Rail Short Haul Intermodal Corridor Case Studies:

Industry Context and Issues

Prepared by

Foundation for Intermodal Research & Education (FIRE)

Christina S. Casgar • David J. DeBoer • David L. Parkinson

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About This Report

Preparation

The Foundation for Intermodal Research and Education (FIRE) prepared this report. FIRE was created as a non-profit corporation [501(c)(3)] under its parent organization, the Intermodal Association of North America (IANA).

The Foundation serves the intermodal freight community by developing and distributing information about intermodal transportation. The Foundation also addresses the interests of intermodal carriers and shippers as an information source for industry statistics, intermodal policy issues, and linking the right players together to solve intermodal challenges.

FIRE also acts as a catalyst to form financial and technical partnerships with communities, governmental agencies, carriers, shippers, and third party suppliers who benefit by leveraged problem-solving approaches.

For additional information about the Foundation, or to view a PDF version of this report, visit the web site at www.intermodal.org/FIRE.

Report Corridor Case Studies: Cost and Benefit Estimates

Precise, long-term intermodal corridor cost estimates for trade-off analyses do not exist, unlike established cost estimates for highway and transit investments. Therefore, the discussions of intermodal corridor costs and benefits are first approximations ***only***. The case study costs and benefits should be considered as reasonable estimates for purposes of illustration and discussion ***only***.

Report Corridor Maps: Visual Tools Only

Corridor maps are an evolving public planning tool. The FHWA and FRA maps are included as visual corridor concepts ***only***.

Report Dissemination

This document was sponsored by the Federal Railroad Administration (FRA), US Department of Transportation (USDOT), in the interest of information exchange. The case studies and findings are the responsibility of the authors and do not necessarily represent offical FRA/USDOT policy.

Foundation for Intermodal Research and Education

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Table of Contents (Study Outline)

Executive Summary

The objective of this report is to provide an industry context for public officials who are interested in rail short haul intermodal corridors and to offer a template for analyzing related costs and benefits. Public agency analysis and investment in short haul corridors present a fundamentally new sort of challenge for public sector transportation planners. Therefore the background material and the case studies open the door to a number of short haul intermodal issues, which are subject to an increasing level of state and local attention. Not only are rail intermodal issues producing state and local impacts but state and local responses will produce impacts on the nation's future freight capacity. Four major themes are developed in this study.

General Themes

1) Freight Volumes and System Congestion are Growing and Concentrating

The study points out that the nation has transformed from a domestic economy into a global economy. Continued growth of the global economy translates into greater intermodal and domestic freight volumes. These volumes are concentrating in key hubs (very often in major metropolitan areas) and are distributed from these hubs via a network of highway and rail services.

In a short haul corridor, these escalating levels of freight are predominately carried by trucks, on the same highway corridors where there is increased personal travel (expressed in vehicle miles traveled (VMTs), and creating levels of compound congestion on highways. These VMT levels are growing at rates which cannot be sustained in a continued growth scenario. An examination of different distribution patterns is needed.

Increased truck VMTs + increased passenger VMTs + increased freight capacity pressures = compound congestion

Public officials, particularly those around major metropolitan areas where major freight hubs exist, will intuitively understand this issue of compound congestion.

2) Public and Private Partnerships for Corridor Solutions are Needed

The second point made in the study is that the movement of people and goods and information is transforming into three overlapping systems that are increasingly interactive and integrated. As the integration and concentration of people and goods movement continues, available capacity becomes more expensive and more difficult to secure in certain key hubs. This phenomenon has prompted a number of corridor-based studies and projects aimed at maximizing existing capacity and freight flows.

Compound congestion + finite capacity = need for public private corridor solutions

3) Economic, Social and Environmental Costs Need to be Part of a Corridor Analysis

In an era of globalization and compound congestion, there is a need for new insights into what the authors have referred to as the "triple bottom line" which includes economic, social and environmental costs for freight corridors. Public investment studies, which incorporate this triple bottom line, are an evolving transport practice (referred to in this report as sustainable freight investments). Therefore, new insights into a wider array of public costs and benefits will have to be developed; this report is a step in that direction. Short haul intermodal corridors can provide relief valves for congestion on a site-specific basis, but short haul corridors will not solve all freight capacity challenges.

To frame that sustainable view, this study calculates the highway user revenues paid by heavy trucks for interstate usage and compares those highway user revenues to current and projected net public costs. The analysis shows that in all corridors, with the exception of the corridor sections involving rural New York State interstate miles, the net public costs of heavy truck mile useage exceeds the user fees paid. From a sustainable perspective, other freight capacity options such as short haul corridor investments need to be considered.

Increased freight volumes + hub concentration + compound congestion = need for new capacity solutions derived through economic, social and environmental analysis

4) New Planning Tools for Corridor Capacity Development are Needed

This dynamic changing shape of freight networks is producing a corresponding shift in the location and scope of freight activities, concentrating the effect of those activities in high volume hubs and corridors. The challenge before planners is that corridor analysis is a rapidly evolving phenomenon but it requires difficult trade-off analyses, and implementation requires a long planning horizon. At present, the tools available to complete a corridor analysis are limited. Further research is needed in network analytics and mapping, analysis of all benefits and costs from a multi-state perspective, and better cargo forecasting studies are also needed. Additionally, two other enormous areas for study are how future freight capacity improvements are financed and how land use planning around existing freight facilities impacts overall congestion.

Public and private capacity challenges + public private investment challenges = need for improved corridor planning tools

Given that corridor analysis tools are an evolving art, this study offers a basic template for analysis. Three corridor feasibility studies are developed in this report. Additionally, a new corridor concept is presented as Appendix Item 10.3. Base case costs and cargo estimates were developed based upon industry averages, and averaged trucking and rail costs per mile were developed. The study templates of estimated costs and benefits are summarized below.

Corridor Cost Feasibility Summary

Three (3) short haul intermodal corridors were examined in this study:

- Savannah to Atlanta, GA (255 highway miles)
- Port of New York/New Jersey (PONYNJ) to Buffalo, NY (388 highway miles)
- Port of New York/New Jersey to Pittsburgh, PA (363 highway miles)

Corridor economics did not include the cost of local intermodal connector and street improvements, but rather captured costs on the interstate routes connecting the origin and destination points. The economics were broken down into three basic components:

1. Trucking costs—averaged at $1.375/mile
2. Rail costs—corridor and hub dependent based on long run variable costs (LRVC)
3. Public Benefits (savings)—Highway and social/environmental costs by intermodal rail move

Summary of the Per Unit (Loaded Semi-Trailer or Container) Economics of the Rail vs. Truck Move					
Corridor	Truck Cost Per Unit ($)	Rail Costs Per Unit ($)	Net Rail vs. Truck Cost Per Unit ($)	Public Benefit-Savings Per Unit By Rail ($)	Total Savings-Rail vs. Truck Per Unit ($)
Savannah-Atlanta	351.00	*468.00	(117.00)	36.00	(81.00)
PONYNJ-Buffalo	534.00	490.00	44.00	42.00	86.00
PONYNJ-Pittsburgh	499.00	480.00	19.00	53.00	72.00
*Best case analysis					

The comparison indicates that the PONYNJ to Buffalo and Pittsburgh corridors are economically feasible today, **IF there is sufficient rail volume for full intermodal trains, and IF facilities/terminal costs are offset by a public entity other than the railroad**. Prudent public investments in short haul projects will be very site specific, and can be approached from a range of options such as start-up dollars, infrastructure subsidies, equipments subsidies, or operating subsidies. Such a range of investment options reflects investment approaches often applied to commuter rail development. The report also outlines how these corridors could be funded through public benefit highway-related savings. Because the Savannah to Atlanta is relatively short (255 highway miles), the rail intermodal economics appear to be less favorable.

Summary of Public Benefits per Corridor for Rail Intermodal Aggregated Benefits Per Year and Over 20 Years (Constant 2000 dollars)		
Corridor	Aggregate Public Benefits One Year ($)	Aggregate Public Benefits 20 Years($)
Savannah to Atlanta	$889,500	$17,800,000
PONYNJ to Buffalo	$1,940,600	$38,812,000
PONYNJ to Pittsburgh	$1,589,000	$31,780,000

The four themes developed in this study, coupled with corridor case study templates, should provide useful insights for public planners looking at infrastructure investment trade-off issues. If, indeed, we need to make future freight infrastructure investments with respect to a triple bottom line, this study offers a step in that direction and should stimulate new thinking about short haul approaches.

Chapter 1—Introduction and Study Overview

1.1—Study Sponsors and Contributors

This report was completed by the Foundation for Intermodal Research and Education (FIRE). The United States Department of Transportation's (USDOT) Federal Railroad Administration (FRA) primarily sponsored the Foundation's work. In addition to the sponsorship of FRA, this study was co-sponsored by CSX Transportation, the Norfolk Southern Railroad (NS), and the Port Authority of New York and New Jersey (PANYNJ). Each of the sponsors is deeply involved in the development of intermodal operations, and the emerging public and private challenges of developing short-haul intermodal corridors.

The report authors include: FIRE Board members David J. DeBoer, Greenbrier Intermodal (ret.) and David L. Parkinson, Consultant to Rail America, each of whom gave invaluable time to the development of this study, and without their combined 55 years of rail expertise, this study would not have been possible. Industry executives provided helpful insights into trucking costs and operating statistics. Christina Casgar, FIRE Executive Director, was responsible for integrating information and preparing the report.

The study team members include: Jane Bachner, William Gelston and Scott Greene, who were instrumental in framing the study concept and providing funds from the Federal Railroad Administration (FRA). Study participants from supporting organizations include: Randy Evans and Bill Goetz from CSX Transportation; James McClellan and Steve Eisenach from Norfolk Southern Railroad; Don Lotz, Robert James and Paul Gessner from the PANYNJ team. Each gave generous support and provided the industry context insights which are fundamental to this study.

Many others provided expert insights and participated in personal interviews to develop this study. Special thanks go to: Thomas Malloy, IANA; Steve Branscum, Jim Fitzgerald and Paul Nowicki, Burlington Northern Santa Fe Railway (BNSF); Doug Miller and Tim Boyce from Canadian Pacific (CP) Expressway; Richard Nordahl of CalTrans; Leo Penne, American Association of State Highway Transportation Officials; Craig Rockey of the Association of American Railroads (AAR); Steve Nieman and Dan Smith of The Tioga Group; Bill Rogers, Motor Freight Carrier Association; and Lance Grenzeback and Dan Beagen of Cambridge Systematics, Inc. Very special thanks go to Harry Caldwell and Bruce Lambert, Federal Highway Administration (FHWA), for noteworthy support on corridor issues and graphics. Finally, the patient and ever-professional editorial services of Marguerite Miller were critical to this study as well.

1.2—Report Funding and Objectives

The authors used best available cost and benefit estimates, **with the objective of providing an industry context for public officials who are grappling with freight corridor issues and require useful background information for analyzing investments in short haul rail freight corridors.** This study offers general guidance and further suggests that additional analytical tools need to be developed.

There is increasing public policy interest in understanding the dynamics of growing freight volumes, yet public officials need a deeper understanding of industry operations and costs to probe investment trade-off issues. This report offers that industry background. Concentration of freight volumes in key corridors, operational insights into the dynamics of rail movements compared to truck movements and considerations about funding freight capacity are covered in this report.

This study's fundamental concern is that the freight transportation system may be:

- at or beyond capacity at certain high-volume hubs and corridors, based on 1998 volumes from US Department of Transportation's FHWA Freight Analysis Framework Data (FAF);
- growing at a level which will exceed capacity limits at certain high-volume hubs and corridors (based on 2020 estimates from FHWA Freight Analysis Framework Data); and,
- funded in such a way that future freight capacity is not addressed nor are the full social costs of transportation modes addressed.

Given these concerns, analysis of a broader spectrum of costs and benefits for highway and rail corridors is a challenge for both public officials and private carriers. An initial template is suggested for officials who need to evaluate corridor costs and benefits.

Actual case study corridors are evaluated in this initial template, but the reader needs to be aware that any numbers cited in this report are only reasonable estimates, and are offered as general guidance for public officials interested in corridor evaluation. It is understood that public agencies undertaking corridor identification and respective costs and benefits would have to develop such projects with the existing 3C (continuous, cooperative, and comprehensive) planning approach. The corridors presented in this report are realistic corridor projects selected by the three study co-sponsors.

1.3—Study Corridors To Be Examined

Each study co-sponsor was actively engaged in this study, and participated by offering information and operating data on a selected study corridor. Therefore this report will focus on three short haul corridors; various graphic depictions of these corridors appear in Chapter 5. The study corridors are:

- The Port of New York and New Jersey (PONYNJ) to Buffalo (selected by the PANYNJ)
- The Port of New York and New Jersey (PONYNJ) to Pittsburgh (selected by NS)
- The Port of Savannah to Atlanta, Georgia (selected by CSX)

1.4—Study Scope and Chapters

The subsequent chapters are:

Chapter 2, Framing the Short Haul Issues, defines the concept of freight corridors and outlines why short haul intermodal corridors are being analyzed as new potential strategies to address growing capacity constraints. This chapter also examines the drivers of finite capacity and a matrix of policy issues, actions steps and stakeholders. The concept of a new policy perspective on capacity development is introduced.

Chapter 3, What Drives Freight and the Need for Corridors, discusses other corridor studies, why and where corridor projects develop, and initial discussion of corridor financing.

Chapter 4, The Business of Intermodal, provides an overview of why the apparent cost advantages of rail versus truck are not always valid, particularly for short hail moves. It discusses some cost issues which relate to the cost factors in Chapter 6.

Chapter 5, Short Haul Corridor Evaluation: Industry Context, provides specific corridor characteristics and descriptive graphics of the three intermodal corridor case studies. The graphics in this chapter will amplify system capacity and network issues.

Chapter 6, Private Sector Cost Factors: Comparison of Trucking Versus Rail Cost Components, introduces industry costs and modal comparisons, including:

- a. Trucking Line Haul Costs
  - i. Capital Costs—Tractor and Trailer
  - ii. Fuel
  - iii. Labor
  - iv. Maintenance
  - v. Scheduling Impacts
- b. Rail Costs
  - i. Capital Costs—Terminal, Land, Paving, Building, Lift Equipment
  - ii. Operating Cost—Terminal Functions (Gate, Hostelling, Lift, Clerical)
  - iii. Capital Costs—Line Haul
  - iv. Operating Costs—Line Haul by Element
    1. Line Haul Vehicle Costs
    2. Maintenance of Equipment
    3. Crew, Fuel, Dispatch
    4. Maintenance of Way (infrastructure)

Chapter 7, Public Benefits and Costs, addresses and quantifies public benefits and costs of the intermodal study corridors and considers the direct and social costs of externalities associated with metropolitan truck moves. The section looks at the benefits of short haul intermodal in the urban and rural areas such as: congestion costs and benefits on urban sections of freight corridors (MPO level), marginal trucking costs, user fees and net corridor costs. These costs and benefits are then examined on each corridor and aggregated over a 20-year period. Preliminary conclusions about each corridor are offered.

Chapter 8, Public Financing Options, provides a financing overview for short haul intermodal systems. Given the increasingly complex public and private costs associated with metropolitan congestion, the study identifies incentives and financing options for urban area intermodal services. It identifies inherent approaches and challenges related to intermodal programs where the private costs and the pubic benefits need to be carefuly evaluated.

A range of financing tools are discussed, including:

- a. Federal and State Grants
- b. Tax Incentives (Intermodal assets and facilities)
- c. Rail investments from States and Ports
- d. Air quality credits and offsets through the CMAQ program
- e. Property tax abatements on specific rail corridors

f. Tax exempt indebtedness
g. Regional financing concepts

Chapter 9 presents the study summary and recommendations.

Chapter 10 contains appendix material.

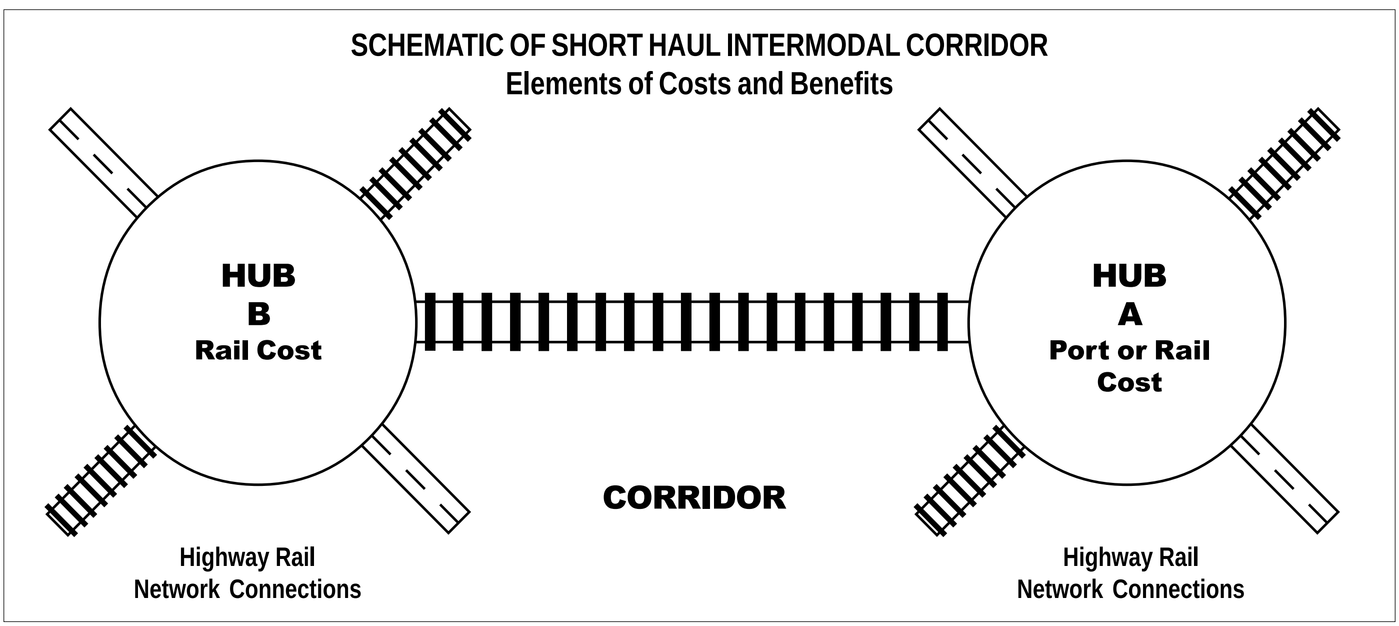
Chapter 2—Framing the Short Haul Issues

2.1—Defining a Short Haul Rail Freight Corridor

For the purposes of this study, a short haul rail freight corridor is a geographically banded area where freight moves in a directional flow connecting major freight nodes (terminals) and has a mainline rail element, with connecting roadways. This definition bears further quantification within the context of any detailed study. Examples are:

- In the past, rail corridors have been considered to be 700 miles or longer, where intermodal is most cost effective. More recently, successful short haul intermodal operations under 700 miles have been appearing and include service innovations such as: Florida East Coast Railroad, the NS Triple Crown Service Network, Canadian Pacific's Expressway and others.
- In this study, analysis is being done on rail corridors which are shorter than 700 miles. That is because these rail corridors served highly congested metropolitan areas, and parallel highly congested highway corridors. New freight movement strategies merit more analysis in a capacity constrained environment.
- Rail corridors have been developing (i.e., Alameda Corridor, the Canadian Pacific (CP) Expressway Corridor and FAST Corridor in Washington State) because they offer an environmentally sustainable means of accommoding freight volume growth. It is increasingly recognized in diverse urban settings, where effective highway options are all but exhausted, that rail intermodal improvements must be considered.
- In order to provide a background context, this report will look at a variety of rail corridors, and their respective characteristics. Some corridors discussed are quite short, such as the Alameda Corridor, which is about 20 miles, and others, such as the CP Expressway Corridor are over 500 miles long.
- Many complex issues surround a discussion of various rail corridor types, meaning that the cost-effective nature of a corridor will be driven by multiple external factors, including network issues, but concentrated freight volumes are a constant characteristic.
- It is critical for public officials to understand that both rail and highway freight corridors have unique aspects of sustainable traffic levels. Developing either rail or highway freight corridors will have to be underpinned by a solid forecast of domestic or global freight flows.
- Scale economies are critical to cost efficient rail corridors due to high capital costs. Terminals on a corridor need to be located and designed with respect for network consideration.

The public planner will have to first understand initial capital costs for short haul intermodal projects, and the relationship of those costs as drivers of rail corridor efficiencies. The initial burden of costs is outlined in the Table 2.1.1. The key



point of the table is that the right of way, track, bridge costs and related maintenance are fixed capital costs for the railroad industry. This is in contrast to the trucking industry, which does not bear the same initial infrastructure costs and investment risks.

Table 2.1.1 Typical Initial Burden of U.S. Freight Transportation Costs
Intial Bearer of Cost*

Model and Type of Cost	Carrier	Government	Other User of Common Infrastructure	Public	Shipper
Truck or Barge					
Vehicle	All				
Infrastructure**	Part	Part	Part		
Air Pollution				All	
Noise Pollution				Part	
Congestion	Part		Part		Part
Accidents	All				
Railroad					
Vehicle	All				
Infrastructure**	All				
Air Pollution				All	
Noise Pollution				All	
Congestion	Part			Part	
Accidents	Part	Part	Part	Part	Part

NOTES:
Source: TRB Special Report 246, *Paying Our Way, Estimating Marginal Social Costs of Freight Transportation*
*The initial burden is the incidence of the cost before the freight tariff is paid by the shipper to the carrier and before user fees are paid by truck and barge operators to government.
**The costs of infrastructure wear caused by traffic are borne initially in part by government in the form of higher road maintenance costs and in part by users in the form of higher vehicle operating costs and fees.

As the above table illustrates, railroads bear **all** of the initial costs for both the vehicle and the infrastructure. Those initial infrastructure costs are significant barriers to short haul corridor development. Land cost in and around container ports can start at over $1 M per acre when land, paving, equipment costs and access roads are fully costed. State-of-the-art intermodal rail terminal costs are also significant initial costs. This study outlines strategies to address those initial cost barriers, and further develops the discussion around why short haul corridors will most likely require new public/private investment approaches.

2.2—Why is This a Rapidly Emerging Public/Private Policy Issue?

Short haul intermodal studies are underway in many parts of the United States, and these US-based studies mirror what is already a policy direction being examined in other parts of the world. The European Union (EU) is well along with studies on integrated intermodal corridors in the European Union context, and has developed a plan called "Priorities for Development of the Trans-European Transport Network" (TEN-T), and is participating in the development of the Betuweroute (a rail corridor that will connect the Port of Rotterdam with the German Rail System). Additionally, the Australian government has examined Greenhouse Policy Options for Transport, including diversion of loads from truck to rail in Report 105 (published by the Bureau of Transport and Regional Economics). Finally in Canada, the Canadian Pacific Railroad is operating the market-viable Expressway intermodal corridor, which moves intermodal trailers on the congested corridor between the Canadian cities of Montreal and Toronto with final linkage to Windsor, Ontario and Detroit, Michigan.

In the United States, our public policy attention to intermodal corridors began with the inauguration of the Alameda Corridor, which is an operating 20-mile rail corridor to shuttle intermodal units out of the Los Angeles/Long Beach Port Complex. The planning of the Alameda Corridor began in the late 1980s, and public funds allocated from the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), leveraged the private investment in the Corridor. In 2002, the Alameda Corridor was dedicated, and today is running at almost full capacity. Other US intermodal corridor initiatives are now underway in these areas:

- The Port Authority of New York and New Jersey has recently launched the Port Inland Distribution Network (PIDN). The PONYNJ to Buffalo Corridor and the PONYNJ to Pittsburgh Corridor are but two corridors in the PIDN initiative. Complete information on the PIDN can be accessed at the web site, www.portnynj.com.
- The Virginia Department of Transportation (VADOT) has I-81, I-85 and I-95 corridor initiatives underway.
- The Virginia Port Authority operates a Virginia Inland Port (VIP) 220 miles inland from the Port, with 5-day a week rail service to the marine terminals.
- The Ports of Philadelphia and The Pennsylvania Department of Transportation (Penn DOT) have an Agile Port Study (an intermodal corridor between Philadelphia and Harrisburg) underway.
- The Ports of Seattle/Tacoma are working with Washington State Department of Transportation (WADOT) on the FAST Corridor.
- The Ports of LA/LB are looking at an Agile Port Concept, as well as an extension of the Alameda Corridor and an Orange County Corridor.
- The five states (NJ, PA, DE, MD, VA) are looking at a Mid-Atlantic Rail Corridor in conjunction with three railroads (CSX, NS and Amtrak).
- The BNSF Railroad is examining development of intermodal corridors in the states of CA, TX and WA states.
- The Texas Department of Transportation (TXDOT) is developing a substantial Trans Texas Corridor Initiative, which is laying out several highway and rail corridors (both passenger and freight) across the state of Texas. BNSF Railroad has presented a proposal to TXDOT to develop a rail corridor from Dallas/Fort Worth to Houston.
- The California Department of Transportation (CalTrans) is looking at several intermodal corridors in that state under an umbrella project entitled California Inter-Regional Intermodal System (CIRIS).

The above list of both public and private transportation providers who are actively studying intermodal corridors validates the need for new planning tools and new approaches. The growing list of corridor projects/studies indicates that alternative policy options to standard highway building responses are necessary strategies to accommodate the sustainable growth in freight distribution. There is an evolving "holistic" approach to goods movement in an environment where highway demand clearly exceeds available and sustainable highway capacity. In many urban areas, it is nearly impossible to build new highways, and if possible, lead times can be over 10 years. There is a growing interest in corridor projects as tools to address the issue of sustainable transport of goods and people. Also included in the report is an attempt to estimate environmental costs and benefits. A matrix of policy issues surrounding these issues appears in Table 2.3.

Table 2.3 - Short Haul Intermodal Policy Matrix

Policy Issue	Action Steps	Parties Involved
System Capacity (Incl. Congestion and Sustainability)	● Public/Private Partnerships ● Terminal and Facilities Planning ● Develop System Planning and Understanding of Corridors ● Assess Relative Costs/Benefits	● Rail Industry ● Maritime Industry ● Trucking Operations ● Federal Government ● State Government ● Local Government
Competing Systems and Funding Thereof	● Public Awareness and Acceptance ● Development of Financial Mechanisms ● Terminal Sharing Agreements ● New State/Rail/Truck Partnerships	● Industry and Public Agency Task Force ● A Special-Purpose Authority which can be a neutral player in Corridor development
System Planning and Integration	● Private Financing Plan ● Design ● Education/Consensus Building re: ■ Safety Benefits ■ Cost of Congestion ■ Drivers of Economic Growth ■ Sustainability Issues ■ Corridor Costs/Benefits ■ Air Quality/Noise ■ Rail and Truck Costs	● Rail Operators ● Federal State and Local Agencies ● Trucking Operators ● Maritime Industry ● A Special Purpose Authority which can plan, develop and implement a corridor project on a timetable acceptable to all stakeholders ● Distribution and warehousing companies

2.3.—Short Haul Intermodal Policy Matrix

These intermodal corridor projects are models, which offer potential solutions to highly congested areas, and the acute need for better trade and distribution lifelines to support seaports and their distribution networks. A series of site-specific regional intermodal corridors could present a strategies to bring some much-needed relief to over-crowded regional highways, reducing emissions and travel times. The growing congestion on freeways and the sustainable distribution challenges faced by producers and consumers suggest that time is running out. There is much to be done to advance intermodal corridor concepts. This study is one step, and pilot efforts will be needed in order to test and realize the benefits of effective and efficient short haul intermodal corridors.

Toolbox Studies for further reading on rail corridor studies for public officials

- *AASHTO Rail Bottom Line Report, 2003*
- *Caltrans CIRUS Study*
- *Trans Texas Corridor Study*
- I-95 Corridor Coalition's *Mid-Atlantic Rail Operations Study*
- TRB/NCHRP Report 399, *Multimodal Corridor and Capacity Analysis Manual*
- TRB Special Report 246, *Paying Our Way, Estimating Marginal Social Costs of Freight Transportation*
- TRB and NCHRP Report 8-39, *Financing and Improving Access to US Cargo Hubs*. (To be published Summer 2003.)
- California Borders and Corridors Study

The simple answer to why short haul corridors are being aggressively analyzed is that we are facing tangible capacity challenges which are of concern to both the public and private sector. Those capacity challenges are:

- Freight volumes are increasing.
- Freight delivery schedules are demanding higher levels of reliability.
- Existing highway capacities are at or beyond design levels in many urban areas.
- Travels times are increasing. As congestion increases, public and private costs related to congestion also increase.
- Highway life cycle costs and highway related environmental impacts related to transportation are becoming an accepted and necessary part of the analysis related to freight investment projects.
- Public challenges and public scrutiny of freight investments is growing.
- In an era of sustainable mobility, public policy must address how to make better use of existing capacity, and how to determine both the private and public value of that capacity.
- One intermodal train can take as many as 100–200 trucks off the highway, and a train can move a ton of freight about 400 miles on a gallon of diesel fuel.

2.4—Toward A New Economic Perspective on Sustainable Capacity Development

The three corridors selected by the study co-sponsors are deemed to be market viable candidates for short haul services. These are corridors where rail intermodal transportation *could* provide an environmentally, economically and socially sustainable compliment or alternative to truck options. Rail intermodal presents benefits for freight movement in high volume corridors since it produces fewer emissions, uses less fuel, is safer, and requires less life cycle investments in infrastructure than additional investments in highway capacity. Just as public benefits are attributed to commuter rail, public benefits can also be attributed to freight rail investments.

A traditional economist's choices focus upon the allocation of scarce resources, where multiple goals and objectives are being evaluated in a business context. In this study we are moving toward a blending of business issues, public policy issues, environmental issues, and new financing capabilities, as part of sustainable transportation investment decisions. By including environmental costs, safety and other social costs and life cycle costs of infrastructure investments, we are posing fundamental questions of sustainable freight options which:

- consider all goals and objectives;
- entail consideration of future effects;
- include a social benefit aspect; and,
- treat environmental costs as legitimate costs of transportation infrastructure and long term mobility.

In short, the analysis presented here looks at a triple bottom line of economic, social and environmental objectives.

This study will not recapitulate the freight growth forecast by the Federal Highway Administration's Freight Analysis Framework (FAF) but it will build upon the FAF assertion that there will be a doubling of freight growth by 2020. Under that overall growth scenario, each consortia of public and private parties interested in short haul corridors will need to assemble this information:

1. Conduct corridor specific studies, including a 10-step process for corridor identification and problem definition as outlined in NCHRP Report 399, Multimodal Corridor Analysis Manual.

2. Construct an analysis of the current operating conditions in the publicly managed part of the corridor.

→ 3. Work with seaport operators and rail operators to understand the industry context for corridor operations which will entail an understanding of capital, operating and externality costs.

→ 4. Formulate potential scenarios for public/private financing partnerships, which will effectively and efficiently utilize both rail and highway infrastructure for both public and private benefits.

→ 5. Consider fundamentally new public/private financing approaches to develop intermodal short haul services, which will address the initial burden of costs issues as illustrated in Table 2.1.1.

This report is focused on enhancing the understanding of items → 3, 4 and 5 above. The study team has concluded that short haul intermodal systems would *not* be expected to make a profit initially. Rail intermodal operations have strong economies of scale, which can only be realized *after* major capital investments. Therefore, in the initial phase there would be some level of operating or infrastructure subsidy assistance (loans, credits, etc.) and the subsidy per movement should decline as the short haul corridor operation reaches traffic volumes, which produce scale efficiencies.

2.5—New Drivers of Supply and Demand, Benefits and Costs

Traditionally railroads have viewed their freight intermodal market to be in corridors of about 700 miles or longer. There are exceptions to this rule, but very few in today's market. Low long haul trucking rates, and high local dray costs, expensive ramp facilities and the need to utilize intermodal assets (trailers, containers, rail cars and mainline capacity) are the reasons railroads have focused on 700-mile plus intermodal routes because those routes produce higher longer-haul financial returns.

Nevertheless, there is a major opportunity for railroads to contribute to the alleviation of metropolitan area traffic congestion, infrastructure wear and tear, and associated environmental problems if short haul freight intermodal services were available. These services would focus on major urban areas where traffic congestion is so severe on the urban area freeways that it impedes traffic flows to unacceptable levels. As an example, 42 of 75 major US urban areas have levels of congestion labeled as "undesirable" today, according to the Texas Transportation Institute's 2002 Urban Mobility Study. Truck traffic associated with these congestion levels is a major contributor to the problem. In order for railroads to implement an intermodal service to alleviate urban congestion, traditional pricing and market factors may need to be supplemented by other incentives, which address the public benefits such as improved travel times, accident reductions, air quality enhancement and similar benefits. Therefore, this study seeks a broader understanding of the costs of truck vs. rail moves for the specific corridors and a discussion of how both technology and policy innovations could impact the costs and benefits of short haul intermodal corridors.

This study addresses several sequential components of short haul intermodal aimed at illustrating how, where and when it can be a viable transport option in the three selected study corridors. The corridor studies focus on freight staging areas (ports or inland hubs) on the periphery of an urban area, from which truck traffic could be diverted to or from a rail intermodal hub for movement into or out of the urban core. Such movements could be made via the "Iron Highway" or newer intermodal technology such as the CP Expressway approach.

Chapter 3—What Drives Freight and The Need for Corridors

3.1—A Strong Global Economy Produces Higher International and Domestic Freight Flows

Globalization has substantially changed the structure of the US economy. Into the 1960s, the United States economy operated almost in isolation from the rest of the world. In 1960 the value of trade in the US economy ran at about 9% of the GDP. Today, the value of trade had increased to 27% of GDP and the US is the world's largest importer and exporter. The continued process of globalization is expected to increase the value of trade to as much as one-third of GDP in the next 20 years (WEFA 2000).

The globalization of markets has a tremendous impact on where goods are produced and outsourced, and is why a speedy and reliable freight movement is an unquestionable strategic competitive advantage. A key trend in the production of goods has been a shift away from vertically integrated production enterprises, (which included the transportation function), to a globally dispersed production process where oftentimes firms outsource their logistics functions.

By 2020, even at moderate rates of economic growth, the total domestic tonnage of freight carried by all US freight systems will increase by 100% in the West; by 89% in the Central and Southern states and 79% in the Northeast, according to the FAF. In this same timeframe, every major US container port is expected to at least double in volume, with select East Coast ports tripling their volume and some West Coast ports quadrupling in the volume of cargo that they will be expected to handle (US Chamber of Commerce Foundation, 2003, Report on Trade and Transportation). This immense volume of international waterborne cargo must pass through major gateway ports, and then be distributed either via highway, water or rail connections.

Only through an aggressive program of intermodal improvements will the ports and their highway and rail partners keep up with this growing cargo demand. However, improvement of the North American intermodal system presents unique challenges. The planning and programming of corridor improvements to serve US ports is not solely in the authority of the port itself, nor is it solely under the authority of the state in which the port is located, nor is it solely under the authority of the rail carrier(s) serving a port. What we are seeing is a system of hubs (major seaport hubs or major rail interchange hubs) that have nowhere to expand. Intermodal hubs involve cooperative efforts between several institutional authorities. Therefore, the response to the expansion of cargo flows is to build high volume corridors in order to sustain the rapid movement of large cargo volumes away from the congested hub.

North America has added very little mileage to the entire intermodal freight distribution system over the last three decades. Highways, long haul rail lines, and ports are increasingly congested because rising demand has absorbed most of the readily available freight capacity. The US highway system, which carries the majority of the domestic freight, has experienced a doubling of vehicle miles traveled in the past twenty years, while highway mileage infrastructure has only increased by 1% according to FHWA.

Similarly, the US rail network, a private sector industry that carries about 40% of domestic freight (ton-miles), has increased the volume of freight it carries by 50% since 1980. At the same time, total available track mileage has been reduced by 35% (An American Transportation Story, 2002). Despite major restructuring and rationalization, the rail industry now finds itself short of capacity in certain congested metropolitan areas and along key mainlines. At the same time, US intermodal traffic has grown from 3.1 million trailers and containers in 1980 to 9 million in 2001 (Value of Rail Intermodal to the US Economy).

Chicago, although not part of this study, is a major inland rail hub. Chicago presents a special intermodal problem and is the setting for some of the most challenging problems involving urban freight movement. All the major railroads interchange traffic in the Chicago urban area and almost a third of all rail movements transit Chicago. According to the Transportation Research Board's study, Special Report 271, 1.2 million containers annually are moved by trucks in order to make the interline exchanges, and that "these highway interchanges are significant for the performance of the nationwide intermodal container transportation system and the costs of intermodal [transportation] to shippers and to the community."

3.2—Economies of Scale and Efficiency

US industries, including rail carriers, trucking lines and seaports, today are participants in an increasingly competitive global market place. In order to survive, they must trim margins and increase productivity to levels that would have been unheard of only a few years ago. In the past, the US logistics system had a built in buffer capacity for error, uncertainty and growth. Today, just -in-time (JIT) delivery is the goal. Business plans are being developed around short arrival windows with little storage for cargo arriving early and no reserve if cargo is delayed. Capital investments are only undertaken if there is very near term return on that capital investment.

One of the problems faced by the intermodal system is that as freight volumes have concentrated at our largest ports, which are co-located in major urban areas. Freight capacity is strained to the limit at those key port cities and rail hubs such as Chicago. Thus, land requirements for intermodal terminals, and the access corridors serving those terminals have to be addressed in new ways. The nation's freight infrastructure is no longer over-designed; today, new collaborative models must forge new ways to address capacity constraints. Hence, the examination of rail corridors is a response to growth in freight matched with a response, which will move that freight growth with scale economies and efficiency.

3.3—Capacity Choke-Points: Examples of Corridor Responses

The FHWA Freight Analysis Framework predicts that the US will experience an overall doubling of freight by 2020. Therefore, in less than twenty years from now, US ports must handle over 50 million Twenty Foot Equivalent Units (TEUs or a twenty-foot long ocean going container) per year. This will be equivalent to almost 30% of the container traffic in the entire world by today's measure. As both domestic and international trade increases, the capacity of America's transportation system must increase in order to sustain and grow this nation's competitive advantage.

Building necessary intermodal freight capacity in a congested metropolitan area is time and capital intensive. The largest and most complex of these critical improvements can take decades to plan, design, and construct. Compounding the enormous costs of port and intermodal investments is the fragmented funding approach(s) of each mode. Highway development can be financed through the Highway Trust Fund. Ports rely on a combination of user fees (port charges) revenue bonds, state debt and private financing by the terminal operators. At the same time, railroad infrastructure is funded through the private capital investment of the railroad companies. The development of intermodal rail corridors is a strategy to accommodate freight growth through the building of corridor assets that capture inherent economies of scale and efficiently utilize existing rights-of-way.

Four corridor projects of varying lengths are described in Tables 3.4, 3.5, 3.6 and 3.7 for additional context purposes. While each corridor has a particular set of characteristics, it is useful to understand where these corridors are located, who are the key stakeholders, the physical characteristics of the corridor, and the order of magnitude costs.

3.4—Characteristics of the Alameda Corridor (California)

Alameda Corridor	
Description	The Alameda Corridor consolidates the four port access rail lines (Port of Los Angeles and Port of Long Beach (POLALB) into a single twenty-mile rail cargo expressway linking the two ports to the transcontinental rail yards east of downtown Los Angeles.
Key Players	POLALB, Federal Government, Union Pacific Railroad, BNSF Railroad, CalTrans, and the Alameda Corridor Transportation Authority (ACTA)
Physical Characteristics	One quarter of all U.S. import products arrive through POLALB as the third busiest container port in the world. Volume of containerized cargo through POLALB doubled in the 1990s. By 2020, cargo is expected to triple to ~ 23.4 million TEUs. The Corridor eliminates 200 street-level rail crossings, increases train speed and cuts exhaust from idling trains, cars and trucks. Corridor is vital component of regions air quality attainment plan.
Costs	Unique $2.4 billion public and private sector partnership. Funding includes: $1.165 billion in revenue bond proceeds, $400 million loan from USDOT, $394 million from POLALB, $347 million administered by LA County Metropolitan Transportation Authority, $154 million in other state and federal sources and interest income. User fees from the railroads will pay off bond debt in federal loan.

3.5—Costs Characteristics of the FAST Corridor (Washington)

FAST Corridor	
Description	The FAST Corridor links three deep water international ports, Tacoma, Seattle, and Everett, WA. It includes major rail corridor and roads to and from port terminals. It is about a 75-mile corridor, which will be developed in three phases.
Key Players	The three ports, Puget Sound Regional Council, Washington State DOT, Washington State Freight Mobility Strategic Investment Board, two counties, BNSF Railroad, Union Pacific Railroad, and the Washington Truckers Assn.
Physical Characteristics	FAST will move nation's freight through major northwest freight corridor, improve competitiveness of three ports (third largest marine container complex in U.S.), improve safety at rail/roadway crossings, provide important linkage to transcontinental railroads moving goods to Chicago rail hub in the Midwest. FAST also mitigates impacts of expanding passenger rail traffic.
Costs	$500 million worth of Phase I projects, leveraged by federal investment of $150 million.

3.6—Characteristics of the Mid-Atlantic Rail Operations Study (NJ, PA, MD, DE, VA)

Mid-Atlantic Rail Operations Study (MAROPS)	
Description	Unique cooperative effort of five Mid-Atlantic states, (NJ, PA, VA, DE and MD) with three railroads (CSX, NS and Amtrak) to address 71 rail infrastructure improvements in a phased 20-year program costing $6.2 billion.
Key Players	I-95 Corridor Coalition, five states, three railroads.
Physical Characteristics	Recognizing that the Mid-Atlantic Rail Corridor functions as a regional network and that traffic on the I-95 highway corridor is already often beyond sustainable limits. The study addresses 71 infrastructure projects, including antiquated tunnels and bridges, connections, clearances, track improvements, terminals and grade crossing improvements for the regional freight and passenger rail network.
Costs	Total cost estimated at $6.2 billion. ● Near-term projects = $2.4 billion. ● Medium-term projects = $1.9 billion. ● Long-term project = $1.9 billion.

3.7—Characteristics of the Canadian Pacific Expressway (Canada)

Canadian Pacific Expressway	
Description	Innovative private sector model for 500-mile corridor with four hubs. Montreal, Toronto, Windsor, and Detroit, Michigan. Operated as a wholesale line haul service for truckers. This corridor employs new railcar technologies.
Key Players	Canadian Pacific Railroad (CPR) and its truck customers operate on this densely traveled NAFTA rail corridor.
Physical Characteristics	Functions like a domestic trailer express shuttle. Unlike other examples, NOT connected to a port. Trucks use pre-appointment system and can check in and out of an Expressway terminal in a 15-minute turnaround.
Costs	No public sector support in present system. CPR conducted three years of trial operations and invested $52 million.

Chapter 4—The Business of Intermodal: Why Trains Don't Always Cost Less Than Trucks

4.1—Existing System Costs: The Industry Context

It seems intuitive. Trucks have one driver for one or two boxes. Trains have a crew of two and may carry two hundred boxes. Ergo, trains are cheaper than trucks, right? It is also said that a long haul truck costs about $1.25 to $1.50 per mile to operate and that intermodal moves cost about $1.40 per car mile or $.70 a container or trailer mile. Still cheaper any way you look at it. In fact, this is an illustration of the fallacy of average costing. It is why the transportation planner is often drawn to the idea of replacing short haul truck movements with short haul trains in order to gain needed highway capacity. This study looks at the facts behind the myth, and explains why the current systems, as operated, do not permit the economic operation of such trains. Appendix item 10.3 posits a new system, applied to a specific zone of highway capacity.

Let's first begin with the problem of average costs. Truckload freight generally begins with the move of an empty trailer to a shipper's dock. The freight is loaded, and the driver pulls the loaded trailer for a line-haul move. In reality, the driver who drops an empty trailer then pulls an already loaded trailer that had been dropped empty earlier. The driver may be a line driver, in which case he/she begins the trip to destination, having already received his destination information from the dispatcher.

If his destination is several hundred miles distant, the average cost previously discussed is probably a reasonable ballpark number. Some obvious differences include different fuel costs by region, relative traffic congestion, relative topography to be traveled en route, and relative time in originating the load at the shipper's dock and relative time in terminating the load at the receiver's dock.

The caveat of distance as applied to the truck movement is also critical. If the movement was a "cross-town move," i.e., moved only a short distance—say, ten miles—the cost would probably rise to between five and ten dollars a mile. When one examines the cost elements separately it is easy to see why this seeming anomaly exists.

First let's take the economics of operation of a highway power unit—the tractor. Just as an automobile gets lower fuel economy in city versus highway driving, so a trucking power unit achieves lower fuel economy in stop and go traffic than if it were out on the open highway. Likewise, (remember we are looking at COST PER MILE, not

Intermodal vs. Trucking Business Model

Perhaps the best analogy for a trucking business model is the choice we make for a personal trip. Do we take our personal automobile or take the commuter train? If we take the auto, we get in at home, drive to where we are going and park. Total trip time is usually less by personal auto.

An economist will tell us that the personal auto trip was probably the most expensive option we could have chosen. An environmental analyst will tell us that it was the most inefficient use of fuel and polluted the air to the greatest extent.

The train reduces these cost and environmental factors but introduces a significant "hassle factor." First, we need to get from home to the station (rail terminal) by auto, bus or taxi. Next we need to buy a ticket and clear security. The train runs on a schedule, which may involve a wait. Lots of others may board the train with us (which is what makes the train efficient). The train lets us off at another rail terminal, which requires another taxi, bus or auto trip to get us to our destination.

Trucks are like our auto, while the train trip is the passenger version of freight intermodal. The tradeoff is hassle factor versus efficiency.

total cost of the move) a tractor and trailer moved ten miles per day has about the same capital cost as a tractor and trailer moved five hundred miles per day. The cost per mile of the latter move per mile is nearly fifty times cheaper FOR THAT COST ELEMENT.

In terms of the labor cost for the driver, if he/she could drive five hundred miles in a day, and makes only one "cross-town move," the driver's cost per mile is also fifty times greater per mile for that shorter move. The driver may, however, be able to make another cross-town move, which would make that cost element only twenty five times higher than the long move.

Certain overhead costs are non-variable, that is, they do not vary by length of haul. Examples would be dispatching and billing costs. A dispatcher needs to give a driver instructions on pickup and delivery for the load regardless of how long the move is. Likewise, a bill of lading and a freight bill procedure are generally the same regardless of length of haul. Certain other costs are generally fixed in nature, such as executive salaries and supervisory costs.

Similarly, rail cost elements vary greatly with distance. In a later chapter, we will take both the rail and trucking cost elements in detail. To understand the differences between intermodal and straight highway moves, let's return to the trucking example. The typical truck move goes from a trucking terminal with an empty trailer to the shipper's dock, where a driver picks up a loaded trailer. Assuming it is a full truckload move, the driver then proceeds with his line haul highway move to the dock of the receiver, and the load is complete.

In the case of intermodal, a dray trucker typically proceeds from the terminal to an intermodal ramp, picks up an empty container and drives to the shipper's facility where he/she picks up a load and takes it back to the intermodal terminal. This is referred to as the origin dray. The cost will vary with mileage and congestion; however, $50–75 for the move would be on the low side of average. On the delivery end, the process is reversed with a termination dray, producing a cost of $100–$150 that the all-highway move does not have.

Next is the processing and loading of the trailer or container at the origin end of the move. This is typically done at a cost of $40–$75. Unloading at the intermodal terminal at destination produces a similar cost. This is an additional $80–$150 in costs not borne by the all-highway move.

Assume the line haul cost elements average $1.40 per car mile or $.70 per trailer or container for an average sized intermodal train. Just using the costs **not** incurred by the highway move, i.e., the terminal and drayage costs, adds an extra $180 to $300 cost per trailer or container by intermodal move vs. by an all-highway move. Intermodal terminal and dray costs (at terminals of origin and destination) are roughly equivalent to a trucker's cost to carry goods 120 to 200 miles. Then the rail line haul costs must be added to the overall costs of the intermodal move. These additional intermodal terminal and dray costs point out why the 700-mile benchmark, as a breakeven point (comparing highway moves to intermodal moves), has been an industry norm.

As long as the intermodal terminal loading/unloading and drayage functions need to be performed by the railroad, those costs will continue to restrict railroads from offering services competitive to the all-highway move for short haul moves. If the scale economies of intermodal are to be utilized, using short haul train services to ease highway congestion, it is clear that a system will have to be developed to remove or reduce the drayage and terminal cost factors, or subsidies will be needed to make the service viable.

Car Type	Drive-on Loading	Mechanized Loading	Standard Hwy. Trailers	Intermodal Trailers	Containers
89 Foot Flat	Yes	Yes	No	Yes	Yes
TTEX	Some	Yes	No	Yes	No, except on chassis
Spinecar	No	Yes	No	Yes	Dual purpose car only
Expressway Car	Yes	Yes	Yes	Yes	No, except on chassis
IM Rampcar	Yes	Yes	Yes	Yes	No, except on chassis
Doublestack	No	Yes	No	Dual purpose only	Yes
Roadrailer	Carless	Carless	No	Special Unit	No

4.2—Existing Intermodal Systems

Existing systems break into three general categories (see following table). They include trailer systems, container systems and specialized non-standard systems. Early intermodal involved the movement of standard highway trailers "circus loaded" onto flatcars, so called because of the similarity to the loading of circus wagons on flatcars in the early days. The trailers were backed onto a string of flatcars by terminal employees in a rail terminal and then secured to trailer hitches on the car.

As terminals grew in size, mechanized loading by front load machines or overhead cranes became common practice. Because of slack action in intermodal trains, and damage done in the terminals to bottom rails of highway trailers, stronger trailers were developed for intermodal service. Today, virtually all trailer loading is mechanized, and few circus-loading ramps exist. There are two exceptions, both of which grew out CSX's Iron Highway model. One is the Canadian National Intermodal Ramp Car, and the other is the CP Expressway Service. These are both used for short haul services and will be discussed later in the chapter.

4.2.1—Trailer Cars (TOFC)

Conventional trailer hauling equipment is of two basic types, the 89-foot flatcar and the articulated spine car (see *Intermodal Freight Transportation*). The 89-foot flatcar was the workhorse of the fleet for several decades. In the era of the 40-foot trailer it remained the standard car type, with two trailers loaded per flatcar. As trailer sizes increased to 45 footers, a method was developed to allow trailer overhang, which added years to the usage of the 89-foot flatcar. As trailer sizes grew to 48, 53, and 57 feet, some 89-foot cars were modified by TTX by semi-permanently connecting two flatcars with a drawbar and allowing the longer trailers to bridge across the gap between cars.

As railroads became more interested in improving net weight to tare weight ratios of railcars, the Santa Fe Railroad developed what would become known as the articulated spine car. A multi-section car with shared articulated trucks between intermediate units, it reduced train weight (and thus, fuel consumption). It also dramatically improved ride quality by the elimination of end-of-car cushioning, thereby eliminating most in-train slack action.

The two relatively new trailer carrying units are the CN Intermodal Ramp Car and the CP Expressway Car. Each car is specifically designed to haul highway trailers in relatively short haul markets. Each is designed as a drive on/drive off rather than a lift on/lift off system. This eliminates the need for expensive lift equipment and for costly paving needed to handle the lift machines. The cars themselves, however, are more expensive per available trailer or container slot than any other alternative.

Toolbox

Study items for further reading on existing rail system specialty cars.

Intermodal Freight Transportation, 4th Edition. Published and available through the Intermodal Association of North America and the Eno Transportation Foundation.

Piggyback and Containers, David J. DeBoer, 1992, Golden West Books.

4.2.2—Container Cars (COFC)

When the international container was introduced in the 1950s the traffic was generally handled on chassis as a trailer on an 89-foot car. Later, some 89-foot cars were built as container only cars, allowing containers to be moved without chassis, and still later as combination trailer/container cars with retractable trailer hitches and retractable container pedestals. These cars served as the fleet mainstay until the arrival of the doublestack car. As spine cars were introduced to handle trailer business, a combination trailer/container version of the car was produced.

Southern Pacific introduced the doublestack container car into service in 1981. With a large reduction in line haul costs (including fuel, net to tare ratios, terminal and capital cost) the doublestack quickly captured the international container traffic. Later, domestic containers also appeared and began to shift long haul traffic from trailers to containers. While domestic containers are very efficient, the system is purpose built and requires mechanized lift on/lift off and all of the terminal services that go with it.

4.2.3—Non-Standard Systems

The most utilized non-standard intermodal system is the RoadRailer, which is a Norfolk Southern product. This system is known as "carless technology" in that the special trailers couple together and serve as their own railcar. Originally built with retractable rail wheels built into the trailer, it has evolved into a specially built trailer that fits onto rail trucks, or bogies to be made up into trains.

Chapter 5—Short Haul Corridor Evaluation: Industry Context

Table 5.1 is a chart of corridor characteristics for the highway/rail corridor case studies. These characteristics, which will be part of any corridor analysis, will need to be developed in partnership with the highway community, the railroads and the ports. These characteristics are fundamental to the cost analysis in Section 6 and the public benefit discussion in Section 7. Any analyst wishing to develop a short haul intermodal corridor study will need to assemble site-specific corridor characteristics in order to determine respective costs and benefits on that corridor.

5.1—Study Corridor Characteristics

CHARACTERISTICS	Savannah–Atlanta	PONYNJ–Buffalo	PONYNJ–Pittsburgh
Terminal Origin Exact Location	Savannah (2) ● Savannah Garden City Marine Terminal ● Bourne Avenue and South Coastal Highway ● Mason ICTF ● Across Coastal Highway from the Savannah marine terminal. (NOTE: CSX cannot access the Mason ICTF. CSX has its own intermodal terminal in Savannah: 2351 Tremont Rd.)	PONYNJ ● Expressrail Dockside at Maher Terminal, Elizabeth, NJ	PONYNJ ● E-Rail, Elizabeth, NJ ● Croxton Intermodal Facility: 125 County Road, Jersey City, NJ ■ Intermediate Terminal en route to Pitts. BethIntermodal, 1600 Coke Works Rd., Bethlehem, PA 18018
Terminal Destination Exact Location	Atlanta (2) ● New service from Savannah– Fairburn terminal: 6700 McLarin Road, Fairburn, GA 30213 ● Hulsey terminal: 173 Boulevard, S.E, Atlanta, GA 30312	Buffalo ● CSX Buffalo Terminal 1250 William St., Buffalo, NY ■ Intermediate Terminal CSX Syracuse CSX Access Rd. Syracuse, NY 13057	Pittsburgh ● NS Intermodal Facility: 701 Wall Ave., Wall, PA 15148 (Pittsburgh) ■ Intermediate Terminal: BethIntermodal 1600 Coke Works Rd. Bethlehem, PA 18018
Corridor Volume Estimate	● 15,000–20,000 units annually, both directions combined ● Majority of units are westbound	Current estimate: ● Buffalo: 25,000 TEUs ● Syracuse: 22,000 TEUs ● Rochester: 36,000 TEUs Projected: ● 99,860 TEUs projected by 2020 ● Majority of units are westbound	● 1999 estimate 3000 TEUs went from PONYNJ to Pittsburgh* ● 2020 estimate: 30,000 TEUs on the PONYNJ to Pittsburgh* *TEU volume estimate from PONYNJ as provided in a 1999 Moffat Nichol Study for the Port
Interstate Routes Serving the Corridor **At Origin**	● I-516→I-16 (Savannah→Macon)	● Origin I-95 (Exit 13A) ● I-95→I-280→I-80→I-380→I-81→I-90	● Origin I-95 (13A) ● I-95→I-78→I-81→I-76→Rt. 30→Wall (Southern Route) ● I-80→I-79 (Northern Route)
At Destination	● I-75 (Macon→Atlanta) ● Distance: 255 miles ● 5 hours driving time	● I-90→I-190 ● Distance: 388 miles ● 6 hours, 40 minutes driving time	● I-376 ● Distance: 363 miles ● 6 hours, 10 minutes driving time

CHARACTERISTICS	Savannah–Atlanta	PONYNJ–Buffalo	PONYNJ–Pittsburgh
Connector Routes to Interstate and Condition [Good/Fair/Poor] of Connector Roads **At Origin**	• Savannah: good	At PONYNJ: Fair→Good • Bay Ave., McLester St.—good with some bottle-necks • North Ave.—fair with growing congestion • I-95 interchange—seriously congested • I-95, I-280, I-81, I-90–all good	At PONYNJ: Fair→Good • At Origin/Croxton: Patterson Plank Road and Secaucus Road: fair moving to poor condition • At origin/E-Rail, fair moving to poor condition
At Destination	• Atlanta: fair	Buffalo • 1250 William St.—good	• Pittsburgh: William Penn Highway, Moss Side Blvd., Wall Ave., fair condition
Rail Corridor to be Used	• CSX Corridor east to west Savannah→Atlanta (Train Q126) • CSX Corridor west to east is Atlanta→Augusta→ Yemassee→Savannah (Train Q125) • 319 Railroad miles	• Water level route Q159 • Chemical Coast Line to National Docks to Northern Branch to River Line via Selkirk • 447 Railroad miles ■ 144 Railroad miles to Selkirk ■ 303 Railroad miles to Buffalo	• E-Rail to Pitcairn (Pittsburgh) ■ 397 Railroad miles • Croxton to Pitcairn (Pittsburgh) ■ 408 Railroad miles • Beth I/M to Pitcairn (Pittsburgh) ■ 328 Railroad miles • Via Cranford-Bound Brook-Manville-Phillipsburg-Bethlehem-Harrisburg-Pitcairn • 397 Railroad miles (used for cost analysis)
Locomotive Horsepower	• 2 locomotives at 8000 hp total	• 2 locomotives at 8000 hp total	• 2 locomotives at 8000 hp total
Elapsed Time for O/D Schedule	• Savannah→Atlanta (16 hrs.) • Atlanta→Savannah (16 hrs.)	• PONYNJ→Buffalo (24 hrs.; incl. 30 min. at Selkirk to change crews plus 8 hrs., 40 minutes at Syracuse to re-block train) • 15 hrs. pure running time	• Premium Service, PONYNJ→Pitcairn (13 hrs. from both E-Rail and Croxton yards) • Non-Premium Service, PONYNJ→Pitcairn (16 hrs. from both E-Rail and Croxton yards) ■ BethIntermodal→ Pitcairn ■ Premium: 10 hrs., Non-Premium: 14 hrs.
Number and Type of Locomotives to be Used	• Two 4000 h.p. locomotives	• Two 4000 h.p. locomotives on Q159 train	• Two 4000 h.p. locomotives
Estimated Fuel Consumption per Locomotive Hour	• 6 gal. per mile for 2 locomotives • Hp/ton ratio is 1.5 to 2.0	• 6 gal. per mile for 2 locomotives • Hp/ton ratio is 1.5 to 2.0	• 6 gal. per mile for 2 locomotives • Hp/ton ratio is 1.5 to 2.0

5.2—Highway Corridor Level-of-Service Maps and Rail Corridor Maps: Capacity and Network Illustrations

Corridor graphics for both rail and highway corridors are evolving public planning tools and are included to illustrate distribution networks and approximate corridor traffic growth over time. The maps included in this section were customized by the FHWA and the FRA respectively.

Highway Corridor Maps

Table 5.2 contains Highway Performance Monitoring System (HPMS) data from FHWA. It provides core data on traffic counts **only on the interstate miles** for the highway study corridors and is the basis for all of the interstate highway corridor level-of-service maps. The highway maps were prepared by FHWA as part of their evolving Freight Analysis Framework (FAF), a comprehensive national data and analysis tool, including county-to-county freight flows for trucks, rail, water and air. Information about the methodology used in developing the FAF is available on the Office of Freight Management and Operations' web site, www.ops.fhwa.dot.gov/freight.

The use of the FAF data and highway corridor congestion maps (maps 5.5 to 5.10) help a planner to visualize current and future interstate corridor traffic. The corridor analysis did not include local intermodal connectors and streets, which local planners will have to consider. In contrasting 1998 volumes to 2020 volumes, (either Average Annual Daily Truck Traffic (AADTT) or FAF trucking units), one sees more than 50% overall growth levels on each study corridor, resulting in corresponding corridor congestion problems.

Rail Corridor Maps

The rail corridor maps were generated by the FRA and appear as maps 5.11 to 5.14. The maps are based on confidential rail waybill sample data submitted to the Surface Transportation Board (STB). Further information requests regarding the maps should be directed to the FRA. Both the PONYNJ corridors (Buffalo and Pittsburgh) are shown together in maps 5.13 and 5.14. As with the highway corridor maps, 1998 volumes are contrasted with 2020 volumes. The rail corridor maps show tons (rather than units) of international container traffic on rail. The maps are included to help a planner visualize rail corridor flows and are for illustrative purposes only.

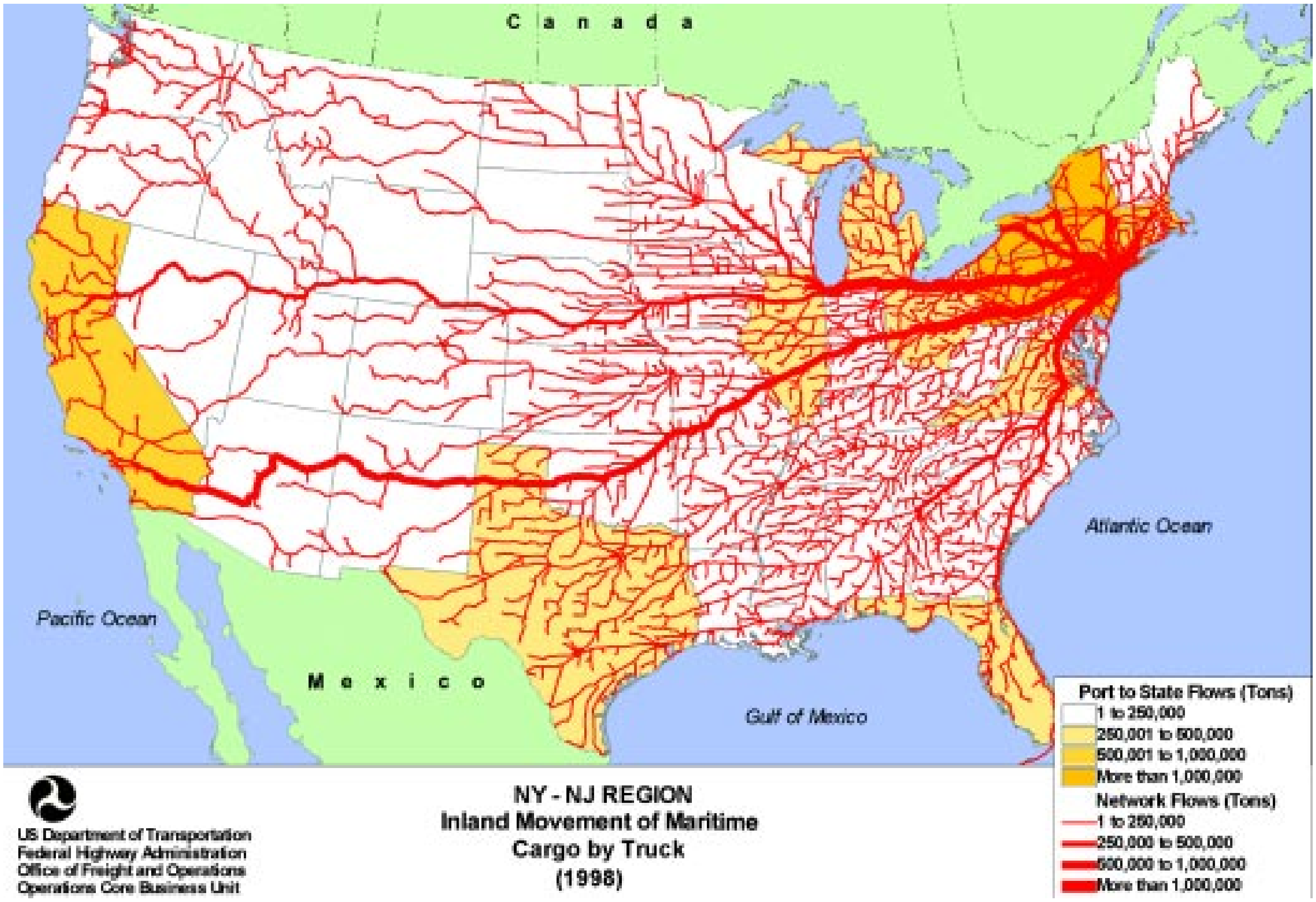
Table 5.2
Freight Analysis Framework Data
Highway Performance Monitoring System (HPMS)

Corridor Description	State	Corridor mileage analysis					Average AADTT*			Average FAF**		
		Total	Urban	Perc.	Rural	Perc.	1998	2010	2020	1998	2010	2020
New York - Pittsburgh	NJ	62.07	33.27	53.60%	28.80	46.40%	11390	15200	17900	4560	5590	5380
	PA	301.43	90.81	30.13%	210.38	69.79%	9030	11720	13250	6690	8430	8960
Total		**363.50**	**124.08**	34.13%	**239.18**	65.80%	**20420**	**26920**	**31150**	**11250**	**14020**	**14340**
Corridor Description	**State**	**Corridor mileage analysis**					**Average AADTT**			**Average FAF****		
		Total	**Urban**	**Perc.**	**Rural**	**Perc.**	**1998**	**2010**	**2020**	**1998**	**2010**	**2020**
Atlanta - Savannah	GA	254	54.14	21.36%	199.32	78.64%	8930	11210	13420	5510	6400	7150
Corridor Description	**State**	**Corridor mileage analysis**					**Average AADTT**			**Average FAF****		
		Total	**Urban**	**Perc.**	**Rural**	**Perc.**	**1998**	**2010**	**2020**	**1998**	**2010**	**2020**
New York - Buffalo	NJ	70.46	44.31	62.89%	26.15	37.11%	12940	17950	22030	5980	8160	9270
	NY	225.86	54.34	24.06%	171.52	75.94%	7050	9680	12060	4320	5840	7050
	PA	91.43	15.89	17.38%	75.54	82.62%	7220	10830	12900	5600	8550	9920
Total		**387.75**	**114.54**	**29.54%**	**273.21**	**70.46%**	**27210**	**38460**	**46990**	**15900**	**22550**	**26240**

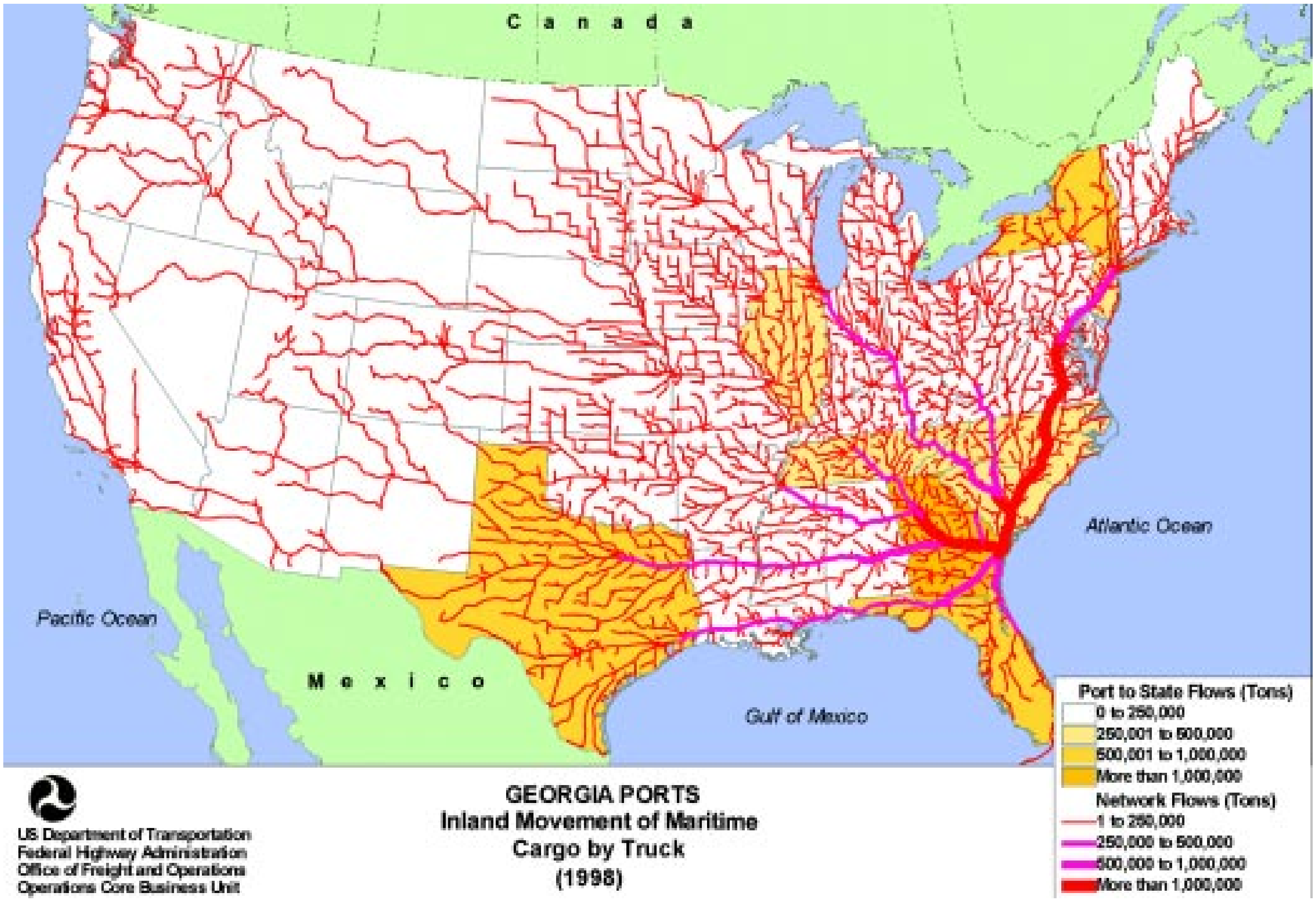
*Average annual daily truck traffic is all trucking units moving in entire region.

**Freight Analysis Framework Truck Traffic: 60,000-80,000 lb. units only, which move from corridor origin to destination.

5.3—USDOT FAF Truck Flow Map—PONYNJ, 1998



5.4—USDOT FAF Truck Flow Map—Georgia Ports, 1998

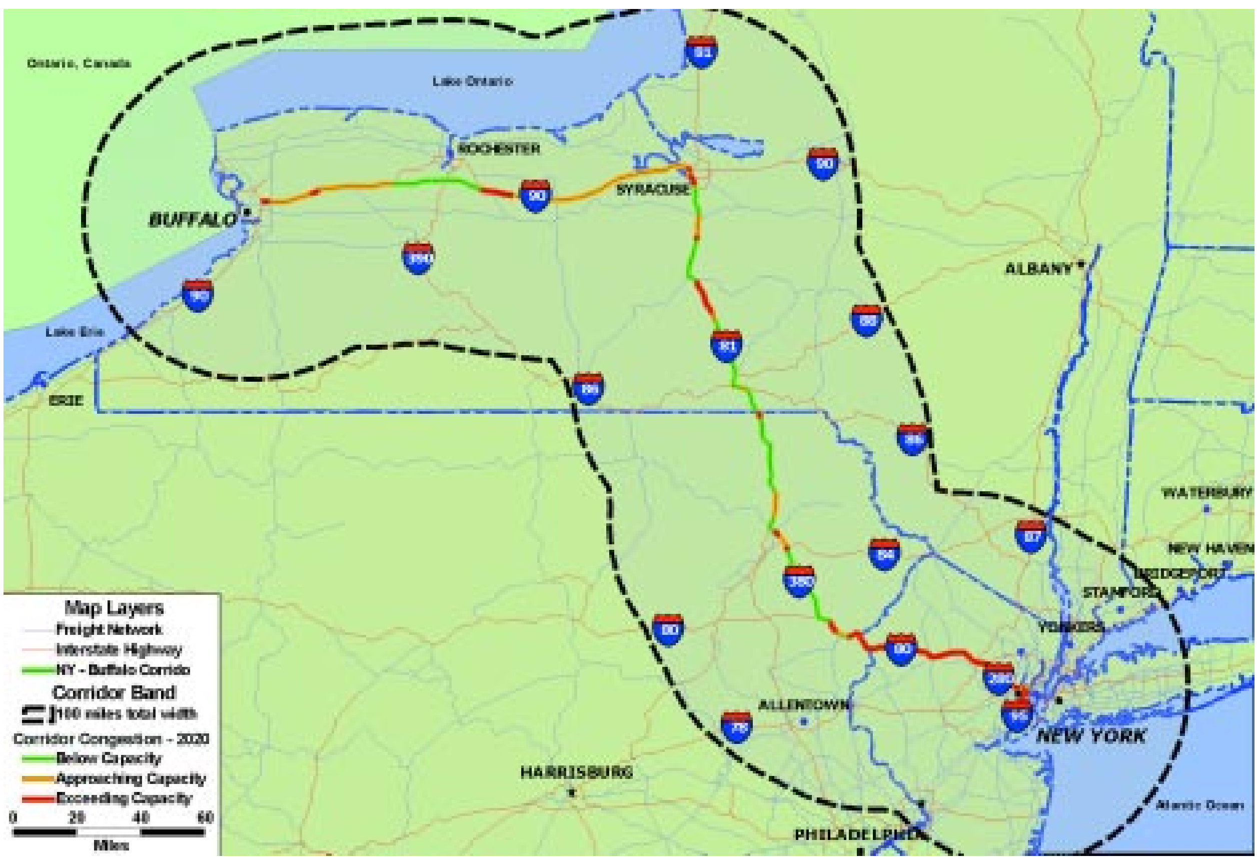


5.5—1998 Savannah–Atlanta Interstate Corridor Congestion

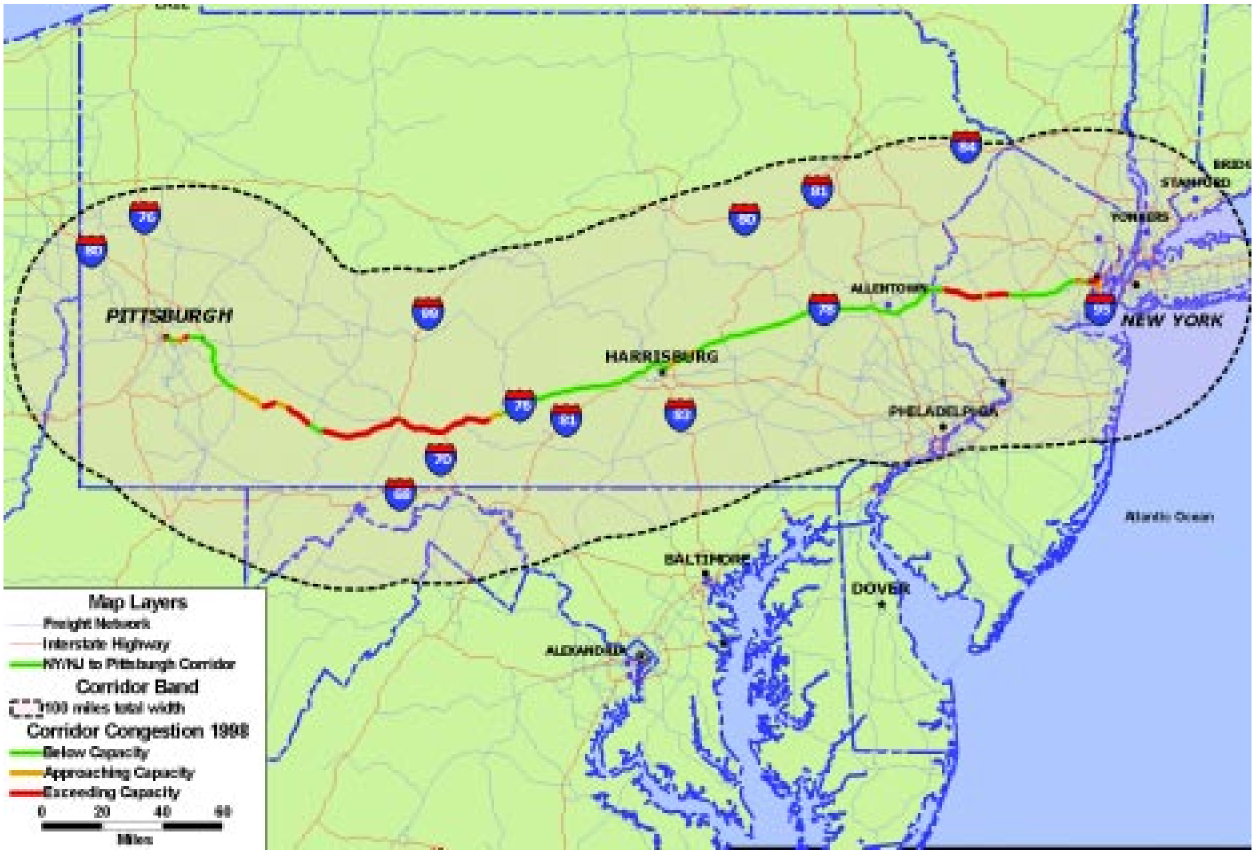
5.6—2020 Savannah–Atlanta Interstate Corridor Congestion

5.7—1998 PONYNJ–Buffalo Interstate Corridor Congestion

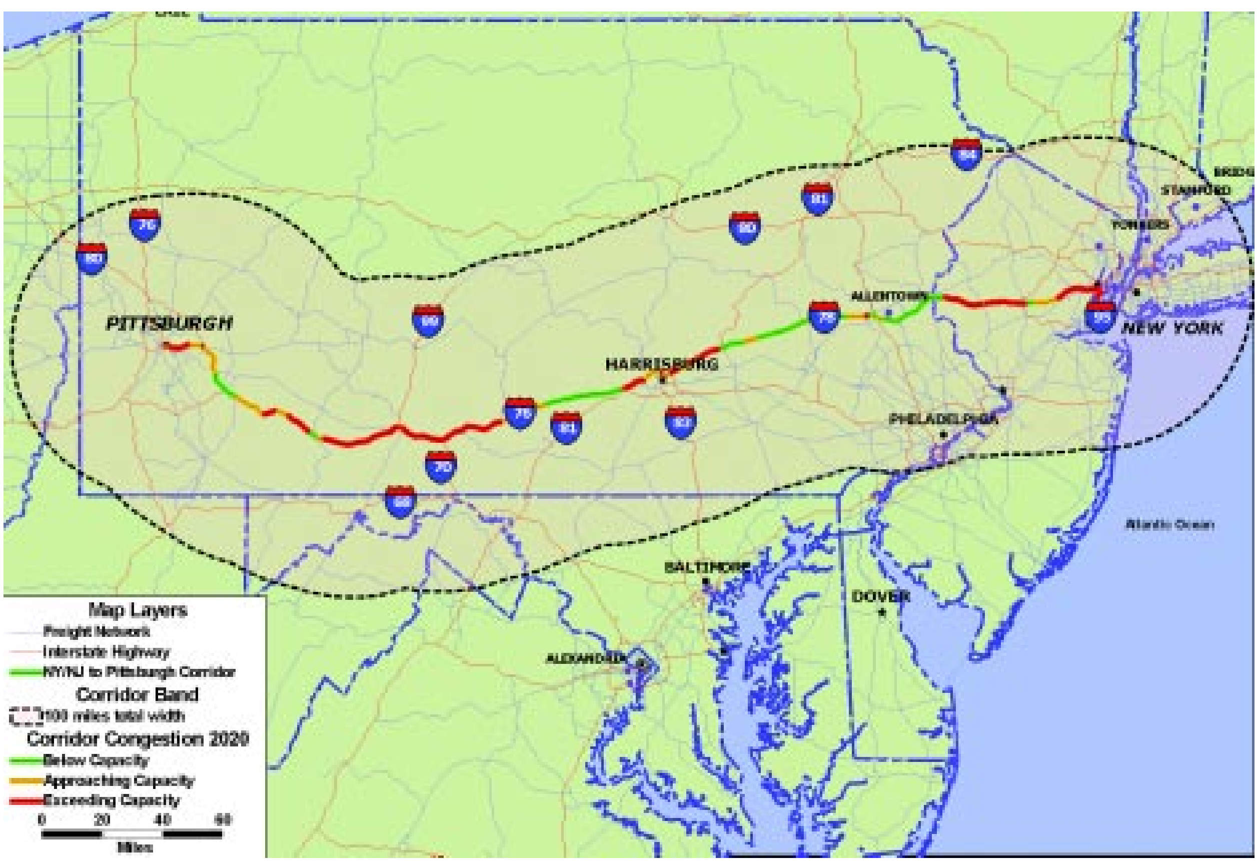
5.8—2020 PONYNJ–Buffalo Interstate Corridor Congestion



5.9—1998 PONYNJ–Pittsburgh Interstate Corridor Congestion



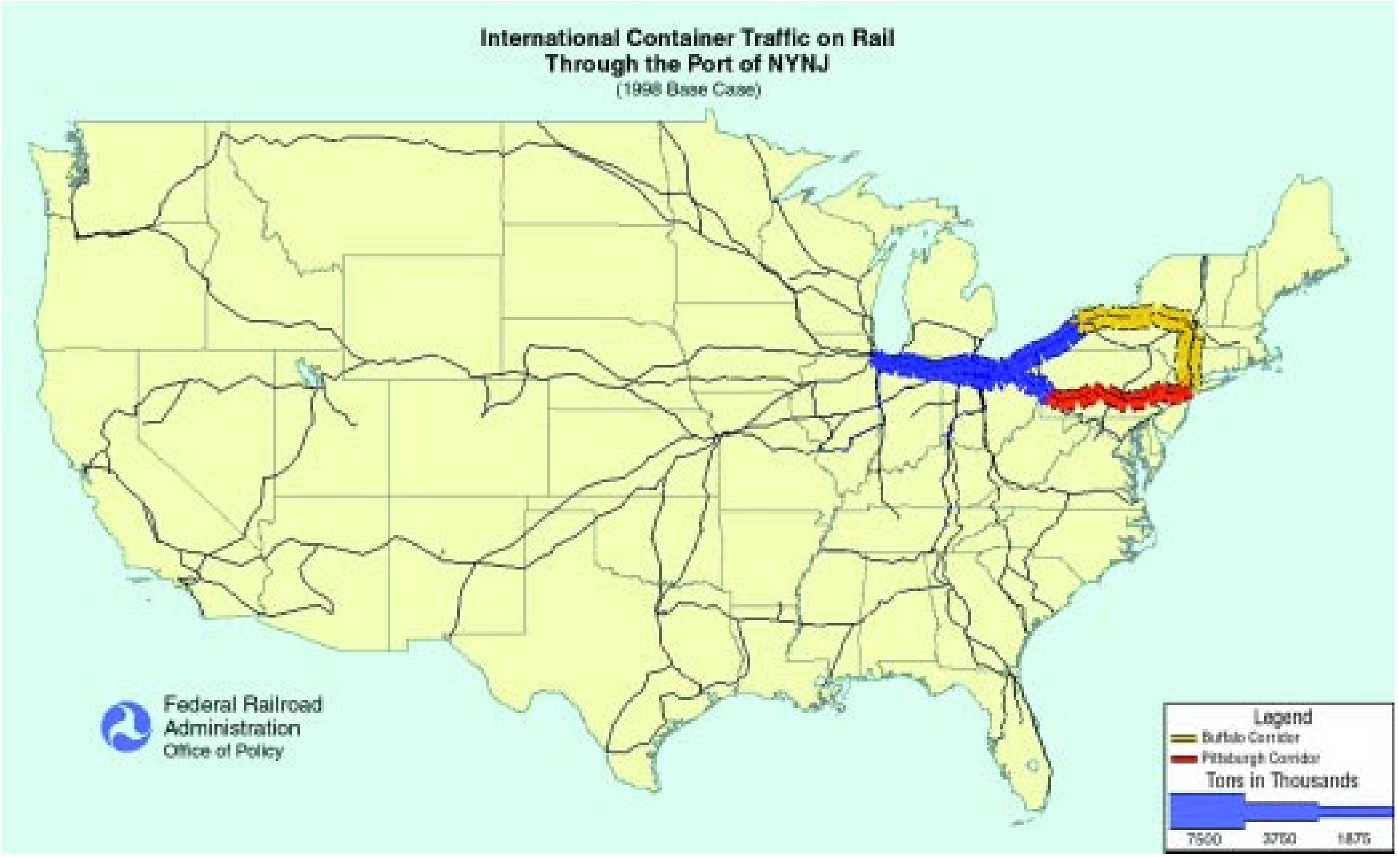
5.10—2020 PONYNJ–Pittsburgh Interstate Corridor Congestion



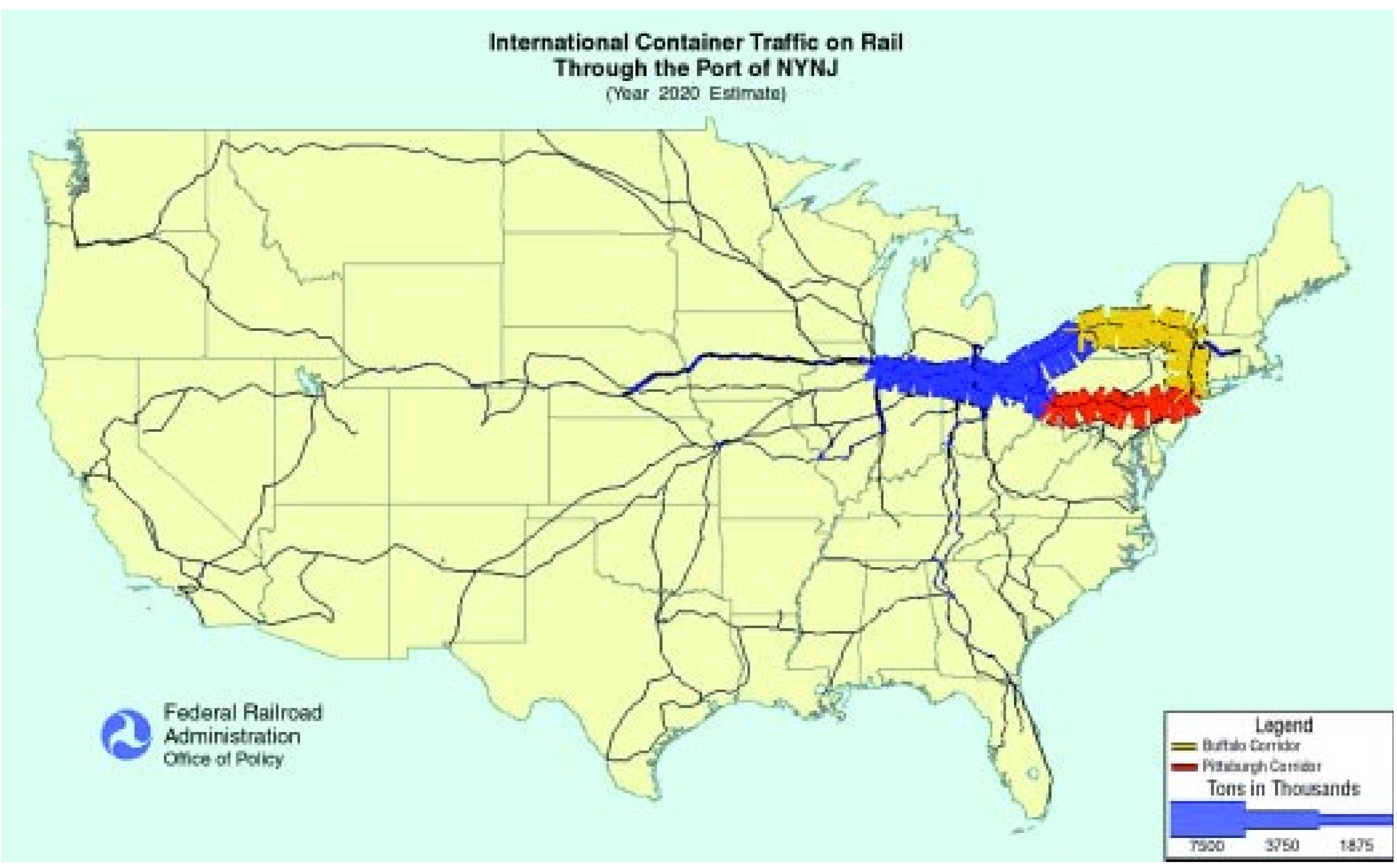
5.11—1998 Savannah–Atlanta Rail Corridor

5.12—2020 Savannah–Atlanta Rail Corridor

5.13—1998 PONYNJ-Buffalo and -Pittsburgh Rail Corridors



5.14—2020 PONYNJ-Buffalo and -Pittsburgh Rail Corridors



Chapter 6—Cost Factors: Comparison of Trucking vs. Rail Cost Components

6.1—Introduction of Rail and Truck Operating Costs

The FHWA Freight Analysis Framework clearly illustrates what we all know as we drive the nation's highways. Serious highway congestion exists today for both automobile and for truck traffic. Left unanswered, these problems will dramatically increase and will seriously impact the nation's productivity. In addition to the direct congestion impact on trucking companies, driver shortages and fuel prices compound productivity problems.

For state transportation planners, building more highway lanes is often a difficult solution. Rail may offer a preferable alternative to absorb growth that would otherwise choke the highway system even further. To understand trade-off issues and whether or not rail may be a solution to the highway problem, one should look at why it has not worked in the commercial marketplace.

Let us now turn to costs and a look at initial templates that could serve as starting points for discussions between state planners, ports and railroads. To understand how a railroad works and how costs are incurred, it is useful to remember that railroads are a volume business. To be economical, rail freight must move in large amounts all at one time. The longer distance that large amount moves, the lower the unit cost and the more competitive the railroad becomes. That being said, railroads can be very competitive for short haul moves of very large volumes—from a single origin to a single destination. Most such movements involve bulk commodities, but there are intermodal moves that also fit the model.

A general cost discussion is included in the Textbox entitled, *Why Railroads are a Volume Business*. This brief discussion allows the state planner an understanding of why a railroad reacts as it does. Unlike a highway move, where government provides the up-front capital for the right of way and attempts to recover that cost through user charges, the railroad has historically provided and maintained its own right of way network. Because it has not been able to recapture enough profit to maintain that network, over 175,000 miles of track has been abandoned by Class 1 railroads since the 1970s (p. 68, *An American Transportation Story*). Of that mileage, 120,000 miles were light density branch lines and 55,000 miles were mainline track reduction, i.e., generally from two tracks to one. This is an important point for state planners to understand, and will be discussed later in this report.

One additional point—as railroad intermodal officers look at business, they focus on point-to-point origin-destination volumes. Generally that volume is divided into domestic traffic and international traffic. The difference in perspective is critical to a state planner's understanding of the opportunity for a rail solution to highway capacity problems.

International traffic is substantially easier to understand. It originates in a port and arrives there in shipload quantities—an ideal fit for rail economics. When the ship arrives and is unloaded, the train is loaded and departs. Just as a railroader looks at origin-destination (O/D) pairs, so too does the port planner. In the port case, containerships discharge the volume of containers needed to aggregate a train; it is virtually automatic and part of the scale economics issue. A critical question is the minimum distance that freight can be economically moved by rail, i.e., to overcome the cost disadvantage of the terminal and the dray costs previously discussed.

Domestic traffic presents a different challenge to the railroad. Here the problem is to aggregate smaller daily O/D traffic blocks into an efficient trainload. Domestic traffic possesses the additional requirement of daily service. No shipper wants to be told that they can ship on Tuesday but not Thursday. Since few O/D city pairs generate trainload volumes, domestic intermodal traffic per day, intermodal trains are generally made up of blocks of traffic. For example, a domestic intermodal train from Los Angeles to New Orleans may also carry blocks of traffic to Dallas and Houston. Understanding the current logic of the rail intermodalist is important to the state planner looking for a solution to highway capacity.

Likewise, the way in which a state planner looks at traffic is critical to the railroader understanding the potential for a rail solution. State planners are used to looking at traffic as segment specific. They use a "hose count," or in some cases, imbedded pavement traffic sensors to determine the level of traffic over a given segment of highway at a given time of day or day of the week. They may also do a visual count of truck versus auto. In this way they identify capacity pinch points and determine where new capacity is needed. They are generally not concerned with specifically where the traffic originated or what its ultimate destination might be or whether it is domestic or international.

Both railroad officers and state planners will have to view new short haul corridors as fundamentally different than previous experiences around corridor development. What is needed in the short haul context is a blending of the highway planner's perspective (focusing on small segments of congested highways), with the rail planner's perspective (focusing on individual O-D market segments on the rail network). Better levels of understanding between highway and rail planners will facilitate the development of short haul corridors that cost effectively address the need for more freight capacity from a system perspective.

Why Railroads Are a Volume Business: What Planners Need to Know About Long Run Variable Costs* (LRVC) for Rails and Network Capacity

Commercial decisions made by railroads are generally not well understood outside the industry. This stems from the position in which railroads found themselves after WW II in a normal, i.e., non-war/non-depression era. Initially pricing occurred on a collective basis. Rate bureaus organized on a geographic basis issued published rates. Disputed rates were appealed either by railroads or shippers to the Interstate Commerce Commission. The process was lengthy, cumbersome and often contentious. With the passage of the Staggers Act, railroads were virtually deregulated and allowed to enter into contract rates with shippers.

In this period, railroads rarely earned their cost of capital. They also suffered from an excess of track capacity in two areas—branch lines and mainlines. This excess capacity existed based on two very different causes. Excess branch line capacity generally existed due to a loss of business. Traffic density decreased until costs far exceeded revenues and generally resulted in abandonment of the branch line. Branch line abandonment amounted to 120,000 miles between 1970 and 2000.

Effective mainline capacity increased greatly in that period due to increased railroad productivity. Larger locomotives, larger and improved freight cars and greater use of unit trains greatly increased potential mainline capacity. Multiple track railroads abandoned track to further increase efficiency and cut costs. From 1970 to 2000, railroads abandoned an estimated 55,000 miles of multiple mainline track. (Unlike branch line abandonment where "the railroad disappears," abandonment of mainline track generally results in the reduction from two tracks to one and the railroad continues to operate.) How a railroad uses its cost system varies greatly depending on its ability to generate a return on investment.

During the Interstate Commerce Commission (ICC, which later became the Surface Transportation Board-STB) era, costing departments were large and very active because justifying rates or track abandonment often depended on extensive cost testimony. Commonly discussed (and understood) rates included cash costs, i.e., those historic operating costs directly incurred by the proposed service, and long run variable costs. At 100% (or 1.0 lrvc) these operating costs are directly incurred by the proposed service but at a sustainable cost level for that service. A lrvc of 1.0 **does not** include either profit or overhead. In a scenario where no major investments in terminal or line capacity are required, many railroads require something in the area of 1.4 lrvc (or 140% of costs) as a reasonable target for pricing purposes. Again, under the ICC costing, full cost, including overhead, generally fell at 1.8 lrvc or 180% of cost. One may begin to grasp why productivity gains, including track abandonment were so vigorously pursued by the railroads over the past forty years.

The consideration of capital costs for terminal or capacity expansion may be critical to state planners as they look at the rail alternative. If major amounts of truck traffic are to be absorbed by rail, serious consideration of public investment will be necessary. State planners already understand Major Investment Study (MIS) planning. Those state planners who are accustomed to managing highway interchange projects amounting to hundreds of millions of dollars, will be the first to understand the costs related to major intermodal terminals costing $50–75 million or a replacement cost of $2–$5 million per track mile for restoration of mainline track.

Terminal capacity requirements are reasonably well understood. Productivity per acre or per lift machine or per gate lane is well understood by railroaders, port engineers and terminal contractors. Less well understood is track capacity. A railroad is a network, and like all networks, a train added or taken away on one piece of the network generally affects other major parts of the network. In addition, the time of day a train is added may have a critical impact on capacity. State planners who deal with rail commuter trains know that adding another train in the morning of afternoon "commute window" is generally both difficult and expensive, while adding an "off peak" train may be relatively inexpensive.

Likewise, adding a sixty-mile per hour train to a railroad where most trains operate at forty miles per hour is generally very expensive in terms of utilized capacity. Slower trains must be generally placed on passing sidings to wait for "meets" with the faster train. This produces larger capital requirements for track capacity to maintain what engineers call a steady state network.

*Costs used for this study are long run variable costs, which are issued annually by the Surface Transportation Board (STB) for each railroad. A basic understanding of these cost parameters is critical to understanding the templates on corridor costs. A long run variable cost multiplier of 1.4 is used on the corridor cost analysis templates, and for this study drayage costs are included.

6.2—Average Long Run Variable Rail Costs

The chart below details the costs that will be used in the costing templates.

2001 Long Run Variable Costs Averaged Costs from Surface Transportation Board R-1 Reports for NS, CSX, UP, BNSF Railroads	
Cost Element	**Cost/Measurement Unit**
Train Mile – dispatching etc.	$3.53 (per train-mile)
Crew Wages	$8.53 (per train-mile)
Maintenance of Way	$0.88 (per thousand gross ton-miles)
Switching Cost	$4.35 (per minute)
Locomotive Maintenance	$1.17 (per unit mile)
Fuel Cost	$0.87 (per gallon)
Locomotive Ownership (per unit hour)	$35.00
Car Costs (2002 TTX rates)	$45.36 per day/per car mile plus $.068/car mile* $16.56 per day/per car mile plus $0.05/car mile (TTEX cars used in Table 6.4.1 By-Pass Concept)
Average Terminal Costs (RR discussions)	$125 x No. of units (two lifts per unit)
Average Drayage Costs (RR discussions)	$150 x No. of units (two drays per unit)
*2001 TTX car costs for a 6,000 foot train = 20 Five Unit Double stack cars (each car is 265 ft. 4 inches in length). Each car costs $45.36 per day + $0.068 per mile and carries10 forty-foot equivalent units (FEUs) per car. 65 89-foot cars. Each car costs $9.60 per day + $.025 per mile, and carries 2 forty-foot equivalent units (containers or trailers). 66 TTEX (each 2 89-foot cars drawbar connected). Cost $16.56 per day plus $0.05 per mile.	

For general context purposes, in order to compare the commercial viability of rail substitution for a highway movement, we will use an estimated average truck cost of $1.375 per mile (based on the ATA reports and industry discussions). While it is beyond the scope of this study template, a comprehensive corridor analysis would require a corridor-specific confidential survey including actual trucking costs and rail corridor costs.

6.3—Planning Template

Let us now turn to the specific corridors chosen for the study. All three are candidates for the movement of port traffic and may be candidates for domestic traffic as well. In addition, in Appendix Item 10.3, there is an illustration, "A New Short Haul Intermodal Concept: The Bypass Route."

The initial step for a planning template is to run the estimated average cost calculation. Assumptions that need to be supplied by the planner include the number of trailers or containers per train, the train weight in trailing tons, the number of locomotives (assume at least 1.5 hp per ton to calculate this. Also add an average of 200 tons per locomotive unit for the total train weight) and the car type (which will add to the trailing tons of the train).

With the estimated average cost, check the assumption for drayage against the actual cost for your example. For ports, on dock or near dock terminals may eliminate or minimize drayage costs unless maritime labor costs in the terminal offset them. Basic terminal costs may be higher or lower and should be checked with the railroads, steamship companies or ports involved. State planners will be able to run the public cost template for the routes involved and to estimate the public cost savings from the highway traffic eliminated.

Following are examples of rail line haul, terminal and drayage costs for the routes selected in this study.

Table 6.3.1
Cost Analysis-NS Corridor: PONYNJ to Pittsburgh

Length of haul: 397 miles
Power: 2 hp/ton, 2-4,000 hp locomotives = 8,000 hp
Fuel consumption: 3 gal. per mile per unit
Train weight = 3800 tons + trailing tons at 3400
Schedule: 16 hours
Units: 200 FEUs

	Costs (2 locomotives pulling 200 FEUs)
LINE HAUL COSTS	
Trainmile 397 train miles x $3.53	$1401
Crew $8.30 x 397 mi.	$3295
MOW 3800 tons (incl. locomotive) x 397 mi./1,000 tons x $.88	$1328
Switching $4.35 x 60 minutes	$261
Locomotive maintenance = 2 units x 397 mi. x $1.17 mi.	$929
Fuel $.87 x 2 units x 3 gal/mi. x 397 mi.	$2072
Locomotive capital costs $35 x 2 units x 16 hrs.	$1120
Daily car lease costs 20 doublestack cars x $45.36 x 3 days	$2721
Per mile car costs = $.068/mi. x 20 cars x 397 mi.	$540
Subtotal	$13,667
TERMINAL COSTS	
Two lifts (origin and destination) @ $125 per lift	$25,000
DRAYAGE COSTS (Bearer of dray cost varies, can be rail, port, shipper, consignee, etc.)	
One move at both origin and destination @ $150 per move	$30,000
TOTAL LINE HAUL, TERMINAL AND DRAYAGE COSTS	$68,667
Cost Per Box (div. by 200)	$343
Cost Per Boxmile (div. by 397 mi.)	$0.86
Cost x 1.4 (long run variable cost multiplier)	$1.20

Table 6.3.2 Cost Analysis-PONYNJ Corridor: PONYNJ to Buffalo	
Length of haul: 447 miles Power: 2 hp/ton, 2-4,000 hp locomotives = 8,000 hp Fuel consumption: 3 gal. per mile per unit Train weight = 3800 tons + trailing tons at 3400 (200 FEUs) Schedule: 15 hours Units: 200 FEUs	
	Costs (2 locomotives pulling 200 FEUs)
LINE HAUL COSTS	
Trainmile 447 train miles x $3.53	$1578
Crew $8.30 x 447 mi.	$3710
MOW 3800 tons (incl. locomotive) x 447 mi./1,000 tons x $0.88	$1595
Switching $4.35 x 60 minutes	$261
Locomotive maintenance = 2 units x 447 mi. x $1.17/mi.	$1046
Fuel $0.87 x 2 units x 3 gal/mi. x 447 mi.	$2333
Locomotive capital costs $35 x 2 units x 15 hr.	$1050
Daily car lease costs 20 doublestack cars x $45.36 x 3 days	$2721
Per mile car costs = $.068/mi. x cars x 447 mi.	$608
Subtotal	$14,902
TERMINAL COSTS	
Two lifts (origin and destination) @ $125 per lift	$25,000
DRAYAGE COSTS (Bearer of dray cost varies, can be rail, port, shipper, consignee, etc.)	
One move at both origin and destination @ $150 per move	$30,000
TOTAL LINE HAUL, TERMINAL AND DRAYAGE COSTS	$69,902
Cost Per Box (div. by 200)	$350
Cost Per Boxmile (div. by 447 mi.)	$0.78
Cost x 1.4 (long run variable cost multiplier)	$1.09

Table 6.3.3 Cost Analysis-CSX Corridor Savannah-Atlanta Length of haul: 319 miles Power: 2 hp/ton, 2-4,000 hp locomotives = 8,000 hp/or 1-4000 hp locomotive Fuel consumption: 3 gal. per mile per locomotive Train weight = 3800 tons, trailing tons at 3400 (200 FEUs) or 1700 tons (100 FEUs) Schedule: 16 hours. Units: 200 FEUs or 100 FEUs			
	$ Costs (2 locomotives pulling 200 FEUs)	**$ Costs(2 locomotives pulling 100 FEUs)**	**$ Costs(1 locomotive pulling 100 FEUs)**
LINE HAUL COSTS			
Trainmile 319 train miles x $3.53	$1126	$1126	$1126
Crew $8.30 x 319 mi.	$2648	$2648	$2648
MOW 3800 tons (incl. locomotive) x 319 mi./1,000 tons x $0.88	$1067	$533 (1900 tons)	$477 (1700 tons)
Switching $4.35 x 60 minutes	$261	$130 (30 minutes)	$130
Locomotive maintenance = units x 319 mi. x $1.17/mi.	$746	$746	$373
Fuel $0.87 x units x 3 gal/mi. x 319 mi.	$1665	$1665	$833
Locomotive capital costs $35.00 x units x 16 hr.	$1120	$1120	$560
Daily car lease costs 20 doublestack cars x $45.36 x 3 days	$2722 (20 cars)	$1361 (10 cars)	$1361 (10 cars)
Per mile car costs = $0.068/mi. x cars x 319 mi.	$434 (20 cars)	$217 (10 cars)	$217 (10 cars)
Subtotal	$11,789	$9546	$7725
TERMINAL COSTS			
Two lifts (origin and destination) @ $125 per lift	$25,000	$12,500	$12,500
DRAYAGE COSTS (Bearer of dray cost varies, can be rail, port, shipper, consignee, etc.)			
One move at both origin and destination @ $150 per move	$30,000	$15,000	$15,000
TOTAL LINE HAUL, TERMINAL AND DRAYAGE COSTS	$66,789	$37,046	$35,225
Cost Per Box (div. by 200 or 100)	$334 (200 FEUs)	$370 (100 FEUs)	$352 (100 FEUs)
Cost Per Boxmile (319 mi.)	$1.05	$1.16	$1.10
Cost x 1.4 (long run variable cost multiplier)	$1.47	$1.62	$1.54

6.3.4—Cost Discussion, General

Let's walk through the analysis. Each cost assumption is outlined to allow the planner to perform "what if" questions. The most critical question is— do we have the volume of traffic required for trainload movement? In the first three corridor examples using 200 containers, the stand alone rail line haul cost portion is 17-18 cents per container mile. With only ten containers per train, the cost is over three dollars per container mile. Railroading is clearly a volume dependent business.

For the Savannah-Atlanta corridor, illustrations on the impact of line haul costs of smaller trains have also been run. Costs for trains of 100 containers have been run using either one or two locomotives to illustrate cost sensitivity.

Since the containers do not load and unload themselves, a terminal is required. Terminals are expensive to build and expensive to operate— especially if they are in an urban area or a port area where land costs alone are very expensive. In our example, terminal costs are a full one third of the total costs.

Drayage costs are also very expensive for reasons previously discussed. Intermodal is able to be competitive at longer distances because it is able to apply a very cheap line haul cost per mile to offset very expensive terminal and drayage costs incurred per container moved.

Note, in each of the three cases the total rail cost per container mile (including a profit factor) is within or lower than our assumed highway trucking costs. Would a railroad be expected to pursue this new "profitable" traffic? Not necessarily. While the profit *margin* may be attractive, the gross profit may be too low to support incremental investment in terminal or right of way capacity to support the traffic growth.

As an illustration, assume the best case, ie., New York-Buffalo at $1.09 per mile per container, a "profit" of 31 cents per container mile for 200 containers yields more than $27,000 per train. If the new traffic displaces existing long haul traffic due to lack of terminal or line capacity, consider what this may mean. If we use the same 31 cents per mile profit but calculate 200 containers in a train moving 1500 miles, the gross profit is over $90,000 per train—more than triple the gross profit of the short haul traffic attempting to use the same terminal. Hence, on the downside, the incentive to shift short haul traffic to rail is minimal for the railroad, absent investment capital cost in terminals or equipment. On the upside, the rail line haul costs are so low that the leverage for the highway planner is high if the highway congestion is severe enough.

6.3.5—Cost Discussion, Specific

The economics of short haul intermodal are very site-specific. Market-by-market and lane-by lane analysis must be undertaken, and costs will vary from corridor to corridor.

The examples in the case studies are average numbers and represent fair first approximations. Real world situations could vary greatly in terms of drayage, empty return ratios, and capital needs. Corridor investments may also vary greatly depending upon the actual mix of costs. The public planner needs to have a very good quantification of the problem to be solved before looking at solutions. Construction of a problem checklist may help; checklist tasks should be:

1. Quantify the problem. How long is the current affected highway segment? Will that distance change before a solution (highway or rail) can be implemented? Does that change the parameters of the solution? How large is the required diversion in order to make a desired impact? Is the problem one of a time of day window? Is the traffic to be diverted balanced?
2. Apply the templates to the specific case being studied. For example, the case studies assumed perfect bi-directional traffic balance. Trucks are generally better able to achieve lower empty return ratios through triangulation than is rail.
3. Assemble as much "real world" freight information from your partners as possible. Are existing terminals at capacity or will additional capacity be required? Does mainline capacity exist? For how many trains? At what time of day?

Next, the planner needs to run through what resources are realistically required to meet the calculated diversion expectations. Again a checklist may help.

1. Startup costs. As we have emphasized throughout, the new freight business venture is not likely to be immediately profitable. Since railroads are a volume business, the public entity should examine whether or not it is willing to be a cost sharing partner in the start-up risk period.
2. As business builds, what kind of cost/benefit is the public entity willing to convert to downstream cost abatement in order to shift or absorb sufficient traffic? Depending on local conditions, public entities could consider (in probable order of cost magnitude):
   a. equipment purchase (locomotives and cars— over 25% of line haul costs);
   b. land acquisition for terminals (including brownfield conversion, zoning, etc.);
   c. physical improvement for terminals (paving and equipment); and,
   d. right of way capacity improvements (rail, ties, signaling).

As an example, if the objective is to move the equivalent of 200 trucks per day from a highway corridor (one train in one direction), the requirements for line capacity may be small or non-existent and would result in 73,000 equivalent truck moves per year (or 146,000 equivalent truck moves if the rail traffic is balanced and fully-loaded trains are run in both directions). This may help highway congestion if the highway capacity improvements occur in a critical time period, for example, rush hour.

On the other hand, a 200 FEU train per hour in each direction over a ten hour window would result in the equivalent of almost 1.5 million truck moves per year by rail.

6.4—Mitigation of Cost Difference

Several options exist to bring rail costs close enough to shift traffic from highway corridors to short haul corridors. A direct operating subsidy could be paid to shippers, truckers, or railroads to shift the traffic. While simple and straightforward, it is probably the least palatable option. More workable would be state assumption of some of the capital costs—an option previously suggested in the CIRUS report to CalTrans by The Tioga Group and in other short haul studies. There are viable models for freight line haul improvements, the key one being the Alameda Corridor which was financed initially through a combination of federal, state and port dollars. States, for decades, have also directed investments into various rail commuter programs in order to free up highway capacity in urban areas. The public transportation investments for the purchase of rolling stock, including cars and locomotives, terminals, servicing facilities and track construction are both well established and highly successful. Similar programs to free up highway capacity in the freight area could prove equally successful. Chapter 8 outlines a menu of public/private financing options for short haul corridors.

In the past, some ports have established "inland ports" or intermodal rail terminals to relieve port capacity problems. While this type of program may accomplish that goal for a port, it has also had a mitigating effect on state highway usage and air quality, benefiting the state involved. A cooperative effort on the part of ports and states to build both inland and near-port terminals, or funds for capital for rolling stock, could go a long way toward the removal of substantial freight traffic from the highways.

6.5—A Corridor Concept for Further Research: The Bypass Route

For purposes of stimulating new thinking, a conceptual model is presented as Appendix item 10.3.

Chapter 7—Public Benefits and Costs

The purpose of this Section is to provide a summary of the public costs and benefits of implementing a short haul intermodal freight rail system in the selected corridors. In summary, these are costs associated with interstate highway use by heavy trucks and include highway wear and tear, new construction and bridge costs, congestion, safety factors and noise and air quality degradation, and are derived from the Federal Highway Cost Allocation Study (1997). This analysis does not include the cost of local intermodal roadway connectors. For the purposes of physical highway maintenance, new construction and bridge work, marginal costs per mile for freeway maintenance and upgrade costs caused by trucks are identified. Likewise, there are safety-related public costs associated with truck movements over the interstate system, which result from the fact that heavy trucks have a higher accident rate per ton-mile of freight moved than does freight rail. Moving the equivalent amount of freight by rail will lower these public costs. Congestion also inflicts certain costs on the public. These include traffic delays, which manifest themselves in higher vehicle operating costs and the costs for lost time (productivity) in slow traffic. Again, an intermodal rail move will result in incrementally lowering these public costs. Finally, there is a cost to the public resulting from air pollution and noise. Trucks, in general, emit about two or more times the amount of air pollutants per ton-mile of freight moved than rail-moved freight. The public cost of noise and air pollution and the benefit of incrementally reducing it by intermodal rail are identified. The sum of the foregoing costs are the net marginal cost per mile for highway movement of this freight. How these costs and benefits were calculated is noted in each table, and detailed in the appendix.

For each of the corridors investigated, the amount of highway user fees contributed by heavy trucks per mile is compiled. The net difference approximates the annual cost to the public for accommodating the freight on the highway and the benefit to be gained by moving the freight by intermodal rail.

The public costs cited herein are not derived by a route-specific mathematical model. Rather, they are derived from current research and transportation data developed by the FHWA, the ATA and others. The costs presented are intended to provide policy and transportation decision-markers, particularly public officials, with a template to measure the public benefits of short haul intermodal freight rail moves. Each corridor should be the subject of a more detailed analysis to support the expenditure of public monies to develop and implement these short haul intermodal freight system improvements.

Chapter 8 addresses possible policy tools and innovative financing packages that will have to be evaluated in order to finance short haul intermodal corridors.

7.1—Highway Marginal Trucking Costs

The following table (Table 7-1) provides the most current highway cost data for the class of interstate trucks, which are required to move the freight subject to this study. The freight is generally described as dry-van or other cargo moving in 40-57 ft. trailers, containers or configurations such as tankers. A gross maximum weight of 80,000 lbs. for the tractor and trailer is assumed, which is consistent with the maximum allowable gross vehicle weight permitted in the states subject to this study. It should be noted that while these data are for analysis year 2000, they are representative of current public costs considering the relatively low rate of domestic inflation.

Table 7.1 2000 Marginal Pavement, Bridge, Congestion, Crash, Air Pollution and Noise Costs for 60,000 lb. and 80,000 lb. 5 Axle Tractor and Semi-Trailer Marginal Costs (Cents per Mile)								
Interstate Highway Class	Pavement Deterioration	Pavement Improvements	Bridge Costs	Congestion	Crash	Air Pollution	Noise	Total
60,000 lb. 5-Axle Tractor and Semi-Trailer								
Rural	3.30	0.42	0.40	1.88	0.88	3.85	0.17	10.90
Urban	10.05	0.42	0.40	18.59	1.15	4.49	2.75	37.65
80,000 lb. 5-Axle Tractor and Semi-Trailer								
Rural	12.7	1.01	1.20	2.23	0.88	3.85	0.19	22.06
Urban	40.9	1.01	1.20	20.06	1.15	4.49	3.04	71.85
Source: (1.) U.S. Department of Transportation, Federal Highway Administration.1997 Federal Highway Cost Allocation Study with Addenda.								

7.2—Highway User Revenues (HUR)

Table 7.2 summarizes the HUR in terms of cents per mile paid by heavy trucks in each of the states involved in the short haul intermodal corridors case studies. They include state and federal fuel taxes, tire taxes, heavy vehicle sales taxes and weight related taxes. Appendix Worksheet 10.4 explains the individual elements making up each State's heavy truck user fees. Appendix Worksheet 10.5 explains how federal user revenues were derived.

Table 7.2 Highway User Revenues for Typical 5-Axle Tractor-Semi-Trailer Combination Revenues (Cents Per Mile)					
State	State Fuel Taxes (Variable)	Other State Taxes	Federal Fuel Taxes $.244/gal.	Other Federal Fees	Total Revenues Per Mile
Georgia	2.15	0.95	4.44	3.24	10.78
New York*	5.69	*5.33	4.44	3.24	18.70
New Jersey	3.18	1.41	4.44	3.24	12.27
Pennsylvania *	5.62	*2.22	4.44	3.24	15.52
Assumes average annual mileage per unit of 77,193 miles and average of 5.5 miles/gallon/unit. Sources: (1) American Trucking Associations, *American Trucking Trends,* 2002 (2) Washington State Department of Transportation, Benefits of Rail Freight Transportation in Washington: A Multimodal Analysis, December 2000 *Pennsylvania Turnpike and NY Thruway tolls are not included, which could add respective HUR for those trucks paying tolls.					

7.3—Net Highway Corridor Costs

Table 7-3 summarizes the net public costs per mile in each of the short haul corridors assuming that the freight subject to this study is moved by interstate trucks over interstate highways. The marginal trucking costs per mile are based on an equal blend of 60,000 lb. and 80,000 lb., 5-axle trailers as estimated in Table 7.1. E.g., for a 60,000 lb. truck, rural costs are $10.90 and for an 80,000 lb. truck, rural costs are $22.06 = a blended average rural cost per mile of $16.48.

7.4—Net Corridor Public Costs

Tables 7.4.1 through 7.4.3 summarize the total public costs in each of the short haul corridors. These costs are related to the volume of units moved through the corridor on an annual basis, if transported by truck versus short haul intermodal. Each table shows the number of miles classified as rural or urban freeways to be traveled by trucks and the classifications are taken from the FHWA Highway Performance Monitoring System (HPMS data). Costs are expressed in 2000 dollars. Table 7.5 aggregates the costs for one year and for over 20 years in constant 2000 dollars.

Volumes in each corridor are an assumed number based on the data and growth characteristics provided by the sponsors. There is obviously some threshold volume which is necessary to establish and sustain the intermodal corridor. For different volume assumptions, the cost per truckload unit can be used to calculate the total cost. Finally, as with the rail cost calculations in Chapter 6, these costs are on a per trip basis in one direction with loaded truck units.

Table 7.3 Net Highway Corridor Costs (cents/mile)			
State/Highway Class	Marginal Trucking Costs	Highway User Fees	Net Public Costs
Georgia			
Rural Interstate	16.48	10.78	5.70
Urban Interstate	54.75	10.78	43.97
New Jersey			
Rural Interstate	16.48	12.27	4.21
Urban Interstate	54.75	12.27	42.48
New York			
Rural Interstate	16.48	18.70	(2.22)
Urban Interstate	54.75	18.70	36.05
Pennsylvania			
Rural Interstate	16.48	15.52	0.96
Urban Interstate	54.75	15.52	39.23

7.4.1—Savannah to Atlanta Corridor—255 miles

Table 7.4.1 Savannah to Atlanta Corridor Summary of Public Costs for Over the Road Transport Versus Rail Intermodal			
Total Interstate Miles	Cents/MilePublic Cost	Total Per Trucked Unit ($)	Average 25,000 Units/Year ($)
Rural Miles (200)	5.70	11.40	285,000
Urban Miles (55)	43.97	24.18	604,500
Total Miles (255)	---	35.58	889,500

7.4.2—PONYNJ to Buffalo Corridor—388 miles

Table 7.4.2 PONYNJ to Buffalo Corridor Summary of Public Costs for Over the Road Transport Versus Intermodal			
Total Interstate Miles	Cents/Mile Public Cost	Total Per Trucked Unit ($)	Average 45,715 Units/Year ($)
Rural Miles New Jersey (26)	4.21	1.10	50,287
Rural Miles New York (172)*	(2.22)	(3.82)	(174,631)
Rural Miles Pennsylvania (76)	0.96	0.73	33,372
Urban Miles New Jersey (44)	42.48	18.69	854,413
Urban Miles New York (54)	36.05	19.47	890,071
Urban Miles Pennsylvania (16)	39.23	6.28	287,090
Total Miles (388)	---	42.45	1,940,602
*If the trucker chooses to route via the New York Thruway, about 15.70 per unit in Thruway fees are lost, thereby making the net benefit per unit $26.75.			

7.4.3—PONYNJ to Pittsburgh Corridor—363 miles

Table 7.4.3 PONYNJ to Pittsburgh Corridor Summary of Public Costs for Over the Road Transport Versus Intermodal			
Total Interstate Miles	**Cents/Mile Public Cost**	**Total Per Trucked Unit ($)**	**Average 30,000 Units/Year ($)**
Rural Miles New Jersey (29)	4.21	1.22	36,600
Rural Miles Pennsylvania (210)*	0.96	2.02	60,600
Urban Miles New Jersey (33)	42.48	14.02	420,600
Urban Miles Pennsylvania (91)	39.23	35.70	1,071,000
Total Miles (363)	---	52.96	1,588,800
*If the trucker chooses to route via the Pennsylvania Turnpike, about $37.70 per unit in Turnpike fees are lost, thereby making the net benefit per unit $15.26.			

7.5—Summary of Aggregated Public Benefits

Table 7.5 summarizes the public benefits in constant 2000 dollars per year and over a period of 20 years.

Table 7.5 Aggregated Benefits Per Year and Over 20 Years (Constant 2000 dollars)		
Corridor	**Aggregate Public Benefits One Year ($)**	**Aggregate Public Benefits 20 Years ($)**
Savannah to Atlanta	$889,500	$17,800,000
PONYNJ to Buffalo	$1,940,600	$38,812,000
PONYNJ to Pittsburgh	$1,589,000	$31,780,000

7.6—General Conclusions on Public Costs and Benefits

The following are general conclusions regarding the short haul intermodal corridors and the public benefit to be gained by implementing freight rail intermodal service:

1. Not surprisingly, the public benefits in terms of dollars per unit moved and total dollars per corridor are proportional to length of haul. The longer the corridor, in general, the greater the public benefit.
2. Public benefits are also significantly greater in the urban portions of the interstate corridors than in the rural interstate corridors. Proportionately, the higher the percentage of the route in urban interstate highways, the greater the public benefit. Since the cost data are based on the 1997 FHWA Study, there will be a substantial increase in public benefits as congestion on the interstate route increases (Chapter 5) and the percent of urban classified freeway miles increases.
3. Because each state has its own fuel tax and truck user fees, as distinguished from federal fees, there is a significant impact on net public benefit depending on which state or states the corridor extends through.
4. Depending on the rail versus truck cost structure in any corridor, as addressed elsewhere in this study, public benefits from moving the freight by intermodal rail versus over-the-road truck can be significant and contribute to acquiring, developing and maintaining the short haul intermodal infrastructure and transport systems.

7.6.1—Savannah to Atlanta Corridor Costs

This corridor exhibits the least net public benefit for intermodal rail because of the relatively short haul (255 miles) and because a relatively small percentage of the highway corridor is in urban areas where highway costs are the highest.

Nevertheless, because Georgia State highway user fees are so low (ranked 50th among states according to ATA's 2002 Trucking Trends), there is a significant public benefit associated with rail intermodal per mile of both urban and rural freeways. Another important observation as seen on the level of service maps in Chapter 5 is that as the Atlanta urban area continues to expand, and truck VMTs rise, interstate miles which are classified as rural in 1998 will convert to urban miles. By 2020, much of I-75 around Atlanta is projected to carry truck traffic at or beyond service design levels.

7.6.2—PONYNJ to Pittsburgh Corridor Costs

This corridor had the second highest public benefit tied to its length of 363 miles and the fact that a fairly high percentage of it is in urban areas (34% versus 21% in Georgia). Moreover, the public benefit on this route is highly dependent as to whether or not the trucker chooses to use the Pennsylvania Turnpike. If the trucker does travel the Turnpike, there is a loss of approximately $38/per truck in Turnpike fees (public benefits), which offsets the net Pennsylvania public benefit of $53/per truck. As in the case of the Atlanta corridor, substantial portions of this route will experience increased congestion and level of service degradation. Urban route miles will increase. Referring to the congestion maps in Section 5, one sees that in 1998 and worsening by 2020, much of the Harrisburg to Pittsburgh corridor is at or above design capacity. By 2020, about 50% of the entire corridor will experience capacity problems.

7.6.3—PONYNJ to Buffalo Corridor Costs

This corridor had the highest net public benefit and longest haul route (388) miles. Also more than 30% of the route is in urban areas. Nevertheless, the rural portions of this corridor in New York actually detract from the public benefit if the freight is moved by rail, because New York has a special tax known as a "Third Structure Tax" which accrues at about 4 cents per mile for trucks. As in the Pittsburgh corridor, the public benefit on the route is highly dependent on whether or not the trucker chooses to use the New York Thruway. If the trucker does travel the New York Thruway, there is a loss of approximately $16/per truck in Thruway fees (public benefits), which offsets the net New York public benefit of $42/per truck. New York has the third highest state user fees for trucks (NJ ranks 42nd and PA ranks 10th in state user fees for heavy trucks according to ATA's 2002 Trucking Trends). As in the case of the Atlanta corridor, substantial portions of this route will experience increased congestion and level of service degradation. Urban route miles will increase over time.

Chapter 8—Public Financing Options

8.1—Innovative Hybrid Investment Programs Are Needed

Throughout this study, it has been asserted that short haul rail corridor improvements may serve a public purpose by helping to relieve the pressure on the region's highway system and meeting the region's social, economic, and quality-of-life needs. When site-specific short haul rail investments meet a public interest, all levels of government (federal, state, regional, and local) will need to work cooperatively with the highway, transit, railroad and port communities to plan, finance, and deliver projects that deal with congested ports/hubs. There is a range of hybrid financing options which would include: initial start-up subsidy, infrastructure subsidy, equipment subsidy, and ongoing operation subsidies. Many of the options mirror how public investments are made in commuter rail services. General financing concepts are briefly outlined in 8.2 to 8.11.

Multi-state corridors present a particular challenge, as individual states, ports and railroads cannot afford the larger improvements, especially since the costs and benefits are unevenly distributed. When investments in one state result in benefits to several other states, to air quality standards, and to travel times, how should the various stakeholders share the costs, the risks, and the benefits?

The Mid-Atlantic Rail Operations Study, a complex multi-state plan, has already explored several approaches to financing complex rail improvements, and several are presented below for discussion purposes only (MAROPS, Cambridge Systematics). However, some of these options face significant barriers to implemention because they are not well suited to: a) the regional scale of intermodal corridors; b) the fact that intermodal investment impacts are highly concentrated but the benefits are highly distributed; and c) the complexities of any national approach would take years, if not decades, to develop. Also, private and public capital is competing for a host of alternative uses, virtually all of which present more immediate returns.

8.2—Self-funding of Improvements by Railroads

By themselves, CSX and the Norfolk Southern cannot support the full cost of corridor programs. The railroads collectively invest about $2.6 billion annually in their systems, but these investments generally cover system maintenance and support of near-term business opportunities for near-term revenue. The short haul corridors in this study will allow the railroads to increase their future business and revenue, but increases in traffic will be realized over the long term rather than the near term. Therefore, a short haul rail investment program requires significant near-term investment to achieve a critical mass of long-term, system wide, private and public benefits. Borrowing on the open market is not an option because the freight railroads are not currently earning their full cost of capital.

8.3—State and Port Rail Programs

In the Northeast and Mid-Atlantic states have invested more than $4 billion since 1992 in infrastructure and operations that directly or indirectly support intercity passenger rail. This state investment includes $2.8 billion in infrastructure improvements and more than $1.4 billion in operations support of intercity passenger rail service on the Northeast Corridor and its feeder services.[1] The PANYNJ and the State of New Jersey have also invested millions in Express Rail, which is located on the PONYNJ in Elizabeth, NJ, and the two states (NY and NJ) have also announced a $50M bi-state rail improvement program. Similarly, the Port of Savannah is completing a multi-million Mason Intermodal Container Transfer Facility (ICTF). These revenue sources are significant, but are not likely to keep pace with freight growth projections. A number of states in many regions cannot by law spend highway gas-tax revenue on rail projects. Other states are prohibited by statute from investing in projects outside their state boundaries, even if such an investment would benefit them significantly.

8.4—Federal Grant Programs

Existing federal transportation programs such as the surface transportation program and the congestion mitigation and air quality program are heavily committed to the maintenance and preservation of the nation's roadway systems. Expanded state eligibility and flexibility in the use of these funds is appropriate where freight-rail improvements have significant highway and public benefits, but the available funds are not adequate. Federal-aid is allocated by formula and must be matched by state or local funds, making it difficult for states to invest in projects beyond their state boundaries.

8.5—Federal Loan and Credit Enhancement Programs

Use of federal loan and credit enhancement programs such as the Rail Rehabilitation and Improvement Financing program (RRIF) and the Transportation Infrastructure Finance and Innovation Act (TIFIA) program is difficult.

8.5.1—**RRIF** is a credit program targeted at rail infrastructure and equipment. Current program requirements governing credit access and risk premiums have discouraged use of the program. Congress is debating changes that would make it more accessible and expand significantly the size of the program for both Class I and short line railroads; however, the railroads, which are not currently earning their return on capital, are reluctant to take on additional indebtedness.

8.5.2—**TIFIA** provides loans, loan guarantees, and lines of credit for large projects. The program is modeled after a loan provided for the Alameda Corridor Transportation Project, a roadway grade crossing and rail corridor project improving access to the ports of Los Angeles and Long Beach. To qualify for assistance under TIFIA, a project must have a source of revenue to cover debt service costs and be valued at over $100 million or 50 percent of the state's annual federal-aid highway apportionments, whichever is less. The federal TIFIA loan cannot exceed one-third of the total project cost, and the project's senior debt obligations must receive an investment-grade rating from at least one of the major credit rating agencies. These factors limit TIFIA's applicability, and neither private railroad projects nor rail-only projects are eligible today.

8.6—Congestion Mitigation and Air Quality (CMAQ) Improvement

Given the air pollution costs and congestion public costs (and the relationship of those costs), CMAQ funds are a viable source of funds to be dedicated to those corridor projects that can be shown to reduce congestion and improve air quality.

8.7—Joint Investment/Toll Programs

The State of Delaware and the Norfolk Southern, for example, have invested jointly in the rehabilitation of the Shellpot Bridge, which provides rail access to the Port of Wilmington. The state is paying the cost of rehabilitating the bridge, and the Norfolk Southern will pay a toll, with an annual minimum guarantee, on railcars crossing the bridge. To encourage Norfolk Southern to grow the rail traffic, the toll per railcar decreases as the total volume of railcars increases. The approach allows the state and the railroad to share the future benefits and risks of the investment.

The approach is and attractive example because it allows the state to target its investment to rail improvements that serve its economic and transportation goals. It is attractive to the railroad because it creates opportunities for new long-term market and revenue growth without increasing corporate indebtedness. Both parties have an incentive to make the investment work because both share the risks as well as the rewards.

The approach works as long as the state can provide funding up front, the tolls are modest, and the volume of freight through the project grows. The approach breaks down where project costs are so high that the state cannot afford the initial investment and where tolls are so high that the railroad cannot compete with trucking. The approach also breaks down if it is applied in an uncoordinated way across a regional rail network. Uncoordinated tolls can divert rail traffic to other routes or increase total freight costs and divert rail traffic to truck.

8.8—Intermodal Tax Incentives and Tax-Exempt Financing

Under this proposal advanced by the Association of American Railroads, all companies, not just railroads making investments in qualified assets to improve efficiency or improve capacity of the national intermodal freight system would be granted tax benefits. These tax benefits could be applied at state and federal levels. Qualified assets could include railroad, truck, specialized rail or truck intermodal equipment and land, which would be eligible for tax incentives. Such a program would address the societal benefits derived from expansion of an intermodal system.

8.9—Fund Rail Infrastructure Through Issuance of Tax Exempt Indebtedness

Under this concept also offered by the Association of American Railroads, holders of Qualified Railroad Indebtedness (QRI) would qualify for income tax exclusion for such QRI. QRI could include indebtedness for the acquisition, construction, improvement, maintenance or repair of Qualified Rail Property (QRP). QRP would include any post December 2002 expenditure for acquisition or maintenance of depreciable property (such as track, bridges, terminal facilities, signals wharves, docks, IT systems or public infrastructure improvements) either used or to be used for a railroad's trade or business. This proposal would encourage expanded use of rail transportation by partially counter-balancing the subsidies provided to heavy trucks. See Table 2.1.1 regarding Initial Cost Burdens.

8.10—A Regional Approach to Organizing and Financing Regional Rail Improvements

Borrowing again from the draft MAROPS Corridor Financing White Paper, the I-95 Coalition, the states, and the railroads have explored regional approaches to organizing and financing rail improvements. These approaches are presented below.

A regional approach to organizing and financing rail investment ensures that adequate funds are available to meet the needs of large-scale projects and takes into account the distribution of costs and benefits. A regional approach:

- Addresses the rail network serving a multi-state trade area;
- Involves the states and the freight, intercity passenger, and commuter railroads;
- Provides a forum to identify needs, define improvements, describe benefits, set priorities for investment, organize multi-year programs, and evaluate results;
- Provides a mechanism for financing the improvements; and
- Provides a mechanism for recouping investments and sharing risks and benefits.

Three regional strategies and implementation issues are discussed in 8.10.1 through 8.11.

8.10.1—National Transportation Finance Corporation (TFC)

The American Association of State Highway Transportation Officials (AASHTO) with support from Mercator Associates has developed the TFC concept. Building upon the TFC concept for freight, this strategy would create a National Transportation Finance Corporation and regional rail advisory committees.

- By an act of Congress, create a National Transportation Finance Corporation (NTFC) as a non-federal, non-profit enterprise with the ability to grant and lend money to the states as well as to regional and local entities to make rail capacity improvements.
- Capitalize the NTFC by direct Congressional appropriation, by authorizing the NTFC to issue tax-credit bonds, or a combination of measures. The direct Congressional appropriation could be a grant or subsidy authority to the NTFC to fund a long-term, low-interest capitalizing loan.
- Authorize the formation of regional rail advisory committees through which coalitions of states would identify regional rail network investment needs, set priorities, support individual state applications for funding, and commit to coordinated sharing of project risks and benefits. The legislation could specify regional rail programs and committees or authorize the Secretary of Transportation to underwrite the development of one or more programs and committees on a pilot basis (e.g., any multi-state rail corridor).
- Provide economic development incentives for state participation by making businesses in states that participate in regional rail advisory committees and projects eligible for federal tax benefits if the businesses invest in qualified rail and intermodal infrastructure projects.[2]
- Adopt procedures for soliciting applications from states or groups of states and awarding funds for rail network improvements. Awards should consider transportation needs and benefits, consistency with the regional rail advisory committee's master plan, state and railroad contributions, and provisions to capture future benefits through tolls or other value-capture mechanisms.
- Allow the states and the railroads, working through the regional advisory committees, to negotiate their contributions on a project-by-project basis, considering public sector benefits, private sector benefits, and risks.
- Encourage the use of regional network tolls or other value-capture mechanisms to recoup a portion of the investment in rail capacity from future growth in rail traffic. Tolls should be based on reasonable expectations of the future network

growth that would be catalyzed by the investments and apportioned equitably among the railroads including, where appropriate, intercity passenger and commuter railroads, based on network access, use, and public and private benefits.[3]

- Permit a portion of toll revenues to be used to capitalize a revolving fund supporting additional rail capacity improvements.

8.10.2—Regional Rail Finance Corporation or Regional Rail Investment Bank

A second strategy would create independent, regional versions of the National Transportation Finance Corporation. A Regional Rail Finance Corporation or Regional Rail Investment Bank would operate in a manner similar to a national corporation and with similar results, but its scope and scale would be smaller. A national corporation, with a larger and more diverse portfolio, would create a bigger, more stable market for tax credit bonds, but a regional corporation or bank serving an economic bloc as large as a corridor, existing within one state's boundaries, or an economic freight corridor that spans many states such as the PONYNJ to Pittsburgh Corridor would be equally viable.

- By an act of Congress, establish Regional Rail Finance Corporations or Regional Rail Investment Banks for specific multi-state regions and rail networks. The RRFCs or RRIBs could be established as non-federal, non-profit enterprises or as multi-state investment banks and authorized to receive funding directly from Congress or from a National Transportation Finance Corporation (if created).
- Capitalize the RRFCs or RRIBs by direct Congressional appropriation, by authorizing the RRFCs or RRIBs to issue tax-credit bonds, by authorizing them to accept funds from a National Transportation Finance Corporation (if created), or a combination of measures. The direct Congressional appropriation could be a grant or subsidy authority to the RRFCs or RRIBs to fund a long-term, low-interest capitalizing loan.
- Charge the RRFCs or RRIBs to identify regional rail network investment needs, set priorities, support individual state applications for funding, and commit to coordinated sharing of project risks and benefits.
- Provide economic development incentives for state participation by making businesses in states that participate in regional rail advisory committees and projects eligible for federal tax benefits if the businesses invest in qualified rail and intermodal infrastructure projects.
- Adopt procedures for soliciting applications from states or groups of states and awarding funds for rail network improvements. Awards should consider transportation needs and benefits, consistency with a regional rail master plan, state and railroad contributions, and provisions to capture future benefits through tolls or other value-capture mechanisms.
- Allow the states and the railroads, working through the regional advisory committees, to negotiate their contributions on a project-by-project basis, considering public sector benefits, private sector benefits, and risks.
- Encourage the use of regional network tolls or other value-capture mechanisms to recoup a portion of the investment in rail capacity from future growth in rail traffic. Tolls should be based on reasonable expectations of the future network growth that would be catalyzed by the investments and apportioned equitably among the railroads, including where appropriate intercity passenger and commuter railroads, based on network access, use, and public and private benefits.
- Permit a portion of toll revenues to be used to capitalize a revolving fund supporting additional rail capacity improvements.

8.10.3—Rail Network Demonstration Program

A third strategy would establish a federal-aid rail demonstration program.

- By an act of Congress, establish and fund a federal-aid rail demonstration program. The model for this program would be the Federal-Aid Highway Program.
- Fund the program through general revenue or other sources and provide a mix of grants, loans, and credit enhancements. The program could also incorporate an expanded RRIF program or a modified TIFIA program utilizing low- or no-interest loans and revolving funds.
- Authorize demonstration funds to underwrite the development of one or more regional transportation coalitions and utilize them to identify regional rail network investment needs, set priorities, support individual state applications for funding, and commit to coordinated sharing of project risks and benefits.[4]
- Make individual states eligible to receive funding for state-specific projects, but encourage and provide incentives to states to coordinate with neighboring states in regional rail coalitions. Incentives for participation in a regional coalition program could include priority consideration, more favorable match requirements, and lower loan rates.
- Provide economic development incentives for state participation by making businesses in states that participate in regional rail coalitions and projects eligible for federal tax benefits if they invest in qualified rail and intermodal infrastructure projects.
- Adopt procedures for soliciting applications from states and awarding funds for rail network demonstration improvements. Awards should consider transportation needs and benefits, consistency with a regional rail master plan, state

and railroad contributions, and provisions to capture future benefits through tolls or other value-capture mechanisms.

- Allow the states and the railroads, working through their regional coalition, to negotiate their contributions on a project-by-project basis, considering public sector benefits, private sector benefits, and risks.
- Encourage the use of regional network tolls or other value-capture mechanisms to recoup a portion of the investment in rail capacity from future growth in rail traffic. Tolls should be based on reasonable expectations of the future network growth that would be catalyzed by the investments and apportioned equitably among the railroads, including where appropriate, intercity passenger and commuter railroads, based on network access, use, and public and private benefits.
- Permit a portion of toll revenues to be used to capitalize a revolving fund (or regional funds) supporting additional rail capacity improvements.

8.11—Implementing a Regional Rail Program

Building a regional rail program will be a challenge, but failing to act will weaken the regional and national transportation systems and undermine the vitality and competitiveness of the US economy. Three actions could be pursued to lay the foundation for a regional rail program:

- Reinforce the mandates of the Intermodal Surface Transportation Efficiency Act (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21) to provide for economically efficient and environmentally sound movement of people and goods in an energy efficient manner, and affirm the importance of freight rail and passenger rail transportation in achieving these goals and underpinning economic development, trade, and commerce.
- Provide funding through a special purpose Corridor Authority (such as the Alameda Corridor Transportation Authority, ACTA) to formally convene and support a regional rail advisory committee. Charge the Corridor Authority (CA) and the committee to develop a national model for organizing and financing regional rail improvement programs. The Corridor Authority and committee should develop and detail the policies, procedures, organization arrangements, and funding mechanisms needed to support a regional rail improvement program, including identifying regional rail network investment needs, setting priorities, soliciting and supporting applications from states or groups of states for funding, assessing risks and benefits, and supporting the implementation of projects. The CA and committee should report the lessons learned and recommend model legislation for a national program that would assist other regions facing similar rail transportation issues.
- Authorize and fund a pilot program of regional rail improvement projects. The core challenges in building a regional rail program are institutional and political—learning how to solve problems across public and private sector boundaries—challenges that can only be met by the experience of building a program. For any demonstration project, benefits and potential funding packages will have to be developed. These will be stand-alone projects, which may not be dependent upon completion of many other elements. They may focus on projects that are of utility to the entire region, not just small segments of many corridors. And they do not require lengthy engineering or environmental reviews.

The states and the railroads have the experience to initiate and manage this program, but federal initiative and support are needed. The problems of the railroads and the consequences of not addressing them are clearer today than when ISTEA and TEA-21 were enacted, and they will sharpen in the coming years. The public and private rail transportation community must advance solutions such as regional rail programs that will improve the productivity and security of the rail system as an integral part of the national transportation system.

Chapter 9—Summary and Recommendations: Toward New Operating Models

9.1—Study Summary Points

This report provides an industry context for public officials who are grappling with freight capacity challenges and solutions in order to accommodate continued economic prosperity fueled by increasing volumes of freight. The authors and study sponsors have used actual case examples to amplify those industry context issues. This study has built upon FHWA Freight Analysis Framework data and found that the demand for highway capacity (both for trucks and other vehicles) is out-stripping highway capacity in certain metropolitan areas. Not surprisingly, our major metropolitan areas are also the sites for intermodal centers. Segments of the Interstate system in these freight dense areas are highly congested, as depicted on the level-of-service maps in section 5. The study has also established that corridor solutions are being pursued not only in the US, but also in international settings where freight growth is dynamic.

While it is clear that short haul rail corridors present viable options to add capacity, the cost burdens of building those short haul corridors will require new public/private financing partnerships, as well as attention to new hybrid intermodal delivery service models.

This nation is facing a crossroad in intermodal transportation planning and financing. The question posed in the AASHTO Rail Bottom Line Report is will the nation's freight rail system continue with its market driven evolution, or will some new model of public/private partnering have to evolve to address key corridors and hubs? This study concludes that new models of public/private partnering must continue to develop, and policy attention should be focused on programs, which address the initial cost burdens of intermodal corridors.

9.2—Study Recommendations: Creating New Models

- **New Planning Models and Tools:** Tools for short haul corridors are an evolving practice. What is exceedingly clear to the study team, is that the public tools to evaluate corridor investments are very incomplete. The groundbreaking work of the FAF is a noteworthy step in the right direction. Nonetheless, deeper analytics of costs and benefits for intermodal investments are sorely needed. The mapping efforts are also vital tools, which can rapidly focus attention on where freight flows are most concentrated, and where corridor investments are warranted. Corridor mapping tools need significant refinement.
- **New Financing Models:** Short haul corridors can relieve some of that congestion, but understanding the initial cost burdens and scale economies of intermodal lead one to conclude that short haul corridors will only be built with some financial stimulus.
- **New Corridor Pilot Demonstaration Projects:** Time is of the essence, and pilot projects could help advance strategies that address inadequate freight capacity. Investing in short haul intermodal is complex and as is clear from this feasibility analysis, some national demonstration models will help further define the feasibility of investing in short haul corridors.
- **New Financial Incentives:** Financial incentives are needed. Given that railroads are capital constrained, and that both public and private benefits are part of the short haul corridor investment picture, some of the public/private financing options discussed in chapter 8 must be applied. Once a corridor is analyzed and deemed to be a viable project, the financing model has to be in place so that the special purpose corridor authority can commence operations.
- **New Partnerships:** New partnerships between the railroads, the ports, the USDOT, and state DOTs can and must create that financial stimulus and move the nation's freight system into a stronger sum of its component parts. A national policy focused on improved freight system productivity has the potential to produce highway benefits, rail benefits, public benefits, environmental benefits and economic productivity benefits.
- **New Transportation Investment Calculus:** Tomorrow's freight network will require short haul corridors to address transportation's triple bottom line and give full consideration to economic, social and environmental objectives.
- **New Short Haul Operation Concepts:** There have been noteworthy operating innovations as previously discussed, but additional "out-of-the-box" thinking will be needed to keep pace with projected freight growth. In order to stimulate further discussions, a new operating concept which the authors have called "A Bypass Route" is presented as Appendix item 10.3.

The USDOT, State DOT's and MPOs (in major urban areas) have made tremendous strides since ISTEA in recognizing freight capacity issues. These public agencies are up to this challenge and they are moving toward new partnership programs with freight operators. As these initiatives are being created a careful balance will have to be maintained so that healthy competitive issues in the freight marketplace are not distorted. At the same time, overwhelming cost issues must be addressed. The case studies presented in this analysis are intended to help public officials to move forward with improved insights into industry issues.

Chapter 10—Appendix Items

10.1—Resource Documents and Working Papers (some items not publicly available)

The Alameda Corridor Transportation Authority, various public information pieces

American Association of State Highway and Transportation Officials, *Freight-Rail Bottom Line Report*, 2003

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10.2—Glossary

Drayage—Transportation of freight by truck, typically local cartage**.**

Hostler Unit—A truck tractor used to move intermodal equipment around a terminal yard. Not intended for over the road use.

Line Haul—The movement of freight over the road/rail from origin terminal to destination terminal, usually separated by substantial distance, does NOT include pick-up and delivery.

Spine Car—An articulated five-platform railcar that allows containers to be double stacked

10.3—A New Short Haul Intermodal Concept: The Bypass Route

The rail solutions examined in Chapter 6 involved the use of existing intermodal tools used in conventional ways with unique financing or funding mechanisms. Another possible solution is to look at the rail system as a short haul solution spliced into a piece of an existing highway move at critically congested points in the highway network—a rail bypass.

Past attempts at short haul system improvements have all involved shifting the entire O/D move via rail. This has always involved making the rail line haul function as efficient as possible. Therefore, the focus was always to eliminate the driver and the line haul tractor from the rail move, as well as perhaps the trailer running gear (hence the container), or even the railcar (hence RoadRailer). This exercise seeks to look at freeing up highway capacity as the primary objective. With this as the focus it is far easier to think "outside the box" since the objective is entirely different.

With this in mind, let's examine the problem of highway capacity. As with any other network, capacity constraints may occur due to time of day (generally commute times) and by given segments of a route. This concept will examine the ability to relieve congestion by applying the railroad portion as a bypass of the congestion for a portion of the route only. That is, the highway move will remain as it is today, except for a "spliced" railroad segment to bypass the congestion.

The key to a new short haul intermodal system is twofold. First, the system needs to be highly service competitive. The key will be to offer rapid, consistent service. Second, the service must be cost competitive with current all highway service. It is the latter factor that has been unable to be met that has defeated any such attempts in the past. Therefore, our initial attempts to design a new system will focus on the cost side of the equation.

Referring back to the initial section of this paper, the two elements present in intermodal that are not present in an all highway move are the dray moves and the intermodal terminal. We will focus our efforts first on the terminal.

Past systems, whether carless technology or the Iron Highway type approach, have focused on the elimination of lift equipment. To the new initiate to intermodal this appears to eliminate a huge portion of terminal costs. The concept is to "throw down some gravel" and produce an instant cheap terminal. Unfortunately, while the initial cost of most lift machines is in the million dollar plus range, over the life of the machine the cost per lift is very small. In fact, the major costs of an intermodal terminal are the land on which the terminal sits, the gate function, and the terminal operations themselves. Let's examine each in turn.

No system yet invented has ever obviated the need or the capital cost of land acquisition and improvement of terminal property. It is the interface between the highway and the railroad and serves both a "surge tank" function and a sorting function for train makeup. Capital costs of land acquisition, paving, gate, office facility and equipment to operate a major terminal can cost as much as seventy million dollars. While this has been a railroad cost burden in the past, it is not clear that it needs to be or should be a railroad burden for a system designed primarily to free up highway capacity. In addition, the envisioned terminal design for the new system minimizes the majority of these capital costs. The terminal is smaller due to the lack of a need to store trailers or containers or to store empty equipment, the gate function is minimized, and intra-terminal hostling and loading is eliminated since it is handled by the highway driver.

The final major cost factor is the operation of the terminal itself. This includes the staffing of such functions as management, clerical, lift equipment operators and groundmen, hostling tractor operators, security personnel and mechanical personnel.

The gate function is a major cost and exists for three primary reasons. First, it is the mechanism by which legal responsibility for the equipment shifts from the highway carrier to the railroad. It is known as an equipment interchange. A lot of time and effort go in inspecting equipment (particularly on inbound moves). Second, the gate function tries to assure proper billing since the railroad must match the equipment with the proper outbound train and then assess proper charges. And finally, the gate function serves as the primary initial security check. Do this driver and this equipment belong here or is someone being let into the terminal to break into, and steal valuable merchandise or take an entire loaded trailer out off the property?

Consider again the functions involved, the functions eliminated from the typical intermodal move, and the effect on overall costs. In our example the trucker again moves from the trucking terminal to the shipper's dock and picks up a load. The driver then proceeds to the interstate and drives until just before he/she hits a known congestion point. The driver proceeds to the Bypass Terminal (probably, actually next to the freeway), takes a ticket from the toll machine and drives the truck onto the Bypass Railcar. Once on the Railcar, the driver can either go to sleep in the sleeper cab of the truck or can go to a passenger coach on the train. The terminal crew secures the tractor and trailer to the car, and removes the portable ramp from the end of the train. The road crew couples up to the Bypass Railcar train and move the train, tractors, drivers, and trailers around the highway congestion to the destination Bypass Terminal where the process is reversed, the driver takes the loaded highway unit off the train, pays the appropriate toll, and is back on the highway.

What then, has been eliminated in the way of traditional railroad intermodal costs? First, no drayage costs have been incurred since this is but a small piece of a highway move. Second, most of the terminal costs are gone. Let's trace the costs that have been eliminated. The gate? No inbound or outbound equipment inspection is required since this is not an interchange move. The equipment has never left the control or possession of the trucker. Second, theft is no more of a problem than if the driver is in the tractor at a truck stop. He/she is with the load at all times and no trailer is ever parked without a tractor, thus stealing the entire load is impossible without an actual highjacking. Third, billing is not a problem since, like a toll road, the charges will be mileage and unit length related, not commodity based. In addition, the driver will be responsible for loading and unloading, eliminating railroad or contractor hostling and loading/unloading.

We now have a system which, if the physical terminal is considered a part of the highway system rather than a part of the railroad system, has eliminated all of the dray costs (unless we consider the short off-ramp distance to the terminal a dray), and most of the terminal operating and all of the terminal capital costs. This leaves small operating terminal costs with few railroad or contract terminal employees or equipment.

The gate consists of a toll ticket machine, loading equipment of perhaps two to four Buck loaders such as are found in railroad auto loading or unloading terminals, personnel to operate them, portable directional signage, hand held input devices for data and billing, and mechanical capability for car repair on the terminal. This is a very small increment, given any reasonable volume, to be added to the basic line haul costs.

Let's now turn to a theoretical example within one of our study corridors. The Bypass Terminal will be located as close as possible to the one or two east-west interstates that operate as the mouth of a funnel for truck traffic from and to the northeast.

Since it is beyond the scope of this project to assess the tradeoffs for specific terminal sites and traffic potential, we will pick two sites—chosen only for the purpose of illustrating the template. Points chosen include the area around Flemington, New Jersey (where highway moves flair out to eastern New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine) and Harrisburg, PA.

Table 10.3.1 New Concept Assumed Cost Analysis-Bypass Route: Flemington, NJ area to Harrisburg, PA Area
Length of haul: 135 miles
Power: 2hp/ton, 2-4,000 hp locomotives = 8,000 hp
Fuel consumption: 3 gal. per mile per unit
Train weight = 5200 tons + trailing tons at 4800 (6000 foot train) Schedule: 5 hours
Units: sixty-six 80,000 lb. semi-trucks on 33 TTEX cars(two 89 foot, drawbar connected)

	Costs (66 semi-trucks)
LINE HAUL COSTS	
Trainmile 135 train miles x $3.53	$477
Crew $8.30 x 135 mi.	$1121
MOW 5200 tons (incl. locomotive) x 135 mi./1,000 tons x $0.88	$618
Switching $4.35 x 60 minutes	$261
Locomotive maintenance = units x 135 mi. x $1.17/mi.	$316
Fuel $0.87 x 2 units x 3 gal./mi. x135 mi.	$705
Locomotive capital costs $35 x 2 units x 5 hr.	$350
Daily car lease costs 33 TTEX cars cars x $16.56 x 1 days	$546
Per mile car costs = $.05/mi. x 33 cars x 135 mi.	$222
Subtotal	$4616
TERMINAL COSTS	
Two lifts (origin and destination) @ $135per lift	Eliminated $0
DRAYAGE COSTS (Bearer of dray cost varies, can be rail, port, shipper, consignee, etc.)	
One move at both origin and destination @ $150 per move	Eliminated $0
TOTAL LINE HAUL, TERMINAL AND DRAYAGE COSTS	$4616
Cost Per Semi (div. by 66 Semi Units)	$70
Cost Per Boxmile (div. by 135 mi.)	$0.52
Cost x 1.4 (long run variable cost multiplier)	$0.73

10.3.2—The Bypass Car

For ease of illustration and costing the car chosen for this example is a drawbar connected two-unit 89-foot car with no hitches and permanent bridge plates to allow car-to-car movement. Unlike previous "circus loading" where trailers were backed onto cars and placed on hitches by rail terminal employees, the Bypass Car will be loaded in a forward drive-on of the tractor and trailer. The semi will be driven by the truck line haul driver up a portable ramp currently used to load autos on railcars. Current operation of these cars (without the tractor remaining aboard) allow trailers to span the distance between cars while being moved in train service if needed. While this may also be possible for the Bypass Car version, the assumed cost example (Table 6.4.1) uses one twin axle tractor with sleeper and a 53-foot trailer semi (averaging 70 feet) per 89-foot car section.

Siderails on the cars help guide loading and unloading and terminal personnel will assist the direction of truckers on the cars. Wheel chocks and set brakes on the semis should insure safe operation of the units after safety testing prior to operation.

10.3.3—Bypass Route Cost Comments

Let's take a look at potential costs of such a service. Remember the assumptions used:

1. A strip terminal adjacent to an interstate in which dwell time of the highway units is minimal (minimizing land requirements), funded and owned by the state;
2. No interchange—hence no in or out gate inspections;
3. A minimal number of terminal employees;
4. One semi per 89 foot car;
5. Trucking savings of fuel, mileage related maintenance, and potentially of driver time.

The resulting line haul cost (including "profit") is about half the cost per mile of a highway move. In addition, the trucker is saving fuel, tire wear and other maintenance items as well as potentially some or all of the driver costs. While the hours of service rules would have to be evaluated for Bypass service, it is similar to the service offered in some areas by waterborne ferry service. Rules applicable to this service count the hours a driver spends on the ferry (and out of the driver's seat) as either rest time (if he sleeps) or as on-duty but not driving. The former is generally not paid time. The latter may or may not be paid time. If it is paid time it is at an hourly rate that is far less than the hourly or mileage rate paid while driving.

Obviously the potential profit per mile incentive is increased for both the trucker and the railroad. The authors strongly emphasize that this concept requires much more analysis in areas such as driver safety and hours of service issues, as well as the potential element of available railroad line capacity. It should be noted that drivers do stay with their units when transiting the Eurostar Tunnel and on some short truck ferry services. With the apparent economic potential, as well as relieving highway congestion, and air quality improvements, it would appear that the Bypass concept is worthy of further analysis.

10.4—State User Tax Worksheet

SECTION 7 APPENDIX ITEM FOR STATE REVENUES CITED IN TABLE 7.2

Annual State Highway User Taxes On A Typical 5-AxleTractor-Semitractor Combination

As of January 2001

State	Annual Registration & Weight Fees ($)	Diesel Fuel Tax Rates ($/Gals.)	Fuel Tax on 14,035 Gallons ($)	Third Structure Tax Rate ($/Mile)	Third Structure Tax on 80,000 Miles ($)	Total Annual State Hwy. User Fees ($)	***Fuel Tax Rate Cents/Mile**	***Other State Fees & Taxes Cents/Mile**
Georgia	737	0.1182	1,659	0	0	2,396	**2.15**	**.095**
New York	995	.3130	4,393	.03900	3,120	8,508	**5.69**	**5.33**
New Jersey	1,087	0.1750	2,456	0	0	3,543	**3.18**	**1.41**
Pennsylvania	1,715	0.3090	4,337	0	0	6,051	**5.62**	**2.22**

NOTE: The chart figures fees for a typical 5-axle tractor-semitrailer combination weighing 80,000 lbs. The registration fees are figured for an interstate vehicle traveling entirely intrastate, which doesn't happen but allows for comparison at full fees. Fees are also those that apply to carriers based in that state and include semitrailer plate fees and registration surcharges. Other fees such as operating authority fees and property, sales, and excise taxes are not included and would affect total carrier costs and state ranking. AZ, CA, CO, ME, MN, MS, MT, NV, ND, SD, UT, WA and WY registration fees contain a valuation component; figured on a $100,000 vehicle.

SOURCE: Zuckert, Scoutt & Rasenberger, LLP., Washington, DC

EXTRACTED FROM ATA'S AMERICAN TRUCKING TRENDS, 2002

*Other state fee and taxes appear in table 7.2 and were determined by dividing the total fees by 77,193 miles/year.

Toll road revenues not included.

10.5—Federal User Tax Worksheet

Section 7 Appendix Item for Federal User Revenues Cites in Table 7.2	
Estimated Truck User Fees per Vehicle-Mile of Travel	
Tax and Use Rates	**Values**
Retail Cost: New Tractor	$75,000
Vehicle Excise Tax: Tractor	$9,000
Useful Life of Tractor (Miles)	500,000
Retail Cost: New Trailers	$35,000
Vehicle Excise Tax: Trailer	$4,410
Useful Life of Trailers (Miles)	750,000
Vehicle Excise Tax per VMT	**$0.0239**

Tire Excise Tax	$207
Tire Life (Miles)	$150,000
Tire Tax per VMT	**$0.0014**

Heavy User Tax (Annual Miles)	77,193
Heavy User Tax per VMT (HUT)	**$0.0071**

NOTE: The Federal Vehicles Excise Tax only applies to heavy trucks operating at 26,000 pounds or greater. It is a one-time charge assessed on new vehicle sales. The Federal Heavy Vehicle Use Tax, which is paid each year, is a maximum of $550 per truck.

SOURCE: Benefits of Rail Freight Transportation in Washington (WADOT), Dec. 2000

Appendix D: Details of Pavement-Related Analysis

Other Federal Fees/$/ Mile

Vehicle	.0239
Tire	.0014
HUT	.0071
Total Other Federal	.0324 or 3.24 ¢/mile

Other Federal Fees/$/ Mile

14,035.00 gallon/year
× 2.44/gallon

$3,425.00/year ÷ 77,193 miles = .0444¢ or 4.44 /mile

10.6—Footnotes for Chapter 8

[1] Coalition of Northeast Governors (CONEG) Policy Research Center, Inc., "The Northeast and MidAtlantic States: Investors in Intercity Passenger Rail That Serves the Region and the Nation." Washington, DC, June 2002.

[2] Rail-related tax incentives might include: 1) reduced tax recovery periods (e.g., to three years for freight handling machinery and equipment, intermodal information infrastructure, and railroad track and signals; and to seven years for wharves and docks, bridges, tunnels, railroad grading, and intermodal transfer facilities [TOFC/COFC, marine container, airport freight, and truck terminals; distribution warehouses; transload facilities; bulk-load facilities; and automotive ramps]); 2) expensing of investments in "qualified intermodal property;" 3) tax credits for some percentage of the cost of investments in or improvements to qualified intermodal property; and 4) tax-exempt financing for investments in qualifying assets. For additional discussion, see proposals for "Tax Incentives for Intermodal Investments," Association of American Railroads, February 2002.

[3] Understanding and allocating equitably the costs, risks, and benefits of regional rail network improvements will eventually require development of network simulation models akin to the highway network models developed by the states and the FHWA. Congress and the Secretary of Transportation may wish to consider early funding for initial development of a pilot regional rail network model. The model also would be of use to the railroads, the FRA, and others developing national security and emergency preparedness strategies.

[4] A possible model for regional, interstate coordination is the Chesapeake Bay Program, created in 1983 as a cooperative restoration effort among Maryland, Pennsylvania, Virginia, the District of Columbia, the Chesapeake Bay Commission, and the Environmental Protection Agency.