4.0 Policy Analysis

4.0 Policy Analysis

The intent of this chapter is to provide planners with approaches and methods to anticipate the freight demand impacts resulting from government policies (both transportation and non-transportation) at all levels of government. Previous chapters have dealt with demand estimation for specific, individual facilities: for existing facilities in Chapter 2 and for new facilities in Chapter 3.

The scope of Chapter 4 is broader. It is not limited to a particular facility (new or prospective). Instead, the emphasis is on estimating the likely impacts of proposed public policies on freight demand (usually by mode or submode) in a metropolitan area, a state, a region, or the nation as a whole. The policy under investigation might be a federal policy, a state policy, or even a policy in a metropolitan area. The policy might be a direct transportation policy (e.g., a fuel tax increase or an increase in some other user fee) or a general policy with transportation implications (e.g., a change in trade policy). Furthermore, the policy may be made at the federal or state level, while its impact at the local level may be of interest to a Metropolitan Planning Organization.

Policy impact specification is facilitated if a systematic, analytical approach is followed. This chapter will develop a four-step approach to assess the transportation demand impact of government policies:

- Structure the policy impact assessment process
- Develop a profile of base-case conditions
- Estimate how the policies under consideration will affect costs and other service characteristics
- Predict the effects of the policies on demand (overall demand or demand by mode or submode)

The next four sections discuss these steps.

■ 4.1 Structuring the Policy Impact Assessment Process

To conserve study resources and improve the accuracy of analysis results, the analyst should take the time, at the start, to structure the analytic

process and provide an overall framework for it. The structuring process, indeed, drives the rest of the analysis – all the way from data collection to the exact quantification of a policy's impact.

The following paragraphs present a series of questions that the analyst should consider at the outset to assist in structuring the policy impact assessment process.

In what ways might the policies under consideration affect demand?

The analyst should examine the attributes of a policy to determine how a mode or modes might be affected by it. In some cases, there is a direct link between a policy and the costs of service for a particular mode or modes. For example, a government policy to increase taxes on diesel fuel will have a direct, quantifiable impact on both truck and rail costs. These increased modal costs must be subsequently evaluated in terms of the impact of increased costs on demand for the respective modes. However, the analyst's initial assessment of the process link between the policy and the mode will dictate how the overall analysis should proceed.

The link between a proposed policy and modal costs may be less direct for other types of policies. For example, government truck size and weight policies will have a direct impact on the types of equipment that motor carriers will be able to use. The costs of providing motor carrier service are, in turn, linked to the types of equipment that carriers' use – i.e., unit costs of transportation tend to decrease with use of larger-sized equipment. Again, a careful structuring of the process will shape the specific analytic approach needed to link a policy (increased size and weight) to modal costs and, in turn, to demand for that mode.

Rather than either directly or indirectly affecting modal demand by changing modal costs, some policies can have a direct impact on modal demand. Included in this group of policies are those dealing with international trade (NAFTA, GATT, etc.) in which the policy itself stimulates trade and the necessary transportation to accomplish the additional trade. Also included in this category are policies requiring U.S. content in domestic production of automobiles, for example, which might lower demand for the freight transportation associated with automobiles produced in foreign countries.

While the structuring of the analytic process for the policies mentioned thus far is straightforward, it should be noted that some policies are more difficult to frame. For example, consider government policies dealing with truck safety. While these policies may have some measurable cost-increasing aspects for the motor carrier industry, they may also lower accidents. Reduced accidents may, indeed, offset the cost of monitoring and implementing the safety program. Thus, the structuring of the analytic process must be careful enough to consider all policy ramifications in order to ensure that the process will cover all aspects of the question.

What types of shipments will be affected?

Identifying the types of shipments that might be affected by the policies under consideration is a key step in structuring the policy impact assessment process. Shipment characteristics to be considered include commodity, origin, destination, weight, value, shipment size, frequency of shipment, mode, equipment type, and routing.

What are the potentially significant impacts of demand changes for the policies under consideration and what procedures will be used to estimate these impacts?

Demand estimation usually is conducted as the first step in a process of evaluating all the important impacts of policy options, rather than as an end in itself. Important impacts might include costs to shippers and receivers, the financial viability of key industries, pavement costs, energy consumption, emissions, etc. The need to estimate certain impacts may place special demands on the analysis process. For example, pavement costs are affected not only by traffic volumes but also by vehicle axle weights. Hence, if pavement costs are an issue, it may be necessary to structure the demand analysis to provide predictions of how the policies under consideration will affect traffic by trucks with different numbers of axles and operating weights. Similarly, if emissions are an issue, it may be necessary to predict demand separately for transportation sub-modes that have significantly different emission rates per ton-mile.

For what time period(s) are demand estimates needed?

The effects of policies on demand may vary considerably over time. Usually, these effects occur as a result of changes in costs to shippers, carriers, or receivers. Since time is required to change equipment, shipping patterns, and other characteristics in response to cost changes, the effects of policies on demand may grow gradually over time. Most commonly, policy analysis focuses on a period when long run changes will have had time to occur. In some cases, however, the short run effects can be important. Consider, for example, policies that would greatly increase the price (or reduce the availability) of fuel. Over the long run, such policies will most likely result in the use of more fuel efficient vehicles. In the short run, however, these policies may be much more disruptive.

What data or forecasts are available for developing a profile of base-case conditions?

Estimating the effects of policies on demand requires that the analyst first develop base-case demand flows in the specific geographic areas under investigation. These areas could involve region-to-region traffic flows; state-to-state traffic flows, etc. The greater the level of detail available regarding existing freight flows, the more detailed the impact assessment will be. Ideally, freight flow data will include commodity-specific, mode-

specific information. Rate and service information for each mode on the freight corridor is important as well. The policy analyst must be creative and persistent in the pursuit of data. Often, the analyst must be willing to make compromises and accept data with deficiencies in order to proceed with the analysis. Also, available data might be dated and require that projections be made in order to bring the data base up to current conditions.

What other resources (time, personnel, etc.) are available for the policy impact assessment process?

The policy development and analysis process may involve considerable trial and error, with ad hoc revisions to policies to address problems with the policies that are uncovered in the analysis process or by others. This places a premium on demand analysis procedures that can be applied quickly and easily.

Many public agencies and private groups with very different perspectives may participate in the policy development and analysis process. It is highly desirable for the various participants in the process to be able to understand the source of demand estimates and, if they choose, to reproduce these estimates. Demand estimates produced by "black box" methodologies (particularly when the results contain anomalies that cannot be easily explained) will carry little credibility in the process.

■ 4.2 Developing a Profile of Base-Case Conditions

In policy analysis, the profile of base-case conditions serves as the platform from which the impacts of policies on demand are projected. To construct this platform, the analyst usually carries out the following steps:

- Identify the types of shipments that might be significantly affected by the policies under consideration.
- Compile information on current demand for these shipments.
- Project current demand forward in time to the analysis period(s)

These steps are discussed in the following subsections.

Identifying Affected Shipments

As noted in the preceding section, key characteristics to be considered in determining whether a shipment will be affected include commodity, origin, destination, weight, value, shipment size, frequency of shipment,

mode, equipment type, and routing. Appendix A provides an extensive discussion of factors that influence freight demand, including factors that influence demand directly (for example by increasing the volume of goods to be shipped) and factors that influence demand through their effects on costs and other service characteristics.

Compiling Data on Current Demand

Ideally, the profile of base-case conditions would cover all shipments affected by the policies under consideration and would distinguish among shipments that might be affected differently. As a practical matter, however, the analyst is usually severely limited by data availability in approaching this ideal.

Data sources for current demand may be obtained from surveys conducted by others or by special ad hoc surveys. Appendix D provides an overview of freight transportation survey procedures and methods that might be used in conducting special ad hoc surveys. However, survey techniques are usually better suited to addressing forecasting problems such as those discussed in Chapter 3, which tend to be more localized in nature.

Existing freight data sources are examined below in terms of structure and coverage for specific demand characteristics. Full descriptions of each data source are contained in Appendix B. Each source is described in terms of:

- source and availability;
- scope of coverage (mode);
- data structures and orientation;
- data collection method and source;
- coverage of specific freight demand characteristics; and
- limitations in coverage and use.

Scope and Structure

Scope of coverage can be defined relative to mode, subsystem, market, or type of activity measured. Databases typically cover one mode or several substitutable modes, and they may focus on a particular transportation subsystem (e.g., Great Lakes), type of operations (e.g., containerized vessel statistics), market (e.g., international trade) or commodity group. Exhibit 4.1 describes the scope of coverage of sources identified.

Exhibit 4.1 Scope of Freight Databases

Data Base	Scope of Coverage
1993 Commodity Flow Survey (CFS)	Originating shipments for all U.S. manufacturing, mining, wholesale and selected retail and service establishments
TRANSEARCH (Reebie)	Traffic between 183 BEAs compiled from several sources
Freight Transportation and Logistics Service (DRI/MH)	Regional commodity traffic by barge, rail and truck compiled from several sources
U.S. Imports/Exports of Merchandise on CD-ROM	Quantity and value of merchandise shipped between U.S. and foreign countries; weight for air and vessel
U.S. Exports by State of Origin (Census)	Value of U.S. exports for all modes; weight for air and vessel
U.S. Exports by State of Origin (MISER)	Value of U.S. exports for all modes; weight for air and vessel
U.S. Exports and Imports Transshipped via Canadian Ports	Value and weight of U.S. imports and exports to foreign countries via Canadian ports
The Directory of U.S. Importers/Exporters	Listing of U.S. companies engaged in international trade; total traffic shown when available
National Transportation Statistics, Annual Report	Activity and industry statistics by mode
U.S. Air Freight Origin Traffic Statistics (Colography)	Weight, value and number of air cargo shipments for selected top U.S. producing industries
U.S. Air Carrier Traffic and Capacity (T-100) Data	Airport-to-airport domestic air freight tonnage for reporting U.S. carriers
FAA Airport Activity Statistics (T-3)	Airport air freight enplaned weight for reporting U.S. carriers
Worldwide (North American) Airport Traffic Report (ACI)	Air freight weight for ACI-member airports
ICC Carload Waybill Sample *	Sample of all rail waybills for movements terminating on U.S. railroads meeting reporting standard
Freight Commodity Statistics (AAR)	All commodity traffic for U.S. Class I railroads
North American Trucking Survey (NATS)	Truck stop sample of truck weights; predominantly long-haul truckload carriers
LTL Commodity and Market Flow Database	Weight, number of shipments, and number of pieces by traffic lane for participating carriers
Truck Inventory and Use Survey (TIUS)	Sample of trucks (including pickups and vans) registered in each state
Nationwide Truck Activity and Commodity Survey (NTACS)	Sample of daily/weekly activity for trucks (including pickups and vans) registered in each state
Port Import/Export Reporting Service (PIERS)	International waterborne shipments entering or exiting U.S. ports (excluding some small-volume ports)
U.S. Waterborne General and Intransit Shipments	Value and weight of waterborne trade between U.S. and foreign ports; low value shipments are estimated
Waterborne Commerce and Vessel Statistics (ACOE) *	Weight and vessel trips for all domestic and waterborne movements on U.S. waterways or via U.S. ports
Ship Movements Database (Lloyd's)	Vessel movements on international trade routes as reported at principal world ports
World Sea Trade Service (DRI/MH)	Weight and containerloads for ocean traffic on over 700 major world trade routes
Lock Performance Monitoring System (PMS) *	Activity at locks owned or operated by the U.S. Army Corps of Engineers
St. Lawrence Seaway Traffic Reports	Weight and number of vessel transits on the St. Lawrence Seaway
Lake Carriers' Association Annual Report	Weight and number of vessels on the Great Lakes reported by LCA members
Exports from Manufacturing Establishments	Export value and related employment for all U.S. manufacturing establishments
Fresh Fruit and Vegetable Shipments	Fresh fruit and vegetable weight by month collected from various sources
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	Fresh fruit and vegetable weight for 23 U.S. and 4 Canadian cities estimated from various sources
Quarterly Coal Report	Weight of coal shipped by all U.S. companies which own, purchase, or distribute 50,000 tons per year
Natural Gas Monthly	Shipment activity for all generating electric utilities and a sample of companies delivering natural gas to consumers
Natural Gas Annual	Activity for all companies that deliver to consumers, handle interstate movements, or are licensed to import/export
Petroleum Supply Monthly	Shipment activity by survey of U.S. refiners, blenders, plant operators, transporters, and importers
Grain Transportation Report	Grain traffic and carloads compiled from various sources

* Public Use Data Only

Exhibit 4.2 further categorizes the sources in terms of their modal coverage, basic structure and level of detail.

The multi-modal sources include the Commodity Flow Survey and TRANSEARCH, both of which provide information on model share on an origin/destination basis. The Census foreign trade statistics distinguish vessel and air movements from total shipments, and will provide rail/truck breakdowns for border traffic in future years. Multi-modal sources also include those which identify, without characterizing, modal use (e.g., Directory of Importers/Exporters) or profile individual modes in standardized formats without considering modal split (e.g., National Transportation Statistics).

In Exhibit 4.1, several types of database are distinguished:

- Shipment-based
  - true origin-destination flows
  - modal origin-destination flows;

- Transport-based
  - modal origin-destination flows
  - point activity at transportation nodes
  - subsystem profile
  - carrier profile
  - modal profile; and

- Other
  - point activity at origin or destination
  - commodity or market profile.

The shipment-based category consists of databases that contain separate records for individual shipments (on either a comprehensive or sample basis). The two subcategories of this category distinguish between general databases that cover movements between production and consumption locations ("true origin-destination flows") and modal databases that cover only (or primarily) that portion of each movement made on a specific mode. Some of the databases in this second category (e.g., PIERS) contain some information on actual origins or destinations. Although the "true O/D" subcategory sounds like it is more specific than the "modal O/D" subcategory, for many databases, true origins and destinations are specified only at a fairly aggregate level of detail and usually the modal specification covers only the principal mode (or, for import/export data, the mode used for entering or leaving this country).

The transport-based category includes databases measuring transportation flows for modal system or subsystems. Some of these databases provide aggregate data on transportation flows. Others provide point activity at

Exhibit 4.2 Mode, Type, and Structure of Freight Databases

Data Base	Mode	Data Base Type	Level of Detail	Domestic/ International
1993 Commodity Flow Survey (CFS)	M	Shipment - True O/D	NTAR-NTAR Combinations	Not Identified
TRANSEARCH (Reeble)	M	Shipment - True O/D	BEA-BEA Combinations	Not Identified
Freight Transportation and Logistics Service (DRI/MH)	M	Transport - Modal Profile	National/Regional Aggregates	Not Identified
U.S. Imports/Exports of Merchandise on CD-ROM	M	Shipment - Modal O/D	Country-U.S. Customs District Combinations	International
U.S. Exports by State of Origin (Census)	M	Shipment - True O/D	State-Country Combinations	International
U.S. Exports by State of Origin (MISER)	M	Shipment - True O/D	State-Country Combinations	International
U.S. Exports and Imports Transshipped via Canadian Ports	M	Shipment - Modal O/D	Country-U.S. Customs District Combinations	International
The Directory of U.S. Importers/Exporters	M	Other - Origin Activity	Company	International
National Transportation Statistics, Annual Report	M	Transport - Modal Profile	National Aggregates	Not Identified
U.S. Air Freight Origin Traffic Statistics (Colography)	A	Other - Origin Activity	U.S. County	Domestic & Intl.
U.S. Air Carrier Traffic and Capacity (T-100) Data	A	Transport - O/D	Airport-Airport Combinations	Not Identified
FAA Airport Activity Statistics (T-3)	A	Transport - Point Activity	Airport	Not Identified
Worldwide (North American) Airport Traffic Report (ACI)	A	Transport - Point Activity	Airport	Domestic & Intl.
ICC Carload Waybill Sample *	R	Shipment - Modal O/D	BEA-BEA Combinations	Domestic & Intl.
Freight Commodity Statistics (AAR)	R	Transport - Modal Profile	Regional Aggregates	Not Identified
North American Trucking Survey (NATS)	T	Shipment - Modal True O/D	City-City Combinations	Not Identified
LTL Commodity and Market Flow Database	T	Shipment - Modal True O/D	ZIP3-ZIP3 Combinations	Domestic & Intl.
Truck Inventory and Use Survey (TIUS)	T	Transport - Carrier Profile	Vehicle	Not Identified
Nationwide Truck Activity and Commodity Survey (NTACS)	T	Transport - Carrier Profile	Vehicle	Not Identified
Port Import/Export Reporting Service (PIERS)	W	Shipment - Modal O/D	Port-Port (Some Shipper/Consignee Locations)	International
U.S. Waterborne General and Intransit Shipments	W	Transport - O/D	Port-Port Combinations	International
Waterborne Commerce and Vessel Statistics (ACOE) *	W	Transport - Point/Sub-system Activity	Port/Waterway Segment	Domestic & Intl.
Ship Movements Database (Lloyd's)	W	Transport - O/D	Vessel Trip (Port-Port)	International
World Sea Trade Service (DRI/MH)	W	Transport - O/D	Coastal Range-Coastal Range Combinations	International
Lock Performance Monitoring System (PMS) *	W	Transport - Point Activity	Waterway Lock	Not Identified
St. Lawrence Seaway Traffic Reports	W	Transport - Sub-system Activity	Waterway Segment	Domestic & Intl.
Lake Carriers' Association Annual Report	W	Transport - Point Activity	Origin Port or Lake	Not Identified
Exports from Manufacturing Establishments	N	Other - Origin Activity	State	International
Fresh Fruit and Vegetable Shipments	MC	Other - Origin Activity	State/Country	Domestic & Intl.
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	MC	Transport - O/D	State-City Combinations	Domestic & Intl.
Quarterly Coal Report	MC	Other - O/D Activity	State/Country Combinations	Domestic & Intl.
Natural Gas Monthly	MC	Other - O/D Activity	State/Country Combinations	Domestic & Intl.
Natural Gas Annual	MC	Other - O/D Activity	State/Country Combinations	Domestic & Intl.
Petroleum Supply Monthly	MC	Transport - O/D	Region-Region (State) Combinations	Not Identified
Grain Transportation Report	MC	Other - Commodity Profile	Coastal Range/Lock	Not Identified or Intl.

* Public Use Data Only

Mode: M=Multimodal, A=Air, R=Rail, T=Truck, W=Water, MC= Multimodal, Commodity-Specific

ports, locks, terminals or border crossings without further information about movements. Measurements of freight demand within this category generally include distributions and cross-tabulations over key factors relevant to the operations of a particular transport system. For example, port statistics might include breakdowns by commodity, vessel type, origin, and destination, but exclude detail on inland mode or shipment size distributions. Data on subsystem activity such as inland waterways or highway segments are similarly structured.

Profiles of carrier operations such as those provided by the Truck Inventory and Use Survey (TIUS) and the National Truck Activity and Commodity Survey (NTACS) can describe demand patterns or trends through association with traffic activity for particular regions of operations, equipment types or commodities. More generalized profiles of modal activity (i.e., without carrier or network orientation) provide similar information at a regional or national level.

The "other" category consists of two subcategories. The larger of these contains databases showing point activity at an origin and/or destination but without any linkages and, except for the Colography Group's air freight statistics, without any modal detail. The last subcategory consists of a single database, the Grain Transportation Report, which is essentially a profile of rail and water transport of grain.

Other key factors in the definition of freight demand databases include the level of detail, and whether or not both domestic and international shipments are covered and whether they are distinguishable.

Coverage of Commodity Characteristics

The relevance of commodity detail in freight demand analysis was detailed previously and the coverage of relevant characteristics is summarized in Exhibit 4.3.

The extent and method of commodity detail in individual data sources reflects the data source and its intended orientation. Trade flow databases use product-based classification systems such as the Harmonized Schedule (HS) of Foreign Trade and the Standard International Trade Classification (SITC), while transport-oriented sources use classifications such as the Standard Transportation Commodity Codes (STCC) or specialized categories of products. Commodity-specific sources may use descriptive categories unique to a particular industry and without a formal coding system, while modal point-specific sources may classify freight solely based on handling characteristics (e.g., bulk, container, or breakbulk) or general service categories (e.g., air freight, express and mail).

The influence of data users is also indicated for certain sources. The importance of monitoring hazardous material activity has resulted in

Exhibit 4.3 Commodity Information in Freight Databases

Data Base	Commodity Classification (Level of Detail)				Comments
	Product	Producer	Transport	Other	
1993 Commodity Flow Survey (CFS)			STCC (5)	Hazmat	STCC (5) for National, STCC(3) for NTAR-NTAR
Transearch (Reebie)			STCC (4/5)		Detail dependent on mode
Freight Transportation and Logistics Service (DRI/MH)			STCC		
U.S. Imports/Exports of Merchandise on CD-ROM	HS (10), SITC (5)	SIC (4)		End User (4)	
U.S. Exports by State of Origin (Census)	SITC (4)	SIC (2)			
U.S. Exports by State of Origin (MISER)		SIC (2)			
U.S. Exports and Imports Transshipped via Canadian Ports	HS (4)				
The Directory of U.S. Importers/Exporters	HS (10), Desc.				
National Transportation Statistics, Annual Report					
U.S. Air Freight Origin Traffic Statistics (Colography)		SIC (4)		Size	Shipment-size categories possible (e.g., Express, Heavy)
U.S. Air Carrier Traffic and Capacity (T-100) Data				Size/Priority	Size/Priority: Express, Freight, Mail (Priority/Non-Priority)
FAA Airport Activity Statistics (T-3)				Size/Priority	Size/Priority: Express, Freight, Mail (Priority/Non-Priority)
Worldwide (North American) Airport Traffic Report (ACI)				Size Group	Size: Freight, Mail
ICC Carload Waybill Sample *			STCC (5)	Hazmat	
Freight Commodity Statistics (AAR)			STCC (5)		
North American Trucking Survey (NATS)			STCC (3)		
LTL Commodity and Market Flow Database				Service	Service: Standard/Non-Standard, Special Equipment
Truck Inventory and Use Survey (TIUS)			TIUS	Hazmat	Survey Classifications
Nationwide Truck Activity and Commodity Survey (NTACS)			TIUS	Hazmat	Survey Classifications
Port Import/Export Reporting Service (PIERS)	HS (10), PIERS				PIERS groups; Full manifest description also available
U.S. Waterborne General and Intransit Shipments	HS (6), SITC				
Waterborne Commerce and Vessel Statistics (ACOE) *			CCDWC		
Ship Movements Database (Lloyd's)					
World Sea Trade Service (DRI/MH)	SITC Groups				Specialized SITC groupings
Lock Performance Monitoring System (PMS) *			PMS (2)		Corps-developed groups
St. Lawrence Seaway Traffic Reports	Special Groups			Toll-Based	
Lake Carriers' Association Annual Report	Special Groups				Bulk Groups, Petroleum, Grains
Exports from Manufacturing Establishments		SIC (3)			
Fresh Fruit and Vegetable Shipments	Desc.				Some grouping for low volume or mixed commodities
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	Desc.				Some grouping for low volume or mixed commodities
Quarterly Coal Report	Desc.				Some commodity breakdown for physical characteristics
Natural Gas Monthly	Desc.				
Natural Gas Annual	Desc.				
Petroleum Supply Monthly	Desc.				
Grain Transportation Report	Special Groups				Total grains; wheat, corn and soybeans

* Public Use Data Only

HS= Harmonized Schedule, SITC= Standard International Trade Classification, SIC=Standard Industrial Classification, STCC=Standard Transportation Commodity Code, CCDWC=Commodity Classification for Domestic Waterborne Commerce, Desc.= Product Descriptions (with no coding system)

special designations in some sources (e.g., the ICC waybill statistics). The increased importance of trade activity to the U.S. economy resulted in the creation of specialized end-user codings for foreign trade, and an expansion in the concordance of trade schedules between countries.

Coverage of Origin/Destination Characteristics

Origin and destination detail is either explicitly represented in the shipment-based sources, or it can sometimes be inferred from the routing patterns of transport-based sources (see Exhibit 4.4). Origin and destination can be directly linked (e.g., PIERS), represented separately (Fresh Fruit and Vegetable Shipments) or represented for just one point (e.g., Colography Group origin areas).

Detailed locations are generally aggregated into groupings (e.g., BEA, NTAR or ZIP3), although PIERS includes actual shipper and consignee names and locations. Other O/D definitions follow political (e.g., state or county) or international boundaries.

Besides the lack of coverage and the limitations of non-shipment-based data, additional problems shown in the O/D characteristics include:

- traffic may be assigned based on billing/documentation locations or the location where the survey information is provided, rather than the actual point of production or consumption;
- multi-location traffic by one shipper may be assigned to a single location;
- O/D definitions may not be directly correlated with other data sources (e.g., BEA definitions vs. state-based statistics); and
- data aggregations for confidentiality purposes may prove ambiguous relative to the transport network (e.g., regional state of export data).

Coverage of Shipment Characteristics

The representation of shipment activity in the databases is based on descriptions of shipment volume, seasonality and other factors (see Exhibit 4.5).

The most common volume measure is weight, which is utilized in most of the data sources. Total shipment value is available for the trade-related sources, and is primarily measured at the U.S. point of import or export. The Colography Group's air freight statistics are the only current domestic source measuring value; although the Commodity Flow Survey (CFS), which will not be available until 1995, will include total value.

Exhibit 4.4 Origin/Destination Information in Freight Databases

Data Base	Origin/Destination Detail	Comments
1993 Commodity Flow Survey (CFS)	State-State, NTAR-NTAR	Anticipated structure
TRANSEARCH (Reebie)	BEA-BEA	Also Canadian province detail
Freight Transportation and Logistics Service (DRI/MH)	Region-Region	For rail traffic only
U.S. Imports/Exports of Merchandise on CD-ROM	U.S.-Country	U.S. trade only
U.S. Exports by State of Origin (Census)	State/Region-Country	U.S. detail differs for 3 data extracts
U.S. Exports by State of Origin (MISER)	State-Country	
U.S. Exports and Imports Transshipped via Canadian Ports	U.S.-Country	Transshipments identified based on non-Canada shipments via Canada border
The Directory of U.S. Importers/Exporters	Address/City	May not assign activity correctly for multi-location companies
National Transportation Statistics, Annual Report		
U.S. Air Freight Origin Traffic Statistics (Colography)	County of Origin	Colography also defines market areas relative to airports
U.S. Air Carrier Traffic and Capacity (T-100) Data		May be inferred from airport O/D
FAA Airport Activity Statistics (T-3)		May be inferred from airport origin
Worldwide (North American) Airport Traffic Report (ACI)		May be inferred from airport origin
ICC Carload Waybill Sample *	BEA-BEA	International shipments are identified
Freight Commodity Statistics (AAR)	2 U.S. Regions	Regions based on railroad headquarters, not operations.
North American Trucking Survey (NATS)	City-City	
LTL Commodity and Market Flow Database	ZIP3-ZIP3/Foreign Area	
Truck Inventory and Use Survey (TIUS)		May be inferred from registration state or states of operations
Nationwide Truck Activity and Commodity Survey (NTACS)	None on Public Use Tape	May be inferred from registration state or states of operations
Port Import/Export Reporting Service (PIERS)	U.S. City-Foreign City/Country; Shipper	Foreign city and shipper only available for exports
U.S. Waterborne General and Intransit Shipments	U.S.-Country	May be inferred from port routing
Waterborne Commerce and Vessel Statistics (ACOE) *		May be inferred from port/waterway routing
Ship Movements Database (Lloyd's)		May be inferred from port routing
World Sea Trade Service (DRI/MH)	U.S.-Country	May be inferred from coastal routing
Lock Performance Monitoring System (PMS) *		May be inferred from lock pool O/D based on lock-to-lock comparisons
St. Lawrence Seaway Traffic Reports	U.S., Canada, Foreign	Inferred from port of lading location
Lake Carriers' Association Annual Report		May be inferred from port of lading location
Exports from Manufacturing Establishments	State of production	
Fresh Fruit and Vegetable Shipments	State of origin; U.S./foreign destination	May only capture modal routing
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	State/country of origin; city destination	23 U.S/4 Canadian cities; may only capture modal routing
Quarterly Coal Report	State/country of origin/destination	Flows by O/D pairs not available.
Natural Gas Monthly	State/Country-U.S./Country	Destination use sector (e.g., utilities) also identified
Natural Gas Annual	State/Country of production/consumption	
Petroleum Supply Monthly	Country for foreign	May be inferred from routing
Grain Transportation Report		

* Public Use Data Only

NTAR=National Transportation Analysis Region, BEA=Bureau of Economic Analyis Region, ZIP3=3-digit U.S. zip code

Exhibit 4.5 Shipment Information in Freight Databases

Data Base	Volume Detail			Seasonal	Comments
	Weight	Value	Other	Detail	
1993 Commodity Flow Survey (CFS)	X	X			
TRANSEARCH (Reebie)	X				
Freight Transportation and Logistics Service (DRI/MH)	X				
U.S. Imports/Exports of Merchandise on CD-ROM	X	X	Unit Quantity	Month	Weight and value for water/air; value for all modes combined
U.S. Exports by State of Origin (Census)	X	X		Quarter	Weight and value for water/air; value for all modes combined
U.S. Exports by State of Origin (MISER)	X	X		Quarter	Weight and value for water/air; value for all modes combined
U.S. Exports and Imports Transshipped via Canadian Ports	X	X			
The Directory of U.S. Importers/Exporters	X	X			Shown for total trade when available
National Transportation Statistics, Annual Report	X				
U.S. Air Freight Origin Traffic Statistics (Colography)	X	X	No. of Shipments		Weight/Number by Shipment Size Categories
U.S. Air Carrier Traffic and Capacity (T-100) Data	X			Month	By cargo type
FAA Airport Activity Statistics (T-3)	X			Month	By cargo type
Worldwide (North American) Airport Traffic Report (ACI)	X				By cargo type
ICC Carload Waybill Sample *	X		Carloads	Day	Rail origination date
Freight Commodity Statistics (AAR)	X			Quarter	
North American Trucking Survey (NATS)	X				
LTL Commodity and Market Flow Database	X		No. of shipments & pieces	Month	
Truck Inventory and Use Survey (TIUS)					
Nationwide Truck Activity and Commodity Survey (NTACS)					Not available for Public Use Tape
Port Import/Export Reporting Service (PIERS)	X	X	No. of packages by type	Day	Vessel arrival date, number of containers also available
U.S. Waterborne General and Intransit Shipments	X	X		Month	
Waterborne Commerce and Vessel Statistics (ACOE) *	X				
Ship Movements Database (Lloyd's)				Day	Weight may be inferred from vessel capacity & assumed load factor
World Sea Trade Service (DRI/MH)	X				Number of containers also available
Lock Performance Monitoring System (PMS) *	X			Month	No. of barges also available; some weekly data is published.
St. Lawrence Seaway Traffic Reports	X				
Lake Carriers' Association Annual Report	X				
Exports from Manufacturing Establishments		X			Total and export shipment by type (direct, support)
Fresh Fruit and Vegetable Shipments	X			Month	
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	X			Month	
Quarterly Coal Report	X			Quarter	
Natural Gas Monthly			Volume (cubic feet)	Month	Price data available
Natural Gas Annual			Volume (cubic feet)		Price data available
Petroleum Supply Monthly			Volume (barrels)	Month	
Grain Transportation Report	X		Volume (bushels)	Week	Number of carloads, price data available

* Public Use Data Only

Some of the commodity-based sources use specialized volumetric units such as bushels of grain, barrels of petroleum, and cubic feet of natural gas. The ICC Waybill Sample identifies number of carloads for each shipment. The Colography and LTL truck statistics measure the number of shipments, which is also implicitly available for shipment-based databases such as PIERS and the CFS. The number of generic "pieces" is defined for the LTL truck source, while number of units for specified package types are shown in PIERS. For intermodal movements, several sources identify numbers of containers or trailers (as shown in Exhibit 4.6, below).

The Census foreign trade statistics includes a unit of quantity at the most detailed commodity-level based on definitions in the Harmonized Schedule (HS). These units can represent weight, dimensional measures (metric board feet), or physical units (pairs of shoes), and generally cannot be aggregated to higher commodity levels without conversion to common units. Each HS commodity can have up to two quantity definitions, although some commodities (typically high value consumer goods) have no unit specified.

A major problem with the foreign trade statistics for Canada and Mexico has been the lack of weight detail for modes other than vessel and air, and no value breakdown for the other modes of transport. A joint program by the Bureau of Census and Federal Railroad Administration (FRA) is currently addressing this problem.

Another key shipment characteristic is the measure of traffic by time period for use in identifying seasonal or other peaking patterns. Some of the shipment-based sources such as PIERS and the ICC waybill statistics provide actual dates of shipment, although both provide transport dates as opposed to true shipment or delivery dates. The detailed PMS lock records, which are only available for internal Corps studies, include date and time of transit which are also valuable in measuring peaking activity.

Seasonal detail for other sources may be obtainable from the release frequency of the data. For instance, Census publishes monthly foreign trade statistics which can be used to develop general seasonal patterns, while other foreign trade data are released in quarterly form based on confidentiality requirements and economic considerations. Some sources related to highly seasonal flows (e.g., published PMS reports and fruit and vegetable statistics) explicitly present peaking patterns in reports. Several annual sources include no seasonal detail.

Coverage of Transport Characteristics

The representation of transport characteristics can be categorized by the following factors (shown in Exhibits 4.6 through 4.8):

Exhibit 4.6 Information on Modal Coverage and Equipment Freight Databases

Data Base	Modal Coverage							Equipment	
	A	T	R	IW	OW	All	Other	Intermodal	Other
1993 Commodity Flow Survey (CFS)	X	X	X	X	X		Pipeline, parcel	Container Weight	
TRANSEARCH (Reebie)	X	X	X	X	X			No. of Containers	No. of Units by Mode
Freight Transportation and Logistics Service (DRI/MH)		X	X	X					Unit traffic/fleet size by mode
U.S. Imports/Exports of Merchandise on CD-ROM	X				X	X		Container weight (vessel)	
U.S. Exports by State of Origin (Census)	X				X	X		Container weight (vessel)	
U.S. Exports by State of Origin (MISER)	X				X	X		Container weight (vessel)	
U.S. Exports and Imports Transshipped via Canadian Ports							Surface total		
The Directory of U.S. Importers/Exporters							List of modes		
National Transportation Statistics, Annual Report	X	X	X	X	X		Pipeline, parcel		Vehicle inventory
U.S. Air Freight Origin Traffic Statistics (Colography)	X								
U.S. Air Carrier Traffic and Capacity (T-100) Data	X								Aircraft departures by equipment type
FAA Airport Activity Statistics (T-3)	X								Aircraft departures by equipment type
Worldwide (North American) Airport Traffic Report (ACI)	X								Aircraft operations by type
ICC Carload Waybill Sample *			X					No. of trailers/containers	Car type
Freight Commodity Statistics (AAR)			X						
North American Trucking Survey (NATS)		X							Trailer type
LTL Commodity and Market Flow Database		X						Identified	Special equipment use identified
Truck Inventory and Use Survey (TIUS)		X							Vehicle type/configuration
Nationwide Truck Activity and Commodity Survey (NTACS)		X							Vehicle type/configuration
Port Import/Export Reporting Service (PIERS)					X			Container no., size and volume	Vessel name
U.S. Waterborne General and Intransit Shipments					X				Tanker identified
Waterborne Commerce and Vessel Statistics (ACOE) *					X				
Ship Movements Database (Lloyd's)					X				Vessel name
World Sea Trade Service (DRI/MH)					X			Containerloads	Vessel type/size categories
Lock Performance Monitoring System (PMS) *				X					Tow, barge type and size
St. Lawrence Seaway Traffic Reports				X				Container weight	Vessel type, class and size category
Lake Carriers' Association Annual Report				X					
Exports from Manufacturing Establishments						X			
Fresh Fruit and Vegetable Shipments	X	X	X		X	X		Piggyback identified	
Fresh Fruit and Vegetable Arrival Totals for 23 Cities	X	X	X		X				
Quarterly Coal Report		X	X	X	X	X	Slurry		
Natural Gas Monthly					X		Pipeline		
Natural Gas Annual					X		Pipeline		
Petroleum Supply Monthly				X	X		Pipeline		
Grain Transportation Report			X	X	X				Rail carloadings, barge, export ship calls

* Public Use Data Only

A=Air, T=Truck, R=Rail, IW=Inland Waterway/Coastal, OW=Other Water, All=Combined All Modes

Exhibit 4.7 Information on System Utilization in Freight Databases

Data Base	System Utilization: Point	System Utilization: Sub-system
1993 Commodity Flow Survey (CFS)	Port of exit: wgt.	O/D Corridor: Ton-miles, wgt.
TRANSEARCH (Reebie)		O/D Corridor: wgt.
Freight Transportation and Logistics Service (DRI/MH)		
U.S. Imports/Exports of Merchandise on CD-ROM	Customs District: wgt., val., qty.	Modal Route: tons, value, qty.
U.S. Exports by State of Origin (Census)	Customs District/Port: wgt., val.	O/D-Port: wgt., val.
U.S. Exports by State of Origin (MISER)		O/D: wgt., val.
U.S. Exports and Imports Transhipped via Canadian Ports	Customs District/Port: wgt., val.	
The Directory of U.S. Importers/Exporters		
National Transportation Statistics, Annual Report		Modal total: Vehicle-, ton-miles
U.S. Air Freight Origin Traffic Statistics (Colography)		
U.S. Air Carrier Traffic and Capacity (T-100) Data	Airport: wgt.	Modal Route: wgt., ton-miles
FAA Airport Activity Statistics (T-3)	Airport of enplanement/departure	
Worldwide (North American) Airport Traffic Report (ACI)	Airport of enplanement/departure	
ICC Carload Waybill Sample *		Modal Route: wgt., ton-miles, carloads
Freight Commodity Statistics (AAR)		Modal Total: wgt., carloads
North American Trucking Survey (NATS)	City: O/D wgt.	
LTL Commodity and Market Flow Database	City: O/D wgt., # of shpmts./pieces	Modal Route: wgt., ton-miles, shpmts./pieces
Truck Inventory and Use Survey (TIUS)		Modal Total: vehicle miles
Nationwide Truck Activity and Commodity Survey (NTACS)		Modal Total: vehicle miles, operating weeks
Port Import/Export Reporting Service (PIERS)	City, Country, Port: wgt., val., packages	Modal Route: wgt., val.,
U.S. Waterborne General and Intransit Shipments	Port: wgt., val.	Modal Route: wgt., val.,
Waterborne Commerce and Vessel Statistics (ACOE) *	Port: wgt., ton-miles	Waterway: wgt., ton-miles
Ship Movements Database (Lloyd's)	Port: vessel calls, capacity	Modal Route: capacity
World Sea Trade Service (DRI/MH)	Coastal: wgt., containerloads	Modal Route: wgt., containerloads
Lock Performance Monitoring System (PMS) *	Lock: wgt., barges, tows	
St. Lawrence Seaway Traffic Reports		Waterway: wgt., vessel GRT, transits
Lake Carriers' Association Annual Report	Port: wgt., vessel calls, shipments	Modal Route: wgt., vessel calls, shipments
Exports from Manufacturing Establishments		
Fresh Fruit and Vegetable Shipments		Modal Route: wgt.
Fresh Fruit and Vegetable Arrival Totals for 23 Cities		Modal Route: wgt.
Quarterly Coal Report	Customs District/Port: wgt., val.	
Natural Gas Monthly		Pipeline: volume
Natural Gas Annual		
Petroleum Supply Monthly		Modal Route: volume
Grain Transportation Report		Coast, Lock: wgt., units

* Public Use Data Only

Exhibit 4.8 Information on Routing, Carrier, and Cost in Freight Databases

Data Base	Routing: Definition	Routing: Distance	Carrier/ Service	Cost/ Rate
1993 Commodity Flow Survey (CFS)	Port of exit for exports	Estimated from O/D & Mode		
TRANSEARCH (Reebie)				
Freight Transportation and Logistics Service (DRI/MH)				Modal profiles
U.S. Imports/Exports of Merchandise on CD-ROM	Customs District			Import freight charges
U.S. Exports by State of Origin (Census)	Customs District/Port			
U.S. Exports by State of Origin (MISER)				
U.S. Exports and Imports Transshipped via Canadian Ports	Customs District			
The Directory of U.S. Importers/Exporters	List of ports			
National Transportation Statistics, Annual Report		Avg. length of haul		
U.S. Air Freight Origin Traffic Statistics (Colography)	Domestic/Export		Shipment size groupings (e.g., express)	
U.S. Air Carrier Traffic and Capacity (T-100) Data	Airport-Airport Segments	Segment miles (estimated)	Carrier	
FAA Airport Activity Statistics (T-3)	Airport of enplanement		Scheduled/non-scheduled	
Worldwide (North American) Airport Traffic Report (ACI)	Airport of enplanement			
ICC Carload Waybill Sample *	BEA O/D; interchange states	Short line miles (estimated)		Carrier revenue
Freight Commodity Statistics (AAR)				Carrier revenue
North American Trucking Survey (NATS)	City-City			
LTL Commodity and Market Flow Database	ZIP3-ZIP3	from ton-miles	Standard/non-standard	Revenue
Truck Inventory and Use Survey (TIUS)	Intra-/extra-state activity			
Nationwide Truck Activity and Commodity Survey (NTACS)	No. of states, highway type	Annual		
Port Import/Export Reporting Service (PIERS)	City-City/Country via Ports		Carrier	
U.S. Waterborne General and Intransit Shipments	Port-Port		Liner, non-liner, tanker	Import freight charges
Waterborne Commerce and Vessel Statistics (ACOE) *	Waterway-Waterway	from ton-miles		
Ship Movements Database (Lloyd's)	Port-Port		Carrier name	
World Sea Trade Service (DRI/MH)	Coast-Coast		Liner/non-liner	
Lock Performance Monitoring System (PMS) *	Lock			
St. Lawrence Seaway Traffic Reports	Waterway sections		Flag of carrier	Revenue
Lake Carriers' Association Annual Report	Intra-lake Port-Port		Flag of carrier	
Exports from Manufacturing Establishments				
Fresh Fruit and Vegetable Shipments	State/country origin - dom./intl.			
Fresh Fruit and Vegetable Arrival Totals for 23 Cities				
Quarterly Coal Report	Customs District (intl. only)			
Natural Gas Monthly	Pipeline company		Pipeline company	Company financials
Natural Gas Annual				
Petroleum Supply Monthly	U.S. Region-Region			
Grain Transportation Report	U.S. export coast; river lock			Ship charter rates

* Public Use Data Only

- modal coverage;
- equipment detail;
- measures of transport system utilization;
- routing detail;
- carrier/service detail; and
- cost/rate information.

Modal coverage techniques include:

- single mode orientation;
- profiles of individual modes (e.g., National Transportation Statistics);
- modal distributions for origin/destination flows (CFS and TRANSEARCH); and
- appropriate modal coverage for commodity flows (e.g., fruit and vegetable data).

Equipment type information includes identification of intermodal activity or the allocation of traffic to equipment categories which are mode-specific. Container weight is typically distinguished for deep water vessel activity (e.g., Census statistics, PIERS, and the World Trade Sea Service) in order to associate traffic with both service patterns and requirements for terminals and handling equipment. The CFS will also identify containerized shipments and provide the only recent source for domestic and cross-border container activity. Piggyback or TOFC operations are also described for rail activity in the ICC waybill statistics and the Fresh Fruit and Vegetable Shipments.

Some sources provide either traffic or transit activity for mode-specific types of equipment. The available distinctions are geared towards specifying equipment/vehicle handling capabilities, size and capacity, or the type of service or operating patterns.

The ICC waybill statistics identifies rail-car type, NATS identifies rail car and trailer type, and the TIUS and NTACS surveys distinguish vehicle type, trailer type, and configuration. Aircraft type in FAA statistics is defined by cargo capacity and carrier type (combination vs. all-cargo), while vessel categories in the World Sea Trade Service distinguish type of vessel and size (e.g., containerships of varying capacities). The PMS lock statistics differentiate between standard mixed barge configurations and integrated tug-barges, a distinction which conveys information on tow operating patterns (multi-stop vs. dedicated pattern) and equipment ownership (common carrier vs. private).

Some sources such as the Freight Transportation and Logistics Service and the National Transportation Statistics also include information on fleet inventories.

Routing information generally is limited to origin and/or destination for a single mode and may aggregate those points into regions. The proprietary waybill statistics identify rail line routings, but the public use tape only provides the BEAs for the origin and destination stations and intermediate interchange states. Similarly, PIERS only identifies port of export and import relative to the international vessel service, but provides a foreign transshipment port if appropriate. PIERS also identifies the carrier and vessel name, so it is possible to associate traffic activity with actual vessel routings or services as derived from other sources (published service listings or Lloyd's). Some sources also provide distance information, usually estimated from known or inferred routings.

A key element of transport-based data is the ability to estimate utilization for elements of the transport system, which in turn can be related to system capacity, congestion conditions or maintenance requirements. Data sources which identify flows through modal nodes (e.g., port statistics) can be used to define utilization in terms of total cargo and transportation volume. Sources identifying flows over modal routes or corridors can similarly be used to derive utilization estimates such as ton- or vehicle-miles.

Where routing detail is not available, aggregate system activity can be estimated and associated with a widely-defined modal system. For example, annual data on total rail carloads from the Freight Commodity Statistics provides some measure of rail system utilization and trends, assuming a relatively stable pattern of origin/destination.

The final category of transport characteristics relates to the type of transportation carrier or service and the associated cost or rate structures. Carrier name is identified in some sources such as PIERS and the FAA air carrier reports. Carrier/service type is identified in Census waterborne sources as tanker, liner or non-liner based on the type of vessel and vessel itinerary. The FAA airport statistics characterize carrier and service type by allocations into the general categories of scheduled/non-scheduled service.

Other carrier-related characteristics can also affect freight demand. For example, identification of vessel flag in waterborne statistics can be used to identify the impact of cabotage and other cargo reservation schemes, as well as to evaluate the general openness of the market.

Cost and revenue information is very limited in these data sources, mostly being confined to:

- revenue data provided for individual shipments (ICC waybill and LTL databases);
- total system revenue (Freight Commodity Statistics);
- financial information for transportation companies or modal groups; and
- import freight charges for foreign air and waterborne imports in Census statistics based on the difference between shipment value at foreign port of export and at U.S. port of entry.

The increasing use of contract and volume-based rates for the different modes has decreased the usefulness of tariff rates in measuring transportation costs. Transportation costing is often based on the allocation of carrier financial statistics over some generalized measures of total activity (e.g., truck maintenance per vehicle-mile) to derive unit cost factors applied over a wide range of operations.

Projecting Demand for Analysis Time Period

The next step in developing a profile of base-case conditions is projecting estimates of current demand forward in time to the analysis time period. Chapter 2 provides an extensive discussion of procedures to be used for this purpose.

To conserve study resources, it may be possible to skip this step and to use current demand as the platform from which the impacts of policies are estimated. If the analysis time period is not too far in the future, and demand is not expected to change much due to exogenous forces, it is unlikely that projecting current demand into the future would greatly improve accuracy.

■ 4.3 Estimating How Policies Affect Costs and Other Service Characteristics

The process of assessing the impact of a given policy on freight demand usually involves the intermediate step of assessing the impact of that given policy on modal costs. This section discusses the process of translating policies into impacts on modal costs as a precursor to assessing the impacts of the policies on modal demand.

Translating Policies into Cost Impacts: A General Framework

The initial step in the process is for the transportation planner to analyze with careful detail how a proposed policy will impact the costs of providing transportation service by one or more mode(s) or modal combinations. For some policies, this step is straightforward. For example, a policy may involve an increase in federal, state, or city tax on fuel or an increase in annual registration fees. Since fuel costs or registration fees are a direct measurable portion of carrier costs, the impact of increasing fuel costs can be translated directly into an impact on modal costs.

However, there is the issue of short-run versus long-run impact that complicates the analysis of even such straightforward policies as increases in fuel taxes or registration fees. Specifically, in the long-run, carriers may shift their vehicle fleet to one that is more fuel efficient or less affected by the tax or fee (e.g., if the tax is on diesel fuel but not on natural gas). While strategies to purchase new vehicles will mitigate the impacts of the policy designed to increase fuel taxes or registration fees, they are clearly long-run adjustments, not even feasible with existing technology, in the case of alternative fueled vehicles for long-distance trucking operations.

With many issues complicating even the straightforward analysis of the impact of fuel price increase or registration fee increases on motor carrier costs, it is not surprising that the assessment of other policies are even more complicated. Take, for example, a policy increasing truck size and weights. While, it may be straightforward to show differences in costs per ton-mile for vehicles of different sizes, there are a whole host of confounding issues with direct bearing on making an overall determination on modal costs. On one level, there is the issue of whether the change in size and weights is a regional change or the issue of the specific highway routes or types to which it applies. The determination of these factors along with behavioral issues such as the speed with which carriers will shift their vehicle fleets to include the larger-size vehicles will determine the specific cost impact of the policy proposed. The transportation planner must carefully assess the cost impact of the policy and make assumptions regarding the timing for the adoption of the new equipment in order to make an accurate assessment of the impact of a policy like an increase in vehicle size and weights.

Another policy with complications involves policy changes in the driver hours-of-service regulations. As an initial step, the analyst would estimate how the new policies would impact the total hours drivers could accumulate on an annual basis. Reductions in annual vehicle miles traveled would impact driver costs per vehicle mile in a direct, straightforward fashion. However, full assessment of the impact of the changes in hours-of-service on carrier costs would be complicated by issues of implementation. Carriers may make basic changes in their operational patterns to adjust to the new hours-of-service regulations.

These adjustments might mitigate some of the impact of the changes and allow drivers to accumulate approximately the same number of annual miles despite the changes in the regulations. However, an assessment of how these adjustments might be made, how many carriers might make the changes, and the specific timing of the changes are all complicating factors that would necessarily confound the assessment of the cost impacts of the proposed policy.

Since the mid-1980s, the Federal Government has significantly increased roadside inspections of motor carrier vehicles as well as general reviews of carrier safety performance. There are direct, measurable costs associated with the increased inspection activity to the carriers. There is the amount of vehicle down-time to conduct the inspections (roadside inspections vary in length from about 20 minutes to over 40 minutes, depending upon the type of inspection and the number of inspectors involved). In addition, if any out-of-service violations are found during an inspection, the vehicle and/or its driver are taken out-of-service until the violation is corrected. Again, this down-time has a direct measurable impact on motor carrier costs. Carrier reviews conducted on-site also involve direct costs to the carrier in the form of management time devoted to preparing responses to the questions of the inspectors. If the carrier is given a conditional or unsatisfactory rating as a result of the review, the costs to the carrier may be far more significant than the direct costs associated with answering the questions of the inspectors. Conditional or unsatisfactory ratings may lead to lost revenue from shippers who refuse to deal with anything but carriers with a satisfactory rating. Thus, carriers must devote resources to ensuring that their rating is satisfactory or suffer the economic losses associated with a conditional or unsatisfactory rating.

The point here is that translating a policy of increased safety inspections into a cost impact on motor carriers is complex. For some carriers, there will be enhanced safety program initiated in order to ensure compliance. These costs, however, can be offset by gains to the carriers due to accidents avoided as a result of the safety program. This last calculation, however, necessarily involves an estimate of the number and type of accidents avoided as a consequence of the initiated safety programs. There is also difficulty associated with estimating the losses associated with either a conditional or unsatisfactory rating. In any event, a policy of initiating increased inspections has a very complex impact on motor carrier costs. The job of the analyst is to trace out the patterns and estimate the impact on costs.

At present there is considerable discussion and test projects dealing with the introduction of advanced technological and communications devices on our nation's highways. Test IVHS programs dealing with commercial operations are beginning in earnest. While the objective is not to discuss the merits of these programs, they involve some innovative ways to gather data regarding trucks passing along the highway in order to speed up and improve the efficiency of the inspection process. If motor carriers had transponders on all their vehicles and roadways were equipped with

transponders, vehicles passing checkpoints could be instantly de-coded for information regarding the vehicle (size and weight); licensing and registration; permitting; driver identification; and (in the future) vehicle operating condition. These innovations would speed up and reduce the time of roadside inspections (a saving to the carrier), although there would be new costs associated with installing transponders on the vehicles. The motor carriers would have higher costs due to the installation of the transponders and would most likely be required to pay a user fee for the services associated with having the transponder read. These higher motor carrier costs, however, might be offset if the result of the improved inspection process is a lower accident rate.

Again, the focus for the analyst is to break down the policy (mandatory installation of transponders on motor carriers and readers on the highway network) into its components and to trace all motor carrier cost impacts. Failure to trace all costs (direct and indirect) will adversely impact the policy assessment process.,

The Clean Air Act has a number of provisions requiring states and metropolitan areas to initiate a series of policy actions for urban areas with pollution levels above federal standards – so called "non-attainment" areas. While states and metropolitan areas are given great latitude in adopting "control measures" to lower pollution levels, some discussion has focused on restrictions being placed on motor carrier activity in metropolitan areas during peak traffic hours. Such restrictions have important cost consequences for the motor carrier industry. The policy analyst would have the burden of developing direct cost estimates associated with any restrictions on the operating patterns of motor carriers. Depending upon the specifics of the plan, the analyst would have to investigate the impact on costs of interstate operations in addition to the local operators. The contemplated restrictions would have direct and indirect impacts on motor carrier costs. There would be delays associated with necessity to stop operations during certain hours of the day. However, the implications on costs might also be felt through hour-of-service restrictions and the additional costs associated with adding drivers as a result of increased layovers. There are also the costs associated with penalties due to carriers failing to meet just-in-time delivery commitments due to the delays associated with restricted operations. The point again is that the direct policy of restricting truck operations has significant indirect impacts on the operations of intercity, interstate motor carriers. If the policy analyst doesn't anticipate these secondary, complicating impacts and assess their cost impacts, the policy will not be analyzed properly.

ABC Costing and the Identification of Cost Drivers

While many additional examples can be used to illustrate the translation of proposed policies into modal cost impacts, the important point is the general one, i.e., planners must break down the impact of any proposed

policy into a comprehensive set of individual impacts on modal costs which are summed together to constitute an overall impact of a policy on modal costs. Fortunately, the process of identification of the specific, individual impacts of a policy and their conversion to overall impact on modal costs is facilitated by recent developments in activity based costing (ABC Analysis) for transportation modes.

"ABC" systems break down all of a transportation provider's costs into distinct activities and account for all of the carrier's costs by these activities. In the motor carrier industry, less-than-truckload (LTL) carriers have the following set of activities, identified as cost drivers: linehaul, pick-up and delivery, platform, and billing and collecting. For truckload (TL) carriers, the major cost drivers are: linehaul, loading/unloading, cleaning, and billing and collecting.[1]

Within each of these cost activity categories or cost drivers, there is a further identification of separable costs. Thus, linehaul costs are broken down into a number of distinct sub-categories. At the broadest level, the linehaul costs are broken into vehicle costs and driver costs. The vehicle costs are composed of: fuel costs (including taxes, maintenance labor, other supplies, depreciation, and all other costs. Even further disaggregation of these costs are possible. These costs could involve: vehicle registration and licensing, fuel taxes, and other taxes and tolls. Labor costs are divided into costs for drivers and all others connected with the linehaul portion of the trip. A final category would account for overhead costs through some allocation of these costs to the linehaul portion of the trip.

Cost Estimating Procedures

Appendix F discusses simple cost estimating procedures for truck, rail, water, and air freight. The discussion covers factors influencing costs, typical unit costs, and how to adjust for inflation.

■ 4.4 Estimating Changes in Demand Due to Policies

The previous section has focused on the process of estimating the impact of proposed policies on modal costs. The issue addressed in this section is developing ways to translate changes in modal costs into changes in modal demand.

[1] Kenneth Manning, Transportation Consulting Group, Bethesda, Maryland, ATA Sales and Marketing Council, Las Vegas, Nevada, April 25, 1995.

The usual practice in making this translation is to assume that estimated changes in modal costs will be passed onto the shippers and not absorbed by the carriers. There are several reasons to feel confident about such an assumption, at least as it pertains to motor carriers. First, experience during the past fifteen years in a lessened regulatory environment has shown that price decreases have been closely paralleling cost decreases. In fact, in some cases, the pace of price decreases is slightly exceeding the pace of cost decreases due to competitive pressures. Second, since profit margins in most areas of the transportation sector (in particular, the for-hire motor carrier sector) are thin, the ability of carriers to absorb cost increases is highly questionable. This assumption seems quite conservative, especially in the short-term (five to ten years). Beyond that, carriers might be in a position to make fundamental adjustments in their operations to negate the cost impacts of the proposed policy.

Techniques for estimating the effects of changes in costs on demand range from simple elasticity methods to complex structural modals involving mode choice models and analyses of shipment routings. Our focus in this chapter is on the use of elasticities because the more complex models are of limited use in policy analysis (due primarily to their extensive data requirements).

The use of price elasticities is a relatively simple way of estimating how changes in cost affect demand. In loose terms, elasticity is defined as the percent change in demand caused by a one percent change in price. For example, a price elasticity of -0.5 indicates that a one percent increase in price per unit would cause a 0.5 percent decrease in the number of units demanded. Economists talk about both *own price elasticities* and *cross price elasticities*. An own price elasticity measures how demand for a good is affected by the price of the good itself; a cross price elasticity measures how demand for a good is affected by the price of a different good (usually competitive to the former). For example, a rail ton-mile cross elasticity with respect to truck price measures the percentage increase in rail ton-miles caused by a one percent increase in truck costs.

In concept, any change in modal transport costs can result in some traffic diversion from one mode to another. In practice, estimates of such diversion generally are important only in the case of diversion between rail and truck and between barge and rail. These two types of diversion are discussed below.

Rail/Truck Diversion

The modal diversion effects of potential policy changes affecting rail and/or truck transport frequently are an issue of some interest, in part because of public concerns about the financial viability of several of the country's major railroads. In the recent past, estimates of these modal diversion effects have been obtained using the Intermodal competition

Model (ICM), a proprietary model developed by the Association of American Railroads (AAR),[2] or from consultant or railroad industry[3] analyses. A new nonproprietary model, the Truck-Rail, Rail-Truck (T-R/R-T) Diversion Model, has recently been developed by Roberts Associates for the Federal Railroad Administration,[4] and public release of this model is expected within the next few months.

Appendix H contains a review of the ICM and also a review of the T-R/R-T Model based on previously released draft documentation. Unfortunately, our review of the latter model raises some serious concerns about parameter values used by the model. Based on currently available information, we do not believe this model is appropriate for analyzing modal diversion.

Appendix G reviews the results of several recent analyses of modal diversion performed using the ICM and other tools. On the basis of this review, a procedure is developed for using aggregate data and separate estimates of the effects of policy changes on transport costs to produce rough estimates of modal diversion. This procedure requires the use of some judgment and the estimates it produces may be off by a factor of two or three; however, it is not proprietary and it does not require the use of disaggregate data on individual shipments. This procedure is presented below:

1. Use procedures presented in Appendix F and other information to estimate the effect of the policy changes under consideration on total logistics costs (TLC) for the affected mode(s).

2. Express any estimated change in truck TLC as a (positive or negative) percentage change in the cost of truck transport, exclusive of other logistical costs (OLC), for all rail-competitive truck movements in the region of interest. Use appropriate judgment in distinguishing between the effects on rail-competitive truck movements and other truck movements.

3. Express any estimated change in rail TLC as a (positive or negative) percentage change in the cost of rail transport, exclusive of OLC, for all truck-competitive rail movements in the region of interest. Use

[2]Scott M. Dennis, *The Intermodal Competition Model*, Association of American Railroads, Washington, D.C., September 1988.

[3] N.A. Irwin and R.A. Barton, *Economics of Truck Sizes and Weights in Canada*, Final Report, Council on Highway and Transportation Research and Development and the Roads and Transportation Association of Canada, Ottawa, July 1987.

[4]Transmode Consultants, Inc., *Truck-Rail, Rail-Truck Diversion Model*, User Manual, Draft, prepared for the Federal Railroad Administration, Washington, D.C., December 1994.

appropriate judgment in distinguishing between the effects on truck-competitive rail movements and other rail movements.

4. Multiply the Step 2 result by 0.4 and the Step 3 result by 0.6, and subtract the latter percentage from the former one.

5. Estimate total rail tonnage that would be affected by the changes in the rail system, and/or if transported by truck, would be affected by the changes in the truck system. Include in this estimate all rail tonnage, including tonnage that is very unlikely to be transported by truck.

6. Apply the percentage developed in Step 4 to the estimate of rail tonnage from Step 5 to obtain an estimate of tons of freight diverted from rail to truck. (A negative value represents diversion from truck to rail.)

The resulting estimate of diversion necessarily will be rough. However, it is likely to be as good an estimate as can be obtained without the use of a disaggregate computer model.

Barge/Rail Diversion

Barge is a low-cost mode that usually is very attractive when barge routings are feasible for large shipments of low-value commodities. However, since barge transport usually entails an access haul to or from the water, there is some traffic for which the rail and barge modes can both compete and for which mode choice can be affected by public-policy changes that have relatively modest effects on modal costs.

The impact of some potential public-policy changes in barge costs, however, could be quite substantial. General revenue currently is used to finance the operation and maintenance (O&M) of the entire inland waterway system as well as a portion of all waterway construction projects. If the barge industry were required to pay for waterway O&M through increased fuel taxes and/or other user charges, barge rates could rise by an average of about 25 percent.[5]

[5] Cambridge Systematics, Inc., et al., *Characteristics and Changes in Freight Transportation Demand*, Interim Report, prepared for the National Cooperative Highway Research Program, August 1993, p. 2-31.

■ 4.5 Case Study: Truck Size and Weight Policy

CS and Sydec are currently analyzing the potential effects of the "Safe Highways and Infrastructure Preservation Act of 1994" (H.R. 4496). This bill includes provisions that would phase out the use of trailers that are longer than 53 feet and that would limit the use of oversize and overweight permits for divisible loads by states that do not have grandfather authority to issue such permits. A case study description of the CS/Sydec analysis of the effects of these two provisions will be distributed at the Workshop.