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Transportation Infrastructure and the Asia-Pacific Food System*¹

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Adequate, well maintained transportation infrastructure is a critical element of the Pacific food system in addressing challenges of rapid urbanization. Policymakers must invest either in streamlining domestic supply chains and/or in facilitating food imports through market opening measures. Economic incentives, competitive transportation and logistic services, and policy reforms, both within the borders of individual economies as well as across the Asia-Pacific region, are also necessary. Important progress is being made in developing and expanding transportation infrastructure to better link food-producing areas with fast growing urban centers. Creating modern infrastructure, improving related services and reforming policies will help build a more seamless Asia-Pacific food system.

1. Introduction

While economic growth and prices are important drivers of food demand, demographic changes including urbanization, population growth and changes in the age structure of populations may have more profound long-term implications for the Asia-Pacific region's food system. It can be argued that the most important demographic issue facing the food system is urbanization.

According to Coyle, Gilmore and Armbruster (2004), urban population growth will be about

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three times greater than that for total Asian-Pacific Region population growth. Urban population grow by over 580 million people between 2000 and 2020, or about 45 percent. The most rapid growth will occur in Vietnam, Indonesia, Singapore, and the Philippines. China's urban population is expected to grow by 300 million (67 percent). In contrast, rural populations are expected to shrink in practically all of the region's countries.

The significant food system impacts from urbanization include demand shifts in diets to more animal and horticultural products, but more important is the greater demand for food service. Supply side challenges include urban congestion and costs in delivering food to central markets. Urban growth will test the efficiency and capacity of the region's food system to deliver a continuous flow of safe, reasonably priced fresh and processed foods. Pressure to better connect urban areas to rural hinterlands and to liberalize trade to meet food needs of growing urban areas will intensify.

Food companies are adapting to better serve the demands of urban populations. For example, Golan, Krissoff and Kuchler (2004) report that American companies spent \$1.6 trillion during 2000 on supply-related activities, including the movement, storage and control of products across the supply chain. U.S. companies are embracing new logistic systems to better control inventories reflecting growing efficiencies in supply management in the U.S. food industry, including traceability systems. Generally, serving densely populated urban areas requires sophisticated distribution systems to deliver often perishable food to the point of sale, as well as strong linkages to the outside world for the provision of agricultural raw material and processed

and fresh foods. Linkages with foreign sources are facilitated by the coastal location of many expanding urban areas and most mega-cities are coastal.

2. Challenges to Transportation Infrastructure

An adequate, well-maintained transportation infrastructure of roads, railroads, waterways, airports and port facilities will be an increasingly crucial element in the Pacific Food System as it continues to address the challenges of rapid urbanization. Food production is the most geographically dispersed industry in the region, while food demand is becoming increasingly concentrated in urban areas.

According to Clark, Dollar and Micco (2004), for most Latin American countries, transport costs are a greater trade barrier to U.S. markets than are import tariffs. Distance, volumes and product characteristics determine shipping costs to the U.S. Also, efficiency at ports is an important determinant of shipping costs. If port efficiency were increased from the 25th to the 75th percentile, shipping costs would be reduced by 12 percent. This means that inefficient ports are equivalent to being 60 percent further away from markets for the average country. Reducing inefficiencies associated with transport costs from the 25th to the 75th percentile could increase bilateral trade about 25 percent. They find that variations in port efficiency are linked to excessive regulation and the general condition of the country's infrastructure, among other factors.

Zhang and Fan (2004) find that there is a large impact of infrastructure development on agricultural productivity in developing countries. The impact of roads, for example, results from lower transportation costs which directly affect farmers' savings in input purchase costs and provide cheaper access to markets. This allows shifting land from low value cereal production to higher value fruit and vegetable production because it reduces perishability risks, but they note that many developing countries have reduced spending on infrastructure development. If the declining trend in infrastructure investment is not reversed, it will challenge the ability to promote agricultural production and productivity growth. They concluded it would be better policy to reduce subsidies on inputs for agricultural production and invest instead in transportation infrastructure.

According to Hummels (2001), the growth of fast transport in the form of air shipment and faster ocean vessels is equivalent to reducing tariffs on manufactured goods from 32 percent to 9 percent between 1950 and 1998. He estimates that an additional day spent in transport reduces the probability that the U.S. will source from a country by 1.0 to 1.5 percent.

Sachs (1997) argues that China's main geographical problem is the large number of peasants living in the interior, hundreds of miles from the coast and that the infrastructure linkages are grossly inadequate.

To control urban food costs, policymakers must invest either in streamlining domestic supply chains, including expensive transportation infrastructure to connect urban centers with food-

producing areas, or in facilitating food imports through market opening measures, or a combination of the two. An efficient food system requires not just adequate transportation infrastructure, but appropriate economic incentives, competitive transportation and logistic services and policy reforms. This includes within the borders of individual economies, as well as across the region. Development of transportation infrastructure obviously contributes to more efficient resource allocation and greater prosperity within an economy. This can benefit consumers with lower prices for greater varieties of foods and realign agri-food trade patterns in the region. Calderon and Serven (2004) note that there is persuasive evidence that adequate infrastructure should be the key element in the agenda of individual countries if they are to achieve the objectives of trade liberalization in the form of efficient resource reallocation and export growth. They also note growing perceptions that budget pressures have reduced infrastructure spending which has not been offset by increased private sector participation, resulting in insufficient increases in infrastructure services.

Development policies for PECC countries must recognize the critical role of transportation infrastructure in linking dispersed food-producing areas with urban consuming areas. Too many agricultural areas in the developing countries are isolated or taxed by inadequate access to markets, resulting in large post-harvest losses, depressed farm prices and higher consumer prices. Even in the developing economies, urban areas are often well connected with the rest of the world through modern ports and airports. Although India is outside of the Asia-Pacific region, Landes (2004) offers a relevant perspective related to India's situation. He argues that weak incentives have led to significant under investment in agricultural marketing and processing, as

well as production. Fragmented marketing chains, along with poor and relatively costly rural road and transport infrastructure leads to inefficient markets. Hence, farmers have received a smaller share of the consumer price and physical losses in the food chain are high. Further, inefficient marketing increases the cost of imported foods because of high margins taken by intermediaries which exacerbate the effect of high tariffs.

3. Progress in Transportation Infrastructure

Across the PECC region, important progress is being made in developing and expanding transportation infrastructure. For example, with the assistance of international lending institutions, China is spending billions of dollars to expand and improve its railroad and waterways systems. NAFTA and privatization of Mexico's rail system have helped stimulate investment in the North-South linkages to better integrate a developing economy with its more developed northern partners. In Southeast Asia, the Greater Mekong River Subregion is investing in road systems that will better integrate six economies and facilitate the marketing of food products from isolated areas to coastal cities and ports.

Developing countries tend to invest first in modernizing ports facilities and airports in or near large coastal urban areas. Since ocean transport costs are the lowest of all transportation modes over long distances, foreign suppliers can sometimes be more competitive in coastal urban areas than can inland domestic producers. This is particularly true currently in China. Inland producers in developing economies often face inadequate transportation infrastructure, making it

difficult to meet high freshness and consistency standards of higher-income urban consumers.

While road and rail systems are generally comprehensive in developed densely populated economies, they tend to be underdeveloped in the less developed countries within Southeast Asia, Latin America and China. A unique challenge in Southeast Asia is overcoming the fragmented geography of its extensive archipelago nations, Indonesia and the Philippines.

A key constraint is the lack of financial resources for expensive infrastructure projects. Most support must come from national and local government or private sources. However, international financial institutions have played a modest role in the development and enhancement of physical infrastructure worldwide, with about 5 percent of the estimated \$100 billion per year required from new investment and maintenance in developing economies provided by them (Fay 2003). However, the Asian Development Bank's share of total lending for transportation infrastructure has been rising with relatively large programs in China and Southeast Asia.

China, Mexico and parts of Southeast Asia, in particular, are quickly expanding or enhancing road and rail infrastructure, supporting rapid growth in their respective economies. According to the Pacific Economic Cooperation Council (2004), the region has the world's three busiest container ports, Hong Kong, Singapore and Shanghai. Perishables and other processed products are often shipped via container, but even bulk commodities like grains and oilseeds that need to be segregated for use in the supply chain are shipped in containers. Shanghai has seen spectacular growth in volume from 500,000 twenty-foot equivalent units (TEUs) in 1990 to 11.3

million in 2003, when it was the world's third busiest port. China's top ten ports grew 24 percent in TEUs from 2002 to 2003, while ports in Korea and Malaysia are also growing rapidly. The port facilities are approaching industry standards, surpassing developed countries' moves per crane hour in Sydney, Southern California and Rotterdam. With regulatory reform, port throughput could be even greater and less costly.

Infrastructure development plays a central but varied role in different parts of the region. In China, connecting interior provinces with populous coastal areas is the main thrust. In NAFTA, North-South linkages integrating the less-developed partner is foremost. In the Greater Mekong River Subregion, linking remote agricultural areas with urban centers and ports takes precedence.

3.1 China

While lagging the more developed economies in the PECC Region, China's infrastructure is expanding rapidly on many fronts, some in collaboration with international lending institutions. China's urban population, concentrated in coastal provinces, will surpass its rural population by 2015. Hence, they have favored investments in coastal regions for many years. But China is now putting more emphasis on developing waterway networks to connect its interior provinces with coastal regions. This should allow China to exploit its agricultural comparative advantage in high-value, labor-intensive perishable food products, as transport and other marketing costs fall.

By 2020, China's road network is forecast to reach 2.5 million kilometers (km), including doubling their major highways to 70,000 km. This should increase profit margins for poor farmers by lowering transport costs for both agricultural inputs and outputs. China also plans to improve road links with its neighbors, including a highway link with Southeast Asia. This will foster growth and economic integration, particularly with remote areas where agriculture remains a dominant sector. Map 1 shows China's major new and upgraded roads.

China's railway system has been in decline, but leadership has realized the need to upgrade the rail system in order to connect the less developed, but resource rich, northern and western parts of the economy with more prosperous manufacturing centers in the East. This will foster development outside the coastal provinces. Public efforts are being made to introduce market mechanisms and competition and to invest in improving and expanding the rail network. These investments are lowering transportation costs by reducing travel times and making service more reliable (Gilmour and Cheng 2003).

China has made port development and modernization a top priority to facilitate trade. To keep pace with the growing trade, China must continue to develop and expand facilities to achieve greater efficiencies in ship navigation and scheduling, berthing, cargo offloading and inspection, customs clearance, security, tracking and storage. The globalized and highly innovative shipping industry makes widespread use of standard-sized containers and ever larger vessels, thereby influencing port development in China and elsewhere. Kost (2004) reports that China's ports handled more cargo containers than did U.S. ports last year.

China possesses the most extensive inland waterway system in the PECC region, with 116,500 km of navigable rivers. The Yangtze River and its tributaries account for about half of the total. New construction is underway to extend and increase the capacity of the Beijing-Hangzhou Grand Canal, which has a navigable length of more than 1,700 km. Plans for the inland waterway network emphasize port development and construction of 15,000 kms in inland river channels in major north-south and east-west corridors (Gilmour and Cheng 2003).

3.2 NAFTA

The food system in the North American Free Trade Agreement (NAFTA) faces different challenges in expanding and enhancing transportation linkages, particularly between Mexico and its northern trade partners, the U.S. and Canada. Mexico's north-south rail and road corridors are being developed to accommodate growing trade and hooking into the well-developed transportation networks existing in the U.S. and Canada. While cross border regulations continue to be a problem their effect is being offset by innovation in information technology and advances in inter-modal systems. New technologies facilitate security and product integrity inspection further from congested border crossings.

NAFTA is the most important regional market for U.S. food and agricultural exports, surpassing East Asia and Europe. Given the long land borders separating the three economies, overland transportation modes are most significant and agriculture dominates them. In the U.S., food, raw commodities, processed agricultural products and farm inputs account for one-third of total

freight shipments, with trucking being by far the leading transport mode. Within NAFTA, trucks account for more than two-thirds of all food shipments. They particularly dominate shipping of meats and other perishables because of the premium on speed and delivery flexibility. The long haul modes of rail, barge and ocean shipping are used for lower-value commodities such as grains and oilseeds.

In Mexico, the highway system has expanded rapidly in recent years. While road length has expanded by one-third between 1990 and 2000, modern privately operated toll roads are underutilized because tolls are too expensive for widespread commercial use. Thus, trucking firms continue to rely on deteriorating public roads, following routes that are longer and less safe.

Over the past decade, three highway corridors have emerged as principal Canada, U.S. and Mexico trade routes. See Map 2.

For long-distance hauls, rail transportation throughout NAFTA is becoming more competitive with trucking for two reasons: mergers and acquisitions that reduced the number of Class 1 rail companies to 9 from 56, and privatization of Mexico's state-run rail system in the late 1990s. The increased efficiencies from U.S. rail mergers has reduced rates for bulk commodities, but also reduced services for more remote agricultural areas. Mexico's privatization led to agreements with U.S. and Canadian rail companies, resulting in upgraded north-south service and increased shipments.

Although most intra-NAFTA trade is overland, in some instances, ocean shipping is an economic alternative. The ocean share accounts for 40 to 50 percent of U.S.-Mexican grain shipments, primarily via U.S. gulf ports. And large container ships now offer rates and transit times are competitive for high-value commodities. Port privatization in Mexico in the 1990s led to increased investment in infrastructure, intensified competition among service providers, and improved port productivity. At Mexico's major ports, fully mechanized terminals are replacing outdated equipment and facilities.

Innovations in information technology is reducing delays caused by inadequate infrastructure and customs and other regulations at international borders. Electronic toll collection systems, vehicle X-ray, and weigh-in-motion devices, electronic data interchange systems and vehicle-to-roadside communication systems, help reduce congestion, thereby lessening infrastructure needs and environmental pollution.

The expansion of inter-modalism is also lowering transaction costs. Standardized shipping containers can be more efficient and versatile than truck trailers or railcars. This, of course, depends on well-developed inter-modal links between rail, truck and marine.

3.3 Greater Mekong River Subregion

In an effort to link remote agricultural areas with urban centers and ports, the Asia Development Bank (ADB) (2002) is supporting an ambitious integration program among six countries in the

Mekong River Region – Cambodia, China, Laos, Myanmar, Thailand and Vietnam. Initiated in 1992, the program is designed to integrate the roads, railroads, and electric power of these six countries and connect them with other parts of the region. The potential exists to improve the economic conditions of 70 million people living in the Mekong basin, many of whom are subsistence farmers. At the heart of the program are three major road projects as shown in Map 3.

The North-South Economic Corridor will connect Kunming in southwestern Yunnan Province, China with Bangkok, Thailand, covering a distance of 2,000 kms. This corridor linking with established roads from Bangkok to Singapore and Kunming to Beijing will provide a 4,500-km continuous, all-weather overland route between Singapore and Beijing. Much work remains to be completed.

By 2006, the all-weather Southern Corridor will connect Bangkok, Thailand, with Ho Chi Minh City, Vietnam. ADB indicates this project will also improve 540 kms of feeder roads, reduce travel times and transport cost, and provide broader access for farm products in the region's major urban markets.

The East-West Economic Corridor stretches almost 1,500 kms from Vietnam to Myanmar. It is the only mainland route that traverses mainland Southeast Asia east to west. Ports on the western end of the corridor will provide farmers and processors better access to South Asian markets.

4. Remaining Challenges

These three examples illustrate how major transportation infrastructure development is taking place throughout the PECC region.

But transportation infrastructure alone will not create an efficient food system, which is a complex of economic relationships that tie the region's food producers to consumers. To efficiently move food to urban consumers also requires appropriate economic incentives, competitive transportation and logistic services and policy reforms. These are particularly important inside the borders of individual economies, but also must be more fully integrated with negotiations to liberalize agri-food trade policies across the region. Infrastructure development, combined with trade policy reform, will lead to a larger proportion of labor-intensive food production occurring in emerging economies with capital-intensive production occurring in more developed economies of the region. This may well increase consumer benefits from lower prices for a greater variety of foods and realign agri-food trade patterns in the region.

However, significant obstacles still remain. China's railways are still hampered by lack of refrigerated cars, containers and the supporting inter-modal infrastructure needed for efficient transport of perishable goods to coastal markets and export positions. As rail transportation inefficiencies are overcome, North China and the Eastern Loess Plateau likely could make further inroads into urban and international markets for fruits, vegetables and other horticultural products. Similarly, South Central China could increase production and trade in citrus and semi-

tropical fruits, as well as some vegetable products and perhaps regain a competitive position for pork production.

China must also improve its cold chain infrastructure and management to accommodate domestic and international demand for perishable foods. Its cold storage capacity is estimated to be only 20% to 30% of demand. The lack of controlled-atmosphere and refrigeration equipment leads to spoilage losses of up to 33 percent of perishable food. While China now produces such equipment, incentives are not yet sufficient for widespread adoption.

Taking another example, if Chile wishes to be an important player in food production and import from different countries from the South, they will need to make major infrastructure investments. Currently, food production is located near the population concentration in Central Chile, where the infrastructure is good. But their current production areas are being pressured by population growth. Real challenges exist to changing the location of processing and marketing services for food. Many roads are still unpaved in rural Chile and services to rural populations are much less than in urban areas. There needs to be improvements to be able to use modern communications to become a participant in the growing international markets. Most imports are from MERCUSOR countries via road into the Santiago area.

In the NAFTA countries, freight movements are hampered, not just by inadequate infrastructure particularly in Mexico, but by an array of protectionist and other regulations across all three economies. Greater border surveillance in the aftermath of September 11, 2001, is also a factor.

Among measures that can impede the flow of trade and imposed costs are cabotage restrictions which are designed to protect domestic trucking and ocean shipping services by limiting the pick up and delivery of cargo within an economy to national carriers. This raises costs to shippers and producers in the home country (Prentice and Ojah 2001).

Given the predominant role of trucking in NAFTA, the absence of a cross-border trucking agreement between the U.S. and Mexico has long been a significant barrier to efficient transportation in the region and contributes to delays at the U.S.-Mexico border. Although required under the NAFTA agreement, nationwide U.S.-Mexico truck access has been hampered by U.S. concerns about the safety of Mexican trucking. Overweight vehicles, lack of operational logs, and no limits on the number of hours driven per shift have been sticking points. The U.S. is now committed to reciprocal access as soon as sufficient resources exist at the border to certify that Mexican trucks comply with U.S. law. Removing border delays and bottlenecks could reduce travel time between Chicago and Monterrey, Mexico, by as much as 40 percent, according to estimates by Texas A&M International University.

Finally, customs regulations have tightened along all international boundaries in NAFTA since September 11, 2001. Time consuming customs procedures are likely to continue. Some northbound delays result from efforts to interdict drugs and undocumented immigrants. Other delays arise from inspections for agricultural pests and diseases. However, traffic volumes across the international boundaries continue to grow.

In Southeast Asia, in addition to improvement and expansion of transportation infrastructure, customs procedures and practices across the six economies need to be streamlined to reduce time spent at border checkpoints.

5. Conclusions

These three examples illustrate how major transportation infrastructure development is taking place throughout the PECC region. Increased linking of dispersed surplus food-producing areas with urban consumers is contributing to a more efficient, seamless regional food system.

But transportation infrastructure is only one of the necessary elements for an efficient food system. Competitive transportation and logistic services and policy reform are also needed to make the improved infrastructure truly efficiency enhancing. Transportation infrastructure development allows comparative advantage to play an important role in expanding or enhancing the ability of price signals to be transmitted through an economy and region. More efficient resource allocation will generate greater volumes of trade, realign agri-food trade patterns and lower consumer food costs across the region. related services and reforming policies will help build a more seamless Asia-Pacific food system.

With improved transportation infrastructure and growing international trade, traditional markets are being replaced by vertically integrated food supply systems in developing countries.

Decision makers will need to fashion policies that not only encourage the modernization of the

retail food sector, but also streamline domestic supply chains. The scope and pace of change in the region's retail food sector is rapidly transforming in the developing countries. The proliferation of supermarkets is fulfilling an economic need to provide low-cost, safe food for growing urban populations across the region. The vertically integrated food supply systems include new entities such as distribution centers, intermediaries to deal with farmers directly and similar institutions. These new services are lowering transaction costs and are also assuring more uniform and consistent quality. This is the next step in advancing a modern food system throughout the Asia-Pacific region.

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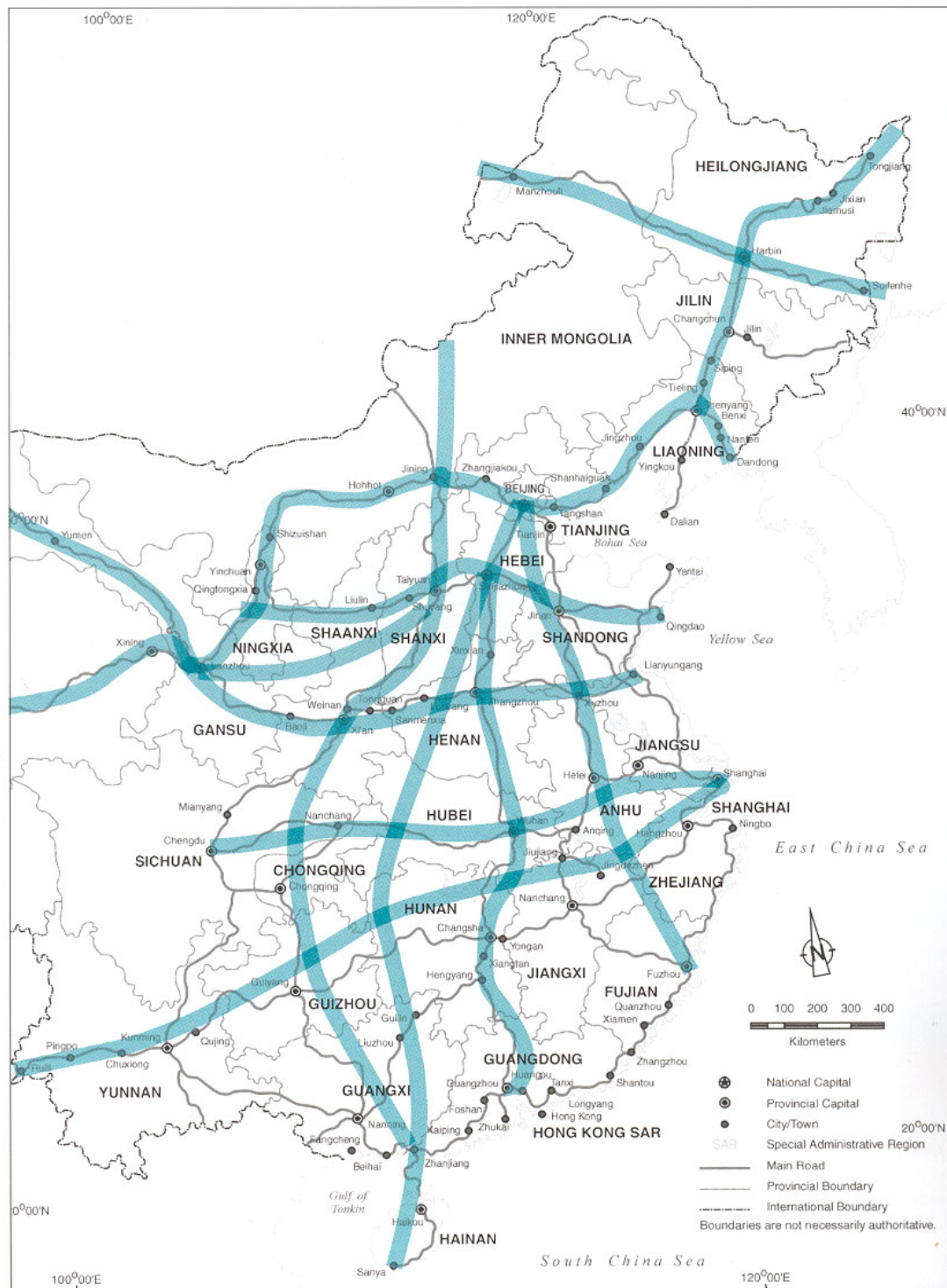
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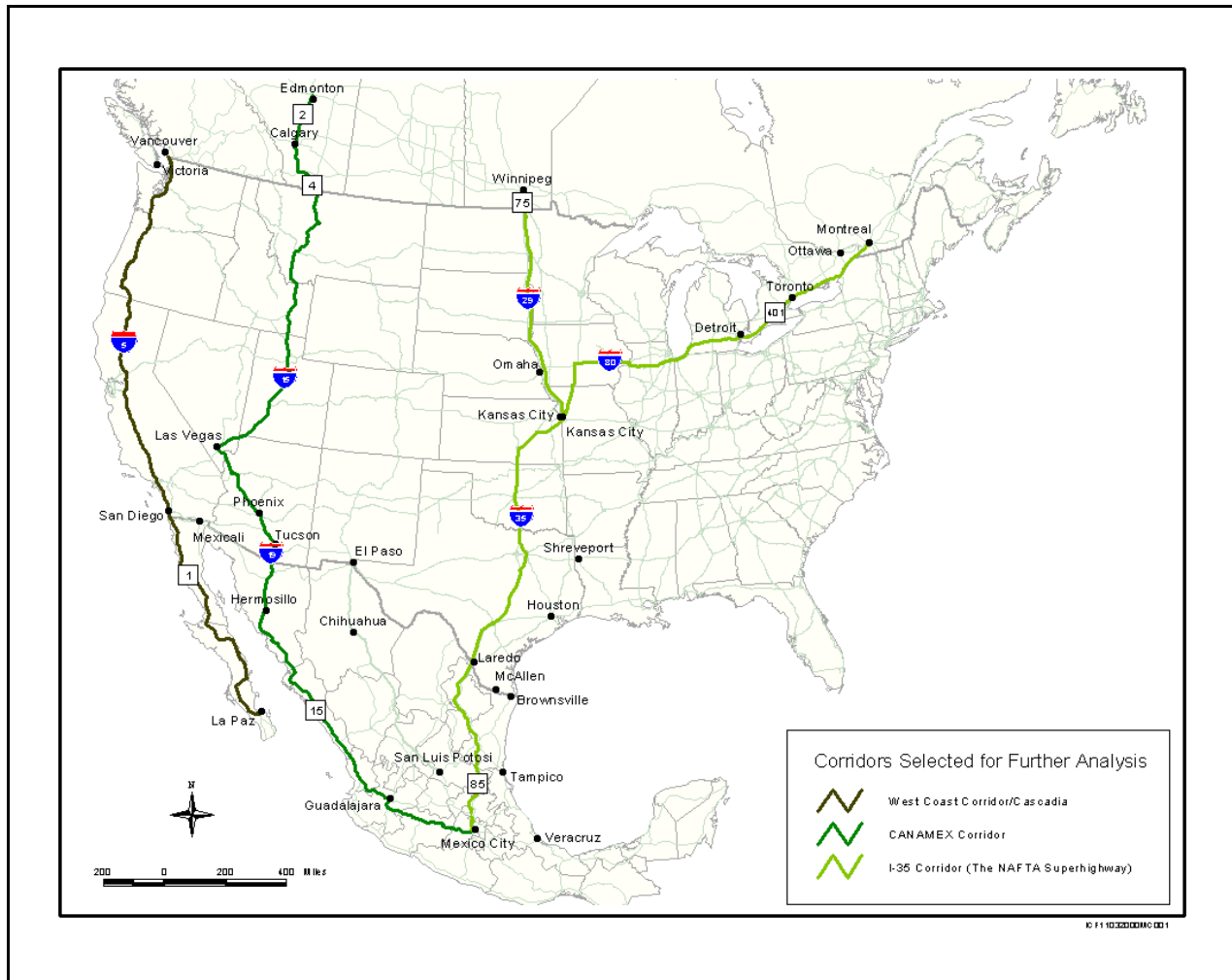
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Map 1 China's Major New and Upgraded Roads

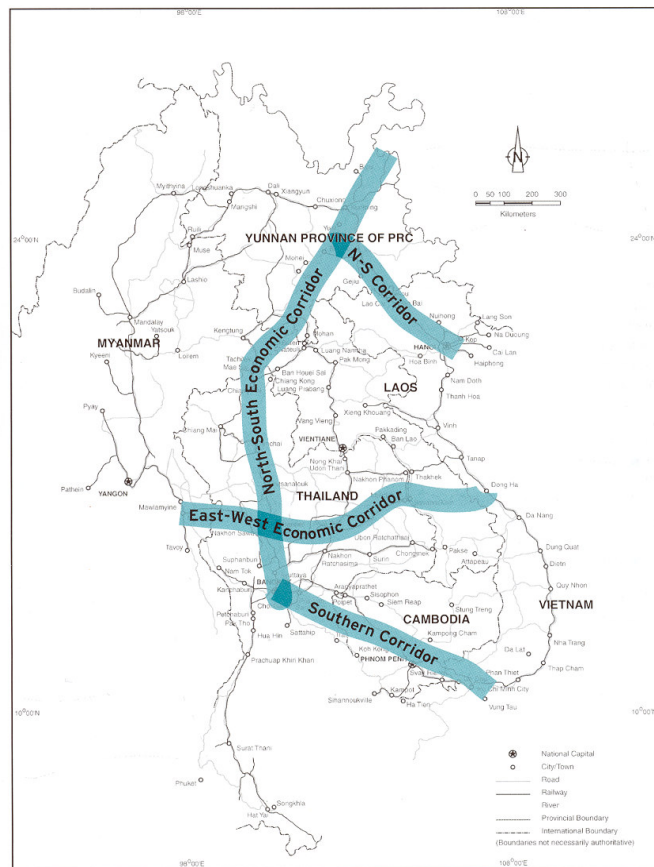


Source: Asia Development Bank

Map 2 - NAFTA's North-South Highway Corridors



Map 3 Greater Mekong Subregion's Road Development



Source: Asia Development Bank