surabaya and Semarang. Jakarta, which currently handles just under 1 million TEUs, plans to have capacity for 2.4 million TEUs by the end of the century.

8.1.3 Singapore

In Singapore, a new U.S.\$890 million container terminal was completed in 1995, increasing the port's capacity by 50%. That expansion is modest compared to what the Port Authority of Singapore plans for the future. It will soon start work on a new port on a patch of reclaimed land next to the present port. When completed, this will be four times the size of Singapore's existing facilities.

Skeptics suggest that Singapore may have crossed the fine line between forward planning and hubris. Singaporeans retort that the growth in trade throughout the region should provide plenty of work for all the new ports, and that the emergence of monster container ships will increase the need for efficient "hub" ports. If there is to be a dominant entrepôt in Southeast Asia, the odds are that it will continue to be Singapore. To make sure of this they are trying to make their port more efficient as well as bigger. Most trade documents are now cleared in 15 minutes; the old paper system took an average of two days.

8.1.4 Hong Kong

The port authority of Hong Kong is also hoping that technology and efficiency will enable it to maintain pre-eminence as rival ports are built in China. But Hong Kong has one obvious problem that is not faced by Singapore: it is no longer master of its own destiny. Indeed, China has been blocking the construction of a new container terminal planned for Hong Kong. The Chinese action – part of its dispute with Britain over the colony's future – means that the existing port will probably hit full capacity in the near future. So, like the Singaporeans, the Hong Kong port authority is betting on efficiency and know-how to maintain its lead.

Table 8-2 summarizes the top twenty world ports by TEU volume of 1993 and 1994. Eleven of the top twenty ports are situated in the Asia-Pacific region with the top two ports in 1994 being Hong Kong and Singapore. Long Beach saw the highest increase between 1993 and 1994, an increase of 24 percent; while Manila, Hong Kong, Tokyo, and Singapore followed with increases of 20 percent, 20 percent, 17 percent and 15 percent, respectively.

8.2 Marine Vessel Routes

Table 8-3 shows activity on the principal Pacific Rim ocean routes. These data come from “Lloyds of London” and are in highly aggregate form. *Lloyds* has complete data on the shipping routes, vessels and voyages annually by region, but it is very costly to access.¹ Thus, these aggregates are the best currently available within budget; other sources are essentially secondary or tertiary users of *Lloyd’s* data who may convert information for added value. These 1993 data were published in 1995. They show that the most active ocean route is China to/from Japan; this route is serviced by over 2 000 vessels a year, undertaking over 8 000 voyages in each direction (i.e., 16 000 plus in total). The next most heavily travelled route is Japan to/from Southeast Asia, where there are about 5 000 voyages, in each direction (9 200 in total), using 1 800 vessels a year.

The next largest group of voyages are Japan to/from Australia and New Zealand, with about 3 500 voyages in each direction (7 000 in total) using 1 200-1 400 vessels each year. Southeast Asia to/from Australia and New Zealand also has intensive traffic, registering some 2 000 voyages in each direction (4 000 in total), employing some 1 000 vessels. There is also significant marine trade between China and Australia and New Zealand — 1 200 voyages (2 500 in total) and around 600 vessels.

Trans-Pacific marine trade is dominated by the Japan to/from U.S. Southwest and U.S. Northwest traffic. On the U.S. Southwest route around 2 000 voyages in each direction (4 100 in total) are undertaken by around 800 vessels. On the U.S. Northwest route, the indicators are 1 800 voyages (3 700 in total), and 700 vessels.

1 For one years data on the Pacific Rim region, the cost would exceed CAD\$ 200 000. *Lloyds* is not prepared to offer a sample of this data at either the 1% or 10% sample level. Other data supplies are value-added resellers of *Lloyds* data and cannot provide a low-cost data solution.

Table 8-2: Top Twenty World Ports by TEU Volume

1993 Rank	1994 Rank	Port	1993 TEUs (in 000s)	1994 TEUs (in 000s)	Change in TEUs (000s)	Change %
1	1	Hong Kong	9 204	11 050	1 846	20%
2	2	Singapore	9 046	10 400	1 354	15%
3	3	Kaohsiung	4 636	4 900	264	6%
4	4	Rotterdam	4 161	4 539	378	9%
5	5	Pusan	3 071	3 213	142	5%
6	6	Kobe	2 696	2 916	220	8%
7	7	Hamburg	2 486	2 726	240	10%
10	8	Long Beach	2 079	2 574	495	24%
8	9	Los Angeles	2 319	2 519	200	9%
9	10	Yokohama	2 168	2 317	149	7%
13	11	Antwerp	1 876	2 208	332	18%
11	12	New York/New Jersey	1 973	2 034	61	3%
12	13	Keelung	1 885	2 021	136	7%
14	14	Dubai	1 679	1 882	203	12%
15	15	Felixstowe	1 639	1 747	108	7%
17	16	Tokyo	1 538	1 805	267	17%
16	17	San Juan	1 555	1 522	(33)	-2%
18	18	Bremen/Bremerhaven	1 355	1 502	147	11%
21	19	Manila	1 247	1 502	255	20%
19	20	Oakland	1 305	1 491	186	14%
TOTAL			57 918	64 868	6 950	12%

Table 8-3: Pacific Rim Routes, Vessels and Voyages, 1993

Route	Number of Vessels	Number of Voyages
U.S. Southwest → Japan	717	2 089
U.S. Southwest → Australia/New Zealand	125	259
U.S. Southwest → West Latin America	65	86
U.S. Southwest → China	197	608
U.S. Southwest → Southeast Asia	246	353
U.S. Northwest → Japan	675	1 786
U.S. Northwest → Australia/New Zealand	162	403
U.S. Northwest → West Latin America	273	466
U.S. Northwest → China	261	838
U.S. Northwest → Southeast Asia	203	490
West Canada → Japan	531	1 248
West Canada → Australia/New Zealand	156	210
West Canada → West Latin America	91	116
West Canada → China	130	318
West Canada → Southeast Asia	131	189
Japan → U.S. Northeast	438	966
Japan → U.S. Southeast	368	869
Japan → U.S. Southwest	909	2 223
Japan → U.S. Northwest	770	1 896
Japan → East Canada	118	194
Japan → West Canada	692	1 389
Japan → Australia/New Zealand	1 462	3 688
Japan → West Latin America	375	536
Japan → China	2 026	8 154
Japan → Southeast Asia	1 792	4 876
Australia/New Zealand → U.S. Northeast	133	200
Australia/New Zealand → U.S. Southeast	65	140
Australia/New Zealand → U.S. Southwest	210	362
Australia/New Zealand → U.S. Northwest	203	473
Australia/New Zealand → East Canada	98	119

Route	Number of Vessels	Number of Voyages
Australia/New Zealand → West Canada	179	246
Australia/New Zealand → Japan	1 229	3 257
Australia/New Zealand → West Latin America	109	140
Australia/New Zealand → China	555	1 177
Australia/New Zealand → Southeast Asia	893	1 939
West Latin America → U.S. Northeast	341	803
West Latin America → U.S. Southeast	278	775
West Latin America → Japan	337	514
West Latin America → Australia/New Zealand	63	96
West Latin America → Southeast Asia	118	138
China → U.S. Northeast	232	567
China → U.S. Southeast	182	512
China → U.S. Southwest	280	715
China → U.S. Northwest	328	961
China → East Canada	74	141
China → West Canada	197	401
China → Japan	2 050	8 014
China → Australia/New Zealand	744	1 387
Southeast Asia → U.S. Northeast	364	709
Southeast Asia → U.S. Southwest	202	306
Southeast Asia → U.S. Northwest	285	598
Southeast Asia → Japan	1 894	5 344
Southeast Asia → Australia/New Zealand	1 141	2 261
Southeast Asia → West Latin America	141	161

Source:Lloyd's Maritime Information Services (LMIS), 1995

For Western Canada, the Japan route is the most important with about 1 300 voyages (2 650 in total), using some 600 vessels. It is important to avoid double counting of vessels that service between Western Canada, U.S. Northwest and U.S. Southwest. Unfortunately, data at this level of aggregation does not allow such consideration.

8.3 U.S. Ports

The West Coast of the U.S. is the principal origin/destination for trans-Pacific maritime trade. Key ports are Los Angeles, Long Beach, Oakland, Tacoma, Portland and Seattle. Some key trade and traffic findings are as follows:

- ▶ The West Coast trade volume (export/import) grew steadily at 3 percent per annum from 1984 to 1994; the pace has quickened to 4 percent per annum growth recently;
- ▶ U.S. exports make up about three-fifths, by volume, of the market and are dominated by commodities;
- ▶ U.S. imports constitute some two-fifths, by volume, of the market and are dominated by manufactures;
- ▶ Import tonnage has been growing at 4 percent annually, while exports have expanded annually at 2 percent by volume over the past ten years;
- ▶ U.S. imports through these West Coast ports are worth about three times the value of exports in total, and over four times (\$2 900) on a per ton basis;
- ▶ Thus the vessel-type for U.S. imports (container carriers) is at variance with the required commodity carrier for exports; this excludes substantial oil imports requiring ocean tankers;
- ▶ There are no readily available detailed vessel arrivals/sailing data for U.S. West Coast ports; and
- ▶ The ports of Los Angeles and Long Beach are the two largest in the U.S. and expect to **double** their cargo volume by the year 2020.

8.3.1 Overview of West Coast Ports

- ▶ The West Coast import/export market experienced a 4 percent increase in 1994 versus 1993. The tonnage increase of 6.4 million tons expanded the West Coast total to 163.1 million tons from 156.7 million tons in 1993. Trade value increased by 13 percent or \$30.3 billion in 1993 to \$255.1 billion in 1994.

- ▶ Since 1984, the West Coast import/export market has increased at an average rate of 3 percent, from 125 million tons to 163 million tons in 1994. The value of West Coast tonnage has almost tripled from \$95 billion in 1984 to \$255 billion in 1994.
- ▶ Except for the oil crisis years (1974-1978), the West Coast has historically been an export dominant market. Exports continued to dominate representing 61 percent of the market in 1994 and 63 percent in 1993.
- ▶ Import tonnage was up 11 percent in 1994 to 64.4 million tons from 58.2 million tons in 1993. Since 1984, import tonnage has increased by 21 million tons, representing a 4 percent annual growth rate.
- ▶ Export tonnage increased in 1994 by 158 000 tons to 98.7 million tons. Since 1984, export tonnage has grown at 2 percent annually for a total increase of 17.6 million tons.
- ▶ The value of West Coast imports (\$189.5 billion) was almost three times that for exports (\$65.6 billion) in 1994. The value of imports increased by 13 percent from 1993 to 1994 while the value of exports increased 15 percent.
- ▶ Since 1984, the value of imports increased by 11 percent annually for a total increase of \$120.1 billion.
- ▶ In 1984, the average value of an import was \$2 940 or over four times the average export value of \$665 per ton.
- ▶ In 1994, the major West Coast ports experienced tonnage growth ranging from 18 percent (Oakland) to -9 percent (Tacoma).
- ▶ West Coast exports tend to be: agricultural products bound for Asian consumer markets; forest and paper products which are in part consumed domestically and in part made into finished goods for cotton export; cotton which is woven into fabric or apparel for re-export; scrap for recycling, electronic components to be assembled as finished consumer goods for export; and machinery for use in manufacturing.

- ▶ Imports, excluding petroleum and petroleum products, are generally represented by high value commodities such as motor vehicles, parts and equipment, and finished products.
- ▶ All U.S. West Coast ports experienced tonnage increases in 1994, except for Tacoma (9 percent decrease) and Portland (no change). Los Angeles' 4 percent increase is primarily attributable to import gains in petroleum oils and semi-finished iron products. Tacoma's decrease is attributable to export losses in rough wood, corn and soybeans.

8.3.2 *Key U.S. West Coast Ports*

- ▶ The total value of cargo passing through the Port of Los Angeles was \$73.4 billion, or \$2.5 billion more than its closest competitor the Port of Long Beach. Los Angeles has almost quadrupled the value of cargo handled since 1984 and is the number one West Coast port in terms of value.
- ▶ The Port of Long Beach was the number one port in 1994, replacing Los Angeles. The Port of Los Angeles was the number one port in 1993 and for the four-year period of 1988-1991.
- ▶ The Port of Long Beach was the number one export port in terms of tonnage in 1994, exporting 16.7 million tons or 17 percent of the total West Coast export tonnage. The Port of Long Beach has been the number one export port since 1991 displacing the Port of Portland.
- ▶ The Port of Long Beach was the number one port on the West Coast based on total import and export tonnage in 1994 with 32.8 million tons or 20 percent of the total West Coast tonnage.
- ▶ In 1994, imports comprised 55 percent of the Port of Los Angeles' international trade, down from 56 percent in 1993.
- ▶ In 1994, the Port of Los Angeles accounted for 21.6 percent of all West Coast imports and 11.7 percent of exports compared to 23.5 percent and 11.0 percent, respectively in 1993. The Port's overall import/export market share increased from 11.1 percent in 1984 to 15.6 percent in 1994. The biggest loss was experienced by Tacoma (8.7 percent to 6.9 percent).

- ▶ The Port of Los Angeles handled trade for over 100 different economies. Its major trading partners were Japan, Chinese Taipei, China, South Korea and Ecuador. These five economies accounted for 59 percent of all import/export tonnage and 68 percent of the dollar value.
- ▶ Japan was the largest in both import and export tonnage and the value of cargo handled. Japan accounted for 25 percent of all tonnage handled at the Port of Los Angeles with Chinese Taipei (16 percent) and China (9 percent). Japan's trade represented 32 percent of the total cargo value handled at the Port followed by Chinese Taipei (17 percent) and China (14 percent).
- ▶ The Ports of Los Angeles and Long Beach accounted for 47 percent of West Coast imports in 1994 (same as in 1993) and 29 percent of exports (up from 28 percent in 1993).
- ▶ Based on tonnage, the Ports of Los Angeles and Long Beach experienced a split of 52 percent imports and 48 percent exports.
- ▶ The characteristics of commodities entering and leaving both Los Angeles and Long Beach followed that reported for the West Coast market as a whole, namely that raw or partly improved products comprised most exports while imports consisted of more processed or finished goods.
- ▶ For all commodities (over 100 000 annual tons) handled in the San Pedro Bay, Los Angeles dominated 34 of 76 commodities in 1994; this was down from 39 of 69 commodities in 1993.
- ▶ The Port of Long Beach is the number one container port in the United States. During 1995, 2 843 502 TEUs crossed Long Beach wharves. The total volume of all forms of cargo was 91.3 million metric revenue tons. The value of cargo passing through Long Beach during 1995 was in excess of \$70 billion.
- ▶ Exports through Long Beach are now growing four times as fast as imports. During the first six months of the 1995-96 fiscal year, exports soared by 25 percent, while imports grew by 6 percent. Today, exports account for 43 percent of all containerized cargo passing through Long Beach – up from 28 percent recorded just 10 years ago.

- ▶ Independently, the ports of Long Beach and Los Angeles are the *two largest in the nation*. Combined, they *rank third in the world* for container trade.
- ▶ The ports of Long Beach and Los Angeles expect to more than double their cargo volume by the year 2020.

8.3.3 Case of Port of Long Beach

The Port of Long Beach is the number one container port in the United States. During 1995, 2 843 502 TEUs crossed Long Beach Wharves. Much of this traffic is attributed to the strengthening of the U.S. economy during 1994 and early 1995.

- ▶ Nearly 80 percent of all international cargo crossing Long Beach is moving to or from Asia. Japan, China, Hong Kong, South Korea and Chinese Taipei are the top five traders.
- ▶ Japan is Long Beach's leading trade partner, and the leading supplier of consumer goods and hi-tech items.
- ▶ Recently (1994-95), two fifths of Long Beach's volume growth was generated by trade with China and Hong Kong. This is the leading U.S. gateway for China.
- ▶ Long Beach is the home to seven of the top ten container lines with direct or feeder service to China.
- ▶ South Korea is a leading buyer of U.S. manufactured goods while it supplies large volumes of clothing, footwear, leather goods and other manufactures through Long Beach.
- ▶ With the shift of some manufacturing from Northeast to Southeast Asia, Indonesia, Malaysia and Singapore are playing expanded roles as suppliers of machinery, plastics and chemicals through Long Beach.

Despite the overall strength of the Asian market, trade with Latin America also spurred the port's success. Chilean Line moved to Long Beach and imported pitted fruits and grapes to stock grocery store shelves during the California winter season. Container lines reported

increased imports of refrigerated fruits, vegetables, fish and meats in their inbound flows, contributing to an overall 200 percent hike in trade between Long Beach and Latin America.

Tables 8-4, 8-5 and 8-6 present trade and traffic, inbound cargo and outbound cargo data for the Port of Long Beach, respectively.

Table 8-4: Port of Long Beach: Trade and Traffic 1985/95

Fiscal Year	Containerized Cargo Value In Millions TEUs	Revenue Tons In Millions of Metric Tons	Cargo Value In Millions of Dollars
1995	2.64	74.7	73435
1994	2.38	65	64465
1993	2.31	67.8	63030
1992	2.16	67.3	56937
1991	2.06	70.9	57007
1990	2.11	67.9	55048
1989	1.85	66.3	45218
1988	1.59	60.6	37195
1987	1.46	55	33289
1986	1.18	51.1	28089
1985	1.04	45.1	19474

Table 8-5: Port of Long Beach: Inbound Cargo Statistics for Fiscal Year 1994/95

Economy	Inbound Metric Revenue Tons	% Change
China	7789896	26.1
Hong Kong	6593588	14.5
Japan	5408265	7.9
South Korea	3336079	14.7
Chinese Taipei	2890253	-4
Malaysia	1625632	28.3
Indonesia	1390892	30.6
Thailand	1289904	15.8
Singapore	817480	3.2
Mexico	785720	-25.7
Philippines	608637	16.4
India	421659	7.5
Canada	337007	-30.8

Table 8-6 Port of Long Beach: Outbound Cargo Statistics for Fiscal Year 1994/95

Economy	Outbound Metric Revenue Tons	% Change
Japan	6570376	10.4
South Korea	3141513	12.6
Hong Kong	2376096	23.8
China	1424218	27.3
Chinese Taipei	1306471	1.1
Singapore	990829	11.2
Australia	524056	22.8
Thailand	499652	38.8
Philippines	456539	31.4
Indonesia	453264	38.3
Malaysia	387551	43.3
Brazil	227414	121.5

8.4 Port of Vancouver

Vancouver is Canada's largest port, and is consistently in the top five North American ports in terms of foreign import and export tonnage. It is the largest bulk port on the North American west coast with tonnage throughput in 1995 exceeding 71.5 million tons. The port has 29 cargo and passenger terminals, including grain, forest products, bulk material, container and cruise passenger terminals. The port handles four business sectors, according to the method of cargo handling:

- ▶ *Bulk Cargo*: approximately 83 percent of total tonnage; top commodities include coal, grain, sulphur, potash, petroleum products, liquid chemicals, phosphate rock and mineral concentrates (See Table 8-7).
- ▶ *General Cargo*: approximately 11 percent of total tonnage; top commodities include lumber, pulp, plywood, woodchips, newsprint, iron and steel.
- ▶ *Containerized Cargo*: approximately 6 percent of total tonnage; top commodities include consumer good imports, lumber, chemicals, newsprint, machinery parts and grain.
- ▶ *Cruise*: Port of Vancouver is home to Vancouver-Alaska cruise lines, nearly 596 724 revenue passengers travelled through the port in 1995.

Table 8-7: Port of Vancouver Statistical Summary

Year	Bulk Cargo	General Cargo	Containers (TEUs)	Total Tonnage
1990	57 100 000	6 630 000	322 569	66 400 000
1991	60 800 000	6 582 000	383 563	70 700 000
1992	53 400 000	6 285 000	441 055	63 300 000
1993	50 905 000	6 399 000	434 004	60 800 000
1994	56 327 000	7 060 000	494 004	67 600 000

8.4.1 Port of Vancouver Expansion

The Port of Vancouver currently has two container terminals located in the Burrard Inlet – *Centerm* and *Vanterm*. To meet the growth in container volumes projected over the next decade, the Port of Vancouver is planning an additional container facility, *Deltaport*, to be situated at Roberts Bank in the outer harbour, 30 nautical miles (40 kilometres by land) from downtown Vancouver and Burrard Inlet. *Deltaport* will double the Port of Vancouver’s overall container capacity to more than one million TEUs per year.

Deltaport will be a state-of-the-art, two berth facility, capable of servicing the world’s largest ships. *Deltaport* will feature:

- ▶ A 40 hectare site (100 acres).
- ▶ Two container berths totalling 670 metres (2198 feet).
- ▶ Berth of 15.85 metres (52 feet) draught.
- ▶ Five Post Panamax container gantry cranes capable of handling 18-wide ships with 50 tonne capacity (four cranes at opening).
- ▶ Grounded operation utilizing rubber tired gantries (RTG) and multiple trailer system (MTS).
- ▶ Container yard storage capacity at three high of 13 000 TEUs.
- ▶ Capacity of 600 reefer points equipped with four-high platforms (420 at opening).
- ▶ Advanced computerized systems including full EDI capability, yard and ship planning, and fully integrated container capacity control.
- ▶ Four rail tracks of 3 500 feet each, providing capacity for two 7 000 foot double-stacked trains (880 TEUs). Grounded storage capacity in the Intermodal Yard of approximately 1 200 TEUs – serviced directly by CP Rail System and CN North America.

- ▶ Intermodal operations by up to four high speed Rail Mounted Gantries (two RMG's at opening).

Deltaport's target date for completion is set for the end of 1996. Construction is on schedule; the berth face is complete and backfilling is underway, construction of the terminal is underway, rail works are in progress and cranes are under construction as well. With this capacity expansion, there will be a discrete jump in Vancouver's TEU throughput from 1997 on.

8.5 *New and Larger Vessels*

It is evident from the recent very strong growth of in-bound TEU (manufactured imports) traffic to the West Coast that there is mounting sea-lane and port congestion. Both Long Beach and Los Angeles see their TEU traffic doubling by 2020. For traffic originating from China, Hong Kong, South Korea, and Latin America, the doubling could occur before 2010.

The rapid build up of trans-Pacific maritime trade is pushing ocean carriers to purchase new and larger vessels. For instance:

- ▶ The Chinese carrier COSCO has recently added six new vessels to its fleet each capable of carrying 3 500 to 3 800 TEUs. COSCO will introduce 5 250 TEU vessels in late 1996.
- ▶ The Korean carrier Hanjin has expanded service by adding five new 4 000 TEU vessels and two express-line 2 700 TEU vessels. Hanjin plans to introduce 5 000 TEU vessels in 1996.
- ▶ US registered 1 000 TEU vessels are regularly sailing full with refrigerated cargo's from Latin America shipping into the U.S. West Coast.
- ▶ Hyundai Merchant Marine of Korea has introduced six new 4 411 TEU mega-container ships on service to Long Beach. Later in 1996 Hyundai will start developing 5 551 TEU ships on its trans-Pacific routes.
- ▶ Orient Overseas Container Line has placed deliveries of six new 4 960 TEU mega-container ships in service on weekly service from Long Beach to China and Southeast Asia.

- ▶ Maersk line has nine 5 500 TEU vessels under construction.

The larger vessels yield substantial economies of scale and can operate at up to 25 knots. By travelling faster with more TEU cargo, these mega-ships can lower operating costs and meet the growing demand for speedy, efficient, reliable trans-Pacific container service.

8.6 Port Forecasts 2010

The foregoing analysis has shown quite clearly that bulk commodities dominate the west-bound (export) North American trade, whereas manufactured goods form the lion's share of the east-bound (import) trade. This implies a mismatch in ship types, with large numbers of bulk carriers having weak direct back-haul to North America and similarly the case for container vessels, ro-ro ships and tankers back-hauling to Asia. If these vessels are too large to traverse the Panama Canal – as is true of the new mega-ship container vessels – they must scramble for export cargo from the U.S. to Japan, Korea, China, Hong Kong and Southeast Asia. This situation is likely to become more exaggerated as time goes by, since commodity export volume is rising at less than 3 percent per annum on average, whereas container TEU traffic coming into North American West Coast ports is increasing at roughly 8.5 percent per annum. Forecasts of TEU loadings at selected North American West Coast ports are shown in Table 8-8.

Table 8-8: Forecasts for Selected North American Ports to 2010 (TEU 000s)

Year	Long Beach	Vancouver	Los Angeles	Oakland	Portland	Tacoma	Total
2010	13.01	2.21	8.62	4.92	0.685	2.39	31.81
2008	10.75	1.92	7.39	4.23	0.621	2.17	27.08
2006	8.88	1.67	6.34	3.65	0.563	1.97	23.07
2004	7.34	1.46	5.43	3.14	0.511	1.78	19.66
2002	6.06	1.27	4.66	2.71	0.463	1.62	16.78
2000	5.02	1.11	3.99	2.33	0.421	1.47	14.34

Appendix A

Survey of Shipping Traffic in Major Asia-Pacific Ports

Table A-1: Port Survey -- Number of Ship Arrivals

ASIA	Number of Ship Arrivals					
Region Economy Port	1989	1990	1991	1992	1993	Average
CHINA						
Shanghai	---	3 045	---	---	---	3 045
HONG KONG						
Hong Kong	18 999	20 363	22 631	28 255	33 042	24 658
INDONESIA						
Belawan	4 383	4 133	3 873	4 640	5 083	4 422
Tanjong Priok	10 124	11 130	12 106	---	---	11 120
JAPAN						
Chiba	86 184	88 732	88 601	87 103	52 545	86 633
Kitakyushu	82 012	80 973	81 882	79 667	76 769	80 261
Kobe	89 628	92 639	91 676	83 551	---	89 374
Nagoya	50 088	50 395	48 817	46 682	46 121	48 421
Osaka	76 422	73 883	70 690	67 906	---	72 225
Shimizu	9 816	10 296	10 517	10 164	9 751	10 109
Tokyo	57 659	55 934	56 753	54 387	50 213	54 989
Yakohama	62 016	61 736	58 831	56 390	55 691	58 933
SINGAPORE						
Singapore	38 942	44 606	70 345	81 334	92 655	65 676

ASIA	Number of Ship Arrivals					
Region Economy Port	1989	1990	1991	1992	1993	Average
<i>THAILAND</i>						
Bangkok	2 255	2 369	2 422	2 517	2 482	2 409
<i>CHINESE TAIPEI</i>						
Kaohsiung	10 974	10 939	11 465	12 234	12 888	11 700
Keelung	7 572	7 623	7 514	7 908	8 005	7 724
Taichung	1 916	2 098	2 620	3 268	—	2 476
<i>KOREA</i>						
Inchon	3 006	3 381	4 060	4 256	4 723	3 885
Kwangyang	21 889	23 847	25 550	27 435	28 612	25 647
Pohang	12 384	10 729	10 300	10 030	10 423	10 773
Pusan	12 414	12 185	14 386	23 714	—	15 676
<i>PHILIPPINES</i>						
Cebu	404	380	371	423	—	396
Davao	2 449	2 326	2 910	2 659	—	2 586
Manila	2 913	2 952	2 764	3 093	3 283	3 001

OCEANA	Number of Ship Arrivals					
Region Economy Port	1989	1990	1991	1992	1993	Average
<i>AUSTRALIA</i>						
Geelong	350	369	452	458	351	396
Gladstone	575	590	676	690	670	640
Hedland	746	755	682	575	617	675
Hobart	490	504	467	580	590	526
Launceston	479	445	—	520	554	500
Melbourne	2 640	2 655	2 569	2 518	2 610	2 598
Newcastle	1 037	1 003	1 176	1 217	1 275	1 142
Port Kemia	525	528	614	469	—	534
Sydney	1 602	1 735	2 340	2 206	—	1 971
<i>FIJI</i>						
Lautoka	279	331	330	342	—	321
Suva	564	562	577	623	—	582
<i>NEW ZEALAND</i>						
Auckland	1 211	1 546	1 158	776	—	1 173
Lyttelton	655	865	1 029	1 064	1 141	961
Napier	294	319	386	492	518	402
Otago	316	326	400	390	472	381
Touranga	531	599	719	780	873	700
Wellington	2 772	2 825	2 842	2 826	3 032	2 859

Source: Shipping Statistics Yearbook 1994
 Institute of Shipping Economics and Logistics (ISL)
 Bremen Germany

Table A-2: Port Survey -- Shipping Tonnage

ASIA				Shipping Tonnage (In 1000)				
Region Economy Port	Average Ship Size	Max. Ship Draught	Unit	1989	1990	1991	1992	1993
CHINA								
Shanghai	8 972	—	grt	—	27 319	—	—	—
HONG KONG								
Hong Kong	4 507	23	nrt	103 147	110 231	116 933	133 485	148 903
INDONESIA								
Belawan	3 446	10	grt	13 839	14 830	14 308	16 112	17 514
Tanjong Priok	—	—	—	—	—	—	—	—
JAPAN								
Chiba	1 518	—	grt	121 782	128 567	128 378	132 384	125 295
Kitakyushu	1 172	—	grt	82 042	84 889	89 903	88 084	89 964
Kobe	3 552	—	grt	270 586	288 352	302 510	296 806	—
Nagoya	4 414	13	grt	173 047	189 411	197 198	200 309	203 595
Osaka	1 924	—	grt	117 492	119 211	122 660	130 631	—
Shimizu	4 788	12	grt	38 942	42 750	44 238	48 379	46 685
Tokyo	2 321	—	grt	117 983	125 508	131 909	133 462	116 557
Yakohama	4 760	—	grt	230 027	235 022	233 218	245 354	265 082
SINGAPORE								
Singapore	6 733	—	grt	430 727	482 968	536 620	578 500	623 800

ASIA			Shipping Tonnage (In 1000)					
Region Economy Port	Average Ship Size	Max. Ship Draught	Unit	1989	1990	1991	1992	1993
<i>THAILAND</i>								
Bangkok	6 797	8	nrt	11 985	13 834	15 372	16 144	16 869
<i>CHINESE TAIPEI</i>								
Kaohsiung	16 405	15	grt	157 785	160 810	170 336	182 685	211 428
Keelung	13 039	14	grt	96 367	97 928	98 959	107 425	104 373
Taichung	10 812	16	grt	20 929	23 628	28 724	35 334	—
<i>KOREA</i>								
Inchon	10 506	—	grt	29 939	35 963	39 749	42 181	49 618
Kwangyang	4 688	—	grt	95 599	106 215	111 597	124 118	134 136
Pohang	5 326	—	grt	52 874	57 959	56 635	56 209	55 514
Pusan	5 707	13	grt	109 511	105 689	116 380	135 329	—
<i>PHILIPPINES</i>								
Cebu	6 262	—	grt	2 616	—	—	2 649	—
Davao	2 979	—	grt	8 160	4 178	8 577	7 920	—
Manila	8 829	—	grt	23 095	27 204	25 682	28 463	28 984

OCEANA				Shipping Tonnage (In 1000)				
Region Economy Port	Average Ship Size	Max. Ship Draught	Unit	1989	1990	1991	1992	1993
AUSTRALIA								
Geelong	21 610	—	grt	7 071	5 956	7 126	6 286	7 585
Gladstone	35 373	18	grt	21 463	21 100	23 696	24 526	23 700
Hedland	45 867	—	grt	21 364	21 411	25 095	25 065	28 300
Hobart	8 259	—	grt	4 660	4 547	4 750	4 720	4 873
Launceston	11 101	—	grt	6 015	—	—	6 228	6 150
Melbourne	13 885	—	grt	33 375	34 719	33 996	34 658	36 239
Newcastle	27 459	15	grt	28 475	—	—	—	—
Port Kemia	41 791	—	grt	15 281	15 961	18 050	19 600	—
Sydney	18 400	—	grt	25 912	25 571	39 930	40 590	—
FIJI								
Lautoka	7 933	—	grt	2 320	2 595	2 487	2 713	—
Suva	6 891	—	grt	3 977	3 905	4 344	4 293	—
NEW ZEALAND								
Auckland	10 000	—	grt	—	—	—	7 760	—
Lyttelton	7 553	12	grt	5 865	6 102	8 189	7 771	8 618
Napier	6 869	10	nrt	1 770	1 939	2 772	3 001	3 558
Otago	12 890	12	grt	4 737	4 783	5 766	5 725	6 084
Touranga	11 733	12	grt	5 856	6 962	8 445	9 244	10 243
Wellington	7 003	—	grt	18 181	—	19 902	—	—

Source: Shipping Statistics Yearbook 1994
 Institute for Shipping Economics and Logistics (ISL)
 Bremen Germany

grt = gross register tonnage
 nrt = net register tonnage

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Appendix B

Acronyms

G

GDP Gross Domestic Product
GRT Gross Register Tonnage

I

IATA International Air Transport Association

L

LNG Liquid Natural Gas

M

MTS Multiple Trailer System

N

NRT Net Register Tonnage

R

RMG Rail Mounted Gantries
RTG Rubber Tired Gantries

T

TEU Twenty-foot Equivalent Units