THE CHAMBER OF COMMERCE OF THE UNITED STATES

LAND TRANSPORT OPTIONS BETWEEN EUROPE AND ASIA:
Commercial Feasibility Study

July 2006

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1. Executive Summary

The land-link between Asia and Europe - among the oldest trade routes in the world - is not used for any large-scale intercontinental commercial trade of containerized cargo today. The current land transport connections between Asia and Europe do exist, but they have no viable share of the commercial market for transport of containerized cargo.[1]

Ocean transportation dominates inter-continental cargo trade between Asia and Europe. International maritime operators have significantly expanded capacity to meet demand from shippers and this has resulted in sustained levels of double digit annual growth in the number of full containers leaving Asia. For high-value and time-sensitive cargo, the use of air transportation has seen similar expansion.

The volume of international containerized cargo shipped using land transport options between Asia (China) and Europe is very limited. Rail transport, in particular the Tran Siberian Railway, may account for up to 3-4 percent of the current volume, mainly from Northern China and the Korean Peninsula, but there is some uncertainty about the exact quantity and type of cargo carried as containerized cargo on these routes.

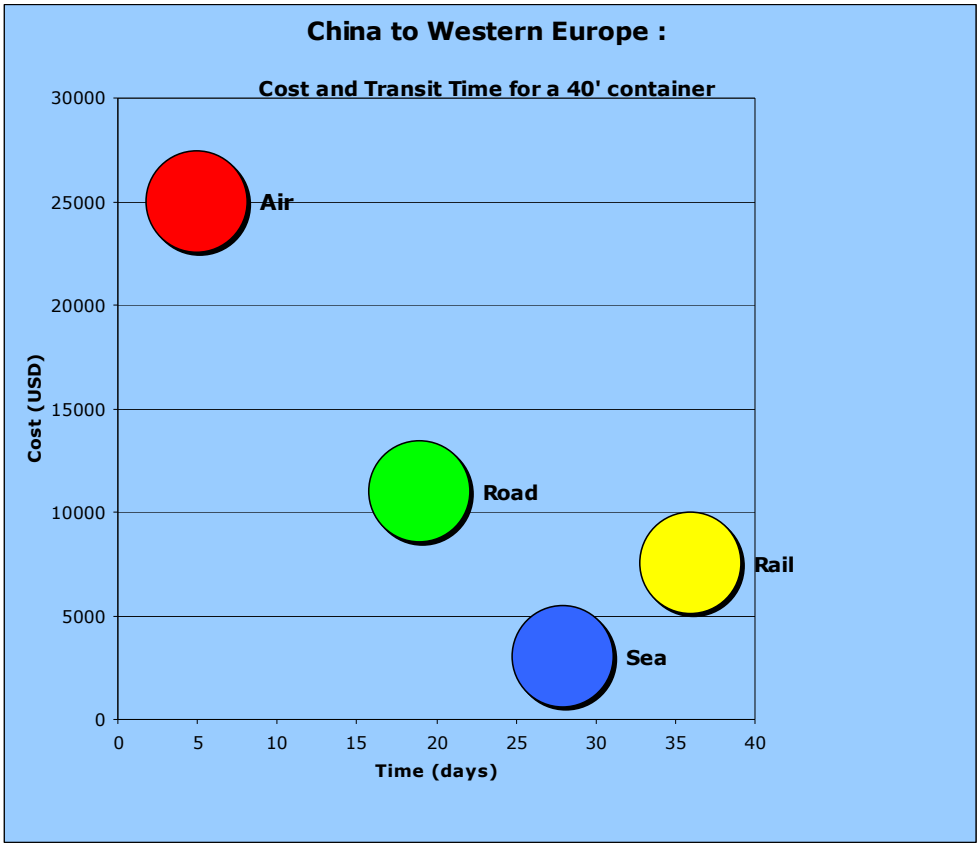
Road transport (trucking) accounts for less than 1 percent of the containerized Sino-European trade measured in volume terms.

[1] Throughout this report "a container" means a 40-feet standard container unit (a "FEU" or "Forty-foot Equivalent Unit") unless otherwise mentioned. A FEU in principle equals two TEU ("Twenty-foot Equivalent Unit") and usually carries up to 26 tons of cargo and holds 67m3 (cubic meters). This is approximately the same as can be loaded on a standard European truck. Increasingly, trucks pick up a FEU (or two TEUs) in the port and deliver directly to the end-users.

Modal split - Transport of Full Load Containers between China and Europe (Million full load TEUs)			
	Westbound	Eastbound	Total
Sea transport	4,5	2,5	7,0
Rail	< 0,2	< 0,1	<0,3
Road (Truck)	< 0,03	< 0,03	<0,06

The main objective of this analysis is to compare maritime, air, rail and trucking options for shipping cargo in a container. The bulk of the analysis focuses on the important link between China (Shanghai) and a destination in Western Europe.

The diagram below shows the transit-times and costs of transporting a 40' container between China (Shanghai) and Western Europe as identified in this study:



The results show clearly that ocean transportation is cheap and reliable, but has long transit times. The other extreme is air transport, which is expensive but fast.

For trucking, the costs are 3 to 4 times that of ocean transport and transit times are found to be roughly one week shorter. However, there seems to be huge potential for shortening transit times of trucking even further. For rail solutions, the transport costs are higher than for ocean transport and the transit times are found to be unpredictable.

Overall, transport costs and transit times have been falling over the last decades. High value goods can be transported around the globe for only a fraction of the retail price. At the same time it has become increasingly important for transport services to deliver on schedule because modern production processes require highly reliable supply chains.

Transport is a cyclical business, and any imbalance between the capacity of the fleet of container vessels and the cargo demand is quickly reflected in the freight rates. As the shipping industry responds to changes in capacity and the supply/demand ratios on the main trade routes, the freight rates for containers can change drastically even over a period of a few months. The cost of using land transport has proven to be more stabile, at least when the ocean shipping rates are compared to land transport rates in mature markets.

There is a strong - and increasing - imbalance in the volumes on these main trade lanes, with more than half of the containers from Europe and from the US going back to Asia empty. This implies high costs for operators in relation to repositioning of equipment – and also results in very low freight rates on those legs.

Furthermore, as volumes have risen, existing infrastructure in ports and the capacity of the onward inter-modal transportation options (trucks and rail lines) have been pressed towards their limits. Congestion has increasingly caused delays and disruptions of vital supply chains. An example with global reach occurred in 2004 when ports at the US West Coast clogged. By early September there were 22 container ships waiting for berth. The situation reverted to normal by the end of November, with ship turnaround times being in the range of 3 to 4 days rather than the 7 to 10 days of the previous months.

While congestion in main container ports has underlined a need for increasing capacity of ports and in-land multimodal transportation options, it has also focused attention on new possibilities for launching transport concepts that avoid the congested main hubs. Trucking can deliver flexible transport solutions that, by definition, deliver the door-to-door transportation that is normally preferred by shippers.

For both road transport and railways there are a number of projects under development that aim at improving the availability of land transport between Asia and Europe. Measured on the potential achievable transport costs and related transit times these new options will, at least theoretically, be competitive with the currently

available options for ocean transport, in particular when servicing some inland origins and destinations.

In addition, recognizing the importance of modern integrated production systems and the need for fast and timely transport services, the implication of high inventory costs are examined in conjunction with the transportation costs and transit times.

The analysis shows that for time-sensitive, high-value cargo, a one week shorter transit time for trucking compared to ocean transport, can level out the difference in the direct transportation costs. The reason is the high inventory costs associated with time sensitive cargo. Therefore, based on a calculation of the combined transport and inventory cost, the analysis indicates that road transport can compete with the dominant mode of sea transportation for high value goods with high time sensitivity, and – under similar conditions – also with air transportation. It is underlined that the assessment of the exact premium for shorter transit times can only be undertaken by the individual shipper and that the results can not be generalized.

Some of the critical issues for the future development of Eurasian road transport include the need to ensure reliability, the importance of securing shorter and predictable border-crossing times and limiting the resources spent with customs formalities. There are also economic uncertainties, including issues relating to state subvention of diesel fuel and to the necessity of maintaining and improving highways and other infrastructure.

Finally, there is increasing focus on trade and transport facilitation. The multilateral organizations in the region (Asian Development Bank, World Bank, and the dedicated UN bodies) have progressively stepped up work to encourage solutions for transport facilitation issues. Similarly, associations representing the transport businesses - and in particular the International Road Union (IRU) - have consistently worked to highlight the potential for landlocked economies in improving the conditions for land transport solutions.

This broad engagement in developing better frameworks for transport facilitation is vital for reaching a stage where very long haul trucking solutions across the Eurasian landmass can become a commercial reality that can generally be considered as a realistic alternative to other available modes of transport.

2. Introduction and Objectives

The U.S. Chamber of Commerce, Washington, D.C. (the U.S. Chamber) requested Rambøll Denmark A/S to undertake a study that analyses the feasibility of making land transport, and trucking in particular, more competitive with the dominant maritime shipping options.

2.1 The scope

The study estimates the door-to-door transport cost for containers, as well as the total door-to-door transport time comparing existing sea routes to existing land routes between China and final destinations.

More specifically, the report provides a best estimate of the door-to-door transport cost for 20' and 40' containers, as well as the total door-to-door transport time (including waiting time at ports of embarkation and des-embarkation), reliability /security comparing existing sea routes to current land routes between China and final destinations.

The report compares transportation costs and transit times, based on freight rate quotations from shippers and freight forwarders, for a selection of relevant destinations and relates these to the general trends and characteristics of freight rates and transport solutions.

Box 2-1: The Beijing-Brussels Caravan

Transport Ministers from 17 Asian and European States met in Beijing in November 2005. Referring to the IRU's (International Road Union) 3rd Euro-Asian Road Transport Conference in Beijing two months earlier the ministers underlined the economic needs and realities of their economies and agreed on the following declaration:

> *"Economic and trade development in Asia and Europe would be greatly enhanced by strengthened mutual co-operation in road infrastructure and transport development. Moreover, the establishment of a sound legal framework governing the facilitation of cross-border and transit transport, as well as the removal of non-physical barriers caused by artificial and bureaucratic formalities blocking facilitated road transport in and between the countries in Asia and Europe, under the auspices of international organizations and financial institutions, is necessary".*

The ministers also recognized how road transport offers a viable, cost-effective and timely solution to satisfy changing trade and production patterns along the ancient Silk Road, between Asia and Europe.

At the same time a remarkable test drive took place: The Beijing-Brussels Caravan set out in the context of the Euro-Asian Road Transport Conference and ended in Brussels on 17 October 2005. The aim of the Beijing-Brussels Caravan project was to demonstrate that road transport is an effective means of shipping cargo by land between Europe and the countries of the Asia-Pacific region.

The participants organizing the Caravan were IRU member associations: CRTA (China), KAZATO (Kazakhstan), ASMAP (Russian Federation), LINAVA (Lithuania), Latvijas Auto (Latvia), and ZMPD (Poland). Following a trans-loading operation the containers under TIR carnets started their journey through Kazakhstan, Russia to the EU. The 4 Euro Standard trucks, each with two drivers, completed the journey as scheduled and without any technical complications due to the good road infrastructure along the 12,000 km Beijing to Brussels journey.

2.2 **Structure of the report**

The report has three main sections: The first section (Chapter 3) gives an overview of the existing transportation options for international containerized trade. Today, maritime transport is by far carrying out most of the world's intercontinental containerized transport. The characteristics of this trade are therefore described in some detail, with focus on key features such as volumes, cost, and reliability.

A second part (Chapter 4) analyses door-to-door freight rates and transit times for a series of transportation options using different modes of transport. The data was collected from shippers and freight forwarders and is used to compare the door-to-door transport costs and transit times for existing transportation solutions.

A final section (Chapter 5) considers the current transport options in the context of the overall logistics cost of companies, and explores the potential benefits and challenges related to an expansion of commercially feasible land transport connections between Asia and Europe in a wider perspective.

3. Current Transport Solutions between Asia and Europe

Integrated global production systems as they have developed over the last decades depend on the availability of efficient transportation solutions.

It has become a necessity for companies to ensure that their global supply-chains are efficient and they rely on efficient transportation and logistics solutions to achieve that. The services involve a complex web of activities designed to ensure the efficient movement of raw materials, intermediate inputs, and finished goods between suppliers, manufacturers, and consumers. Transport and logistic service professionals manage these factors and product flows by combining supply chain consulting, transportation management, freight transport, and other related services with the goal of assuring timely deliveries, lean production and reduced inventory costs.

3.1 How fast and cheap transport became available

Over the last decades, all modes of transport have seen dramatic reductions in both transport costs and transit times.

3.1.1 Transport costs

Advanced economies have attained a gradual and remarkable reduction in transport costs since the 1950s. In trucking, for example, deregulation has increased competition and spurred intermodal cooperation between trucking and rail lines. In addition, larger capacity has increased payloads and better highways have reduced transit times.

During the 30 years from the mid-1970s when containerization was gradually introduced in international commercial trade, the cost of international sea transportation has dwindled, in some cases to less than a quarter of what it used to be (in real USD terms).

This is mainly a result of the development of global networks for containerized cargo, although similar patterns of long term reduction of transport costs are also found just as profoundly in the bulk markets.

How much is inside a 40' container?

Today, intercontinental ocean transportation costs make up only a small fraction of the retail price of goods – with ocean freight often making up less than 2 percent. A few practical examples underline this:

- The full door-to-door transportation cost of a pair of sports shoes from coastal Asia to a destination on the US West Coast is in the range of 0.25 USD for each pair.

- To carry a VCR from Asia to the US generates approximately one dollar of ocean transportation costs.

Air transport has seen similar huge reductions in the cost and availability of new integrated cargo concepts and products.

All major economies are affected by this: In 2005, for example, American businesses imported roughly 11 million loaded cargo containers into the United States. This equals an average of about 1.5 billion USD worth of containerized goods through U.S. ports each day.

"Low transport costs help make it economically sensible for a factory in China to produce Barbie dolls with Japanese hair, Taiwanese plastics and American colorants, and ship them off to eager girls all over the world," writes Marc Levinson in the new book *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger* (Princeton University Press , 2006).

In 2006, at projected trade growth rates, the transport industry will handle roughly 12 million U.S. import container loads. With trade growth trends expected to continue after 2006, the demands on the entire transportation sector to handle these large cargo volumes efficiently is both a major challenge and vital to the American economy.

3.1.2 **Transit times**

The development of modern transportation solutions have generally reduced transit times for international transport. Containerization, better logistics operations in general, economies of scale, improved technology for trucks, vessels and terminals, and the creation of coherent transportation networks have shortened transit times for both domestic and international cargo.

Before 1970, for example, general cargo from Hong Kong would in some cases require 40 days to reach destinations in Europe, compared to around 3 weeks today.

But the remarkable growth of international transportation has also strained the capacity of the transportation networks and created congestion and bottlenecks in the international transportation system. The inability of maritime terminals to expand port capacity and a general shortage of infrastructure, including highways, rail lines and terminals, increasingly result in delays and disruption of vital supply-chains.

Faced with the risk of port congestion, delays and expensive disruptions to supply chains, companies shipping their containerized goods from North America, Europe and Asia need to address a number of challenges in order to avoid a direct impact on their businesses – and ultimately harm international trade.

Port diversification and the use of alternative cargo routings stand as key responses to these challenges. It is also against this background that the U.S. Chamber of Commerce has requested the present exploration of an alternative land-based trade route from Asia to Europe.

The following sections outline the key features of international containerized trade as it has developed until today.

3.2 International maritime transport

Intercontinental transport demand, measured by volume, is almost exclusively met by the maritime transport industry. The industry has responded to the demand from businesses for cheap, reliable and efficient transportation solutions by building up global networks of container line operations. There have been at least three key drivers of this development (Stopford 2000):

- Containerization of general cargo transport that allowed for extensive use of automation has dramatically reduced unit cost.

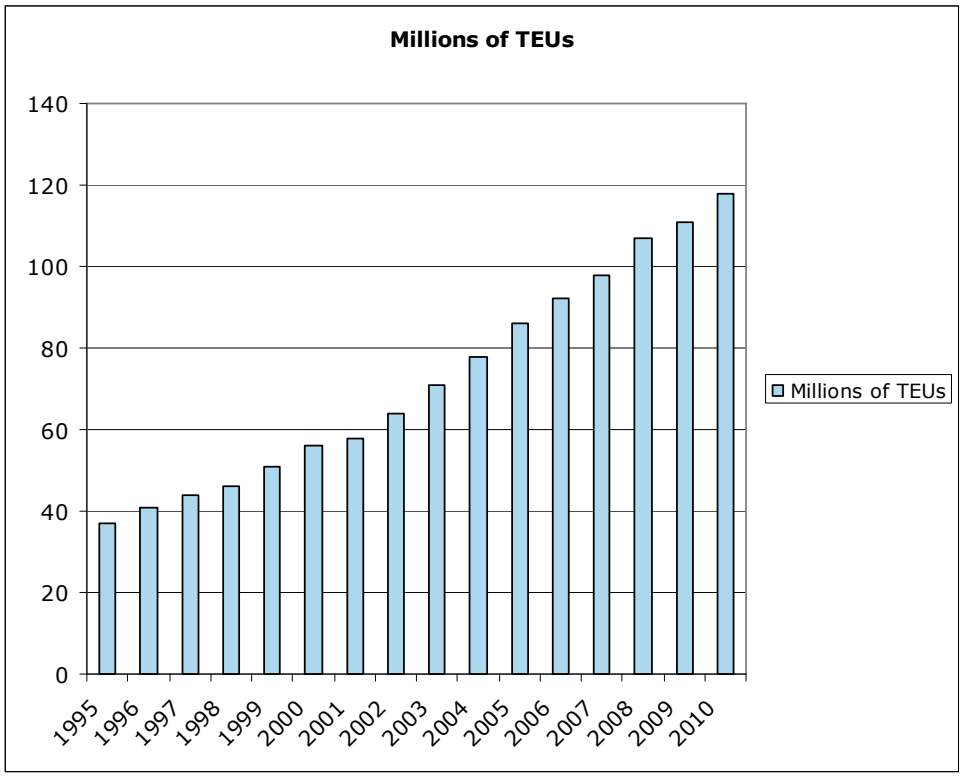
- Increased economies of scale, mainly by applying ever larger container vessels, combined with the build-up of vibrant and coherent global networks (usually based on the hub-and-spoke principle).

- Increased availability of international communications (from telex, fax, EDI to more recent www-based solutions).

"..stack 'em high and sell 'em cheap …"

Figure 3-1 below illustrates how the number of full load containers has grown steadily, and is expected to continue to do so in the years to come.

Figure 3-1 Development in total number of full load containers transported



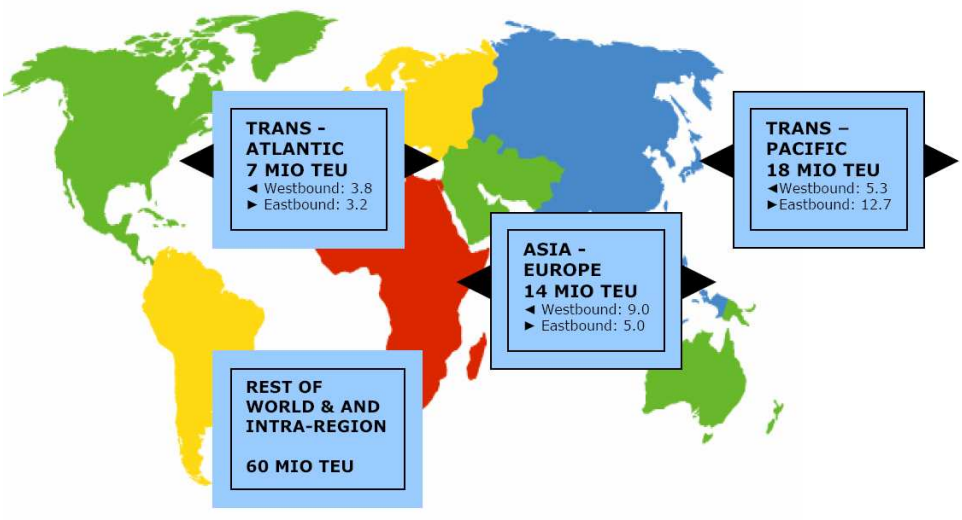
Source: Global Insight, 2005

In the decade from 1995 to 2005 the total worldwide transportation of full load containers has more than doubled. But there have occurred significant changes in the patterns and structures of this trade.

3.2.1 **The 3 main trade routes**

Diagram 3-1 shows the 3 main intercontinental trade routes; Trans-Pacific, Asia-Europe, and Trans-Atlantic, and the number of full load containers (TEUs) moved in each.

Diagram 3-1: World Container Flow 2005 (Million Full Load Containers)



Source: Own compilations based on ECSA (European Communities Shipowners Association & Drewry Shipping Consultants Ltd).

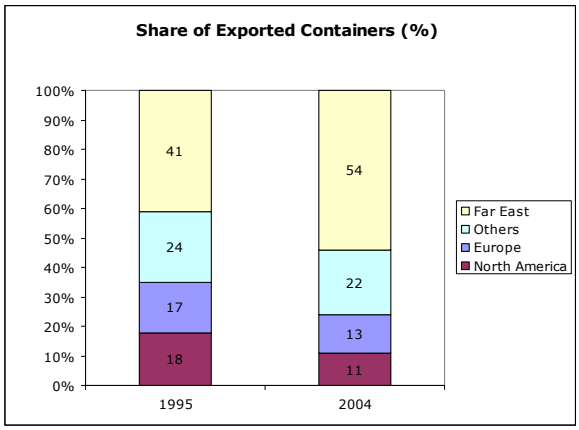
While the intra-Asian transport of full load containers is larger than any of the inter-continental lanes, it continues to be the intercontinental trade lanes, and in particular the large Trans-Pacific traffic, which is price leading. It is also on these 3 lanes that new technological solutions, adjustments to sailing schedules and the re-configuration of the global networks are first introduced by the operators.

The number of containers leaving China with a European destination keeps growing. Industry analysts set the share to be more than 50 percent of the total Asia to Europe traffic. This means at least 4.5 million full load containers in 2005. The estimated yearly growth rate continues to be in the range of 10 percent for 2006 and beyond.

On the Asia to North America route (eastbound) the share of Chinese exports is believed to be over 60 percent, which means that approximately 7 million full load containers are moving eastbound from China to the US. Half of these containers are going into the ports around Los Angeles, while the rest either enter at other ports on the North American West Coast or are transported through the Panama Canal to ports on the East Coast. Due to higher transit costs and tight capacity, an increasing number of containers destined for the US East Coast ports are routed westbound from Asia via the Suez.

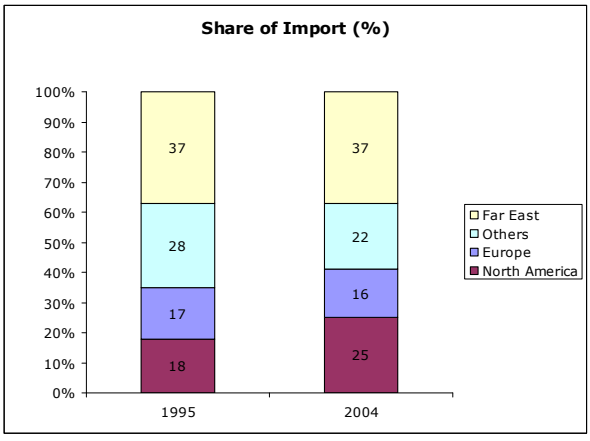
Exports. Asia has been developing very fast and continues to take up a larger share of the total exports of full load containers. Since 1995 container exports from the Far East to the world tripled (including intra-Asian trades). Compared to a share of

40 percent in 1995, it reached around 55 percent in 2004. More than half of the full containers exported in the world today are shipped from Asia. This share has been constantly rising over the last decade and there are no signs of a shift in this pattern.



Imports. When compared with the share of imported containers, Asia again takes a leading role, with more than a third of the world imports (full containers) taking place in Asia. This share was constant between 1995 and 2005.

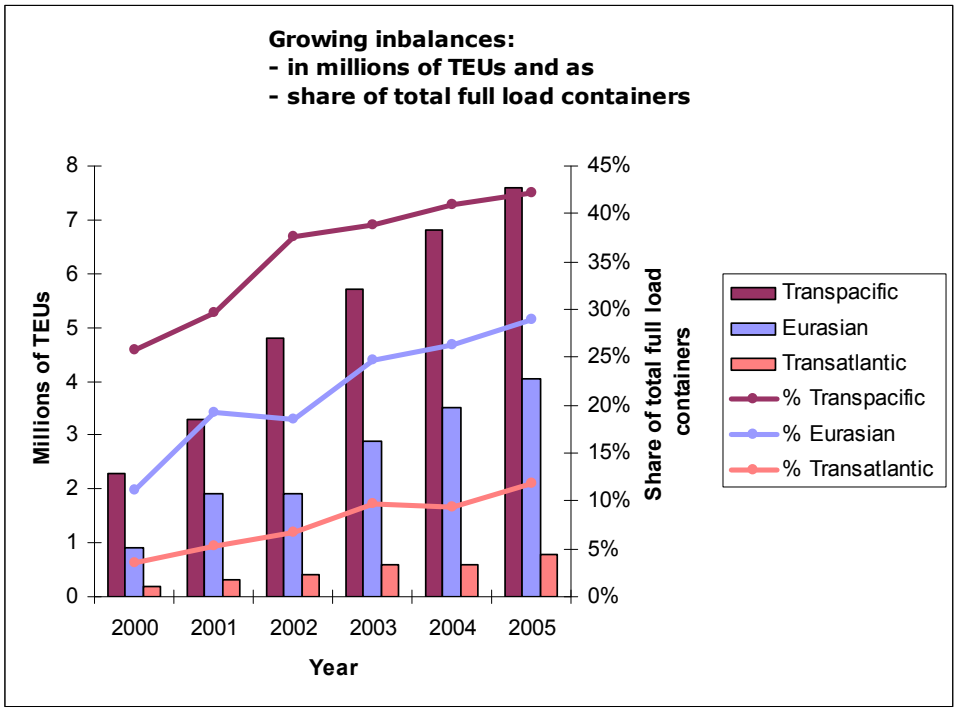
North America represents a larger share of imports today than a decade ago and now covers 25 percent of world imports (full containers). Europe has stayed at a constant level (of 16-17 percent) and the rest of the world has slid below the share of North America.



3.2.2 **Imbalances**

One of the key features of world container trade today is imbalance.

The simple fact that more full containers leave Asia than come back has created a major challenge for international transportation operators. Industry estimates of these imbalances vary significantly. However, for the 3 main intercontinental trade lanes: Asia-Pacific, Asia-Europe, and Trans-Atlantic, the imbalances have grown significantly, with more than 50 percent of the containers on both the Asia-Pacific route and the Asia-Europe route going back to Asia empty.[2] Imbalances also existed a decade ago – but on a much smaller scale (in the 20-30 percent range).



Sources: Own calculations based on Drewry & UNCTAD Review of Maritime Transport 2004.

The Trans-Atlantic trade route used to be more or less balanced, but now features a much larger number of full containers going westbound. The imbalance between

[2] March 2006 estimates from TSA (the Transpacific Stabilisation Agreement), a group of the largest container lines in the Pacific trade, state that 2006 will bring an 11% increase in equipment repositioning expenses. This is due to a 2.8-to-1 imbalance of equipment and cargo in the Asia-US market in favor of imports to the US, and a staggering 4.3 to 1 imbalance in the China-US market.

eastbound and westbound trade naturally has a direct effect on the rates that international transport operators can charge for their services.

A typical 2005 freight rate for a 40' container going from China to the US West Cost was in the range of 2,500 USD (including all port charges on both ends), while the rates for a similar container going in the opposite direction will be charged less than half. The imbalance has similar impact on the freight rates for cargo going from Europe to Asia.

3.2.3 **Reliability and transshipments**

The high volumes and economies of scale related to sea transportation (and air cargo solutions), have also resulted in a high degree of reliability. A recent analysis by Drewry shows that 80 percent of vessels from a wide selection of ocean carriers arrive within less than 1 day delay, and that some carriers run with considerably higher reliability. [3] Generally, it appears that reliable sea transportation is available as a standard for shippers without paying extra for premium service.

For every full load container it takes at least two moves by the port terminal operators (when loaded and unloaded). However, as containers are often transshipped in main ports (hubs) a journey of a container may easily require several more moves in port terminals.[4]

Transshipment of containers makes up an important part of the growth in throughput of containers in many large container ports. Singapore, for example, is a typical transshipment port with few exports originating from its hinterland. It essentially serves as freight hub for the region. Containers pass through Singapore - full or empty – and are transshipped to their next destination.

Shanghai, on the contrary, is mainly used for exports of goods that have been manufactured locally. Ports like Long Beach, California, combine the functions of transshipment and end-destination. Examples are also found in the Middle East where ports such as Salalah (Oman), Jedda (Saudi Arabia) and Dubai (U.A.E) have grown rapidly in recent years mainly based on transshipments, and where the domestic/regional demand (import/exports) make up smaller but steadily growing volumes.

3.2.4 **Congestion in ports and terminals**

Congestion in transshipment ports is essentially an issue that the international transportation operators can address through the organization of the routing of a container and the trimming of their networks. Congestion in ports of origin and destination are much more complex, and involve a much wider range of actors, includ-

[3] Drewry Shipping Consultants, 2006: "Container Shipping Insights, 1Q06".
[4] The total number of containers handled by terminals was approximately 250 million in 2005.

ing the port terminals, the customs facilities and the operators organizing the pre- and onward inter-modal transport of the cargo by truck, rail or barges.

Naturally, is does not matter much to the end-customer if a container is delayed because of an issue in a transshipment port, in the port terminal of the origin/destination - or if it is caused by bottlenecks pertaining to parts of the inter-modal transport executed by rail or trucking companies.

However, for this analysis of door-to-door solutions between Asia and Europe, it is important to assess the costs and risks associated with a longer and more complex multi-modal supply chain compared to the simplicity of transportation based on a pure trucking solution.

As volumes have risen, existing infrastructure in ports and the capacity of the onward inter-modal transportation option (by trucks and rail lines) have been pressed towards its limits. Congestion has increasingly caused delays and disruptions of vital supply chains.

The congestion experienced in 2004 (see box) created a need to divert container vessels in Europe. As delays started to build up in Rotterdam, with waiting times of up to 24 hours reported during the summer, four of the five members of the Grand Alliance (a leading group of cooperating container operators) suggested using the empty Ceres Paragon terminal in Amsterdam.

The first mainline vessels called in this terminal in early October, but only for a single call. Across the Channel, congestion in Felixstowe and Southampton was caused by the lengthened dwell time of import containers. In October, the average truck turnaround time increased from six hours to one day. By year's end, the situation reverted to normal (UNCTAD, 2005).

Some ports, like Antwerp in Belgium, have high capacity for loading and unloading which results in short vessel turn-around times. This gives operators a possibility of catching up on schedules when time is lost as a result of congestion in other ports of call. However, in the case of Antwerp, a tide sensitive channel and limited draft restricts access and reduces the possibilities of using the port as an alternative.

In 2004 ports at the US West Coast clogged, as a result of shortages of longshore labor per shift, traffic increases, and protracted negotiations for extending working hours for terminal gates. By early September there were 22 container ships waiting for berth, with a peak of 33 during Labor Day, and one month later there were still 26 vessels on the roads. This situation altered global shipping schedules: in Australia ports were skipped to recoup delays on the US West Coast, and 19 ships were diverted to Oakland, Seattle and Manzanillo (Mexico) by mid-September. The situation reverted to normal by the end of November, with ship turnaround times being in the range of three to four days rather than the 7 to 10 days of the previous months. (Source: UNCTAD Review of Maritime Transport, 2005)

Another key element of congestion in ports occurs when the onward land transport backs up. In particular, the US West Coast ports have seen increasing problems with long lines of trucks waiting for hours to enter the port terminals. This adds to delays and significantly reduces the efficiency of the transport chain and hampers business opportunities of the operators. In a number of reported cases independent for-hire truck operators were tied up in queues at terminals for as much of half their effective daily working hours.

Large terminals, both in Europe and in the US, have seen a rise in utilization-rates, and have implemented measures to increase capacity, e.g. by extending business hours. Building new terminal capacity requires long-term planning and competes with a range of other potential uses of available land.

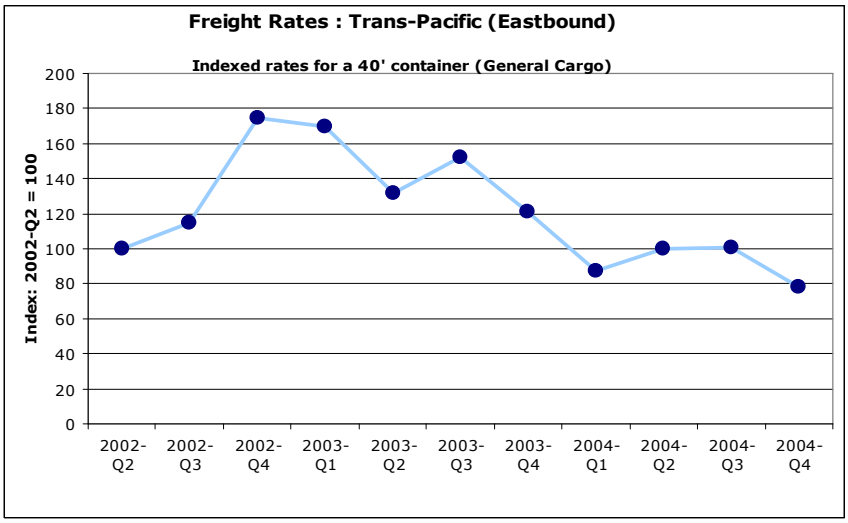
While a repetition of the 2004 delays was essentially avoided in 2005 - and although operators throughout the transportation industry seem to have taken the relevant precautions for 2006[5] - many of the leading port terminals and the related inland infrastructure clearly run towards the limits of their capacity. The planned expansion of port terminal capacity below the projected rise in global trade implies that both the vessel-related and landside delays risk escalating in the coming years.

3.2.5 **Volatility of maritime freight rates**

Shipping has always been known as a cyclical industry, where increased investment in capacity when rates are high multiplies the downward pressure on freight rates in times when the market slumps.

The leading maritime freight rates are quite volatile. They are essentially determined by the balance between available capacity and demand for transportation from shippers. As mentioned, the long term trend of rates has been downwards, and is a result of a number of factors such as economies of scale, use of information technology, and technological improvements.

[5] See for example the "Port Tracker" report by the National Retail Federation, as referred in "Logistics Management", 6 June, 2006).



Source: ICF Consulting, 2005

This graph illustrates how freight rates hover up and down and oscillate in a very broad range. For example, between the second and fourth quarters of 2002 the indexed freight rates initially rose almost 90 percent, but over the following year dropped to a level of 25 percent less than the Q2/2002-level. Freight volumes increased by at least 20 percent during the same period. Compared to other modes of transport, maritime transport has often proved to fluctuate more dramatically than air transport, and in particular more than land transport (rail and trucking).[6]

The current downward trend of freight rates is mainly attributed to new added capacity. The level of new orders for container vessels was at unprecedented levels in 2005 – with contracts for new-built container vessels equaling more than two-thirds of the capacity of the existing fleet. Again, industry analysts vary in their estimates for how great an impact this historically high adding of capacity will finally have on rates; some see overcapacity ending in a debacle for freight rates, while others estimate that excess capacity will be absorbed by the end of 2007.

By April 2006 rates on the leading shipping lanes had dropped to a level between 20 to 30 percent compared to the beginning of the year, despite rising fuel charges. Some analysts attribute this to the glut of vessel capacity, and a slowing of the China-US trade (see for example CII-Logistics). Other analysts remain confident that there will be no permanent sharp drop in rates, and attribute recent levels to off-peak levels linked to the first two quarters of the year (see, for example, TSA).[7]

[6] Economic Assistance Study on Liner Shipping, May, 2005, Prepared for: Directorate General for Energy and Transport, European Commission, ICF Consulting.
[7] Refer to www.ciilogistics.com and for TSA Transpacific Stabilization Agreement (www.tsacarriers.org).

The volatility of maritime freight rates has great importance for the comparisons between modes of transport in section 4. If rates even on the main trade lanes can swing up or down by 50 percent or more during a year, the sustainability of investments in land-based transport solutions are naturally directly affected.

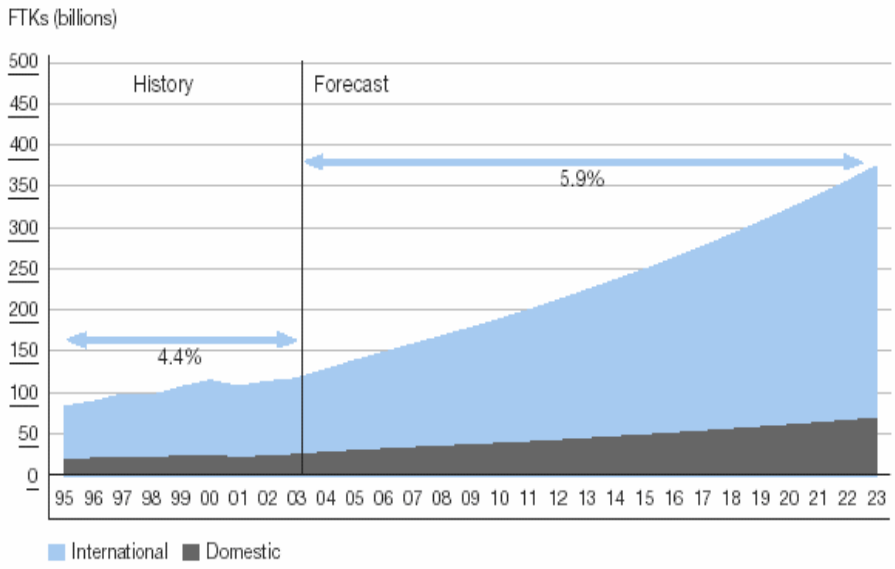
3.3 Air transport

Like maritime transportation, the growth of air cargo has been remarkable. While maritime transport covers all types of products, air cargo essentially serves as a solution for high-value and time-sensitive shipments.

3.3.1 Volumes and expected growth rates

On a world-wide basis, air cargo traffic is expected to increase by 5.9 percent per year until 2023. This is an increase from approximately 150 billion FTK (Freight Ton Kilometers) in 2005 to 375 billion FTK in 2023. [8] However, the expected annual increase for Asia is estimated higher at 7.3 percent. For the China-US and China-Europe routes, the expected growth rate will be 7.7 percent and 7.8 percent, respectively.

Air cargo traffic development:



This estimate is based on a strong increase in Chinese GDP and the fact that export and import accounts for about 75 percent of that GDP. The above mentioned high

[8] Adopted from Airbus: Global Market Forecast 2004-2023, section Air Cargo Forecast, Airbus 2005

growth rates mean that the two legs from China to the US and from China to Europe will have the biggest share of the world air cargo market in 2023. In total the two market segments will account for almost 50 percent of the market.

Today, China has the most ambitious airport development program ever seen and the Asian carriers have the biggest backlog in the world with respect to new and converted cargo aircraft. The aircraft deliveries mainly include different types of Boeing long-haul freighter aircraft, but Airbus is also competing for this market. There is little doubt that the Chinese air cargo market will be the dominant market for international air cargo in the next decade.

In addition to the development among Asian, and specifically Chinese carriers, European and Russian carriers are assigning considerable capacity for the Chinese market. Both Aeroflot and Volga/Dnepr have established a "cargo air bridge" between China and Russia and China and Europe based on a fleet of Boeing 747 freighters and big Russian cargo aircraft.

3.3.2 **The logistics of air transport**

The logistics of air transport is basically a door-to-door concept. Almost all major cities have an airport and the international cargo alliances (e.g., SkyTeam, Oneworld, WOW) and the big cargo airline operators (e.g., Korean Air, Lufthansa) have set up different door-to-door concepts where the short road transport from the shipper to the airport and from the airport to the recipient is included in the transport package.

Air cargo is not only transported in dedicated long-haul freighter aircraft but also as belly cargo in passenger aircraft. The use of the widely distributed passenger airline system means that the cargo load can always be transported by air to the nearest airport or almost to the door of the recipient.

The ultimate high-speed door-to-door concept has been developed by the big integrators like UPS, DHL and FedEx where a shipment from China is delivered at the client's doorstep within 1-2 days--but of course at a high cost.

3.3.3 **Types of goods transported by air**

The goods transported as air-cargo are primarily time sensitive, high-value and high-tech goods. On routes from Asia, high tech goods account for 40 percent of the air

cargo measured by tonnage but represent 75 percent of the value of the transported goods. In 1995 the value share was just 25 percent.

Secondly, fashion goods and textiles are important as air cargo loads. Most of the fashion textiles for Western markets are produced in China. Due to the high profit margin and rather low weight of these goods, air transport is economically feasible. One of the advantages of air cargo is that the goods do not need to be transported in a big bulk container like a ship-container, but can be split into smaller loads right from the producer to the end recipient. Thirdly, perishable goods such as flowers, fresh fruit, juices etc. can, in the future, be important commodities for air transport from China.

3.4 Land Transport - The Trans-Eurasia Land Bridge

Land transportation, by rail or by road, has only been used to a limited extent for the purpose of intercontinental transportation between Asia and Europe. The current land transport connections between Asia and Europe do exist, but they have no viable share of the commercial market. Bulk goods and transportation of commodities such as coal, agricultural products, iron and oil dominate. Containerized cargo makes up only a very limited share of the overall cargo volumes currently transported.

3.4.1 Rail

The Trans Siberian Railways (TSR) network and the network going from China to Kazakhstan are both connected to Western Europe.

The connection between Kazakhstan and China is not designed for container transportation. In Kazakhstan and China rail networks connect at the Druzhba/Alashankou interchange. The track-gauge is different in the two countries and goods have to be reloaded. Kazakhstan and China have recently decided to upgrade this connection.

The Trans Siberian rail network links China and Western Europe. The volume of containers has been rising and several sources, including the Russian railways and the leading freight forwarding company, TIR, have reported that the number of transit containers is rising. According to Russian railway authorities, export container volume on the TSR has increased by an annual average of 50 percent since 1999 and reached almost 400,000 TEU in 2004. Most of these related to Russian trade whereas international transit through Russia comprised between 100.000 and 150.000 TEU a year. The indication is that the current capacity of the TSR network can be as high as 0.9 million containers – of which 0.4 million can be international transit.

The main users of the eastward rail connections through Siberia are Korean shippers. The volume from Korea was about 150,000 TEU in 2004, a year-on-year growth of almost 30 percent. The cargo includes home appliances such as vacuum cleaners, refrigerators, etc. as well as automobile parts and chemical products (See Box 3-1

below). Similar volumes of about 150,000 TEUs are quoted for Chinese shippers in 2004.

In principle, containers can be transported from the Far East via Russia to Western Europe by rail in less than 15 days.

Several international transport operators are reported to be interested in developing the rail-link between the Far East and Europe. The key features of such transport solutions are stacked container trains running on reliable schedules and using double track connections where possible.

The possibility of a trans-Eurasian rail-link competing with maritime transport is being promoted by organizations such as the International Union of Railways (UAC). In an interesting concept branded the "Northern East West Freight Corridor" (or N.E.W.) the option of shipping containers via rail across Asia to Europe is promoted. The containers are foreseen to be reloaded and forwarded by sea from a port in Norway to final destinations in North America.

The project focuses on two different land transport corridors: the East Asia link - connecting from Vostochny (Russia) and the Central Asia link – connecting from Urumqi (China). The project emphasizes that while these two links have traditionally been seen as competitors, in reality they serve two different markets/regions in China and the two should be developed simultaneously.

The current transit time for linking Western China with the Baltic Sea is stated to be less than 12 days. This includes a technical gauge change at the Kazakh/Chinese border, which is stated to last four days. Border procedures between Russia and Kazakhstan are not specified. The main reasons stated by the project for developing a link between Kazakhstan and Western China is the shorter distance between Europe and Western and Central parts of China; regions that are currently undergoing significant economic development. The project specifies a need to facilitate border procedures, and expects a possible speed of above 950 km a day for these rail operations.

Other studies refer to test-runs of express container trains carried out on the China-Kazakhstan-Russia-Belarus-Poland-Germany route, aimed for transport of goods to/from the Western regions of China. The delivery time of goods on this itinerary is 12-14 days, with a speed of 800-950 km per day. [9]

[9] United Nations (2003)

Box 3-1: Comparing rail and sea transport options out of Korea.

By the end of 2005, the Russian railroad authorities had plans to increase the current Busan-Finland TSR transportation rate more than 30% to US$4,600-US$5,000 per 40' container from the current US$3,500-3,900. The authorities referred to a sharp increase in international oil prices and the need to improve revenue. The Korean export association reacted promptly by stating that a rate increase would burden the domestic export industry with a combined 52.3 billion won (55 million USD) in additional logistics expenditures.

The Korean exporters claimed that the domestic industry was seriously considering switching to the sea route, which had showed a stable downward price trend. However, the companies were concerned that an increase in supply lead time (20 days by TSR compared with 34 days by sea) would result in loss of sales opportunities, decrease in export amount, inventory shortages at destination, the re-containerizing process required when switching to ship, etc.

The exporters foresaw a decline in price competitiveness, increase in local prices and the resulting decreased exports. Refrigerators, in particular, are likely to suffer a 5-10% local price increase with the rate hike.

The Koreans have promoted the rail option based on a study showing that it takes 20-to-25 days to transport a container by TSR from Busan Port in Korea to Moscow via Vostochny Port, a distance of 10,280km. About 35 days are required if they are shipped by sea from Busan to St. Petersburg Port (Russia) and then overland to Moscow, a distance of some 23,000km. The costs were stated to be 2,700 USD per container compared to 3,800 USD if routed by sea. (Source: Korean International Trade Association, KITA, January 2006)

3.4.2 **Road Transport - Trucking**

The possibility of using a road transport connection between the Far East and Europe has, in practical terms, existed for several years and in particular since the border between China and Kazakhstan was opened for commercial trade. It has gained more viability as the infrastructure such as terminals and customs facilities, not least the highways, have been gradually upgraded.

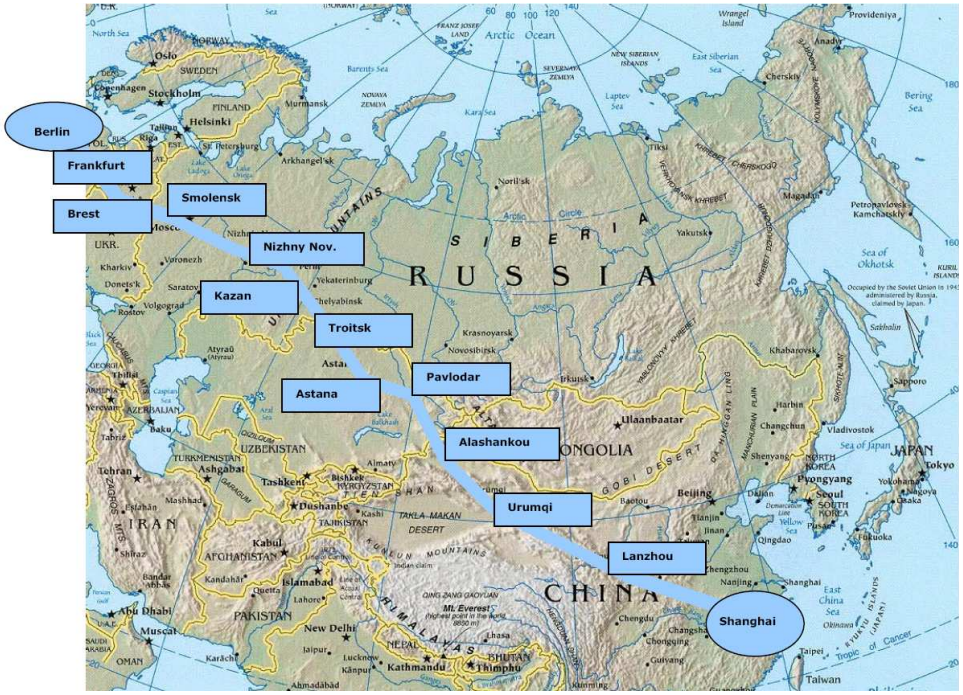
However, the volume of commercial trade remains very limited. While there are no exact statistics for this trade it is estimated that in 2005 approximately 0.2 million tons of cargo passed the border on trucks. The size of the trucks used varied - and generally they tended to be small. One industry source indicated that approximately 12,000 trips yearly by trucks were involved in the trade.

Between China and Russia the volumes transported by road are higher, but not directly comparable. The total cargo transported by truck is estimated to be 1.8 million tons (in 2005) up more than 80 percent over a 5 year period. The Russian association of operators (ASMAP) estimates that this comprises approximately 0.2 million trips by trucks of various sizes.

The cargo volumes mentioned above also include road trains carrying containers originating in China with a destination beyond Kazakhstan. The estimated volume varies significantly from a few thousand to a higher estimate indicating a level of 10,000 containers in 2005. These estimates are based on industry sources. It has not been possible to verify more specific data from official statistics.

Foreign trucks are not allowed to operate in China at this stage. Therefore, the loaded containers have to change vehicle/operator and transit at the Kazakh/Chinese border (with the main location being Khorgos). Containers can also be picked up at the train terminal on the Chinese side Alashankou/Dostyk or at Kazakh facilities at Bakhty.

Map 3-1: A Route from China to Western Europe.



3.4.3 **Developing new trucking options between Asia and Europe**

Increasing demand for flexible transport solutions for cargo from Western China to Europe has led to growing interest in developing new transport options based on using trucks.

One significant contribution has come from the trucking business in Kazakhstan. Through its national association, KAZATO, it has been promoting proposals that can establish viable international trucking operations linking China and Europe.

The association states that there is a potential volume for transit operations of 0.3 million tons a year (about 15,000 trips) without additional capital investments and upgrading of customs facilities.

With minimal improvements in infrastructure and in particular the establishment of dedicated corridors for customs facilitation at border crossing points, the association estimates that a volume of 1.5 million tons of cargo (around 75,000 trips) is realistic.

Their 5-year ambition comprises: transit of 5 million tons of cargo, corresponding to 250,000 yearly trips and requiring a build-up of the fleet of Kazakh trucks (10,000 units or more) to engage in the trade.

The objective of the industry's project is to develop a framework for high volume trucking solutions between the Kazakh-Chinese border and Western Europe.

Transit times are estimated to come down to 9 days during summer and 12 days during winter. The corresponding freight rates stated by the Kazakh trucking companies - and based on the current cost structure - are stated to be 5,500 USD for the transportation of a 40' container (FEU) and cover a distance of more than 5,800 km.

The maximum load will be approximately 20 tons of cargo given the current road restrictions in Kazakhstan. The transport includes pick up at the rail terminal at the Chinese border in China and delivery at the customer's facilities in Europe (Berlin).

Box 3-1: Relevant routes for road transport of Eurasian cargo:

Route:

1. Route E-105, E-22: St. Pertersburg (port)-Moscow – Nizhnly Novgorod – Ekatereinburg – Omsk - Vladivostock (Port)/Vostochny (port)
2. Route E-85, E-30, E-125: Brest – Moscow – Nizhnly Novgorod – Ufa – Chelyabinbsk – Kurgan - Petropavlovsk – Astana – Almaty (connects with 1 and 3)
3. Route E-40, E-013, E-012: Almaty – Sary-Ozek – Khorgos – Urumqi – Xi'an – Lianyungang (port) / Shanghai (connects with 2)

This level of freight rates/transit times are based on a number of assumptions, including the following main points:

- loading and unloading clearance at the Kazakh/Chinese border takes a maximum of 24 hours
- crossing the Kazakh/Russian border takes no more than 2 hours
- diesel fuel cost is kept at current levels (approximately 0.45 USD per liter).

All three assumptions are critical. First, border waiting times in the Central Asian region have often been documented to be considerably longer than stated here. As mentioned in the rail study above, four days for clearance at the Kazakh/Chinese border is sometimes the reality. Similarly, border transit times between Central Asian Republics/Russia are often documented to last much longer than two hours.[10] Thirdly, the fuel cost can vary. Kazakhstan maintains some of the lowest fuel prices in the world. As part of the government's subvention of prices, fuel costs less than 40 percent of the world market prices (Asia Development Bank, 2006a). Finally, practical implementation of this trucking solution can be hampered by often reported issues such as unofficial payments, and other costs related to delays.

3.5 Summary - Transport between Asia and Europe

Currently, maritime transport is the dominant mode of cargo transportation between Asia and Europe. The international maritime operators have significantly expanded capacity to meet the demand of companies and this has resulted in sustained levels of double digit annual growth. For high value and time-sensitive cargo the use of air transportation has seen similar expansion.

The volumes of international containerized cargo shipped using rail or road transport options between Asia (China) and Europe are currently very limited.

Rail transport, in particular using the Tran Siberian Railway, may account for up to 3-4 percent of the current volume, mainly from Northern China (and Korea) but there is some uncertainty about the exact quantities and type of cargo.

Road transport (trucking) accounts for less than 1 percent of the containerized Sino-European trade, measured in volume terms.

Modal split - Transport of Full Load Containers between China and Europe

(Million full load TEU)

	Westbound	Eastbound	Total
Sea transport	4,5	2,5	7,0
Rail	< 0,2	< 0,1	<0,3
Road (Truck)	< 0,03	< 0,03	<0,06

[10] Asian Development Bank (2006b), and Molnar & Ojala (2005).

While the long term general trend of transport costs has been downwards for all modes of transport, ocean transport freight rates are particularly volatile. The cost of using land transport has proven to be more stabile, at least when the ocean shipping rates are compared to land transport rates in mature markets.

As volumes have risen, existing infrastructure in ports and the capacity of the onward inter-modal transportation options out from the main ports (by trucks and rail lines) have pressed towards their limits. Congestion has increasingly caused delays and disruption of vital supply chains.

For both road transport (trucking) and rail transport there are a number of projects under development for improving the transport solutions between Asia and Europe. Measured on the potential achievable transport cost and related transit times, these new options will theoretically be competitive with the currently available options for ocean transport, in particular when servicing some inland origins and destinations.

4. Comparison of Transport Costs and Transit Times

An essential part of this study is a comparison of the total door-to-door transportation costs and transit times for a range of currently available transport solutions carrying containerized cargo from Asia to Europe.

4.1 Methodology and Data

Quotes were requested from freight forwarders and transport operators for a specified list of transport services and destinations. The requested quotes cover the costs and transit times for transport of various types of cargo in a 20' and in a 40' container. The quotes include the full door-to-door transportation costs and the related transit times for the relevant modes of transport (maritime, air, rail and trucking).

The bulk of the analyzed freight rates cover transport out of China (Shanghai) to various major European destinations and to the US (East and West Coast). This reflects the actual flow of cargo. For the purpose of comparing alternative routings of cargo certain other destinations are covered, including Dubai (in the Middle East) and a port on the Black Sea (Novorussiysk).

The study is based on true door-to-door solutions. To allow for a comparison between the modes of transport, the data presented for the sea, air and rail solutions are inter-modal, i.e. they include 100 km of trucking at both origin and destination. This makes it possible to assess the cost and transit time of each option more directly.

4.1.1 Assumptions

The analysis rests on a number of key assumptions, including the following:

- Freight rate quotations are stated for a single container. Larger customers are usually able to obtain significantly better rates from operators. However, this applies to all modes of transport.
- Insurance cost and other payments related to liabilities are not included. However, obligatory payments for surveillance/guarding are included in the quoted freight rates. As a general rule, this type of cost is lower for transportation solutions that enjoy large volumes.
- Transit times are stated as indicated by the freight forwarders/operators. However, delays caused by congestion or other situations can occur.
- Both freight rate quotes and transit times are based on a relatively small sample for each of the analyzed transport legs.

The rates and transit times presented in the study represent a "photograph" and need to be considered in the context of more general developments. The quoted freight rates, for example, only reflect a particular situation of an operator on the

date the quote was requested. If an operator at that particular time had extra free capacity on a particular leg it could result in a lower price, while an operator with an urgent need to reposition equipment (containers) to other destinations would most likely quote a higher rate.

Seasonal fluctuations in freight rates may also affect collected rates. A change in specific surcharges, such as the BAF (Bunker Adjustment Factor) is another example, although shifts in fuel prices will impact all modes of transport in the longer run. The freight rates quoted in this analysis were all valid by the end of April 2006.

Transit times are typically affected by the application of new technological solutions, and better regulatory practices, but also depend on issues such as rescheduling of existing services depending on demand for services, changes in transport networks etc. For example, time spent at border crossings can be significantly reduced with little investment if the issue is made a priority by the competent authorities.

4.1.2 **Description of data – Can the modes of transport be compared at all?**

The data analyzed cover very different transportation options. Ocean transportation to and from China is characterized by very high volumes and economies of scale. Similarly, land transport (both trucking and rail) is also used intensively and to the maximum economy of scale for multimodal solutions linked to ocean trade and as a standalone option for intra-regional transport both in Europe and – for rail – in particular the US.

Leading transportation solutions for containerized cargo in mature economies can clearly be compared, but even a simple model comparing time and cost parameters for a mature market is not without challenges. An example of this is the ongoing discussion about whether to opt for shipping through the Panama Canal rather than using the land-bridge options for containerized cargo arriving from Asia at the US West Coast with an end-destination at the East Coast and at inland locations.

However, it is much more problematic to compare transport solutions where one is already operating on a large scale in a mature market (such as ocean transport from Asia to Europe) and the other (such as Trans Eurasian trucking) which has yet to be marketed commercially to shippers.

Although experience with the effects of economies of scale from other mature markets can be simulated, they will not automatically apply for these new transport options. A key concern is how to build confidence among shippers that new trucking solutions can be made available on a frequent, cost-effective, and reliable basis.

The uncertainty associated with early-stage land transport solutions is also reflected in the freight rate quotations analyzed in the following sections. The quotes obtained for Eurasian land transport solutions have a much higher uncertainty and deviation

between the lowest and highest freight rates and transit times than in the case of ocean transport. In mature markets the trend is normally the opposite; there is considerable fluctuation in the prices of sea transport while rates for land transport show much less variation.

This has implications for the long-haul land transport solutions linking Asia and Europe (both trucking and rail). On the one hand it is likely – or even inevitable following from experience from many maturing markets - that once a higher volume and a steady flow of full containers is reached, competition will narrow the difference between individual freight rate quotes, and economies of scale will drive rates downwards, while new technological solutions will become feasible and spur further cost-effectiveness and reliability.

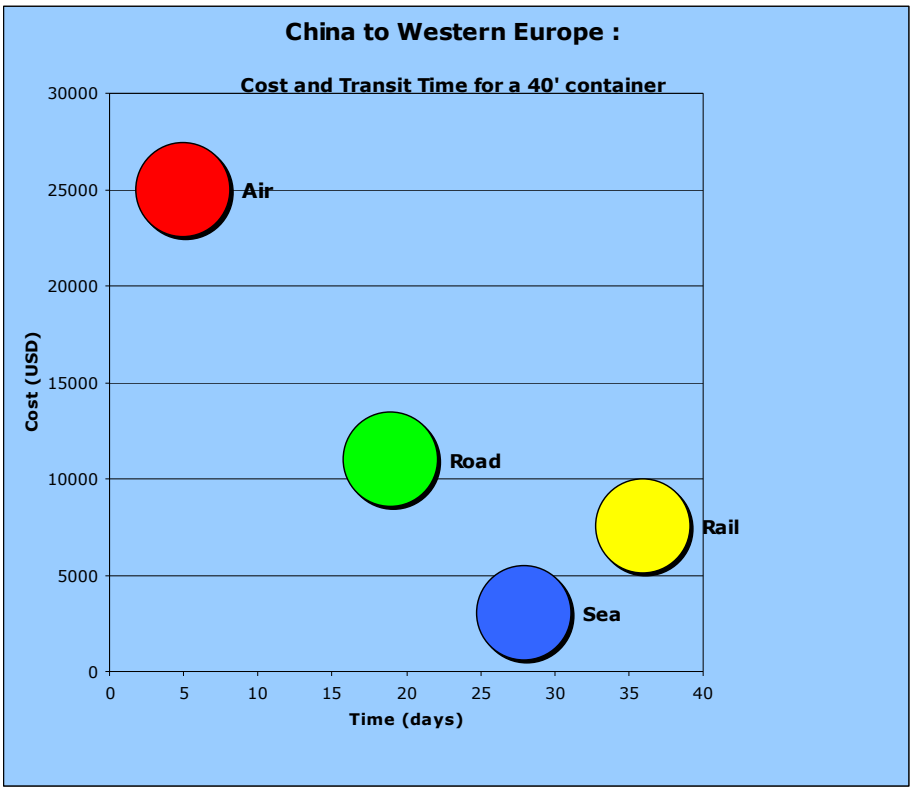
On the other hand it is quite complex, at micro level, to establish if the current freight rate quotes and statements on transit time have a solid foundation that builds on sustainable business models for the companies involved. At a more general macro-economic level, it is questionable whether existing infrastructure can provide the required framework for a build-up of volumes, and from a regulatory perspective it is possible that the conditions for key factor inputs to the sector will be affected. This could apply to issues such as the wage and labor conditions for drivers, technological and environmental standards for trucks and possible discontinuation of state subvention of fuel.

Transport is a cyclical business and freight rates fluctuate, in essence, they depend on the supply/demand balance. While this analysis does not claim to provide an authoritative pricelist for individual business decisions, it does deliver clear guidance for assessing the main transport options available for shippers. Much larger samples and specific models and market insight is required to get the full picture. It will always be for individual shippers to negotiate freight rates with their preferred transport operators. Larger customers may be able to obtain conditions which are more favorable than those analyzed in this report.

4.2 Summary of results – All modes of transport

The main results illustrated in diagram 4-1 reveal that sea transportation is clearly the cheapest option (3,000 USD) measured by freight rate, but also has a long transit time (28 days). Air transport is the most expensive (25,000-45,000 USD), and has a very short transit time (less than a week). Trucking lies between these extremes for both cost (11,000-13,000 USD) and transit time (18 days in the fastest option).

Diagram 4-1: The Freight Costs and Transit Times



The rail transport options covered by this analysis show a very broad range of costs (4,000-10,000 USD) and transit times (14 to 45 days). The data obtained for this particular leg shows a huge gap between the officially scheduled transit times and the transit times quoted by freight forwarders for complete door-to-door solutions. Similarly, the obtained freight rates for the relevant rail solutions are higher than the generally promoted prices. Because of these differences, both freight rates and transit times have to be treated with great caution and - beyond this general assessment - the data for rail transport is probably not precise enough to be included in a comparison between the three other modes of transport.

Table 4-1: Typical transport costs and transit times for transport between China and Western Europe.

Mode of transport[11]	Cost (USD)	Transit time (days)
Sea	3,000	28
Road	11,000	19
Rail	7,500	36
Air	45,000	5

The data in table 4-1 cover costs and transit times for a 40' container loaded with 20 tons of cargo by sea, road and air from China (originating at a factory 100 km from the port) to Western Europe (end-user located 100 km from the sea port). The rates cover full door-to-door transportation.

The entire list of specific quotes for a selection of destinations is found in Annex 1.

4.2.1 **Maritime transport**

From	To	Cost (USD per 40' container)	Time (Days)	Cost - Opposite direction (USD per 40' container)
Asia (China)	US West Coast	3,300	15	1,600
	US East Coast	5,000	26	2,000
	Europe (North)	2,800	28	1,100
	Middle East	2,100	15	1,100
Europe	US East Coast	2,800	11	1,800

The table above clearly reflects the effect of imbalances referred to in section 3.2.2 above, and it is considerably more expensive to use transport services out of China bound for the US or Europe than using it for return cargo. The quotations from forwarders can be split into two main chunks: port-to-port ocean transportation, and related trucking. The ocean transport varies between 2,500 USD (China to Europe) and 5,000 USD (China to US East Coast). The trucking portion was approximately 150 USD in China and 150 USD for the trucking link to the end-user in the US or in Europe.

[11] For air transport, cargo is transported in specialised containers, usually proprietary of the airline. The cost of air transport is based on the price for 10 tons and includes reloading and transport by truck to and from the airport. This is approximately half the maximum weight of cargo that can be held by a fully stuffed 40' container used in shipping and for land transport. For road transport through Kazakhstan, the effective maximum load is 20 tons.

4.2.2 **Road Transport - Trucking**

From	To	Cost (USD per 40' container)	Time (Days)
China (Shanghai)	Western Europe (Hamburg) – Central Asian Operator	11,000	19
China (Shanghai)	Western Europe (Hamburg) - European Operator	12,000	26
Other destinations			
China (Shanghai)	Istanbul	10,000	22
China (Shanghai)	Novorossiysk	8,100	18
China (Shanghai)	Riga	10,500	22

The full road transport option from China to Europe is not currently available as an integrated transportation solution from freight forwarders on a commercial basis. Therefore, the identified rates are a combination of two legs: the first is from the coastal areas of China (Shanghai) to the border between China/Kazakhstan (a distance of 4,800 km, a reported to cost 5,400 USD and taking 8 days). This leg will be carried out by a Chinese operator. The second leg is from the China/Kazakhstan border and further on to Western Europe (a distance of 6,200 km, a reported cost of 5,600 USD and lasting between 9 and 12 days when the transport is undertaken by a Central Asian trucking company). The freight rates obtained from Western European operators are higher (7,100 USD) and the transit time is reported to be 18 days.

The eastbound rates (from Europe to Central Asia) are slightly higher than going in the opposite direction. This reflects a more balanced picture of the trade volumes here than in the case of the Asia-Europe trade.

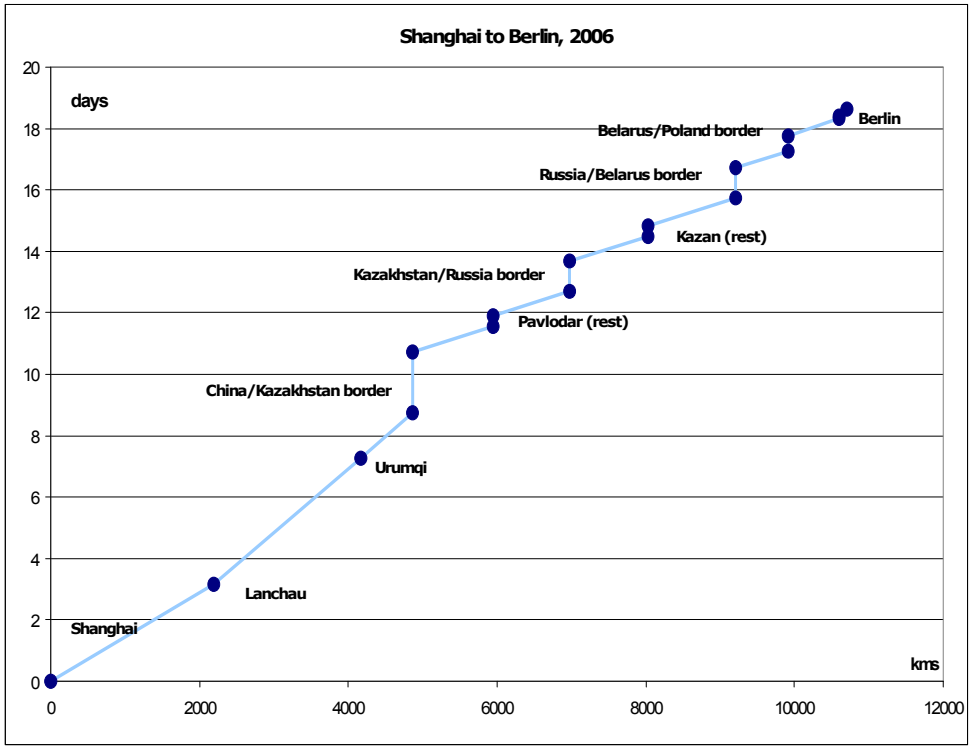
In Kazakhstan, the road transport operators are focusing on developing a fast and dedicated trucking service between the Chinese border and destinations in the EU and Russia. Although the service is still in its early stages the freight rates and transit times are considerably below those of operators based in Western Europe.

The results imply the following key data for trucking between Asia and Europe.

From China (Shanghai) to Western Europe (Hamburg) – a distance of 11,000 km for a 40´container (FEU):

From	To	Cost/distance (USD/km)	Average speed (km/day)
China (Shanghai)	Europe (Hamburg) Central Asian Operator.	1,1	575
China (Shanghai)	Europe (Hamburg) Western European Operator	1,25	425

The results can be compared with similar results from other studies (e.g. Molnar and Ojala, 2003) and they are considerably more optimistic both in terms of actual cost and transit times.[12]



[12] A 2003 study found transport of a 40' container by truck from Almaty (Kazakhstan) to Urumqi (China) - a distance of 1,200 km – to cost 2,150 USD (i.e. 1,9 USD/km) and lasting 5 days (i.e. less than 250 km/day). Measured against these benchmarks the 11,000 km from coastal China to Europe would take more than 40 days and cost 20,000 USD.

Another recent study reported indicative transport cost and transit time for large exporters for a 40' container by road from Almaty (in Eastern Kazakhstan) to Western Europe to be 8,000 USD (including unofficial payments) and the transit time to be 13 days[13].

From	Country	To	Activity	Distance (km)	Time (days)
Shanghai	CHI	Lanchou	Road	2,190	3.1
Lanchou	CHI	Urumqi	Road	1,980	4.1
Urumqi	CHI	Alashanhou	Road	700	1.5
Alashan (border with Kazakhstan)	CHI/KAZ	Dostyk (border with China)	Border Crossing	-	2.0
Dostyk (border with China)	KAZ	Pavlodar	Road	1,070	0.8
Pavlodar	KAZ	Pavlodar	Rest	-	0.3
Pavlodar	KAZ	Kaerak (border with Russia)	Road	1,040	0.8
Kaerak (border with Russia)	KAZ/RUS	Troitsk (border with Kazakhstan.)	Border Crossing	-	1.0
Troitsk (border with Kazakhstan)	RUS	Kazan	Road	1,050	0.8
Kazan	RUS	Kazan	Rest	-	0.3
Kazan	RUS	Smolensk (border with Belarus)	Road	1,180	0.9
Smolensk (border with Belarus)	RUS/BLR	Smolensk (border with Belarus)	Border Crossing	-	1.0
Kranoe	BLR	Brest (border with Poland)	Road	700	0.5
Brest (border with Poland)	BLR/POL	Brest (border with Poland)	Border Crossing	-	0.5
Brest (border with Poland)	POL	Frankfurt a O (border with Germany)	Road	690	0.5
Frankfurt a O (border with Germany)	POL/GER	Frankfurt a O (border with Germany)	Border Crossing	-	0.1
Frankfurt a O (border with Germany)	GER	Berlin	Road	100	0.3
Total				**10,700**	**18.6**

[13] World Bank, 2005 Tajikistan, Trade Diagnostic Study, Background report.

The Asian Development Bank (2006) has analyzed the conditions for a shipment of a full load truck (which more or less equals a 40' container) for an average trip from four Central Asian Republics to Western Europe. The bank finds the cost to be 6,000 to 7,000 USD and the transit times to be 15 to 20 days.

Compared to other recent studies of actual transport cost and transit time the quotes reported in this study are significantly below on both these parameters, where general data suggest that both cost and transit times could be 25 to 33 percent higher compared to the best freight rates and transit times obtained for this study.

For general comparison, the cost of trucking for a 40' container in the EU and US is usually reported to be 1.25 – 1.75 USD per km for long-distance intra- regional transport operations. The average distance that can be covered by a truck in a long-haul intra-EU transport is usually in the range of 750 km/day.

Trucking is used extensively for intra-regional transportation, i.e. between destinations in Europe and between destinations in the US.

4.2.3 **Rail**

From	To	Cost (USD per 40' container)	Time (Days)
China (Shanghai)	Europe (various destinations in the EU)	6,900 to 8,700	32 to 45

The freight rates and corresponding transit times obtained for transport by rail are surprisingly high. The freight rates obtained for the transportation of a 40' container by rail are all considerably higher (between 30 percent and 60 percent) than the listed rates. Transit times are also much longer. The transit times for rail transportation between Shanghai and Western Europe should ideally take less than 20 days. According to some of the recent projects that are promoting rail transport solutions between Asia and Europe, transit times from an origin in Western China (such as Urumqi) to a Western European destination should take 8 days or less and the internal transport in China less than a week, resulting in a potential total transport time of less than 15 days.

An analysis of alternative routings – using the Central Asian railways systems resulted in even higher freight rates and transit times: the quotes suggest that the transportation from Shanghai to Istanbul would cost around 11,000 USD and last 40 days. The long transit times are also found in other recent studies, e.g. Asian Development Bank (2006). In the same study the bank concludes that the shipment of a 40' container by rail for an average trip from the four Central Asian Republics to

Western Europe will cost between 3,700 and 4,500 USD and last between 20 and 25 days.

Rail cost and transit time: Asia-Europe and the United States (Transport of a 40' container by rail):

From	To	Distance (km)	Costs (USD)	Transit time	Costs/distance (USD/km)	Average speed (km/day)
China (Shanghai)	Western Europe	11,000	7,500	30	0,68	360
US West Coast	US East Coast	4,500	2,500	8	0,55	560

If freight rates and transit times obtained for this analysis of rail transport between Asia and Europe are compared with similar services in the US and Europe, it indicates that Eurasian rail solutions are not yet fully developed. For example, if the cost/distance parameters usually available for transport by a standard US rail operator could be applied, it would result in lower costs (at least 20 percent) and shorter transit times (33 percent more distance per day) than identified in this study.

4.2.4 **Air**

For air transport the following costs and transit times were reported.

From	To	Costs (USD per ton)	Transit time (Days)
China (Shanghai)	US West Coast (Los Angeles)	2,100	5
	US East Cost (New York)	2,600	5
	Europe (Hamburg)	2,500	5

For air transport the cost and transit time estimates are stated for 1 ton of cargo. A normal 40' container can hold between 20 and 25 tons, but will typically be loaded with 8 to 12 tons. The quotations above cover unit loads for freight of 1 ton or a maximum of 6 cubic meters (m^3). The listed prices are for premium service solutions with a high quality carrier and short transit times. Several new air transport concepts are under development that allow for less costly air transportation.

Different types of cargo will have a different relation between weight and volume, and this can clearly affect the transport cost. To cover the costs of trucking, approximately 150 USD in China and 150 USD for the trucking link to the end-user in the US or in Europe were added.

In a recent analysis of air transport from the Central Asian Republics it is estimated that the cost is approximately 15 times higher than container shipping (not including in-land transport) which indicates a similar level as found in the present analysis. The study underlines that by using Russian/Central Asian air cargo operators it is possible to achieve substantial reductions (33 percent or more).[14]

The freight rates quoted above are - as for all other prices in this analysis - for a small shipment of cargo covered in a single container. The rates for air transport are very sensitive to volume, and shippers willing to sign agreements for larger volumes can obtain significant reductions.

4.3 Summary - Transit time and the cost of transportation

4.3.1 The cost of inter-continental transport

The analysis of the various options shows that measured by costs alone, shipping ocean cargo is clearly the most inexpensive option for shippers. Freight rates for ocean transportation are currently at historically low levels, and are far lower than the transport costs related to other modes of transport even when freight rates that include full door-to-door transport solutions are compared. These analyzed freight rates cover 100 km of road transport both at origin and destination.

For land transport the focus has been on transport solutions that connect Asia (Shanghai) with selected destinations in Western Europe. For the new trucking solutions the related costs are found to be 3 to 4 times higher than for sea transport measured on the basis of pure door-to-door transport cost.

New concepts for rail transport are also being developed. The listed prices for these services are lower than for trucks. However, the actual quotations obtained for this analysis were much higher than the listed prices with surcharges and additional fees included. In this analysis the best freight rates obtained for rail transport were approximately 25 percent lower than the comparable trucking solutions.

As would be expected, the cost of using air cargo is considerably more expensive to use that the other modes of transport. Because the freight rates are based on weight

[14] Molnar and Ojala, 2003. The authors also find that typical transit time – without the inland transportation is between 2 and 7 days depending on destinations and schedules. This underlines that not all air cargo are premium services and that transit time for door-to-door transport can get longer depending on the specific solutions available.

(and spatial volume) rather than unit prices (like a 20' or 40' container) it is difficult to compare prices directly. If the maximum weight that can be held in a 40' container is compared directly with the cost of 1 ton of air cargo, air transport will be at least 20 times as expensive as ocean cargo. However, a 40' container used in shipping will often hold less than the maximum weight (e.g. 8 to 12 tons) and then the weight based transportation costs will be somewhere between 5 and 10 times that of ocean shipping.

4.3.2 **The transit times**

Most containerized cargo is transported by sea with transit times that vary from 12-15 days for Trans-Pacific and 25-30 days for cargo going from Asia to Western Europe. Air transportation is much faster and depending on the type of services it takes less than a week.

For land transport the transit times from Asia to Europe are less predictable. The transit times of currently available trucking and rail solutions could be as low as 16-20 days, but the actual transit times are found to be a great deal longer, in particular for solutions based on railways.

Still, transportation by truck from China to Western Europe is quoted as having a transit time between 7 and 10 days shorter than for sea transport for destinations that are located 100 km away from the sea port.

Transit time in terminal is a critical factor. As illustrated by the 2004 port congestion incident. Usually, efficient sea ports will allow for minimal waiting time, where time-sensitive containers leave the port for onward transportation on the day it arrives. In the case of Rotterdam, for example, transit time is usually down to a few hours if required. The average stay of a container is in the range of two days. To improve port efficiency ports usually charge shippers if containers are not picked up within a specific timeframe.

At rail terminals and border crossings, in particular in Central Asia, the transit times for containers are highly unpredictable. This results in considerable uncertainty among shippers as regards the overall transit time for Eurasian rail options.

Both reliability and shorter transit times have a value for the transport users, and can be critical depending on the type of cargo and the production processes of the customer. Chapter 5 analyses the value for lower transit times for a range of goods.

5. Developing Eurasian Land Transport Options

Based on the analysis in the previous sections, this final chapter assesses the link between transport costs, transit time and the overall logistics costs for companies.

5.1 The value of short transit times - Inventory cost

Goods can lose a substantial part of their value during transportation if transit times are long. This is especially true of perishable goods (in particular food) or goods subject to frequent changes in consumer preferences, such as high fashion apparel. High transport costs and long and unpredictable transit times if found to undermine competitiveness of exports of landlocked countries in world markets, make their imports more expensive and limit their participation in international trade (Asian Development bank, 2006).

Unpredictable transit times also preclude "just-in-time" business practices, which reduce costs of production by minimizing inventory holdings and require timely delivery. The estimated value of a one day shorter transit time depends on the value of the goods transported and how disruptions impact the end-users ability to use the transported goods effectively at the time it arrives.

Some researchers have estimated that each day in travel is worth an average of 0.8 percent of the value of a product for US trade in manufactured products (Hummels, 2001). For a transit time of 20 days this translates into a "tariff" of 16 percent.

Similarly, each additional day spent on moving containerized products from a factory gate to a ship reduces trade by at least 1 percent and that a day in ocean transit reduces the probability that a country will export to the US by 1 percent for all products and 1.5 percent for manufactured products (Asian Development Bank 2006). The daily depreciation rate of some high-value goods, such as consumer electronics, can be as high as 2.5 percent.

Table 5-1 shows how the cost of inventory can be included in the overall comparison of transport costs and transit times from the previous chapters of this analysis. The table is first calculated for average valued cargo (in the transpacific trade the average value of cargo in a 40' container is approximately 60,000 USD).

Table 5-1 also shows that for goods of average value the time-sensitivity of the cargo does not change the overall ranking of the transport solutions. Ocean transport, with the longest transit time, continues to be the favorable option when the combined transport and inventory cost are added together. The combined transport and inventory costs are much closer than when comparing the pure transport costs.

Table 5-1: Combined transport and inventory cost (average value of goods: 60,000 USD)

Mode of Transport	*Transport Cost*	*Time*	*Inventory cost*		*Total cost (Transport + Inventory)*	
			Time sensitivity		Time sensitivity	
			High (0,8%/day)	Low **(0,2%/day)**	High (0,8%/day)	Low (0,2%/day)
Sea	3,000	28	13,400	3,400	16,400	6,400
Road	11,000	19	9,100	2,300	20,100	13,300
Air	25,000	5	2,400	600	27,400	25,600

In table 5-2 time sensitivity is calculated for cargo of higher value. The table shows how the combined costs of transport and inventory costs are now at the same level for sea, road and air cargo in the case of high time sensitivity (0.8 percent). For cargo with lower time sensitivity the ranking between the modes of transport (sea, road and air) remains unchanged, although the difference between the total costs of the three options is clearly reduced.

Table 5-2: Combined transport and inventory cost (High value goods: 120,000 USD)

Mode of Transport	*Transport Cost*	*Time*	*Inventory cost*		*Total cost (Transport + Inventory)*	
			Time sensitivity		Time sensitivity	
			High (0,8%/day)	Low (0,2%/day)	High (0,8%/day)	Low (0,2%/day)
Sea	3,000	28	26,900	6,700	29,900	9,700
Road	11,000	19	18,200	4,600	29,200	15,600
Air	25,000	5	1,200	29,800	29,800	26,200

Accurate calculations of the combined transport and inventory costs are directly linked to the business conditions facing an individual company and its production processes. A general calculation (such as done in tables 5-1 and 5-2) can therefore

only be indicative. For modern manufacturing processes predictability may have a greater impact than the short lead times for sub-components in itself. In this case reliability of the various transport options therefore becomes a key issue.

Based on a calculation of the combined transport and inventory cost, the analysis indicates that road transport can compete with the dominant mode of sea transportation for high value goods with high time sensitivity, and – under similar conditions – also with air transportation.

5.2 High demand for reliability of new trucking solutions

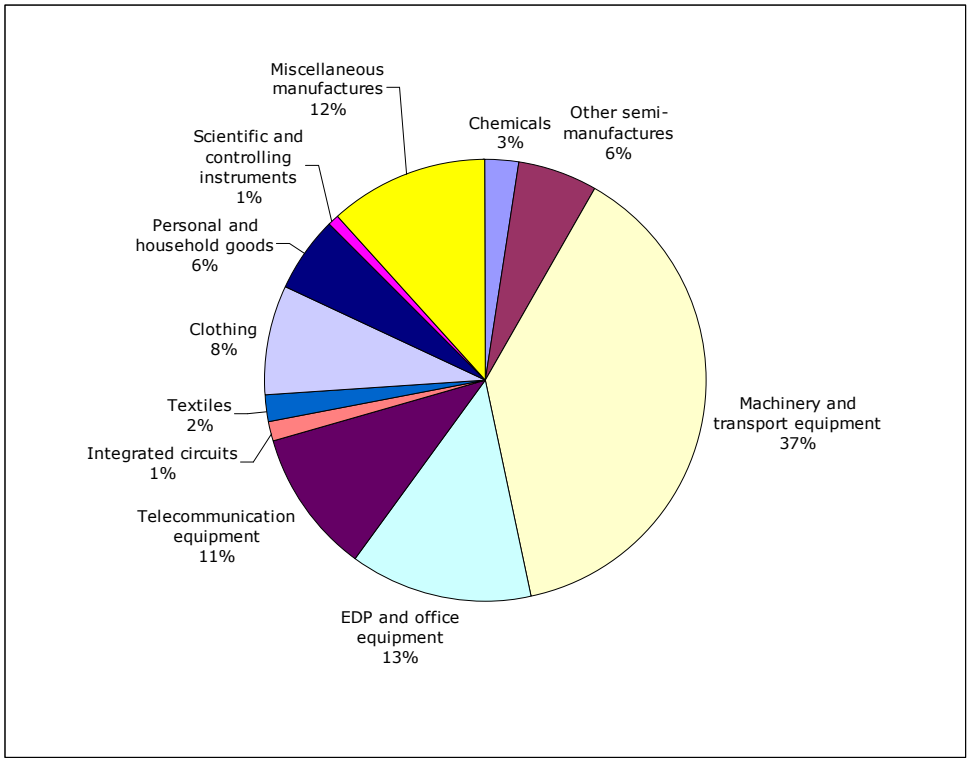
High volumes and economies of scale related to sea transportation (and air cargo solutions), have also resulted in a high degree of reliability. Section 3 above notes that reliable sea transportation is available as a standard for shippers without the requirement for paying an extra premium to get reliable services. Delays may be common for some shipping lines, but a selection of the leading operators emphasize that reliability and delays of more than one day are not usual on the main trade routes.

The road transport solutions between Asia and Europe are still very limited in terms of volume and immature when it comes to marketable solutions. It is therefore too early to determine if trucking solutions across the Eurasian landmass can develop and guarantee similar high reliability as time-sensitive shippers know from sea transportation.

The key issues at stake involve border crossing and other facilitation issues. Numerous studies have shown that several days can be lost in such procedures, and that the related costs are high, indicating that unofficial payments, as a precondition of border-crossing, or in the form of a requirement for hiring semi-compulsory guarding/surveillance services – can make up more than a quarter of the total transport costs (1,000 to 1,500 USD per truck per trip in some reported cases).

Other issues include the reluctance of forwarders to market trucking solutions that are still considered to be too uncertain in terms of securing the return of the equipment. One of the freight forwarders that was approached for a freight rate stressed that the rates were conditional upon the customer also acquiring the container itself. The forwarder mentioned that containers not handled by leading ocean operators disappeared on a regular basis.

Table 5-3: Composition of China's exports to the EU (by value, 2004).



WTO, World Trade Statistics, 2005.

Table 5-3 above shows how China's exports to Europe break down in to different product groups (by value). Within several of these product groups, high-value goods make up a significant share (e.g. electronics).

Potentially, there will be users of transportation services that are willing to pay for short transit times and high reliability for transport of even large quantities of such high-end types of goods. Transport operators will be able to charge rates that are above the average ocean transportation freight rates for delivering those types of services.

In order to be able to exploit the benefits of a premium trucking concept based on faster transit times, road transport operators on the Eurasian link will have to be able to show the ability to deliver reliable and frequent services. If they can offer multiple weekly frequencies it will make the trucking option more attractive for customers. One of the benefits of road transport is flexibility, where door-to-door pick-up and delivery can, in principle, be ordered to suit the customers' production processes.

5.3 Trade and transport facilitation

The Asian Development Bank (2006) concludes in its analysis of trade barriers in the Central Asian Republics (CAR):

> *….significant barriers to trade in Central Asia are high transport costs and long and unpredictable transit times for international shipments to and from the CARs.*

This is not only due to the landlocked and remote location of the CARs and their difficult topography but also:

> *….to deficiencies of the CARs' transport networks, and high costs and low quality of transport and logistics services in the region. In addition, there are difficulties with movements of goods and transport equipment across borders and through the territories of the CARs and neighboring countries. For example, the actual transport costs for shipments by road from Istanbul, Turkey to the CARs are about 2.0–3.0 times as expensive, while the actual transit time is 1.5–2.0 times as long as those in the "ideal world" (i.e., a world with balanced transport flows, competitive markets for transport services, smooth border crossing, low transit fees, and no visa problems and unofficial payments).*

Increased regional cooperation in transport and customs transit would help to reduce transport costs and make transport times shorter and more predictable for international shipments. This would in turn help the region expand trade, especially with distant countries.

The report makes a number of recommendations on how to improve and facilitate the development of an efficient transport industry in the Central Asian Republics. It suggests that countries, as a start, develop an effective and relatively inexpensive regional transit system for short-distance customs transit by road, based on the model of the so-called TIR system. Eventually, the report recommends full implementation of the TIR Convention as the best solution for expanding trade in the region. The report also advocates countries to integrate maintenance of existing national networks more closely with the international transport networks.

The initiatives and recommendations outlined in the Asian Development Bank report will directly help to underpin the build-up of trans-Eurasian trucking solutions. They may also sustain the development of a land-bridge that can address the transportation needs of the rapidly expanding trade between East and South Asia and Europe. The overall conclusion remains that countries in the region will require increased regional cooperation in transport and customs transit to reduce transport costs and make transport times shorter and more predictable for international shipments.

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Annex 1: Transport Costs and Transit Times: Various Destinations.

Road				
Europe/Kazakhstan				
To Khorgos from:	**20' Container**		**40' Container**	
	Transit Time (days)	**Cost (USD)**	**Transit Time (days)**	**Cost (USD)**
Berlin	18	4,550	18	7,000
Istanbul	14	2,860	14	4,400
Riga	14	3,380	14	5,200
Rotterdam	18	4,680	18	7,200
Novorossiysk	10	2,275	10	3,500
Dubai	n.a	n.a	n.a	n.a
From Khorgos to:	**20' Container**		**40' Container**	
	Transit Time (days)	**Cost (USD)**	**Transit Time (days)**	**Cost (USD)**
Berlin	18	4,225	18	6,500
Istanbul	14	2,860	14	4,400
Rotterdam	18	4,225	18	6,500
Riga	14	3,250	14	5,000
Novorossiysk	10	2,275	10	3,500
Dubai	n.a	n.a	n.a	n.a
China /Kazakhstan				
To Khorgos from:	**20' Container**		**40' Container**	
	Transit Time (days)	**Cost (USD)**	**Transit Time (days)**	**Cost (USD)**
Shanghai	7 to 9	3,630	7 to 9	6,650
Beijing	7 to 9	3,500	7 to 9	5,720
From Khorgos to:	**20' Container**		**40' Container**	
	Transit Time (days)	**Cost (USD)**	**Transit Time (days)**	**Cost (USD)**
Shanghai	7 to 9	3,630	7 to 9	6,650
Beijing	7 to 9	3,500	7 to 9	5,720
North America				
To Chicago from:	**20' Container**		**40' Container**	
	Transit Time (days)	**Cost (USD)**	**Transit Time (days)**	**Cost (USD)**
Los Angeles	5	2,125	5	3,950
New York	2	1,150	2	1,940

Sea

Including 100 km of road transport both at origin and final destination (i.e. intermodal)

Eurasian – Westbound	20' Container		40' Container	
From Shanghai (China) to:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Hamburg	30	1,649	30	2,740
Rotterdam	27	1,627	27	2,719
Riga	37	1,775	37	3,179
Istanbul	35	1,945	35	2,976
Dubai	17	1,422	17	2,362
Transpacific – Eastbound	20' Container		40' Container	
From Shanghai (China) to:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
San Francisco	19	2,949	19	3,700
Los Angeles	15	2,649	15	3,400
Vancouver	21	3,162	21	4,002
Transatlantic – Westbound	20' Container		40' Container	
To New York from:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Hamburg	15	2,434	15	3,043
Rotterdam	11	2,417	11	3,132
Novorossiysk	44	3,424	44	4,359
Istanbul	37	2,907	37	3,837
Riga	23	2,695	23	3,463
Transpacific – Westbound	20' Container		40' Container	
To Shanghai (China) from:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Hamburg	44	978	44	1,377
Rotterdam	33	956	33	1,355
Riga	45	1,027	45	1,560
Novorossiysk	37	1,300	37	1,719
Istanbul	27	1,129	27	1,539
Dubai	17	882	17	1,372
Transpacific – Westbound	20' Container		40' Container	
To Shanghai (China) from:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
San Francisco	19	1,732	19	2,011
Los Angeles	15	1,464	15	1,743
Vancouver	21	1,962	21	2,282
Transatlantic – Eastbound	20' Container		40' Container	
From New York to:	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Hamburg	16	1,421	16	2,056
Rotterdam	10	1,351	10	1,880
Istanbul	36	1,678	36	2,179
Riga	22	1,548	22	2,289

Rail

Including 100 km of road transport both at origin and final destination (i.e. intermodal)

From Shanghai by TRANSSIB to :	20' Container		40' Container	
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Warsaw	32/35	5532	32/35	8200
Moscow	30/32	3919	30/32	6467
Riga	45/46	4958	45/46	7108
Hamburg	45/50	6050	45/50	8425
From Shanghai by TRASECA to:	20' Container		40' Container	
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Istanbul	40	7540	40	11467
Riga	37	7060	37	10749
From San Francisco to:	20' Container		40' Container	
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
New York	8 to 12	1871	8 to 12	2208
Vancouver	5 to 8	1866	5 to 8	2871
Boston	8 to 12	2197	8 to 12	2253
Charleston	8 to 12	2171	8 to 12	1968
To Shanghai by TRANSSIB from:	20' Container		40' Container	
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Warsaw	30/32	3025	30/32	4650
Moscow	30/32	3200	30/32	5400
To Shanghai by TRASECA to:	20' Container		40' Container	
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
Istanbul	40	7308	40	11235
Riga	37	6852	37	10541
	Transit Time (days)	Cost (USD)	Transit Time (days)	Cost (USD)
New York	8 to 11	1663	8 to 11	1963
Vancouver	5 to 8	1866	5 to 8	2871
Boston	8 to 11	1953	8 to 11	2003
Charleston	8 to 11	1930	8 to 11	1750

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