NCFRP

REPORT 6
(Revised)

NATIONAL
COOPERATIVE
FREIGHT
RESEARCH
PROGRAM

Sponsored by the
Research and
Innovative Technology
Administration

Impacts of Public Policy on the Freight Transportation System

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

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Impacts of Public Policy on the Freight Transportation System

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Research sponsored by the Research and Innovative Technology Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2011
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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

America's freight transportation system makes critical contributions to the nation's economy, security, and quality of life. The freight transportation system in the United States is a complex, decentralized, and dynamic network of private and public entities, involving all modes of transportation—trucking, rail, waterways, air, and pipelines. In recent years, the demand for freight transportation service has been increasing fueled by growth in international trade; however, bottlenecks or congestion points in the system are exposing the inadequacies of current infrastructure and operations to meet the growing demand for freight. Strategic operational and investment decisions by governments at all levels will be necessary to maintain freight system performance, and will in turn require sound technical guidance based on research.

The National Cooperative Freight Research Program (NCFRP) is a cooperative research program sponsored by the Research and Innovative Technology Administration (RITA) under Grant No. DTOS59-06-G-00039 and administered by the Transportation Research Board (TRB). The program was authorized in 2005 with the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). On September 6, 2006, a contract to begin work was executed between RITA and The National Academies. The NCFRP will carry out applied research on problems facing the freight industry that are not being adequately addressed by existing research programs.

Program guidance is provided by an Oversight Committee comprised of a representative cross section of freight stakeholders appointed by the National Research Council of The National Academies. The NCFRP Oversight Committee meets annually to formulate the research program by identifying the highest priority projects and defining funding levels and expected products. Research problem statements recommending research needs for consideration by the Oversight Committee are solicited annually, but may be submitted to TRB at any time. Each selected project is assigned to a panel, appointed by TRB, which provides technical guidance and counsel throughout the life of the project. Heavy emphasis is placed on including members representing the intended users of the research products.

The NCFRP will produce a series of research reports and other products such as guidebooks for practitioners. Primary emphasis will be placed on disseminating NCFRP results to the intended end-users of the research: freight shippers and carriers, service providers, suppliers, and public officials.

NCFRP REPORT 6 (Revised)

Project NCFRP-02
ISSN 1947-5659
ISBN 978-0-309-21335-6
Library of Congress Control Number 2011932595

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The project that is the subject of this report was a part of the National Cooperative Freight Research Program, conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council.

The members of the technical panel selected to monitor this project and to review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical panel and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at:

http://www.national-academies.org/trb/bookstore

Printed in the United States of America

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FOREWORD

By William C. Rogers
Staff Officer
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NCFRP Report 6 (Revised): Impacts of Public Policy on the Freight Transportation System describes the numerous ways that government policy decisions can affect the freight system and, in turn, how understanding the differing concerns and priorities of governments is crucial to better consideration of the potential impacts of public policy. Using interviews with industry experts and an extensive review of documents, the research identifies current and recent policy issues with potential freight system impacts, evaluates the magnitude of the impacts, and assesses the extent to which the impacts were unexpected. Among the types of impacts identified were (1) changes in costs and revenues to freight carriers and shippers, (2) changes in freight volumes or shifts in mode, (3) changes in freight service quality, and (4) changes to freight system operations and safety. The research will promote a better understanding at all levels of government of the complex relationships inherent in public policy and foster appreciation for how public policies affect the freight transportation system.

The freight system is largely a private-sector enterprise, but public policy decisions have major impacts on its development and operations. To a large degree, the system is invisible to most Americans, and to most people, the phrase "transportation policy" is usually associated with passenger transportation. Even for most transportation officials, the freight transportation system receives little thought. Not only is the freight system little known or understood, there is even less understanding of the many links through which policy actions, whether related to transportation or not, can affect the movement of freight.

Under NCFRP Project 2, ICF International was asked to examine a wide range of public policy decisions made since 1980, as well as some policies currently being debated but not yet enacted, in order to reveal the numerous ways that government policy decisions have affected (or could affect) the freight system. In addition to identifying freight system impacts, the report also assesses the extent to which such impacts were unexpected by the relevant decisionmakers. Lastly, the report considers the opportunity to improve public policy decisions through access to better information about freight system impacts.

Editor's Note: *NCFRP Report 6 (Revised): Impacts of Public Policy on the Freight Transportation System* replaces *NCFRP Report 6* of the same title, previously distributed. Revisions have been made to two sections of the report, as follows:

- The section on "Truck Size and Weight Rules," in Chapter 4 has been corrected and updated.
- The second paragraph of "Operations and Maintenance Policy," in Chapter 6 under Summary Discussion, has been revised.

The assistance of C. Randal Mullett (Con-way, Inc.) and Dr. Michael Belzer (Wayne State University) in this work is acknowledged with thanks.

C O N T E N T S

Note: Some of the figures and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

SUMMARY

Impacts of Public Policy on the Freight Transportation System

The nation's freight transportation system is largely invisible to most Americans, including many public officials. Not only is the freight system little known or understood, there is even less understanding of the many links through which government actions, whether related to transportation or not, can affect the movement of freight. This research is intended to address this shortcoming by examining freight system impacts relative to a wide range of public policies. The study focuses on recently enacted policies as well as some policies currently being debated but not yet adopted.

Through an extensive literature review, numerous interviews with freight industry experts, and some new analysis, this report reveals the numerous ways that government policy decisions have affected (or could affect) the freight system. Potential effects include changes in costs and revenues to freight carriers and shippers, changes in freight volumes or shifts in mode, changes in freight service quality, and changes to freight system operations and safety. In addition to highlighting freight system impacts, the report assesses the extent to which such impacts were unexpected by the relevant decisionmakers. Finally, the report considers the opportunity to improve public policy decisions through access to better information about freight system impacts.

What Public Policies Can Affect the Freight Transportation System?

Many government policies have affected or could affect the freight system. Most policies relate to one of the following topics:

- Safety
- Security
- Land Use
- Environmental
- Energy and Climate Change
- Infrastructure Operations and Maintenance
- Infrastructure Investment
- Infrastructure Finance
- Trade and Economic Regulation

Table S-1 provides examples of policy decisions at all three government levels that may affect the freight system.

Table S-1. Examples of public policies that may affect the freight system.

Policy Category	Federal	State	Local/Regional
Safety	• Truck, railroad, and aviation HOS rules • Interstate speed limits • Truck electronic onboard recorder rules • NHTSA rules for trucks • FRA inspection of tracks and vehicles • FAA rules for aircraft design • Hazmat rules • Coast Guard rules for barges	• Highway speed limits • Enforcement of FMCSA truck rules • Restrictions on locomotive horns	• A few local railroad speed limits • Parking and truck access restrictions
Security	• Transport. worker iden. credential (TWIC) • Truck driver background checks • U.S. exit fingerprinting rules • Chemical facility anti-terrorism standards • Screening cargo on passenger aircraft • Customs rules/programs (FAST, CTPAT)	• Some routing and infrastructure access restrictions	• Some routing and infrastructure access restrictions
Land Use	• Brownfields programs	• Land use planning requirements	• Zoning and planning • Redevelopment • Truck parking limits
Environmental	• Emission standards • Fuel standards • Air quality standards • CMAQ Program • Management of dredging spoils • Water pollutant discharge rules for vessels	• Air quality programs • CA in-use truck standards • CA MOA on Tier 2 locomotives and idling	• Truck idling limits • Airport noise limits • Vessel speed limits • Vessel shore power requirements • Port dray truck rules
Energy and Climate Change	• Requirements or subsidies for alt. fuels • GHG cap and trade • CAFE standards for trucks • Programs and incentives to improve fuel efficiency (e.g., SmartWay)	• Requirements or subsidies for alt. fuels • GHG cap and trade • CA truck fuel efficiency requirements	• Investment/ incentives for alternative fuel infrastructure and vehicles
Infrastructure Operations and Maintenance	• Truck size and weight rules • COE maintenance dredging • COE lock and dam maintenance • COE decisions on water levels	• Highway operations and maintenance decisions • Enforcement of size and weight rules • Hwy seasonal load limits • Truck routing restrictions	• Truck routing limits • Truck parking restrictions • Port and airport operations
Infrastructure Investment	• Level of highway funding • Support for large, targeted projects • Highway design standards • Some aid for RR infrastructure • Level of inland waterway investment	• Level of highway funding • Project selection and design	• Local roadway funding • Project selection and design
Infrastructure Finance	• Fuel taxes (on-road) • Fuel taxes (inland towing) • Approval for tolls and other user charges • Airport peak pricing policy	• Fuel taxes (on-road) • Other taxes • Tolls and other user charges • Privatization of roads • Port fees	• Tolls • Local taxes • Privatization of roads • Port fees (e.g., TEU fee, gate pricing)
Trade and Economic Regulation	• NAFTA, other trade agreements • Jones Act • Agricultural subsidies • STB rules on railroad rates	• None	• None

How Do Public Policies Affect the Freight Transportation System?

To illustrate freight system impacts, this report reviews more than 25 government policy decisions. Table S-2 summarizes some of the potential effects of different types of policy. Although this is a summary, it illustrates the diversity of impacts and complexity of the issue.

Table S-2. Examples of freight system impacts.

Type of Policy	Potential Impacts
Direct taxes or charges to carriers (fuel taxes, vehicle excise taxes, tolls)	Change in carrier costs Change in shipper costs Shifts in modal share between truck and rail Change in freight volumes in corridors
Environmental regulations that increase equipment or fuel prices	Change in carrier capital and operating costs Change in shipper costs
GHG cap and trade	Loss of rail carrier revenue Increase in carrier fuel costs
Renewable fuel standards	Potential increase in rail carrier revenue Increase in carrier fuel costs
Air-cargo screening on passenger flights	Degraded service in air cargo Shift to all-cargo carriers
Fingerprint rules for outbound ships and planes	Increase in carrier costs
Rules that directly change operations (truck route restrictions, parking restrictions, restrictions on rail operations)	Increase in carrier costs Change in freight volumes in corridors Degraded service
Land use policies that affect location of freight facilities	Increase in carrier costs Increase in shipper costs Possibly degraded service
Dredge spoil disposal policies	Increase in shipper costs Shifts to other ports
Driver hours of service rules	Increase in costs for some carriers
Truck size and weight rules	Change in fuel use Change in shipper costs
Truck speed limits and speed governor rules	Decrease in fuel costs Increase in capital costs for some carriers Change in profitability for some carriers

Availability of Information on the Effects of Policies

Information on the effects of various policies on the freight system is ultimately useful only if it improves future policy decisions. There is great variation in the quality and depth of analysis of freight system impacts done in advance of a policy decision and the degree to which results are available to decisionmakers. Many of the policy examples reviewed in this study involve rules and regulations established by Federal agencies that apply directly to freight carriers. Most of the safety, security, and environmental policies fall in this category. The Federal rulemaking process typically requires that freight industry impacts are analyzed in these instances. Although these analyses may not be perfect, they provide an opportunity for decisionmakers to consider freight system impacts and for stakeholders to comment on the analyses.

There are other regulations that apply directly to freight carriers for which an analysis of freight system impacts is generally not performed for various reasons. For example, if the regulation applies to a much broader segment of the transportation sector than just freight (e.g., all motor vehicles or all aircraft), then the analysis may not consider those effects that are freight-specific. Alternatively, if the regulation is enacted at the state or local level, or imposed by Congress, there may be no requirement for any analysis of industry impacts. Finally, freight system impacts may not be analyzed simply because they are (1) not recognized, (2) considered negligible, or (3) too difficult to quantify.

Then there are all the policies that do not involve regulations directly applicable to freight carriers. Most decisions about infrastructure investment, pricing, trade, land use, and energy/climate change fall in this category, as do some environmental, safety, and security regulations. These types of policy decisions rarely receive a forward-looking analysis

Table S-3. Classification of policy examples—availability of impact information.

	Regulations that Apply Directly to Freight Carriers	Other Public Policies
Freight System Impacts Analyzed	Hours of Service for Drivers Truck Speed Limits and Governor Rules Aircraft Fuel Tank Flammability Rules TWIC for Ports and Inland Towboats Emissions Standards for Diesel Engines Int'l Air Emissions Regulations for Vessels Federal Truck Size and Weight Rules	
Freight System Impacts Generally Not Analyzed	Alien Fingerprint Rules for Outbound Planes and Ships Air Cargo Screening Requirements Idling Restrictions for Trucks and Locomotives Water Pollutant Discharge Rules for Vessels State Truck Route Restrictions Local Truck Access and Parking Policies Local Restrictions on Locomotive Horns State Truck Size and Weight Rules	Local Land Use Policies Restrictions on Disposal of Port Dredging Spoil Local Policy to Oppose a Railroad Acquisition Highway Infrastructure Investment Inland Waterway Infrastructure Investment Highway Tolls and Other User Charges Lockage Fees for Inland Waterways Peak Pricing for Port Trucks Peak Pricing for Airports GHG Cap and Trade Renewable Fuel Standards, Incentives

of freight system impacts; however, they may have the largest and most far-reaching impacts on the freight system.

Table S-3 shows these three categories of policies with examples of each. Note that these are necessarily generalizations and numerous exceptions exist. For example, although most state and local governments do not perform a systematic analysis of the industry impacts of truck idling regulations, California undertook such an analysis.

Decisionmaker Constituencies

The other element of the decision context concerns the institutional and political setting in which decisions adverse to the freight system are made. In some cases, good information on freight system impacts would make little difference in a policy decision because the decisionmakers are driven by other imperatives. One example of this would be restrictions on truck traffic on local roads, imposed by local or state governments. From the point of view of a city council or county board, by far the dominant issue may be quality of life in the affected area. Concerns about the efficiency of freight movement probably will carry little weight in such decisions. An exception might occur if a significant local employer were damaged to the extent that it might consider moving its facility. In these cases, state governments may be taking a broader economic view, but decisionmakers must also answer to voters for whom quality of life is an immediate, palpable issue, and the efficiency of the national freight system is a distant abstraction.

The point is not that these governments are making "good" or "bad" decisions, but that differing levels and differing types of governments have different concerns and priorities, and one has to bear these in mind when analyzing policy choices. It is generally true that the lower the level of government, the more officials are concerned with purely local impacts and the less concern they have for national effects. It is also true that, the lower the level of government, the less the impact on the national system of the decisions of *any single* government. But similar decisions by many local governments can affect the national system.

One example of local government decision is local parking restrictions coupled with local and state failure to provide adequate truck rest stop and parking facilities.

Decision Context Framework

The decision-making context reveals three general cases in regard to understanding the freight system, the potential effects of the policy, and the priority accorded to effects on the freight system:

- Case 1
  - Policymakers have a good understanding of the freight system and the potential effects of a policy decision.
  - Policymakers have a relatively high level of concern for freight system efficiency.
  - Additional information on freight impacts may be helpful to policymakers, but is unlikely to change decisions in most cases.
- Case 2
  - Policymakers have a limited understanding of the freight system and the potential effects of a policy decision.
  - Policymakers have some concern for freight system efficiency.
  - Additional information could change decisions.
- Case 3
  - Policymakers have a poor understanding of the freight system and potential effects of a policy decision.
  - Policymakers have little or no concern for freight system efficiency.
  - Additional information probably would not change decisions.

Table S-4 summarizes how these three cases apply to the policy examples covered in this report.

Conclusions

The research indicates the following:

1. **A wide variety of public policies can affect the freight transportation system.** In many cases, this potential for impacts is obvious, as in the case of investment and operations decisions concerning freight system infrastructure or environmental and safety regulations affecting freight equipment. In other cases, the potential to affect the freight system is less obvious. This is particularly true in the case of policies enacted to achieve goals unrelated to transportation (e.g., land use policies or dredge spoil disposal policies) and policies that affect the entire transportation system, both passenger and freight (e.g., highway investment policy, alien fingerprinting rules, or renewable fuel standards).
2. **There are relatively few examples of recent public policies that have had unexpected impacts on the freight transportation system.** Among the more than 30 individual policies examined in this study, only a handful have resulted in impacts on the freight system that were not recognized by the decisionmakers. These few examples include highway and waterway investment and finance policies, as well as some local government decisions regarding land use and truck access.

   When they have occurred, unexpected impacts have been relatively minor in many instances. For example, the magnitude of the 2006 truck "pre-buy" that resulted from new EPA emission standards was unexpected, but its effects on the freight system were minor. Nearly all of

Table S-4. Decision context of policy examples.

Category	Policy	Level of Implementation		
		Federal	State	Local
Safety	Hours of Service Rules for Drivers	Case 1		
	Truck Speed Limits and Governor Rules	Case 1	Case 2	
	Aircraft Fuel Tank Flammability Rules	Case 1		
	Restrictions on Locomotive Horns	Case 1		Case 3
Security	TWIC for Ports and Inland Towboats	Case 1		
	Alien Fingerprint Rules for Outbound Planes, Ships	Case 2		
	Air Cargo Screening Requirements	Case 2		
Land Use	Local Land Use Policies			Case 2
Environment	Emissions Standards for Diesel Engines	Case 1	Case 1	
	Idling Restrictions for Trucks and Locomotives		Case 3	Case 3
	Restrictions on Port Drayage Trucks			Case 2
	Restrictions on Disposal of Port Dredging Spoil	Case 2	Case 2	Case 3
	Water Pollutant Discharge Rules for Vessels	Case 2		
	International Air Emissions Regulations for Vessels	Case 1		
Energy and Climate Change	GHG Cap and Trade	Case 2		
	Renewable Fuel Standards, Incentives	Case 2		
Operations and Maintenance	Truck Route Restrictions		Case 2	Case 3
	Local Policy to Oppose a Railroad Acquisition			Case 3
	Local Truck Access and Parking Policies			Case 3
	Truck Size and Weight	Case 2	Case 3	
Infrastructure Investment	Highway Infrastructure Investment	Case 1	Case 1	
	Inland Waterway Infrastructure Investment	Case 2		
Infrastructure Finance and Pricing	Highway Tolls and Other User Charges	Case 2	Case 2	
	Lockage Fees for Inland Waterways	Case 2		
	Peak Pricing for Port Trucks			Case 2
	Peak Pricing for Airports	Case 1		

the safety, environmental, and operations policies the research team examined have had either minimal freight system impacts or impacts that were fully anticipated by policymakers.

Some of the policies reviewed, particularly those related to security, had not been in place long enough to assess their effects at the time of the research. Some of these policies, such as the TWIC rules, may eventually have significant and possibly unexpected freight system impacts.

3. **Significant unexpected freight system impacts are unlikely to occur in a short time frame for policies recently adopted or currently debated.** The lack of unexpected impacts is not surprising, given our focus on recent (primarily since 1990) policies and the nature of the policy issues during that period. One can certainly identify older policy decisions that have eventually resulted in major freight system impacts. Examples include the Federal-Aid Highway Act of 1956 that established the Interstate system or the Jones Act of 1920 that affects coastal shipping. But the major freight system impacts of these policies were not felt for decades. Other historic examples, such as the Motor Carrier Act of 1980 that deregulated trucking, have resulted in major freight system impacts in a relatively short time frame. But no current or recent policies involve such a major restructuring of the freight industry.
4. **There are few situations in which better information on freight system impacts could change policy decisions.** In many cases, government decisions that affect freight transportation are made in the context of either (1) good information on potential impacts and a con-

cern for the freight system or (2) a lack of concern about freight system impacts. In the latter situations, providing policymakers with better information about freight system impacts will make little or no difference.

Examples of policy decisions that *could* potentially be influenced by better information include

- Truck speed limits
- Some Federal security regulations (e.g., air cargo screening)
- Local land use decisions
- Environmental regulations on dredge spoil disposal and vessel water pollutant discharge
- GHG cap and trade and alternative fuels regulations
- State truck route restrictions
- Road pricing for trucks
- Investment and finance decisions for inland waterways

These are the Case 2 examples. In all of these cases, more or better information on the freight system could potentially improve policy decisions at the Federal, state, or local levels. The key to bringing about better decisions—better in the sense that effects on freight are considered—is greater awareness of freight on the part of relevant officials. There is no single way to bring this about. It is probably easiest to achieve at the Federal level, where executive agencies could ensure that they give freight impacts full consideration when analyzing effects of proposed rules. An information program with the goal of calling the attention of state officials to non-transportation policy areas where decisions can affect the efficiency of freight movement could also be considered. Perhaps this might best be done by state DOTs making other elements of their own state governments more aware of potential effects on freight.

Table S-4 shows that, among the policies reviewed in this report, only three of the Case 2 examples are at the local level, and two of those are concerned with truck movements at ports. These are instances where state DOTs or other state agencies could offer useful information in some cases. If local authorities perceive a state DOT as encroaching on their responsibilities, such efforts could be counterproductive. However, freight industry executives have pointed out that state economic development agencies have sometimes been effective in showing local governments how, for example, new intermodal terminals can bring jobs and tax revenues. There is no single or simple way to bring a higher level of freight awareness to relevant officials, but there are many possible ways that could be effective in different contexts.

CHAPTER 1

Introduction

The nation's freight transportation system is invisible to most Americans. In the public mind, "transportation policy" is usually associated with passenger transportation, primarily highways, public transit, and air travel. When freight transportation is considered, the focus is often on one mode of transport rather than on the freight system as a whole. And what is true of the general public is also true for a great many public officials whose decisions can significantly affect the freight transportation system.

Because of freight transport's lack of prominence, many policymakers have an inadequate understanding of how their decisions can affect the freight transportation system. This research is intended to address this shortcoming by examining freight system impacts across a wide range of public policies. The study focuses on recently enacted policies as well as some policies being debated but not yet adopted. Both transportation and non-transportation policies are included.

Through an extensive literature review, numerous interviews with freight industry experts, and some new analysis, this report reveals the many ways that government policy decisions have affected (or could affect) the freight system. Potential effects include shifts in freight mode as well as changes in the following:

- Costs to freight carriers
- Revenues to freight carriers
- Costs to freight shippers
- Freight volumes
- Freight service quality
- Freight operations
- Freight system safety
- Freight fuel use or emissions

In addition to highlighting freight system impacts, the report assesses the extent to which such impacts were unexpected by the relevant decisionmakers. Finally, the report considers the opportunity to improve public policy decisions through access to better information about freight system impacts.

Definition of Policy

It may be helpful to define "policy" in the context of this work. "Policy" is often used in two different ways. One has to do with general statements of principles or goals. The other has to do with specific government actions. Broad "policy statements" by government agencies or officials fall into the former category. These statements may convey intent or desire to adopt measures for stated purposes—cleaner air, greater fuel efficiency, reduced highway congestion, etc.—but are not, themselves, government actions that affect the behavior of individuals, firms, or other government agencies. One may call this policy-in-principle.

One may call the latter case policy-in-fact. This comprises formal action by elected officials or government agencies, including programs for investment (e.g., direct spending, grants, and credits), taxes and fees of all kinds, rules and regulations that directly constrain behavior, and legal action by governments. Government decisions to adopt such measures—the real policy decisions—are the policies of interest here, because, one way or another, such decisions either directly affect behavior of various entities relating to freight carriage or change in some way the environment in which actors in the freight system operate and make decisions.

Methodology

The research team began the study by developing a broad list of public policies that could directly or indirectly affect the freight transportation system. This initial list of policies guided the next phase of the research—a search for literature analyzing the effects of these policies on the freight sector. The literature search covered all of the primary freight transport modes: trucking, railroads, inland waterway towing, ports and maritime, and air cargo. The types of documents identified include Federal and state regulatory impact analyses, reports from Federal agencies such as the U.S. Government Accountability Office (GAO), congressional testimony, academic journal articles, news stories, and TRB publications.

In the next phase of the project, the research team built on the information gathered in the literature search by interviewing freight transportation stakeholders, primarily industry executives and academic researchers. The goal of the interviews was to find out directly from industry experts which public policies have had the largest or most unexpected effects on the freight system. The research team developed a standard interview questionnaire, which was then customized for each transportation mode. The research team conducted approximately 40 stakeholder interviews across all of the primary modes of freight transport.

Based on the results of the literature search and the stakeholder interviews, the research team amended and winnowed its initial list of policies to identify approximately 12 policies most worthy of further analysis. In developing this list, we looked for policy choices with relatively strong and recent impacts on the freight modes and the efficiency of their operations. For this purpose, the research team relied on the literature and, importantly, on freight industry reactions to policy issues.

The research team held two focus groups with trucking industry experts and railroad industry experts. The focus groups provided an opportunity for an in-depth discussion of some of the most important policy decisions affecting these two modes.

For approximately ten policies or policy areas, the research team performed a more detailed analysis of freight system impacts. The research team also conducted four case studies to better understand the background and factors that led to a policy action, the positions of stakeholders on the issue, and the effects of the policy action on the freight system.

Report Organization

The remainder of this report consists of five chapters and four appendices. Chapter 2 offers an overview of the freight transportation system, describing each of the major modes, the infrastructure, the private-sector stakeholders, and the general role of government. Chapter 3 identifies public policies that can affect the freight transportation system in nine policy categories. Chapter 4 reviews 23 public policies to assess their freight system impacts and the degree to which the impacts were unexpected. Chapter 5 contains four case studies that present a more in-depth examination of select policy decisions. Chapter 6 presents a summary and synthesis of the research, including an examination of the role that information plays in influencing policy decisions.

Appendix A lists the interviewees and focus group participants. Appendix B contains a more detailed discussion of the effects of five specific policies. Appendix C lists the literature reviewed as part of this study. Appendix D lists abbreviations, acronyms, and initialisms found throughout the report.

CHAPTER 2

Overview of the Freight Transportation System

What Is Freight Transportation?

Simply defined, freight transportation is the movement of goods from one area to another. Freight transportation allows production and consumption to occur at different locations. Transportation is necessary for economic specialization. Freight transportation allows companies to (1) specialize in producing the products for which they are best suited and (2) trade with other companies to obtain products that can be made more efficiently by others.

Freight transportation can be considered from the perspectives of both supply and demand. Demand comes from businesses that need to move raw materials, supplies, and finished products. These businesses, called shippers, are the purchasers of freight transportation.

The supply of freight transportation is provided by the infrastructure and the companies that move the goods, called carriers. Freight infrastructure includes the roadway system, railroads, airports, marine ports, locks and dams on rivers, and pipelines. Freight carriers are the owners or operators of the trucks, trains, ships, and airplanes that provides transportation to shippers.

Other important private players in freight transportation include freight brokers, freight forwarders, and third-party logistics providers. Freight brokers assist shippers and carriers in assembling paperwork for international or complicated shipments. Freight forwarders consolidate multiple small shipments into larger shipments for transport. (This often involves preparing shipping and customs documents as well.) Third-party logistics providers (3PLs) are companies employed to assume freight/logistics tasks previously performed in house by shippers.

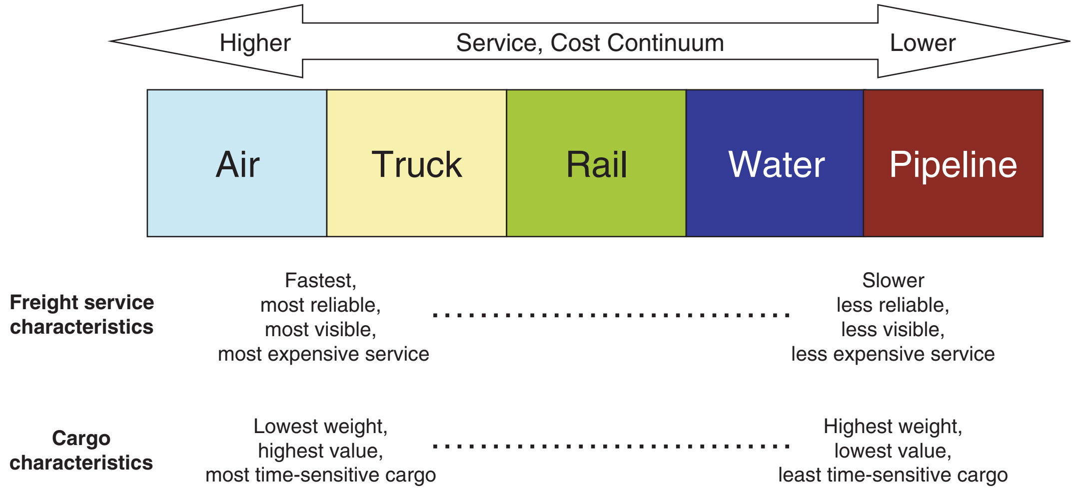
The Freight Transportation Modes

The primary modes of freight transportation are truck, rail, marine, air, and pipeline. Each of these modes tends to provide different types of services and move different cargo types. One can think of freight transportation modes as providing a continuum of speed and service types (see Figure 2-1). One end of the freight service continuum is characterized by fast and reliable delivery, but these high levels of service also cost the most. Air transportation is the most expensive and fastest. Truck transportation provides rapid and flexible service for shippers, but at higher cost than rail transport. Marine and pipeline transportation are the least expensive in terms of cost per ton-mile, but they provide less rapid and flexible freight service.

Cargo characteristics determine the type of transportation service demanded by shippers. Companies shipping high-value or perishable cargo tend to select truck or air transport to reduce transit time and gain higher levels of reliability. Air freight carries high-value goods for which delivery within a few hours is often critical, such as express parcels and fresh flowers. Trucks move a range of products, but they move a greater percent of higher value commodities like finished consumer products, computers, and pharmaceuticals. Railroads tend to carry lower value, slow-moving bulk traffic (e.g., coal and grain), although they also move some higher value products (e.g., auto parts and finished vehicles). Domestic marine transport tends to carry low-value bulk cargo (e.g., coal and grain) for which speed does not matter. Pipelines are used primarily for petroleum products and natural gas. Overall, more expensive transportation services provide shippers greater visibility in terms of where their shipment is and when it will be delivered.

The length of haul is also an important shipment characteristic that determines mode choice. Trucks tend to capture a greater percentage of short-haul freight movements. Rail, marine, and air shipments tend to have a longer average shipment distance.

Freight shipments often use more than one mode of transportation. Trucks connect shippers to rail or marine transportation modes or provide the "last mile" of freight transportation to the customer. "Intermodal" freight typically refers to freight moving in containers or trailers that can easily be transferred



Source: Adapted from National Highway Institute Course 139001, "Integrating Freight in the Transportation Planning Process."

Figure 2-1. Freight service and cost continuum across modes.

between ships, railroads, and trucks. By reducing the cost of using multiple modes of transportation, intermodal freight movement allows shippers to use lower cost modes (such as rail or marine) for long-haul movements and then switch to truck carriers to reach a final destination.

Figure 2-2 shows the modal shares of U.S. freight transportation in terms of value, tons shipped, and ton-miles. (One ton-mile is a ton of freight moving one mile.) Trucking, measured by value and tonnage, is the dominant freight mode. Freight in the "multiple modes" category includes parcels and U.S. mail, most of which involves trucking as well. Rail accounts for a large portion of ton-miles in part because it involves some very long hauls.

The following sections provide a brief overview of each of the different freight modes.

The Air Cargo System

Air cargo traffic is dominated by large hub airports, such as Los Angeles International, Miami International, and Anchorage International Airports, and the hub airports for Federal Express and UPS (Memphis and Louisville, respectively). Several dozen smaller freight-only airports have an important role in the air cargo system. Virtually every airport handles at least some air cargo.

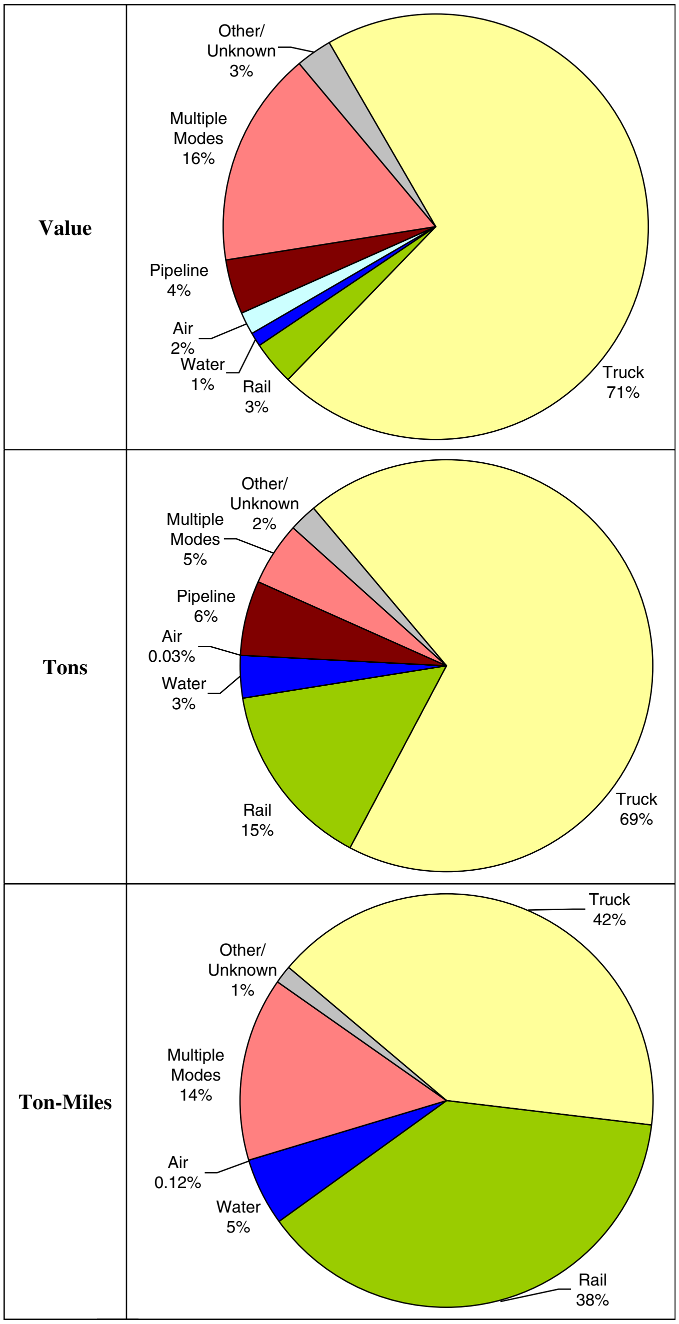
The U.S. air freight industry has four basic types of carriers:

- **Express consignment air carriers,** such as Federal Express and UPS, run scheduled flights and use a hub-and-spoke system, where cargo is flown to a limited number of hub airports before being sent on to its ultimate destination. Express carriers operate as integrated carriers, meaning they provide door-to-door transportation using their own or contracted airplanes and trucks.
- Most **passenger airlines** carry freight in the belly of passenger planes. Cargo is carried to maximize the use of the aircraft, but cannot be completely loaded until the air carrier knows how many passengers and how much luggage a flight will be carrying.
- **Cargo-only carriers** operate aircraft (freighters) that carry only cargo on fixed schedules. Express carriers and some passenger carriers may operate some cargo-only planes as well. These operators receive cargo directly from shippers and from freight forwarders. Large cargo-only carriers include Atlas Air, ASTAR Air Cargo, and Polar Air Cargo.
- A number of air carriers provide only **charter air cargo service.** Charter operators are generally small. A single customer, such as a consolidator, may hire the aircraft for a specific trip.

As shown in Figure 2-3, the express carriers transport 70 percent of all domestic air cargo tonnage.

The Trucking System

The roadway network is the infrastructure for freight trucks. The National Highway System (NHS) consists of 160,000 miles of roadway important to the nation's economy and mobility, including the Interstate Highway System, many state highways, and key intermodal connectors. Figure 2-4 shows the major highways on which freight truck activity is concentrated. Highway segments shown in red and orange carry the highest truck volumes—more than 10,000 trucks on a typical day. On the red segments, at least 25 percent of all vehicles are freight trucks; on the orange segments, trucks are less than 25 percent of the total. Highway segments in green and black carry fewer than 10,000 trucks per day; trucks make up at least 25 percent of the traffic volume on the green segments.

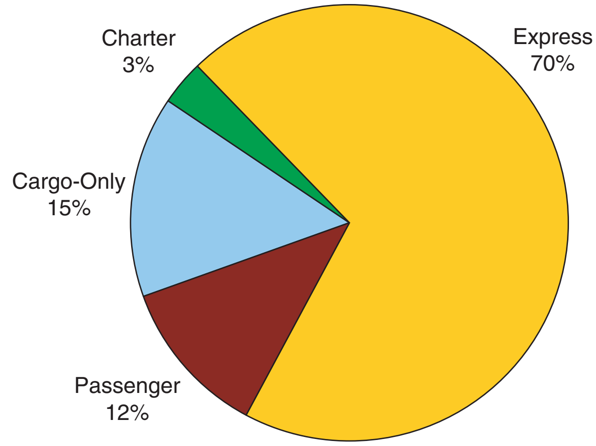


Source: BTS, *National Transportation Statistics 2009*.

Figure 2-2. U.S. freight transportation by mode, 2007.

Nearly all long-haul, intercity trucking is done by combination trucks (i.e., tractor-trailer rigs, typically with five axles), while urban trucking is dominated by single-unit trucks. Intercity trucking comes in three basic forms: truckload, less-than-truckload, and private.

- **Truckload** (TL) service provides shippers who can fill an entire truck with direct point-to-point service. The largest truckload carriers include Schneider National, J. B. Hunt, Swift, Werner, and US Xpress.



Source: FAA, T-100 data.

Figure 2-3. U.S. air cargo tonnage by carrier type, 2007.

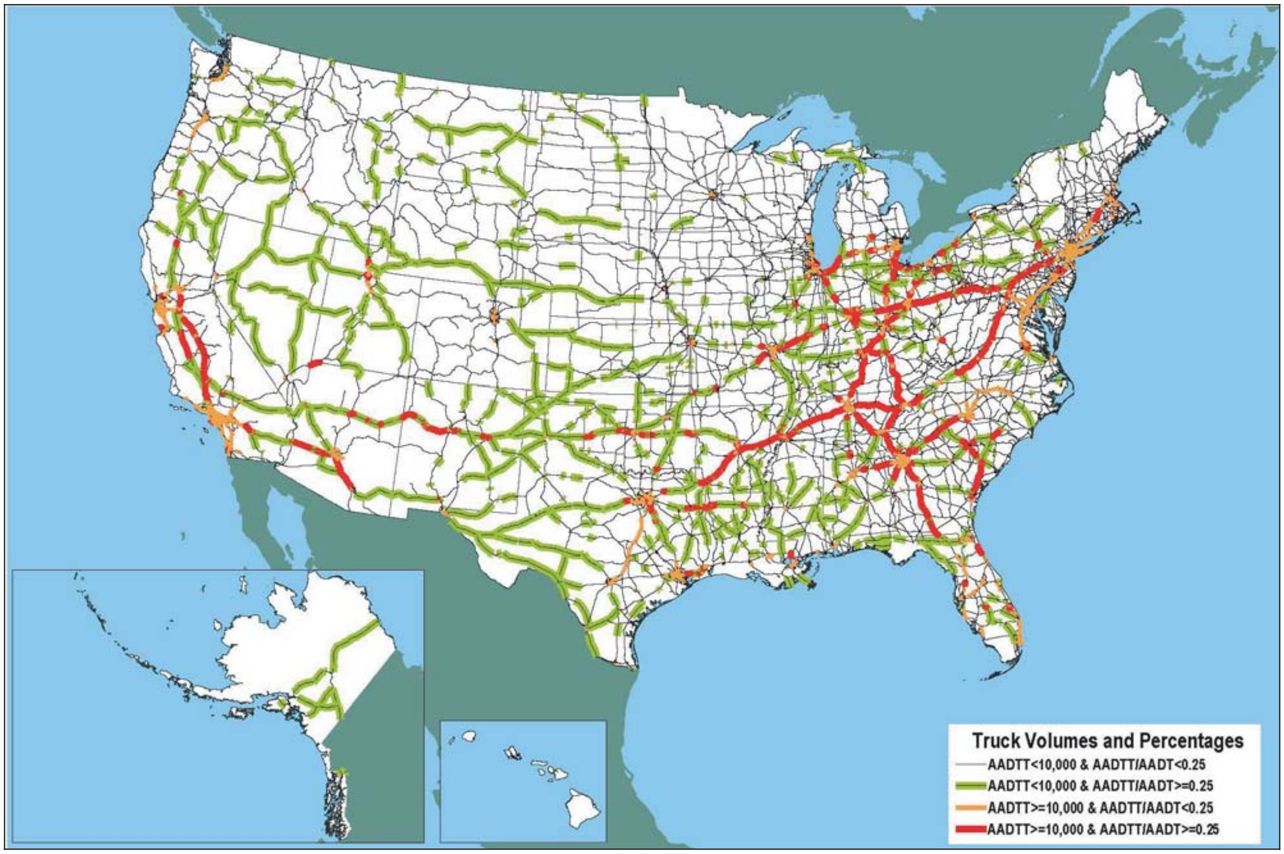
- **Less-than-truckload** (LTL) service is used by shippers with smaller shipments that do not require a whole trailer. LTL carriers provide local pick-ups, consolidate shipments into full truckloads at a terminal, carry shipments to a destination terminal, and then provide local delivery from there. Yellow Roadway, ABF, Con-way, Old Dominion Freight, FedEx Freight, and UPS Freight are the largest national LTL carriers.
- **Private trucking** comprises shippers that carry their own cargoes, usually because they believe it gets them the highest level of reliability. Private carriage is often used by major retailers with large and elaborate supply-chain networks. Large private truck carriers include Coca Cola, Sysco, Walmart, Tyson Foods, and Safeway.

The LTL and TL sectors are completely different in terms of number of firms. An LTL operation of any size requires a network of terminals. The large national carriers each have 200 to 300 terminals. In truckload service, by contrast, there are virtually no barriers to entry. If an individual can afford a tractor and trailer and find a few customers, he or she can get in the business. Including single-truck "owner operators," there are hundreds of thousands of truckload motor carriers in business. There is a high degree of competition in the trucking business. Virtually all shippers have access to more than one trucking firm.

The Railroad System

The railroad network in the United States consists of approximately 171,000 miles of track and numerous switching yards where trains are assembled and disassembled.[1] Railroads provide three basic services:

[1] BTS, Miles of Freight Railroad Operated by Class of Railroad: 2007.



Note: AADTT is annual average daily truck traffic; AADT is annual average daily traffic (all vehicles).
Source: FHWA, *Freight Story 2008*. Developed from Freight Analysis Framework, version 2.2.

Figure 2-4. Major truck routes on the national highway system, 2002.

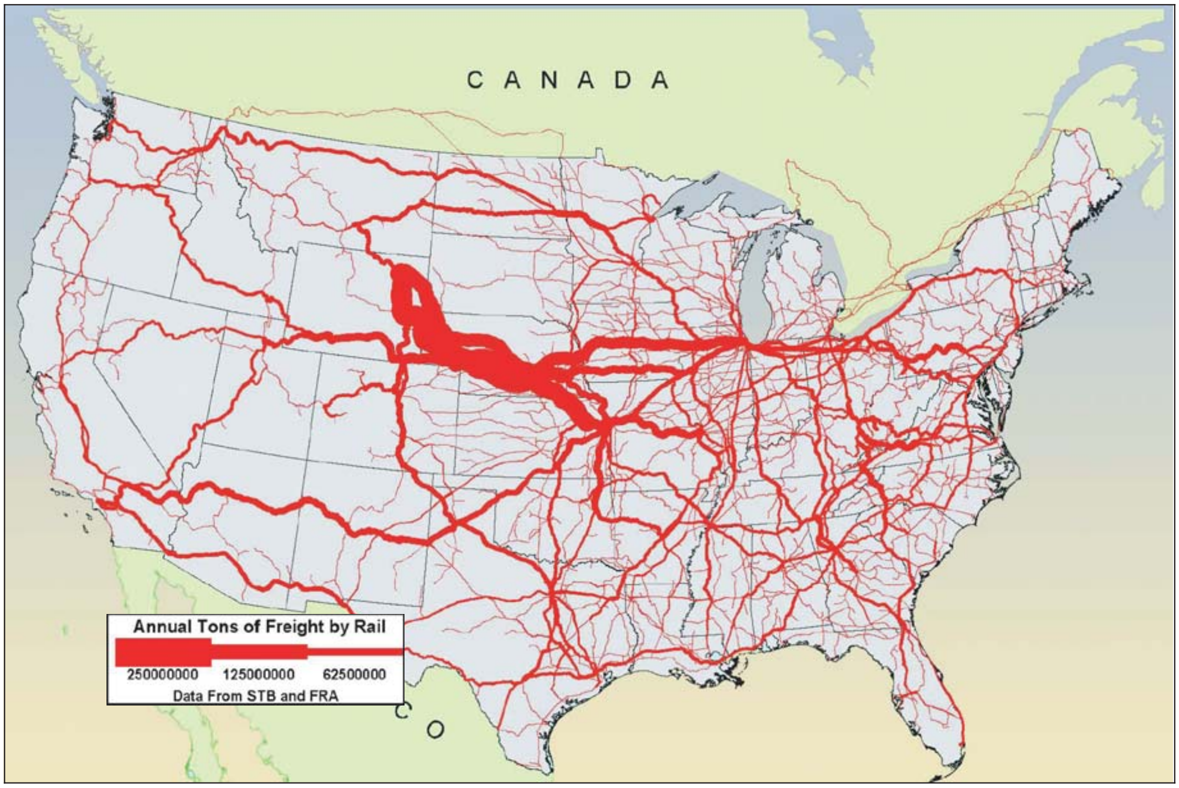
- **Unit trains** move bulk goods for shippers who can load an entire train at one time. This usually involves 100 or more cars. Unit trains are typically loaded with coal or grain; coal trains originating in Wyoming's Powder River Basin account for a large portion of rail network tonnage (see Figure 2-5).
- Railroads also provide **intermodal service.** This involves loading trailers and containers onto railcars. Shippers tend to use intermodal service for higher value goods. Using rail intermodal service can lower rates for shippers for long hauls as compared to all-truck transportation. Rail lines between West Coast ports and Midwestern distribution hubs (e.g., Chicago) carry heavy intermodal traffic.
- Last, railroads also provide **carload service.** This is for shippers who load one or a few cars at a time and can tolerate long transit times in exchange for low rates.

The rail sector is dominated by four mega-carriers: Union Pacific (UP) and Burlington Northern Santa Fe (BNSF) in the West and CSX and Norfolk Southern in the East. These four carriers move more than 90 percent of U.S. rail ton-miles. Three other carriers of significant size are the U.S. subsidiaries of the two major Canadian railroads, Canadian National and Canadian Pacific, and Kansas City Southern, which has a sizable regional operation roughly in the middle of the United States. These three carriers together have 8 percent of the combined revenue of the big four. After that, there are a few hundred small regional carriers and short lines.

Clearly, there is a high degree of concentration in this sector. This reflects the enormous investment in infrastructure required to be in the railroad business on a large scale. The degree of competition varies with individual markets. As noted, rail intermodal service is in direct competition with truckload service in many markets. Truckload is also a competitor in most other rail markets, except long movements (more than 200 to 300 miles) of coal and grain. There is significant competition among railroads in most, but not all, markets. Some coal and grain shippers have access to only one rail carrier.

The Ports and Inland Waterway System

The U.S. marine freight system consists of waterways and ports, including inland ports and ocean ports. Ocean port infrastructure is managed by various public and private port authorities funded primarily through user fees. Measured by tonnage, the two largest U.S. ports are the Port of New Orleans and the Port of Houston, both of which handle more than



Source: FHWA, *Freight Facts and Figures 2007.*

Figure 2-5. Tonnage on the railroad network, 2005.

200 million tons of freight (much of it bulk petroleum products). Measured by value, Los Angeles is the largest U.S. port. The neighboring ports of Los Angeles and Long Beach are the major gateway for imported freight from Asia; together they handle one-third of all U.S. marine container traffic. On the East Coast, New York/New Jersey, Savannah, Norfolk, and Charleston are major container ports. The top U.S. container ports are illustrated in Figure 2-6.

The inland and intracoastal waterway network is also an important component of marine transportation infrastructure in the United States. This network includes the Mississippi River and its tributaries, the Gulf Intracoastal Waterway, the Atlantic Intracoastal Waterway, and the Columbia-Snake Waterway in the Pacific Northwest. The system includes 191 commercially active lock sites, which allow barges to reach inland ports such as Memphis, Chicago, Minneapolis, Pittsburgh, and Lewiston, ID. The Saint Lawrence Seaway is another important waterway, providing ocean-going vessels access to the Great Lakes. As shown in Figure 2-7, the bulk of domestic marine freight transport occurs on the Mississippi and Ohio Rivers, and to a lesser extent, the Great Lakes.

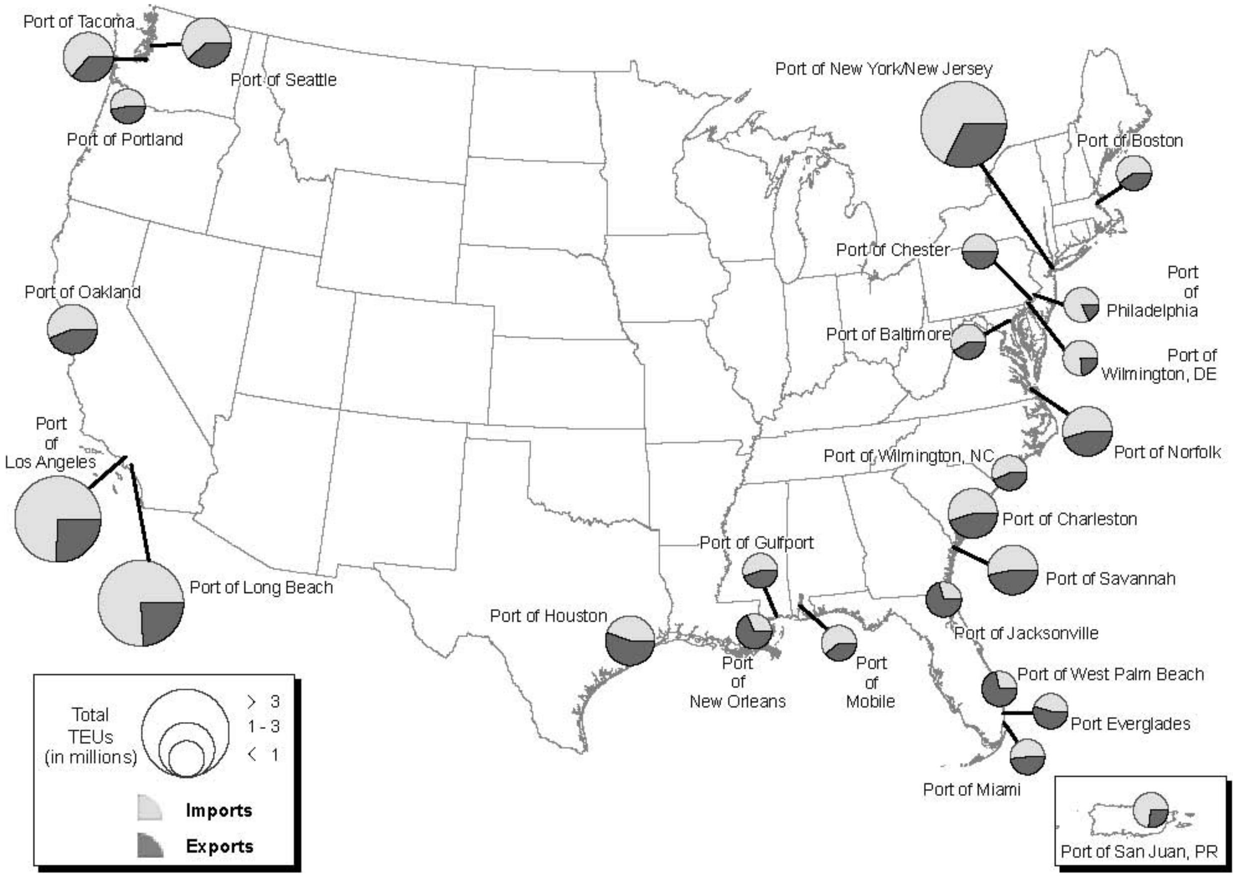
The Pipeline System

Pipelines are used primarily to move petroleum products and natural gas, as well as some other chemicals. The pipeline system consists of several different components.

- **Collection pipelines** move products from sources such as wells on land or offshore or from oil tankers or liquefied natural gas (LNG) tankers. These pipelines move products to storage, refineries, or other processing centers.
- **Transmission pipelines** transport large quantities over longer distances. Transmission lines deliver natural gas to distant power plants, large industrial customers, and municipalities for further distribution. Petroleum transmission lines deliver crude oil to distant refineries. Transmission lines also deliver refined products to distant markets, such as airports, or to depots, where fuel oils and gasoline are loaded into trucks for local delivery.
- **Distribution lines** move natural gas and consist of main lines, which move gas to industrial customers, and smaller service lines that connect to businesses and homes.

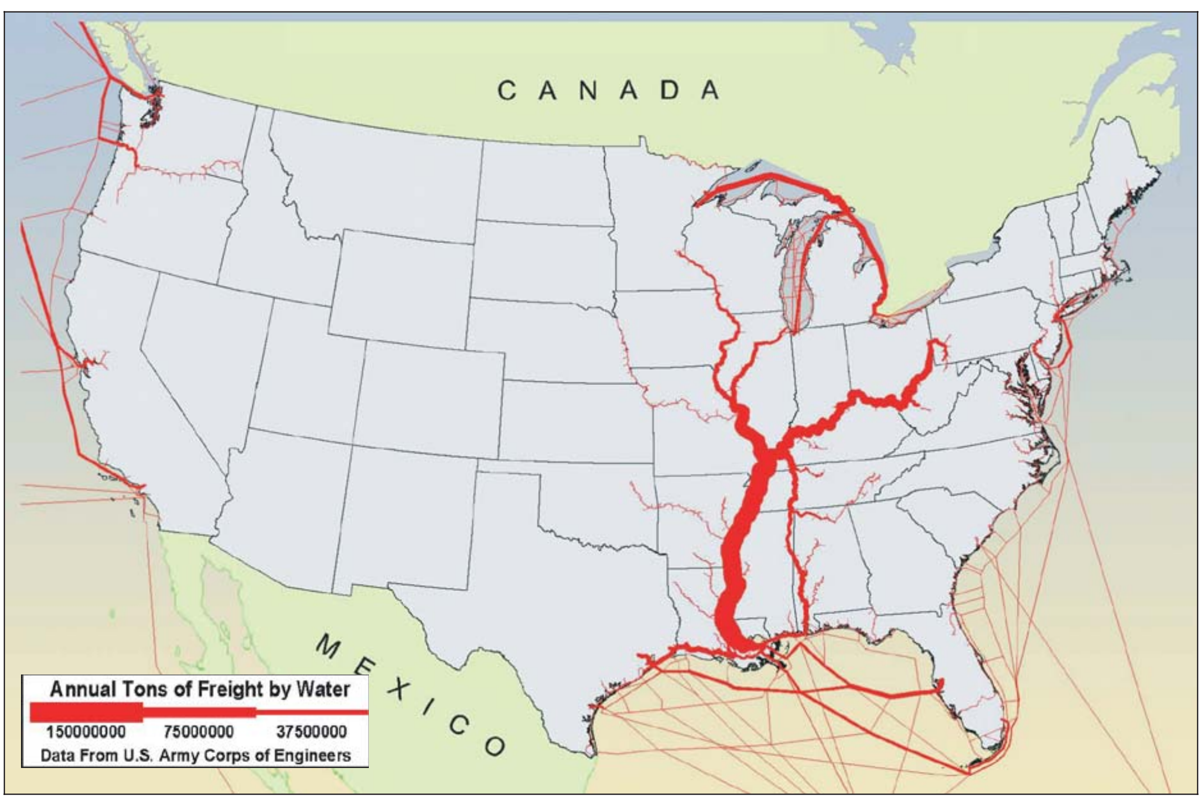
In total, the United States has more than 2.3 million miles of pipeline; roughly 450,000 miles of which are collection and transmission lines. Approximately 900 billion ton-miles of petroleum and natural gas are moved in pipelines annually.[2] See Figure 2-8 for an illustration.

[2]Dennis, Scott, "Improved Estimates of Ton-Miles," *Journal of Transportation Statistics,* Volume 8, Number 1, 2005.



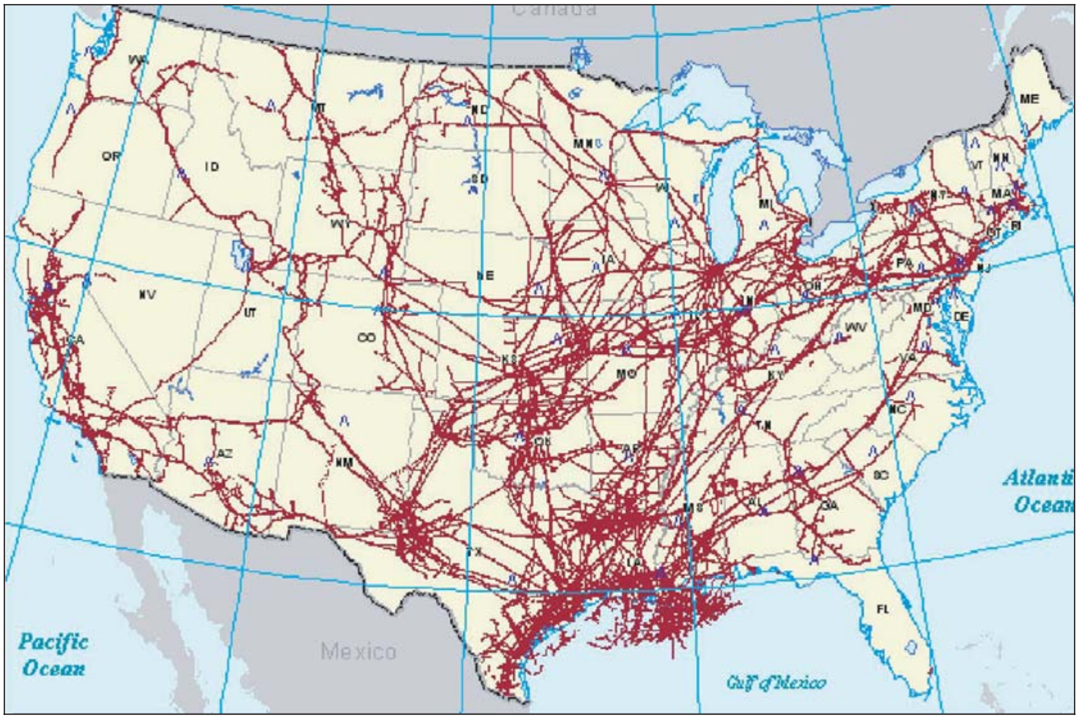
Source: BTS, *America's Container Ports: Freight Hubs That Connect Our Nation to Global Markets*, June 2009.

Figure 2-6. Top U.S. container ports, 2008.



Source: FHWA, *Freight Facts and Figures 2007.*

Figure 2-7. Tonnage on the domestic waterway network, 2005.



Source: National Highway Institute Course 139001, "Integrating Freight in the Transportation Planning Process."

Figure 2-8. U.S. pipeline network.

The Role of Government

Government at all levels has a role in building, operating, maintaining, and regulating the freight system, although the specific government roles vary considerably across the modes.

At the Federal level, the two major government roles in freight are (1) funding and related cost-recovery policies and (2) regulation, especially safety and environmental regulation. For highways, the Federal government sets overall levels of Federal aid and, through the earmarking process, takes a hand in project selection. Congress must also provide the financing for highway investment through fuel taxes, other user charges, or various credit devices. The Federal government has a similar role in providing funding for airport infrastructure. (In this regard, both the FHWA and FAA set standards for highway and runway design.) FAA directly funds and operates the air traffic control system. The U.S. Army Corps of Engineers (USACE) is responsible for maintaining and improving the inland waterway system, including building locks and dredging navigation channels. Railroads and pipelines are in a separate category in terms of funding; with limited exceptions, they bear the full financial responsibility for their infrastructure.

In terms of safety regulation, numerous Federal agencies are involved, including FAA, the Federal Motor Carrier Safety Administration (FMCSA), National Highway Traffic Safety Administration (NHTSA), Federal Railroad Administration (FRA), the Coast Guard, the Maritime Administration (MARAD), and the Pipeline and Hazardous Materials Safety Administration (PHMSA). The Environmental Protection Agency (EPA) establishes many environmental rules that affect freight carriers. The Transportation Security Administration (TSA) makes security-related rules. The U.S. Congress may enact regulatory laws in any of these areas.

The Surface Transportation Board (STB) is unique in the extent of its role as a Federal economic regulator. Railroads have monopoly power in some of their markets. STB must decide rate cases in such markets and make rules regarding these issues.

The state role in freight system funding is similar to the Federal role. State legislatures set highway funding levels and play a role in project selection; they are also involved in setting fuel taxes and other user charges to finance the system. States may invest in ports and airports as well. State authorities have responsibility to enforce some safety regulations, such as supporting FMCSA rules and weight limits. State legislatures set speed limits, subject to Federal constraints. States can impose some environmental regulations, such as requirements for impact analysis and mitigation for transportation projects. California is unique among states in its authority to set motor vehicle emission standards.

Local government roles tend to be similar for all modes, mostly relating to land use planning and local rules to minimize the adverse effects of freight facilities, such as noise, traffic, and lighting. Decisions in these areas primarily affect trucking and rail, but they can also affect barge and aviation operations. Many seaports and airports are owned and managed by a public port authority, sometimes created by a local government and sometimes created by a state.

Table 2-1 shows the principal Federal and state agencies with direct policy responsibilities for the freight system.

Table 2-1. Summary of major government roles in freight systems.

Mode	Funding Agencies		Regulating Agencies	
	Federal	**State**	**Federal**	**State**
Air	Congress FAA (traffic control, airports)	Legislatures DOTs (airports)	FAA EPA TSA PHMSA	N/A
Truck	Congress FHWA	Legislatures DOTs	FMCSA (operations) NHTSA (vehicles) EPA TSA PHMSA	Legislatures DOT Law enforcement DMV
Rail	minimal	minimal	STB (economic) FRA EPA TSA PHMSA	Environmental agencies
Water	Congress Corps of Engineers	Legislatures	Coast Guard MARAD Fed. Maritime Commission TSA PHMSA	Legislatures Environmental agencies
Pipeline	minimal	minimal	PHMSA FERC (economic)	Environmental agencies Offices of pipeline safety

CHAPTER 3

What Public Policies Can Affect the Freight Transportation System?

Chapter 2 introduced the role of government at the Federal, state, and local level in funding, operating, and regulating the freight transportation system. Many government policies were developed with the intent to directly affect freight carriers or shippers. Although the magnitude of freight system effects may be different than expected, and the policies may have other unintended spillover effects, the primary cause-effect relationship for these policies is usually clear. Other government policies affect the freight system more indirectly, in that the intent of the policy was not to cause a freight system effect. An example of such an indirect impact is the growth in railroad transport of Power River Basin coal resulting from the Clean Air Act.

In this section, the research team illustrates the many government policies that have had or could have freight system effects. The research team has organized this review around the following nine policy categories:

- Safety
- Security
- Land Use
- Environmental
- Energy and Climate Change
- Infrastructure Operations and Maintenance
- Infrastructure Investment
- Infrastructure Finance
- Trade and Economic Regulation

Safety Policy

Safety is a broad area with significant policy-making roles for both the Federal government and states. Much of the regulatory decision making is at the Federal level. FMCSA, for example, sets safety rules for trucking, including the hours-of-service (HOS) rules for drivers and rules for electronic on-board recorders. The National Highway Transportation Safety Administration (NHTSA) sets vehicle-design standards.

The primary safety functions of the Federal Railroad Administration (FRA) are inspection procedures and standards for equipment (cars and locomotives), track, and signals. These include standards to be met for different track speeds. In the past, Congress legislated some safety rules, such as requiring that brakes be in operating condition, but most of these (except HOS) are now managed by FRA. Standards for materials and the design of equipment, track, and signals are set by an industry body for equipment (the Association of American Railroads [AAR]) and by a professional association of engineers for track and signals (the American Railway Engineering and Maintenance Association [AREMA]). HOS rules for train crews are, for the most part, set by Congress.

Hazardous materials transport is the focus of much Federal policy debate, including the safety of hazmat transportation in general, liability costs to carriers, safety and security risks, and community concerns over hazmat passing through localities. FAA sets safety policy for aircraft that can affect the air cargo industry. Coast Guard safety rules affect barge operations.

The states make decisions regarding highway speed limits (albeit they are constrained by Federal laws) and play an important role enforcing size-and-weight rules for trucks, FMCSA rules regarding truck operations, speed limits, and other regulations. State and local governments have recently been involved in policy decisions affecting the use of locomotive horns at grade crossings and funding for grade-crossing improvements using Federal grants. Local governments may establish truck parking policies or other access restrictions in the name of improving pedestrian or vehicle safety. Table 3-1 lists examples of safety policies that may affect the freight system.

Security Policy

Following the events of 9/11, the Federal government has proposed and implemented new rules and regulations related to transportation security, some of which affect freight. Many of these policies focus on screening workers and restricting

Table 3-1. Examples of safety policies that may affect the freight system.

Federal	State	Local/Regional
• Truck HOS rules • Railroad HOS rules • Aviation HOS rules • Interstate speed limits • Truck speed governor rules • Truck electronic onboard recorder rules • Other FMCSA rules for drivers and carriers • NHTSA rules for trucks • FRA inspection of tracks and vehicles • FAA rules for aircraft design; inspection of aircraft • Hazmat rules • Coast Guard rules for barges and barge operations	• Highway speed limits • Enforcement of FMCSA truck rules • Restrictions on locomotive horns	• A few local railroad speed limits • Parking and truck access restrictions

freight-terminal access to authorized persons. Examples include the driver background checks required under the PATRIOT Act, the Transportation Worker Identification Credential (TWIC) program for access to secure areas of port facilities and vessels, and rules for fingerprinting aliens exiting the United States on cargo planes and ships. Other Federal rules focus on the security of cargo (e.g., requirements for screening cargo carried on passenger planes).

Some state and local government agencies have implemented freight access restrictions, primarily for security purposes. For example, trucks were prohibited from using some New York City tunnels following 9/11. The District of Columbia adopted a ban on railroad hazmat shipments through the city center, although the rule was blocked by a court decision. Table 3-2 lists examples of security policies that may affect the freight system.

Land Use Policy

Land use policy occurs almost exclusively at the state and local level. States (in some cases) set policies that affect local land use planning practices, and states may also be involved in actions that affect state land (e.g., open space protection) and economic development. Most land use decisions are made at the local level. Policies regarding zoning, planning, redevelopment, and property taxes can all have important indirect effects on the freight system. Policy choices in these areas can, for example, affect locations of warehouses and truck and rail terminals. Local governments make many other types of decisions regarding the development and use of land with potential freight impacts (e.g., requirements for noise barriers, truck parking, truck routing, truck idling, street geometrics, and signalization). In a few cases, Federal policies and programs can influence land use patterns in ways that affect freight. For example, EPA's Brownfields Program has led to redevelopment of land in freight-intensive areas. Table 3-3 lists examples of land use policies that may affect the freight system.

Environmental Policy

As with safety, environmental policy is a broad area in which all three levels of government have an active role. The most significant environmental policies affecting freight concern air quality. EPA sets national engine emission standards for new trucks, locomotives, marine vessels, and aircraft and regulates transportation fuels to achieve emission reductions. (The California Air Resources Board [CARB] has similar authority in California.) These policies are closely related to energy and climate change policies. EPA also establishes

Table 3-2. Examples of security policies that may affect the freight system.

Federal	State	Local/Regional
• TWIC • Truck driver background checks • U.S. exit fingerprinting rules • MARAD foreign crew ID requirements • TSA airport security protocol • Chemical facility anti-terrorism standards • Screening cargo on passenger aircraft • Screening of import containers • Customs rules/programs (FAST, CTPAT)	• Some routing and infrastructure access restrictions	• Some routing and infrastructure access restrictions

Table 3-3. Examples of land use policies that may affect the freight system.

Federal	State	Local/Regional
• Brownfields programs	• Land use planning requirements	• Zoning • Land use planning • Redevelopment • Property taxes • Truck parking • Truck routing

ambient air quality standards and related air quality planning rules, which can affect transportation planning and infrastructure investment. Other Federal environmental regulations that may affect the freight system include those related to water quality, toxic substances, and solid waste. Government agencies at all levels may be involved in decisions on the disposal of harbor dredging spoils, which directly affect ports.

States (and, in some cases, regional agencies) develop and implement air quality plans. Local governments can enact restrictions on freight operations (primarily trucks) in the name of environmental quality. For example, many states and cities have adopted regulations on truck (and occasionally locomotive) idling. Local governments can set regulations on noise or the visual impacts of freight facilities (e.g., lighting). Some port authorities (particularly the Ports of Los Angeles and Long Beach) are pursuing various environmental policies, including vessel speed limits, requirements for vessels to use shore power, clean fuels rules, and port truck emissions limits. Table 3-4 lists examples of environmental policies that may affect the freight system.

Energy and Climate Change Policy

Historically, energy policy was almost exclusively the preserve of Federal policymakers. Recent concern about global climate change has recast many energy policy issues in terms of greenhouse gas (GHG) emission reduction. This is a policy category where states (and sometimes local governments) have pursued policies that promote alternative energy sources and reduce GHG emissions ahead of Federal action. Federal programs, such as the EPA's SmartWay Transport Partnership, currently provide incentives to improve freight fuel efficiency through public recognition and funding for improvements (e.g., truck stop electrification). EPA may soon establish heavy-duty truck fuel efficiency standards.

Both the Federal government and some states have set standards for use of renewable fuels, including blending ethanol with gasoline and use of biodiesel. California has adopted a low-carbon-fuel standard that mandates a reduction in fuel carbon-intensity; several other states are considering similar policies. Congress is debating comprehensive climate change legislation that would establish a national GHG cap and trade program covering transportation fuels, following the lead of three different state consortia: the Western Climate Initiative (WCI), the Midwest GHG Reduction Accord (MGGRA), and the Regional Greenhouse Gas Initiative (RGGI) in the Northeast. California is pursuing several rules to reduce GHGs from freight movement, including requirements for fuel efficiency equipment on trucks. Both state and local government help to promote alternative fueling infrastructure and vehicles, sometimes affecting freight. Concern about climate change is also prompting some state and local governments to enact policies and programs to reduce freight GHG emissions by improving system efficiency. Table 3-5 lists examples of energy and climate change policies that may affect the freight system.

Infrastructure Operations and Maintenance Policy

States are primarily responsible for highway operations and maintenance decisions. The principal policy decisions relate to spending levels, but include policies such as seasonal

Table 3-4. Examples of environmental policies that may affect the freight system.

Federal	State	Local/Regional
• Emission standards • Fuel standards • Air quality standards and planning requirements • CMAQ Program • Management of dredging spoils • Water pollutant discharge rules for vessels • Oil spill prevention rules (e.g., double hulls)	• Plan and enact air quality programs • CA in-use truck standards • CA MOU on Tier 2 locomotives • CA MOU on locomotive idling • Drayage truck rules at ports	• Restrictions on truck idling • Airport noise restrictions • Restrictions on visual impacts (e.g., lighting) • Ocean vessel speed reduction • Vessel shore power requirements • Port drayage truck rules • Port fuels rules

Table 3-5. Examples of energy and climate change policies that may affect the freight system.

Federal	State	Local/Regional
• Requirements or subsidies for renewable fuels (ethanol, biodiesel) • GHG cap and trade • Clean Air Act regulation of GHGs • CAFE standards for trucks • Investment and incentives for alternative fuel infrastructure and vehicles • Programs and incentives to improve fuel efficiency (e.g., SmartWay)	• Requirements or subsidies for renewable fuels (ethanol, biodiesel) • Low-carbon-fuel standard • GHG cap and trade • CA truck fuel efficiency requirements • Investment and incentives for alternative fuel infrastructure and vehicles	• Investment and incentives for alternative fuel infrastructure and vehicles

load limits on highways as well as restrictions on truck routing. USACE is directly responsible for operation and maintenance of locks and dams on navigable rivers and for channel dredging in rivers and ocean harbors. Local government policies regarding truck routing and parking affect infrastructure operations, as do local decisions to oppose railroad acquisitions that might increase rail traffic. Local authorities also control many port and airport operational decisions. For example, hours for gate access to ports and for port operations are often set by local authorities. The Federal truck size-and-weight rules were established in part to limit highway pavement damage as well as for highway safety reasons. Other Federal and state government safety policies affect freight system operations—these were discussed under Safety Policy. Table 3-6 lists examples of infrastructure operations and maintenance policies that may affect the freight system.

Infrastructure Investment Policy

Federal government policy regarding infrastructure investment includes the level of aid to states for highways and direct investment in river and harbor navigation facilities. Rarely, the Federal government may provide investment aid to freight railroads; examples include Federal support for the Alameda Corridor Project and a few rail projects through the Congestion Management and Air Quality Improvement (CMAQ) Program. The amount of Federal funding and the types of improvement projects have major implications for the performance of individual facilities and the freight system as a whole. The distribution of funding across modes affects the costs and performance of each mode and the potential for competition among modes.

At the state, MPO, and local government level, relevant policy decisions concern the level of investment and project selection. State, MPO, and local decisionmakers lead decisions regarding roadway access to freight terminals (e.g., airports, seaports, and rail yards). Again, these investment decisions can directly affect the performance of the freight system and, consequently, the cost of freight transport. The modal distribution of state and local freight infrastructure investment is in part determined by the modal split at the Federal level, because Federal funding typically requires a local match. Table 3-7 lists examples of infrastructure investment policies that may affect the freight system.

Infrastructure Finance Policy

Both the Federal government and states impose fuel taxes in order to build, operate, and maintain the highway system. States may also adopt other user charges (e.g., tolls) to finance highways; Federal approval is required for Interstate highways. Other regional authorities, local governments, and private facility operators can also set highway and bridge tolls in

Table 3-6. Examples of infrastructure operations and maintenance policies that may affect the freight system.

Federal	State	Local/Regional
• Truck size and weight rules • Corps of Engineers maintenance dredging • Corps lock and dam maintenance • Corps decisions on water levels and flows on rivers	• Highway operations and maintenance decisions • Enforcement of size-and-weight rules • Seasonal load limits on highways • Truck routing restrictions	• Truck routing restrictions • Truck parking restrictions • Opposition to railroad acquisitions • Port and airport operations

Table 3-7. Examples of infrastructure investment policies that may affect the freight system.

Federal	State	Local/Regional
• Level of highway funding • Support for large, targeted projects • Highway design standards • Some aid for railroad infrastructure • Level of inland waterway investment (for repair/construction of locks and dams) • Modal split of funding	• Level of highway funding • Project selection • Design and build highway projects • Modal split of funding	• Local roadway funding • Project selection • Design and build roadways • Modal split of funding

some cases. The policy decisions in this category concern which mechanisms to use and how much money is required from each. Recently the policy decision-making process has expanded to include means for drawing in private funds—the Transportation Infrastructure Finance and Innovation Act (TIFIA) program and outright privatization of highways are two examples. The Federal government can also impose user charges to finance waterway infrastructure and aviation systems.

The level and type of fuel taxes, tolls, and other user charges affect freight carriage in numerous ways. These charges directly affect carrier operating costs and therefore influence the price of freight transport and the decisions of shippers. Tolls or other user charges on individual freight facilities can affect routing choices and, in some cases, time-of-day decisions. Table 3-8 lists examples of infrastructure finance policies that may affect the freight system.

Trade Policy and Economic Regulation

The Federal government establishes U.S. trade policy (e.g., the North American Free Trade Agreement [NAFTA] and other trade agreements), which affect the flow of goods both over land borders and through seaports and airports. Federal (and California) policy also affects the extent to which foreign trucking firms and drivers operate on U.S. highways. Federal subsidies for agricultural products and other commodities influence freight flows. Closely related is economic regulation, carried out exclusively at the Federal level. The principal example is Surface Transportation Board (STB) regulation of railroads, primarily for grain and coal. (Congress preempted state economic regulation of trucking in 1994.) The Jones Act is, in effect, another form of trade policy, requiring that coastwise maritime freight be carried in U.S.-flagged vessels.

These policies can affect the aggregate level of freight transport, shipper mode choice, carrier routing decisions, and the use of individual freight corridors and terminals, as well as efficiency of freight system components. For example, trade agreements that lower tariffs can stimulate freight movement between some nations, sometimes at the expense of others. By lowering the cost of international trade, trade policy can also stimulate total trade and encourage U.S. companies to rely more on foreign suppliers.

Economic regulation, or the removal of it, can affect the freight system profoundly. A prime example is the deregulation of trucking. The Motor Carrier Act of 1980 led to explosive growth in the truckload sector and the emergence of the competitive, low-cost truckload carriers we know today. Much of current U.S. logistical patterns—especially the wide use of just-in-time delivery, using fast and reliable trucking to hold down inventory costs—are built on the innovations in trucking that followed deregulation. Table 3-9 lists examples of trade policies and economic regulations that may affect the freight system.

Table 3-8. Examples of infrastructure finance policies that may affect the freight system.

Federal	State	Local/Regional
• Fuel taxes (on-road) • Fuel taxes (inland towing) • Approval for tolls and other user charges • Other finance programs (e.g., TIFIA) • Airport peak pricing policy	• Fuel taxes (on-road) • Other taxes • Tolls and other user charges • Other finance programs (e.g., infrastructure banks) • Privatization of roads • Port fees (e.g., TEU fee, gate peak pricing)	• Tolls • Local taxes • Privatization of roads • Port fees (e.g., TEU fee, gate peak pricing)

Table 3-9. Examples of trade policies and economic regulation that may affect the freight system.

Federal	State	Local/Regional
• NAFTA, other trade agreements • Jones Act • Agricultural subsidies • Customs regulations • STB rules on railroad rates	• None	• None

CHAPTER 4

How Do Public Policies Affect the Freight Transportation System?

Introduction

Government policy decisions can affect the freight transportation system in numerous ways. Many of these effects are small, but some can be significant. Because the freight transportation system is the backbone of the U.S. economy, changes in freight movement can ripple through U.S. society and affect us in our daily lives.

Freight system effects can be complex, and an understanding of the effects often requires at least a basic knowledge of the policy context. To illustrate these effects, this chapter reviews 23 government policy decisions, listed in Table 4-1. Some of these examples reflect a single law or government agency rulemaking (e.g., HOS rules for truck drivers). Other examples reflect a set of multiple policy decisions with a similar objective (e.g., Federal emission standards for diesel engines). In a few cases, the "policy" is one of inaction rather than action (e.g., inland waterway infrastructure investment).

Given that this research is to inform policy debates, the research team focused on examples of recently enacted policies (nearly all post-1990) and also some proposed policies that have not been enacted.

- **Recently enacted** policies may have effects that can be observed, or the effects may not yet be evident. In many cases, the effects of these policies have been projected as part of an impact analysis, although such analyses may not have considered the impacts on *all* components of the freight system.
- **Proposed policies** obviously do not have effects that can be observed, although effects can be projected based on similar past policies. Effects may have been projected (e.g., by the government, an affected party, or a researcher), particularly for Federal government rules on safety, security, or environmental issues.

For each example, the research team briefly describes the policy and its effects to the extent they are understood. The information on effects was informed by an extensive literature review, interviews with approximately 40 freight industry experts, and two focus groups. For five of the examples, a more detailed examination of the effects of the policies is included in Appendix B.

The research team then briefly discusses the extent to which any effects were unexpected by the involved policymakers and the extent to which understanding the effects is relevant to decision making. This last point—the decision-making context and role of information—is discussed in greater detail in Chapter 6.

HOS Rules for Truck Drivers

Policy Description

The truck driver HOS rules have been the subject of some controversy since they were first issued in 1938 to improve highway safety by reducing truck driver fatigue. After a significant change in 1962, the rules remained largely the same until 2003. During this period, the HOS rules limited operators of commercial vehicles to 10 hours of driving before an 8-hour rest break and an on-duty period of not more than 15 hours before the 8-hour break. The 15-hour "clock" would, however, stop when a driver went off duty for a meal or any kind of short rest. Thus, the elapsed time from the start of the on-duty period to the end could easily exceed 15 hours.

In 2003 the rule was modified to enhance truck safety by reducing fatigue. The new rule put drivers on a 24-hour cycle of on- and off-duty time, consistent with natural circadian rhythm. The rule also reduced the on-duty hours from 15 to 14 and extended the required rest period to 10 hours. Further, and importantly, the new 14-hour on-duty clock does not stop for an interim break. Fourteen hours after the start of an on-duty period, a driver cannot drive until after a 10-hour break. The rule also increased total driving time from 10 to 11 hours per day. The HOS rules also address total driving time in a multi-day period. Under the old rule, drivers were

Table 4-1. Policy examples discussed in this section.

Policy	Policy Category	Affected Modes
Hours of Service for Truck Drivers Hours of Service for Train Operators Truck Speed Limits and Governors Aircraft Fuel Tank Flammability Rules Restrictions on Locomotive Horns	Safety	Trucking Railroads Air cargo
TWIC for Ports and Inland Towboats Alien Fingerprint Rules for Outbound Planes and Ships	Security	Inland towing Ports Air cargo
Federal Emissions Standards for Diesel Engines California In-Use Truck Emission Standards Idling Restrictions for Trucks and Locomotives Restrictions on Port Drayage Trucks Restrictions on Disposal of Port Dredging Spoil Water Pollutant Discharge Rules for Vessels International Air Emissions Regulations for Vessels	Environmental Protection	Trucking Railroads Inland towing Ports
State Truck Route Restrictions Local Policies to Oppose a Railroad Acquisition Truck Size and Weight Rules	Operations and Maintenance	Trucking Railroads
Highway Infrastructure Investment Inland Waterway Infrastructure Investment	Infrastructure Investment	Trucking Inland towing
Highway Tolls and Other User Charges Lockage Fees for Inland Waterways Peak Pricing for Port Trucks Peak Pricing for Airports	Infrastructure Finance and Pricing	Trucking Railroads Inland towing Ports Air cargo

limited to 60 hours of driving in 7 days and 70 hours of driving in 8 days. The new rule changed the method of calculating the allowed driving time, permitting drivers to reset the multi-day periods by taking 34 consecutive hours off duty. After such a break, the multi-day period restarts from zero hours, whether or not a driver has reached the limit. The truck driver HOS rules are summarized in Table 4-2.

The new rule generally has been accepted by the industry but continues to face challenges from public-interest and labor organizations who argue that the rule compromises driver health and public safety. Further legal challenges to the rule and administrative action to change the rule will likely occur in the future.

Policy Impacts

The effects of the new rules vary across industry sectors. The rule has imposed some costs on long-haul truckload (TL) firms by reducing the total hours that their drivers can be on duty in a single stretch. Long-haul TL drivers spend a significant amount of time at loading docks. Under the old rule, drivers frequently logged time waiting in a queue as off-duty

Table 4-2. Summary of truck driver HOS rules.

11-Hour Driving Limit	May drive a maximum of 11 hours after 10 consecutive hours off duty.
14-Hour Limit	May not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. Off-duty time does not extend the 14-hour period.
60/70-Hour On-Duty Limit	May not drive after 60/70 hours on duty in 7/8 consecutive days. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.
Sleeper Berth Provision	Drivers using the sleeper berth provision must take at least 8 consecutive hours in the sleeper berth, plus a separate 2 consecutive hours in the sleeper berth, such that the total is 10 hours.

time. This was not legal, but it prevented the waiting time from constraining their allowed driving and on-duty time. For most long-haul TL drivers, the non-stopping clock has had a greater effect on time from start to end of an on-duty period than the reduction of on-duty time from 15 to 14 hours. Because waiting time now reduces time available for driving, the ability of long-haul TL drivers to use the allowed 11th driving hour is limited.

The inability to stop the clock for a break may also be a factor when new rules (e.g., local requirements that deliveries be made only at certain times) force changes in scheduling. That a driver cannot go off the clock when, for example, such a change introduces a delay at the end of a trip, may introduce new complexities into trip planning.

FMCSA analysis of survey data before and after the 2003 rule change suggests that the rule has reduced hours on the job for drivers.[3] In fact, on-duty hours fell from 64 to 62 for an 8-day period in a random selection of drivers. It is likely that this effect was greatest for long-haul TL drivers in unscheduled operation. Less-than-truckload (LTL) over-the-road drivers are almost always on schedules, and the same is true for many private drivers. Given that these latter groups of drivers typically do not come close to exhausting their on-duty hours, more of them are likely to be driving at least part of the 11th hour.

A study by J. B. Hunt found that 74 percent of their drivers used the 34-hour restart provision at least once in 30 days.[4] Increased scheduling flexibility from the 34-hour restart period has been widely perceived as a benefit under the new rule. Aside from the flexibility, many drivers appreciate that the restart makes it easier for them to keep track of their allowable hours under the multi-day provision; the procedure for the old rule was complicated.

Unexpected Impacts

A number of industry comments have suggested that the rule change has not had a negative impact on trucking productivity. Industry trends in safety performance measures have been positive. Large truck fatality and injury rates per mile have decreased during the period that the new HOS rule has been in effect.[5] In general, these results are consistent with the forecast impacts in the regulatory impact analysis (RIA) for the rule. The decisionmakers in FMCSA had a clear idea of what the effects would be.

As a result of the non-stopping 14-hour clock in the 2003 rule, carriers have had a stronger hand in working with shippers and receivers to reduce driver wait times. In many cases, carriers have imposed detention charges. As a result, shippers and receivers have had to take measures to reduce waiting time at their loading docks. The effect of reduced waiting time was not specifically analyzed in the RIA as a benefit of the rule. In this sense, this was an unexpected impact.

HOS Rules for Train Operators

Policy Description

The railroad HOS rules were originally created by statute in 1907 to correct abusive labor conditions in the railroad industry. Until recently, the law required that train crews and dispatchers work no more than 12 hours at a time. After 12 hours on duty, there must be 10 hours off duty. However, if crews work less than 12 hours, they are only required to be given 8 hours of rest.

In some cases, a train crew will reach its HOS limit at a place where they cannot be released from duty. In these cases, crews are required to stop the train, wherever it is, and wait for a new crew. The time after the train stops and before the crew can go off-duty is known as "limbo" time. Limbo time has come to mean time spent waiting for a new crew plus time traveling to the location where they can be released from duty. Limbo time does not count toward on-duty or off-duty time. Detailed provisions for limbo time are in each railroad's labor agreements, and they vary among carriers.

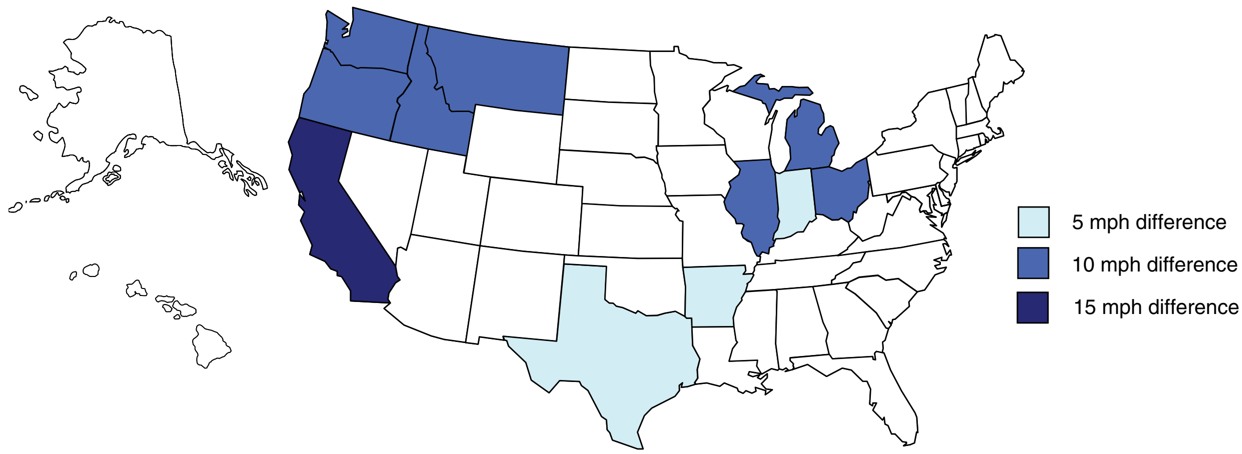
On September 12, 2008, a Metrolink passenger train collided with a Union Pacific freight train in Los Angeles, killing 25 people. Following the accident, Congress pushed rapidly to pass a rail safety law. On October 16, 2008, President Bush signed the Rail Safety Improvement Act of 2008 into law. Believing that long work hours contributed to the accident, the law revised the railroad HOS rules that went into effect in July of 2009. Specifically, the Act

- Limits the total on-duty and limbo time for train crew and dispatchers to 276 hours per month;
- Keeps total allowable shift time at 12 consecutive hours;
- Increases uninterrupted off-duty hours from 8 to 10 hours in a 24-hour period, regardless of prior on-duty time; and
- Requires 2 consecutive days off after 6 consecutive days worked or 3 consecutive days off after 7 consecutive days worked and reduces allowable limbo time to 40 hours per month and then to 30 hours per month 1 year after enactment.

Policy Impacts

Overall, recent changes to the HOS rule will likely improve safety on passenger and freight railroads. The changes address

[3]FMCSA, Final Rule: Hours of Service of Drivers, August 25, 2005, 70 FR 49977-50073.
[4]Ibid.
[5]Insurance Institute for Highway Safety, "Fatality Facts: 2006," www.iihs.org/research/fatality_facts_2006/largetrucks.html#sec1



Source: Insurance Institute for Highway Safety, Highway Loss Data Institute, http://www.iihs.org/laws/speedlimits.aspx

Figure 4-1. Auto/truck difference between maximum interstate speed limits, 2009.

widely acknowledged limitations of the current work rules. Authority over the rules was moved from the Department of Labor to the FRA to ensure a greater focus on safety.

Unexpected Impacts

The rules will reduce train operator fatigue, but will likely require that railroads hire more staff for train crews. More restrictive work rules will make it more likely that a fully rested train crew might be unavailable for service. In some cases, this could cause delays in the movement of freight or passenger trains during times of heavy demand. Over time, one would expect railroads to hire staff and adjust operations to reduce the likelihood of this happening.

Another possible response to the new rule is that railroads may seek to reduce the number of crew required to staff a train. The Rail Safety Improvement Act requires that railroads adopt positive train control. When positive train control technologies are fully implemented, railroads may be able to argue that train crews can safely be reduced to a single person.

Because the new rules were implemented just prior to this writing, it is difficult to identify any unexpected impacts at this time. The speed with which the bill was passed suggests that Congress may not have fully considered all of its potential effects. In addition, because the rule was implemented by statute, a notice and comment period and a formal RIA were not conducted. FRA is issuing some new rules to implement parts of the law.

The demographics of the current railroad workforce will require companies to hire aggressively. Retirement of a large cohort of workers will soon require significant new staff recruitment. The HOS rule changes will require more new workers beyond those needed for replacement. To the extent that new and less experienced staff constitute a higher safety risk, the initial safety benefits of the rule may not be as large as expected, but this effect would disappear over time, as the new staff acquires experience.

Truck Speed Limits and Speed Governor Rules

Policy Description

The first speed limits were introduced in 1901 to improve roadway safety. Since then, setting speed limits has been mostly the purview of state governments. To reduce fuel consumption during the energy crisis, the Emergency Highway Energy Conservation Act was passed in 1973, which created a national speed limit of 55 miles per hour. In response to public pressure for higher limits, Federal law was modified in 1987 to allow speed limits as high as 65 mph. National speed limits were repealed in 1994. Although advocates of the national speed limit in 1973 estimated that it would reduce fuel consumption by 2.2 percent, widespread non-compliance resulted in fuel savings that were substantially lower, between 0.5 and 1 percent.[6]

Following the repeal of the national speed limit in 1994, many states have raised speed limits to 70 or 75 mph for automobiles and introduced differential speed limits for cars and trucks. These limit heavy trucks to maximum speeds that are as much as 15 mph less than automobiles (see Figure 4-1).

A related policy debate concerns mandatory speed governors on trucks. The American Trucking Associations (ATA)

[6]Steven L. Johnson and Naveen Pawar, "Cost-Benefit Evaluation of Large Truck-Automobile Speed Limit Differentials on Rural Interstate Highways," Prepared for the Research and Special Programs Administration, US DOT. November 2005.

submitted a petition in 2006 requesting that FMCSA require manufacturers to allow the adjustment of speed-limiting devices to no more than 68 mph on all new trucks over 26,000 pounds GVW.[7] Approximately 77 percent of ATA's members have speed limiters set at 68 mph or lower.[8] The Province of Ontario recently passed a law requiring trucks with a model year of 1995 or newer to be speed limited at 65 mph, and the Province of Quebec has adopted similar rules.[9]

Policy Impacts

The safety impact of lowering speed limits and creating differential speed limits for cars and trucks has been the subject of debate among researchers and policymakers. Research clearly finds that lower vehicle speeds reduce the severity of crashes and the incidence of fatalities.[10] Lower speeds also improve truck-braking distances. On the other hand, differential speeds caused by lower speed limits can increase crash risk. Many researchers have argued that it is the speed difference between vehicles, not the absolute speed, that is most important for creating crash risk. Trucks traveling at speeds lower than the rest of traffic interact with more vehicles, increasing risk. In addition to the car-truck differential, speed limits over 65 mph tend to increase speed differentials between trucks by dividing trucks into company drivers (who tend to be speed limited at lower levels) and owner-operators (who typically can travel at higher speeds). Overall, researchers and policymakers have not reached consensus on the impact of differential speeds.

Regarding mandatory truck speed governors, large trucking companies, many represented by ATA, are supportive; they argue mandatory truck speed governors improve safety, reduce fuel consumption, and lower vehicle maintenance costs. Small owner-operators represented by the Owner Operator Independent Drivers Association (OOIDA) have opposed the ATA speed limiter proposal, arguing that it is a public relations stunt by large businesses that could disadvantage small firms.[11] There are also regional differences in firms' view of truck speeds. Interview respondents noted that trucking firms with major western operations would suffer significant driver productivity losses if speeds were reduced from 75 mph to lower levels. For a more detailed discussion of the effects of truck speed policies, see Appendix B.

Unexpected Impacts

The fuel economy impacts of the 1973 law were overestimated because lawmakers did not consider the effects of noncompliance. With respect to the recent increase in highway speed limits, the negative effects of differential speed limits were not fully expected by legislators and policymakers. The safety benefits of these policies have yet to be conclusively documented with scientific studies. Nonetheless, many industry safety managers are proponents of reducing truck speeds based on their firms' experience.

A potential unexpected impact of governing speed could be higher driver turnover, because many drivers oppose the use of speed governors, especially when drivers are paid by the mile or trip. If driver turnover increases and results in experienced drivers being replaced with inexperienced drivers, this could increase safety risk. Surveys of drivers have also suggested that being speed limited at lower speeds can cause fatigue in drivers on long trips. Drivers will obviously be on the road for less time if they travel at higher speeds. Speed-limited drivers also expressed frustration at being trapped in the right-hand lane and being forced to constantly deal with merging traffic.[12]

Aircraft Fuel Tank Flammability Rules

Policy Description

Since 1960, 18 airplanes have been damaged or destroyed as the result of fuel tank explosions. Such an explosion was determined to be the cause of the 1996 crash of TWA Flight 800 off Long Island, New York. This accident resulted in the death of all 230 people aboard. Although investigators have not always identified the ignition source of these explosions, for some of the most recent incidents, investigators determined that the explosion involved empty or nearly empty center-wing fuel tanks that contained flammable vapors when the fuel tanks exploded.[13]

In response to these incidents, FAA issued a final rule in July 2008 that requires manufacturers and operators of certain jet aircraft (both new and existing) to meet performance requirements for reducing fuel tank flammability to an acceptably safe level.[14] Although the rule does not direct the adoption of

[7]ATA, "Petition for Rulemaking before the National Highway Traffic Safety Administration (NHTSA) to amend 48 CFR Part 571 to Require Vehicle Manufacturers to Install Speed Limiting Devices Set at No More than 68 MPH on New Trucks with a GVWR of Greater than 26,000 Pounds," 2006.

[8]"Truckers Back a National 65-mph Speed Limit," *U.S. News and World Report,* March 26, 2008.

[9]"Ontario to Require 65-MPH Speed Limiters on Trucks," *Transport Topics,* June 18, 2008.

[10]TRB, *Safety Impacts of Speed Limiter Device Installations on Commercial Trucks and Buses: A Synthesis of Safety Practice,* 2008.

[11]OOIDA, "OOIDA Accuses Feds of Pandering to Big Business by Toying with Speed Limiter Idea," press release, January 26, 2007.

[12]Johnson and Pawar, November 2005.

[13]FAA, "Reduction of Fuel Tank Flammability in Transport Category Airplanes," Notice of Final Rule, July 21, 2008, 73 FR 42445.

[14]FAA, 73 FR 42444–42504.

specific technologies, the rule assumes that the affected aircraft will have to be equipped with some additional technology to render flammable vapors inert ("inerting technology") and that the cost will be borne by the aircraft owner or purchaser.

In its Notice of Proposed Rulemaking, FAA chose to exempt from the rule aircraft used in all-cargo operations because the potential benefits (in terms of lives saved) are far less than with passenger aircraft. However, the agency invited comments on whether it should apply the new requirements to all-cargo airplanes. Comments on the proposed rule from air cargo companies and associations supported FAA's stance in the proposed rule that all-cargo airplanes should be exempted. The commenters noted that FAA's cost-benefit analysis showed that the benefits of applying the rule to all-cargo airplanes were far outweighed by the costs. FedEx Express added that its own cost figures for installing and maintaining an inerting system were significantly greater than the numbers FAA used.

In the final rule, FAA kept the provision exempting existing all-cargo airplane operators from the requirement to retrofit their jets with fuel-inerting technology. But FAA did require that *new* all-cargo airplanes meet the rule's performance requirements for fuel-tank flammability. FAA concluded that this requirement for new cargo aircraft would be cost-effective, because the installation of the technology could be efficiently integrated into the production process for new airplanes. Also, the agency asserted that, in most cases, this integration would be done for the passenger version of the same airplane, so additional engineering work would be minimal. In the final rule, FAA also required that when any airplane is converted from passenger use to all-cargo use, the cargo operator must keep in operation any fuel-inerting technology already on the airplane.

Policy Impacts

As part of its rulemaking process, FAA estimated undiscounted compliance costs of $100 million ($37 million discounted) for air cargo operators. By comparison, FAA estimated undiscounted compliance costs of $2.1 billion ($1 billion discounted) for air passenger carriers. The rule is too new to allow a look-back analysis of actual compliance costs. In the research team's interviews with air cargo carriers, it was noted that if the rule were to add time to preparing an airplane for flight, the rule could prove costly to air cargo carriers offering expedited, time-definite deliveries. However, the written comments of FedEx Express, UPS, and the Air Cargo Association did not express any concerns about flight delays, so it appears unlikely that delays will result from the rule.

Unexpected Impacts

It appears that any impacts of this policy on the freight industry have been fully explored during FAA's rulemaking process. FAA completed a detailed RIA with impacts broken out for the air cargo industry.

Restrictions on Locomotive Horns

Policy Description

Collisions at highway rail crossings are the second biggest cause of injuries and fatalities in railroad operations.[15] As a supplement to grade crossing equipment, the sounding of a locomotive's horn before a highway grade crossing provides an additional way to alert motorists of the direction and imminent approach of a train. Nonetheless, to reduce noise levels, many communities have enacted restrictions and bans on the use of locomotive horns, especially communities with a large number of grade crossings and high train volumes.

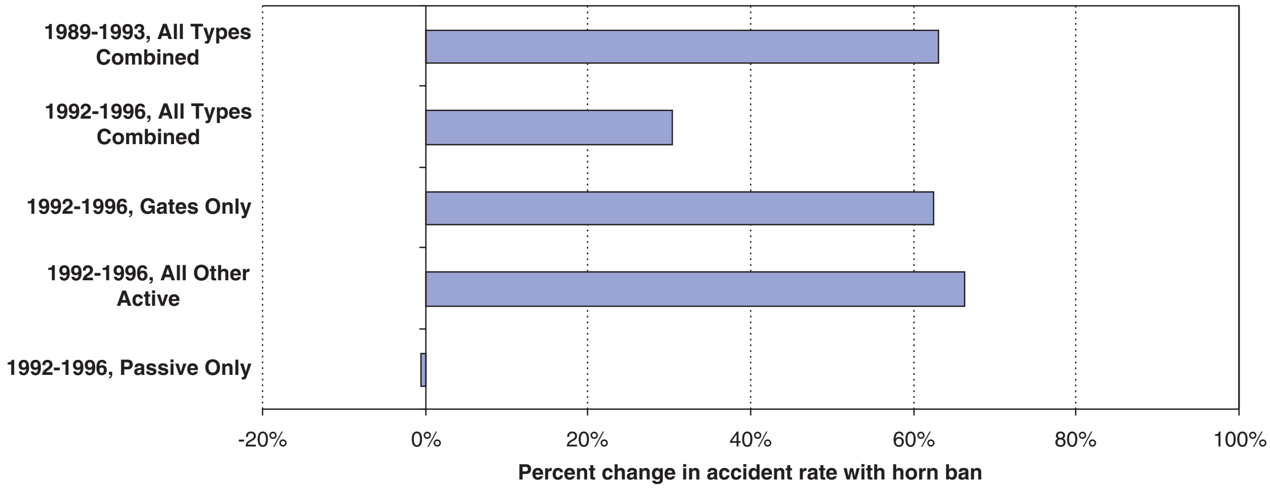
The issue was placed on the public agenda in Florida in 1984 by a state law that allowed communities to ban the night-time use of train horns at gated grade crossings associated with intrastate rail carriers. As a result of this, night-time horn bans were implemented at approximately 500 grade crossings. A 1992 FRA study found that night-time collisions in Florida had increased 195 percent at the grade crossings with horn bans, while daytime collision rates had remained unchanged.[16] This information was distributed to the state of Florida and the localities maintaining the horn bans. None of the bans was repealed as a result of this study. Because of concern over the safety effects of horn bans, Congress passed the Swift Rail Development Act in 1994. Among other things, this law instructed FRA to issue a rule requiring the use of locomotive horns at all public highway rail crossings.

Policy Impacts

In 1995, FRA conducted a nationwide study on train horn bans. This study was updated in 2000. This research found that enacting horn bans in the absence of substitute safety measures significantly increased the risk of grade-crossing collisions.[17] Using data over the period 1992–1996, horn bans were found to increase the accident rate 30 percent for all types of crossings and 62 percent at crossings with gates (Figure 4-2). Horn bans had no significant effect on accident rates with only passive safety devices (i.e., nothing but crossbucks).[18]

In April 2005, FRA issued a rule requiring that locomotives sound their horns at public highway crossings but provided

[15]FRA, Final Environmental Impact Statement: Interim Final Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings, December 2003.
[16]FRA, *Florida's Train Whistle Ban,* 2nd ed., September 1992.
[17]FRA, *Nationwide Study of Train Whistle Bans,* April 1995.
[18]FRA, *Updated Analysis of Train Whistle Bans,* January 2000.



Source: FRA, *Updated Analysis of Train Whistle Bans,* January 2000.

Figure 4-2. Comparison of crossing accident rates with and without horn bans.

some exceptions to this requirement. These exceptions are as follows:

- The locomotive speed is 15 miles per hour or less and the train crew or appropriately equipped flaggers provide warning to motorists; or
- If the highway-rail grade crossing corridor is equipped with supplementary safety measures at each public highway-rail grade crossing; or
- If the locomotive is within a quiet zone and the highway-rail grade crossing corridor has a Quiet Zone Risk Index at or below the Nationwide Significant Risk Threshold or the Risk Index with Horns.

Communities that wish to apply for a quiet zone could be required to provide supplemental safety measures to reduce the risk of grade crossings in the proposed quiet zone. These could include four-quadrant gates, permanent or night-time closing of some crossings, conversion of two-way streets to one-way to avoid the need for the expensive four-quadrant gates, and crossing gates with medians or traffic separators. Some communities have incurred costs between $200,000 to $1,000,000 per grade crossing to improve safety measures.[19] Implementing a quiet zone also transfers liability for any collisions that do occur from the railroad to the local government.

Unexpected Impacts

The research team believes that most localities enacting horn bans understood that they were incurring safety risks in order to reduce noise levels around rail lines. Even when the magnitude of the safety impacts was documented in an FRA study in 1992, none of the localities with horn bans repealed them.

The research team cannot document a cost to rail carriers from increased grade-crossing accidents, but it is clear that deaths and injuries expose carriers to potential liability. The quiet-zone provision for shifting liability to local governments has some mitigating effect in this regard. Further, the rail industry does not want to be perceived as a threat to safety.

One can also consider the horn bans within a larger context of public policymaking. In many cases localities allowed developers to build residential housing units near rail lines. In other cases, railroads sold land that was near their right-of-way without giving adequate consideration to the long-term effects of the development that would occur. When viewed in this larger context, the long-term impacts of these public policy decisions were unexpected.

TWIC for Ports and Inland Towboats

Policy Description

As part of the response to the events of 9/11, the Maritime Transportation Security Act of 2002 required the Department of Homeland Security (DHS) to issue regulations to prevent individuals from entering secure areas of vessels or certain port and offshore facilities without a biometric security credential from the Federal government. The law required that individuals pass a background check by DHS before they received a credential. The law also specified that vessel and facility owners prevent individuals without a biometric security credential from accessing secure areas unless accompanied by another individual having a credential.

[19]John Heckman, "Train 'Quiet Zones' Can Be More Dangerous and Costly," *Newton Kansan,* November 13, 2008.

In January 2007, the Transportation Security Administration (TSA) and the U.S. Coast Guard published companion final rules for the TWIC program. The rules apply to all credentialed merchant mariners and to workers who require unescorted access to secure areas of ports and vessels (e.g., longshoremen and truck drivers). To obtain a TWIC card, these personnel must undergo a security threat assessment by TSA and pay a user fee. The TWIC requirement was phased in across the country between 2008 and 2009. As of September 2009, TSA had enrolled more than 1.3 million people and had printed about 1.2 million credentials.

Policy Impacts

Many of the nearly 2,000 written comments on the proposed TWIC rules said that the compliance costs would be too high and would greatly exceed any security benefits, at least for particular portions of the maritime industry. The impacts most often cited by commenters related to

- The fees associated with obtaining a TWIC card,
- Other costs for employees to obtain a TWIC card (e.g., making two trips to an enrollment center),
- The effect of delays in processing TWIC applications on workforce and hiring,
- The cost of providing escorts to those not possessing a TWIC card, and
- The cost of installing TWIC cardreaders at facilities or on vessels (a requirement that was dropped from the final rule).

The regulatory impact analysis for the final TWIC rule provided a wide range for the agency's estimate of the total discounted, 10-year cost of compliance: $700 million to $3.2 billion. In part, TSA attributed the variance in its estimate to uncertainty about the opportunity costs associated with the enrollment process and the waiting time to receive a TWIC. Another reason for the variance was uncertainty about the cost of complying with the requirement to escort those without TWIC cards when they visit secure areas of a vessel or facility.

The port officials the research team interviewed in the midst of the phased rollout of the TWIC program generally expected the rule's biggest impacts to fall on the trucking industry. They suggested that a high percentage of truck drivers would fail to qualify for a TWIC card, or that many drivers would not receive a TWIC card before the rule went into effect. However, one port official said that most truck drivers who had been initially disqualified from receiving a TWIC card had been able to get one by going through the appeals process. TSA data shows that, through August 2009, the agency had initially disqualified less than 5 percent of TWIC applicants and that it had granted more than 85 percent of the appeals requested.[20]

In general, port officials who were interviewed did not expect the TWIC rules to impede the flow of goods through ports. In fact, one port official suggested that, if implemented properly, the rule could *improve* the flow of goods. This lack of concern may be due to the Federal government's decision to drop the requirement for facilities and vessels to install TWIC cardreaders from the final rule.

Several freight officials, as well as commenters to the TSA and Coast Guard dockets, said that the proposed rules seemed geared to large, coastal ports and showed little appreciation for the operational realities of the inland towing industry. They asserted that the compliance costs for inland freight carriers would far outweigh the minimal safety benefits that would be achieved by applying the rule to them. In response to these concerns, Congress amended its requirements for the TWIC rule through the Security and Accountability For Every Port (SAFE Port) Act of 2006. In that law, Congress required TSA to allow new workers to start working immediately if they pass an interim check against various terrorist databases. Freight officials who were interviewed during the rollout of the TWIC program reported mixed results. Some complained about long delays in obtaining TWIC cards for employees, while others reported no major issues.

Unexpected Impacts

It would have been difficult for Congress to anticipate the full impact of the TWIC requirements when it passed the Maritime Transportation Security Act in 2002, because it left the exact requirements of the rule to DHS to determine. By the time the final rules were issued, however, TSA and the Coast Guard had received nearly 2,000 written comments on the proposed rules and had also held four public meetings around the country, which together drew roughly 1,200 people. Among those commenting were representatives of ports and inland waterway carriers, and they largely raised the same concerns as the research team's interviewees. DHS had to be aware of the potential impacts of the rules when it issued them in 2007.

Because the research team interviewed freight experts just as the TWIC Program was being rolled out, it was difficult for them to assess the actual impacts of the program. The issuance of some TWIC cards has been delayed by computer problems and other technical issues, but the rule's regulatory impact analysis included a range of costs to account for such delays.

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[20]TSA, "TWIC Dashboard: August 26, 2009," http://www.tsa.gov/assets/pdf/twic_dashboard.pdf

Alien Fingerprint Rules for Outbound Planes and Ships

Policy Description

Under the current U.S. Visitor and Immigrant Status Indicator Technology (US-VISIT) Program, the U.S. government collects biometric data (digital finger scans and photographs) from aliens seeking to enter the country. The Federal government then checks that information against its databases to identify suspected terrorists, known criminals, or individuals who have previously violated U.S. immigration laws. Currently, however, there is no system to help the Federal government determine whether or not an alien has overstayed the terms of his or her visa or other terms of admission.

Following the 9/11 terrorist attacks, the National Commission on Terrorist Attacks upon the U.S. (the 9/11 Commission) observed that several of the 9/11 hijackers could have been denied admission to the United States based on previous violations of immigration laws, including having previously overstayed their terms of admission. In response, the Implementing Recommendations of the 9/11 Commission Act of 2007 required that an exit system be implemented to complement the existing entry system. In April 2008, DHS proposed a rule to create the exit system. The rule would require aliens leaving the United States from an air or sea port to provide biometric information if they were required to do so when entering the country.

Policy Impacts

Freight carriers were not sure that the rule would apply to their crews or other workers traveling, but they submitted comments to the docket asserting that complying with the rule would be very costly. Their overriding concern with the rule, one that was shared by passenger carriers, was that it would require the carriers themselves to collect the biometric information and submit it to DHS. They said that it would be more appropriate for the Federal government itself to collect the data.

Specifically regarding the rule's potential impacts on the freight industry, the Cargo Airline Association (CAA) said that crews and workers traveling on all-cargo aircraft do not necessarily access the aircraft through a central location, so collecting fingerprints from them would be more difficult and more costly than for passenger carriers. For example, CAA said that there is no obvious place (e.g., a passenger ticket counter) in the all-cargo environment to collect the required biometric data. Furthermore, CAA said that, because the number of affected aliens in the all-cargo environment would be relatively small, the cost to carriers per individual fingerprinted would be much greater than for passenger carriers. One all-cargo manager said that his company's crewmembers move all over the company's network and mix with other flight crews continually, so the company could not avoid the rule's requirements by limiting alien crewmembers to domestic routes.

In formal comments, the Chamber of Shipping of America (CSA), which represents maritime carriers, said that, if the rule applied to its members, they would have to install biometric collection equipment on their vessels to take fingerprints of their crews. This approach would be the only workable one, because the carriers generally do not own or operate the facilities at which they berth. CSA said that, because vessel crews typically number less than 30, installing such equipment would be "cost-prohibitive."

Unexpected Impacts

If this policy were implemented as proposed, with the requirements extending to all crewmembers on air cargo planes and marine freight vessels, then it could result in impacts on the freight industry that were not expected by the policymakers. This is because the primary focus has been on aliens traveling via passenger airlines and cruise lines. The RIA for the rule refers repeatedly to "passenger carriers" and does not explicitly identify freight carriers as part of the regulated population. For example, the RIA assumes that the rule would apply to only 9 sea carriers and 33 seaports, totals that clearly do not capture the operations of cargo vessels at U.S. ports.[21] It is reasonable to believe that those drafting the rule may not have considered cargo carriage or the rule's impact on it.

Federal Emission Standards for Diesel Engines

Policy Description

Diesel engines are a major source of air pollution, including ground-level ozone (smog) and particulate matter (PM). Many areas of the country do not comply with Federal ambient air quality standards for these pollutants. In order to reduce the public health impacts of air pollution, EPA has adopted increasingly stringent emission standards for new heavy-duty trucks, locomotives, and marine vessels. The standards have taken effect in phases. Truck standards have generally preceded locomotive and marine standards by 5 to 10 years in terms of level of emission control. To meet the standards, manufacturers have used, or will use, several new technologies, including exhaust gas recirculation (EGR), diesel particulate filters (DPF), and selective catalytic reduction (SCR).

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[21]DHS, *Air/Sea Biometric Exit Project: Regulatory Impact Analysis,* DHS-2008-0039-0002, April 17, 2008, p. 45.

Policy Impacts

The addition of emission control technologies undoubtedly raises the cost of new trucks, locomotives, and vessels. It can also increase maintenance and operating costs for vehicle owners. In addition, the advent of new emission standards can disrupt normal purchasing patterns, with carriers buying more or fewer new pieces of equipment in a given year than they otherwise would.

To date, the effect of emission standards on new equipment purchase price has been small. EPA estimated that the 2007 truck standards would result in additional costs of about $2,300 per engine in 2007, or roughly 3 percent of the purchase price of a new Class 8 truck.[22] The locomotive and marine vessel standards currently in effect are less stringent than the truck standards, and their effect on purchase price is considered to be quite small. The actual effect on prices is difficult to quantify because the changes occurred concurrently with other improvements.

The most stringent level of standards, not yet in effect, will likely require use of SCR and have a significantly larger effect on equipment prices. For example, the Tier 4 locomotive standards, which take effect in 2015, may require a separate urea rail car and development of urea fueling stations. EPA estimates a price impact of $84,000 per locomotive, or 4 percent of the price of a new locomotive.[23] For marine vessels with large (Category 2) engines, the effect on price is expected to be approximately $250,000, or 7 percent of vessel purchase price.[24]

The effect of emission standards on maintenance and operating costs is probably more important than the effect on purchase price. EPA originally estimated that the 2007 truck standards would increase operating costs by $3,800 over the lifetime of the engine. Some fleet owners believe the actual costs have been higher. For example, one large truckload carrier has claimed that the cost of maintaining engines compliant with the 2002/04 standards (using EGR) is about $8,000 more than earlier engines, and the maintenance cost for 2007-compliant engines (using DPFs) has been an additional $9,000.[25] Manufacturers acknowledge some maintenance cost increases, but note that the changes deliver better performance and some of the initial bugs have now been fixed.

Most of the emission reduction technologies cause a slight reduction in fuel economy, although manufacturers claim they have offset these effects with other types of improvements. The emission-control equipment has also necessitated a shift to ultra-low-sulfur diesel fuel, which costs about 5 cents more per gallon.

A related effect of the 2007 truck standards was the large "pre-buy" that occurred in 2006. Fearing maintenance problems and a decline in fuel economy, many carriers purchased large quantities of new trucks before the 2007 standards took effect. This caused disruption for the truck makers, and sales of new trucks dropped off significantly in 2007 as a result.

Unexpected Impacts

The impacts of emissions standards on equipment costs are expected. EPA regularly performs cost-benefit analyses of their regulations, which include estimates of impacts on new equipment costs as well as operation and maintenance costs. In their regulatory documents, EPA makes the case that the economic benefits of the policies (improved public health) exceed the costs to industry.

Some would argue that EPA underestimates the impacts to industry, particularly the impacts of the recent truck standards on maintenance costs. Anecdotal evidence supports these claims, although there is very limited information from objective neutral parties on the issue.

The magnitude of the 2006 truck "pre-buy" appears to be unexpected and unintended. Some industry observers note that EPA could have structured the regulations differently so as to minimize this impact. Although it caused disruption to truck and engine manufacturers, there is little evidence that the pre-buy had significant impacts on the freight transportation system.

California In-Use Truck Emission Standards

Policy Description

California is the only state with authority to set its own motor vehicle emission standards. Air quality problems associated with diesel emissions have been particularly acute in California; in response, the state has pursued policies to reduce diesel emissions. In recent years, California's standards for *new* vehicles have mirrored USEPA standards. However, because of the relatively slow turnover of the truck fleet, it can take many years to fully realize the benefits of emission standards affecting only new trucks. To speed the introduction of low-emission technologies for trucks, California broke new ground in December 2008 by adopting emission standards for *in-use* (existing) on-road trucks. (A similar set of in-use standards for off-road equip-

[22]USEPA, *Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements,* EPA420-R-00-026, December 2000.

[23]USEPA, *Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder,* EPA420-R-08-001, March 2008.

[24]Ibid.

[25]Daniel P. Bearth, "Fleets Find Higher Costs, Uncertain Life Cycles," *Transport Topics,* Oct. 20, 2008.

ment was adopted in 2007.) The rules apply to all trucks that operate in California, including those registered in other states. For fleets with four or more vehicles, the regulations require that pre-1994 trucks be installed with exhaust-retrofit devices beginning in 2010, and these requirements extend to pre-2004 trucks beginning in 2011. The regulation adds compliance flexibility by allowing fleets to choose among three compliance options that best suit their situations. Fleets with one to three vehicles are exempt from the 2010 and 2011 retrofit requirements, but must show partial compliance by 2013.[26]

Policy Impacts

The California regulations could have a significant impact on fleets that operate older vehicles. These fleets will be forced to install exhaust-retrofit devices (costing $5,000–$20,000) or replace their vehicles sooner than they otherwise would. The California Air Resources Board (CARB) notes that the rules will affect approximately 170,000 businesses and almost a million vehicles. Hardest hit will be fleets with four or more trucks that operate older equipment. Large long-haul carriers, which typically do not operate trucks more than 4 or 5 years old, will be largely unaffected. California is making available some incentive funding to assist fleets with compliance

CARB has modeled the economic impacts of the rule.[27] CARB notes

> The total increased cost of the regulation is estimated to be $5.5 billion (2008 dollars). While it is expected that most fleets will pass through these costs to their customers, this is expected to result in a negligible impact on consumers, equating to about a few cent increase for a pair of shoes, less than one one-hundredth of a cent increase per pound of produce, or an increase of from $3 to $10 for a new car.

Unexpected Impacts

As with the Federal emission standards, California's standards are subject to extensive analysis of potential impacts through the rulemaking process. CARB has estimated the number of trucks and fleets that will be affected and the cost to different types of fleets. CARB also held public meetings across the state to receive feedback on their proposed rules; many trucking industry representatives provided comments. The in-use truck rules have not yet taken effect, so the extent to which CARB's predicted impacts are accurate is not known. Because an emission regulation of this type is unprecedented, the potential for unexpected impacts is likely higher than other types of emission regulations.

Idling Restrictions for Trucks and Locomotives

Policy Description

Truck idling contributes to air pollution and noise impacts. In response, approximately 15 states, as well as some cities, have adopted idling restrictions for trucks.[28] Most of the regulations limit idling to between 5 and 15 minutes, with exceptions in situations such as traffic congestion, extreme temperature, and service/repair. Fines typically range from $100 to $500, escalating in some jurisdictions for multiple offenses. California's law is considered the most restrictive; it prohibits idling for more than 5 minutes within California's borders and requires that new trucks be equipped with a non-programmable system that automatically shuts down the engine after 5 minutes of idling.[29]

Locomotive idling regulations are much less common. In 2005, CARB signed a Memorandum of Agreement (MOA) with the Burlington Northern Santa Fe (BNSF) and Union Pacific (UP) railroads that obligates the railroads to significantly reduce diesel emissions in and around railyards throughout California. Under the agreement, UP and BNSF agreed to phase out non-essential idling within 6 months and install idling reduction devices on all their California-based locomotives within 3 years.[30] No other state has enforced a locomotive idling law.

Policy Impacts

Idling restrictions create an initial cost for carriers if they require the installation of an auxiliary power unit (APU) or other technology in order to comply. APUs cost $7,000 to $10,000, plus installation. Trucks can also be retrofitted with automatic engine shut-down systems. Some industry experts believe that California's law has had a significant cost impact, particularly for carriers that do not rapidly turn over their fleets and have therefore needed to retrofit their trucks with shut-down systems. Large long-haul fleets operating in California have been purchasing new trucks with the shut-down systems at minimal additional cost.

Carriers benefit from fuel savings when they reduce idling. For this reason, most large carriers, as well as the American

[26]A full description of the proposed regulations can be found at: www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm

[27]CARB, "Cost Model Methodology for the Statewide Truck & Bus Regulation," July 2, 2008.

[28]American Transportation Research Institute (ATRI), Compendium of Idling Regulations, updated 2005.

[29]For information, see: http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm

[30]For information, see: http://www.arb.ca.gov/railyard/ryagreement/ryagreement.htm

Trucking Associations (ATA) and state trucking associations, do not object to reasonable idling laws. With high fuel prices and corporate environmental initiatives, many large carriers have similar internal policies to discourage long-term idling.

CARB performed a cost-benefit analysis when developing the state's idling regulation.[31] CARB estimated that the trucking industry would experience a net benefit from the law, with fuel savings offsetting the cost of APU installation within 5 years. The total statewide cost savings estimated by CARB was nearly $500 million for the period 2005–2009, and an additional $100 million for the period 2010–2013.

The major trucking industry objection to idling laws comes from the inconsistencies in laws among different jurisdictions. This is particularly true at the city level, where some cities have imposed very strict idling limits or "no idle zones" in delivery areas. Carriers report that they can have difficulty complying with laws when each state and city has a different time limit and set of exemptions. The net impact on the trucking industry of the differing laws is likely minimal, however, serving more as an annoyance than a significant cost impact.

UP and BNSF voluntarily entered into the California agreement and both report that it has not been burdensome to them. There have been no significant impacts on operational efficiency. The cost of installing idling reduction devices has been minimal and is soon recovered through fuel savings. As a consequence, the railroads are voluntarily applying similar practices outside of California. Some argue that the railroads would benefit by more aggressive adoption of idle-reduction technologies and practices, particularly in the eastern United States.

Unexpected Impacts

The impacts of idling restrictions are not unexpected. State agencies that have adopted idling limits are probably aware that truck owners may be compelled to install idle-reduction devices. State agencies also likely believe that trucking companies benefit from reduced idling in the long run, which is supported by the fact that large carriers and trucking associations typically support reasonable state idling laws.

The team's research suggests that many state and local governments are not aware of the inconsistencies in regulations across jurisdictions. There is little evidence that states and cities have attempted to harmonize their idling laws with their neighbors. Again, the impacts of inconsistent regulation, by itself, are probably not significant. EPA's efforts to standardize state idling laws may help remedy this situation in the near future.

Restrictions on Port Drayage Trucks

Policy Description

Trucks serving ports can be a significant source of air pollutant emissions, in part because they tend to be older and higher polluting than long-haul trucks. As part of a joint effort to reduce air pollutant emissions related to their operations, the Ports of Los Angeles and Long Beach have recently launched the Clean Truck Program. The goal of this program is to reduce emissions from drayage trucks by 80 percent by 2012. This program is just one component of the San Pedro Bay Ports Clean Air Action Plan, which the two ports adopted in November 2006. The Clean Truck Program is designed to replace the oldest and dirtiest of the roughly 16,000 to 18,000 trucks that visit the ports regularly and retrofit others with pollution-control equipment. The program is being phased in over 4 years and will ultimately affect most trucks that serve the ports.

CARB has also enacted a statewide regulation to reduce emissions from drayage trucks that operate at California's ports and intermodal railyards. This rule, which went into effect in December 2008, is very similar to the drayage restrictions in the ports' Clean Truck Program, albeit with a slightly longer implementation timeline.

To help the owners of drayage trucks (mostly owner-operators) purchase new trucks or retrofit their existing trucks, the ports are providing $1.7 billion in leases, loans, and grants. To generate funding, the ports have adopted fees of $35 per 20-foot-equivalent unit on loaded containers entering or leaving the ports by drayage truck. The state of California is providing an additional $400 million to help finance retrofits and replacements. Even with this assistance, however, vehicle owners will be asked to shoulder 20 to 50 percent of the cost of the new vehicle or retrofit.[32]

The Clean Truck Program also includes non-environmental provisions, some of which aim to reshape significantly the structure of the drayage market. These provisions have generated strong opposition from the motor-carrier industry and some Federal agencies. These provisions are included in concession agreements that the ports are requiring carriers to sign to continue servicing the ports. The most controversial provision requires carriers to switch from using owner-operators to using employee drivers. Currently, drayage is handled primarily by independent owner-operators who contract with

[31]CARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling,* July 2004.

[32]The Ports of Los Angeles and Long Beach Clean Truck Program, "Program Announcement #SPBP-PA002: Availability of Truck Replacement Funds Under the Goods Movement Emissions Reduction Program, Fiscal Year 2007–08," October 20, 2008.

licensed motor carriers and are paid by the dray. The market is highly competitive and, as a result, drayage truckers earn incomes below those of truckers in other comparable markets.[33] In justifying this requirement, the Port of Los Angeles said that requiring carriers to use employee drivers would enable the port to hold carriers accountable for maintaining trucks and for employing properly credentialed drivers. The port also argued that the requirement would reduce the number of trucks needed to provide drayage.[34]

The concession requirements, and the employee driver provision in particular, have prompted legal challenges by ATA and the Federal Maritime Commission (FMC). At present, both ports have implemented the initial phase of the Clean Truck Program, which includes the ban on pre-1989 trucks and the requirement for carriers to obtain concession agreements. In addition, all trucks entering port terminals must be registered in the ports' Drayage Truck Registry.

Policy Impacts

The Ports of Los Angeles and Long Beach commissioned studies to estimate the likely impacts of the Clean Truck Program on the drayage fleet, on the competitiveness of the ports, and on the freight transportation system in general. These analyses considered not just the environmental provisions but also the other provisions of the program.[35] These analyses predicted that the Clean Truck Program would result in the closure of some carriers and an increase in the cost of drayage service. One analysis, commissioned by the Port of Los Angeles, estimated that drayage costs would increase by $1.1 billion per year at the Port of Los Angeles alone.[36] For the state drayage truck rule, CARB estimated that 23,000 to 32,000 drayage trucks will be subject to vehicle retrofit and replacement requirements at a total cost of $1.1 and $1.5 billion.[37] The cost to an individual truck owner would be approximately $10,000 if covered under Phase I (primarily retrofits) or $33,000 if covered under Phase II (vehicle replacement).

Unexpected Impacts

The ports have studied the potential impacts of this policy extensively. The increase in drayage costs resulting from the policy is not unexpected, although the total cost may ultimately be higher or lower than current projections. The effects of the concessions requirements, if allowed, could be unexpected because such a provision is unprecedented in the United States.

[33]Boston Consulting Group, "San Pedro Bay Ports Clean Truck Program: CTP Options Analysis," prepared for the Port of Los Angeles, March 2008, p.4, http://www.portoflosangeles.org/CAAP/CTP_Analysis.pdf

[34]Port of Los Angeles, "Los Angeles Harbor Commission Approves Clean Truck Program Concession Agreement," May 15, 2008.

[35]For a list of relevant studies, see p. 37 of the Boston Consulting Group's March 2008 analysis, http://www.portoflosangeles.org/CAAP/CTP_Analysis.pdf

[36]Boston Consulting Group, p. 80.

[37]CARB, *Technical Support Document: Regulation to Control Emissions from In-Use On-Road Diesel-Fueled Heavy Duty Drayage Trucks,* October 2007.

Restrictions on Disposal of Port Dredging Spoil

Policy Description

To maintain adequate channel depths for shipping, the U.S. Army Corps of Engineers (USACE) is responsible for dredging major navigation routes. The disposal of dredged material, known as dredging spoil, has often been a contentious issue and one affected by multiple policy decisions. Dredged material may contain industrial contaminants that have built up in the sediment of navigation channels. On-land disposal of this material may affect local habitats. Ocean disposal of dredged material may affect fish habitats, water quality, and other aspects of the marine environment.

Regulation of the disposal of dredging spoil is a shared responsibility between EPA and USACE. After USACE has approved a project from an economic and engineering perspective and prepared a dredging management plan, EPA must still approve the disposal of the dredging spoil. Disposal of dredged material into inland waters is governed by Section 404 of the Clean Water Act (CWA). Disposal of dredged material into ocean waters is governed by the Marine Protection, Research and Sanctuaries Act, also known as the Ocean Dumping Act. State and local authorities also get involved in these decisions when they oppose disposal sites that are under consideration.

If an area has been designated a Superfund site, USACE suspends dredging maintenance activities in that portion of the river until after a Record of Decision (ROD) has been signed and remedial actions have been completed by the principal responsible parties under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

Interpretation of the Resource Conservation and Recovery Act (RCRA) is another source of legal complexity in the disposal of dredging materials. The USACE policy is that dredged materials are not a solid waste and thus not subject to solid waste regulations under RCRA. Some Federal and state agencies do not concur with this policy. As a result, there is a considerable amount of confusion about the application of solid waste regulations to contaminated sediments in different states.[38]

[38]Great Lakes Dredging Team, *Decision Making Process For Dredged Material Management,* October 13, 1998.

Policy Impacts

The economic benefits of dredging deeper ship channels derive from the fact that deeper channels allow larger ships to call at a port. Over time, the marine shipping industry has been moving to larger container ships, and this trend is expected to continue. Because the cost of operating a container ship does not increase proportionally with the size of the vessel, larger ships reduce the cost of shipping freight. Ports that do not have channel depths to serve larger container ships can lose business to those that do. In addition, lower cost freight transportation may benefit local businesses that rely on trade.

Deeper channels are also important for other cargoes, especially for liquid bulk (e.g., petroleum) and dry bulk (e.g., coal). For instance, tankers that are too heavily laden for a channel must offload oil to barges in order to reduce their draft. Lightering, as this is called, adds to the cost of moving petroleum through these channels.

Issues over spoil disposal have often delayed dredging projects. Some high-profile projects have been held up by problems in obtaining environmental permits or by litigation from concerned communities after the permits have been issued. An example is the Port of Oakland, where litigation over various disposal options delayed for 11 years the start of a major dredging project to increase channel depths to 42 feet. This included challenges by California's Water Resources Control Board and Department of Fish and Game, EPA, a fisherman's association, and a local water authority.

Industry experts have suggested that those ports that upgrade their facilities first often receive long-term benefits from locking in market share. The first port of call for a ship is a "revenue goldmine" for the receiving port because all of the containers for inland sites tend to unload there. It can be difficult to get shippers back once they leave a port, because of the business infrastructure involved in a terminal agreement. Shippers develop long-term terminal agreements, move equipment, and have long-term contracts with trucking firms, drayage operations, and railroads. Thus, policy decisions regarding dredging can have major impacts on the freight system across nearly all modes and a large geographic scale.

Unexpected Impacts

Government agency decisions that delay individual dredging projects (e.g., the Oakland example) are probably made with at least some recognition of their economic repercussions related to freight movement. The Port of Oakland's dredging plans were contested by a diverse range of parties, many of whom were not primarily concerned with the economic impacts. Had they foreseen clearly the effects on the port, it is not clear that they would have acted differently. They saw the particular environmental issues with which they were concerned as more important than the port's level of traffic.

GAO has argued that the COE has overestimated the benefits of some dredging projects.[39] In this sense, the magnitude of positive impacts may be unexpectedly small for some projects.

Water Pollutant Discharge Rules for Vessels

Policy Description

In 1973, less than 1 year after the CWA was enacted, EPA promulgated a regulation that excluded discharges incidental to the normal operation of vessels from requiring a permit under the National Pollutant Discharge Elimination System (NPDES). This exclusion was revoked as a result of a 2005 U.S. District Court decision. In 2008, President Bush signed two laws that exempted certain vessels from the need to comply with NPDES permits. The first law exempted recreational vessels and instead directed the Coast Guard to promulgate a regulation to require recreational boaters to use best management practices identified by EPA.[40] The second law imposed a 2-year moratorium on requiring NPDES permits for incidental discharges other than ballast water from vessels less than 79 feet long or commercial fishing vessels of any length.[41]

EPA issued a final Vessel General Permit (VGP) in December 2008. This permit applies to incidental discharges into U.S. waters. The permit establishes effluent limits (mostly in the form of best management practices) to control the discharge of 26 different vessel waste streams. The permit also includes specific requirements for certain vessels (including barges and oil tankers) that have incidental discharges not shared by other types of vessels. In addition to the effluent limits, the permit includes requirements for inspections of vessels, recordkeeping, and reporting.

Policy Impacts

EPA's rulemaking will increase compliance costs for most marine vessels engaged in U.S. freight movement. In its final economic impact analysis for the VGP, EPA estimated that the permit would apply to roughly 38,000 freight or tank barges and 8,300 freight or tank ships (these figures include both domestic and foreign vessels). EPA estimated that the total annual incremental compliance costs for both domestic and foreign freight vessels would range from $5.6 million to $16 million annually. The cost attributable to the paperwork

[39] GAO, "Delaware River Deepening Project: Comprehensive Reanalysis Needed," June 7, 2002.

[40] P.L. No. 110-288.

[41] P.L. No. 110-299.

burden alone was $0.4 million to $3 million annually for all freight vessels. EPA also estimated that less than 6 percent of the approximately 1,600 affected small entities involved in freight transportation would incur compliance costs exceeding 1 percent of revenues.[42]

Maritime trade associations have argued that EPA's economic analysis contained serious flaws. For example, the commenters said that EPA incorrectly assumed that vessel owners and operators are already conducting some of the required activities, either because they are standard industry practices or because they are already required by other regulations. They also argued that the economic analysis understated the compliance cost burden, because it did not adequately reflect the diversity of affected vessels and their operations. In interviews, freight executives were more concerned about the paperwork and bureaucracy associated with the NPDES permitting regime than with the cost of performing the best management practices identified in the permit.

Unexpected Impacts

It is too soon to determine if the EPA's regulatory action is having unexpected impacts on the freight system. If the freight industry's criticisms of VGP and EPA's economic analysis are valid, the compliance costs for the industry will be higher than the agency expected. Compliance costs for discharge rules will ultimately raise the cost of marine freight transport. The degree to which carriers can pass on these higher costs to shippers depends on many factors, including the presence of competing modes. In some situations, compliance costs for discharge rules would lead to slightly higher costs for transported raw commodities, intermediate products, and finished goods. If alternative modes, such as rail, offer competing service, marine vessel compliance costs could lead to a shift to these alternative modes.

International Air Emissions Regulations for Vessels

Policy Description

Oceangoing vessels emit large quantities of nitrogen oxides (NO_x), sulfur oxides (SO_x), and PM, all of which can contribute significantly to air pollution problems in U.S. coastal cities. The EPA does not have regulatory authority over foreign-flagged vessels; emissions regulation can only be achieved through international treaties. In July 2008, President Bush signed the Maritime Pollution Protection Act, which cleared the way for U.S. ratification of the international treaty regulating emissions from large diesel-powered, oceangoing vessels. Under this treaty, known as MARPOL Annex VI, oceangoing vessels must limit NO_x emissions from their main propulsion engines. The treaty also sets a cap on the sulfur content of the fuel these vessels burn, and it includes a program for designating special sulfur oxide Emission Control Areas (ECAs) where more stringent fuel controls apply.

In October 2008, the Member States of the International Maritime Organization (IMO) (including the United States) adopted amendments to Annex VI that set even tighter international standards for marine diesel engines and their fuels. Beginning in 2015, new and existing ships operating in ECAs will be required to use fuel with no more than 1,000 parts per million (ppm) (0.1 percent) sulfur, which represents a 98-percent reduction from today's global cap. Beginning in 2016, new ships operating in ECAs must also have advanced-technology engines designed to cut NO_x emissions by roughly 80 percent. The new fuel standards will phase in over time, beginning with an interim fuel sulfur standard in 2010.

Although two ECAs have already been established in Europe, there are currently none in North America. The EPA originally considered an ECA for the West Coast only. The United States and Canada have now proposed the designation of the entire West, East, and Gulf Coast coastlines as a North American ECA. The proposed ECA would extend 200 nautical miles from shore and would exclude western Alaska and the arctic coasts. If approved, the ECA could enter into force as early as 2012.

Policy Impacts

If a North American ECA were created, oceangoing cargo carriers would have to purchase low-sulfur fuel, which is more expensive than conventional fuel, or install scrubbers on their ships to capture the sulfur before it is emitted. EPA has noted that the economic impacts on ships engaged in international trade are expected to be modest. EPA estimates that operating costs for a ship in a route that includes about 1,700 nm of operation in the proposed ECA would increase by about 3 percent, which would raise the cost of transport of a 20-foot-long container by about $18. Two researchers have examined the cost of reducing sulfur emissions off the West Coast of the United States only under two scenarios for sulfur content and two scenarios for the ECA distance (Table 4-3).

In the research team's interviews with port officials, officials most often expressed concern about the effect that a regional ECA (e.g., Pacific Coast) would have on the relative competitiveness of affected ports. They suggested that a regional ECA would drive cargo to other, unaffected ports. Port officials expressed similar concerns about establishing an

[42]USEPA, *Economic and Benefits Analysis of the Final Vessel and General Permit,* December 18, 2008.

Table 4-3. Estimate of ECA cost.

Sulfur Content	ECA Distance from Coast: 100 nautical miles	ECA Distance from Coast: 200 nautical miles
0.5 percent	$94 million	$180 million
1.5 percent	$73 million	$140 million

Source: Wang, Chengfen and James J. Corbett, University of Delaware, A Preliminary Estimation of Costs and Benefits for Reducing Sulfur Emissions from Cargo Ships in the U.S. West Coastal Waters, prepared for 2007 TRB Annual Meeting (TRB 07-302).

ECA in U.S. waters only, or in U.S. and Canadian waters, but not in those of Mexico. These officials suggested that a nationwide or, better yet, a continent-wide, ECA would keep the playing field level among North American ports. These initial concerns were likely instrumental in the decision to propose an ECA for all U.S. coasts.

Shippers have been supportive of international regulation of oceangoing vessels. For example, the Pacific Merchant Shipping Association (PMSA) and the World Shipping Council endorsed the October 2008 amendments to Annex VI. This support seems to stem from a desire for uniform regulation. Such a desire helps explain PMSA's opposition to a recently proposed California regulation that would require oceangoing vessels to use low-sulfur fuel when traveling within 24 nautical miles of the state.[43]

Unexpected Impacts

Because an ECA has not yet been established in the United States, it is not possible to assess the degree to which impacts are unexpected. The IMO requires that extensive analysis and documentation accompany a country's ECA application. Accordingly, EPA has already begun to estimate the economic impacts of an ECA designation.[44] The analyses done thus far do not appear to estimate the diversion of cargo activity that could result from designation of a North American ECA.

State Truck Route Restrictions

Policy Description

Local governments often discourage heavy trucks from traveling on their roads because of concerns about noise, emissions, and safety impacts of trucks. In addition, governments may be concerned about pavement damage caused by heavy trucks. Such policies have recently become more widespread at the state level, with both New Jersey and New York adopting rules confining line-haul truck movements to certain main roads. New Jersey's rule designates the National Network as the roads to be used for line-haul movements and a New Jersey Access Network to be used until a truck reaches the appropriate local roads for getting to a shipper or receiver.[45] The New York State DOT's (NYSDOT's) regulation designates certain highways, Interstates, and other main inter-city routes for line-haul movement and an access network for getting to, or close to, pickup and delivery points.[46] Other states, including Maryland, Virginia, and Oregon, have implemented truck routing restriction rules that vary in their scope.

Policy Impacts

These rules force truckers, at least in some instances, to use routes other than those they would have chosen. To the degree this is the case, these rules impose costs in terms of operating costs and transit time, if not in other ways. The research team's interviews with trucking firms suggest that a requirement to stay on major highways for through travel is not viewed as too onerous, provided the requirement does not force them to run on toll roads.

Trucking executives emphasized, however, that there were frequently major problems with the access routes they were required to use and, beyond that, with local restrictions affecting the roads, or types of equipment, that could be used to reach facilities of shippers and receivers. It was these rules, they said, that imposed the greatest costs and operating problems. Several industry experts observed that, if rules on local roads and access roads became too restrictive for 18-wheelers, distribution centers and LTL terminals would have to move out of the state, with local service provided by straight trucks. The effect of this would be higher costs of doing business for a wide range of businesses and a negative economic-development effect from the departure of the terminals and warehouses.

Unexpected Impacts

The negative impacts of these policies generally are not unexpected. When state and local officials restrict heavy-truck movement, they certainly know that there will be a negative effect on the trucking industry. Trucking-industry representatives and lobbyists will have made that case. But this, of

[43]John McLaurin, President, Pacific Merchant Shipping Association, comment submitted to CARB regarding its *Proposed Regulation Order Airborne Toxic Control Measure for Fuel Sulfur and Other Operational Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline,* July 23, 2008.

[44]For example, see U.S. EPA, *Global Trade and Fuels Assessment Future Trends and Effects of Requiring Clean Fuels in the Marine Sector,* November 2008.

[45]NJDOT, Truck Access: Adopted Repeal and New Rules [N.J.A.C. 16:32].

[46]See NYSDOT, https://www.nysdot.gov/programs/truckpolicy

itself, would be unlikely to deter legislators and officials who have decided that reduced heavy-truck traffic on local roads will be of benefit. To the extent that businesses in their state or area experience higher trucking costs, it probably will not register on the political scale, unless the cost is high enough to cause firms to consider relocation. One trucking executive observed that his firm had to discontinue service to a customer in an eastern state when local restrictions made service too costly for them. He believed, however, that the customer was able to find another carrier that was willing to bear the costs of service in that area.

Relocation of terminals and distribution centers might have enough of an economic impact to catch the attention of officials, and this would likely be an unexpected impact and one not directly intended. But the research team cannot infer that relevant officials would have acted any differently in such a case, even had they known that they might lose some jobs and raise costs for affected businesses.

Local Policies to Oppose a Railroad Acquisition

Policy Description

For reasons of quality of life and safety, local governments may take actions to block a proposed railroad acquisition so as to prevent increases in railroad traffic in their communities. Increased rail traffic may cause more noise and roadway congestion. Specific concerns include blockage of street traffic at grade crossings, safety, and train noise and vibration. The benefits of rail traffic increases often include freight-system efficiency gains.

As a general principle, local governments have no authority to constrain levels of rail traffic on an existing line or otherwise interfere with rail operations. However, local governments can attempt to influence railroad traffic in the case of merger and acquisition proceedings before the Surface Transportation Board (STB). Local governments typically do this by formally adopting a resolution opposing the acquisition, then submitting comments to the STB. Some may go further by hiring consultants to conduct analysis that bolsters their case or filing a lawsuit against the STB or railroad.

Policy Impacts

In the case of rail mergers or acquisitions, local (or state) governments can ask the STB to either reject an acquisition or impose conditions, which imposes costs on railroads. A good example is Canadian National's (CN's) recently approved acquisition of the Elgin, Joliet, and Eastern (EJ&E), a short line that runs just west of Chicago through many suburban neighborhoods with a southern terminus in Indiana. CN believes it will obtain significant efficiency gains by rerouting traffic over the EJ&E from other lines in the Chicago area. Shippers supported the acquisition, because they also perceive improvement in moving through the congested Chicago rail nexus.[47] The result will be a major increase in traffic through the towns on the EJ&E line with corresponding decreases in traffic through other communities.

Typical mitigation measures requested in cases of this nature include construction of a new line bypassing the towns or elimination of grade crossings by construction of overpasses or underpasses. Sound barriers or earthen berms are also sought to mitigate noise impacts. At least nine towns and one county filed comments opposing the acquisition. Barrington, IL, argued that no mitigation was possible so that the proposed acquisition should be rejected.[48] The STB ultimately approved the transaction with mitigating conditions.[49] The required conditions included two grade-separation projects with CN required to bear 67.0 percent of the cost of one and 78.5 percent of the other. Various safety and noise measures were also included as conditions. Beyond the STB-imposed mitigations, CN entered into voluntary arrangements with a number of towns. CN has estimated the cost of the voluntary agreements at $60 million.[50] (CN has not made a public estimate of the cost of the required mitigations.)

Unexpected Impacts

From the perspective of local elected officials, negative financial effects on the CN are not relevant and neither is the efficiency enhancement that would have been lost if the STB had turned down the transaction. The focus of these officials is the impact on life in their towns and not on larger questions about the efficiency of the freight system. It is likely that they are not aware of negative impacts on the system, but it is also the case that knowledge of such impacts would be unlikely to change their positions.

The STB is, of course, keenly aware of impacts on the freight system; it is the Board's task to analyze and understand those impacts. The Board's decision was fully informed on the efficiency issues. Greater knowledge of the effect on the freight system would not have changed the positions of the parties in this case. The STB had sufficient knowledge, and the positions of the local officials would not have been affected if they had had the same knowledge.

[47]National Industrial Traffic League, comment, January 28, 2008, STB Finance Docket 35087.

[48]Village of Barrington, comment, February 15, 2008, STB Finance Docket 35087.

[49]STB, Decision No. 16, Canadian National Railway Company and Grand Trunk Corporation—Control—EJ&E West Company, December 24, 2008, STB Finance Docket 35087.

[50]CN press release, "CN reaches seventh Illinois voluntary mitigation agreement for EJ&E transaction," December 23, 2008.

Truck Size and Weight Rules

Policy Description

Laws and regulations governing truck size and weight limits have been enacted to serve various purposes. The first state laws date back to the early 1900s, while the first federal laws date from 1956 when the current federal-aid highway program was created. The purpose of earlier laws and regulations was to fix design parameters for road construction. The 1982 Surface Transportation Assistance Act (STAA), which preempted state regulations more restrictive than the federal limits on the Interstates, was designed to reduce the costs of interstate commerce. The 1991Intermodal Surface Transportation Efficiency Act (ISTEA), which blocked the states from allowing expanded use of longer combination vehicles (LCVs), was justified by Congress as a safety measure ([50a]). The main provisions of the current laws and federal regulations are as follows:

- Maximum gross weight of vehicles on Interstate highways: 80,000 lbs
- Maximum axle weight on Interstate highways: 20,000 lbs on a single axle; 34,000 lbs on a tandem axle
- States may not impose lower limits than the federal limits on Interstate highways
- Width of vehicles: states must allow 102 in. on the National Network (Interstates plus 160,000 miles of other main roads)
- Trailer length and numbers: states must allow single trailers at least 48 feet in length and tractors pulling two 28-ft trailers on the National Network.

Grandfather clauses in federal law allow the operation of trucks not complying with federal limits in states where such trucks were in operation at the time of the enactment of the federal limit. The states regulate size and weight on state roads not covered by federal law.

The most important category of truck exceeding the federal limits that operates in the United States is the LCV, a vehicle with two trailers having a combined total length greater than that of the two 28-ft trailers allowed by federal law or with three trailers. Most LCV operations are subject to maximum gross weight limits of greater than 80,000 lbs. LCVs operate on the turnpikes of several eastern states and more extensively in a group of western states (Figure 4-3).

Policy Impacts

The benefits and costs of increasing the federal size and weight limits have been debated for decades. Bills that would liberalize the limits have been introduced repeatedly in Congress, with the support of industry groups and some states, but no major revision in federal legislation has been enacted since 1982. Studies conducted in 1990 and 2002 by TRB[50a,50b,50c] concluded that liberalizing size and weight regulations by allowing vehicles with greater cargo volume capacity and/or greater cargo weight capacity could reduce fuel consumption in freight transportation and also reduce total shipper costs. The main arguments against increasing the limits have been that (1) highway safety would be degraded; (2) diversion of freight from rail to truck would increase social costs; and (3) highway agencies could not afford the cost of upgrading infrastructure to accommodate larger trucks. The 1990 TRB studies concluded that the safety impacts of liberalized limits would be positive because the dominant influence on safety would be a reduction in truck VMT. However, the 2002 TRB study acknowledged that understanding of the safety factors that determine the safe performance of large trucks is incomplete and therefore called for regulatory changes to be tested in rigorously monitored large-scale pilot tests. Regarding highway agency costs, the TRB studies recommended that truck fees be adjusted to cover the cost of providing infrastructure for them. The studies predict that liberalizing limits would divert some freight from rail to truck. This diversion would not increase the social cost of freight transportation, provided (1) trucks paid fees that covered their infrastructure costs; and (2) pollution, safety, and congestion effects are small or positive.

The 2002 TRB study emphasized that changes in size and weight regulations made in coordination with complementary changes in highway management would offer the greatest potential for improving system performance. The study recommended (1) adjustments to truck fees to cover highway agency costs; (2) improved bridge management; (3) systematic monitoring of truck traffic; (4) reform of enforcement methods; and (5) vehicle safety regulations governing the performance of larger trucks.

The most recent study by the USDOT did not attempt to resolve the issue of whether productivity gains from increased limits would outweigh safety costs. The report noted that LCVs ". . . generally show poorer stability or control properties than the base tractor-semitrailer configuration." The study also reported productivity gains but left the question of net benefits or costs open.[51]

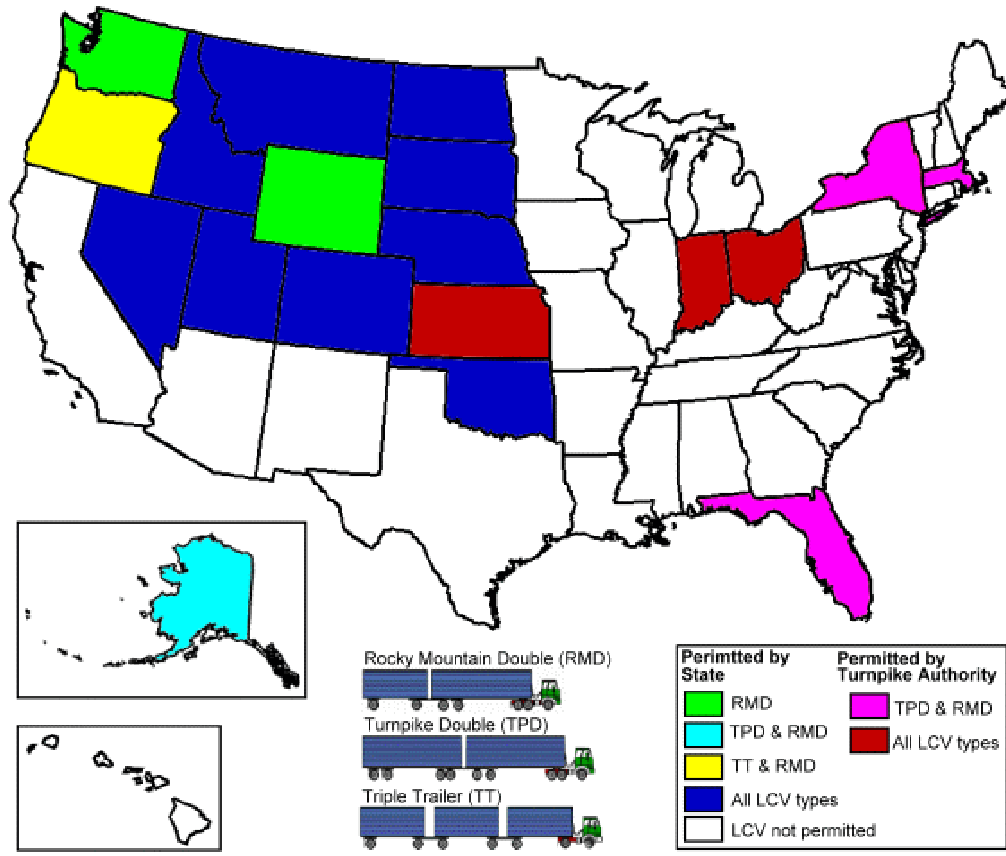
Separate from the Federal limits, the *variation* in size and weight rules among western states produces economic inefficiency. First, the variation reduces competition because the

[50a]TRB. 2002. *Special Report 267: Regulations of Weights, Lengths, and Widths of Commercial Motor Vehicles.* National Research Council, Washington, D.C.

[50b]TRB. 1990a. *Special Report 225: Truck Weight Limits: Issues and Options.* National Research Council, Washington, D.C.

[50c]TRB. 1990b. *Special Report 227: New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal.* National Research Council, Washington, D.C.

[51]USDOT, *Comprehensive Truck Size and Weight Study: Executive Summary,* August 2000, p. ES-10.



Source: U.S. Department of Energy, *Fact #411: February 13, 2006 States that Allow Longer Combination Vehicles*
Note: Michigan allows double-trailer combinations exceeding 80,000 lbs, but with restrictions that prevent the operation of the LCVs illustrated.

Figure 4-3. States that allow longer combination vehicles.

equipment acceptable in one state cannot always be used in neighboring states. One option for carriers wishing to do business in multiple western states is to use equipment that complies with the most stringent state rule under which they operate, but this would put them at a competitive disadvantage with other carriers that can run longer and heavier trucks. Another option for carriers is to purchase extra equipment for use in particular western states, but this will also raise costs for the carrier compared with rivals that operate within only one state. Finally, carriers could have drivers stop at state lines to readjust loads to comply with rules in the next state, but this process will also increase costs and make operations more complicated.

Harmonizing the size and weight rules among the grandfathered western states would improve the economic efficiency of the freight transportation system, but such a change would also have other effects on the freight system, depending on the levels at which the harmonized standards are set.

Two USDOT studies shed some light on how the impacts on the freight system would differ depending on where the harmonized standards are set. One included modeling of a "Federal uniformity scenario" in which the grandfather provisions in Federal law would be revoked and states would be required to adopt the Federal weight limit of 80,000 pounds. In a subsequent study, USDOT analyzed a "western uniformity scenario" in which the maximum GVW limits of 13 western states would be harmonized at 129,000 pounds. (This limit is near the high end of the range among the grandfathered states.) Table 4-4 summarizes the impacts of these two scenarios; see Appendix B-2 for more information on these impacts.

Unexpected Impacts

Regarding the Federal rules, this is a case in which both Congress and the USDOT are well aware of the impacts of the decision not to raise the limits beyond their present levels. In 1982 and 1991 Congress made clear decisions to come down on the safety side of the issue. It did so in full knowledge of the productivity cost, and the USDOT has made no effort to persuade Congress to do otherwise.

Table 4-4. Summary of impacts of harmonization of state truck size and weight rules.

Type of Impact	Metrics	Impacts in Federal Uniformity Scenario (80,000 lbs max GVW)	Impacts in Western Uniformity Scenario (129,000 lbs max GVW)
Freight distribution by type of truck	VMT by truck configuration	Significant decrease in VMT traveled by doubles, triples, and 6-axle single trailers. Increase in VMT by 5-axle single trailers.	Significant shift of VMT from single trailers to double- and triple-trailers
Mode share	Percentage	Mode shift not analyzed	Little or no shift from rail to truck
Safety	Crash rate involving trucks per million truck VMT; rate of fatal truck crash per million truck VMT	Net impact is unclear: reduced VMT by longer, heavier trucks would reduce crash severity and possibly number of accidents, but increase in total truck VMT would likely increase number of accidents	Net impact is unclear: decrease in total truck VMT would likely reduce number of accidents; but more VMT by longer, heavier trucks would increase crash severity and possibly number of accidents
Fuel consumption	Gallons of diesel	Higher due to increase in truck VMT	Lower due to decrease in truck VMT, but partially offset by reduced fuel economy of heavier trucks
Air quality	Tons of emissions	Higher due to increase in fuel consumption	Lower due to decrease in fuel consumption
Traffic operations	Vehicle-hours of delay; cost of congestion	Slight increase in number of vehicle-hours of delay due to increase in truck VMT	Slight decrease in delay due to fewer truck VMT, but offset somewhat by effect of longer, heavier trucks on traffic flow
Shipper costs	Dollars	Higher due to increase in cost-per-ton-mile	Lower due to decrease in cost-per-ton-mile
Railroad revenues	Dollars	Higher due to decreased competition from longer, heavier trucks	Lower due to increased competition from longer, heavier trucks

Regarding the state variation, state legislatures adopted laws permitting larger vehicles in the past, in part because of special characteristics of traffic moving within their states, such as mining operations and steel production. It is a reasonable surmise that state legislatures focused on operating conditions within their own boundaries and paid little attention to potential effects on interstate operations. Congress has been focused on the safety issue and made a deliberate decision to shut down the process by which individual states were permitting heavier and longer trucks and has shown no interest in allowing more exceptions to bring about harmonization in the western states. So it is likely that negative impacts were neither intended nor expected. But it is doubtful that Congress or state legislatures would have acted differently with more information or closer analysis of the consequences of varying size and weight limits among states.

Level of Investment in Highway Infrastructure

Policy Description

Federal and state policy decisions regarding investment in highway infrastructure can have major impacts on the freight system. Fiscal realities for the states are such that they are not in a position to take up the slack. Some states may be able to use a combination of tolls and private financing, but there is often significant political resistance to these approaches to raising money.

Policy Impacts

The impacts of policy decisions that result in underfunding of highway infrastructure include higher freight transportation costs due to worsening congestion, safety, and pavement condition. In the research team's interviews, condition of highway infrastructure did not surface as one of the first concerns of trucking firms. Large firms had fairly strong negative views of new tolls (discussed below in the section on user charges) but acknowledged that new tolls for new capacity were acceptable, albeit with some reservations. The research team's discussions with truckers suggest that the industry does not perceive capacity as a systemwide issue but, rather, as a matter of specific choke points that need to be addressed. A somewhat similar view is reflected in GAO's recent paper on freight transportation.[52] The GAO paper puts the

[52] GAO, "Freight Transportation: National Policy and Strategies Can Help Improve Freight Mobility." GAO-08-287. January 2008.

issue in a systemic context but focuses on particular bottlenecks and trouble spots. GAO is, however, explicit on the point that funding from state and Federal sources is insufficient for new capacity given that most of the available funds must be used for maintenance and rebuilding, leaving little for new capacity. The result is diminishing performance of highway-freight carriage.

Unexpected Impacts

The policy choice in this case is more one of inaction than action, and the impacts are probably not expected nor intended by most policymakers. Legislators, focused in part on projects in their own districts or states and in part on the total amount in a highway bill, are not likely to be consciously considering effects on the freight system. Decisionmakers may realize there are some negative effects of not providing a higher level of investment but underestimate the magnitude of the impact. In the absence of a catastrophic breakdown in the system, members of Congress are not likely to perceive themselves as choosing to reduce the performance of highway-freight movement, although that may be a result of funding levels. In general, legislators at all levels of government will be thinking primarily of passenger service as they consider support for highway improvements.

This is also likely to be the case where local officials have a hand in project selection. Local officials typically operate in a political environment where peak-period congestion for commuters has the highest priority. In a paper prepared for the Section 1909 Commission, the point is made that MPOs have insufficient freight-planning capability.[53] It is likely that the shortcomings of these institutions in regard to freight planning reflect, in part, the priorities of state and local legislative bodies.

Level of Investment in Inland Waterway Infrastructure

Policy Description

Industry executives and academic observers share the view that there is a serious shortfall in investment in the inland waterways. Although some of the concern is about lack of capacity—e.g., small (600-foot) locks at some points on the Upper Mississippi—the much greater concern is perception of a growing probability of a catastrophic failure as the infrastructure ages. With some exceptions, most of the original lock-and-dam sets were built in the 1920s and 1930s. There have been replacements—most of the lock-and-dam sets on the Ohio River have been replaced. Nonetheless, much of the infrastructure is old. One paper states that almost half of all lock chambers on the inland system were built more than 50 years ago.[54]

Policy Impacts

Although the industry experts interviewed agreed there is a growing risk of lock or dam failure, opinion diverged on how great the risk is. One of the industry executives observed that the infrastructure is "robust" and the locks and dams built in the 1920s and 1930s are "resilient," given proper maintenance. But this individual still noted that, as the facilities continue to age, the risk of failure will grow. Others believe that the risk today is considerable.

Nationwide, inland barges move a relatively small share of total domestic tonnage, and any negative impacts would be restricted geographically and to a limited set of commodities. Shallow-draft water carriage accounted for 3.9 percent of freight tonnage and 6.9 percent of ton-miles in 2002. The consequences of a failure would depend on the specifics of the facility that fails. Most, though not all, locks are doubles—either two 1,200-foot locks or a 1,200 with a 600-foot auxiliary. (Some locks are smaller with auxiliaries as small as 360 feet.) In the former case, failure of either lock would, depending on the traffic volumes during the outage, result in zero or very little delay or some noticeable delay, but the traffic would keep moving. If a 1,200-foot lock with a 600-foot auxiliary failed, the delays would be considerably greater. A 15-barge tow, typical for the Upper Mississippi, can pass through a 1,200-foot lock intact, but would have to be broken up to use a 600-foot auxiliary, moved through in two passes, and then put back together. Aside from the delay, one industry executive noted that there are safety issues as well, because risk of injury to crew is greatest when tows are being put together or broken up.

If a single lock fails, then river traffic is stopped until the lock can be repaired. As almost all the traffic is bulk commodities of one kind or another, it would have to shift to rail for at least part of its journey—faster but more costly per ton-mile. The worst case would be a dam failure, which would close the river for the entire stretch between the dams next above and below the failed dam and, presumably, require more time for repair. For an estimate of the cost of a lock failure, see Appendix B.

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[53]Cambridge Systematics, "Implications of Investments Targeted at Reducing Rail, Rail/Highway, Rail/Port, Highway/Port, Rail/Barge, and Highway/Barge Freight Bottlenecks," Briefing Paper 4L-07, prepared for the Section 1909 Commission, April, 2007, p. 5.

[54]Michael Bronzini, "Inland Waterways: Still or Turbulent Waters Ahead?" *Annals of the American Academy of Political and Social Science,* Vol. 553, p. 70, September, 1997.

Unexpected Impacts

All the industry experts the research team interviewed believe that Congress is paying little attention to the likelihood of a significant infrastructure failure on the inland waterway system. These industry expects offer several reasons for this lack of attention. One is the constrained fiscal condition of the Federal government. Congress has been reluctant to provide increased resources for infrastructure even where there is widespread support for such increases. Congress likely does not see failure of inland navigation facilities as life-threatening events, even though flood control was one of the original reasons for building the system of dams on the Mississippi and its major tributaries. The political pressure generated by a bridge collapse with loss of life is not present here.

To the extent that the issue gets consideration, it may be seen as a case in which the maximum damage would be a temporary increase in the cost of moving certain commodities and, therefore, an issue not meriting a high priority in the use of scarce funds. On September 29, 2009, the 1,200-foot main chamber of Markland Locks and Dam on the Ohio River failed. It is still out of service, and traffic is using the 600-foot auxiliary with substantial delays. It will be instructive to see what response, if any, this outage brings from Congress.

Highway Tolls and Other User Charges

Policy Description

Highway construction and maintenance are largely paid for with revenues from fuel taxes and other user charges, including tolls. Both the Federal government and states impose fuel taxes. States, regional authorities, local governments, and private facility operators can set highway and bridge tolls. The levels and forms of these taxes and charges affect the use of different parts of the system and the levels of use by different groups of vehicles.

The form of charges can also affect the time of day at which different groups use certain segments. This would be the case with prices that vary, in some fashion, with level of use. Charges of this nature are intended to reduce congestion at peak-demand times. Where tolls are used primarily to recover the cost of infrastructure, they tend to be flat charges, often with higher charges for heavier vehicles. Most tolls are intended for cost recovery, although there is increasing use of variable pricing to reduce congestion.

Policy Impacts

Tolls, in particular, affect freight carriage because tolls are operating costs for trucking firms that can't easily be passed on to customers. Trucking firms are affected in two ways. The amounts of fuel taxes (or any other use taxes not specific to a particular segment) affect total vehicle miles of travel (VMT) of highway freight, just as any other cost of truck operation does. Tolls will also affect which roads truckers use, and peak-period pricing will have some effect on when they use them.

All charges to truckers affect the total cost of highway freight carriage and, therefore, the relative costs of highway and rail carriage. The relative costs of these modes determine, in part, their relative shares of freight traffic. Beyond that, however, the overall efficiency of the freight system is affected if the highway charges paid by truckers do not reflect the full costs of truck use of the highways. There is an economic cost to society when the relative costs of competing modes are skewed by public policy. Most observers believe that 5-axle trucks (18-wheelers) do not generate sufficient user charges to cover their direct cost impacts on highways. The most recent Highway Cost Allocation Study from FHWA found that heavy 5-axle trucks met 80 percent of their cost responsibility.[55] The transportation economists interviewed for this study were essentially in agreement that underpricing of highway use by heavy trucks leads to a loss of economic efficiency as the nation uses more truck carriage and less rail carriage than the underlying real costs would indicate.

One potential operational impact of new tolls is diversion—truckers taking to alternate routes, frequently lower grade roads—in order to avoid tolls. One trucking executive said his firm diverted from all tolled roads without exception. Another said his firm would avoid tolls on existing roads, but would do a benefit-cost analysis of using a tolled road with new capacity. The executives pointed out that diverting to avoid a toll does not save them the full amount of the toll, because operating costs will rise, and speed will fall, on most alternate routes. The crash rate is also likely to be higher. For a more detailed assessment of tolling impacts, see Appendix B.

Recent work on toll roads in Ohio has shown that the elasticity of truckers' demand for tolled, high-quality roads is about 0.13 (e.g., doubling tolls would lead to 13 percent diversion).[56] Given the high volumes of truck traffic on these roads, that means a significant increase in truck traffic on alternate routes—two-lane roads in many cases. Thus, in addition to increased operating costs for trucking firms, there are additional costs to society in terms of increased congestion and increased crash rates on the alternate routes.

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[55] USDOT, FHWA, 2000 Addendum to the 1997 Federal Highway Cost Allocation Study, May 2000.

[56] Peter Swan and Michael H. Belzer. "Empirical Evidence of Toll Road Traffic Diversion and Implications for Highway Infrastructure Privatization," 2007, submitted for presentation at the 2008 TRB meeting.

Unexpected Impacts

In the case of costs to trucking firms from highway tolls, one can safely say that decisionmakers (typically states) were aware that new tolls would increase truckers' costs. Whether decisionmakers saw the costs in larger terms as an impact on the freight system is doubtful. That state legislators or transportation officials anticipated significant diversion from tolled roads seems less likely; and the same would be true for external costs of truck diversion to lower level roads. Officials are reaching for tolls as a response to severe financial pressure on their states, and awareness of increased cost to truckers and to motorists might not be sufficient to dissuade them.

Lockage Fees for Inland Waterways

Policy Description

Historically, the inland towing industry paid no user charges or taxes. The Federal government financed the inland navigation system out of general funds under the principle that flood-control and navigation projects provided a broad public benefit, such that the financing burden should not be placed on the users of the navigation system. This was in contrast to the highway and aviation systems, where revenues from user taxes and fees have long been expected to cover a very high proportion of Federal expenditures.

The principle of paying for the inland system as a general, public benefit was partially abandoned with the Inland Waterway Revenue Act of 1978 and the Water Resources Development Act of 1986. As a result of these Acts, vessel operators on most of the inland waterway system pay a $0.20 per gallon fuel tax, the revenues from which accrue to the Inland Waterways Trust Fund.

The Bush Administration proposed phasing out the fuel tax and replacing it with a lockage fee. With the lockage fee, a tow would pay a fee per barge per lock. For each lock with a main-chamber length of 600 feet or more, the fee would start at $50 per barge in 2009 and increase in $10 increments to 2012. For locks with a main chamber less than 600 feet, the fee would be 60 percent of that for the larger locks. (For context, all of the locks on the Mississippi and Ohio Rivers have main chambers of at least 600 feet.)

Policy Impacts

According to industry testimony, the fee level reached in 2012 would roughly double the total payments from inland towing.[57] Lockage fees would also entail some shifting of the burden among users. The fuel-tax payment depends on fuel consumption and therefore will vary with the number and weight of barges. The lockage fee would vary with the number of barges and number of locks used. Thus, a towboat operating in free water on the Mississippi downstream from Locks and Dam 27 would pay no user fee at all, and traffic on the Upper Mississippi, the Ohio, and other tributaries would pay fees. The largest relative shift of burden would be from tows that never use locks at all to tows that do use locks.

Although the relative change in tax burden within the industry would have some effect, the greater effect would be the increase in the overall tax burden on inland towing. This would necessarily raise barge rates and affect barge share relative to rail. The effect would, of course, be greatest for moves with a high number of locks relative to length of haul. But because the lockage fee drops for smaller locks and smaller tows, this might have the curious effect of favoring the less cost-effective traffic—small tows on low-volume rivers. A more detailed assessment of the impacts of this proposed policy is included in Appendix B.

It is possible that the cost to the industry from a mode shift might be offset if the higher revenues from the fee caused Congress to increase the level of investment in the inland waterway system. This, in turn, could increase towing efficiency, allowing the barge industry to regain some modal share.

Unexpected Impacts

In this case, the research team has to speculate about the impacts of a proposal that has not been implemented and may well not be implemented. One clear intent of the policy proposal is a substantial increase in user-fee payments from the inland barge industry. Presumably, the purpose of the lockage fee is to tie the pricing of the system closer to the degree of use of the facilities that account for most of its cost. The proposed policy does that to some degree, but it is far from the marginal-cost pricing for which many economists would argue. The flat fee per lock per barge takes little account of cost differences among river segments and, as noted, the lower fee for smaller locks might reduce cost recovery on low-volume segments.

Peak Pricing for Port Trucks

Policy Description

The Ports of Long Beach and Los Angeles are the largest container ports in the United States. Local roads are often congested with trucks traveling to and from the ports. To address this issue, the California Legislature proposed a law to tax containers moving through the port between 8 AM and 5 PM. The purpose of this proposed tax was to shift traffic into off-peak hours.

[57]Stephen Little, Waterways Council, Inc., statement before the Committee on Transportation and Infrastructure, U.S. House of Representatives, April 30, 2008.

To provide an alternative to this tax, an industry group composed primarily of importers and exporters created the Off Peak Program.[58] Containers shipped through the ports during peak hours (3 AM to 6 PM) are charged a traffic mitigation fee. The proceeds of the fee were used to reimburse terminal operators for the cost of keeping their facilities open during off-peak hours. The coalition created a non-profit organization called PierPASS to administer the program. Currently, shippers moving cargo from port terminals during the day are subject to a $50 fee for 20-foot containers and a $100 fee for 40-foot containers. Cargo owners can avoid this fee by moving containers during off-peak periods.

Policy Impacts

Overall, this program has been successful in shifting truck traffic into off-peak periods. An independent study of PierPASS found that prior to the program, 17 to 21 percent of port truck traffic moved during off-peak hours. The share of non-exempt cargo that moves in off-peak hours increased from around 30 percent shortly after the program inception to nearly 40 percent at present.[59] The standardization of off-peak terminal hours was an important element of the program's success.

Negative impacts of the PierPASS program have fallen primarily on drayage truck drivers, because they often must work longer hours and generally receive no change in compensation. Some warehouse operators have been forced to adjust their operating hours without the ability to pass on higher costs.[60]

Fees on port trucks or containers may cause diversion of marine traffic to other ports. There is no evidence that such a diversion has occurred as a result of the Off Peak Program. One recent study estimated traffic diversion from the port's Clean Truck Program (which involves a fee of $35 on each loaded 20-foot container and $70 on each loaded 40-foot container) would be merely 0.5 percent.[61] Another study looked at the diversion effects of different levels of container fees.[62] That study found that, without port access road congestion improvements, a fee of $60 on a 40-foot import container would reduce import volume at the Ports of Long Beach and Los Angeles by 6 percent. If the container fee were used for roadway congestion relief, the fee could go as high as $200 per 40-foot container before significant diversion to other ports would occur.

Unexpected Impacts

The Off Peak Program was a response to imminent action that was being proposed in the state legislature. Some interview respondents noted that the legislature had not done analysis of the potential collateral impacts, including such issues as driver shortages at night or local area noise and congestion impacts from nighttime dropoffs. Additional costs of the program may fall on shippers and receivers, who may need to adjust facility schedules to accommodate longer hours.

Exporters of lower value products have been hurt more by container fees than have other businesses. The fees represent a larger percentage of the value of their product. For instance, some agricultural shippers use containers to ship grain. In general, U.S. exports have a lower value per ton than imports. Because of this, container fees have a larger impact on the price of U.S. exports than foreign imports. The long-term cumulative economic impact of container fees has not been extensively considered.

Peak Pricing for Airports

Policy Description

In July 2008, as part of a broader attempt to use market-based pricing to address congestion across the U.S. transportation system, FAA amended its policy statement regarding airport rates and charges.[63] According to FAA, the intent is to provide incentives to air carriers to use congested airports during off-peak hours or to use alternate airports to meet regional air service needs. According to FAA, the change does not allow congestion pricing, *per se.* Rather, it allows airport operators to allocate new categories of cost to peak-hour landing fees, thus achieving some of the effects of congestion pricing. Specifically, the policy amendment

- Expands the ability of airport operators to include in the peak-period user charges of a congested airport a portion of the airfield costs of other, underutilized airports owned and operated by the same entity; and
- Permits the operator of a congested airport to add to peak-period user charges a portion of the cost of airfield projects under construction. (Previously these costs could be recouped only after project completion.)

Policy Impacts

This policy increases costs for carriers who keep some of their flights in peak periods. There is also a cost to carriers of

[58]The History of PierPASS. https://www.pierpass-tmf.org/Documents/PierPASSHistory.pdf

[59]PierPASS Review: Final Report. BST Associates. July 9, 2008.

[60]Genevieve Giuliano and Thomas O'Brien, "Impacts of Impacts of the Long Beach and Los Angeles Ports PierPASS Program," Presentation at the National Urban Freight Conference, December 5, 2007.

[61]*Container Diversion and Economic Impact Study: Effects of Higher Drayage Costs at San Pedro Bay Ports,* prepared for the Ports of Los Angeles and Long Beach, September 27, 2007.

[62]Leachman & Associates, *Final Report Port and Modal Elasticity Study,* Prepared for Southern California Association of Governments, September 2005.

[63]FAA, "Policy Regarding Airport Rates and Charges," Notice of amendment to policy statement, July 14, 2008, 73 FR 40430–40445.

shifting flights from the peak, given that they would not have been choosing to operate in a time of congestion unless they found some benefit in doing so. Because air cargo traffic can more easily operate during off-peak times than passenger traffic, freight system impacts of this policy are likely minimal.

CAA and FedEx Express asserted that higher landing fees alone would not cause all-cargo air carriers to relocate to secondary airports. They noted that the cargo carriers must consider issues of greater importance than landing fees (e.g., the airport's proximity to customers and the need for ground infrastructure such as warehouse space).

CAA and carrier executives also noted that, although most all-cargo operations are during off-peak hours, some daytime flights are necessary. For at least some of those daytime flights, they argue, the cost of adjusting operations and schedules to avoid peak periods will far outweigh the increase in the landing fee. In this light, the policy amendment will result in increased costs to air-cargo operators.

Unexpected Impacts

In its *Federal Register* notices, FAA indicated some consideration of the potential impact on the air-cargo industry. For example, in its notice of proposed amendment to its policy statement, FAA considered permitting the operator of a congested airport to add the cost of airfield projects under construction to landing fees throughout the day, not just the fees for peak periods.[64] However, the agency concluded that doing so would penalize cargo operators and others already avoiding peak periods without providing an incentive to change flight schedules. However, there is no indication that FAA conducted a quantitative analysis of how the policy amendment would affect carriers (either passenger or cargo).

[64]FAA, "Policy Regarding Airport Rates and Charges," Notice of proposed amendment to policy statement, January 17, 2008, 73 FR 3310–3316.

CHAPTER 5

Case Studies

This section presents four case studies that explore policy decisions and their impacts in greater detail. The intent of the case studies is to help readers better understand the background and factors that led to a policy action, the positions of stakeholders on the issue, and the impacts of the policy action on the freight system.

The policy actions selected for case studies are those that the research team believes have had, or will have, impacts that are unexpected or unintended by the policymakers. They are

1. Local Land Use Policies Affecting Port Facilities and Other Freight Terminals
2. Local Truck Access and Parking Policies
3. Air Cargo Screening Requirements
4. State and Federal Climate Change Policies

The first two case studies cover primarily local government actions with a similar purpose. The policies occur in cities throughout the United States, most noticeably in large metropolitan areas but sometimes in smaller cities. In both cases, the freight system impacts are often not considered by the policymakers or are considered but ignored.

The third case study covers a single recent policy decision with direct and potentially large impacts on the air cargo sector, and potentially the trucking sector as well. This case study illustrates how broad public and Congressional objectives (in this case, security from terrorist attacks) can trigger specific policies, and the challenges confronting the government and the freight industry to develop and implement a policy that achieves broader public goals without overly burdening the freight industry.

The fourth case study covers a collection of state and Federal policies concerning climate change, some of them enacted but many just proposed. Although the discussion of policy impacts in this example is mostly speculative, it was selected as a case study because of its high degree of relevance to current policy debates and its potential for freight system impacts.

Each case study is organized into four sections: setting, stakeholders, policy actions, and policy impacts.

Case Study 1: Local Land Use Policies Affecting Port Facilities and Other Freight Terminals

Setting

After decades of predominantly outward growth, many U.S. cities are now experiencing redevelopment along their waterfronts and in their urban centers. In part, this trend is a result of "smart growth" policies that promote infill development as a way to reduce congestion, improve accessibility for residents, and reduce air pollutant emissions. In some cases, the areas targeted for infill development have historically been used for manufacturing and warehousing but now have high vacancy rates, as firms involved in these activities have gone out of business or moved elsewhere. In other cases, however, there may be continuing demand for industrial and warehousing space in the same areas targeted for infill housing or retail. Such is the case in portions of the South Bay Cities north of the Port of Los Angeles.

Rezoning land previously set aside for industrial or freight-related activities can be appealing to local actors, both public and private. Freight-related or industrial land uses generally produce relatively low rents, translating into low land values. Rezoning of such property often means that property owners will earn higher rents or proceeds from property sales. An analysis conducted for the San Francisco Bay Area's Metropolitan Transportation Commission found that local government tax revenues for retail, office, and housing developments were 2 to 10 times higher than for warehouse use (see Table 5-1).[65]

[65]Hausrath Economics Group, "Task 4 Report: Existing Conditions and Trends Regarding Real Estate, Land Use and Community Factors with Implications for Goods Movement Industries," prepared for the Metropolitan Transportation Commission, October 2003, pp. 48–53.

Table 5-1. Tax revenue estimates for hypothetical development, inner east bay of San Francisco bay area.

Land Use	Annual Local Tax Revenues to City General Funds	Tax Revenues Per Sq. Ft. of Land
Warehouse	$61,000	$0.28
Light Industrial/Manufacturing	$57,200	$0.26
R&D Flex	$80,600	$0.37
Retail	$306,300	$1.41
Business Park/Campus	$189,700	$0.87
Office – 3-story	$286,600	$1.32
Office – 8-story	$687,400	$3.16
Townhouses	$99,300	$0.46
Apt./Condos/Lofts – 45/acre	$169,600	$0.78
Apt./Condos/Lofts – 100/acre	$384,200	$1.76

Source: Hausrath Economics Group, "Task 4 Report: Existing Conditions and Trends Regarding Real Estate, Land Use and Community Factors with Implications for Goods Movement Industries," prepared for the Metropolitan Transportation Commission, October 2003.

Local governments are likely to see tax revenues increase (although demand for public services will also grow). Rezoning of freight-related property is likely to increase costs to users of the freight transport system, but these cost increases are more widely dispersed than the perceived local benefits.

Sometimes it is not so much the promise of financial gain as it is the adverse impacts of goods movement that prompt local governments to make land use decisions that discourage freight-related uses. These adverse impacts include air and noise pollution, lights from nighttime operations, poor aesthetics, and traffic congestion from truck and train movements.

Although it is not usually an intended result, local land use decisions of this kind can limit the ability of urban ports to operate or expand and can have a similar effect on other types of freight facilities such as truck and rail terminals. Although ports are limited to land with access to deep water and usually cannot relocate, owners of truck terminals or distribution centers can respond to changes in land use by moving to outlying areas. The new location of a terminal may be farther from freight destinations such as ports, retail centers, and manufacturing plants, resulting in an increase in truck VMT and empty miles traveled.

In exceptional circumstances, a local government will purposely arrange for the relocation of a freight facility out of the urban center. Such an action may be motivated by the freight facility's contribution to local congestion and air pollution. This last case differs from the first two in that the deliberate aim of the action is to relocate freight facilities—the relocation is not a side effect of local land use decisions.

Stakeholders

In most U.S. cities, numerous agencies have a role in these kinds of land use decisions. Local planning and zoning authorities are the primary actors in these situations, although some states have authority over local land use decision-making. State and local economic development agencies also can be involved—either as proponents for preserving land for freight-related uses or for converting the land to other uses. Local elected officials are usually involved in some way; local legislation may be required for some land use changes. State and local transportation departments are involved in that they are responsible for managing any infrastructure improvements or modifications that may be needed to accommodate changes in land use.

With regard to property near the urban waterfront, port authorities have a strong interest in preserving adjoining land for freight uses, and their interests are usually closely aligned with those of freight carriers and shippers. However, as owners of waterfront property, they may benefit financially from the ability to use that property for higher value, non-industrial uses.

Private-sector stakeholders with an interest in the location of urban freight facilities include

- **Freight carriers and facility owners.** Development pressure on centrally located property pushes freight facilities to other, usually outlying, locations where rents are lower and space is more abundant. However, the more remote locations also likely entail increased travel times, greater number of miles traveled, and higher fuel costs. In the extreme, freight facilities may move to another jurisdiction.
- **Freight shippers and receivers.** Shippers and receivers benefit from faster and less costly transportation services. Changes in the location of freight facilities may increase costs to them or decrease the quality of freight service, but unless they rely heavily on a particular freight facility, they are not likely to engage actively in this type of land use debate.
- **Owners of property near freight facilities and real-estate developers.** Alternative land uses offer the possibility of financial gain for owners of industrial property and real-estate developers.

- **Residents in the vicinity of freight facilities.** Urban residents near freight facilities are affected by traffic and other quality-of-life issues such as noise, dust, odors, and emissions from trucks or from on-site industrial activities. These concerns may also draw the attention of environmental and public health advocates.

Policy Actions

Three key ways in which local land use policies affect the freight system are as follows:

1. **Zoning decisions that limit port expansion and redevelopment.** In making decisions regarding the use of waterfront property, local officials and their constituents may prefer other land uses such as retail, office, or residential over industrial uses. For example, land near the Port of New York that was previously vacant or used for freight warehouses has been redeveloped into high-value commercial and residential property. Freight distribution centers have therefore, moved away from New York to the New Jersey suburbs and eastern Pennsylvania where land values are lower, although access to the container ports in the New York area is more difficult.[66]
2. **Land-use decisions that discourage non-port-related freight facilities in the urban core.** Local land use decisions may result in other freight facilities such as truck terminals being located far from residential and retail districts, as well as from areas zoned for light industry or warehouses. This may be the inadvertent effect of allowing land uses near existing terminals that drive up rents and push the terminal owners to relocate. Alternatively, it may result from deliberate attempts to keep truck traffic away from particular locations. For example, during interviews, trucking industry representatives said that some local governments have encouraged construction of distribution centers (DCs), seeing them as a source of taxes and employment, but have not allowed a trucking terminal as part of the DC cluster. The result can be longer runs for trucks going to and from the DC cluster but no reduction in local truck traffic.
3. **Intentional relocation of freight terminals.** In rare cases, a local government takes direct action to relocate a freight terminal out of the urban center. This occurs in situations in which there are no more cost-effective ways to further mitigate the adverse impacts of freight activity such as congestion and pollution. For example, Florida has proposed spending as much as $650 million to divert freight trains from a rail line running through the Orlando region to another rail line running west of it, while providing CSX with a new terminal to replace the existing one in Orlando.[67] The reasons behind this are: to reduce street congestion in Orlando due to trains blocking grade crossings and to make the lines currently used by CSX available for commuter rail. A similar proposal has been put forward in Colorado—the Colorado Department of Transportation is studying a proposal to shift freight trains out of the Interstate 25 corridor through Denver to a new alignment on Colorado's eastern plains.[68]

Policy Impacts

When local government land use policies prohibit the construction or expansion of freight facilities desired by industry or encourage redevelopment with non-freight-related land uses in areas close to ports or other major terminals, these policies can result in negative impacts on the freight system. Travel distances and transit times may increase for trucks, thereby raising operating costs. For example, if a truck terminal is relocated so as to increase average one-way port dray by 25 miles per load, using the national average figure of $1.73 for truck per mile costs, a conservative estimate for increase in drayage costs would be $43 per truckload.[69] Assuming 500 truck trips into and out of the terminal per day, the increase in trucking costs would be at least $21,000 per day, or over $5 million a year, assuming 250 working days. In reality, however, the impacts of such a relocation would not be this simple. The negative impacts of a location farther from a port could be at least partially offset by lower property taxes and closer access to warehouses or other destinations. These impacts would change over time if other terminals relocate in response to the same development pressures.

Because of the interconnected nature of land use and the transportation system in a metropolitan area, determining the impacts of a land use policy would be impossible to quantify without use of regional land use and travel demand models. Although many MPOs have used their models to test the impacts of alternative regional land use scenarios, the research team is not aware of any regional modeling exercises that sought to understand impacts of freight facility relocation.

Transportation infrastructure generally has great visibility and large local impacts. Because of network effects, the negative

[66]GAO, *Freight Transportation: National Policy and Strategies Can Help Improve Freight Mobility*, GAO-08-287, January 2008, p.14, http://www.gao.gov/new.items/d08287.pdf

[67]"Hopes for Rail Renewed," *St. Petersburg Times,* July 13, 2009, http://www.tampabay.com/opinion/editorials/article1017557.ece and also http://www.sunrail.com/

[68]"Study: Benefits of Rerouting Freight Trains Across Plains Outweigh Costs," *Denver Business Journal,* February 10, 2009, http://www.bizjournals.com/denver/stories/2009/02/09/daily24.html

[69]ATRI (2008). An Analysis of the Operational Costs of Trucking.

impacts are largely local, while many positive impacts are distributed throughout the transportation network.[70] This being the case, it is not surprising that local land use authorities are more attuned to the local benefits of their decisions than to the costs imposed on carriers, shippers, and all those who ultimately benefit from efficient freight transport.

Over time, legal, financial, and institutional mechanisms have been developed to balance the broader economic interests against local economic and quality-of-life interests. Some of these mechanisms are Federal (e.g., cost-sharing for transportation infrastructure improvements), while other mechanisms are in place at the state or regional level. The following two examples illustrate some of these legal, financial, and institutional mechanisms.

Port of Miami River

The Port of Miami River is a collection of 32 private marine terminals that serves as a shallow-draft port for smaller vessels coming from the Caribbean and Central and South America. These terminals handled nearly 500,000 short tons of freight in 2007, compared to the roughly 7 million short tons handled by their neighbor, the deep-water Port of Miami.[71] In 2007, the city of Miami lost three consecutive court decisions over land use designation changes that it made so that large-scale residential developments could be built along the Miami River. The lawsuits were brought by the Port of Miami River's terminal operators, who sought to retain the waterfront for marine industrial uses. In the court decisions, the judges held that the separate amendments to the city's comprehensive plan, when taken as a whole, amounted to changing the character of the waterfront without proper long-range planning or input from appropriate agencies, departments, and citizen groups.[72]

In response to the court rulings, the Miami City Commission approved amendments to the city's comprehensive plan that would permit residential and mixed-use development along the river, despite objections from the marine industry and the city's Planning Advisory Board. Those amendments were then forwarded to the Florida Department of Community Affairs, which is responsible for ensuring that local comprehensive plans and amendments comply with the state's Growth Management Act. In July 2008 and again in January 2009, the department rejected the city's amendments. Among other issues, the state agency expressed concern about the proposed changes related to land uses along the Miami River. In particular, the state agency found that, as amended, the city's comprehensive plan did not include strategies for preserving recreational and commercial working waterfronts, as required by state law.[73]

The city, the Florida Department of Community Affairs, and the Miami River Marine Group are now scheduled to enter formal mediation in October 2009. If mediation is unsuccessful, the case will go before an administrative law judge. Ultimately, if the city does not bring its comprehensive plan into compliance with state law, the state can withhold infrastructure funding from the city.[74]

If the City of Miami succeeds in its efforts to redevelop the Port of Miami River area, it is unlikely that most of the marine terminals could relocate to other nearby locations. Even with the crash in residential real estate values in South Florida, land values are unlikely to support creation of new marine terminals. Some of the marine traffic currently served by the terminals could shift to other port facilities, including those at the neighboring deep-water Port of Miami. Ultimately, some shippers would likely see an increase in freight transportation costs as a result of the redevelopment, and the region would most likely lose some of the associated business activity.

Port of Baltimore

The recent experience of the City of Baltimore, Maryland, provides an interesting contrast to that of Miami and demonstrates the ability of a larger port and its industrial partners to preserve waterfront property for marine industrial uses. The Port of Baltimore is a major East Coast port, handling more than 41 million short tons in 2007.[75] In 2004, Baltimore created a maritime overlay zoning district (see Figure 5-1) that largely prohibited residential and commercial development on waterfront property adjacent to deep-water shipping channels. The zoning district was intended to help streamline the development process by avoiding costly and time-consuming delays associated with site-by-site decision making regarding change of use. It was also intended to prevent the "leapfrogging" of mixed-use development into maritime areas that had begun to occur.[76]

However, by as early as 2007, terminal operators and port-related industries began arguing that the 2014 sunset date for the zoning district was not far enough into the future and was

[70]Genevieve Giuliano, "The Changing Landscape of Transportation Decision Making," lecture presented to TRB 2007 Annual Meeting.

[71]U.S. Army Corps of Engineers, 2007 Waterborne Commerce of the United States, http://www.ndc.iwr.usace.army.mil/wcsc/wcsc.htm

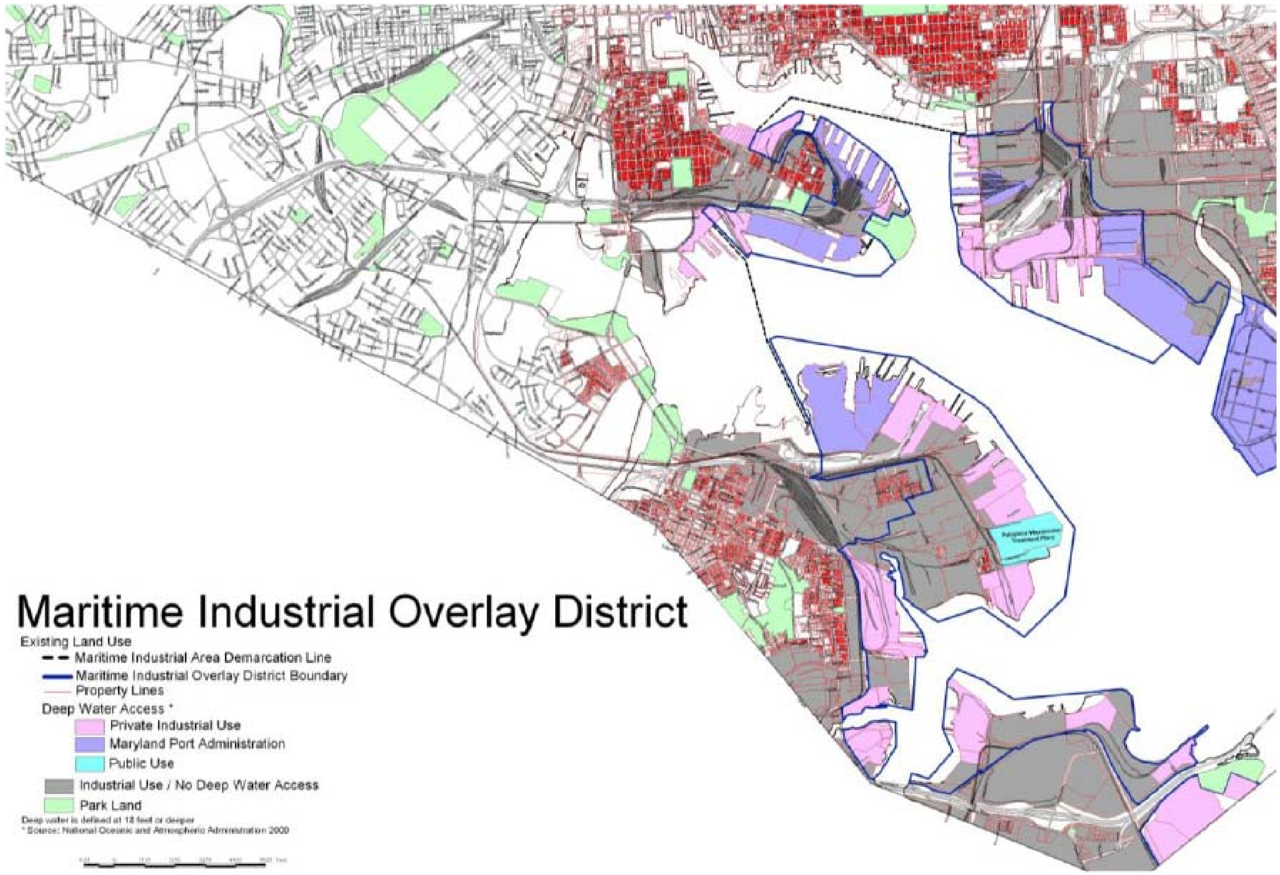
[72]Risa Polansky, "Miami Changing Land-Use Plan After Court Defeats on River Uses," *Miami Today,* November 15, 2007, http://www.miamitodaynews.com/news/071115/story3.shtml

[73]Florida Department of Community Affairs, "Objections, Recommendations, and Comments for City of Miami, Amendment 08-1ER," July 18, 2008.

[74]Jacquelyn Weiner, "Battle over Miami River Designation Headed for October Mediation," *Miami Today,* July 23, 2009.

[75]U.S. Army Corps of Engineers, 2007 Waterborne Commerce of the United States.

[76]City of Baltimore Planning Department, *Maritime Industrial Zoning Overlay District: 2007 Annual Report.*



Source: City of Baltimore Department of Planning.

Figure 5-1. Baltimore maritime industrial overlay district.

therefore discouraging facility upgrades and expansions.[77] Port interests argued for moving the sunset date further into the future or making the zoning district permanent. In contrast, property owners and the real estate development community sought to add more flexibility to the zoning district. For example, they asked that property owners be allowed to request removal of property from the district. In particular, they wanted to be able to redevelop locations within the zoning district that industrial tenants were no longer using. Industry advocates said that giving property owners such an option would break up the integrity of the district and allow development to creep in.

Industrialists, developers, and city officials worked for more than a year to develop a compromise. The City Council commissioned a study by a local foundation, whose conclusions on how to balance the interests of industry and development helped in developing a solution.[78] In May 2009, Mayor Sheila Dixon signed a bill to extend the sunset date of the zoning district to 2024. The legislation allows landowners to petition the City Council for removal from the zoning district starting in 2014, but they will have to prove that removal of a particular property will not adversely affect the district.

It is too early to discern the impacts of extending the sunset date of the zoning district. However, had it not been extended, it is reasonable to conclude that capital investment in the industrial facilities in the zoning district would have slowed as the original 2014 sunset date approached. Other factors, such as market conditions and the cost of relocating, would also affect the investment decisions. The relative importance of each factor could differ greatly from firm to firm. A 2006 report by the Baltimore City Department of Planning highlighted several firms that had relocated to, or expanded operations near, the Port of Baltimore because of land use conflicts at other ports.[79]

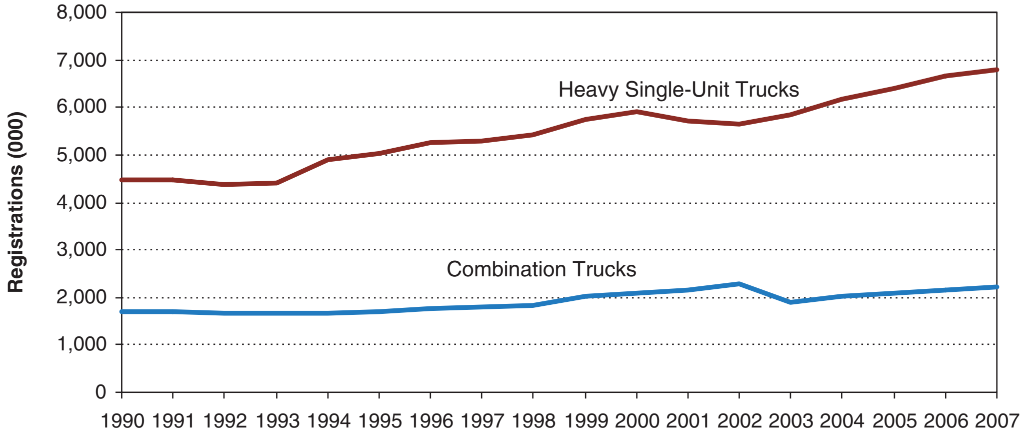
Summary

The relatively small Port of Miami River apparently does not have the political or economic clout to convince city leaders to

[77]Scott Dance, "Port in a Storm: Financing Scarce for Waterfront Industry's Expansion," *Baltimore Business Journal,* December 21, 2007.

[78]Scott Dance, "Mayor Dixon Signs Bill Protecting Port of Baltimore's Maritime Zoning until 2024," *Baltimore Business Journal,* May 12, 2009. The Abell Foundation's report, *Charting the Future of Baltimore's Industrial Waterfront* is available at http://www.abell.org/pubsitems/CD_BaltWaterfront_0109.pdf

[79]City of Baltimore Planning Department, *Maritime Industrial Zoning Overlay District: 2006 Annual Report.*



Source: FHWA, Highway Statistics.

Figure 5-2. Freight trucks registered in the United States.

preserve the waterfront for marine industrial uses. However, because of Florida's state laws protecting working waterfronts, the port has been able to use litigation and administrative processes to counter the city's efforts to rezone the waterfront for residential development.

Conversely, the Port of Baltimore features more prominently in the Baltimore economy and is run by the Maryland Port Administration, a state agency. While it does not have the same type of protections in state law that Florida ports have, its economic clout, along with that of port-related companies, is sufficient to obtain protection of waterfront property through city zoning.

Case Study 2: Local Truck Access and Parking Policies

Setting

Trucks are the primary means of transporting goods within urban areas. These vehicles are used to carry out a wide range of services, including parcel and courier services; pickup and delivery of freight for retail establishments, homes, and offices; movement of household belongings; and transport of all types of waste. The volume of freight activity has increased over time because of its direct links with growth in population and economic output, as well as the adoption of practices in supply-chain management and logistics that rely on smaller, more frequent, and more reliable deliveries.[80] As shown in Figure 5-2, the number of single-unit freight trucks registered in the United States has grown from 4.5 million in 1990 to 6.8 million today, an increase of more than 50 percent.

Although trucks are essential to the modern economy, they present challenges to urban policymakers. Challenges include congestion; safety risks to motorists and non-motorists (e.g., cyclists and pedestrians); physical damage to infrastructure; and environmental impacts in the form of noise, vibrations, and emissions. Such issues with freight delivery have likely challenged governments as long as cities themselves have existed. The oldest known example of a policy requiring off-peak deliveries of freight is Julius Caesar's edict banning commercial deliveries during daytime hours in Rome.[81] Given the difficulty of increasing roadway capacity in urban areas and the expected increases in truck traffic, policymakers will be faced with ever greater challenges in managing truck traffic on urban streets.

Stakeholders

Trucking companies are subject to a complex overlay of Federal, state, and local regulations regarding vehicle routing, loading/unloading times, and parking. Federal regulations prohibit states from restricting commercial motor vehicles that do not exceed the Federal maximum size limits applicable to the National Network.[82] These vehicles must be allowed reasonable access between the National Network and freight terminals, as well as facilities for food, fuel, repairs, and rest.[83] States have authority to restrict truck travel on other routes, provided that these restrictions do not violate the constitutional ban on restrictions of interstate commerce.

[80]Anne G. Morris, Alain L. Kornhauser, and Mark J. Kay, "Getting the Goods Delivered in Dense Urban Areas: A Snapshot of the Last Link of the Supply Chain," *Transportation Research Record 1653*, 1999.

[81]José Holguin Veras, "Necessary Conditions for Off-Hour Deliveries and the Effectiveness of Urban Freight Road Pricing and Alternative Financial Policies in Competitive Markets," presented at the TRB 2008 Annual Meeting, Washington, DC, January 2008.

[82]The National Network includes (1) the Interstate Highway System and (2) highways, formerly classified as Primary System routes, capable of safely handling larger commercial motor vehicles, as certified by states. The total National Network system is about 200,000 miles.

[83]23 CFR 658.19.

With regard to truck routing, some states have designated highway networks that large trucks must use until they reach the appropriate local roads for getting to a shipper or receiver. Similarly, if allowed by applicable state law, cities have designated truck routes within their boundaries. In general, trucks must remain on these designated routes except as necessary to reach a pickup or delivery location. Local rules may also require trucks exceeding certain dimensions or weight to obtain permits.

Parking and loading/unloading of trucks is typically regulated by local transportation or public safety agencies. Cities typically prohibit or greatly restrict truck parking in residential areas. For commercial areas, cities commonly designate acceptable times and areas for loading and unloading. Local rules regarding truck activity are enforced by local police or parking enforcement authorities.

Private-sector stakeholders with an interest in the regulation of truck activity in urban areas include

- **Shippers and receivers.** Shippers and receivers in urban areas are interested in timely and cost-effective freight delivery and want to be able to interact with carriers during their normal business hours and with minimal disruption to their ongoing operations.
- **Freight carriers.** Carriers doing pickup and delivery in urban areas want the flexibility to select their routes and pickup and delivery times. They also want adequate space for parking and loading and unloading of freight.
- **Residents and local advocacy groups.** Communities, represented by local residents and/or advocacy groups, are typically concerned with the noise, pollution, safety risks, and parking issues associated with truck traffic.
- **Other urban travelers.** All traffic on urban roads is affected by congestion related to truck activity (e.g., traffic bottlenecks from double-parking of trucks) or the safety risks of traveling in truck traffic.
- **Local highway or public works agencies.** These agencies are concerned about truck traffic increasing the cost of maintaining local transportation infrastructure.

Policy Actions

The types of restrictions on freight transportation typically imposed by local authorities include the following:

1. **Time-of-day restrictions on freight activity.** Trucks often have restricted time windows for delivery and pickup in dense urban areas. Near residential areas, cities may prohibit nighttime truck activity. For example, in Dallas, trucks are not allowed to travel off a designated truck route on streets adjacent to single-family and duplex residences between 10 P.M. and 6 A.M.[84] In central business districts (CBDs), cities may restrict loading and unloading during peak travel periods as a way of easing traffic congestion.

   Recently, more attention has been given to the use of variable pricing mechanisms to encourage traffic (including freight vehicles) to move to non-peak travel periods. A prominent example is London's cordon pricing system, which applies to both passenger and freight vehicles. New York City proposed implementing a similar system, but the New York State legislature did not provide the necessary approvals. Individual freight facilities such as ports have also begun to use variable pricing to encourage shifts in freight traffic. For example, the PierPASS program at the Ports of Los Angeles and Long Beach offers financial incentives to move cargo at night or on weekends.
2. **Route and access restrictions by vehicle weight and size.** In cities such as New York, Chicago, Dallas, and Seattle, trucks of certain dimensions or weight are required to remain on designated truck routes to the extent feasible. Trucks exceeding a city's size and weight limits often must obtain an oversize permit prior to traveling.[85] Route restrictions based on vehicle size and weight are often motivated by roadway characteristics such as pavement condition, road geometry, and bridge heights. The impacts of truck traffic on residential areas are also an important factor in the selection of truck routes. In some cities such as Los Angeles and Miami, the level of concern about the impacts of truck traffic has prevented the cities from designating official truck routes, although *de facto* truck routes already exist.[86]
3. **Restrictions on loading and unloading.** A major constraint on loading and unloading freight in urban areas is the availability of loading and unloading zones for commercial vehicles. Many cities restrict truck parking to designated curbside loading zones and set time limits for parking there. If carriers find the supply of designated loading and unloading areas to be insufficient, they often opt to park illegally and pay any resulting fines.

   Local land use planning and zoning authorities can also affect the ability of trucks to load and unload freight through specifications on the number and size of docking facilities at large buildings. Carriers may incur delays if the number of loading bays at commercial buildings is too small to accommodate the volume of freight activity. In

[84] Edwards and Kelcey Engineers, Inc., Truck Route Management and Community Impact Reduction Study, Technical Memorandum 1: Traffic Policies and Regulations, March 2007, p.82, http://www.nyc.gov/html/dot/downloads/pdf/tm1trafpolicies.pdf

[85] For example, see New York City Department of Transportation, "Oversize/Overweight Permits for Commercial Vehicles and Trucks," http://www.nyc.gov/html/dot/html/motorist/oversize.shtml, accessed September 8, 2009.

[86] Edwards and Kelcey Engineers, Inc., *Technical Memorandum 1,* p.83.

addition, carriers may find it necessary to break loads into smaller shipments or use smaller delivery vehicles if docking facilities cannot accommodate larger trucks or receive large pallets.[87]

The effects of these types of policies on freight transportation can be exacerbated by urban development patterns. The CBDs in many U.S. cities were originally developed with networks of alleys and loading zones to accommodate urban goods movement. As the economic structure of many cities has shifted from manufacturing to service industries, the value placed on these access facilities has diminished. Urban redevelopment efforts have often consolidated smaller parcels and eliminated alleys and other facilities for truck access, encouraged by changes in development practices that value rentable space over truck access.

Policy Impacts

Cities impose truck access and parking restrictions to further goals such as congestion relief, traffic safety, improved air quality, reduced noise, and infrastructure preservation. However, these policies impose direct and indirect costs on actors in the freight transportation system. These costs are detailed below.

Time-of-Day Restrictions

Time-of-day restrictions may require trucks to operate during more congested travel periods than carriers would otherwise choose to deploy their vehicles. Congestion-related delays increase the cost of labor and fuel per goods movement. A study by the American Transportation Research Institute (ATRI) estimated that the marginal costs for the trucking industry were $1.73 per mile and $83.68 per hour in 2008. This includes an average labor cost of about $25 per hour.[88] Therefore, a conservative estimate for the average cost of 1 hour of delay each day per truck would be more than $20,000 per year (assuming 250 working days).

Carriers' capital costs may also increase if they opt to use more vehicles to make the same number of goods movements. Carriers offering time-definite delivery services would be most likely to invest in additional vehicles and drivers. Given that congestion is likely to affect all carriers operating in a particular city, these costs probably are passed on to a carrier's customers. For example, it is common practice for carriers to assess a "New York arbitrary" congestion charge of at least $150 for each vehicle destined for the five boroughs, Long Island, and Westchester County.[89]

Policies intended to push freight movement to off-peak periods can result in different types of freight system impacts. If these restrictions push deliveries outside the normal working day, carriers may incur higher costs to provide evening, night, or weekend service. Carriers, particularly the private carriers, expeditors, and LTL firms, may have more difficulty finding drivers to work off-peak hours and may need to pay wage premiums as a result. In the case of off-peak incentive programs such as PierPASS at the Ports of Los Angeles and Long Beach, negative impacts have fallen primarily on drayage truck drivers (who work longer hours without a change in pay) and on warehouse operators (who must adjust hours and absorb higher costs), as noted in Section 4.[90]

Route and Access Restrictions

Route and access restrictions may increase a carrier's costs by increasing the number of miles traveled and time required per goods movement. These restrictions may also impose delay costs to the extent that they prevent trucks from seeking less congested alternative routes. For example, a 2007 study determined that only 5 percent of New York City's streets were designated as truck routes and that most of the truck routes were operating at or near capacity. The study also found that New York City had experienced a 35 percent increase in truck volumes during the preceding 20 years but had not added any miles to its truck routes.[91]

A carrier can avoid having to comply with route and access restrictions by using smaller vehicles, but the carrier will face higher operating costs to break down shipments and transfer them to the smaller vehicles. As mentioned above, a carrier's operating and capital costs will also increase if it purchases more vehicles to make the same number of goods movements. Using ATRI's figures for vehicle operating cost per hour and assuming smaller vehicles, each vehicle added to the fleet would cost over $100,000 more per year to operate.

Carriers face the same types of decisions when dealing with urban customers who have docking or curb space that cannot accommodate large pallets or large trucks. To handle deliveries

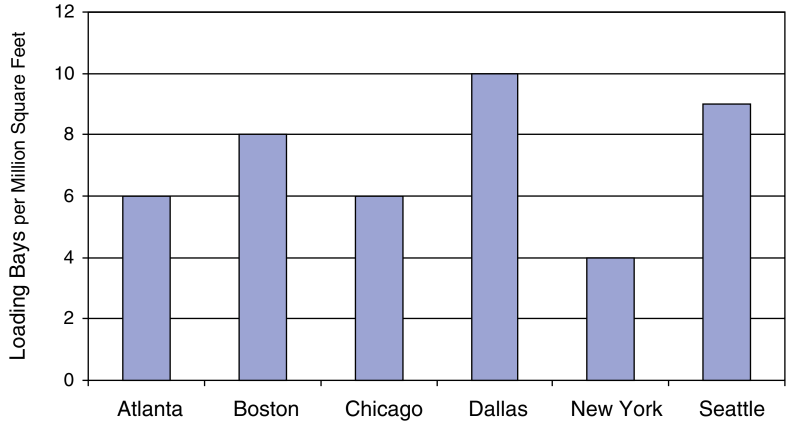
[87]Anne G. Morris, Alain L. Kornhauser, and Mark J. Kay, "Urban Freight Mobility: Collection of Data on Time, Costs, and Barriers Related to Moving Product into the Central Business District." *Transportation Research Record, 1613,* 1998.

[88]ATRI, "An Analysis of the Operational Costs of Trucking," 2008.

[89]Anne G. Morris, Alain L. Kornhauser, and Mark J. Kay, "Urban Freight Mobility: Collection of Data on Time, Costs, and Barriers Related to Moving Product into the Central Business District." *Transportation Research Record 1613,* TRB, National Research Council, Washington, DC, 1998.

[90]Genevieve Giuliano and Thomas O'Brien, "Impacts of Impacts of the Long Beach and Los Angeles Ports PierPASS Program," Presentation at the National Urban Freight Conference, December 5, 2007.

[91]Edwards and Kelcey Engineers, Inc., *Truck Route Management and Community Impact Reduction Study,* Executive Summary, Prepared for New York City, 2007.



Source: Anne G. Morris, "Developing Efficient Freight Operations for Manhattan's Buildings." Prepared for the Steven L. Newman Real Estate Institute, Baruch College, CUNY, Spring 2009.

Figure 5-3. Minimum number of loading bays required for large commercial buildings.

to these customers, carriers need to break loads into smaller shipments and use smaller vehicles for the last leg of the delivery, which increases operating costs.[92]

Another option for carriers is to subcontract the last leg of the trip to local niche carriers who have smaller trucks and understand the gamut of restrictions on truck activity in a particular city.[93] This option requires transfer of the freight as well as the administrative costs of engaging another company in the delivery process.

Restrictions on Loading and Unloading

Parking restrictions may make it harder for trucks to find parking or may require drivers to park farther from their destinations, thus increasing operating costs by adding to the amount of time needed for each pickup or delivery. Another option frequently chosen by truck drivers is to park illegally and risk receiving parking tickets. In the 12-month period ending June 30, 2006, commercial delivery companies received an average of 7,000 parking tickets per day in New York City, resulting in more than $102 million in fines. UPS received about 15,000 tickets a month and paid nearly $19 million in fines. FedEx was second with fines totaling $8.2 million.[94] These two carriers also incurred the most parking tickets in San Francisco during the same period. In that city, UPS paid $673,334 in fines and FedEx paid $434,046.[95] In addition to the cost of the tickets themselves, carriers also incur the administrative costs of paying them. In addition, trucks that obstruct a moving lane when parking illegally impose delays on other road users, including other trucks.

Local land use planning and zoning authorities affect the ability of trucks to load and unload freight through specifications regarding the number and size of docking facilities at large buildings. As shown in Figure 5-3, a 2009 survey of zoning officials found a relatively wide range in the minimum number of loading bays that cities require for new commercial buildings. New York City, the most densely populated of the cities surveyed, had the lowest requirement for the minimum number of loading bays at large commercial buildings.[96] Researchers have cited the insufficient number of loading bays and an inadequate number of freight elevators as major contributors to increases in freight turnaround times at New York City properties. The authors surmised that commercial real estate developers do not provide more loading bays because they would rather use the valuable street-level space for commercial tenants.[97]

Pickup and delivery activities of large trucks can exacerbate traffic delays if the trucks are parked in ways that impede the flow of traffic. A 2004 study estimated that lane-blocking pickup and delivery activities in urban areas resulted in nearly one million vehicle-hours of delay in 1999. However, this impact was minuscule when compared to the traffic impacts of roadwork, weather, accidents, and other causes of traffic delays. According to the study, truck pickup and delivery activities caused less than 0.03 percent of total vehicle-hours of delay, the smallest impact from any source in the study.[98]

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[92]Anne G. Morris, Alain L. Kornhauser, and Mark J. Kay (1998). "Urban Freight Mobility: Collection of Data on Time, Costs, and Barriers Related to Moving Product into the Central Business District." *Transportation Research Record 1613,* TRB, National Research Council, Washington, DC, pp. 27–32.

[93]Morris, et al., 1999.

[94]The Associated Press, "Parking Fines a Big Cost for Delivery Firms," September 1, 2006.

[95]Rachel Gordon, "Parking Tickets by the Truckload: 18 S.F. Businesses Rack Up Thousands of Citations, Pay City on Monthly Plan," *San Francisco Chronicle,* February 24, 2007.

[96]Anne G. Morris, "Developing Efficient Freight Operations for Manhattan's Buildings," prepared for the Steven L. Newman Real Estate Institute, Baruch College, CUNY, Spring 2009.

[97]Ibid.

[98]Oak Ridge National Laboratory, "Temporary Losses of Highway Capacity and Impacts on Performance: Phase 2," prepared for the U.S. Department of Energy, November 2004, p.87. The study assumed that 20 percent of all pickup and delivery events involve illegal parking that blocks a lane.

The Product Supply Chain

If policies regarding truck activity in urban areas increase the cost of freight transportation or add to the time needed to deliver freight, the policies will affect a wide range of business decisions and will affect participants all along supply chains. For example, transport delays tie up inventory in transit, which may require shippers to hold higher inventories.[99] In addition, transportation costs also can limit the geographic size of the markets in which firms operate. As the costs of transportation to a given area increase, fewer producers will ship products to that market, which will, in turn, narrow the selection of available goods and decrease competition.[100]

The impact of truck access and parking policies is likely to be small relative to the impacts of traffic congestion. Winston and Langer estimated that the cost of congestion (both recurring and incident related) to the highway freight sector in 1997 was about $10 billion (in 2000 dollars), with a cost to motor carriers of about $2.5 billion and to shippers of about $7.6 billion.[101]

Case Study 3: Air Cargo Screening Requirements

Setting

The events of 9/11 illustrated the vulnerability of the U.S. commercial passenger air transportation network to attack. Though the specific threat vector employed on 9/11 was a human one, the actions of 9/11 raised serious concerns that cargo (both passenger luggage and commercial freight) represents a threat to passenger air travel as well. Less than 2 months after the 9/11 terrorist attacks, the Aviation and Transportation Security Act was passed, which created the Transportation Security Administration (TSA).

The 2001 law creating TSA gave the agency duties that include the following:

> (1) be responsible for day-to-day Federal security screening operations for passenger air transportation and intrastate air transportation; (2) develop standards for the hiring and retention of security screening personnel; (3) train and test security screening personnel; and (4) be responsible for hiring and training personnel to provide security screening at all airports in the United States where screening is required.

After a period dominated by politically charged debate over what should be done to better safeguard U.S. air travel, President Bush established the National Commission on Terrorist Attacks on the United States. Formed in November 2002 and more commonly referred to as the 9/11 Commission, this 10-member bi-partisan body of former elected officials and appointees was charged with preparing a "full and complete account of the circumstances surrounding the September 11, 2001 attacks," including preparedness for, and the immediate response to, the attacks. Between November 2002 and the date the report was published in July 2004, the commission interviewed more than 1,200 people in 10 countries. The report itself, which numbers more than 560 pages, contains 41 separate recommendations. Most of the recommendations are strategic in nature. Only one sentence of one recommendation specifically calls for air cargo screening:

> Recommendation: The TSA and the Congress must give priority attention to improving the ability of screening checkpoints to detect explosives on passengers. As a start, each individual selected for special screening should be screened for explosives. Further, the TSA should conduct a human factors study, a method often used in the private sector, to understand problems in screener performance and set attainable objectives for individual screeners and for the checkpoints where screening takes place.
>
> Concerns also remain regarding the screening and transport of checked bags and cargo. More attention and resources should be directed to reducing or mitigating the threat posed by explosives in vessels' cargo holds. The TSA should expedite the installation of advanced (in-line) baggage-screening equipment.
>
> Because the aviation industry will derive substantial benefits from this deployment, it should pay a fair share of the costs. The TSA should require that every passenger aircraft carrying cargo must deploy at least one hardened container to carry any suspect cargo. *TSA also needs to intensify its efforts to identify, track, and appropriately screen potentially dangerous cargo in both the aviation and maritime sectors.*[102] (emphasis added)

This recommendation directly led to the air cargo screening requirement now being implemented.

Stakeholders

There are, effectively, two sides to this issue. Although there is agreement among all involved that screening is necessary to ensure the safety of air travel, significant differences exist regarding how best to achieve that end. On one side there is TSA, responsible for defining acceptable measures for mitigating the risk of terrorist exploitation of the transportation system as a whole, and the air transportation system specifically. On the other side is a portion of the air cargo transportation community, which consists of commercial passenger airlines, freight forwarders, cargo handling facilities, and shippers. These stakeholders are represented not only by individual businesses, but also by a substantial collection of advocacy groups and associations. Although these interests are not monolithic in nature, the research team's efforts indicate substantial agreement among the various parties regarding the

[99]Clifford Winston and Chad Shirley, "The Impact of Congestion on Shippers' Inventory Costs," prepared for FHWA, February 2004, p.1.

[100]GAO, *Freight Transportation: National Policy and Strategies Can Help Improve Freight Mobility,* GAO-08-287, January 2008, p. 21.

[101]Winston and Shirley, pp. 7–8.

[102]"9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States," p. 393.

implementation of cargo screening requirements and their desire to mitigate its effects on the community.

The level of cooperation between TSA and the air cargo community has been significant, but cooperation appears to be less so between the air cargo community and the U.S. Congress. Industry testimony and public comments argue that the screening rule represents an unfunded mandate that places undue burden on businesses and not enough on the government. This point is made clear in several instances cited later in this case study. Hence, although the industry generally expresses support for the policy, it is at odds with legislators regarding the fair distribution of the burden of compliance and has submitted testimony on several occasions that argue that point.

Policy Actions

Little more than a year after the release of the 9/11 Commission Report, Congress enacted the Implementing Recommendations of the 9/11 Commission Act of 2007. The bill easily passed votes in both houses of Congress and was signed into law by President Bush in August 2007. Although the 9/11 Commission's report said simply that TSA needed "to intensify its efforts to identify, track, and appropriately screen potentially dangerous cargo," the new law laid out specific and aggressive requirements for TSA. The law requires TSA to implement a system to screen 50 percent of all cargo carried on passenger aircraft by February 2009 and 100 percent of such cargo by August 2010.

The law specifies that TSA

> . . . shall require, at a minimum, that equipment, technology, procedures, personnel, or other methods approved by the Administrator of the Transportation Security Administration, are used to screen cargo carried on passenger aircraft to provide a level of security commensurate with the level of security for the screening of passenger checked baggage.

The law goes on to state that

> . . . acceptable methods of screening include x-ray systems, explosives detection systems, explosives trace detection, explosives detection canine teams certified by the TSA, or a physical search together with manifest verification.[103]

The law allows the TSA to

> . . . approve additional methods to ensure that the cargo does not pose a threat to transportation security,

but specifically excludes

> . . . solely performing a review of information about the contents of cargo or verifying the identity of a shipper of the cargo that is not performed in conjunction with other security methods, including whether a known shipper is registered in the known shipper database.[104]

[103]Public Law 110-53, August 3, 2007, Sec. 1602, (a) (2).

[104]Ibid, Sec. 1602, (a) (5).

Faced with this mandate, TSA officials concluded that it would be impractical to screen the approximately 12 million pounds of cargo transported daily on passenger aircraft at the time the cargo is enplaned. In fact, TSA concluded that doing so would result in airport congestion that would pose a security vulnerability and a threat target of its own. Furthermore, the current state of screening technology does not allow adequate screening of cargo that has already been built into large pallets or unit load devices (ULDs). Air freight is commonly delivered to airports in this form.[105]

Faced with these challenges, TSA has adopted an alternate approach of allowing air cargo carried on wide-body planes (e.g., Boeing 747, 757, and 767) to be screened earlier in the supply chain as long as a secure chain of custody is maintained until the cargo is transported. The main component of this approach is the Certified Cargo Screening Program (CCSP), a voluntary program under which TSA-approved forwarders and shippers may screen cargo at the piece level before putting it in pallets/skids or ULDs and prior to tendering it to passenger carriers. The airlines do not have to re-screen such cargo. Cargo carried on narrow-body planes (e.g., Boeing 737) must be screened by the airlines themselves. Narrow-body planes carry primarily small express shipments and do not carry cargo pallets/skids or ULDs.

The screening requirements specified in the law were met with a significant degree of concern by members of the air freight transportation community. In testimony offered to the Transportation Security and Infrastructure Protection Subcommittee of the House Committee on Homeland Security in March of 2009,[106] Air Transport Association of America President James May expressed significant concern about the ability of the community to meet mandated screening levels. Mr. May stated that

> The biggest challenge in meeting the August 2010 deadline is the lack of TSA-certified screening technology to inspect large air cargo pallets. Most pieces of cargo transported on wide-body aircraft are consolidated into large shipments and 75 percent of cargo is transported on wide-body aircraft.[107] That fact gives you an idea of the magnitude of the challenge that we face.

Mr. May went on to describe the challenge in further detail, stating

> Shippers and freight forwarders typically create these pallet-size shipments before they are tendered to an airline. The dilemma is

[105]John Sammon, Assistant Administrator, DHS, written testimony for the Subcommittee on Transportation Security and Infrastructure Protection, House Committee on Homeland Security, July 15, 2008.

[106]Available at: www.airlines.org/government/testimony/2009/ATA+Testifies+on+Air+Cargo+Screening.htm

[107]TSA estimates run as high as 80 percent, though narrow-body flights account for 90 percent of all cargo-carrying flights and 85 percent of all passenger travel.

> that screening is required at the piece level but existing technology cannot screen large consolidated shipments. The nature of our business and available screening equipment are, at least for the time being, badly mismatched.

He further explained that

> Breaking down consolidated shipments at an airport cargo facility is not practical. Shipment size, time constraints and facility limitations are the main difficulties. A pallet can have as many as 200 pieces on it. Dismantling it and screening each piece is labor intensive and time consuming. To place this in some perspective, it can take 75 minutes for two employees to break down and reassemble a pallet. In addition, airport cargo facilities were never designed to be high-volume disassembly and reassembly locations. They are not big enough to perform that role, especially at peak times.

Mr. May urged caution on the part of TSA to avoid imposing requirements that will result in airport cargo facilities becoming choke points and implored the DHS to act immediately in three specific areas:

1. Enlarge rapidly the number of CCSP facilities at large shippers.
2. Expand as swiftly as possible the use of TSA-certified explosive-detection canines to screen large air cargo consolidations; and
3. Provide for additional Federal funding or incentives (e.g., tax relief for privately purchased screening equipment) for all TSA-certified indirect air carriers and other qualified CCSP participants.

The TSA has acknowledged the challenges associated with meeting the wide-body screening requirements, in particular, and in June of 2009 issued supplemental guidance regarding air carrier compliance. In the document, TSA states

> Shipments tendered on skids and shrink-wrapped (typically transported on wide-body aircraft) must be taken apart so pieces can be screened. Most wide-body cargo flows through freight forwarders (consolidators), who typically "containerize/palletize" this cargo prior to tendering it to airlines. Airlines lack space/facilities to "de-palletize," screen, and re-configure these shipments, so if "airlines only" must screen all such cargo, they anticipate significant delays, increased processing/cut-off times and costs.

In forewarning the challenges presented to the air cargo community, TSA explains that the 50 percent mandate was met without significant challenges, but that shippers, forwarders, and airlines need to be mindful of several issues that will complicate compliance with the 100-percent threshold. Namely

- The economic downturn caused a 35-percent drop in the movement of cargo compared with 2007, which made compliance with the 50-percent requirement easier. Economic recovery will lead to an increase in cargo volume, making compliance with the 100-percent requirement even more difficult.
- Airlines still lack space/facilities to de-palletize, screen, and re-configure large shipments.
- Screening difficult, complex, skidded cargo for wide-body planes has not been addressed. Most shipments screened today are not skidded and move on narrow-body aircraft.
- Some commodities were screened by an alternate means for a limited time (until August 31, 2009). Those alternatives are no longer available.
- About 85 percent of current screening entities (airlines and CCSP freight forwarders) use explosives trace detection (ETD) as their primary method of screening. Resolving an ETD alarm generally requires physical inspection (opening boxes and removing content), which adds considerable delay and cost.

Policy Impacts

The results of the implementation of the cargo screening requirements will be difficult to quantify fully for some time, largely because the implementation deadline for screening 100 percent of cargo has not yet passed. However, a combination of considered opinion offered by government and industry experts and anecdotal evidence sheds light on what can be expected.

Current Challenges

In March of 2009, GAO issued testimony to Congress on the state of the air cargo screening mandate.[108] In the testimony, GAO outlined the challenges that TSA and the air cargo transportation community have experienced and will continue to face as the August 2010 deadline for 100-percent screening approaches. Most notably, the testimony indicates that TSA acknowledges it is unlikely that screening requirements will be met by that date. The testimony cites challenges associated with the implementation of CCSP, the technology options available for screening, the TSA staff available for overseeing certification, and the screening of shipments originating outside the United States as significant barriers to meeting the deadline.

Air cargo transportation providers have not signed up for CCSP as rapidly as was expected, and even if they had, the GAO report says TSA does not currently have the staff to inspect and certify all of the various facilities that would need certification. Furthermore, if large numbers of facility operators wait until

[108]GAO-09-422T, "Aviation Security: Preliminary Observations on TSA's Progress and Challenges in Meeting the Statutory Mandate for Screening Air Cargo on Passenger Aircraft," GAO, March 18, 2009.

the last possible moment to enroll, the ensuing rush to gain certification likely will overwhelm TSA's capacity to process them. TSA has indicated that it is actively recruiting the necessary inspectors, but that there may not be enough to conduct compliance inspections of all the potential CCSP participants, which TSA estimates could be in the thousands.

TSA has embarked on pilot implementations of technology and is evaluating the suitability of different technologies, but none of them have completed the qualification process. As of the delivery of the GAO testimony, TSA had not approved any technologies capable of screening consolidated pallets or containers containing multiple commodities. In addition to the fact that screening facilities that do not participate in TSA's Air Cargo Screening Technology Pilot will not receive any public funding to implement technology, the GAO reports that, ". . . industry stakeholders expressed concerns about purchasing technology that is not guaranteed to be acceptable for use after August 3, 2010."

To better understand these specific challenges and their implications across the air cargo spectrum, the research team relied on a combination of documentation about, and input provided by, representatives from air transport associations, air carriers, freight forwarders, cargo handlers, and TSA.

Air Carrier Compliance Costs

The screening requirements specified in the law are not accompanied by funding for the implementation of the security devices or regimen by which the requirements are to be accomplished.[109] Hence, commercial airlines and the entities that tender freight to them (i.e., shippers and freight forwarders) must assume the burden of any costs associated with compliance.

Across the board, industry representatives argue that compliance will impose a significant financial burden on the air cargo community, yet little specific evidence has been made available to substantiate or refute such claims. In testimony provided to the House Committee on Homeland Security in April 2009, representatives from the Air Transport Association, IATA, the National Air Carrier Association, and several shipper organizations suggested that, "Much has been accomplished in the United States thus far—at great cost to the airlines." However, the testimony offers no details regarding actual outlays. The testimony further decries the financial burden that the CCSP, which it cites as potentially "very practical," is expensive for freight forwarders and shippers. Finally, the testimony mentions the challenges associated with screening palletized loads and offers recommendations to enhance the program, including: increasing the number of CCSP facilities, providing government funding or incentives for the purchase of screening equipment, and swiftly expanding the use of TSA canines.

For its part, TSA appears to understand and, in large part, sympathize with the air cargo transportation community. The agency recognizes that there will be costs associated with compliance and that the overwhelming majority of those costs will be borne by the private-sector entities that ship, forward, and transport goods on passenger aircraft. More specifically, TSA acknowledges that costs will be twofold: there will be costs associated with (1) equipment purchase and implementation as well as personnel and (2) shipment delays caused by bottlenecks in screening operations. TSA established the CCSP to mitigate those costs and expects that enrollment will accelerate as the August 2010 deadline approaches.

Ultimately, air carriers, freight forwarders, and cargo handling facilities concur that they will have the bulk of the burden for security screening. What that will mean in terms of total cost of compliance appears to be very much uncertain. In February 2009, American Airlines announced that it had expended more than $3 million in equipment and training to meet the 50 percent screening threshold,[110] but very little information about these expenditures was offered. Asa Hutchinson, chairman of the Safe Commerce Coalition and former Homeland Security undersecretary for border and transportation security, has stated that to meet the 100 percent threshold, expenditures will likely be double those for meeting the 50 percent requirement, and perhaps more.[111] Mr. Hutchinson goes on to speculate that the total price tag is, "impossible to calculate," but that it will be "costly" for the air cargo industry. General estimates for equipment prices range from about $35,000 for an explosives trace detector (typically used for individual parcel screening) to $400,000 for a large X-ray machine (to scan palletized loads).[112] The research team's extensive search to retrieve cost data for other expenses (e.g., personnel, training, and facilities) revealed no quantitative data.

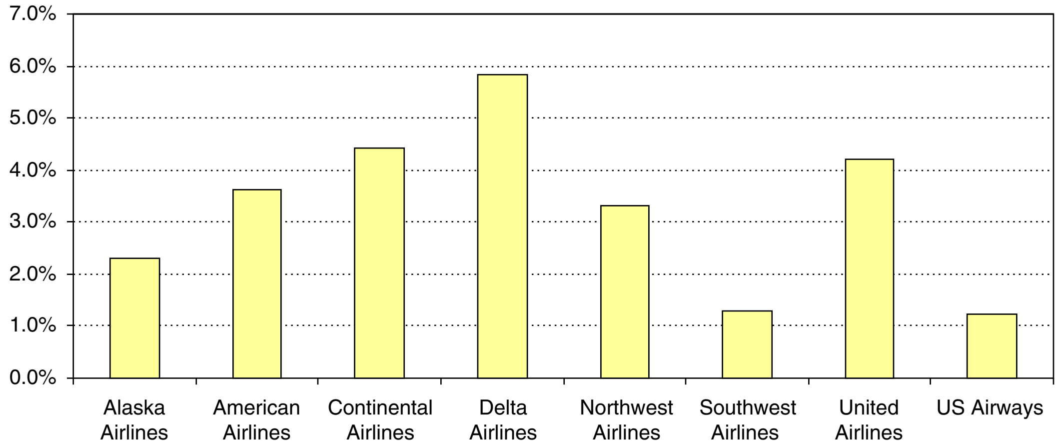
Public statements by air carriers seem to reveal resignation that they will be left to absorb much of the initial costs. However, there also appears to be a consensus that these costs will ultimately be passed on to customers (i.e., shippers and freight forwarders) in the form of cargo screening surcharges. To date, airlines appear to be resistant to be the first to pass along these costs, particularly given the current economic conditions. In fact, industry associations report that shippers are already

[109]The Air Cargo Screening Technology Pilot Program provided up to $375,000 for each of 12 technology implementation evaluation projects at freight forwarder locations.

[110]"Airlines May Struggle with 2010 Cargo Screening Rule (Update 2)," Bloomberg .com, March 18, 2009.

[111]Ibid.

[112]"Time to Scramble: Cargo-Screening Deadline Approaches," *DC Velocity Magazine,* January 2009.



Source: Air Carrier Financial Statistics (Yellow Book), RITA/BTS.

Figure 5-4. Freight revenue as percent of total transportation revenue, 2008.

refusing to pay any such surcharges because all-cargo airlines do not assess them.

Individuals within the industry and TSA contacted for this study indicated that American Airlines has been very active in implementing screening technologies and processes and has been working actively with supply chain partners to achieve the August 2010 goal. Southwest Airlines, also referenced by several study interviewees, has only narrow-body aircraft and has apparently made the necessary investments to fully screen all of the cargo carried by its fleet. As of this writing, efforts to gain additional information from both airlines have been unsuccessful. Other airlines (i.e., Continental and Lufthansa) have been cited as being active in pursuing compliance with the screening rule.[113]

Air Cargo Market Share

Should one or two large airlines impose cargo security screening fees, others will be likely to follow, and shippers and forwarders will be forced to pay these fees or move their freight to all-cargo carriers. However, according to representatives from air transport associations, this would further diminish the competitiveness of the commercial passenger carriers because their service has historically provided a cost advantage over all-cargo services. Passenger airlines will then be left to rely on quicker delivery—the result of the lack of a need for an overnight sort—as the primary differentiator. In an air cargo market that some estimate is down by 30 to 35 percent, competition is intense, and an overall soft economy has shippers that routinely ship by air increasingly using trucks for delivery. This combination of circumstances has airlines implementing incentive programs, such as reduced shipping rates for prescreened cargo and more flexible cut-off times for cargo. Still, some fear that the cargo that has gone to other providers may never come back in significant numbers. From the industry perspective, any loss in revenue or profit would not be a large proportion of their income. For most passenger carriers, cargo is less than 5 percent of total revenue (see Figure 5-4). Nonetheless, when profit margins are close, small decreases at the margin can be damaging.

Delays

In addition to (1) loss of revenue because of competition and (2) increases in costs for screening systems, personnel training, and incentive programs, "They should also expect costly delays," says Steve Burke, senior vice president of East Coast Airport Services, which handles cargo for several airlines. His six-door facility adjacent to Boston's Logan International Airport handles about 4 million pounds of freight each month, the majority of it on skids or pallets. Once the law is in full effect, efficiency and timeliness will be a thing of the past, he predicted at a recent symposium. "Instead of unloading 10 skids off a truck, I'll be unloading and checking in 1,000 loose pieces. Trucks will be backed up around the block waiting to unload." Adding capacity is not an option for Burke's company, which lacks both the physical space and the money for more dock doors, dock workers, and screening equipment. With many other air-cargo facilities around the country facing similar constraints, he said, the effects could be "earth-shattering."[114]

[113]"TSA Belly to Belly Takes Hold," *Air Cargo News,* July 20, 2009.

[114]"Time to Scramble: Cargo-Screening Deadline Approaches," *DC Velocity Magazine,* January 2009.

Forwarder Compliance Costs

Accurate data about the cost of compliance for forwarders is equally difficult to obtain. The Air Forwarders Association has been working with its membership to understand the requirements imposed on the community and appear to be somewhat caught in the middle. With few exceptions (e.g., pharmaceutical manufacturers and seafood suppliers), shippers are leaving compliance to forwarders and airlines. At the same time, airlines receiving palletized loads are not eager to invest in costly x-ray equipment and are turning to forwarders and cargo handling facilities to screen cargo before it becomes palletized. TSA estimates that freight forwarders are screening about 30 percent of the current 50 percent (or a total of 15 percent of all cargo being screened), with air carriers performing the rest. That 15 percent equates to roughly 1.8 million pounds of cargo screened daily by forwarders.[115]

According to TSA Cargo Division General Manager Ed Kelly, independent cargo screening facilities (ICSFs) are playing an important role in helping small and medium-sized freight forwarders (often referred to as indirect air carriers) meet the requirements.[116] According to an article in *Air Cargo News,* "TSA has worked with industry to establish facilities in 18 cities across the country where cargo can be screened."[117] Still, the numbers represent a very small percentage of the thousands of facilities that handle cargo.

Cooperation

Despite (1) ongoing concerns over how the 100 percent screening requirement will ultimately affect the air cargo industry and (2) differences of opinion regarding how best to ensure the safety of passenger aircraft, representatives from industry and the TSA continue to work together to address these issues. TSA and industry representatives interact regularly, sharing ideas and concerns, and seeking a workable, practical solution. The CCSP is seen as a positive development and an indicator that TSA is listening to the industry. As of February 2009, TSA reported that more than 700 applications had been received and more than 170 different entities had been certified.[118] Still, as the GAO report indicates, TSA does not have the staff to process applicants quickly.

All entities involved appear to concur that canine screening potentially offers the least intrusive and most time-efficient method for screening palletized cargo. In fact, industry representatives have called for a significant expansion in the program. However, it does not appear that TSA is willing to commit to an ongoing operational role of screening all palletized shipments, and only TSA-certified and handled canines are considered acceptable for use in screening.

Seemingly lost in the debate is the issue of screening of inbound freight originating in foreign countries. Specifically, the current screening rule imposes requirements that, according to IATA, violate the bi-lateral air service treaties currently in place between the United States and nations that engage in air commerce with it. Rather than dictate terms that some fear could trigger trade wars, IATA contends that TSA should revisit and renegotiate exiting air service treaties to institute methods that recognize screening activities in foreign countries. Had U.S. Customs and Border Protection (CBP) been involved at the onset, as IATA argues they should have, the result could have been one that uses risk assessment methods and international agreements that are currently in place for land- and sea-based cargo security programs.

Case Study 4: State and Federal Climate Change Policies

Setting

Various policies have been introduced or adopted at the state and Federal level to reduce GHG emissions that contribute to global climate change. Freight transportation generates more than 7 percent of all U.S. GHG emissions, and more than a quarter of GHG emissions are from the transportation sector. Moreover, freight GHG emissions have been growing more than twice as fast as those from passenger transportation.[119] Many of the climate change policies, therefore, target transportation fuels or the freight industry specifically. Some policies target other sectors but are likely to affect the freight sector.

The recent introduction of new policies to reduce GHG emissions has been driven both by the recommendations of scientific panels and the recent shift in political control at the Federal level. The most authoritative information on the science of climate change comes from the Intergovernmental Panel on Climate Change (IPCC), a United Nations body. The IPCC has documented that the global climate has been warming since the industrial revolution, largely due to human activity.[120] During the last 100 years, global average surface temperatures have increased in total by about 1.4°F, and average temperatures in the Arctic region have increased at almost

[115]Based on total estimated daily air cargo on-board passenger aircraft of 12 million pounds, as cited in "Air Cargo Screening Moves Ahead," *Aviation Today,* July 13, 2009.

[116]"TSA Belly to Belly Takes Hold," *Air Cargo News,* July 20, 2009.

[117]Ibid.

[118]"Achieving 100% Cargo Screening on Passenger Aircraft," Non-SSI Presentation, TSA, February 2009.

[119]John Davies, Cristiano Facanha, Joseph Aamidor. "Greenhouse Gas Emissions from U.S. Freight Sources: Using Activity Data to Interpret Trends and Reduce Uncertainty." TRB Annual Meeting 2008, Paper #08-2594.

[120]IPCC. 2007. "Climate Change 2007: The Physical Basis. Summary for Policymakers." Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Available at: http://www.ipcc.ch/SPM2feb07.pdf

twice the global average rate.[121] Current evidence of global climate change includes

- **Sea Level Rise and Retreating Ice.** During the 20th century, global sea levels rose about 5 to 9 inches.[122] Mountain glaciers have retreated in all regions of the world.
- **Weather Patterns and Extremes.** A significant rise in precipitation has been observed over eastern parts of North and South America, northern Europe, and northern and central Asia. In already dry regions, such as the Sahel, Mediterranean, southern Africa, and parts of southern Asia, there has been a significant decrease in precipitation. More powerful hurricanes and tropical cyclones have been observed in the North Atlantic over the past 35 years.[123]
- **Evidence of Ecosystem Changes.** Climate-induced changes have been observed in at least 420 physical processes and biological species or communities.[124]

As more current evidence of climate change is observed and as the IPCC and other experts have increased their level of certainty that recent climate change is the result of human-caused GHG emissions, the debate has shifted from the causes of climate change to the search for solutions. In the last few years, policymakers at the state and Federal level who are concerned about the potential effects of global warming have proposed different policies to reduce GHG emissions.

Stakeholders

Numerous stakeholders are involved in the policy debate over climate change. These stakeholders include

- **Energy companies** producing coal, oil, electricity, natural gas, renewable fuels, and other energy products.
- **Manufacturing industries,** particularly those that are energy intensive. They will likely be disproportionately affected by the regulation of GHGs.
- **Freight carriers in all modes** (i.e., truck, rail, marine, and air) also have a major interest in the formation of climate change policies. Fuel is one of the most significant operating costs for transportation carriers. Climate change regulation will increase the cost of transportation fuels and will likely alter the demand for freight transportation and the structure of transportation markets.
- **Environmental groups** are also key stakeholders in the climate change policy arena. To a great extent, their focus on the issue of climate change has put the issue on the public agenda.
- **Different regions** are stakeholders as well. Different regions of the United States differ with respect to the economic sectors that make up their economy, the patterns of energy use, and their sensitivity to the impacts of changes in the price of energy. These regional differences have been reflected in the policies of state governments—some have been active in mandating GHG emissions reductions, while others have resisted these measures.
- **Business stakeholder groups,** including manufacturers, transportation carriers and shippers are not monolithic. Many businesses have sought to reduce their environmental footprint because they realize their customers care about environmental issues. Others have not been proactive in implementing such policies.

Policy Actions

Enacted or proposed climate change policies include the Federal Renewable Fuels Standard, Cap and Trade policies, carbon taxes, EPA regulation under the Clean Air Act, corporate average fuel economy (CAFE) standards, low carbon fuel standards, and California's fuel efficiency requirements. Each of these policies and their relationship to the freight sector are summarized below.

Federal Renewable Fuels Standard

The renewable fuels standard was enacted to reduce emissions of GHGs and to limit U.S. dependence on foreign oil. Enacted in 2005, the law was amended in 2007 to increase the volume of renewable fuels produced in the United States. The law requires refiners to blend specific volumes of renewable fuels into the fuel that they produce. Current ethanol production is 9 billion gallons per year, comprising approximately 6 percent of motor fuel used. The 2007 Energy Independence and Security Act (EISA) stipulates that ethanol blending must increase to 15 billion gallons by 2012 and 36 billion gallons by 2022. EISA requires major increases in biofuel production from non-conventional feedstocks, such as agricultural waste, municipal waste, switchgrass, or wood. If these mandated production targets are achieved, significant additional quantities of biomass and ethanol will need to be transported, much of it by rail. Railroad capacity may be strained by this demand, and significant new investments in rail infrastructure may be needed.

Cap and Trade

On June 26, 2009, the House passed the American Clean Energy and Security Act of 2009. This bill, also known as the

[121] Ibid.
[122] Ibid.
[123] Ibid.
[124] UNFCCC (United Nations Framework Convention on Climate Change), 2007. "Feeling the Heat." Current Evidence of Climate Change Section. Available at: http://unfccc.int/essential_background/feeling_the_heat/items/2918.php

Waxman-Markey bill, proposes to establish a cap and trade system to reduce GHG emissions. The bill requires a 17 percent emissions reduction from 2005 levels by 2020 and an 80 percent reduction by 2050. In general, the bill would cap GHG emissions and gradually reduce the cap. EPA would issue or auction permits to emit GHGs, and these permits could be traded between firms. This would allow those firms with the lowest cost for emissions mitigation to make reductions first. Transportation fuels would be regulated with an upstream cap on the GHG emissions from refiners. A cap and trade system would make carbon-based forms of energy more expensive, which would increase the cost of transportation and influence the mix of commodities moved by the freight system.

Critics of a cap and trade system have argued that it would likely introduce additional volatility into the price of fuel given that the price of carbon allowances would vary based on economic activity. Economic growth would tend to increase prices, while the onset of a recession could result in sharp reductions in the price of allowances.

Carbon Tax

A carbon tax has been proposed as an alternative to a cap and trade system. The purpose of a carbon tax is to reduce the carbon content of fuels by making carbon-intensive fuels more expensive. By raising the cost of fuel, a carbon tax would also tend to encourage fuel efficiency and reduce demand for transportation. Some economists and industry representatives have argued that a carbon tax would have certain advantages over a cap and trade system. A carbon tax would build on existing fuel taxes, be easy to implement, and have low government administrative costs. Some industry representatives have also argued that an important benefit of a carbon tax would be to provide industry with a level of certainty about how much fuel prices would increase because of GHG regulation. Certainty about higher future prices would provide clearer incentives to businesses to make long-term investments in fuel-efficient equipment. One drawback to a carbon tax is that it would apply equally to firms, irrespective of their compliance costs for reducing emissions. British Columbia, Canada, recently became the first jurisdiction in North America to implement a carbon tax. The tax is set to increase gradually each year through 2012, with all of the revenues returned to consumers through a package of tax cuts and credits.

EPA Regulation under the Clean Air Act

In April 2007, in the Massachusetts versus EPA case, the Supreme Court ruled that GHGs are air pollutants under the Clean Air Act. The court instructed EPA to decide whether GHG emissions endanger public health and welfare. In April 2009, EPA declared that GHG emissions do endanger public health, clearing the way for EPA to regulate GHG emissions under the Clean Air Act. If Congress does not act, EPA could use its current authority to regulate GHG emissions. This could involve the regulation of motor vehicles as well as GHG emissions from industrial and commercial sources.

The administrative costs of regulating GHGs could be significant, depending on the form of regulation. One of the most challenging issues in administering an emission control program is determining a baseline from which reductions can be measured. Protocols for determining GHG baselines and full lifecycle emissions are still under development. Unlike the criteria pollutants traditionally regulated under the Clean Air Act, which focus only on emissions from the vehicle tailpipe, regulating transportation GHG emissions requires the consideration of the global consequences of an action, including upstream emissions (from the production and transport of fuels) and potentially downstream emissions (from the disposal of equipment).

CAFE Standards for Trucks

EISA requires EPA to develop fuel economy standards for medium- and heavy-duty trucks. A CAFE standard requires the vehicle fleet sold by a manufacturer to meet an average fuel economy. Based on the timeline provided by the law, new regulations for trucks will likely not take effect before 2016.[125] Developing and implementing fuel efficiency standards for trucks will be more complicated than developing standards for cars and light trucks. The heavy-duty vehicle fleet contains a diverse range of equipment sizes and types, with disparate operational and usage profiles. Accurately measuring the fuel efficiency of this equipment requires the use of a variety of different test cycles. Currently little data can be used to capture the diversity of usage and activity profiles of different types of vehicles.

Another factor complicating the implementation of CAFE standards for heavy-duty trucks is that the engine, chassis, and body of trucks are often produced by different manufacturers—One manufacturer may produce the chassis, a second builds the engines, and a third assembles the vehicle. Furthermore, the fuel efficiency of combination trucks is affected by the type of trailer used. Trailers are made by yet another manufacturer. Determining which entities should be responsible for the combined fuel efficiency performance of the vehicle will thus be difficult.

The appropriate metric to be used to measure efficiency is also unclear in the case of heavy-duty trucks. Although miles per gallon (mpg) is often used, fuel use per ton-mile for freight

[125]M. J. Bradley and Associates. "Setting the Stage for Regulation of Heavy-Duty Vehicle Fuel Economy & GHG Emissions: Issues and Opportunities."

trucks is also relevant. For instance, LCVs might receive a low fuel efficiency rating in miles per gallon, but be more efficient on a ton-miles per gallon basis.

A heavy-duty vehicle fuel efficiency standard can be segmented by vehicle class, requiring a higher efficiency standard for smaller vehicle classes. This can provide perverse incentives to manufacturers if not properly implemented. For instance, many have argued that having separate passenger car and light-duty truck CAFE standards encouraged manufacturers to build and market heavier trucks and SUVs to consumers so as to avoid the more stringent fuel efficiency standards for passenger cars. Fuel efficiency standards that provide different standards for different truck classes could thus have similar unintended consequences and might either encourage manufacturers to build larger and heavier vehicles to avoid more stringent standards in lighter vehicle classes or, alternatively, if fuel efficiency standards raise the cost of using large combination vehicles, some carriers might be encouraged to make more frequent deliveries using smaller trucks, which could result in more VMT and GHG emissions on a ton-mile basis.

California's Low Carbon Fuel Standard

California has adopted a low carbon fuel standard (LCFS) that will require a 10-percent reduction in the carbon intensity of transportation fuels sold in the state by 2020. On December 31, 2008, representatives from 11 Northeastern and Mid-Atlantic states signed a Letter of Intent to develop a similar LCFS at a regional scale. Other states have passed biofuels mandates to require blending of biodiesel into diesel fuel.

The LCFS requires that the lifecycle emissions associated with the fuel sold by a distributor in the state meet an average CO_2-equivalent content. Lifecycle emissions include the expected emissions from the combustion of fuel, as well as emissions from upstream fuel production processes (e.g., resource extraction and transportation of raw materials to the refiner). Distributors can comply with the California LCFS in three ways:

1. Distributors can blend low GHG biofuels into gasoline or diesel. Biofuels produced from cellulose or waste would be considered to reduce lifecycle GHG emissions.
2. Distributors can buy low GHG fuels such as natural gas, biofuels, electricity, and hydrogen.
3. Distributors can buy credits from other refiners who have made reductions in lifecycle emissions.

Implementation of an LCFS at the state or regional level would likely be significantly less effective than a national LCFS because a statewide LCFS would tend to encourage distributors to shift clean fuels to states or regions with carbon standards and sell higher carbon fuels in states without the standard. California has exempted marine bunker fuels from the regulation, because ships could easily avoid purchasing fuel in California. If an LCFS resulted in a significant cost difference, it is likely that there would be some shift in diesel fuel sales to other states. Interstate heavy-duty vehicles already tend to purchase a disproportionate amount of fuel in low-tax states.

California's Freight Vehicle Fuel Efficiency Requirements

In 2006, the California legislature passed the Global Warming Solutions Act (AB 32) to reduce GHG emissions in the state. The legislation requires the CARB to develop programs to reduce GHG emissions to 1990 levels by 2020. In response, CARB has proposed a list of early action measures that could be implemented by 2010. One of these proposed measures is the Heavy-Duty Vehicle GHG Emission Reduction Measure. The regulation will require the use of technologies that improve the efficiency of heavy-duty tractors and trailers operating in California. Specifically, the proposed rule will require the use of side fairings and low rolling resistance tires on heavy-duty combination trucks operating in the state after 2011. In addition, the rule requires model year 2011 and later tractor sleeper cabs used in California to be SmartWay certified. This rule would exempt some categories of trucks, including those operated less than 50,000 miles per year. California and other states have also considered freight operating restrictions to reduce GHG emissions, including speed limits for trucks and ships.

CARB has estimated that the heavy-duty vehicle GHG measure will reduce GHG emissions by approximately one million metric tons of CO_2-equivalent by 2020, statewide. CARB estimates that between 2010 and 2020, trucking companies will save approximately $8.6 billion by reducing fuel consumption by 750 million gallons in California and 5 billion gallons across the country.

There was significant concern expressed by trucking firms about the likely benefits and costs of the rule. Most of the benefits of aerodynamic technologies are achieved at speeds over 60 miles per hour (mph). On many roadways in California, traffic congestion and a 55 mph speed limit for trucks reduces the benefits of implementing side fairings. Trucking firms also noted that diverse operating conditions often make it difficult to generalize the costs and benefits of new technologies. For instance, fleet managers claim that trailer side fairings can be damaged by snow banks. In cold weather, trailer side fairings may also build up ice that can detach from the truck and damage other vehicles. Given that CARB's regulation would apply to all vehicles operating in the state, carriers throughout the United States would be required to comply.

Another challenge with implementing this policy is that motor carriers often do not own the trailers they haul. The rule could make them responsible for the equipment of other businesses over which they have little control.

Policy Impacts

The likely impacts of the climate change policies recently enacted or under consideration are not well understood. Although discussing impacts on the freight system is inherently speculative, it is useful to identify some of the likely effects by considering the general economic effects of price increases on supply chains and transportation markets. The observed impacts of other policies that have affected freight transportation costs can also shed light on potential climate change policy impacts. In the following sections the research team discusses

- Impacts on transportation costs
- Impacts on supply chains
- Impacts on coal demand and the rail system
- Impacts resulting from lifecycle emissions effects

Impacts on Transportation Costs

GHG regulations will increase the price of fuel. Analytical opinions vary regarding the magnitude of these price increases. The Energy Information Administration projects that the Waxman-Markey Cap and Trade bill will increase diesel fuel prices by $0.25 to $1.73, depending on the specific regulatory scenario.[126] Although many analyses assume that fuel cost increases will be seamlessly passed on to shippers and consumers, there is significant industry concern that fuel cost increases will reduce transportation carrier profits. Depending on specific transportation contracts that have been negotiated, some carriers may be limited in their ability to impose fuel surcharges for fuel price increases in the short run. If cap and trade or other GHG policies introduce additional fuel price volatility into the market, transportation carriers may have difficulty hedging their fuel prices, or they may need to pay more to hedge against price spikes.

Some industry experts are concerned that policymakers may not fully understand the current technological limitations for different types of fuel production. Mandates to use lower carbon fuels that are currently in limited supply could lead to significant price spikes unless markets can adapt rapidly. The technologies to produce cellulosic ethanol or other low-carbon biofuels (e.g., algae biodiesel) at an industrial scale have yet to be developed. Regulatory analyses often assume aggressive rates of technology development and adoption. These may in fact occur, but the price of rapid innovation could be high.

In some cases, regulatory barriers or public opinion may stand in the way of new sources of energy. For example, fueling stations in California were recently required to halt the storage of pure biodiesel in underground storage tanks because the additives used in pure biodiesel were not fully vetted by regulators. As another example, the EIA scenarios for cap and trade programs assume increases in nuclear power generation of 100 to 150 percent.[127] This could require the construction of 100 new nuclear power plants. EPA lists "the degree to which new nuclear power is technically, politically, and socially feasible" as one of the key uncertainties in their projections.[128] Given that no new nuclear power plants have been constructed in the United States in the last 30 years, this projected rate of development for a controversial and unpopular energy technology appears optimistic. To the extent that low carbon energy sources from nuclear and renewable sources of energy are slower to come online than EIA predicts, the price of carbon allowances and fuel prices will be higher than projected.

Impacts on Supply Chains

Freight transportation is the backbone of the manufacturing economy. Significant productivity improvements in manufacturing have been based on making supply chains lean and implementing just-in-time (JIT) inventory management systems. By substituting transportation for inventory, businesses have been able to reduce the cost of goods, thereby encouraging increased demand and driving economic growth over the last 30 years.[129] Improvements in the efficiency of freight transport and reductions in the cost of transportation have also made the increased globalization of economic activity possible.

Increases in the cost of transportation caused by GHG regulations will likely affect the structure of supply chains. Although the forecast price increases for Waxman-Markey and other climate change policies are less than recent market price spikes, the types of effects caused by GHG regulation would likely be similar to those observed recently. In response to the recent run-up in energy prices, there is considerable anecdotal evidence suggesting that businesses have sought to shorten supply chains.[130] Future price hikes would likely cause businesses to reduce foreign sourcing of supplies or to use geographically closer foreign suppliers to reduce transportation cost.

In addition, significant fuel price increases will likely have at least an incremental impact on domestic distribution networks. As transportation costs rise, some businesses may seek to locate warehouses and facilities closer to their customers.

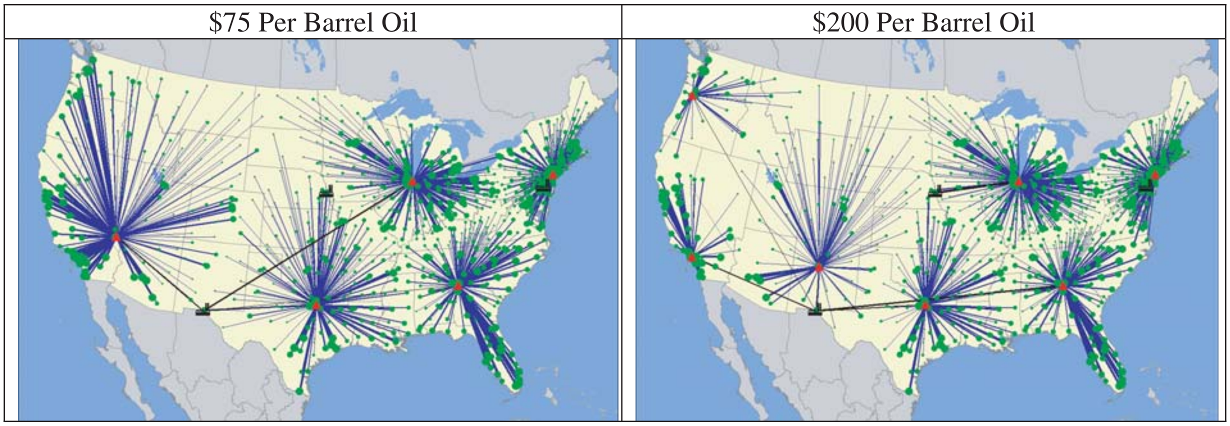
[126]Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009, EIA, August 2009.

[127]EPA, "Preliminary Analysis of the Waxman-Markey Discussion Draft: The American Clean Energy and Security Act of 2009 in the 111th Congress," 4/20/09.

[128]See http://www.epa.gov/climatechange/economics/pdfs/WM-Analysis.pdf

[129]*The Freight Story*. FHWA. http://ops.fhwa.dot.gov/freight/publications/fhwaop03004/index.htm

[130]See "Shipping Costs Start to Crimp Globalization," *New York Times,* August 3, 2008. Also: "Stung by Soaring Transport Costs, Factories Bring Jobs Home Again," *Wall Street Journal,* June 13, 2008.



Source: D. Simchi-Levi, “Operations Rules: Delivering Customer Value through Flexible Operations.” MIT-Press, September 2010.

Figure 5-5. Hypothetical effect of change in oil prices on distribution centers.

There may be some reversal in the recent emphasis of firms on JIT inventory management. Firms may choose to hold more inventory and use less transportation. Figure 5-5 shows a simulation of how the movement of oil from $75 to $200 per barrel could cause a firm to move from five distribution centers to seven to reduce the cost of transportation.[131] Long-term expectations for the cost of transportation will ultimately shape how businesses invest in logistics in the future.

Rising fuel costs could also cause firms to shift freight between transportation modes. Because trucking and air are relatively energy-intensive modes of transport, increased fuel costs would tend to make them more expensive relative to marine and rail transport. Customer service requirements, access to competing modes of transport, or a short length of haul may limit the ability of businesses to shift freight onto other transportation modes. Nonetheless, cost increases in energy-intensive transportation modes are likely to shift some competitive hauls to other modes.

U.S. climate change policy that significantly affects fuel prices could have supply chain impacts that extend globally. International supply chains are complex and sensitive to price. In many cases, shippers have a choice between a wide range of sourcing options, transportation routes, and facilities. In these cases, shippers are very price sensitive and can make changes to their supply chain to avoid regulatory costs imposed piecemeal or only at a regional level. For instance, the market for marine bunker fuels is essentially a worldwide market. Ships calling on East Coast ports can refuel in Panama or even Singapore rather than the United States, and those calling on West Coast ports can refuel in Asia. Individual regions or even nations that regulate marine bunker fuel may find that they have limited ability to impose changes in one place without losing market share.

Policies that affect fuel prices could shift marine traffic to competing ports. For example, in recent years, the share of Asian trade that calls directly on East Coast ports has grown at the expense of West Coast ports (which are dominated by Los Angeles and Long Beach). This is in part because of the lower cost (but longer transit time) of an all-water route compared with a route involving rail transport across the United States. The ability to shift to an all-water route may be even greater once the capacity of the Panama Canal is increased by the addition of a new set of larger locks. Some ports in Canada, particularly Vancouver and (to an increasing degree) Prince Rupert, have excellent rail connections and compete with Seattle and Tacoma. To the south, ports in Mexico (including the proposed port at Punta Colonet) may be able to compete strongly with West Coast ports if rail connections to the Southwest can be solidified.

Of course, fuel price is only one component in the selection of ocean trade routes. The Southern California ports continue to be very attractive to ocean carriers because such carriers prefer to call at the largest local market first and offload inland cargoes there. Recent research suggests that ocean carrier demand at the Ports of Los Angeles and Long Beach is relatively price inelastic if the increment is below $60 per 40-foot import container.[132] Conversely, a recent study for the Port of Seattle estimated that that port could lose 30 percent of its business if its costs rose by as little as $30 per full-size container.[133]

The possibility of a shift to short sea shipping (SSS) resulting from the fuel cost increases possible under cap and trade or

[131]“Rising Fuel Prices/The Effects of Energy Prices on Global Trade Patterns,” FHWA, *Talking Freight,* October 15 2008, http://www.fhwa.dot.gov/freightplanning/08talking.htm

[132]Leachman & Associates, *Final Report Port and Modal Elasticity Study,* Prepared for Southern California Association of Governments, September 2005.

[133]Telephone interview, Officials at the Port of Seattle, February 2009.

even an LCFS appears to be limited, for various reasons. The potential utility of SSS in California is limited by the state's small number of ports. Officials at the Port Authority of New York/New Jersey estimate that even a large fuel cost increase would be likely to raise SSS's share of traffic only from its current 1 percent to no more than about 4 percent even by 2030.[134] The Jones Act, which requires U.S. flagged vessels for cargo between U.S. ports, limits the efficient use of SSS and is one reason why SSS is less popular in the United States than elsewhere (such as Europe). In extreme cases, SSS could become important if fuel prices increased enough to discourage trucking and railroads: port cities could be more closely linked to each other than to nearby cities inland.

Unintended or perverse consequences of climate change policy, in the forms of leakages that reduce efficiency at the same time that they increase emissions, are more likely if policies are not coordinated and carefully structured. One example of this kind of unintended consequence is the possibility of shifting waterborne freight to land transport if rules affecting ports are too onerous. Some SSS companies in Europe have warned that higher fuel prices (related to desulfurization of bunker fuel) will push traffic off of ships and onto more carbon-intensive modes, like trucks. The European Community Shipowners Association warned of the environmentally counterproductive consequences of raising the cost of fuel for short trips across the Baltic and North Seas, noting the potential to shift from the sea to land-based transport with a larger environmental footprint.[135]

Impacts on Coal Demand and the Rail System

Regulation of GHGs could significantly reduce the demand for western U.S. coal and the associated revenues and profits that railroads make from transporting coal. Coal transport is a large piece of railroad business, accounting for 44 percent of tonnage, 24 percent of carloads, and 21 percent of gross revenues.[136]

Pricing carbon would have multiple effects on the technologies used to generate electricity. To reduce their carbon emissions, coal-fired power plants may need to employ carbon capture and storage technologies. Most existing coal-fired plants burn pulverized coal to generate power. The need to capture and store carbon would require wide-scale implementation of integrated gasification combined cycle (IGCC) technology, which involves gasifying coal and burning the gas. This allows carbon emissions to be more efficiently removed. IGCC capital costs vary with the type of coal used and work best with bituminous coals; performance is not as good with lower rank and higher ash coals such as western lignite and subbituminous coal. As a result, cap and trade legislation is expected to significantly reduce the volume of coal used from the Powder River Basin.[137] According to EIA, if the Lieberman-Warner Act were passed, production of coal from this region would drop from about 400 millions tons currently to only 8 to 77 million tons in 2030.[138] Estimates for the Waxman-Markey bill are similar. Analysis of the Waxman-Markey bill estimates that nationwide coal production volumes (in tons) would be 19 to 83 percent lower under the bill.[139] The high end of this range (83 percent) would represent a loss of approximately 18 percent of rail industry revenue from the current baseline and an even larger drop in profit.

The specific geography of coal production and use would influence the policy implications for the railroads. Although approximately 64 percent of coal consumed nationwide is moved by rail, 98 percent of coal from Wyoming (where Powder River Basin production is predominantly located) is moved by rail.[140] Figure 5-6 shows how important Powder River Basin coal is to rail traffic. Major reductions in coal production in the Powder River Basin will thus affect railroad traffic significantly. Reduced coal production both reduces coal traffic and shifts demand to regions that have other competing transportation modes (e.g., barge, truck, and slurry pipeline). These markets provide more competition and smaller margins for rail traffic. Railroads will thus suffer both lost revenue from reduced rail traffic and reduced margins from the remaining business. The railroads that currently serve this region, UP and BNSF, would experience the largest revenue loss.

The geographic distribution of policy impacts would also be affected by differences in the use of coal for electricity generation. For instance, coal accounts for 94 percent of electricity generation in Indiana, while California only generates 1 percent of its electricity from coal. Generators in the Midwest, Southeast and Southwest rely more on coal than do generators in other parts of the country. As a result, reductions in coal traffic would not be evenly distributed across the states, but will be concentrated in specific regions and corridors.

Climate change policies could create new business for railroads as well. Ethanol mandates and subsidies have recently generated new business for railroads moving ethanol to market. The rapid increase in ethanol production driven by the 2005 Energy Policy Act initially caused shortages in available

[134]Telephone interview, Officials at the Port Authority of New York/New Jersey, February 2009.

[135]"Bunker Busting: How To Clean Up Shipping," *Wall Street Journal,* Keith Johnson, April 10, 2008.

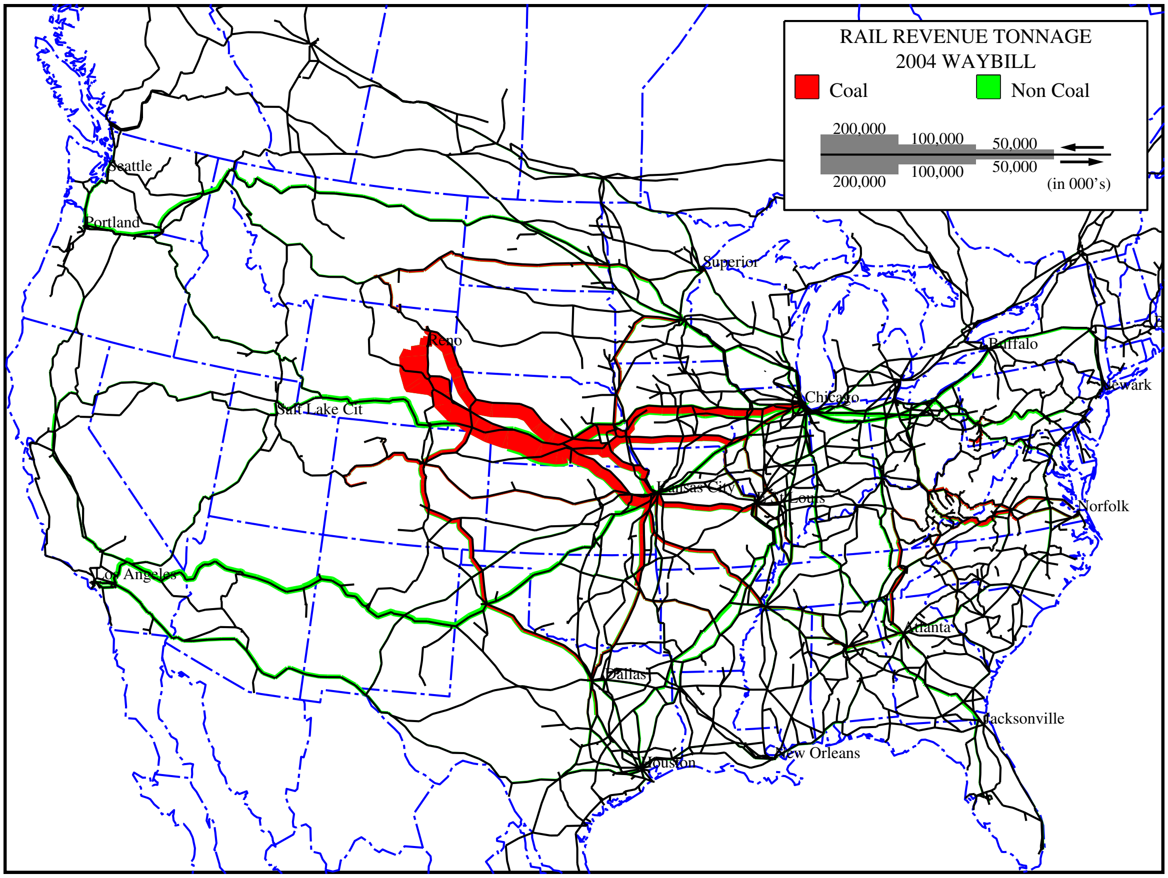
[136]Railroads and Coal. AAR. July 2008.

[137]Berlin, Ken; Sussman, Robert. Global *Warming and the Future of Coal: The Path to Carbon Capture and Storage.* Center for American Progress, May 2007.

[138]Energy Market and Economic Impacts of S.2191, the Lieberman-Warner Climate Security Act of 2007. EIA.

[139]Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009. Energy Information Administration. August 2009.

[140]EIA. Coal Transportation Issues. http://www.eia.doe.gov/oiaf/aeo/otheranalysis/cti.html



Source: McCollum, David. *Future Impacts of Coal Distribution Constraints on Coal Cost.* 2007. University of California Davis.

Figure 5-6. Rail revenue tonnage, 2004.

tank cars.[141] Interviewees noted that shippers have largely paid the bill for the new equipment required, as well as investing capital in rail sidings to accommodate longer unit trains for large ethanol shipments.

To date, climate change policies have not had significant freight system impacts. Transporting ethanol remains a relatively small share of railroad revenues—approximately 1 percent. Initial equipment shortages have been resolved with limited impact on the railroad industry. Although domestic demand for coal has grown slowly in recent years, foreign exports have led to continuing growth in overall coal traffic volumes, at least through 2008.[142]

Impacts Resulting from Lifecycle Emissions Effects

GHG emissions have essentially the same climate change effects, no matter where they occur on the planet. So the regulation of GHGs requires consideration of emissions across the full lifecycle of activity, rather than simply considering the emissions within a given region as is done for traditional criteria pollutants. This can make it challenging to design policies that reduce freight GHG emissions without creating unexpected freight system and environmental impacts.

A good example of this issue is the ship speed rule under consideration for areas around the Ports of Los Angeles and Long Beach to reduce California's GHG emissions. Both ports already have a Vessel Speed Reduction Program covering ships within 20 nautical miles for the purposes of reducing smog-forming NO_x emissions. Slower speeds also reduce GHG emissions because of the relationship between speed and fuel efficiency. Fuel consumption is roughly proportional to the cube of speed, so slowing a ship from 25 knots to 12 knots leads to a nearly 90 percent drop in the rate of fuel use. But if the ship increases speed somewhere else in its journey to make up for a near-port drop in speed, the savings can be wiped out. CARB estimates that if its proposed rule causes even a ½ knot increase in other parts of the trip, it would cancel out the savings from slow speeds close to the port.[143]

[141]USDA. Ethanol Transportation Backgrounder. September 2007.

[142]"Weekly US Rail Shipments Sink Again Last Week," *Forbes,* December 11, 2008.

[143]Public Workshop: Vessel Speed Reduction for Ocean-Going Vessels, Sacramento, July 29, 2009. http://www.arb.ca.gov/ports/marinevess/vsr/docs/072909speakingnotes.pdf

Table 5-2. Classification of climate change policies with freight system impacts.

	Technology Mandates	Operating Practice Regulation	Pricing
State and Local	Biofuel mandates CA LCFS CA HDV GHG Measure	Ship speed rules Idling Truck speed limits	Port container fees
National	CAFE for trucks CAA GHG Regulations Renewable Fuel Standard	Truck speed limits	Cap and trade Carbon taxes

The practice of cold-ironing by vessels in a port offers another example of the complexity of calculating lifecycle emissions. Switching ships from using on-board diesel generators to the grid clearly reduces criteria pollutant emissions within a port. The GHG emissions consequences are also very likely to be good, but the quantitative effects will depend on the source of the electricity. Even in California, a substantial amount of the electricity is generated from conventional fuels, which have a high carbon content. Of greater relevance, though, is the marginal source of electricity. Electric utilities tend to use coal for base load generation and natural gas or other cleaner sources of energy to satisfy peak loads. The source for incremental megawatt hours of electricity will change throughout a given day, because the sources for peak and base-load power are different. The emissions consequences of cold ironing thus depend on the time of day of use and the specific sources of power in that location.

Summary

Table 5-2 summarizes some of the most important climate change policies, proposed or implemented, that are likely to have freight system impacts. One can classify these policies based on their geographical scale of application (i.e., national, state, and local) and the type of policy tool used (e.g., technology mandates, operating practice regulation, and pricing). The likely impacts of these policies, and the uncertainties associated with their impacts, vary according to these key characteristics.

One potential set of unintended impacts stems from trying to address a global air emissions problem with local, state, or even national regulations. Local regulatory strategies can cause global and national supply chains to adapt so as to avoid costs imposed in specific regions. Local air emissions regulations can create offsetting lifecycle emissions increases in other regions or components of the supply chain.

Although the geographical scope of regulatory activity is important, the technological scope of a policy may also create unintended impacts. Regulating or mandating specific technologies or operating practices can cause unanticipated adjustments in market behavior. For example, requiring trucking firms to invest in specific vehicle technologies reduces the resources available for other capital investments that might be more appropriate for the specific circumstances of a firm's operations. The direct impacts of a regulation can be offset by the unseen secondary market impacts.

Unexpected impacts of climate change policy are likely to be minimized if they involve pricing applied at the largest geographical scale possible. Policies such as cap and trade programs or carbon taxes impose costs based on the outcome desired, as opposed to mandating the specific means to achieve the outcome. As such, these policies tend to require less foresight of policymakers and provide the most flexibility for industry to achieve the desired outcomes. However, even national-level pricing policies are likely to cause unforeseen and unintended impacts. The secondary market impacts of price increases are often hard to predict and quantify because it is often unclear how supply chains might adjust to changes in transportation costs. The significant secondary impacts of GHG mitigation policies on supply chains and economic productivity have not been fully considered.

CHAPTER 6

Conclusion

Information on the impacts of various policies on the freight system is ultimately useful only if it improves future policy decisions. The previous chapters offer examples of how public policy decisions have affected the freight transportation system and the extent to which those impacts were unexpected. It is also useful to consider the context in which policy decisions are made in order to understand how better information on impacts might improve policy decisions.

For our purposes, decision context has two significant elements: (1) the information about, and understanding of, the freight system impacts that is available to the decisionmakers; and (2) the constituency to which the decisionmakers must answer and what that constituency expects of the decisionmakers.

Availability of Information on Impacts of Policies

As illustrated in Chapters 4 and 5, there is great variation in the quality and depth of analysis of freight system impacts done in advance of a policy decision and the degree to which results are available to decisionmakers. Many of the policy examples reviewed in this study involve rules and regulations established by Federal agencies that apply directly to freight carriers. Most of the safety, security, and environmental policies fall in this category. The Federal rulemaking process typically requires that freight industry impacts be analyzed in these instances. These analyses may not be perfect. For example, they often estimate only cost to an industry segment and do not extend the analysis to impacts on systemwide performance, modal competition, and so forth. Nonetheless, such analyses provide an opportunity for (1) decisionmakers to consider freight system impacts and (2) stakeholders to comment on the analyses.

Other regulations apply directly to freight carriers for which an analysis of freight system impacts is generally not performed, for various reasons. For example, if the regulation applies to a much broader segment of the transportation sector than just freight (e.g., all motor vehicles or all aircraft), then the analysis may not consider those impacts that are freight-specific. Alternatively, if the regulation is enacted at the state or local level or imposed by Congress, there may be no requirement for any analysis of industry impacts. Finally, freight system impacts may not be analyzed simply because they are not recognized or are considered negligible or too difficult to quantify.

Then there are all the policies that do not involve regulations directly applicable to freight carriers. Most decisions about infrastructure investment, pricing, trade, land use, and energy/climate change fall in this category, as do some environmental, safety, and security regulations. Although these types of policy decisions rarely benefit from a forward-looking analysis of freight system impacts, these decisions may have the greatest and most far-reaching impacts on the freight system.

Table 6-1 shows these three categories of policies with examples of each. These categories are necessarily generalizations and numerous exceptions exist. For example, although most states and local governments do not perform a systematic analysis of the industry impacts of truck idling regulations, California did undertake such an analysis.

Decisionmaker Constituencies

The other element of the decision context concerns the institutional and political setting in which decisions adverse to the freight system are made. In some cases, good information on freight-system impacts would make little difference in a policy decision because the decisionmakers are responding to other imperatives. One example of this would be restrictions on truck traffic on local roads imposed by local or state governments. From the point of view of a city council or county board, by far the dominant issue may be quality of life in the affected area. Concerns about the efficiency of freight movement will likely carry little weight in such decisions. An exception might occur if a significant local employer were damaged

Table 6-1. Classification of policy examples—availability of impact information.

	Regulations that Apply Directly to Freight Carriers	Other Public Policies
Freight System Impacts Analyzed	HOS for Drivers Truck Speed Limits and Governor Rules Aircraft Fuel Tank Flammability Rules TWIC for Ports and Inland Towboats Emissions Standards for Diesel Engines Int'l Air Emissions Regulations for Vessels Federal Truck Size and Weight Rules	
Freight System Impacts Generally Not Analyzed	Alien Fingerprint Rules for Outbound Planes and Ships Air Cargo Screening Requirements Idling Restrictions for Trucks and Locomotives Water Pollutant Discharge Rules for Vessels State Truck Route Restrictions Local Truck Access and Parking Policies Local Restrictions on Locomotive Horns State Truck Size and Weight Rules	Local Land Use Policies Restrictions on Disposal of Port Dredging Spoil Local Policy to Oppose a Railroad Acquisition Highway Infrastructure Investment Inland Waterway Infrastructure Investment Highway Tolls and Other User Charges Lockage Fees for Inland Waterways Peak Pricing for Port Trucks Peak Pricing for Airports GHG Cap and Trade Renewable Fuel Standards, Incentives

to the extent that it might consider moving its facility. In these cases, state governments may be taking a broader economic view, but decisionmakers must also answer to voters for whom quality of life is an immediate, palpable issue and the efficiency of the national freight system is a distant abstraction.

The point is not that these governments are making "good" or "bad" decisions. Rather, it is that differing levels and differing types of governments have different concerns and priorities, and one has to bear these in mind when analyzing policy choices. It is generally true that the lower the level of government, the more officials are concerned with purely local impacts and the less concern they have for national effects. It is also true that, the lower the level of government, the less the impact on the national system of the decisions of *any single* government. But similar decisions by many local governments can affect the national system. One example of this is local parking restrictions coupled with local and state failure to provide adequate rest and parking facilities.

Decision Context Framework

Combining these two elements of the decision-making context, the research team can identify three general cases in regard to understanding the freight system, the potential impacts of the policy, and the priority accorded to effects on the freight system.

Case 1

- Policymakers have a good understanding of the freight system and the potential impacts of a policy decision.
- Policymakers have a relatively high level of concern for freight system efficiency.
- Additional information on freight impacts may be helpful to policymakers, but is unlikely to change decisions in most cases.

Case 2

- Policymakers have a limited understanding of the freight system and the potential impacts of a policy decision.
- Policymakers have some concern for freight system efficiency.
- Additional information could change decisions.

Case 3

- Policymakers have a poor understanding of the freight system and the potential impacts of a policy decision.
- Policymakers have little or no concern for freight system efficiency.
- Additional information would not likely change decisions.

These cases can be summarized as follows: In Case 1, policymakers understand the freight system, and they care about it. In Case 2, they have partial freight system knowledge; they care some and might care more, if they knew more. In Case 3, they have little or no knowledge of the freight system and are unlikely to care about adverse impacts. Figure 6-1 illustrates the relationship between concern about adverse impacts relative to an understanding of impacts.

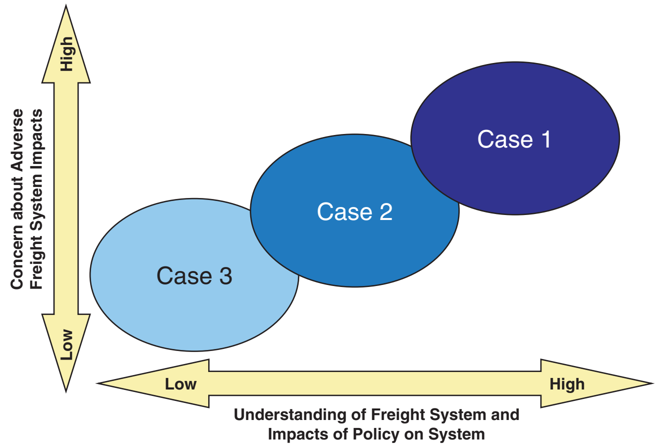


Figure 6-1. Three cases for decision-making context.

Summary Discussion

This section briefly discusses how these three cases for decision-making context apply to the public policies reviewed in this report. The application of this framework is inherently subjective, and others might argue with the case category applied to some policy examples. Nonetheless, this framework illustrates that a significant portion of policy decisions (those identified as Cases 1 or 3) would not likely change as a result of better information on freight system impacts.

Safety Policy

Safety policy areas are primarily at the Federal level, with the exception of state speed limits and local restrictions on locomotive horn use, which involve both local governments and the USDOT. For HOS (trucking and rail) and horn restrictions, considerable information is available to the USDOT and Congress, and both entities are aware of impacts on the freight system. At the Federal level, these are Case 1 policy areas. This is also true, to a degree, for speed limits and governors, although it may be that both Congress and the Executive Branch could benefit from a better understanding of freight impacts. States do not likely understand the impacts of differential speed limits for trucks and might change their policies with more information; the research team considers this policy a Case 2.

Local restrictions on locomotive horns at grade crossings are a Case 3 issue. Presented with abundant data on the crashes that result from banning horns, localities have persisted with bans (see Section 4). Grade-crossing crashes impose some cost on railroads in dealing with legal issues that might arise and temporary effects on operations. Also, the rule that the USDOT finally issued allows horn bans to remain in place under certain conditions, one of which is reduced train speed. Additional information for local governments on costs to railroads would not change their policy preferences.

Security Policy

Security policies, nearly all Federal, present a somewhat mixed picture. By the time DHS issued its final TWIC rule, it had acquired a great deal of information and heard industry concerns in detail. Much of industry concern was addressed when DHS dropped the requirement for a real-time cardreader from the final rule. DHS acted in full knowledge of the consequences; this was a Case 1 policy choice. When considering the fingerprinting requirement for outbound ships and planes, it appears that DHS was largely focused on passenger carriers and simply did not think about effects on air cargo or ocean carriage. Better information might have changed the policy decision, so this is a Case 2 example. The requirement for 100 percent screening of belly cargo for passenger planes came from Congress. The effect is likely to be significant changes in the way domestic air cargo moves, as cargo shifts away from passenger carriers. As illustrated in the case study in Section 5, it is unlikely that these impacts were fully expected. The research team considers this a Case 2 choice; more information on the consequences might or might not have resulted in a different regulation.

Land Use Policy

Land use issues are in the domain of local governments; these are issues in which city councils, county boards, and planning commissions are responding to quality-of-life concerns and the desire for local economic development. But some of them are also issues where additional information may be helpful. One example relates to truck terminals. From the interviews, the research team learned that local governments will sometimes encourage a cluster of distribution centers—sources of taxes and jobs—but be unwilling to allow a truck terminal in the same cluster because of its perceived negative impacts. This is a case where the authorities could be shown that trucks must bring goods to and from the distribution centers in any event and forbidding a truck terminal in the distribution center cluster may actually increase truck traffic, noise, and emissions on local roads.

Recent history suggests that, in the face of demand for residential, office, and retail redevelopment, preservation of harborfront land for port and related freight uses will be a hard sell in many cities. However, the case study in Section 5 shows how local officials' understanding of freight system impacts can sometimes lead to a solution that satisfies the competing interests. On balance, the research team categorizes land use decisions as Case 2; additional information on the freight system and policy impacts can make a difference.

Environmental Policy

Environmental policy decisions occur within various contexts. At the Federal level, EPA rules that directly affect freight carriers almost always involve an attempt to quantify freight industry impact. This has been the case for air quality regulations, such as diesel engine emissions standards and the proposed sulfur oxide Emission Control Area for ships. Inland waterway towing company executives commended EPA for its handling of these policies, and industry experts in all modes believe the negative impacts of these rules to date have been minimal. There remains uncertainty about the potential impacts of the most stringent standards for locomotives and marine engines (Tier 4). Nonetheless, this is clearly a Case 1 example. EPA's policy decisions have been informed by an understanding of freight system impacts and a desire to minimize adverse impacts where possible.

Disposal of dredging spoil can involve all levels of government, as discussed in Section 4. Local authorities have protested and filed lawsuits to delay dredging projects. In many cases, the prolonged resistance of local authorities has made it clear that they are indifferent to any economic gains for their region that might come from a deeper channel. On the face of it, one would suppose that local officials would be open to the economic-development argument, especially in light of competition among ports. But the record suggests otherwise, so the research team considers this a Case 3 example. When Federal and state policymakers get involved in these decisions, there is clearly a need for better information about freight system impacts, and such information could influence decisions.

Vessel-discharge rules are an oddity. This is a case where a Federal court extended existing rules to cover inland waterways, although EPA had always construed the law not to cover inland barges and towboats. Better information on the freight system would not have changed the judge's mind. Barge-industry executives believed that EPA needed more information on towing operations before applying discharge rules to them. So the research team considers this a Case 2 choice for EPA.

State and local idling restrictions are generally a Case 3 example. Truck and locomotive idling is considered a nuisance and largely unnecessary. Information about freight system impacts would not likely change these decisions. Moreover, many observers of both the truck and rail industries believe the idling restrictions work to the long-run benefit of both industries because of fuel savings. In the case of California's truck idling regulation, it appears that policymakers did analyze impacts of the rule.

Energy and Climate Change Policy

The energy and climate change policy developments have been occurring at both the Federal and state level. Regarding national or regional GHG cap and trade policies, it appears that the potential for negative impacts on railroads has not, thus far, been given much consideration. Whether it would make a difference in a final decision is unclear, but this is an example where additional information could make a difference. So this is a Case 2 example.

Renewable fuel standards and incentives also fall in the Case 2 category. These include ethanol and biodiesel mandates as well as fuel-neutral low carbon fuel standards. To date, the Federal policy decisions have mostly been made in Congress, where support for agriculture appeared to be a main driver in decisions, action was taken with little information on the impact on the freight system. Although the research team's interviews suggest that there have been no negative freight system impacts to date, the potential for such impacts, such as higher fuel costs or engine maintenance costs, clearly exists. Both state and Federal policy-making in this area could benefit from more information on freight system impacts.

Operations and Maintenance Policy

State-imposed route restrictions on trucks appear to be a Case 2 example. In devising these restrictions, state governments (e.g., New Jersey and New York) are clearly focused on quality-of-life issues. It also appears that they have given some consideration to the economic effects of restricting truck operations and believe they have struck the right balance between quality of life and the efficiency of freight movement. Nonetheless, it is possible that additional or better information might lead to some adjustment in their choices. With regard to local government restriction on truck routing and parking and resistance to increased rail traffic, these are clearly Case 3 examples. Additional information would not change decisions.

Federal size and weight rules for trucks were revised in 1982 after lengthy debate and were somewhat revised again in 1991. Abundant data were available to inform these debates. Since then, the U.S. DOT conducted a major size and weight study in 2000, and TRB has conducted several studies at the request of Congress and recommended pilot tests of increased limits. Although these studies further the understanding of potential freight system impacts, Congress has taken no additional action since 1991 that has made any real change to size and weight rules. This appears to be a Case 2 example at the federal level and a Case 3 example at the state level. The research team's interviews showed industry concern about state size and weight rules in the western states. The concern is not about the absolute levels of the limits but about variations among states. It is likely that state governments have only limited concern about the system effects of these rule variations, since their main focus is on conditions and operational requirements in their own states. Better information on the costs of differing rules would probably not affect these states' choices.

Infrastructure Investment Policy

The USDOT and Congress have both a high level of concern for the condition of the highway system and a great deal of information on the issue, although little of that information is specifically on freight. Overall fiscal issues and the lack of adequate financing devices account for inadequate investment, not lack of information or lack of concern. Thus, this is a Case 1 example. The research team believes the same is true at the state level.

The highway system is ubiquitous, but the inland waterways are not; their role in the freight system is not widely known or understood in Congress. USACE understands the importance of the waterways but has found it difficult to get its message across effectively. Waterway investment is a Case 2 example. More and better information could make a difference in policy choices in Congress and, indeed, within the Executive Branch.

Infrastructure Finance and Pricing Policy

Finance and pricing issues are somewhat more complex than questions about the level of infrastructure investment. In Congress, highway and (potentially) waterway pricing issues are perceived largely as getting the right level of revenue to support the programs. Questions about economically efficient prices and potential costs of distorted relative prices do not generate a high level of interest in Congress, state legislatures, or in the Executive Branch outside a fairly narrow circle. As the examples illustrate (see Appendix B), roadway pricing can have significant freight system impacts, and this information could influence decision-making. Thus, the research team considers Federal and state infrastructure pricing to be Case 2 examples.

Peak pricing for trucks at the Ports of Los Angeles and Long Beach was instituted with limited information about potential impacts. In this instance, the local program was implemented to avoid what was perceived to be a less desirable state mandate. The decisionmakers in these types of policy debates have a concern about freight system impacts, and, at least in future policy decisions, their decisions would be influenced by a better understanding of impacts. This is a Case 2 example.

Airport peak pricing appears to be a Case 1 example. FAA has a high degree of system understanding and appears to have considered the impacts of its recent rulemaking on the air cargo industry.

Table 6-2 summarizes how the three cases of decision contexts apply to the policy examples covered in this report.

Conclusions

This study examined how public policy decisions can affect the freight transportation system. Using interviews with industry experts and an extensive review of documents, the research team identified current and recent policy issues with potential freight system impacts, evaluated the magnitude of the impacts, and assessed the extent to which the impacts have been unexpected. The research team drew the following general conclusions based on this research.

1. **A wide variety of public policies can affect the freight transportation system.** In many cases, this potential for impacts is obvious, as in the case of investment and operations decisions concerning freight system infrastructure or environmental and safety regulations affecting freight equipment. In other cases, the potential to affect the freight system is less obvious. This is particularly true for policies enacted to achieve goals unrelated to transportation (e.g., land use policies or dredge spoil disposal policies) and policies that affect the entire transportation system, both passenger and freight (e.g., highway investment policy, alien fingerprinting rules, or renewable fuel standards).
2. **There are relatively few examples of recent public policies that have had unexpected impacts on the freight transportation system.** Among the more than 30 individual policies examined in this study, only a handful have resulted in impacts on the freight system that were not recognized by the decisionmakers. These few examples include highway and waterway investment and finance policies, as well as some local government decisions regarding land use and truck access.

   When they have occurred, unexpected impacts have been relatively minor in many instances. For example, the magnitude of the 2006 truck "pre-buy" that resulted from new EPA emission standards was unexpected, but its effects on the freight system were minor. Nearly all of the safety, environmental, and operations policies the research team examined have had either minimal freight system impacts or impacts that were fully anticipated by policymakers.

   Some of the policies the research team reviewed, particularly those related to security, had not been in place long enough to assess their impacts at the time of the research. Some of these policies, such as the TWIC rules, may have significant, and possibly unexpected, freight system impacts.
3. **Significant unexpected freight system impacts are unlikely to occur in a short time frame for policies recently adopted or currently debated.** The lack of unexpected impacts is not surprising, given the research team's focus on recent (primarily since 1990) policies and the nature of the policy issues during that period. One can certainly identify older policy decisions that have eventually resulted in major freight system impacts. Examples include the Federal-Aid Highway Act of 1956 that established the Interstate system or the Jones Act of 1920 that affects coastal shipping. But the major

Table 6-2. Decision context of policy examples.

Category	Policy	Level of Implementation: Federal	State	Local
Safety	HOS Rules for Drivers	Case 1		
	Truck Speed Limits and Governor Rules	Case 1	Case 2	
	Aircraft Fuel Tank Flammability Rules	Case 1		
	Restrictions on Locomotive Horns	Case 1		Case 3
Security	TWIC for Ports and Inland Towboats	Case 1		
	Alien Fingerprint Rules for Outbound Planes, Ships	Case 2		
	Air Cargo Screening Requirements	Case 2		
Land Use	Local Land Use Policies			Case 2
Environment	Emissions Standards for Diesel Engines	Case 1	Case 1	
	Idling Restrictions for Trucks and Locomotives		Case 3	Case 3
	Restrictions on Port Drayage Trucks			Case 2
	Restrictions on Disposal of Port Dredging Spoil	Case 2	Case 2	Case 3
	Water Pollutant Discharge Rules for Vessels	Case 2		
	International Air Emissions Regulations for Vessels	Case 1		
Energy and Climate Change	GHG Cap and Trade	Case 2		
	Renewable Fuel Standards, Incentives	Case 2		
Operations and Maintenance	Truck Route Restrictions		Case 2	Case 3
	Local Policy to Oppose a Railroad Acquisition			Case 3
	Local Truck Access and Parking Policies			Case 3
	Truck Size and Weight	Case 2	Case 3	
Infrastructure Investment	Highway Infrastructure Investment	Case 1	Case 1	
	Inland Waterway Infrastructure Investment	Case 2		
Infrastructure Finance and Pricing	Highway Tolls and Other User Charges	Case 2	Case 2	
	Lockage Fees for Inland Waterways	Case 2		
	Peak Pricing for Port Trucks			Case 2
	Peak Pricing for Airports	Case 1		

freight system impacts of these policies were not felt for decades. Other historic examples, such as the Motor Carrier Act of 1980 that deregulated trucking, have resulted in major freight system impacts in a relatively short time frame. But no current or recent policies involve such a major restructuring of the freight industry.

4. **There are a limited number of situations in which better information on freight system impacts could change policy decisions.** In many cases, government decisions that affect freight transportation are made in the context of either (1) good information on potential impacts and a concern for the freight system or (2) a lack of concern about freight system impacts. In these situations, providing policymakers with better information about freight system impacts would likely make little or no difference.

Examples of policy decisions that *could* be influenced by better information include

- Truck speed limits
- Some Federal security regulations (e.g., air cargo screening)
- Local land use decisions
- Environmental regulations on dredge spoil disposal and vessel water pollutant discharge
- GHG cap and trade and alternative fuels regulations
- State truck route restrictions
- Road pricing for trucks
- Investment and finance decisions for inland waterways

These are the Case 2 examples. In all of these cases, more or better information on the freight system could improve policy decisions at the Federal, state, or local levels. The key to bringing about better decisions—better in the sense that impacts on freight are considered—is greater awareness of freight on the part of relevant officials. There is no single way to bring this about. It is probably easiest to achieve at the Federal level, where executive agencies could ensure that they give freight impacts full consideration when analyzing effects of proposed rules. An information program with the goal of calling the attention of state officials to non-transportation policy areas where decisions can affect the efficiency of freight movement could also be considered. Perhaps this might best be done by state DOTs making other elements of their own state governments more aware of potential impacts on freight.

Table 6-2 shows that among the policies reviewed in this report, only three of the Case 2 examples are at the local level, and two of those are concerned with truck movements at ports. These are instances where state DOTs or other state agencies could offer useful information in some cases. If local authorities perceive a state DOT as encroaching on their responsibilities, such efforts could be counterproductive. However, freight industry executives have pointed out that state economic development agencies have sometimes been effective in showing local governments how, for example, new intermodal terminals can bring jobs and tax revenues. Clearly, there is no single or simple way to bring a higher level of freight awareness to relevant officials, but there are many ways that could be effective in different contexts.

APPENDIX A

Interviewees and Focus Group Participants

Table A-1. Interviewees.

Last Name	First Name	Title	Organization	Type
Ackers	David		Werner Enterprises	Trucking
Anonymous		General Manager of Terminal Operations	Mid-Atlantic port	Port
Berry	David	Vice President	Swift Transportation Co., Inc.	Trucking
Burks	Steve	Associate Professor of Economics and Management	University of Minnesota-Morris	Trucking
Carr	Mark		AEP River Operations	Inland Waterways
Cartwright	Kerry	Director of Goods Movement	Port of Los Angeles, CA	Port
Chambers	Frank	President and CEO	Aviation Facilities Co., Inc.	Air Cargo
Collette	Susan	Ground Transportation Manager	Los Angeles World Airports	Air Cargo
Ditmeyer	Steve	Adjunct Professor	Michigan State University	Academic (Rail)
Freire	Armando		Roadlink	Railroad/Trucking
Gallamore	Robert		Gallamore Group	Academic
Gregory	Steve	Senior Strategic Planner	Port of Oakland, CA	Port
Hankins	Brant		Atrium Doors and Windows	Trucking
Hixon	Jim		Norfolk Southern	Railroad
Kruse	Jim	Director, Center for Ports and Waterways	Texas Transportation Institute	Inland Waterways
Lahsene	Susan	Transportation Planning Manager	Port of Portland, OR	Port
Mancini	Lisa		CSX	Railroad
Marian	Tom		Buffalo Marine Service, Inc.	Inland Waterways
McCullough	Gerard	Associate Professor	University of Minnesota	Academic (Rail)
Moore	Scott		Union Pacific	Railroad
Morgan	Linda	Partner & Chair of Transportation Practice Group	Covington & Burling LLP	Railroad
Mullett	Randy		Con-way Inc.	Trucking
Nurthen	Bill	General Manager, Program Support and Performance Management	Port Authority of New York/New Jersey	Port
Osterberg	Don		Schneider National, Inc.	Trucking
Pallme	Dan	Director of Business Development	Comtrak Logistics	Trucking
Pena	Genaro	Director of Marketing	Houston (TX) Airport System	Air Cargo
Philip	Craig		Ingram Marine Group	Inland Waterways
Pommer	Russell		Atlas Air Cargo	Air Cargo

(continued on next page)

Table A-1. (Continued).

Last Name	First Name	Title	Organization	Type
Rickerhauser	Pete		BNSF	Railroad
Senecal	Patty		Transport Express	Trucking/Port
Shelton	Ben		Union Pacific	Railroad
Spychalski	John	Professor Emeritus of Supply Chain Management	Penn State University	Inland Waterways
Swan	Peter	Assistant Professor of Logistics and Operations Management	Pennsylvania State University - Harrisburg	Academic (Trucking)
Walker	Tom		A. Duie Pyle	Trucking
Weakley	Tom	Director of Operations	Owner-Operator Independent Drivers Association Foundation	Trucking
Woodruff	Matt		Kirby Corporation	Inland Waterways

Table A-2. Trucking focus group.

Last Name	First Name	Organization
Belzer	Michael	Wayne State University
Burks	Steve	University of Minnesota
Corsi	Tom	University of Maryland
Miller	Dave	Con-way, Inc.
Mullet	Randy	Con-way, Inc.
Murray	Dan	American Transportation Research Institute (ATRI)
Osterberg	Don	Schneider National
Siebert	John	Owner-Operator Independent Drivers Association
Wells	Jack	U.S. DOT, Office of the Secretary of Transportation
Zahn	Al	Con-way, Inc.

Table A-3. Railroad focus group.

Last Name	First Name	Organization
Ditmeyer	Steven	Formerly with the Federal Railroad Administration
Gallamore	Robert	Gallamore Group
Gray	John	Association of American Railroads
Maestri	Bruno	Norfolk Southern
McCullough	Gerard	University of Minnesota

APPENDIX B

Details on Impacts of Selected Policies

For a subset of the policies considered as part of this research, the research team performed a more in-depth exploration of freight system impacts. In some cases, this involved original analyses; in others, the research team merely synthesized and reported on impacts analyzed by others. This appendix presents this information for the following five policy examples, all of which were introduced in Section 4.

- Truck Speed Limits and Governors
- Truck Size and Weight Rules
- Inland Waterway Infrastructure Investment
- Highway Tolls and Other User Charges
- Lockage Fees for Inland Waterways

Truck Speed Limits and Governor Rules

Efforts to rein in the top speeds traveled by heavy trucks on U.S. highways have taken two approaches: differential speed limits and truck speed governors. The use of differential speed limits has been driven largely by concern for public safety, whereas the use of speed governors on trucks has been motivated by both public safety and an interest in achieving better fuel economy. The two approaches have similar impacts in that they result in trucks traveling more slowly and usually at speeds lower than those of the cars around them.

Safety Impacts

The safety impact of creating differential speed limits for cars and trucks (either through lower posted speed limits for trucks or the use of speed governors) has been the subject of much debate among researchers and policymakers. Research clearly finds that lower vehicle speeds reduce the severity of crashes and the incidence of fatalities. This is because impact force during a vehicle crash varies with the square of the vehicle speed.[1] Lower speeds also improve truck braking distances, which helps truck drivers avoid accidents. However, there is also a relatively strong consensus among researchers and practitioners that a higher variance in vehicle speeds (i.e., speed differential) increases the risk of accidents by increasing the number of vehicle interactions.[2] There is no clear consensus as to whether the net impact of these factors is positive or negative.

Analysis of crash data has provided mixed evidence on the safety impacts of lower speed limits for trucks. In a 1991 report, NHTSA found that more than 90 percent of combination-unit truck crashes and 95 percent of single-unit truck crashes occurred on roadways where the speed limit was less than 65 mph and where the incidence of truck speeding in excess of 65 mph was low.[3] This analysis, although dated, suggests that speed governors could help prevent only a small portion of truck crashes.

In the United Kingdom, all large combination trucks were speed limited after 1993. Between 1993 and 2005, the accident involvement rate for this vehicle class fell from 40 to 30 per hundred million vehicle-kilometers. During the same period, the accident involvement rate for *all* heavy goods vehicles increased slightly from 18.5 to 18.8 per hundred million vehicle-kilometers.[4] Although this data does not isolate the effect of mandatory speed governors, it supports the hypothesis that they improve highway safety.

TRB's 2008 synthesis found a lack of relevant published research on how speed governors affect safety and instead

[1]TRB. *CTBSSP Synthesis 16: Safety Impacts of Speed Limiter Device Installations on Commercial Trucks and Buses.* 2008.
[2]Johnson, Steven L. and Naveen Pawar. *Cost-Benefit Evaluation of Large Truck-Automobile Speed Limit Differentials on Rural Interstate Highways.* For the Research and Special Programs Administration, U.S. DOT. November 2005.
[3]NHTSA. *Commercial Motor Vehicle Speed Control Safety.* Report # DOT-HS-807-725. May 10, 1991, p. ES-1.
[4]TRB. *CTBSSP Synthesis 16: Safety Impacts of Speed Limiter Device Installations on Commercial Trucks and Buses.* 2008.

Table B-1. Estimated cost of vehicle retrofits for mandatory speed governors.

	Cost Per Truck	Non-Recurring Vehicle Manufacturer Cost
Use existing electronic control module (ECM)	$100	$0
Modify and deploy ECM software to make maximum road speed a factory password-protected feature	$300	$100 million
Replace ECMs with ones that are "hard wired" to prevent tampering with maximum road speed	$2,000	$400 million
Install mechanical speed governors on older trucks	$1,000 - $1,500	$0

Source: TMA.

conducted a small survey of fleet safety managers. For those fleets using speed governors, safety was selected as the primary consideration for selecting the maximum speed, followed by fuel economy. Roughly 56 percent of those surveyed said that the use of speed governors had reduced the frequency of crashes; 27 percent indicated that speed governors had had no impact, and 14 percent said that they could not determine whether governors had had any impact. This response was not as conclusive as the responses fleet managers provided regarding the impact of speed governors on fuel economy and number of speeding violations.

Operational Impacts

By limiting the top speed at which trucks travel, speed governors can affect many aspects of a carrier's operations. For example, a lower maximum speed improves fuel economy and likely reduces truck maintenance costs. At the same time, however, a lower maximum speed can result in trucks traveling fewer miles per day, which can affect revenues and labor costs. This section explores the impact of truck speeds on various aspects of a carrier's operations.

Vehicle Modification Costs

Obviously, trucks do not need any new equipment to comply with posted speed limits. However, to comply with a speed governor mandate, owners of late-model trucks (mid-1990s or later) would, at a minimum, need to access the engine's electronic control module and change its maximum speed setting. Fleet maintenance personnel would be able to do so with the correct electronic service tool. In a submission to a NHTSA rulemaking docket, the Truck Manufacturers Association (TMA) estimated the cost of this operation at $100 per truck.

As shown in Table B-1, TMA also estimated that making it harder for the maximum speed setting to be changed by drivers or vehicle owners would increase the cost per truck. It would also require vehicle manufacturers to redesign and redeploy ECM software for approximately 40 different engine control systems. Hard wiring the ECM to make tampering even more difficult would entail the design of both new hardware as well as software. Trucks built from 1990 to around 1995 do not have the same type of programmable ECM as newer trucks. According to TMA, if these trucks were subject to a speed governor requirement, they would have to be outfitted with a mechanical speed governor at a cost of $1,000 to $1,500 per truck.[5]

The USDOT has reported that in 2002 there were about 2.6 million Class 7 or 8 trucks in the U.S. fleet.[6] If, as mentioned previously, 75 percent of those trucks already have maximum speed settings in place, that would leave at least 0.6 million trucks without speed governors. In its submission to the NHTSA docket, TMA provided data on the maximum speeds set for a sample of truck purchasers in 2005. Of the vehicles sold with maximum speed limits that year, roughly 45 percent had maximum speeds set at 69 mph or higher.[7] Assuming this proportion holds true for the entire fleet, another 0.9 million trucks would need to have their maximum speed limit adjusted downward if the Federal government were to set the maximum truck speed at 68 mph (as requested by ATA and the other petitioners). Therefore, at a minimum, a speed governor mandate could cost $150 million (1.5 million trucks at $100 per truck).

This cost could be reduced by grandfathering older vehicles. For example, the nine large U.S. carriers that petitioned the Federal government for a mandatory speed governor rule requested that the rule apply to trucks of model year 1990 or newer. In its petition, ATA requested that the rule apply only to new trucks, which would eliminate the need to retrofit the existing fleet.

[5]Robert Clarke, President, Vehicle Manufacturers Association, submission to Docket No. NHTSA-2007-26851, March 27, 2007.

[6]U.S. DOT, BTS, *National Transportation Statistics,* Table 1-21: Number of Trucks by Weight, http://www.bts.gov/publications/national_transportation_statistics/html/table_01_21.html

[7]Robert Clarke, President, Vehicle Manufacturers Association, submission to Docket No. NHTSA-2007-26851, March 27, 2007.

Effect on Fuel Efficiency

There is consensus that reducing the top speed of trucks improves fuel economy, but the estimated amount of savings varies. The research team used EPA's Physical Emission Rate Estimator (PERE) model to estimate fuel consumption rates of motor vehicles under different driving conditions. Modeling of a "typical" tractor-trailer produced a fuel-efficiency penalty of about 0.08 mpg for every mph increase above 55 mph. Johnson and Pawar estimated that each mile-per-hour increase in speed beyond 55 mph decreases fuel efficiency by 0.03 to 0.08 mpg, depending on the type of road and the speed variance of traffic flow.[8] ATA's 1996 estimate of the fuel efficiency penalty of higher speeds was slightly higher. ATA estimated a penalty of 0.10 to 0.14 mpg for each mile-per-hour increase in speed beyond 55 mph.[9] Another study estimated that reducing the freeway driving speed of a typical long-haul combination truck from 70 mph to 65 mph would reduce fuel use per truck by 972 gallons per year, a 6 percent savings.[10]

Effect on Equipment Maintenance Costs

A 1996 ATA publication indicated that operating equipment above 55 mph generally decreases component service life and shortens preventive maintenance intervals.[11] However, in 2005, Johnson and Pawar found no support for more frequent maintenance intervals. Regarding tires, Johnson and Pawar found no objective research data related to the effect of speed on tire wear at the speeds commonly traveled on rural interstates. However, the majority of maintenance managers surveyed by the authors said that tire wear increases beyond a 65 mph operating speed. Several studies also attributed lower brake maintenance costs to lower maximum speeds.

Insurance Costs

Studies found that when setting premiums, insurers do not offer "front-end" premium discounts to carriers using speed governors. Rather, insurers look only at a company's experience ratings.[12] Instead, insurers will reduce premiums for carriers with the best demonstrated safety records. Therefore, it is possible that speed governors eventually generate insurance savings for carriers that use them, but there is no data available to estimate the amount of savings.

[8]Johnson and Pawar, pp. 128–129.

[9]ATA (The Maintenance Council). *55 vs. 65+: An Equipment Operating Costs Comparison.* 1996, p. 13.

[10]Jeffrey Ang-Olson and Will Schroeer, "Energy Efficiency Strategies for Freight Trucking: Potential Impact on Fuel Use and Greenhouse Gas Emissions," *Transportation Research Record 1815,* 2003.

[11]ATA, 1996.

[12]Johnson and Pawar, p.127; TRB, 2008, p. 32.

Driver Retention

The common perception is that truck drivers are strongly opposed to the mandatory use of speed governors, especially when they are paid by the mile or by the trip. A 2007 OOIDA survey of 3,400 members who are company drivers found that 82 percent would prefer to work for a company that does not use speed governors, all other things being equal. Only 4 percent said they would choose a company using speed governors.[13]

In contrast, in a 2008 survey of fleet safety managers, 64 percent said that driver attitudes toward speed limiters were largely neutral, and 23 percent said driver attitudes were positive. Seventy-seven percent of the managers said that the impact of speed limiters on driver hiring and retention was neutral.[14] It may be that driver opposition is softening as the voluntary use of speed governors becomes more widespread among carriers.

Driver Compensation

Because some drivers are paid by the number of miles they drive, reducing the maximum speed of trucks could result in loss of income for those drivers. The amount of reduction would depend on what percentages of miles were driven at speeds exceeding the new limit. Drivers who log many miles in western states where speed limits are higher would stand to lose more income than other drivers.

In its rulemaking petition to NHTSA and FMCSA, ATA suggested that, because of the chronic shortage of long-haul drivers, carriers would need to compensate drivers for any loss of income.[15] However, there is very little in the literature about how the voluntary adoption of speed governors has affected driver compensation thus far.

Profitability

Johnson and Pawar found that the profitability of operating a fleet at higher truck speeds (specifically, 70 mph vs. 65 mph) was highly dependent on the characteristics of the fleet and various external variables such as the price of fuel. The authors were able to construct a plausible scenario in which operating trucks at the higher speed of 70 mph increased profits, but fuel was assumed to cost $2.00 per gallon.[16] At higher prices, it would presumably be more difficult to construct scenarios where operating at higher speeds actually increased profits.

[13]TRB, 2008, p. 14.

[14]TRB, 2008, p. 33.

[15]ATA, rulemaking petition to NHTSA and FMCSA, October 20, 2006.

[16]Johnson and Pawar, p. 119.

Table B-2. Hours of delay per heavy vehicle crash, 2000.

Road Class	Property Damage Only	Injury	Fatality
		Urban	
Interstate	2,260	7,344	21,749
Other Freeway	1,766	5,737	16,990
Major Arterial	949	1,929	9,127
		Rural	
Interstate	814	2,646	7,835
Other Freeway	416	1,350	3,999
Major Arterial	255	829	2,454

Source: NHTSA, 2002.

Given the highly competitive nature of the trucking industry, one could reasonably conclude from the widespread voluntary adoption of speed governors that they probably increase profits and, at worst, have no impact at all on profits.

Other Types of Impacts

Two other potential impacts of lower speed limits for trucks are worth mentioning. First, lower speed limits could affect the amount of congestion experienced on the nation's highway system. Second, how the truck speed limits are applied and enforced could affect competitiveness.

Traffic Flow

Lower speed limits for trucks have a mixed effect on congestion, and it is not yet clear whether the net impact is positive or negative. On the one hand, some studies suggest that lower speed limits for trucks can increase congestion, because trucks end up clustering together and impeding the flow of traffic.[17] On the other hand, if differential speed limits or speed governors reduce the frequency and severity of crashes involving trucks, then they also reduce the hours of delay associated with such crashes. A 2002 study for NHTSA estimated the hours of delay caused by heavy vehicle crashes in the year 2000. The results are shown in Table B-2.[18]

The study valued hours of delay at $13.86 in urban areas and $16.49 in rural areas; the difference is due to the differences in average vehicle occupancy in the two settings. Using these estimates of dollar values and hours, a fatal crash on an urban interstate causes more than $300,000 in time delays, while an accident with property damage only on a rural major arterial causes $4,200 in time delays.

[17]Johnson and Pawar, p. 93.

[18]NHTSA, *The Economic Impact of Motor Vehicle Crashes 2000.* May 2002.

Truck Size and Weight Rules

The regulations of truck size and weight have a multitude of impacts on the truck industry as well other modes. Truck size and weight regulations can also affect overall highway safety, traffic operations, fuel consumption, and emissions. When the first Federal limits were imposed in 1956, a grandfather clause allowed states to retain any truck size and weight limits exceeding the Federal limits as long as these limits were in place at that time. As a result, the current size and weight limits reflect a patchwork of Federal and state limits, with many situations in which equipment acceptable in one state cannot be used in neighboring states.

In 2000, the USDOT completed a 6-year, comprehensive study of truck size and weight policy options. This study included modeling of a "uniformity scenario" (later referred to as the "Federal uniformity scenario") in which the grandfather provisions in Federal law would be revoked and states would be required to adopt the Federal weight limit of 80,000 pounds on all Interstates and National Network highways.[19] In a follow-on study published in 2004, the USDOT analyzed a "western uniformity scenario" in which the maximum gross vehicle weight limits of the grandfathered western states would be harmonized at 129,000 pounds. (This limit is near the high end of the range among the grandfathered states.) Thus, the USDOT has looked at the likely impacts of harmonization at the high end and low end of the range of possible choices. The impacts modeled by these two studies are compared below.

In comparing the impacts of the two studies, one should note that the two studies did not use the same time periods for their analyses. For its 2000 comprehensive study, the USDOT used 1994 as the base year and compared policy impacts in the year 2000. For the later study of the western uniformity scenario, the USDOT used the year 2000 as the base year and compared policy impacts in 2010. Despite this disparity, it is worth comparing the direction of policy impacts (increases vs. decreases) and the percentage changes projected.

Changes in Freight Distribution by Type of Truck and Mode

As shown in Table B-3, in the Federal uniformity scenario, the imposition of the Federal size and weight rules on the grandfathered states would result in a projected increase in total truck VMT of 3.5 million miles. This increase in overall VMT is caused by shifting freight traffic from longer and heavier vehicles to 5-axle tractor semitrailers. More of the

[19]A few states have weight limits *below* Federal limits on non-Interstate portions of the National Network. Under the uniformity scenario, those states would be required to bring weight limits up to Federal limits on those highways.

Table B-3. VMT by vehicle configuration: Federal uniformity scenario versus policy baseline, 2000 (national level).

Vehicle Configuration	Base Case VMT (millions)	Federal Uniformity Scenario	
		VMT (millions)	Percent Change
5-axle Tractor Semitrailer	83,895	91,205	+9%
6- or 7-axle Tractor Semitrailer	6,605	3,660	-45%
5- or 6-axle Double	5,994	5,986	--
5- or 6-axle Truck Trailer	2,358	2,455	+4%
7-axle Double	632	290	-54%
8- or more axle Double	759	198	-74%
Triple	126	54	-57%
Total	**100,369**	**103,848**	**+3.5%**

Source: USDOT Comprehensive Truck Size and Weight Study Final Report, Vol. 3, Ch. 4.

smaller vehicle combinations are needed to transport the same amount of freight.

For this scenario, the USDOT did not attempt to estimate the diversion of freight from truck to rail.

In the western uniformity scenario, total truck VMT in the region is estimated to decrease by 4.8 million (25 percent). Currently, LCVs are not often used for shipments for which one or both trip ends are outside the 13-state region. About half the VMT within the region for such shipments is projected to shift to LCVs. This shift would require carriers to assemble and disassemble the twin and triple trailers for travel outside the region. Despite the extra cost this would impose on carriers, the USDOT concluded that the net cost savings would still be attractive to carriers.

For shipments entirely within the region, the percent of VMT in LCVs was projected to increase from about 9 to 78 percent. Less than one-tenth of 1 percent of rail traffic in the region was estimated to divert to LCVs.

Safety Impacts

The issue of safety is probably the most studied and most controversial aspect of truck size and weight policy. Truck size and weight rules affect safety in several ways. First, these rules affect the total number of miles traveled by trucks, which in turn affects the exposure of the overall truck fleet to crashes. Second, these rules affect vehicle performance, such as minimum braking distance and the propensity to roll over. Many other aspects of truck trips also affect safety, including driver performance, roadway design, vehicle maintenance, traffic conditions, and weather. Because of the many factors, isolating the effect of truck size and weight rules has proven difficult.

In its 2000 comprehensive study, the USDOT did not present quantitative assessments of the safety impacts of the various scenarios that it analyzed. Instead, the agency presented data on the crash rate history of different vehicle types and findings from engineering studies of vehicle safety performance. Regarding crash rates, the agency compared the fatal crash rates of single-trailer combination trucks and multi-trailer combination trucks during the period 1995 to 1999. As shown in Figure B-1, for most roadway classes, the fatal crash rates for single-trailer and multi-trailer combination trucks did not differ greatly. The one exception was the roadway class of "other rural roads," on which multi-combination trucks had a much higher fatal crash rate.[20]

The 2000 study did not draw clear conclusions regarding the safety impacts of each scenario under scrutiny. However, from the information presented, one can conclude that, all other things being equal, the increase in heavy truck VMT resulting from the Federal uniformity scenario would result in more fatal truck accidents. At the same time, the shift of freight traffic from multi-combination trucks to single-trailer trucks might reduce the number of fatal truck accidents. The net impact is unclear.

Like its predecessor study, the USDOT's 2004 analysis did not offer a quantitative assessment of the net safety impacts

Table B-4. VMT by vehicle configuration—western uniformity scenario versus policy baseline, 2010 (13-state level).

Vehicle Configuration	Base Case VMT (millions)	Scenario	
		VMT (millions)	Percent Change
5-axle Tractor Semitrailer	14,476	3,442	-76%
6-axle Tractor Semitrailer	1,924	938	-51%
5- or 6-axle Double	1,351	750	-44%
6-axle Truck Trailer	626	607	-3%
7-axle Double	188	2,190	+1,065%
8- or more axle Double	213	5,626	+2,541%
Triples	45	473	+951%
Total	**18,823**	**14,028**	**-25%**

Source: USDOT, *Western Uniformity Scenario Analysis*, Table ES-2.

[20]It is worth noting that only 5 percent of the VMT by multi-combination trucks was accumulated on that type of road. U.S. DOT Comprehensive Truck Size & Weight Study, Vol. 3, Ch. 8, p. VIII-4.

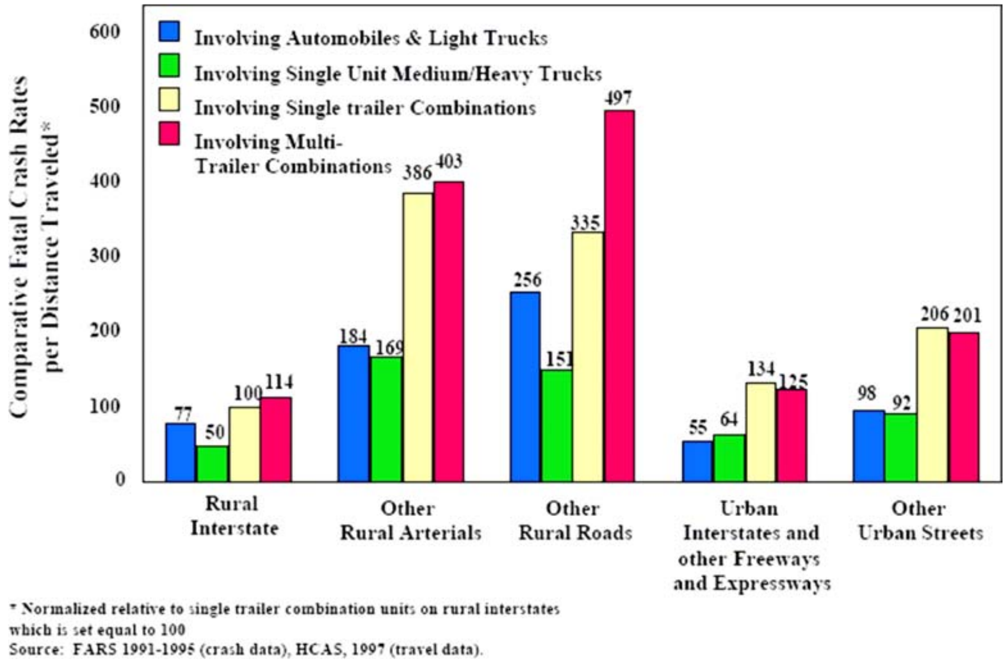


Figure B-1. Fatal crash rates by vehicle type and road type, 1995–1999.

of the western uniformity scenario. Instead, the agency concluded that the fatal crash and travel data did not allow a detailed examination of LCVs separately from the 28-foot double trailers currently allowed on the National Network under Federal rules. According to the USDOT, the measurement problem was threefold: (1) fatal accidents are rare occurrences, (2) there are few LCVs currently operating, and (3) there is only limited travel data collected on them. Regarding this last point, the agency noted that there is no Federal requirement to collect data for specific types of multi-trailer combination vehicles and, at the time of publication, only 2 of the 13 states actively collected separate VMT for different types of multi-trailers.[21] In the end, the agency concluded that, even though the reduction in VMT by heavy trucks would lower crash exposure, there were too many other uncertainties regarding other safety impacts of LCVs to reach a firm conclusion on the net safety impact of the western uniformity scenario.[22]

Fuel Consumption and Air Emissions

Under the Federal uniformity scenario, truck VMT was estimated to increase by 4 million miles, because more truck trips would be required to move the same amount of freight. This increase in VMT translated into increased fuel consumption of 635 million gallons.

For the western uniformity scenario, truck VMT was projected to decrease by 4.8 million miles (25 percent) because the use of longer, heavier trucks would translate into fewer truck trips. The 25 percent reduction in truck VMT was estimated to result in a reduction in fuel consumption of 613 million gallons (12 percent). Fuel savings were not directly proportional to the reduction in VMT because fuel economy decreases as vehicle weight increases.[23]

For both studies under consideration, the U.S. DOT assumed that total truck emissions would vary directly with changes in fuel consumption. DOT did not attempt to quantify how changes in emissions would translate to changes in air quality. The research team calculated the change in greenhouse gas (GHG) emissions, shown in Table B-5. Total U.S. GHG emissions from heavy trucks are approximately 386 million metric tons of CO_2-equivalent. So the Federal uniformity scenario would increase this total by 1.6 percent, while the western uniformity scenario would decrease U.S. heavy-truck GHG emissions by 1.5 percent.

Traffic Operations

Because of the shift of freight from heavier and longer vehicles to 5-axle semitrailer combinations at 80,000 pounds, the Federal uniformity scenario was projected to increase traffic congestion and associated costs in the year 2000 by 100 million vehicle-hours (0.4 percent).

[21] Western Uniformity Scenario Analysis, p. VII-20.

[22] Western Uniformity Scenario Analysis, p. ES-6.

[23] USDOT, WUSA, p. ES-8.

Table B-5. Impacts of scenarios on fuel consumption and GHG emissions.

	Federal Uniformity Scenario	Western Uniformity Scenario
Fuel Consumption	+635 million gallons	-613 million gallons (-12%)
GHG Emissions	6.2 million metric tons CO_2-eq	6.0 million metric tons CO_2-eq

Table B-6. Impacts of scenarios on traffic operations.

	Federal Uniformity Scenario	Western Uniformity Scenario
Traffic Delay	+100 million vehicle-hours (+0.4%)	Small decrease
Congestion Costs	+$1.9 billion	Small decrease

Table B-7. Impact of scenarios on shipper costs.

	Federal Uniformity Scenario	Western Uniformity Scenario ($2000)
Shippers Using Trucks	+6.4 billion (+3%)	-$2 billion (-4%)
Shippers Using Rail	Not estimated	-$30 million (<1%)

Unfortunately, the congestion model used in the comprehensive study published in 2000 was not applicable to the western uniformity scenario because the model does not allow for analysis at less than a national level. In its analysis of the western uniformity scenario, the USDOT made only qualitative assessments of the likely impacts on traffic flow. The agency concluded that because of the shift of the reduction in total truck VMT, one could expect a slight decrease in delay in the 13 western states.

Shipper Costs and Railroad Revenues

Changes in truck size and weight regulations affect the transportation costs incurred by freight shippers. If the regulations become more restrictive, then amount of payload per truck will decrease and the cost per ton-mile of transportation will increase. Conversely, if the regulations become more permissive, then the amount of payload per truck will increase and the transportation cost per ton-mile will decrease. Changes in truck size and weight regulations affect rail shipper transportation costs as well, because some shippers will divert their freight to trucking or will obtain reduced rates from the railroads as they compete with lower truck rates.

As shown in Table B-7, in the Federal uniformity scenario, the USDOT estimated that the transportation cost for shippers using trucks would increase by $6.4 billion per year, or about 3 percent. For the western uniformity scenario, the USDOT estimated savings to shippers of about $2 billion annually, or about 4 percent of total shipper costs for moves by truck in and through the region.

These additional costs estimated for the Federal uniformity scenario are higher than the projected savings in the western uniformity scenario, because the removal of the grandfather provisions in Federal law would affect more than the 13 western states analyzed in the USDOT's 2004 study.

For the Federal uniformity scenario, the USDOT did not estimate the impact on rail shippers, but the agency surmised that the impact would be small because most of the potentially affected freight trips were of relatively short distances.[24] For the western uniformity scenario, the USDOT was able to estimate savings for shippers using rail. The agency estimated that the increased competition of the longer, heavier trucks would generate minor savings of about $30 million per year for shippers using rail. Of this amount, $3 million in savings would accrue to shippers who actually switch from rail to trucking; the rest would accrue to rail shippers through lower rates.[25]

Level of Investment in Inland Waterway Infrastructure

Lack of investment in inland waterway infrastructure increases the probability of a lock or dam failure. There is no information to reliably estimate how this policy decision affects the probability of failure. But the research team can estimate the cost of a failure.

Complete quantification of the cost of a lock or dam failure would require data on the actual delay and the value of the particular goods being moved. In the case of a total failure and a forced mode shift, one would need to know the actual reduction in transit time and the difference between barge and rail rates for the specific cargo involved, as well as the value of that cargo. Given that the research team is examining a hypothetical case, we rely on the average value of goods moving by barge

[24]USDOT, Comprehensive TS&W Study, p. XII-3.
[25]USDOT, Western Uniformity Scenario Analysis, p. ES-9.

and the difference between average barge rates and average rail rates. We also know tonnage moving on the Upper Mississippi and the Ohio Rivers. This allows us to say something about the potential magnitude of the costs of a structure failure.

Delay Costs

Average value per ton for shallow-draft, domestic water carriage is \$250.[26] Delays, as opposed to complete stoppages, are far more likely to occur on the Ohio River than on the Upper Mississippi, because all the Ohio River locks are doubles. In 2006, 241.5 million tons moved on the Ohio.[27] Thus, the total value of this traffic was \$60.4 billion. For simplicity in developing an approximation, we assume that the traffic was evenly distributed over the 20 locks on the Ohio. Thus, the value of the annual traffic moving through any one lock was also \$60.4 billion.

All but three of the locks have 1,200-foot main chambers; of these, all but one has 600-foot auxiliaries. A 15-barge tow can pass through a 1,200-foot lock in about 30 minutes.[28] With a 600-foot auxiliary, the tow has to be broken up, moved in two passes, and put back together. We assume this procedure adds 1 hour to the time for locking through. There are often queues at locks, so waiting time would also increase. We assume an average of 3 hours of extra waiting time, so 4 hours is added to the transit time for each tow. We now assume that it takes 2 months to repair the failed lock (1/6th of a year). Assuming no seasonal variations, \$10.1 billion worth of goods will experience a 4-hour delay ($60.4 \text{ billion} \div 6 = 10.1 \text{ billion}$).

We assume the owners of the cargo are paying annual interest at 6.5 percent.[29] The result is a delay cost of \$300,000 ($(0.065 \div 365 \div 6) \times \$10.1 \text{ billion}$). This value is offered strictly to give a rough sense of order of magnitude. If, as is likely, we have underestimated the effect of queuing, the value would be greater but still not large. An increase by a factor of 5 would bring the amount to \$1.5 million. This reflects the low value per ton of traffic moving on the rivers.

Forced Mode Shift

A total blockage, forcing a shift of cargo to rail or possibly truck, could occur from a lock failure on the Upper Mississippi where only 3 of 29 locks are doubles. In 2006, 71 million tons moved on the Mississippi above the mouth of the Missouri.[30] We assume a lock fails at or near the mid-point between the mouth of the Missouri and Minneapolis and that it affects half the total tonnage, or 35.5 million tons. Assuming, again, 2 months for lock repairs, affected tonnage would be approximately 6 million tons ($35.5 \div 6 = 5.9$).

There could be various responses to the blockage. Blocked traffic could move between a point downstream from the failed lock and origins and destinations to the north by rail or truck. Some traffic could be transferred to rail or truck for portage around the blockage and put back on the river. To offer some rough sense of the magnitude of impact, we assume a scenario in which traffic moves 100 miles by rail when it would otherwise have been on the river, and we assume no change in distance, only change in mode.

In 2007, average rail rates were \$0.03 per ton-mile and barge rates were \$0.014 per ton-mile, a difference of \$0.016.[31] For our scenario, we assume a greater difference for several reasons. A rail carrier might be in a strong bargaining position because of the blockage. Also, extra costs for transloading would be spread over a relatively short move. It is reasonable to use a difference of \$0.02 per ton-mile. Thus, shipping cost for each ton would increase by \$2.00. Given that 6.0 million tons are affected, the total cost is \$12 million ($\$2.00 \times 6.0 \text{ million} = 12 \text{ million}$).

Table B-8. Cost of a lock failure.

Nature of cost	Possible range of cost
Cost of delay	\$300,000 to \$1.5 million
Cost of mode shift	\$12 million to \$60 million

Cost Summary

These cost estimates are clearly rough and are intended only to give a sense of the order of magnitude of impact. If anything, they are probably low. For example, the assumption of 2 months to fix a failed lock could be optimistic. It may be useful to think of a range in which the above estimates are the low end and the high estimate is greater by a factor of five. This is shown in Table B-8.

Highway Tolls and Other User Charges

Tolls affect which roads truckers use, because tolls change the relative costs of the roads available for a given move. The most direct impacts on the freight system are the costs to

[26]Calculated from 2007 Commodity Flow Survey, Preliminary, December 2008, Table 1.

[27]Waterborne Commerce of the United States, USACE, 2006, Part 2, p. 61.

[28]Michael Bronzini, "Inland Waterways: Still or Turbulent Waters Ahead?" *Annals of the American Academy of Political and Social Science,* Vol. 553, p. 70, September, 1997.

[29]Federal Reserve Board, data on business lending in November 2007. http://www.federalreserve.gov/releases/e2/200712/default.htm

[30]Waterborne Commerce of the United States, USACE, 2006, Part 2, p. 203.

[31]Rail rate from AAR, *Railroad Facts,* 2008, p. 30. Barge rates calculated using a revenue amount extrapolated from the 2002 Economic Census to 2007 and ton-miles from the CFS, Preliminary, December 2008, Table 1.

trucks diverting to alternate routes to avoid tolls. These are the costs and operating problems of switching to different roads or different times from those otherwise preferred. But these are not the only impacts. Other users of the roads to which trucks divert may be affected by the increase in truck traffic on those roads. Also, reduction in truck traffic on the tolled road may affect, positively, other users of that road.

Highway tolls can also affect railroads. All charges to truckers affect the total cost of highway freight carriage and, therefore, the relative costs of highway and rail carriage. The relative costs of these modes determine, in part, their relative shares of freight traffic. This affects the revenues and earnings of truck and rail carriers.

Beyond that, the efficiency of the freight system is affected if freight movement on highways is mispriced. If truckers are paying less (or more than) marginal cost, the freight system will not function at maximum efficiency, and the effects will be felt throughout the economy.

Accordingly, the following are the four principal areas of impact from highway pricing:

- Costs to trucks that divert from a tolled road
- Impacts on trucks that stay on a tolled road
- Impacts on mode share between highway and rail
- Effects on the whole economy and society from an inefficient freight system

Potential for Quantification of Impacts

Diversion Effects

Regarding costs to trucks that divert to alternate roads, there is enough information to permit estimates of changes in crash rates, fuel consumption, and speed. This allows us to estimate crash costs, fuel and other operating costs, and delay costs per diverted truck VMT. Two available estimates of diversion rates, one based on an actual tolled road, give us a basis for making a plausible approximation of total costs to diverted trucks from similar roads. Details on these cost estimates are presented below. We cannot make comparable estimates of the effects on other traffic on the roads to which trucks divert or the roads from which they divert. We can, however, offer some speculation as to whether such impacts would be noticeable. No data support a national aggregate estimate of the costs (or benefits) of diversion.

Effects on Truck/Rail Mode Share

We are not aware of any useful data or analyses that would permit a quantitative estimate of revenue impact on rail carriers related to a given change in the overall price of highway carriage. The prevailing view in both the trucking and rail industries is that higher costs for truckers would shift some traffic from highway to rail but not a large amount. ATA supports a fuel-tax increase to improve highways and is not concerned about possible loss of traffic. Regarding tolls, our discussions with rail executives suggest they do not expect much of an impact on mode share simply because tolls only apply to a small portion of traffic. Higher fuel taxes or a general VMT-based tax would have a stronger effect in this view.

There is a widespread view among rail managers, rail-industry analysts, and shippers that the quality, especially reliability, of rail service is a far more important factor than price in determining shipper choice of mode in markets where there is significant rail-truck competition. In particular, these markets are rail-intermodal service and carload service. (Rail carload service is movement in shipments of one or a few cars at a time, as opposed to shipments that require a full train.) It is also worth noting here that some large truckload carriers that offer rail intermodal service are making a deliberate effort to shift more of their long-haul traffic (over 1 day's drive) to rail intermodal.

Wider Impacts on the Freight System and the Economy

As a matter of economics, there is no question that the freight system would be more efficient if the inputs used for providing freight service were correctly priced. Where inputs are purchased in open markets, and there is no monopoly power, we can assume relative prices of inputs accurately reflect their relative costs, and there are no significant distortions. Highway use is not priced in an open market, and the providers of highways, the Federal and state governments, have monopoly power. There is no alternative to buying fuel and paying the Federal tax, and the same is true for many state taxes. Although trucks and other motor vehicles can switch to alternate routes, toll authorities have a high degree of market power.

There is consensus among economists and others who study transportation that use of highways is not optimally priced. To our knowledge, there are no usable data or analyses that would provide a basis for estimating the value of the efficiency gain that would ensue if highways were correctly priced. We know there would be gains, possibly significant gains, but we have no way for making a plausible estimate of their magnitude. The same observation applies to any benefits from congestion pricing, whether to trucking or to the wider economy.

Estimate of Costs to Diverted Trucks

Although we cannot establish a national estimate for costs to diverted trucks, we can estimate a range of costs for what might be a typical tolled highway. In order to do this, we need to estimate diversion rates and the changes in crash, fuel, and other operating costs, as well as speed and delay costs that trucks would incur from taking sub-optimal routes.

We focus the analysis on combination trucks, which account for almost all of non-local highway carriage. Five-axle truck-trailer combinations with 18 wheels are, by far, the preponderant configuration. We are looking at inter-city traffic, so we concentrate on rural roads. Diversion rates will be much lower for short, urban trips where switching to alternate routes may cause a disproportionate increase in distance and where alternate roads in a feasible distance are unlikely to be Interstates or high-quality freeways.

Diversion Rates

There have been two recent systematic attempts to estimate the degree of diversion of truck traffic from a road after a toll is imposed: a study of potential diversion from a toll on I-81 in Virginia and an empirical study of the diversion impact of tolls on the Ohio Turnpike.[32,33] The I-81 study was based on estimating costs to truckers of diverting from I-81 with estimates for various classes of traffic, including varying lengths of haul. For this study, the authors assumed truckers would compare costs of staying on I-81 with costs of diverting and choose the least-cost alternative. The authors of the Ohio Turnpike study used data on Class-8 truck VMT nationally, for Ohio, and for the Ohio Turnpike to estimate a demand curve as a function of the toll rate and speed.

These two efforts led to somewhat different results, but we can use them together to establish a plausible range for diversion effects. The I-81 study yielded toll division impacts shown in Table B-9.[34] The results of the Ohio Turnpike study are shown in Table B-10.

We have already noted the difference in method between these studies. The I-81 diversion estimate is based on estimates of comparative costs between a tolled I-81 and alternate routes for loads with various origins and destinations. The Ohio study is based on an empirical demand curve applied to rates and speeds. The Reebie estimate of diversion is much higher than the one offered by Swan and Belzer. One reason is that the trips are probably longer on I-81. The Reebie study states that average length of haul for trucks on the Virginia segment of I-81 is 1,000 miles.[35] This is through freight moving between the Southeast and the Northeast. We do not know average trip length for the Ohio Turnpike, but, given that Ohio is a major manufacturing state with several large metropolitan areas, it is likely that higher proportions of moves have either origins or destinations in Ohio or are entirely intrastate. Longer moves are more likely to divert than shorter ones, because more alternate routes are feasible.

Table B-9. Estimate of truck diversion on I-81 in response to tolls.

Toll (dollars per mile)	Percentage of truck VMT diverting
0.05	09.0
0.10	14.0
0.12	16.0
0.15	23.0
0.18	31.0
0.20	36.0
0.30	67.0
0.40	81.0

Source: Bryan, J., et al., Reebie Associates and Atherton, Mease & Company. “The Impact of Tolls on Freight Movement for I-81 in Virginia”; prepared for Virginia Department of Transportation, 2004.

There is no reason to expect that these two studies would yield closely similar results; they used different methods applied to quite different traffic. It is reasonable to suppose, however, that the very high diversion rates for I-81 at $0.20 per mile and higher would not often be found on short tolled segments with higher percentages of local trips.

To get a sense of actual toll rates in addition to the Ohio Turnpike, we looked at rates for 5-axle trucks imposed in Indiana and Illinois. For the Indiana Toll Road (157 miles), the rate is $0.17 per mile.[36] Rates are higher on the Illinois toll roads.[37] The low end of the range is $0.21 for night rates and $0.28 for day rates on the longer segments—I-90 (76 miles) and I-88 (96 miles). The high end is day rates of $0.42 to $0.53 on the shorter segments—I-94 and I-355 (both 30 miles).

In summary, this gives us the following per mile truck toll rates in these states:

- Ohio: $0.13
- Indiana: $0.17
- Illinois: $0.28–$0.53 (day rates)

Toll authorities, whether public or private, do no set prices at levels that lead to high diversion rates; they lose revenue if they do that. The Reebie study suggests that the maximum revenue rate for I-81 would be in the range of $0.12 to $0.15.[38] Reference to the above table with the Reebie results suggests maximum diversion rates, at these prices, of 15 percent to 25 percent. The Ohio case shows that toll authorities will not

[32]Bryan, J., et al., Reebie Associates and Atherton, Mease & Company. “The Impact of Tolls on Freight Movement for I-81 in Virginia”; prepared for Virginia Department of Transportation, 2004.

[33]Swan, Peter, Pennsylvania State University, and Michael Belzer, Wayne State University, “Empirical Evidence of Toll Road Traffic Diversion and Implications for Highway Infrastructure Privatization,” 2007.

[34]Values in table are from Bryan, et al., p. 9.

[35]Memorandum from Reebie to VDOT, February 11, 2004.

[36]Indiana Toll Road website, https://www.getizoom.com/index.jsp

[37]Illinois Tollway toll calculator, http://www.illinoistollway.com/portal/page?_pageid=133,1397406&_dad=portal&_schema=PORTAL

[38]Bryan et al., p. 10.

Table B-10. Estimate of truck diversion on Ohio turnpike in response to tolls.

Year	Actual toll (dollars per mile)	Percentage of truck VMT diverting
2001	0.18	13.62
2002	0.18	13.68
2003	0.18	13.56
2004	0.18	13.00
2005	0.13	05.01

Source: Swan, Peter, and Michael Belzer, "Empirical Evidence of Toll Road Traffic Diversion and Implications for Highway Infrastructure Privatization," 2007.
Note: The speed limit on the turnpike was raised from 55 mph to 65 mph in early September of 2004.

always price to maximize revenue. This suggests that we can think of $0.15 to $0.25 as a likely range for tolls on longer roads; and we can think of 5 percent to 25 percent as a plausible range for diversion rates.

Crash Costs

Estimating crash costs requires values for

- Cost per crash for 5-axle trucks and
- Increment in crashes per VMT for shift from Interstate to lower quality roads.

We assume the cost per crash for combination truck (tractor and one trailer) to be $164,000.[39] This is the average over all crash types: fatality, injury, and property-damage only (PDO).

Estimating change in crash rate due to diversion poses some difficulty, because of the nature of the data. FMCSA reports fatal crash rates for large trucks by FHWA road class but not rates for other crashes. (This is because available data on fatal crashes are better than data on other crashes.) One way to deal with this problem is to find a way to scale up from fatal crashes to all crashes. FMCSA does provide data on all large-truck crashes broken out by crashes on divided highways and on highways not divided.[40] These data show that fatal large-truck crashes, as a percentage of all large-truck crashes, are virtually the same on these two road types: 1.3 percent on undivided highways and 1.4 percent on divided highways.

These data do not separate rural and urban crashes. This diminishes their accuracy for our purposes but does not eliminate their usefulness. For one thing, fatal crash rates on rural and urban Interstates are almost the same: 1.3 and 1.2, respectively, per 100 million VMT. Fatal crash rates on rural arterials and urban "Other" facilities are also very close: 2.1 and 1.8, respectively.[41] Crash rates on rural "Other" are much higher, 4.4, but only 17.0 percent of rural VMT for combination trucks is on "Other" roads.[42] For these reasons, we believe that these data on divided and undivided highways give us a plausible approach to an estimate.

FMCSA's definition of large trucks includes all trucks over 10,000 pounds. Thus, the FMCSA data on large-truck crashes include many vehicles in addition to the combination vehicles doing most of the hauling of highway freight. (FMCSA puts out data on combination trucks' fatal crashes but does not relate them to type of road.) This is a potential distorting factor, but we note that trucks over 26,000 pounds account for a disproportionate share of large-truck crashes, especially the more severe ones. Crashes involving trucks over 26,000 pounds are 89 percent and 58 percent, respectively, of large-truck fatal and injury crashes.[43] (This particular data set does not provide full information on PDO crashes.) We conclude that using data for large-truck crashes will not unduly distort our estimates.

The divided highways should be roughly comparable to Interstates and Non-Interstate Principal Arterials in FHWA's classification of rural highways, and the undivided highways should be comparable to rural "Other" roads. Therefore, we can use fatal-crash percentages of all crashes on undivided and divided highways, 1.3 percent and 1.4 percent, respectively, as the basis for scaling up to all crashes. For this purpose, we take the reciprocals of 0.13 and 0.14 as scaling factors to obtain rates for all crashes from the reported rates for fatal crashes. These factors are, respectively, 77 for undivided roads and 73 for divided highways.

We apply these factors to FMCSA's reported fatal crash rates per 100 million VMT for three classes of rural roads: Interstate, Non-Interstate Principal Arterials, and Other.[44] Table B-11 shows the results.

[39]Eduard Zaloshnja and Ted Miller, "Unit Costs of Medium and Heavy Truck Crashes," prepared for F MCSA, December 2006, p. 8, Tables 3 and 5. The value in Table 3 for quality of life (QALY) was adjusted using the number in Table 5 for QALY when value of a statistical life (VSL) is $5.75 million. DOT's estimate of VSL was increased to $5.8 million in a directive from OST of February 5, 2008.
[40]FMCSA, "Large Truck Crash Facts 2005," (LTCF), 2007, Table 30.

[41]Fatal crash rates are from FMCSA LTCF, Table 19.
[42]VMT data are from FHWA, "Highway Statistics," Table VM-1.
[43]FMCSA LTCF, Table 39.
[44]FMCSA LTCF, Table 19.

Table B-11. Estimated crash rates by rural road type per 100 million VMT.

Road Type	Fatal Crashes	Scaling Factor	All Crashes
Interstate	1.3	73	95
Non-I-S Principal Arterials	2.1	73	153
Other Roads	4.4	77	339

Table B-12. Combination-truck VMT by rural road type.

Road Type	Percent of VMT
Interstate	52.2
Non-I-S Principal Arterials	31.0
Other Roads	16.8

Table B-13. Road types used by diverted trucks.

Road Type	I-81 Percentage of VMT	Ohio Turnpike Percentage of Trucks		
Interstate	69.0	55.9		
		All Non-Interstate	4-lane	2-lane
Non-Interstate	31.0	44.1	22.8	21.3

Source: I-81 values calculated from Bryan et al., p. 14; data in Figure 6. Ohio Turnpike values calculated from Swan and Belzer, p. 18, Table 10.

To estimate change in crash rates due to diversion, we have to know the distribution of diverted truck traffic over road classes. The current distribution of combination-truck VMT over rural road types is shown in Table B-12.[45]

In the I-81 study, Reebie estimated the percentage of VMT diverted to Interstates and to all other roads and found 69 percent diverted to Interstates. Swan and Belzer estimated number of trucks diverted by road type. The findings are shown in Table B-13.

The high percentage of diversion to Interstates from I-81 surely reflects the long average length of haul on I-81 in Virginia. The estimated truck diversions from the Ohio Turnpike show percentages by road type not dissimilar to the actual VMT percentages from FHWA data. (If average length of haul for combination trucks on the Ohio Turnpike is close to the national average length of haul, the percentage of trucks diverting is an acceptable proxy for percentage of VMT.) It is reasonable to assume that the 4-lane non-Interstate is roughly comparable to non-Interstate arterials and the 2-lane non-Interstate is roughly comparable to "Other" roads. Both of the estimates suggest that truckers choosing alternate routes do not use 2-lane roads if they can possibly avoid it. From these estimates we may infer that diverted combination-truck VMT will be distributed over road types, with some adjustment, in essentially the same way as all combination-truck VMT. For purposes of this analysis, we assume the following distribution of diverted-truck VMT (see Table B-14).

We assume, for all cost-estimation purposes, that the tolled road is an Interstate or a freeway of comparable quality. Therefore, the pre-diversion crash rate is 95 per 100 million VMT as shown in the above table of crash rates. The rate for diverted trucks is the average of the crash rates of the three road types weighted according to the distribution of the diverted traffic. The diverted crash rate is 155, so the change in crash rates is 60 crashes per 100 million VMT. (Diverted crash rate is calculated as: $0.6 \times 95 + 0.2 \times 153 + 0.2 \times 339 = 155$.)

With a cost per crash of $164,000, this yields a crash cost of approximately $10 million per diverted 100 million VMT ($164{,}000 \times 60 = 9{,}840{,}000$).

[45]"Highway Statistics," Table VM-1.

Fuel and Other Operating Costs

Fuel, maintenance, and tire costs will vary directly with the change in road types. To estimate fuel costs of diversion, it is necessary to make assumptions about average speed of combination trucks by road type and to obtain data on variation in fuel consumption with truck speed.

Discussions with people in the trucking industry suggest that large trucking firms tend to set governors in the 60 to 65 mph range, so their trucks average less than 60 mph on Interstates. Owner-operators and small firms that do not use governors would have somewhat higher speeds. We assume speeds by road type as shown in Table B-15.

Because of the lower speeds and our focus on rural roads, fuel consumption per mile drops for the diverted trucks. Given the assumed distribution of diverted traffic over road types, fuel consumed per mile is 0.157 gallons ($0.6 \times 0.172 + 0.2 \times 0.146 + 0.2 \times 0.126 = 0.157$). We assume $2.50 per gal-

Table B-14. Assumed distribution of diverted truck VMT.

Road Class	Percentage of VMT
Interstate	60.0
Non-I-S Principal Arterials	20.0
Other Roads	20.0

Table B-15. Assumption for speed and fuel economy by road type.

Road Class	Average Speed[46]	Miles per Gallon[47]	Gallons per Mile
Interstate	62	5.83	0.172
Non-Interstate Principal Arterials	50	6.83	0.146
Other	40	7.95	0.126

lon for the price of diesel fuel.[48] The result is a reduction in fuel cost of $.035 per mile.

Costs of maintenance and tire wear are currently a little less than 20 percent of fuel cost per mile.[49] We assume that ratio to hold for this analysis; therefore, we can increase the change in fuel cost by 20 percent to obtain an estimate of $0.042 as the reduction in operating cost per mile. This is equal to $4.2 million per 100 million VMT.

Table B-16. Summary of annual cost changes per 100 million diverted VMT.

Cost Component	Cost (million)
Crashes	$10.0
Fuel and operating costs	$-04.2
Delay	$12.0
Total	$17.8
Total adjusted for added distance	$18.0

Delay Costs

We estimate delay costs with the same average speeds assumed above and the same distribution of diverted trucks over road types. The result is an average speed of 55.2 mph for diverted trucks ($0.6 \times 62 + 0.2 \times 50 + 0.2 \times 40 = 55.2$). This leads to an increase in trip time of 0.002 hours per mile (pre-diversion mile).[50] This yields approximately 200,000 additional hours per 100 million VMT without allowing for any additional miles.

For cost per hour of delay, we look at the revenue that tractor and driver generate in an average hour. If it takes a load an extra hour to reach its destination, the firm has lost an hour's use of the tractor and, hence, the revenue it would generate in an average working hour. Approximately a year ago, industry executives in private conversations with us indicated an average revenue per day for a tractor in truckload service of about $700 to $725. In today's market, that could be somewhere from $600 to $650. Current market conditions are not typical, however, so we assume $700. Available data tells us that 12 hours is an acceptable estimate of the average working day of a long-haul driver.[51] On this basis, lost revenue is $58.33 per hour. The cost of 200,000 additional hours is $11,590,307, which we may round to $12 million for our estimate.

Cost Summary

Table B-16 summarizes the annual cost changes per 100 million diverted VMT. Some of the alternate routes chosen will result in longer distances. The Reebie paper estimates the increase at 1.1 percent.[52] This yields the adjusted total of $18 million per 100 million VMT.

Table B-17 shows the amount of VMT diversion estimated for I-81 and the Ohio Turnpike under different pricing scenarios. For I-81, tolls of $0.12 and $0.15 were chosen because the Reebie paper suggested that these are the maximum-revenue toll rates. For the Ohio Turnpike, diversion amounts for 2004 and 2005 were chosen because of the change in toll rates: $0.18 in 2004 and $0.13 in 2005 and the change in the speed limit in September of 2005 (55 mph to 65 mph).

This cost estimate does not include increased maintenance costs on roads to which trucks divert. It is based on some reliable data and some plausible assumptions based on reliable data. It could be adjusted up or down to some degree. Nonetheless, it gives a rough sense of the magnitude of the direct costs from diverted trucks in some typical toll scenarios.

The estimate does not include impacts on other traffic on roads to which trucks divert and from which trucks divert. We do not have sufficient data to estimate quantities for such impacts. It appears, however, that impacts on other traffic could be significant, at least for some segments. The Reebie estimate for I-81 suggests 15 percent to 25 percent of truck

[46]Speeds are based on ICF team's own expertise and e-mails from two trucking executives. One executive stated that his company expected an average speed of 45 mph off the Interstate. Thus, we assigned 50 mph to higher-quality non-Interstate roads and 40 mph to other non-Interstate roads.

[47]ATRI data.

[48]*Transport Topics,* March 23, 2009, gives current price just over $2.00, but these are abnormal conditions. One year ago, the price was $3.97, and that may have been an extreme. We assume $2.50, for this estimate.

[49]ATRI, "An Analysis of the Operational Costs of Trucking," December 2008, p. 21, Table 4.

[50]Change in time per mile is the difference between time required to travel one mile at new speed and one mile at old speed. $(1 \div 55.2) - (1 \div 60)$.

[51]FMCSA Field Survey.

[52]Bryan et al., p. 13.

Table B-17. Truck VMT diversion and associated annual cost.

	Toll Rates	VMT Diverted (millions)	Annual Cost (millions)
I-81	$0.15	82	$14.8
	$0.12	56	$10.0
Ohio Turnpike	$0.18	133	$23.9
	$0.13	54	$09.7

VMT diverting at revenue-maximizing tolls. Depending on the amount of other traffic on a segment, this could have some effect on level of service. The Swan and Belzer estimate for the Ohio Turnpike shows 13 percent of VMT diverting at the toll of $0.18 per mile. This could be noticeable on some segments but would likely have little impact on most segments. Regarding roads to which trucks are diverted, Swan and Belzer present data showing that some segments could see increases of several thousand trucks per day.[53] That is certainly enough to degrade the level of service on some segments.

Lockage Fees for Inland Waterways

There have been recent proposals to phase out the fuel tax to towboats and replace it with a lockage fee. The most significant impact of such a policy would be the increase in the tax burden on inland towing, which might cause an increase in barge rates and have some effect on mode shift. We estimate the change in the tax burden on the inland towing industry that would result from the proposed lockage fee. For this purpose, we compare projected revenues from the lockage fee with current and projected payments on the fuel tax. We can then compare the new tax burden and the change in tax burden with projected towing-industry revenue.

The latest published estimate of towboat revenues is from the 2002 Economic Census: $2,557 million from inland towing.[54] Published data from the 2007 Economic Census do not yet include revenues from inland towing. Available data from the Commodity Flow Survey (CFS) do, however, include ton-miles of shallow-draft water carriage in 2007. By comparing this figure with ton-miles carried in 2002, we obtain the change in the amount of freight carriage sold. Over this period, ton-miles decreased from 212 billion to 164 billion, by a factor of 0.77.[55] If we also adjust for the change in the price of inland carriage, we can obtain a reasonable estimate of 2007 revenue from inland towing. Price indices for water transportation show a price increase from 2002 to 2007 by a factor of 1.19.[56] This leads us to an estimate of 2007 revenue of $2,356 million.[57]

It is desirable to estimate industry revenue for three reference years: 2004 and 2013 in addition to 2007. Industry tax burden in 2004 is relevant because that was the last year in which the full deficit-reduction tax of $0.043 per gallon was levied on towboats. The Office of Management and Budget (OMB) has projected revenue from the proposed lockage fee out to 2013. We can therefore compare total tax payments to industry revenue in 2004, 2007, and 2013. Industry revenue declined from 2002 to 2007 at an annual rate of 1.63 percent. Assuming a constant rate of decline over that period, revenue in 2004 would have been $2,474 million.[58] In projecting fuel-tax revenue out to 2013 (as a baseline), OMB assumes that the decline in barge traffic in recent years stops and fuel tax revenue grows at a very slight rate from 2007 to 2013: 0.36 percent.[59] We use this growth rate to project from 2007 revenue and obtain 2013 revenue of $2,407 million.[60]

We obtained tax payments data for 2004 and 2007 from the Congressional Budget Office, Tax Analysis Division. Estimated tax payments for 2013 are available from the FY 2009 President's Budget, cited above. Table B-18 shows the relative burden of tax payments in the three reference years, assuming the implementation of the lockage fee in FY 2009.

We see that the highest burden is for the lockage fee in 2013, 5.2 percent of industry revenue. (The burden is actually higher in 2012, but the fee does not stay at the 2012 level; it drops back because of the balance in the trust fund.) The second highest burden was in 2004 when the industry was still paying the full deficit-reduction tax of $0.043 per gallon in addition to the user tax of $0.20 per gallon. The burden was lightest in 2007 when the deficit-reduction tax was zero.

The most meaningful measure of the increase in burden is the tax increase as a percentage of revenue. This tells us how much the industry would have to increase its prices in order to recover fully the tax increase. And this, in turn, tells us

[53] Swan and Belzer, p. 18, Table 10.

[54] 2002 Economic Census, Product Lines, Transportation and Warehousing, Table 1, p. 7 (NAICS 483211 [coastal and inland freight, product codes 44010, 44030]).

[55] 2002 CFS, Table 1a, p. 1; 2007 CFS, Preliminary Release.

[56] BEA, Gross Domestic Product by Industry, indices for water transportation http://www.bea.gov/industry/gpotables/gpo_action.cfm?anon=94425&table_id=23984&format_type=0

[57] Calculation: $0.77 \times 1.19 \times 2,557 = 2,356$

[58] Calculation: $2,557 \times (1-0.0163)^2 = 2,474$

[59] Calculated from OMB projections in FY 2009 President's Budget, Analytical Perspectives volume, Table 17-3 (p. 266) and Table 17-4 (p.269).

[60] Calculation: $2,356 \times (1.0036)^6 = 2,407$

Table B-18. Inland waterway towing revenue and tax payments.

Fiscal year	Industry revenue (million)	Tax payment (million)	Tax % of revenue	Change in tax as % of revenue*
2004 fuel tax with $0.043	$2,474	$110.0	4.4%	NA
2007 fuel tax without $0.043	$2,356	$87.3	3.7%	NA
2013 fuel tax projected	$2,407	$93.0	3.9%	NA
2013 lockage fee projected	$2,407	$126.0	5.2%	1.4%

*Change in tax as a percentage of revenue is only relevant for 2013; we do not have an estimate of what the revenue from the lockage fee would have been in the earlier reference years.

the degree to which the tax increase would have an impact on mode share and on total movement of freight. It cannot be assumed, of course, that the towing industry would, or could, raise rates by enough to fully offset the tax increase. But the amount of a 100-percent passthrough shows us the maximum possible effect on mode share.

As shown in Table B-18, the 2013 tax increase ($33 million) is 1.4 percent of total revenue. For the traffic using locks, the tax increase would be more than 1.4 percent, because the traffic not using locks would not pay the fee at all. The Economic Census data on revenue from inland towing show a very small share, less than 10 percent, coming from coastal carriage.[61] Some inland river traffic also does not use locks, although it is not likely a large share of total movement. Let us assume as an upper bound that one-third of the total revenue would come from non-lock traffic. If one-third of the traffic pays no tax, the percentage of revenue coming from lock-using traffic would be 1.5 times the percentage coming from all traffic.

So the extreme case would be that the lockage fee would mean a tax increase of 2.1 percent of the revenue of lock-using traffic. A 2.1 percent increase in average rates of lock-using barge traffic is unlikely to have a significant impact on mode share between barge and rail. It is not likely that all of the increase could be passed through, so the real effect would be a slight increase in barge rates and a slight decrease in earnings from carriage using locks. The aggregate impact would likely be negligible.

[61] 2002 Economic Census, cited above.

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APPENDIX D

Abbreviations, Acronyms, and Initialisms

3PLs	Third-party logistics providers
AADT	annual average daily traffic
AADTT	annual average daily truck traffic
AAR	Association of American Railroads
ABF	(this is the name of a freight carrier)
APU	auxiliary power unit
AREMA	American Railway Engineering and Maintenance Association
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis
BNSF	Burlington Northern Santa Fe
BTS	Bureau of Transportation Statistics
CAA	Cargo Airline Association
CAFE	corporate average fuel economy
CARB	California Air Resources Board
CBD	central business district
CBP	U.S. Customs and Border Protection
CCSP	Certified Cargo Screening Program
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFS	Commodity Flow Survey
CMAQ	Congestion Management and Air Quality Improvement
CN	Canadian National (a railroad)
COE	Army Corps of Engineers
CSA	Chamber of Shipping of America
CWA	Clean Water Act
DC	distribution center
DHS	Department of Homeland Security
DPF	diesel particulate filters
ECAs	Emission Control Areas
ECM	electronic control module
EGR	exhaust gas recirculation
EIA	Energy Information Administration
EIA	Economic Impact Analysis
EISA	Energy Independence and Security Act
EJ&E	Elgin, Joliet, and Eastern

EPA	Environmental Protection Agency
ETD	explosives trace detection
FMC	Federal Maritime Commission
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
GAO	Government Accountability Office
GHG	greenhouse gas
GVW	gross vehicle weight
HOS	hours of service
ICSFs	independent cargo screening facilities
IGCC	integrated gasification combined cycle
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
JIT	just-in-time
LCFS	low carbon fuel standard
LCV	longer combination vehicle
LNG	liquefied natural gas
LTL	less-than-truckload
MARAD	Maritime Administration
MGGRA	Midwest GHG Reduction Accord
MOA	memorandum of agreement
mpg	miles per gallon
mph	miles per hour
NAFTA	North American Free Trade Agreement
NHS	National Highway System
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OMB	Office of Management and Budget
OOIDA	Owner Operator Independent Drivers Association
PDO	property-damage only
PERE model	Physical Emission Rate Estimator model
PHMSA	Pipeline and Hazardous Materials Safety Administration
PM	particulate matter
PMSA	Pacific Merchant Shipping Association
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RGGI	Regional Greenhouse Gas Initiative
RIA	regulatory impact analysis
ROD	Record of Decision
SAFE Port Act of 2006	Security and Accountability For Every Port Act of 2006
SCR	selective catalytic reduction
SO_x	sulfur oxides
SSS	short sea shipping
STB	Surface Transportation Board
TEU	20-foot equivalent unit
TIFIA	Transportation Infrastructure Finance and Innovation Act
TL	truckload
TMA	Truck Manufacturers Association
TSA	Transportation Security Administration
TWIC	Transportation Worker Identification Credential
ULDs	unit load devices
UNFCCC	United Nations Framework Convention on Climate Change

UP	Union Pacific
USACE	U.S. Army Corps of Engineers
US-VISIT	U.S. Visitor and Immigrant Status Indicator Technology
VGP	Vessel General Permit
VMT	vehicle miles of travel
VSL	value of a statistical life
WCI	Western Climate Initiative

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation