



**Drivers of Change:
Thinking About North American Freight
Transportation Infrastructure in 2030**

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The purpose of this paper is to stimulate thinking and discussion about how North America's freight transportation infrastructure system will change over the next two decades. The paper argues that conventional analyses of freight transportation infrastructure development, driven by projections of volumes of goods to be moved do not provide sufficient tools to convincingly portray what might emerge in coming years taking into account change factors such as technology, modal role and sustainability developments .

I suggest that we need to think in more systematic, scenario-based terms. In this paper, I have tried to identify a wider array of "drivers" that can shape the infrastructure system in the future. There are others, I am sure, that should be included in this analysis.

The key questions we must confront have to do with how the influence of these (and other) drivers will be felt and how they might interact with each other.

A key danger we face is that in our efforts to respond to the crises of congestion and capacity, we build too much or too little, in the wrong places and with insufficient attention to connectivity – because we have not weighed sufficiently the potential impact of this wider array of drivers of change.

Our goal must be, first, to create a vision of what a North American freight transportation system should/could look like in, say, 2030 and, second, to ask how we get there from where we are. Given our world of rapid and transformative technological change, this is no small order. More realistically, we need to create several possible visions of a North American freight transportation infrastructure in 2030, based on different combinations of drivers. A single report cannot provide the "answers." Instead we should think how we can mobilize research assets in research community and the private sector and embark on a multi-dimensional dialogue on these matters.

A large community of researchers works on transportation, logistics and supply chain management. We need to open pathways so that ideas are not lost in obscure papers and the same discussions are not endlessly repeated. If we could mobilize only a small segment of this community to work on North American issues and create a framework for collaboration and sustainability, we would have accomplished much.

Such a process would meet a second key need – to build an active and informed constituency that would support the creation of an efficient and secure North American freight transportation infrastructure for the 21st century.

Finally, a personal note: I have borrowed and lifted ideas and information from many sources. But the responsibility for this essay is totally mine. No one else should be implicated in whatever charges may be laid against it.

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I. Background

I.1. An Emerging North American Economy

In the 1980 and '90s, the structure of the North America's economies changed. In the face of increasing international competition and falling profit margins, many American firms rationalized their Canadian (and Mexican) branch plants into integrated North American production, supply and distribution operations (as the American auto industry had done in the 1960s). Flows of goods across North America's internal borders grew rapidly in this period – and an increasing share of these flows consisted not of final products, but of components and parts moving within company supply chains. Cross-border supply chains linking production, distribution and marketing resources across the NAFTA nations became a distinguishing characteristic of the North American economic system.¹

NAFTA provided critical support for these developments not only by the commitment to remove tariffs and other trade barriers, but also by signaling that the three North American governments would encourage open cross border market growth in most sectors of their economies.

Increasingly elaborated supply chains depended on efficient transportation systems. Transportation providers were able to meet the increasing demands of users because excess capacity existed in many systems, because of available new technology (unit trains, double stacking of containers, larger trucks) and because consolidation in the trucking and rail industries enabled suppliers to work more efficiently. Government policy focused on privatization and deregulation, although US highway legislation also provided funds for many local transportation projects. Companies in this environment worked out individual strategies for building new continental systems and solved problems themselves as they arose.

I.2. Facing a Freight Transportation Crisis

By the turn of the century, however, this situation had begun to change. The end of excess capacity, the emergence of global manufacturing value chains with vastly increasing demand for freight transportation capacity because of rising imports from Asia, the impact of post-9/11 measures on borders and ports, the continued failure to harmonize regulations and the accumulated weight of delayed maintenance all strained the capacity of the North American freight transport system to service the economic system as it had emerged over the previous decades. Many experts now spoke of an emerging crisis in North America's freight transportation system.

¹ Our colleague Isabel Studer reminds us that North American and international firms did not always optimize these North American production systems. For many firms, global rather than North American production strategies took predominance, and production was increasingly relocated to Asia. NAFTA's promise that Mexico would become a major center for North American production was not realized in many sectors of the economy. Note too, however, that increasing volumes of goods from Asia have been an important driver of change in North America's freight transportation system.

Concern about an emerging crisis is widespread. A series of reports drafted over the past few years all reach the same conclusions:

The US is now in a situation where its ports and inter modal terminals can no longer build their way out of capacity problems. (US Chamber of Commerce)

Capacity is overwhelmed by supply chains, disruptions are increasing, the system is “brittle” with growing risk of continent wide economic damage. (Rand Corporation)

The warning light is flashing...there is no slack in the system” (ITI White Paper)

The US needs a systems-based and multi-modal agenda for the nation’s freight needs...” (The Brookings Institution)

Mexico is at the crossroads between stagnation and advancement. Its future in advanced manufacturing depends on its addressing such issues as privatization, regulatory frameworks, inter-modal transport and security (American Chamber of Commerce, Mexico)

Canada’s transportation network in all provinces and territories needs upgrading, modernization and improved regulation, including \$97Billion in new construction (Council of the Federation)

The covering letter to a recent report by the Government Accountability Office opens by stating: “Strong productivity gains in the U.S. economy hinge, in part, on transportation networks working efficiently... However, the increasing congestion within the freight transportation system poses a threat to the efficient flow of the nation’s goods and has strained the system in some locations. Moreover, recent growth in international trade has placed even greater pressures on ports, border crossings and distribution hubs – key links in the freight transportation system. Congestion delays that significantly constrain freight mobility in these areas could result in serious economic implications for the future.”²

UPS CEO Mike Eskew summed up this view: “What’s shocking, quite frankly, is the inability of our transportation infrastructure to keep up with the normal day--to-day stresses imposed upon it....Our highways, waterways, railroads and aviation network are simply not keeping up with ordinary demands.”

The transportation crisis threatens North America’s integrated production system. A review of recent research on freight transportation infrastructure conducted by the North American Transportation Competitiveness Research Council concluded: *The JIT –lean inventory advanced manufacturing system developed since the 1970s that enables North America to compete*

² United States Government Accountability Office, GAO Report to the Ranking Member, Committee on Environment and Public Works, U.S. Senate, Freight Transportation: National Policy and Strategies Can Help Improve Freight Mobility (January 2008)

*successfully with Asian and European manufacturers is now reaching its capacity limits. The supporting transportation infrastructure is now inadequate to handle the projected volume growth of North American supply chains freight flows.*³

“The result,” observes Professor Mary Brooks, one of Canada’s best known specialists on freight transportation, *“has been to boost buffer stocks, and force just-in-time supply chain managers to re-examine their sourcing options; it is of concern to Canada that many U.S. companies will source domestically rather than within NAFTA due to border uncertainty.”*⁴

I.3. Responses to this emerging crisis

The situation has certainly been recognized. The three North American governments have responded to the growing crisis of capacity and congestion with recent transportation infrastructure initiatives.⁵ Several organizations have emerged as well – for example, the Coalition for America’s Gateways and Trade Corridors and the recent initiative by Mayor Mike Bloomberg and Governor Arnold Schwarzenegger to create Building America’s Future, a non-partisan coalition for federal infrastructure investment.⁶

The responses suffer however, from three key failings:

- They are still national initiatives and lack connectivity across borders. National leaders remain reluctant to acknowledge the real nature of the North American economic system – that is, three independent nations sharing what is in many sectors a single, deeply integrated economic space. As a result, we lack a vision of what a North American freight transportation system could/should look like in, for example, the next two decades.
- Responses tend to be driven by a single variable – that is, by linear projections of volumes of goods to be moved. There is a general failure to envisage the situation in context of multiple agents that drive change.
- None of this suggests how coordination among the three nations on freight transportation infrastructure might be improved.

A final word in this introduction: The most immediate threat to the North American economic system is US border policy, and business leaders and community leaders have focused most of their attention here. But the hardening of borders is only one of the crucial problems that must be faced not only to build an efficient and secure freight transportation system in North America for the next decades, but even to maintain the existing system. This note examines broader issues of developing a freight transportation infrastructure strategy for the 21st century.

³ Guy Stanley, Review of Recent Reports on North American Transportation Infrastructure, North American Transportation Competitiveness Research Council, Working Paper 3 (September 2007) <http://natcrc.org>

⁴ Mary Brooks, “Mapping the New North American Reality: The Road Sector,” Study Group on Mapping the New North American Reality (http://www.irpp.org/miscpubs/archive/NA_integ/papers.htm)

⁵ See the North American Transportation Competitiveness Research Council’s latest Working Paper on National Infrastructure Initiatives

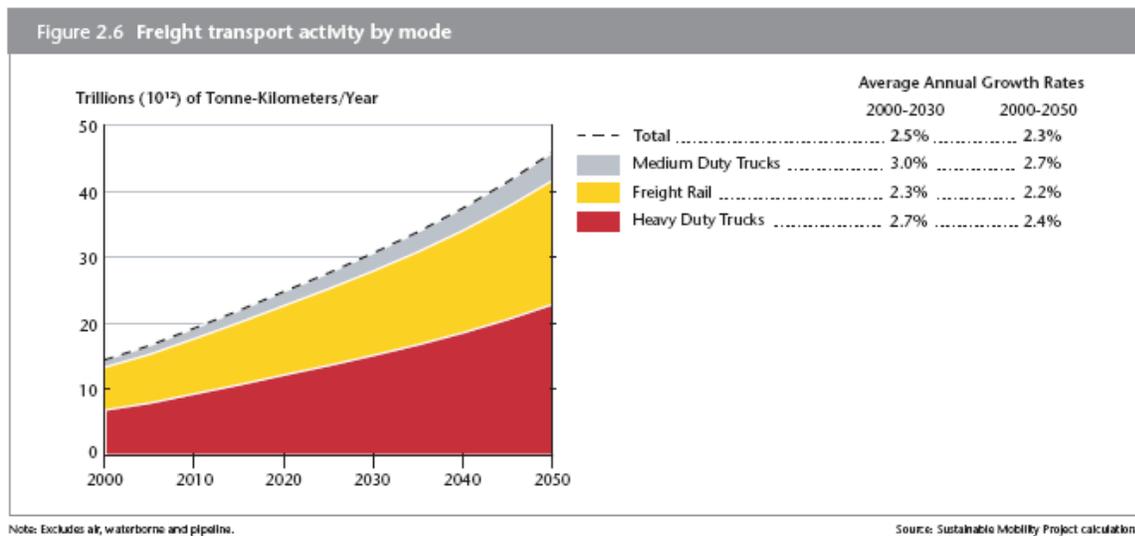
⁶ There has been much ongoing work on border and regulatory issues, most importantly, the Border Transportation Working Groups and the NACC.

II. Thinking about a North American Freight Transportation System in 2030

The take-off point for many discussions of freight transportation is the prospect of increasing congestion resulting from growing volumes of goods being transported into ports, across North America’s borders and over the transportation network. Projections of volume generate projections of the need for port, container, truck, highway, and railway capacity.

For example, the Federal Highway Administration estimates that if the U.S. economy grows at a conservative annual rate of between 2.5 and 3% annually over the next 20 years, domestic freight tonnage will nearly double and freight moving through the largest U.S. ports could triple or quadruple.⁷ The U.S. DOT projects that the volume of goods moving by truck and rail will increase by 98% and 88% respectively from 2002 to 2035.⁸

The problem is that we are not sure where the projections come from and, more important, when carried out beyond the short-term, they begin to lose credibility. In the chart below, it’s not that the projected growth rates seem excessive. It is the sheer number of heavy trucks projected to be on the road in the next decades that does not seem credible. (For additional examples of this kind of projection, see appendix below.)



Many feel that an analysis cannot rest solely on linear projections of freight volume. We must have a better understanding of the wider array of factors that will drive change in freight transportation systems over the next decades – factors that will influence the volumes of goods transported and also the nature of these goods and the pathways along which they will move.

⁷ John D. Schulz, “Shippers need to join users in developing strategic plan ‘to rebuild America,’” Logistics Management, 11/2/2007

⁸ GAO report, Op Cit

III. An Alternative Approach: What factors will influence the volumes, nature and pathway of goods that need to be moved?

We should think in terms of systemic assessment, of scenarios rather than straight-line projections. By scenario, we mean a vision of the future shaped by a set of inter-connected variables. These are possible and probable factors (“drivers of change”) whose interaction, together with “wildcards” (factors with low probability but high impact), will shape future environments and events.

We can begin with a very simple model – a range of scenarios of possible North American freight transportation systems with two limiting cases. In one limiting case, the North American economies have become almost completely closed off from each other and international trade; in the other, the North American economic systems are “perfectly” integrated.

What we want to know is, first, where on this range – from complete integration to complete disintegration – we are most likely to find ourselves in 2030 and, second, what factors are most likely to drive this outcome.

III.1. Drivers of Change

Drivers of change are factors or forces that will shape the transportation system over future years. Drivers include macro-environmental factors that create the broad context for development and micro-environmental factors that affect particular elements of the system. All interact and influence each other within the system/scenario.

III.1.1. Macro-environmental drivers include global economic growth, the global political environment and technological development. These are primary forces that will influence the volumes of goods that must be moved.

Baseline Scenario: There is little agreement today among experts on what we might expect over the next few years in any of these areas. But to facilitate our discussion, we might start with a base case structured by several core assumptions. Assume in the forecast period moderate growth in the international economy with moderate growth in the movement of goods to North American ports. Assume there will be no political crises of a magnitude that would lead to dramatic changes in US policy (eg., a full lock-down at ports and borders). Assume, finally, that this will continue to be a period of rapid and transformative technological change.

Technological change may well be the most powerful driver of change. Global competition even in a slow growth economy will stimulate technological development, as will rising fuel prices and increasingly severe environmental regulation. (The view here is that companies adopt new technologies not when times are flush but when things are tough and they are desperate to find ways to reduce costs.) Technological change will affect every dimension of the freight transportation value chain – from cargo vessels and port development to airplanes, trains, trucks, engines and fuels and to what is carried and where it comes from and where it goes to.

These baseline assumptions are scarcely uncontroversial. Other scenarios might be envisaged. For example, slower global growth or global recession with rising fuel prices or increased global conflict; or more rapid growth, driven by technological innovation; or a reconfigured global economy with less international trade and regional growth strategies with regional mercantilist policies (North America, Europe, growing Asia).

Perhaps the most uncertain element of our baseline scenario is the assumption that there will be no global political crises that could result in the closing of US borders. (The clear and obvious conclusion here is that transportation stakeholders must work vigorously with others to try to ensure that border closure is not the only response available in the event of another terrorist incident.)

We need to talk about these macro-environmental drivers and begin to get some sense of how different configurations of these basic factors will affect volumes of goods moved in the global and North American transportation systems.

III.1.2. Micro Environment drivers: Freight transportation movement will be affected not only by these macro-environmental drivers but also by a wide array of “micro-environmental” drivers that affect specific dimensions of freight transportation. In the scenarios, each factor influences all of the others.

a. *Energy costs*

Energy costs will be responsive to the macro-environmental factors and will be responsive as well to changes in levels and patterns of demand. Obviously, energy cost will have a substantial impact on fuel prices and on all dimensions of freight transportation. (According to the AAA, the average US diesel price reached \$3.83 a gallon, up from about \$1.50 at the beginning of 2004.⁹)

Other than in a deep global recession, it is difficult to imagine that energy prices will fall substantially. It seems reasonable to assume that demand pressure (driven substantially by China and India) is likely to keep energy prices high.¹⁰

How will an environment characterized by much higher fuel prices affect the freight transportation system?

b. *Environmental change/policy pressure*

If recent IEA projections are even roughly accurate, will see greatly increasing environmental pressure over next decades (largely because of increasing hydrocarbon use – and particularly the

⁹ Christopher Maag, “Paying at the Pump, in a Big Way,” New York Times, March 11, 2008

¹⁰ See International Energy Agency, World Energy Outlook 2007: China and India Insights “...if governments stick with current policies (which the IEA calls the “reference scenario”), the world’s energy needs will be more than 50 per cent higher in 2030 than today, with developing countries accounting for 74 per cent, and China and India alone for 45 per cent, of the growth in demand.” Martin Wolf, “Welcome to the new world of runaway energy demand,” Financial Times (Nov 14, 2007)

use of coal – in China and India) We can anticipate that the increasing quest for “sustainability” will mean increasingly severe environmental policy constraints that will affect many aspects of freight transportation.

In 2004, the transport sector produced 23% of world energy-related CO2 emissions and its growth rate is highest among the end-user sectors. Road transport currently accounts for 74% of total transport CO2 emissions. The share of non-OECD countries is 36% now and will increase rapidly to 46% by 2030 if current trends continue. The IEA reports that transport’s share of CO2 emissions is gradually increasing in all regions of the world: its share of world emissions from fuel combustion stands at 30% in the OECD economies.¹¹

| | OECD Economies |
|---|-----------------------|
| Transport | 30.3% |
| <i>Road</i> | 22.9% |
| <i>International Maritime</i> | 2.4% |
| <i>Domestic Aviation</i> | 1.9% |
| <i>International Aviation</i> | 1.8% |
| <i>Domestic Navigation</i> | 0.4% |
| <i>Other Transport</i> | 0.9% |
| Energy | 42.1% |
| Manufacturing Industries and Construction | 14.0% |
| Other Sectors | 13.6% |

The Environmental Protection Agency issued new, tougher air-pollution standards for diesel-powered locomotives, ships, ferries and tugboats. They will have to eliminate 90 % of the soot and 80 % of the nitrogen oxides in their exhaust by 2030.¹²

c. Trucks and trains in this emerging environment

A key question is how the trucking industry will respond in this situation. It is pretty clear that the same diesel trucks will haul more goods over existing highways. (“In 2007, two thirds of U.S. oil consumption – and half of global oil consumption – will be sucked up by cars and trucks. Reinventing the car is the only serious way to wean the world off oil.”¹³) What kind of changes can we anticipate in the nature of trucks? What kind of more fuel efficient/ environmentally friendly technology?

To change fuel systems, the supply structure must also be changed. Gasoline stations out, what’s in? And how does this happen?

We talk about changes in road configuration: Longer trucks, truck trains, dedicated truck lanes and limited access truck corridors. How will rising fuel and regulatory costs affect highway

¹¹ See Institute of Transportation Studies, University of California at Davis, “Transportation and its Infrastructure” http://pubs.its.ucdavis.edu/publication_detail.php?id=1137

¹² Juliet Eilperin, “Tougher Pollution Rules Issued for Ships, Locomotives,” Washington Post (March 15, 2008)

¹³ Vijay V. Vaitheeswaran, “Oil”, Foreign Policy Nov/Dec 2007

construction? And, another set of issues (see below), how will public attitudes influence these developments?

Rail is environmentally friendlier. But the industry agrees that we have come to the end of existing excess capacity. The rail companies are putting significant amounts of money in new investment. A recent Wall Street Journal article speaks of a “railroad renaissance”: *For the first time in nearly a century, railroads are making large investments in their networks... Since 2000 they've spent \$10 billion to expand tracks, build freight yards and buy locomotives, and they have \$12 billion more in upgrades planned. Their campaign is altering the corridors of American commerce, more so than any other development since interstate highways spread to the interior.*¹⁴

But even so, there are questions.

A report on rail capacity and investment to 2035 has recently been issued by the AAR.¹⁵ The analysis rests on several key assumptions. One is that it is focused on the US primary rail freight corridors (“These corridors, which constitute about one-third of all continental U.S. rail freight miles, are expected to absorb the bulk of the forecast traffic and nearly all of the investment to expand capacity.”) The second is that projected investment required to 2035 “assumes no shift in modal tonnage shares among rail, truck, and water beyond those projected by the U.S. DOT.”

We can ask whether by some point in time, the role of trucks in the freight system will have changed. Is it reasonable to wonder if – given fuel costs and the cost of environmental regulation, plus the cost of fitting new, more fuel efficient and more environmentally acceptable technology and of creating a new fuel supply system – trucks will continue to move some 70% of all freight volume? Second, can we assume that today’s network of primary corridors will efficiently reflect changes in our national population and production map that take place over the next decade or two?

Is it reasonable to ask how rail might adapt to this new situation – to new demands in a new environment? How can rail coverage be improved? How can rail deal with huge bottlenecks (like Chicago)? Unlike highways and airports which are financed by governments, rail lines are privately owned. Is it possible to build new rail lines?

III.1.3. What other issues might affect transportation infrastructure demand and/or supply?

Other issues might also drive change in our transportation systems. For example:

¹⁴ Daniel Machalaba, “New Era Dawns for Rail Building: Lines Add Tracks, Upgrade Tunnels To Take On Trucks, Wall Street Journal (February 13, 2008)

¹⁵ National Rail Freight Infrastructure Capacity and Investment Study prepared for The Association of American Railroads by Cambridge Systematics, Inc. (September 2007)

a. Supply chain structure

In the past years, supply chains have greatly lengthened. The Ford model, based on internalization and vertical integration, brought all the elements of a firm's value chain under one management and created a unified planning system. Transportation cost, uncertainty and planning requirements created a strong locational bias. In the past few years – given the revolutionary impact of containers – supply chains have extended distantly, and out-sourcing has further complicated value chain and supply chain management.

Is there reason to believe that this extended supply chain model might be transformed? Reports underline that China's "huge economy, which has long offered some of the world's lowest manufacturing costs, is losing its claim on cheapness as factories get squeezed by rising prices for energy, materials and labor."¹⁶ As Chinese labor costs rise, a firm's competitive advantage could be enhanced by diminishing "floating inventories" and otherwise cutting transportation and logistics costs. (A Canadian report on "Low Cost Country Sourcing" found that the minimum lead time for products sourced from China is approximately three times that of products sourced from North America. In terms of lead time variability, "products sourced from China generally have a maximum lead time ranging from one to more than six months while for North American sourced products, the typical range is 10 to 30 days."¹⁷) Various forms of protectionism may also increase cost and uncertainty of extended supply chains. Meanwhile, we are likely to see new innovations in automated production. If any of this happens, increases in seaborne container traffic may slow or even reverse.

A "tipping point" analysis would be interesting here – that is how high must factor costs (such as labor) or ocean freight increase to swing the flows in reverse?

The bottom line here is important. There seems to be no reason to assume that the globalization of supply chains – largely driven by the search for low-cost, skilled and disciplined labor and the existence of increasingly inexpensive sea transport (containers) – is the final stage in the evolution of corporate supply strategy. And this underlines the view that assumptions about increasing volumes of goods must be tested more rigorously.

b. Changes in what is transported

How will possible change in what is shipped influence demand for infrastructure? Given rapidly increasingly global demand, a wide range of commodity (coal, wheat, corn) costs are likely to remain high.

World demand for food supplies is increasing today in the same way that demand for energy and other commodities increased in the past ten years. As incomes rise in India and China, the demand for grain is increasing. Demand has also been increased by bio-fuel consumption. Supply has been stagnant for years and JIT approaches have reduced carryover inventories to the

¹⁶ "Rising costs squeeze Chinese factories; some companies look to cheaper markets," International Herald Tribune, (February 22, 2008)

¹⁷ Supply Chain & Logistics Association Canada, "Low Cost Country Sourcing: A Canadian Manufacturing Perspective" (Industry Canada, September 2007)

point that minimal buffer stocks exist. Any supply weakness in a major production zone (e.g. drought) now is showing up in price increases. This is a new economic paradigm that could shape political tensions and trade restrictions. As a major source of grain exports, North America's transport sector could be tested by outbound conflicts with inbound shipments. We could see substantial changes in food products that are transported and by the expansion of the "Cold Chain" food transportation system.

Similarly, what about changes in energy shipments – less coal, for example, and more ethanol (or sugar or corn)? More demand to ship biofuels?

The trend in the US and Canada (although also in Mexico) away from a manufacturing economy to a service and knowledge-worker economy may imply that growth in freight volume will come almost entirely from imported finished goods while movement of bulk materials and intermediate components and WIP will continue to decline (with the possible exceptions of coal and grain). This would have substantial implications for the railroads and inland marine and might somewhat mitigate trucking demand growth.

c. Climate Change

How might climate change and global warming affect freight transportation systems? Will rising food prices create new markets and new producers and demands for new transportation systems?

Will climate change concerns diminish the use of air cargo and costs on perishables rise steeply from rising jet fuel costs and emissions taxes get imposed? More radically, what might be the impact of climate change on port exposure and vulnerability to, for example, coastal flooding?¹⁸

d. Location of ports and transportation corridors

Most North American ports say that they will continue to expand capacity (see the chart on Projected U.S. Port Demand below, page 22). But one can ask whether, given the movement of people to city centers and the rising values of waterfront property¹⁹ as well as intensifying environmental pressures²⁰, these forecasts will be accurate. Instead, will we see the migration of ports out of urban centers to more remote areas (Prince Rupert Port, Lazaro Cardenas, Punta Colonet) and even to "inland ports" (Kansas City, Memphis)?

Canada and Mexico are betting that major US ports (in particular Long Beach and Los Angeles) will be unable to meet the demand for more capacity and ever-larger vessels, and that Prince

¹⁸ See OECD Environment Working Paper "Screening Study: Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Interim Analysis: Exposure Estimates", OECD 2007

¹⁹ See Christopher B. Leinberger, "The Next Slum?" Atlantic Monthly (March 2008)

²⁰ "U.S. ports are among the biggest sources of air pollution and greenhouse gas emissions in their cities, and progress toward reducing harmful emissions has been slow.... Ports pose grave health risks to millions of people living in metropolitan coastal areas, especially those living nearest the ports. "The combination of growing U.S. port activity, the densely populated regions where most ports are located, and the prevailing onshore wind patterns that accumulate rather than disperse port air pollution create a 'perfect storm' of threats to public health." Energy Futures, Inc, "U.S. Container Ports and Air Pollution: A Perfect Storm" (February 2008)

Rupert Port, Lazaro Cardenas and Punta Colonet will be able to compete successfully for a substantial share of this trade.

Ottawa's National Policy Framework notes that "Canada has a range of opportunities to connect North America with the world, by exploiting advantages in geography, transportation and commerce." The Framework continues: For example, gateway and corridor strategies can leverage significant Canada-US trade flows as part of national strategies to position Canada to benefit from the emergence of new economic powers such as China and India.... Transportation systems are key to Canada's successful relationship with the US Maximizing the free flow of goods, services and capital with the US is a key priority for Canada. The National Policy Framework for Strategic Gateways and Trade Corridors and future gateway strategies provide new avenues to advance competitiveness in the North American context."²¹ Mexico's new national infrastructure initiative takes the same position – that Mexican ports can play a greater "North American" role.

Aside from the question of whether projections of increasing volumes of containers arriving at North America's ports will be accurate, the development of these more remote ports places great new demands on transportation and border infrastructure. Containers arriving at Prince Rupert Port will enter the US through Chicago. It is at least a question as to how the projected millions of new TEUs will find their way through this highly congested city.

Another model is also discussed – the creation of massive hub ports (Halifax? Havana? Perhaps even at sea?) and new feeder lines of smaller ships that will move containers to other, smaller entry ports. This opens the increasingly discussed issue of "SSS" – short-sea shipping.²² Or another strategy: Here the trend would not be toward still larger ships with more containers, but rather, boxes would be sorted by destination at the port of departure, and smaller loads would be carried to that port and its region.

We could also see more rapid growth of inland ports in which major transmodal and inter-modal switching will take place – but more distant from urban centers – or the creation of more distribution centers on the edges of urban development and smaller trucks to urban cores.

We are seeing a variety of experiments as, for example, consumer goods firms seek to discover the best locations for consolidation, de-consolidation and sortation with the objective of taking out a high-cost echelon in the supply chain; e.g., packing store-ready direct to store containers in China.

The point is that we are almost surely entering a period of greater flexibility and choice in terms of ships, routes and destinations, and that every option will create a new set of demands for port and land infrastructure and that some of these options will place substantial new pressures on

²¹ National Policy Framework, p 6

²² Mary Brooks (Dalhousie University) has written many useful papers on short sea shipping. See also United States Government Accountability Office, Report to the Senate Committee on Commerce, Science, and Transportation and the House Committee on Transportation and Infrastructure, FREIGHT TRANSPORTATION: Short Sea Shipping Option Shows Importance of Systematic Approach to Public Investment Decisions (July 2005)

borders. A very interesting question is who along the entire value chain will actually choose and who will make decisions regarding new ships, routes and destinations.²³

e. Demographics

The changing demographic structures in all three North American nations will certainly affect patterns of demand and wealth – and well as location of population centers – and thus the need for freight transportation.

It is not just the demand side that will be affected. The supply of labor will also be affected by demographic change. The aging of the US and Canadian populations (among other issues, to be sure) has severely affected the availability of truck drivers.²⁴ Similarly, a labor availability issue may be looming for the US and Canada as their populations age which might mitigate potential closing of wage differentials vis-à-vis China and India.

f. Industry structure and governance

Another area of potential change over the next few years which could have a profound impact on freight transportation infrastructure has to do with possible changes in the ownership of transportation assets and the entry of new players.

Consolidation in the transportation industries has been driven by cost pressures, regulation and capital market liquidity, and we are now seeing new players, blurred borders, and new business models. For example, Berkshire Hathaway now owns 17.2% of BNSF and other railroads, and The Children's Investment Fund, a London-based hedge fund, and Carl Icahn have been buying into CSX. AIG Global Investment Group, a U.S.-based arm of AIG, took control of six U.S. ports from Dubai Ports World, which had acquired P&O Ports North America. (The biggest port operator in the world is Hutchison Port Holdings, which handles some 50 million containers per year. It is a part of Hutchison Whampoa of Hong Kong.)

It is not clear how this would affect the issues we have been discussing. But it is difficult to imagine (assuming, of course, that the current financial crisis does not lead to a global spiral downward) that hedge funds, equity funds and sovereign wealth funds will not be increasingly interested in the world of freight transportation, that new players will not arrive on the scene and that each of these new players will not have its own set of interests.

²³ Another hot area in retail now is SKU segmentation and designing networks and flow-paths to optimize on-shelf costs and in-stock needs. With the increase in CPFR (Collaborative Planning, Forecasting, and Replenishment) and SC visibility tools and the increased sophistication of network modeling capabilities, the big retailers are really fine-tuning their entire distribution and transportation networks. Also, with the advent of collaborative bid optimization technologies, the ability for carriers and shippers to jointly squeeze out empty miles is becoming much more sophisticated and ultimately driving truck-miles out of the network. (Comment from Randy Garber)

²⁴ See "The U.S. Truck Driver Shortage: Analysis and Forecasts," prepared for The American Trucking Associations BY: Global Insight, Inc. (May 2005)

g. Government policy

Government policy is a powerful factor affecting transportation infrastructure – not just in terms of policies dealing directly with infrastructure but in terms of a wide range of policies and attitudes that shape the context of transportation infrastructure policy.

A North American vision?

Most important, will the three national governments generate the will to press forward with North American economic integration? Will they move on with the harmonization of regulations affect transportation?²⁵ Can the SPP process ultimately prove successful? Or will we see greater protectionism and/or efforts to diversify relationships as an alternative to deepening North American ties (eg., Canada’s “Third Option” or Mexico’s pre-NAFTA efforts to develop a free trade agreement with the EU)?

Security

In our base case, security concerns continue to be extensive and costly. What would happen after another terror event in the US (or in Canada or Mexico)? What changes in security procedure can we anticipate at our internal borders and ports? Will we see more use of risk assessment to cut the number of actual checks, or a push to open every box and examine every truck?

The issues extend well beyond terrorist threats. Drugs are central at most US-Mexico border crossings. Enforcement of safety standards for foodstuff will probably become more important.

As more trucks and trains cross the borders, more trained personnel will be required at the borders. Will they be on duty? Can we anticipate that arrangements will be made by the three North American governments to move more security procedures away from the border – from inspections and sealing trucks in factories or even the creation of some sort of “North American security perimeter”? In short, will security continue to trump trade (and competitiveness) – regardless of the impact on congestion and delay?

Environmental policies and growth policies

Will future policies be driven more by environmental concerns or should we assume that consumption/economic growth driven policies will continue to dominate? Will we see a shift to low/slow growth attitudes? Jean-Louis Borloo, the French environmental minister, was reported last fall as saying “For 30 years, we’ve built a lot of roads and a lot of highways. That’s over. Our road capacity is not going to increase further.”²⁶ This seems unlikely, even for France, but a wave of environment-driven policies is not out of the question.

²⁵ Some colleagues, Mary Brooks for example, emphasize that regulatory harmonization may well be as or even more important than infrastructure in ensuring the integration of North America’s freight transportation system.

²⁶ Christopher Caldwell, “Road-building turns a corner,” *Financial Times* (Nov 3-4, 2007)

Centralization – decentralization/ earmarks and “iron triangles”

Canadian and US transportation infrastructure and policy have been largely the responsibility of state and provincial governments.

A key provision of the US Intermodal Surface Transportation Efficiency Act (ISTEA, 1991) called for the designation of a National Highway System – an interconnected network of highways linking major population centers, providing access to international border crossings, ports, airports, public transportation facilities, and other intermodal facilities and serving major travel destinations. This would have been the first effort to develop a national system since the Interstate highways were built in the 1950s. A decade later, after millions of dollars had been spent (an increasingly large share of which spent on earmarks), little remained of goal. The strategic objective was derailed by the localization of US politics and interest group pressure.

One could argue that, barring widespread perception of national danger and a unique political configuration (for example, President Eisenhower’s particular interest in transportation and the Cold War moment), the localization of transportation infrastructure policy making and the increasing power of interest groups in the US system of government means that it is almost impossible to build a straight road across state borders or, more broadly, that the chances of successful reconstruction of infrastructure is low. One could continue with this line of analysis and argue that the same configuration of interest group pressure prevents much needed harmonization of transportation regulations.²⁷

Public goods – marketization

Will we see a continuation of the trend toward the privatization of transportation infrastructure or the building of new public systems? The new “third way” in transportation infrastructure construction is, of course, the quest for “innovative financing.”²⁸

h. Public Opinion

We must also factor in to this analysis a wide range of public attitudes with regard, for example to globalization and North American integration. The 2007 Pew Global Attitudes Survey reports that the US has seen the biggest rise in opposition to globalization of the 47 countries polled; 59% of Americans felt international trade is benefiting them as opposed to 78% in 2002.²⁹

A substantial number of Americans (Canadians, Mexicans as well) feel North American integration is toxic (to judge by dozens of websites). And even among those who support more integration, NIMBY remains strong. For example, recent plans by BNSF to create a new

²⁷ Indeed, this analysis might provide a pretty robust vehicle for explaining what has happened in the past decade with regard to freight transportation infrastructure policy, and how we find ourselves in the current situation of a remarkable contradiction between government policy on infrastructure (which remains in national boxes) and the reality of North American economic integration.

²⁸ See the current Canada’s National Policy Framework, Mexico’s new infrastructure initiative and Washington’s Corridors of the Future programs. All focus on the search for “innovative financing.”

²⁹ Lexington, “The people versus the powerful,” *The Economist* (February 9, 2008)

logistics facility in Kansas City – which would generate new jobs and help create a critical mass of transportation assets there – generated a loud blowback among community groups. “Build it, but not here.”

i. Cost: Who pays for all of this?

Behind all of this lurks another set of very powerful questions. How is all of this paid for? Even to bring existing infrastructure in the US, Canada and Mexico up to a reasonable condition will cost an enormous amount. How will new infrastructure be financed?

The entire Building Canada program projects an investment of \$33 billion over 5 years. Mexico’s infrastructure program calls for \$7 billion of public and private spending. Washington’s recent Corridors of the Future projects make available only \$65.9 million in federal funds to develop and attract public-private partnerships and even the largest project, the Port of NY and NJ, projects spending of around \$5 billion.

Costs, however, seem to live in a totally different universe. A paper issued by the National Chamber Foundation of the U.S. Chamber of Commerce estimates that by 2015, the cost just to “maintain” U.S. “pavements, bridges, and transit infrastructure” would amount to \$295 billion. To “improve” these systems would cost \$356 billion. The report concludes that total cost to improve the system for the period from 2005 to 2015 will be \$3.4 trillion but that total revenue will be only \$2.4 trillion, leaving a cumulative gap of approximately \$1.0 trillion.³⁰ Granted this is a much larger project than the transportation infrastructure programs we have described, but everything will certainly compete for public and private funds nonetheless.

An AAR commissioned study of US rail capacity estimates that an investment of \$148 billion (in 2007 dollars) for infrastructure expansion over the next 28 years is required to keep pace with economic growth and meet the U.S. DOT’s forecast demand. Without this investment, 30% of the rail miles in the primary corridors will be operating above capacity by 2035, causing severe congestion that will affect every region of the country and potentially shift freight to an already heavily congested highway system.³¹

Note that the low-hanging fruit is gone. The AAR study notes “Most of the moderate-cost capacity expansions have already been made; future capacity expansions will be purchased at a higher cost because they will require expensive new bridges and tunnels and more track and larger terminals in developed areas.”³²

Note, too, the growing shortage in the “capacity to build capacity”. We are likely to see competition not just for funds, but for construction capacity. This will raise costs and build more delay into construction timetables.

³⁰ *Future Highway and Public Transportation Finance Phase I: Current Outlook and Short-Term Solutions* prepared by Cambridge Systematics, Inc. under contract to the National Chamber Foundation® of the U.S. Chamber of Commerce, 2005)

³¹ Op. cit National Rail Freight Infrastructure Capacity and Investment Study

³² Op. cit National Rail Freight Infrastructure Capacity and Investment Study

Moreover, transportation infrastructure constitutes enormous sunk costs with many vested interests (economic and political). The construction of new infrastructure is the result of huge political pressures.

Infrastructure is typically viewed as a commodity with relatively low returns on investment. Given very long lead times to get projects online and uncertainty over the next years, are private sources of funding likely? What kind of “innovative financing” is possible given the amounts that seem to be required even to maintain existing systems let alone create necessary new systems?

IV. Finally, another very significant issue

Our focus thus far has been on what we should do and the factors that will shape the transportation in the next decades. There is perhaps an even more powerful question of “how” we can do these things.

How do we (and who is “we”?) make decisions about all of this? North America differs profoundly from Europe in that the NAFTA process created no institutional arrangements to monitor developments in areas like transportation infrastructure, let alone to identify emerging problems or suggest responses or solutions.³³ We must bear in mind that while we deal with issues like the crisis in freight transportation infrastructure we are also dealing with issues of governance and, potentially, of significant institutional innovation.

The “we” question is very important. Most of the people who write/think about North American integration come from a background of trade negotiation or trade theory and tend to think in a framework of trade negotiations and agreements among classically sovereign nations. It is not clear (to me at least) of how this model fits in a situation of existing deep structural integration.

Second, little thought has been given to the mobilization of constituencies that support these developments. Thus while many groups exist in North America that strongly support economic collaboration/integration (for example, municipal leaders, business groups), efforts to mobilize them have been extremely limited. Instead, consultations (think of SPP and the NACC) have been conducted behind a veil of secrecy that frightens and offends vast numbers of people.

³³ As noted above, there are the two bilateral Transportation Border Working Groups and the North American Competitiveness Council as well as the Border Trade Alliance and the Cam-Am BTA. But none of these organizations are focused on North American freight transportation infrastructure.

V. What is to be done?

We seek to launch a project in three distinct dimensions:

One dimension is to consider how we can think about a North American freight transportation system. Our suggestion here is to think in a scenario format, developing a vision (or visions) of a future (say 2030) North American freight transportation system and asking what factors will shape that system over the next years.

A second dimension is to create a research network to carry out this exercise. The answer is not to commission a single report. Instead, perhaps we can think of a networked research effort, combining the work of a number of groups of researchers focusing on particular pieces of the project and regularly exchanging ideas and findings. Neither extensive new research nor new research capacity are required. We need to mobilize existing transportation research assets to focus attention on these North American issues and to create a framework for research collaboration and sustainability.

There are no clear answers to the questions raised in this essay. We need to create a dialogue among groups of specialists and interested parties. We need to compare a range of responses to the questions raised in this essay and others that have been missed or will arise.

We need to build a constituency that understands the issues involved in creating an efficient and secure North American freight transportation infrastructure and is prepared and able to work with policy makers to initiate the process of building this system. Coming up even with good answers without a broad base of support will not work. (See what happened with SPP)

We have learned that issues of transportation infrastructure affect individuals and communities in many ways and generate fear on many dimensions. We must avoid a “democratic deficit” situation when communities feel they have been by-passed in making decisions that will affect their lives and welfare.

Question: Should we urge the creation of a North American Freight Transportation Infrastructure Council (a similar but improved version of the North American Energy Working Group)? Which other organizations can we reach out to in this process (the NACC, for example)?

For sure, we must build a network that connects key transportation associations, transportation user and provider firms, corridor and border groups and research centers which could represent the spectrum of interests that must be considered in any potential “solutions”. We should not seek to create a new set of resources that would appear to be competitors with existing groups, but rather leverage existing resources in new directions.

To conclude, let me quote one of the initial members of the TRC planning group:

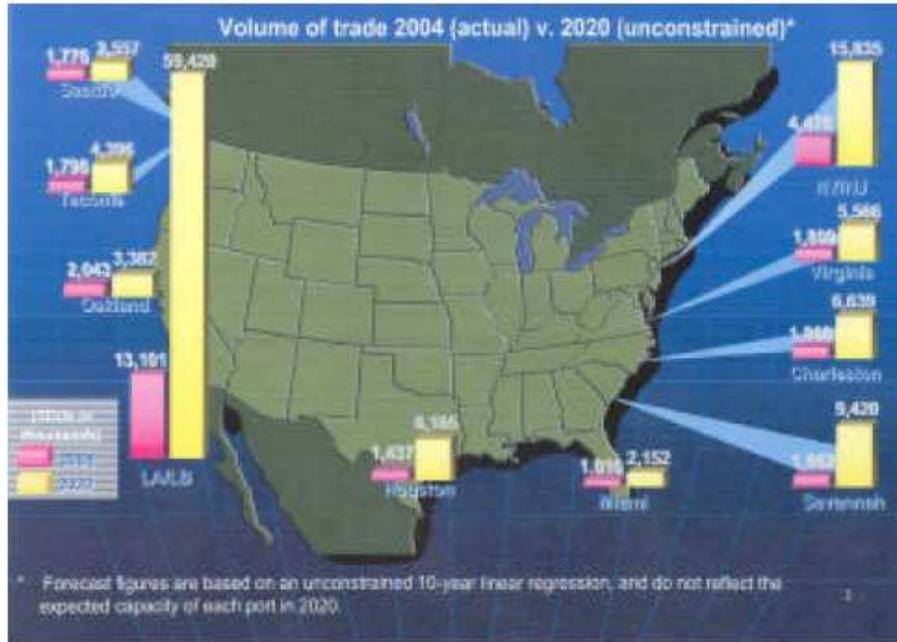
I think to enlist the participation of carriers and shippers, they will need to clearly see how research and papers will be parlayed into action with government decision-makers. I also think some tangible examples of the types of actions we would expect to push

forward would be helpful; e.g., ability to get on the agenda with senior Federal officials responsible for cross-border trade and transportation issues; establishing a tri-lateral NA transportation commission with teeth; forming or expanding Private-Public Partnerships, etc. Otherwise, I fear that business leaders will conclude that it's an interesting academic exercise, but will be skeptical about the Council's ability to translate the findings and thinking into action. I suppose that is where the Drivers of Change essay comes into play; i.e., making the compelling call for action by all stakeholders—why they can no longer afford to sit on the sidelines and hope the three governments will actually take on the issues. I would like to see the Drivers paper not only highlight the problems we are facing and will face in the near future but also the upside potential of taking positive action now—not just eliminating constraints to trade and transportation but actually enabling growth beyond that which is possible under traditional trade and transportation policy, law and regulations. This isn't just about “liberating” 20th century trade and transportation practices from infrastructure constraints—it's ultimately about taking transportation efficiency to whole new levels. Bottom line is how does the Council leverage research and papers to spur meaningful action and change with government policy and funding entities?

Appendix – demand forecasts

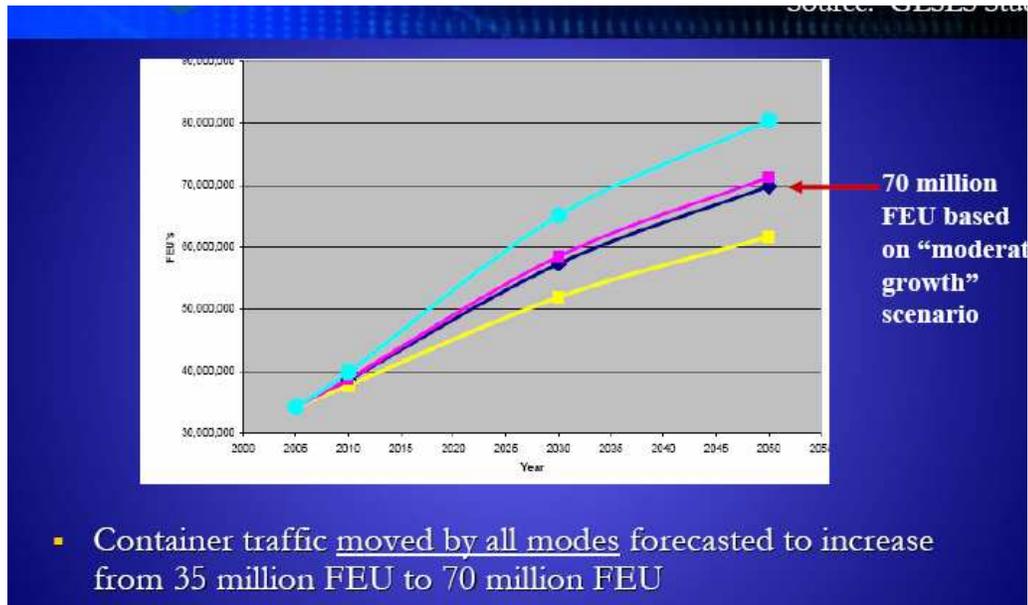
Example 1: Port freight demand projections

Fig. 3 Projected U.S Port Freight Demand



Source: Bohnert, R., U. S. Maritime Administration, 2007.

Example 2: Projected container traffic

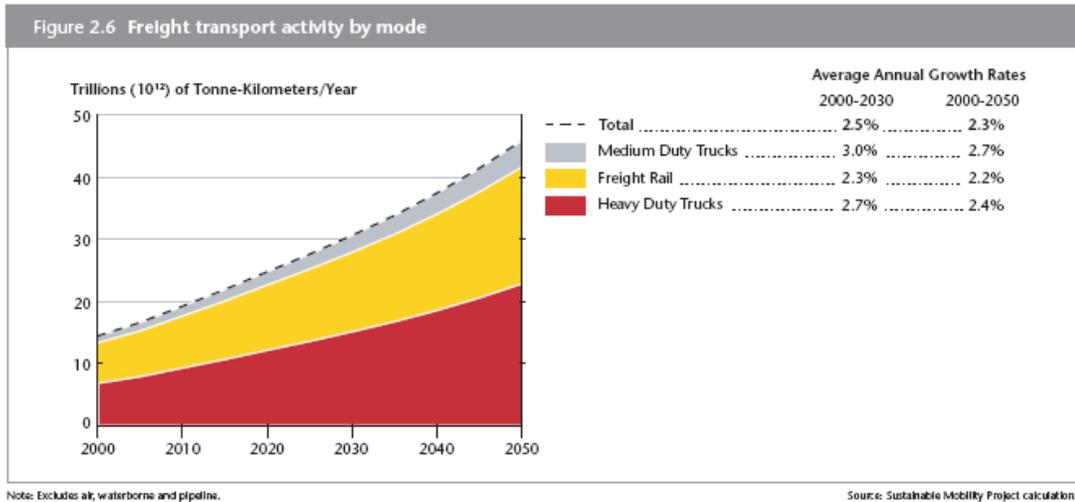


Example 3 Canadian projections of port demand

“The capacity of these facilities created by **Asia’s massive container port development** and the investment that has gone into them, is a tangible measure of Asian countries’ anticipated trade in manufactured products over the next 10-15 years. ... It has been estimated that as a result of surging Asia Pacific trade, West Coast freight demand has been growing at a rate equivalent to one Port of Vancouver -- some 1.8m TEU -- per year.... Setting this against the capacity of ports on the west coast of North America highlights the inadequacy of port infrastructure on this side of the Pacific to keep up with the scale of expected trade growth. It also underlines the urgency of Federal and provincial “Gateway” initiatives to expand Western Canada’s ability to cope with this level of trade - - exports as well as imports.

Despite forecasts that container throughput of BC ports will grow from 1.86m TEUs in 2004 to 5.41m TEUs in 2015, political support for action has been slow. Fortunately, some progress is now being made. The Port of Vancouver plans to more than double its capacity by 2020, although expansion projects are hampered by complexities beyond its control, such as environmental assessments and coordination with supporting road and rail development. The Port of Prince Rupert is set to open a new container facility in 2007, capable of handling 500,000 containers a year; this number is planned to eventually increase to 2m TEU. Together, Vancouver and Prince Rupert by 2008 will have the capacity to handle 3.79m containers. But this just meets the 2010 throughput demand prediction of 3.55m TEU.” (Asia Pacific Bulletin, Asia Pacific Foundation of Canada, June 14, 2006)

Example 4: Carrier demand (Sustainable Mobility Project calculations)



Example 5: Rail capacity requirements

This study estimates that an investment of \$148 billion (in 2007 dollars) for infrastructure expansion over the next 28 years is required to keep pace with economic growth and meet the U.S. DOT’s forecast demand. Of this amount, the Class I freight railroads’ share is projected to be \$135 billion and the short line and regional freight railroads’ share is projected to be \$13 billion. Without this investment, 30 percent of the rail miles in the primary corridors will be operating above capacity by 2035, causing severe congestion that will affect every region of the country and potentially shift freight to an already heavily congested highway system. (Final report, National Rail Freight Infrastructure Capacity and Investment Study)

Example 6: Growth in the Demand for Freight Transportation

To more clearly understand the severity of the trends that are discussed in the section above, it is helpful to review how the demand for freight transportation is expected to change in the future. Numerous studies have been conducted to forecast growth in freight transportation demand. Although the results of those studies may differ, they all point to explosive increases in demand—increases that are sure to further erode the performance of our current freight system unless something is done.

Based on an evaluation of multiple studies, a plausible demand growth scenario for each mode was developed for this analysis. Under our scenario, the annual growth rates in ton-miles for the period between 2000 and 2020 are as follows:

- ⌚ Trucking = 2.5% per year,
- ⌚ Rail = 2.0% per year,
- ⌚ Barge = 0.70% per year, and

- ⌚ Air freight = 4.0% per year.

As depicted in Exhibit ES-6, even under what some may argue to be conservative demand forecasts, these growth rates mean that by the year 2020 our freight system will have experienced a 64 percent increase in trucking ton-miles, a 49 percent increase in rail ton-miles, and a 15 percent increase in barge traffic—all while the demand for air freight will have more than doubled. To put these growth rates in context, consider the following.

- ⌚ **Trucking:** At the national level, a 64 percent increase in truck ton-miles between 2000 and 2020 means 79 million more intercity truck shipments per year by 2020. As an example, at a regional level, this growth would mean 5 million more intercity truck shipments per year out of the Houston region by 2020, or nearly 7 million more truck VMT per year on Houston area roadways.
- ⌚ **Rail:** At the national level, a 49 percent increase in railroad ton-miles between 2000 and 2020 means that 7.8 million more rail carloads will be originated per year by 2020, or 90,000 more freight train movements will be originated per year by 2020. At the regional level, such growth implies 360,000 more rail carloads originated per year in Chicago by 2020, or more than 4,000 more yearly freight train movements in the Chicago area by 2020.
- ⌚ **Barge:** A 15 percent increase in barge ton-miles between 2000 and 2020 means that 37,000 more barge movements will occur on the Ohio River per year by 2020 and 25,000 more barge movements will occur on the Lower Mississippi River per year by 2020.
- ⌚ **Air:** A 120 percent increase in air cargo ton-miles between 2000 and 2020 means 9,600 more annual air cargo plane departures at LAX by 2020 and 3,500 more annual air cargo plane departures at Dallas-Fort Worth Airport by 2020.

The ramifications on our freight system's ability to accommodate this growth in demand are severe, especially given little or no change in government policies and programs designed to enhance the system's effective capacity.

("2010 and Beyond: A Vision of America's Transportation Future: 21st Century Freight Mobility" Final Report, August 2004, Prepared for: The National Cooperative Highway Research Program NCHRP Project 20-24 (33) A)