Vermont Statewide Freight Study

Executive Summary

prepared for

Vermont Agency of Transportation

prepared by

Cambridge Systematics, Inc.

with

Parsons Brinckerhoff
Fitzgerald & Halliday, Inc.

January 2001

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Executive Summary

1.0 Introduction

The Vermont Agency of Transportation (VAOT) has recognized the need to incorporate freight transportation planning into the statewide transportation planning process. To achieve this goal, the Statewide Freight Study was initiated by VAOT in the fall of 1999. This study encompassed many different but complimentary components that have been completed and integrated to provide a comprehensive freight study.

The goals of this study included:

- Develop a better understanding of the freight transportation system in Vermont;
- Acknowledge and address public concerns regarding specific freight movement practices;
- Provide data that can be used to preserve and improve the transportation system;
- Expand the tools available for freight planning efforts; and
- Begin to identify and prioritize future investments in the freight transportation system.

The findings, conclusions, and recommendations of this study are provided in Section 6.0 of this executive summary.

1.1 Background of Freight Transportation

Over the last decade, public planning agencies have begun to recognize the importance of incorporating freight-specific planning initiatives into existing practices. Prior to this, freight transportation planning was a relatively low priority for the public sector. This was due to a combination of factors, including the dominance of the freight sector by private operators, which made public intervention more complicated. In addition, the limited planning resources that were available were used for major passenger transportation initiatives.

This situation began to change due to the emphasis placed on multimodal planning in the Intermodal Surface Transportation Efficiency Act (ISTEA). The subsequent Transportation Equity Act for the 21st Century (TEA-21) reinforced this movement towards more comprehensive freight and passenger initiatives. The increasing economic competitiveness among states and regions within the U.S., and the globalization of the economy have further increased the importance of a state's freight transportation infrastructure. The deregulation of freight transportation dramatically changed business practices and created new competitive opportunities across modes. The changing nature of business practices, with an emphasis on reliable, just-in-time delivery (JIT), places a premium on the efficient operation of the freight transportation system. It also increases the burden on that infrastructure

because inventory that used to be stockpiled in warehouses is increasingly stockpiled in freight vehicles of one kind or another in transit.

The deregulation of the trucking industry, the continued decline of the railroad industry, and the shift of the Northeast economy from manufacturing to services have all combined to dramatically increase truck traffic on the region's roadways. The North American railroads have undertaken many initiatives to improve service to compete with each other and the trucking industry for freight traffic. This has included development and deployment of new technologies, such as double-stack cars, and container- and trailer-on-flatcar (COFC/TOFC) services. These new technologies provide increased economies of scale, faster service, and multimodal coordination. However, the technologies themselves required expensive modifications to the existing infrastructure.

There also has been a continuing emphasis on consolidation among the Class I railroads. This included the mergers of Burlington Northern and Santa Fe, the Union Pacific and Southern Pacific, and the split of Conrail between CSX and Norfolk Southern. Each of these mergers was undertaken to make the resulting railroads more competitive in the movement of freight. However, each example resulted in periods of far worse service, which had national and international ramifications. To some degree, these service failures are still being mediated. In fact, the most recent merger attempt by BNSF and CN was rejected by the STB.

Many of these railroad trends are exacerbated in the Northeast, including Vermont, based on the lack of investments in upgrading the rail infrastructure, and limited access of competing railroads. As a result, this region faces a situation in which truck volumes are increasing as truck lengths and weights have grown. This contributes to traffic congestion in a variety of ways. Areas experiencing significant highway traffic growth such as Chittenden County, are working to accommodate increased traffic on a fixed infrastructure. Also, areas where the physical infrastructure is constrained are working to accommodate larger vehicles, such as rural roadways and small town centers where large trucks have difficulty negotiating tight roadway geometries (i.e., Woodstock and Brandon). In addition, trucks are seen as having major environmental and quality of life impacts. As a result, there are pressures at the local and state levels to limit truck operations.

Globalization of the economy has also changed the transportation and service requirements of shippers and receivers. Manufacturers can serve markets globally, but this requires a greater reliance on and greater efficiencies in the transportation system. As a border state, the liberalization of trade with Canada brought about by the U.S.-Canada trade pact and subsequently by the North American Free Trade Agreement (NAFTA), has significant implications for the movement of freight into and through Vermont.

Increased reliance on the Internet, e-business and subsequently e-commerce have also impacted freight transportation. Many new Internet-based businesses have set up capabilities to sell products on-line to a global market. The supporting transportation system was overlooked as this new mechanism to reach broader markets was developed. This was shown during the Christmas season of 1999, when a huge increase in demand without the necessary capacity resulted in some companies not being able to deliver products to consumers on or before Christmas Day.

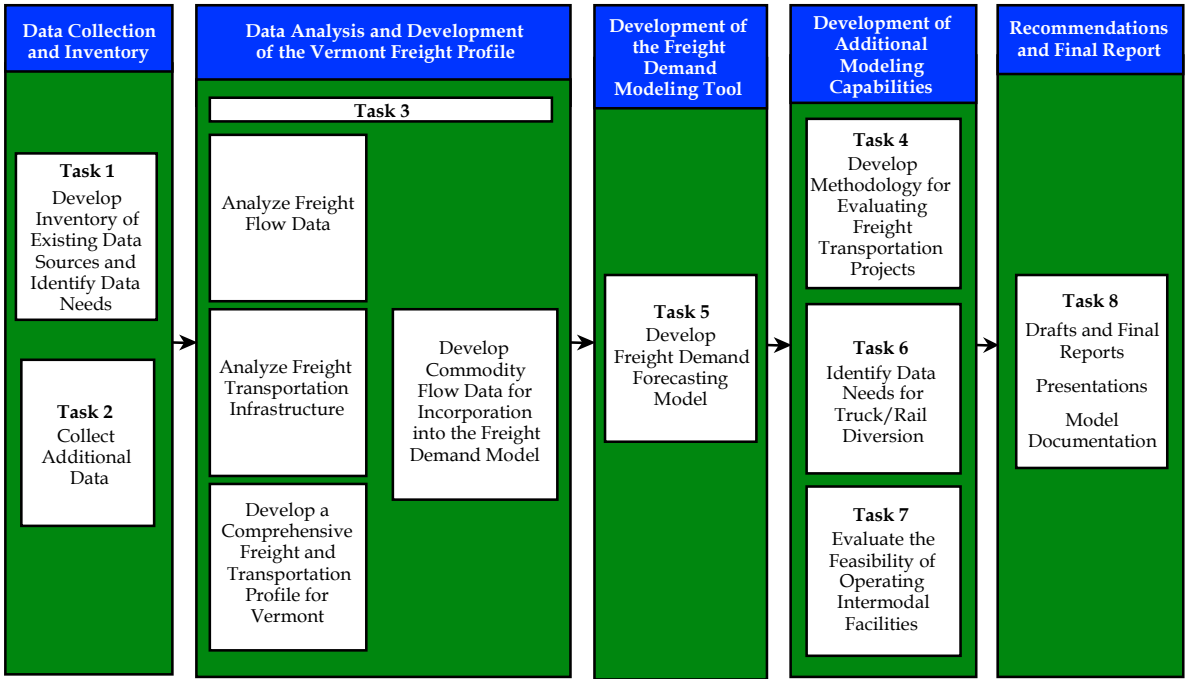
1.2 Project Approach

A comprehensive and multimodal approach was developed for the Vermont Statewide Freight Study. The approach included consideration of Vermont's freight transportation infrastructure, including all modes, major freight generating facilities, intermodal terminals, infrastructure conditions and capacities, congestion points, and planned improvements. Key logistics patterns, economic trends, and major concerns regarding the freight system were also included. The study's findings are based on both existing VAOT data sources and new data gathered specifically to address the needs of the project. The project was organized into five areas and eight distinct tasks. The five study areas consist of:

1. Data Collection;
2. Data Analysis and Development of the Vermont Freight Profile;
3. Development of a Freight Demand Modeling Tool;
4. Development of Additional Modeling Capabilities; and
5. Development of Recommendations and Documentation.

Figure ES.1 illustrates the relationship between these five areas and the project's tasks.

Figure ES.1 Project Organization



2.0 Data Collection and Inventory

To address the identified data needs a comprehensive data collection strategy was developed and implemented. This data collection plan was tailored to collect the needed data, and serve the future analytical needs of VAOT. This consisted of collecting and reviewing existing data and collecting new data as necessary.

Develop Inventory of Existing Data Sources. A thorough examination of existing data sources was undertaken to ensure that previous efforts by public and private freight stakeholders in Vermont were used effectively. Sources pertaining to Vermont's freight transportation system, such as physical infrastructure components, the freight flows moving in Vermont by mode and by commodity, and policy and planning initiatives, were included in this scan.

Accessing Reebie Associates TRANSEARCH Database. The Reebie Associates' TRANSEARCH database is a nationally recognized source of high quality freight data. A customized version of the TRANSEARCH database was purchased for Vermont. The database included trips with origins and destinations in Vermont as well as trips moving through Vermont. The database disaggregated Vermont into 14 areas/counties. The rest of North America was segmented into 16 regions to clarify the locations of origins/destinations of Vermont's freight. These data were organized by mode, origin/destination, and commodity to detail the goods that are moving into, out of, within, and through Vermont.

Conduct Roadside Truck Driver Origin/Destination (O/D) Surveys. Roadside surveys were conducted to supplement the commodity flow data, and identify logistics patterns and key issues affecting the state's freight transportation system. Specific routes to be surveyed were selected based on areas with the highest truck traffic, according to VAOT traffic counts, and areas where truck traffic was a local concern. Surveys were conducted at 15 sites across the state, totaling 1,264 statewide. The surveys gathered information on the respondent's vehicle, current trip (including commodity hauled, origin/destination, route, and type of facility served), as well as their previous and next trips. The results of these surveys were entered into a Microsoft Access database for storage and analysis.

Surveys of Motor Carriers and Shippers/Receivers. Surveys were developed to detail the operations, typical freight volumes, and concerns of freight shippers, receivers, and haulers across the state. Unique survey instruments were created for the motor carrier and shipper/receiver communities to address their specific types of operations. The surveys were designed to address the specific operations of each. The motor carrier survey was designed to focus on characteristics such as type and size of equipment, number of shipments hauled, identification of key routes, and identification of system strengths and weaknesses. The shipper/receiver survey was designed to focus on characteristics such as the type of operation, type of freight generated, key transportation service requirements, volume of freight generated, and identification of system strengths and weaknesses. The survey effort was conducted with the assistance and endorsement of the Vermont Truck and Bus Association and the Associated Industries of the Vermont. In total, approximately 800 surveys were distributed (585 to shippers/receivers and 210 to motor carrier).

Thirty-six percent of the motor carrier surveys were returned and 26 percent of the shipper/receiver surveys were returned.

Conduct Personal Interviews with Key Freight Stakeholders. In addition to the statewide survey effort, a sample of Vermont-based motor carriers, shippers and receivers were interviewed. These interviews further detailed the respondents' operations, typical freight volumes, and infrastructure requirements, as well as their perspectives on the state transportation system's strengths, weaknesses, and opportunities. Companies were interviewed based on geographic and commodity diversity, as well as recommendations from the staffs of VAOT, regional economic development corporations, regional planning commissions, and the Chittenden County Metropolitan Planning Organization. Over 30 companies and organizations were included in this interview process. An operational summary and logistics overview was developed for several of the private sector representatives. This information was used to describe the freight transportation industries in Vermont.

3.0 Data Analysis and Development of the Vermont Freight Profile

3.1 Economic and Demographic Data

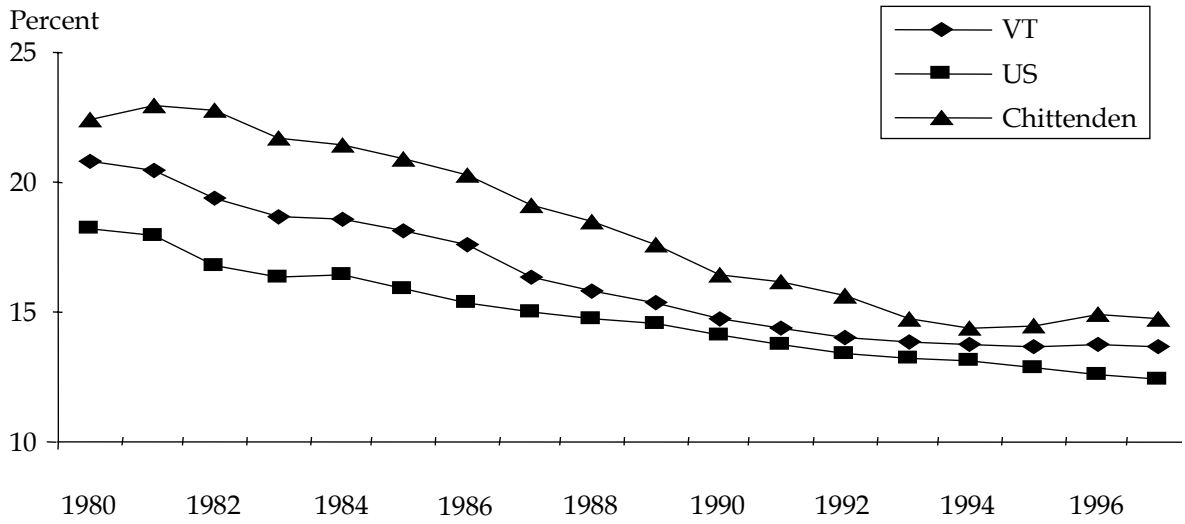
Vermont's economy has performed well over the past decade. The employment growth and unemployment trends mirror those at the U.S. level and outpace economic trends in the rest of New England.

Unemployment. From 1990 to 1999, Vermont's unemployment rate was lower than that of the U.S. and has been steadily falling since 1992, the height of the early 1990s recession. The state's annual unemployment rate in 1999 was 2.9 percent and was even lower (1.9 percent) in Chittenden County. These low-unemployment rates typically indicate robust local economic conditions, but with the potential for labor shortages, especially for skilled positions. Unemployment rates do vary substantially by county.

Employment and Population Growth. From 1990 to 1998, Vermont's employment growth (almost 12 percent) was less than the U.S., however it easily outpaced growth in New England. Much of this growth occurred in Chittenden County, which expanded its employment base by 13 percent over this time period. Employment growth in Vermont was led by the services (especially business and health services) and retail trade industries. Population growth in Vermont experienced similar trends when compared to the U.S. and New England.

Manufacturing Activity. While Vermont may have a reputation as a relatively rural state, it actually possess a larger share of manufacturing employment to total employment (17 percent in 1998) than the U.S. according to the Vermont Department of Employment and Training. Figure ES.2 presents the manufacturing share of total employment for the U.S., Vermont, and Chittenden County from 1980 to 1997.[1] The trends for all three regions are downward, though both Vermont and Chittenden enjoyed a minor manufacturing revival in the mid 1990s. Vermont has a relatively large concentration of jobs in manufacturing industries compared to the U.S. and Chittenden County has an even larger concentration, and generates 43 percent of the state's manufacturing wages.[2] However, the relative importance of manufacturing has decreased, even though total manufacturing contributions to GSP have grown. Manufacturing employment concentrations differ widely by county in Vermont. Figure ES.3 displays manufacturing employment density per square mile in 1998.

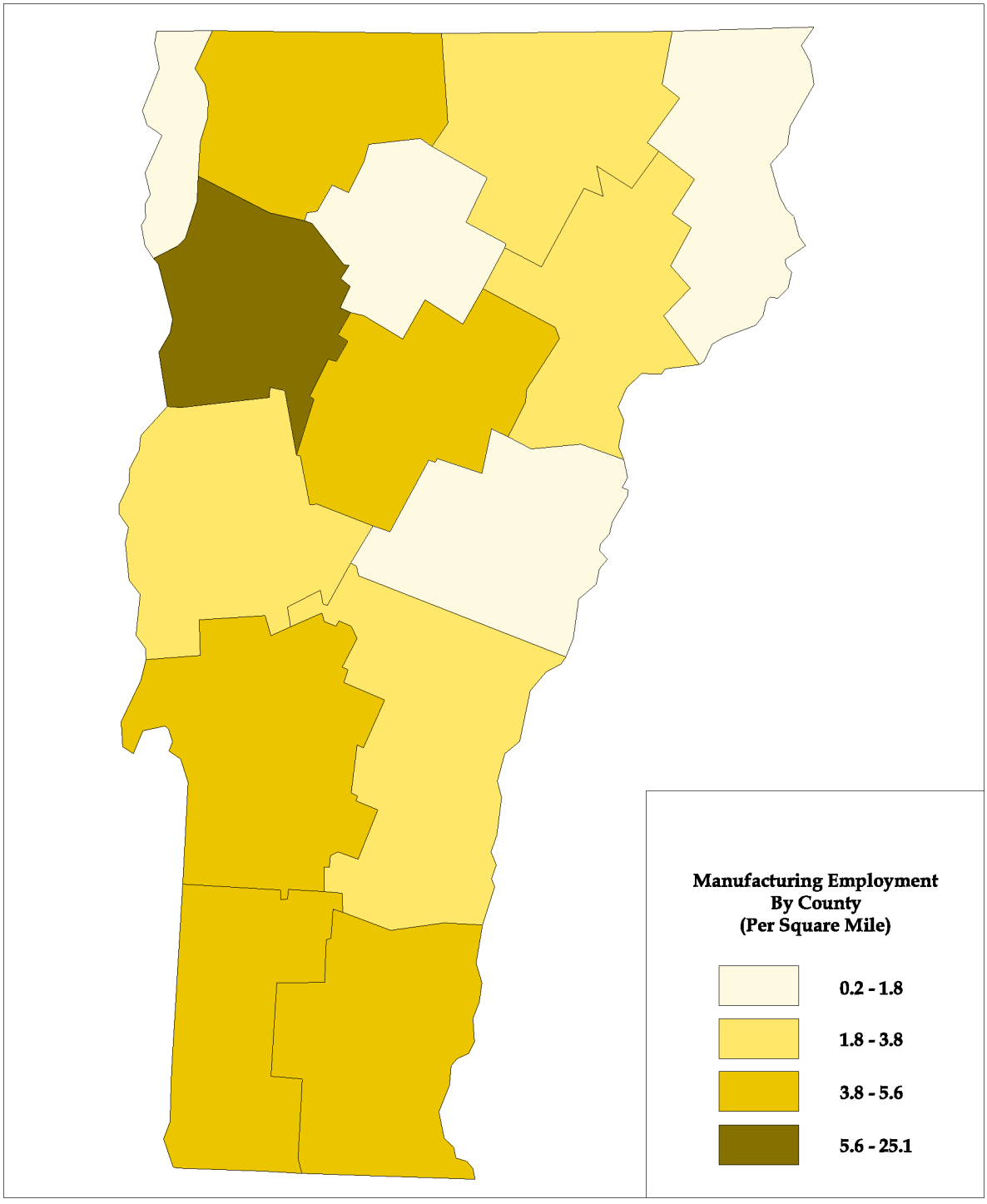
Figure ES.2 Manufacturing Share of Total Employment



[1] U.S. Bureau of Economic Analysis was used for the time-series comparison of the U.S., Vermont, and Chittenden County because of the consistency of the data.

[2] "Manufacturing Prosperity in Vermont," by Dr. Arthur Woolf of Northern Economic Consulting, Inc., prepared for the Associated Industries of Vermont, September 1999.

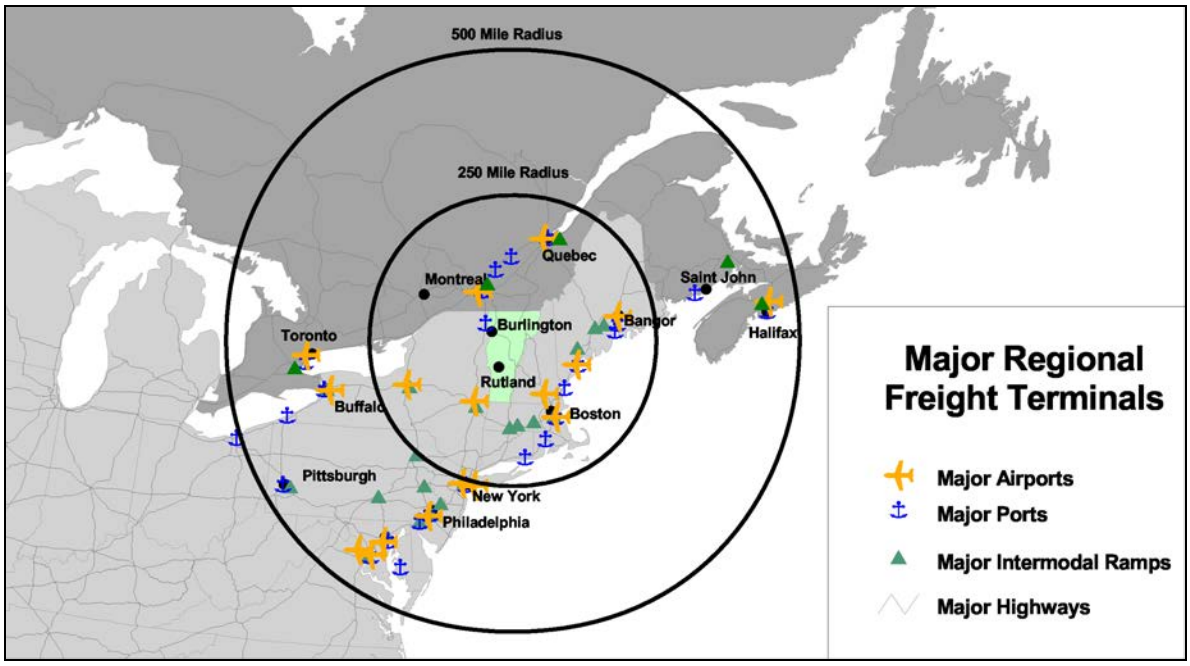
Figure ES.3 Manufacturing Employment Density by County, 1998



3.2 Modal Profiles

Vermont's freight transportation system is composed of four, largely interdependent modes. These modes link Vermont's businesses and consumers with raw materials, suppliers, manufacturers, distributors, and markets within the state and around the region, nation, and world. Understanding the role each mode plays in the state's freight infrastructure and the important connections between these modes was a necessary first step in analyzing Vermont's freight system. The regional freight transportation system also was reviewed as part of this analysis. This was critical given Vermont's location, geography, and freight infrastructure. Further, these regional links allow many products consumed and generated in Vermont to be part of the regional, national, and international supply chains. Figure ES.4 shows the locations of major freight terminals that currently serve Vermont shippers and receivers. The remainder of this section summarizes the specific modal systems in Vermont and discusses regional freight gateways.

Figure ES.4 Regional Freight Terminals Within 500 Miles of Vermont



Truck

Trucking is by far the dominant mode of freight transportation in Vermont. Trucks account for 91 percent of the freight moving into, out of, within, and through Vermont. Additionally, trucks link Vermont's rail and air facilities to most of the state's individual companies and all of its consumers. Trucks also provide the only link to water freight services for Vermont businesses. Vermont's lack of a water port makes the over-the-road link to the region's ports crucial to the state's economy. The trucking industry relies on the state's highway and road infrastructure to safely and efficiently deliver its cargo and

serve its customers. The state of Vermont owns and operates 2,454 miles of rural roadways and 177 miles of urban roadways, including 280 miles or rural interstate and 40 miles of urban interstate3.

The Vermont Truck Network was designated by statute in 2000 (Title 23, Section 1432c). The Vermont Truck Network consists of all or sections of 15 Interstate highways, United States and Vermont routes. The formation and acceptance of this network was a critical issue for both the private industry and the citizens of Vermont. The shippers, receivers, and truckers were being constrained significantly in key freight corridors and the public was extremely concerned with trucks in small town centers. The approval of this network was a major step forward.

A roadside survey of over 1,200 commercial vehicle drivers identified Interstate 91 at Vernon (Massachusetts border) as the single most used gateway in the state for truck traffic. This gateway accommodated a nearly equal number of inbound movements (217) and outbound movements (216). Interstate 89 at Hartford (New Hampshire border) and Route 4 at Fair Haven (New York border) were the second and third most used gateways. Figure ES.5 compares the gateways identified by this survey effort.

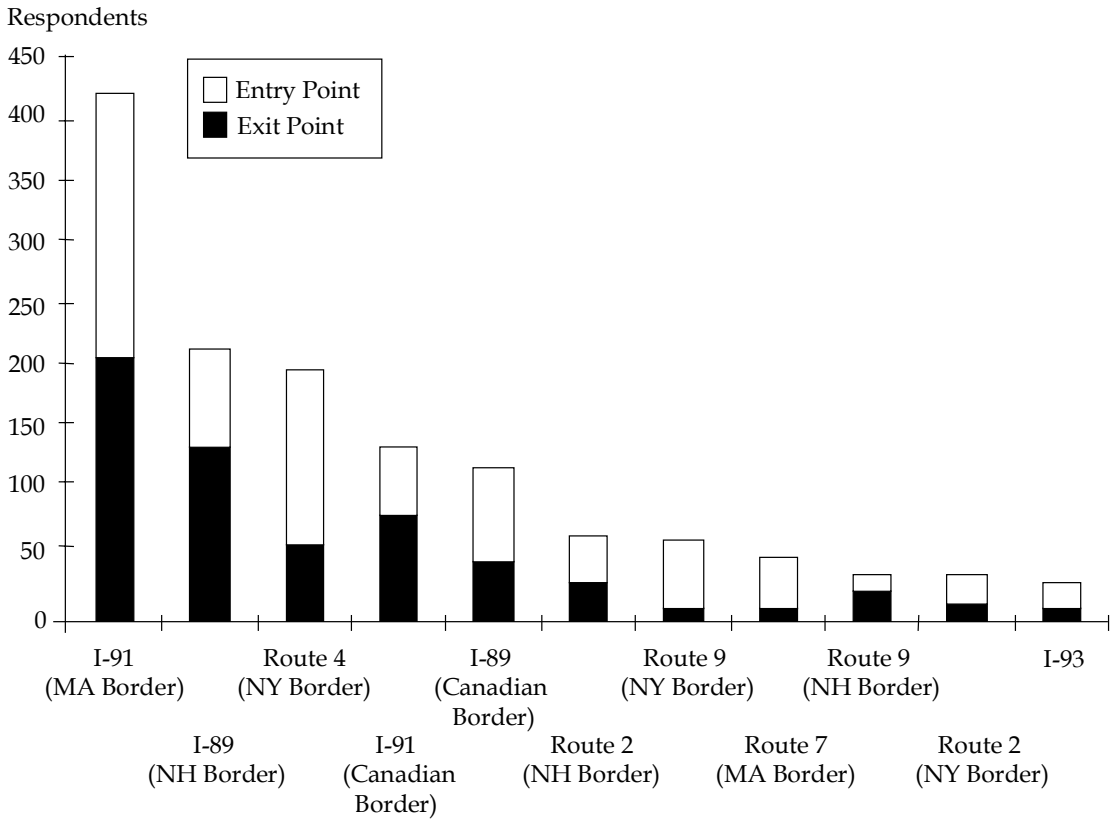
Vermont is served by a diverse trucking industry. Several large national LTL carriers have terminals in Vermont, yet the Vermont-based carriers are typically very small carriers that operate within their local area. Fifty-four percent of the motor carriers domiciled in Vermont operate less than five trucks, including 24.7 percent that operate only one vehicle.[4] Fifty-nine percent of the motor carriers operate primarily within 50 miles of their base of operations. These companies directly support Vermont's key industries.

Many of the motor carriers serving Vermont neither are based in the state nor operate a terminal in the state. The majority of commercial vehicle drivers surveyed at the roadside were from out of state. While Vermont was the single largest base state of respondents, the other states combine to exceed Vermont carriers. Some of these out-of-state carriers were making their first trip to Vermont in years, highlighting the increased demand for freight service in the state; while others have regular pick-up and deliveries in the state. One independent trucker from Alabama, picks-up paper products in Louisiana every week, delivers it to Chittenden County and hauls empty wooden pallets back south as a back-haul.

[3] U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, 1998.

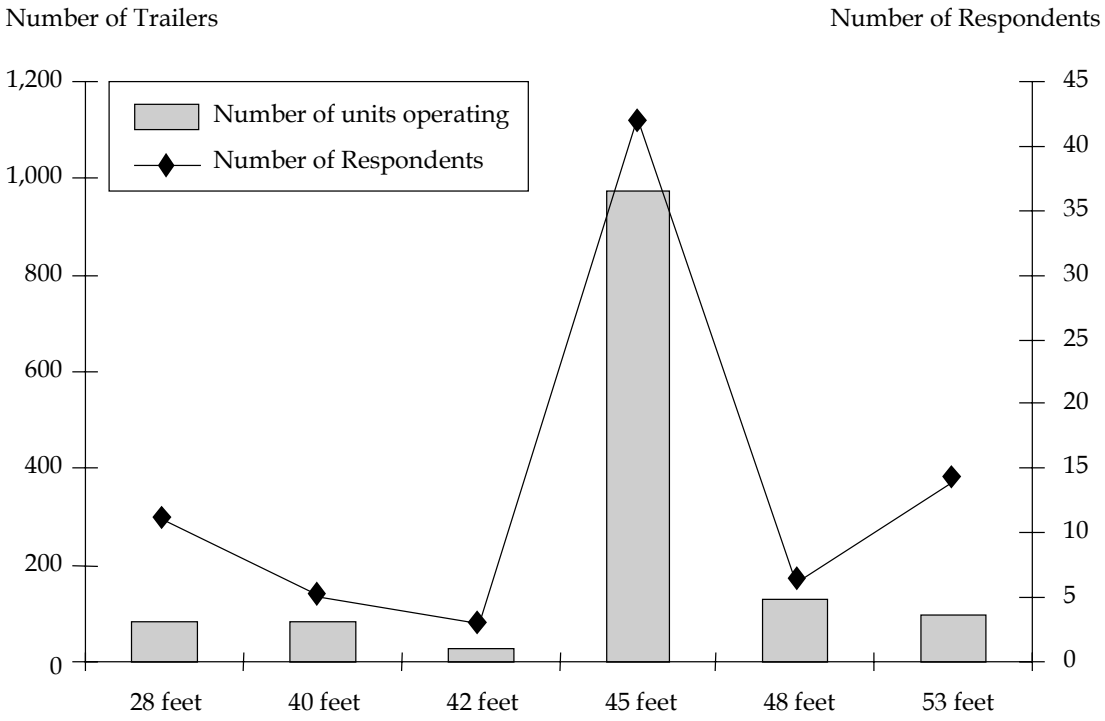
[4] Vermont Vehicle Use and Inventory Survey, 1997 Economic Census. U.S. Census Bureau, the Office of Statistics.

Figure ES.5 Key Entry/Exit Gateways



The equipment utilized by the motor carrier industry is highly diversified. The commodity being hauled and the type of service provided typically dictate the types of equipment utilized. The equipment most associated with the motor carrier industry is the tractor semi-trailer. These combinations vary in size and load capacity. While the standard trailers used today by the industry are 45- and 48-feet long, 53-foot trailers are becoming more common as pressures for increased efficiency continue to escalate. A survey of Vermont motor carriers revealed that Vermont motor carriers are feeling the need to deploy larger trailers. Even though the number of 53-foot trailers deployed by motor carriers in Vermont remains small, more respondents have deployed these trailers than 48-foot trailers. Many motor carriers (especially the LTL carriers) also are utilizing 28-foot trailers ("pups"). Figure ES.6 shows the survey results of trailer usage by Vermont motor carriers.

Figure ES.6 Motor Carrier Survey Results
Distribution of Trailer Length in Vermont



Rail

Rail is responsible for moving the second greatest amount of freight into and out of Vermont. Almost seven percent of Vermont's freight, by weight, is transported by rail. Rail is used for the movement of several key commodities. The four largest commodities transported by this mode (non-metallic minerals; clay, concrete and glass; stone; and food and kindred products) account for 75 percent of the mode's total. Ten railroads currently are operating in Vermont, consisting of the following: Boston and Maine Corporation; Clarendon & Pittsford Railroad Company; Green Mountain Railroad Corporation; Vermont Railway Inc.; Washington County Railroad; Lamoille Valley Railroad Company; New England Central Railroad Company; Northern Vermont Railroad; Saint Lawrence and Atlantic Railroad Company; and Twin State Railroad Company. There currently are plans to expand rail service in Vermont. Vermont's Rail Policy Plan, was updated in 1998. The Vermont Rail Capital Investment Policy Plan currently is underway and will provide recommendations on future rail improvement projects. Preliminary results from the study have been included in this report.

In 1964 the state of Vermont gained the distinction of becoming the first state in the nation to enter into the business of owning railroad property and securing the services of a designated operator. This was a bold step for a small, mainly agricultural state. There were no other states that could provide partnering or lessons learned to help in the

process. However, with the Rutland Railroad having filed for abandonment of all service in 1962, the state of Vermont was faced with the prospect of having a piecemeal and disjointed railroad system at best, or no rail service on the western side of the state at all. In either case, the employment and the economic prosperity, particularly of western Vermont, were at stake.

In addition to the state-owned operations, several Class I railroads were operating in Vermont in 1964. The Canadian Pacific, Central Vermont/Canadian National, Delaware & Hudson and Boston & Maine all had operations in Vermont at this time. By 1997, however, these Class I operators were no longer in Vermont.[5] Today, all the railroads that operate in Vermont are classified as Class II (a line-haul railroad with revenues between $40 million and $256 million and with more than 350 miles of track) or Class III railroads (operating revenues of $20 million or less).

These regional and local railroads, both public and private, are key elements of the larger regional and North American rail networks. The privately-owned New England Central Railroad operates as a key north-south rail link between New London, Connecticut and St. Albans, Vermont, connecting with CSX, Guilford, and the Canadian National railroads along its 375-mile corridor. The privately-owned St. Lawrence & Atlantic Railroad similarly provides a connection with the Canadian National and with Guilford near Portland, Maine. The Northern Vermont also provides a connection to the CP Rail System. As the trend towards consolidation of the Class I railroads continues, and their routes are restructured, Vermont's rail lines and their connections to these systems are of strategic importance for the economic health of the state and New England as a whole.

A significant concern in Vermont today are the weight restrictions on almost all of the rail system. Currently, the system is operating at 263,000 pounds per car. The U.S. and Canadian Class I railroads are operating at a minimum of 286,000 pounds, and as high as 315,000 in some corridors. This limits the short line operators' abilities to accept interline traffic. This is an issue for many short lines throughout North America. This limit is based primarily on the bridge ratings, but also involves some rail beds and track gauges.

The survey of shippers/receivers conducted as part of this study, indicates that approximately 20 percent of the respondents have rail sidings at their facilities. These rail sidings provide direct access to the region's rail system. Firms that do not have their own rail siding often utilize warehouse/distribution resources near the rail facility to store their freight until it is needed. These warehouses allow shippers to reap the cost savings and increased load capacity of rail service, while still providing just-in-time deliveries to the production facility.

[5]The lack of Class I service in Vermont is due to a change in the operating revenue threshold requirement to be classified as Class I ($250 million), and the reduction in the region's manufacturing (and corresponding rail traffic) which has led to the abandonment of some lines and services in New England.

Water

Vermont's geography leaves it without a water freight terminal. As such, Vermont relies on the regional freight infrastructure and trucks for its access to water freight facilities. Most of the region's largest port facilities are within 250 miles from Vermont and therefore are accessible within a single days drive from almost any where in the state. These regional ports include Quebec, Montreal, Boston, New York/New Jersey, Providence, and New London. Within 500 miles of the state lie other major ports, including Philadelphia, Baltimore, Saint John, and Halifax. The only waterborne service that exists in Vermont consists of the ferries crossing Lake Champlain. The ferry movements across Lake Champlain typically connect Chittenden County with Northeastern New York. The ferries offer trucks serving these areas reduced trip times compared to the alternate routes such as U.S. Route 4, U.S. Route 7, Vermont Route 22A, U.S. 2, and Interstate 89.

The industries of Vermont rely on the regional water facilities for access to a variety of commodities. A manufacturer of paper products uses the Port of Quebec to import raw materials from South America. The Burlington airport utilizes the Port of Boston/Chelsea for its aviation fuel. Likewise, manufacturers utilize these ports to export their goods to their global distribution centers and international markets. Exported goods range from computer components to finished consumer goods. In addition, intermodal connections are used to access Pacific Rim markets through West Coast ports via transcontinental truck/rail intermodal service.

Air

Air plays a secondary role in transporting freight into and out of Vermont. In total, air freight operations transport a total of 5,314 tons based on the 1997 TRANSEARCH data. Air cargo services are used primarily for light, high value products. The commodity flow analysis was based on weight rather than value. If value was the proxy used, the contribution of air operations to freight movement in Vermont would increase, but it would still represent an insignificant portion of the freight in Vermont. This freight typically consists of small parcels delivered by courier services and United States mail. Three airports form the backbone of the state's air freight infrastructure. These airports include, Burlington International Airport, Rutland Regional Airport, and Edward F. Knapp State Airport. All three of these airports have runways in excess of 5,000 feet.

As with the rail system, the VAOT has taken an active role in preserving the airport infrastructure. It owns and operates the majority of airports in the state. The primary exception to this is Burlington International Airport, which is owned by the city of Burlington. In addition, the VAOT developed the Vermont Airport Capital Facility Program, which was completed in March 2000. This program addresses several key issues, including: defining a 10-year capital facility needs of state and municipality-owned airports; development of a project ranking system and a prioritized list of projects; and a financial plan for the project improvements.

Service is provided to Vermont by the major parcel delivery services (United Parcel Service, Federal Express, and Airborne Express.) Service also is provided by local air freight companies that "inter-line" with the national delivery services at the larger freight hubs. Some service also is provided in passenger aircraft.

Air freight operations in Vermont are hampered by the state's geography and road infrastructure. Some areas are poorly served by air service, while others rely on out of state airports. For example, the Northeast Kingdom is without next-day air service. Southwestern Vermont and southeastern Vermont utilize out-of-state airports to meet their needs. Shippers in the Bennington area utilize the airport in Albany, NY as their air freight center because the lack of a limited access north-south highway in the western portion of the state makes New York more attractive. Similarly, the southeastern shippers utilize New Hampshire's airports, such as Manchester and West Lebanon. These airports have established markets and service that are difficult for Vermont airports, such as Hartness, to compete with. In order to guarantee next-day delivery, courier companies must have a network of airports in Vermont. The highway infrastructure is such that some areas are difficult to serve with over the road service, especially during the winter months.

3.3 Commodity Flows and Logistics Patterns

A critical component of a freight study is the development of an understanding of what goods are moving, how they are moving, where they are moving to and from, and why they are moving the way they are. A combination of commodity flow data and qualitative interviews with shippers and receivers provides the data necessary for this component.

Commodity Flow Analysis

The commodity flow analysis is based on the TRANSEARCH commodity flow data purchased by the VAOT from Reebie Associates. This data provides freight flows by weight moving into, out of, within, and through the state of Vermont for 1997. This data is disaggregated by commodity, mode, and origin/destination pair. It was also forecast to 2005, 2010, and 2020.

The commodity flow analysis provides summaries of these characteristics. Note that the database has enormous potential for detailed analyses. Although this study reports highlights and key findings, the database is available through the VAOT for future applications. The following summarizes the analysis:

- Vermont receives significantly more goods than it ships (7.1 versus 2.9 million tons annually). Through moves (overhead) represent the single largest type of movement, representing 35 percent of all freight flows in Vermont. Figure ES.7 shows the breakdown of freight flows by type of movement.

- Truck is the dominant mode of transportation for all freight flows in Vermont, presenting 90 percent by weight. The rail mode share reaches 10.5 percent for inbound freight flows, versus a 6.6 percent share for all movements. Figure ES.8 provides the mode shares for all freight movements.

Figure ES.7 Total Statewide Freight Flows by Type of Movement

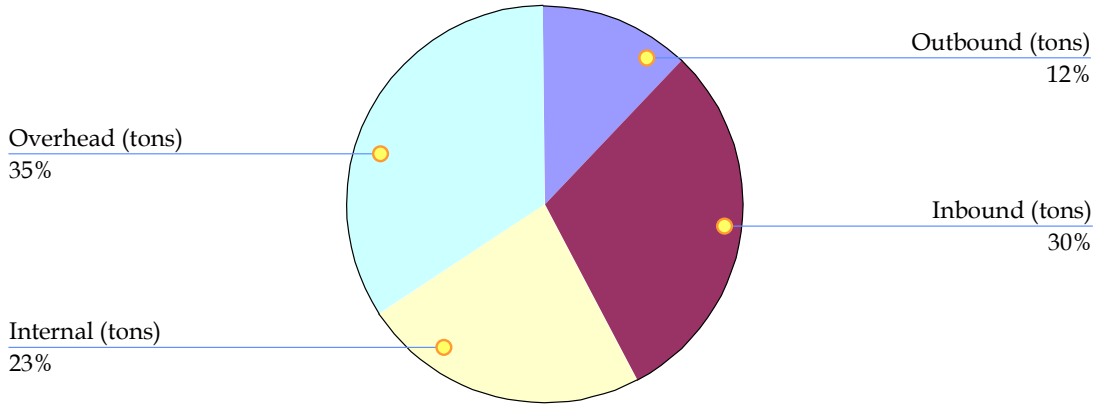
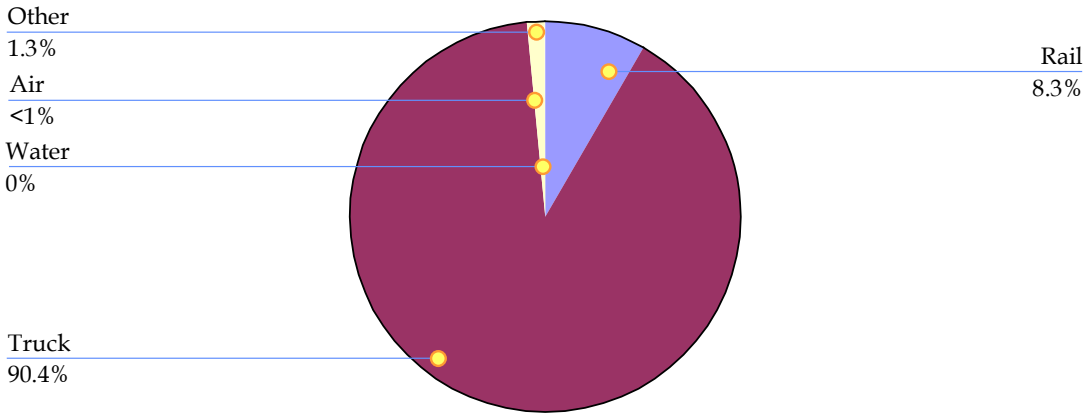


Figure ES.8 Statewide Mode Share for All Movements



- The top four commodity groups consist of primary forest materials (15 percent); clay, concrete, glass, or stone (13 percent); food or kindred products (13 percent); and warehouse, distribution, intermodal (13 percent), and account for 55 percent of the total flows. Figure ES.9 shows the top 10 commodities in Vermont.
- Vermont's number one trading partner is itself, representing 36 percent of total tonnage. This is followed by New Hampshire (13 percent), New York (11 percent), and eastern Canada (8 percent). These four represent 68 percent of total tons flowing into, out or, and within Vermont. Figure ES.10 shows Vermont's major trading partners.
- Chittenden County is the key receiving county in Vermont, receiving 2.9 million tons per year. This dominant position is not present in outbound flows where Rutland and Chittenden counties are similar (0.541 versus 0.624 million tons). Figures ES.11 and ES.12 show the distribution of inbound and outbound freight flows by county. Figure ES.13 shows the county level flows by type of movement.

Figure ES.9 Top Commodities in Vermont

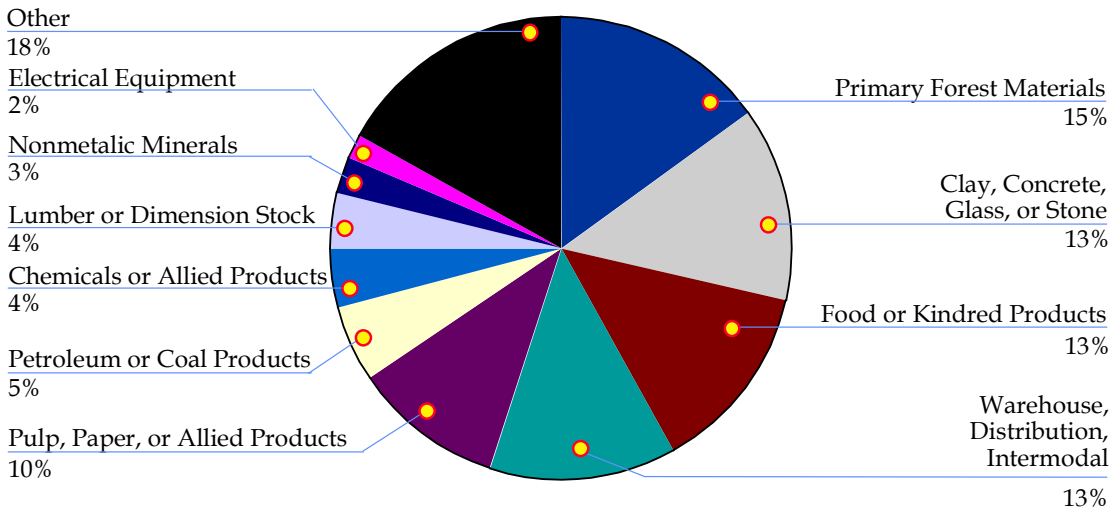


Figure ES.10 Major Trading Partners

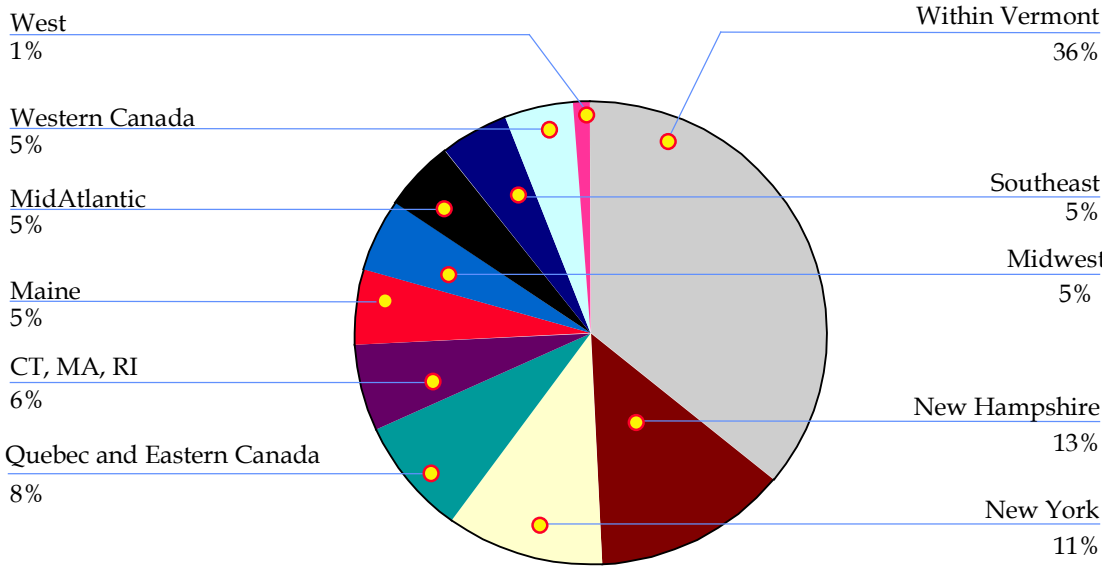


Figure ES.11 Destinations of Total Inbound Commodity Flows

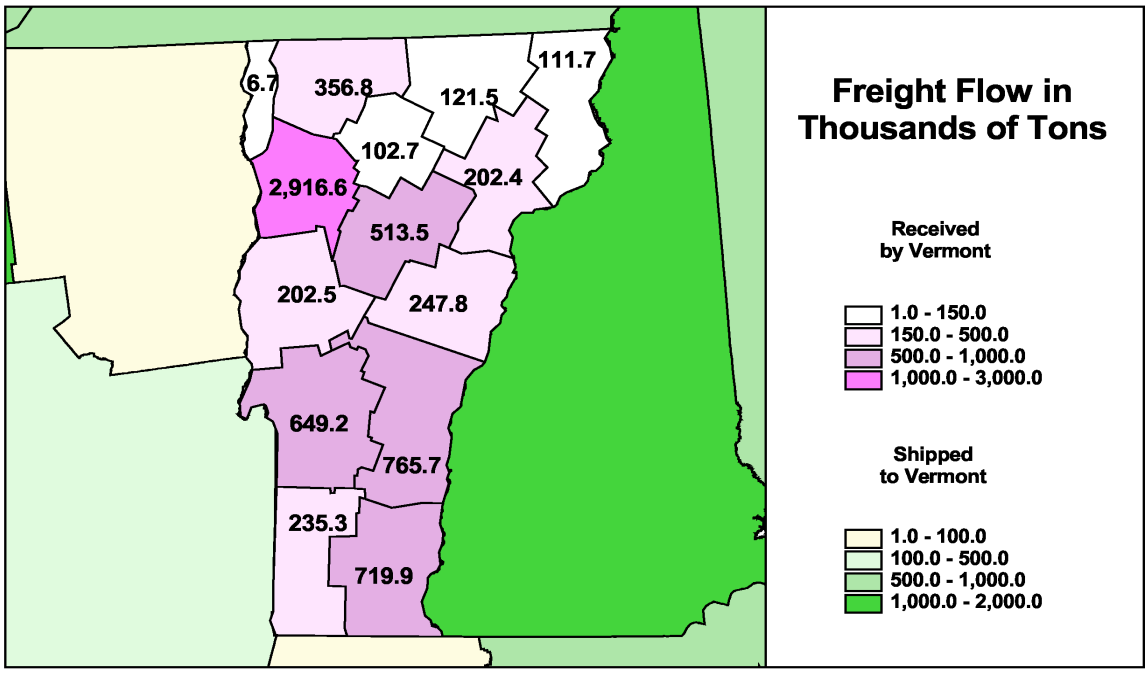


Figure ES.12 Origins of Total Outbound Commodity Flows

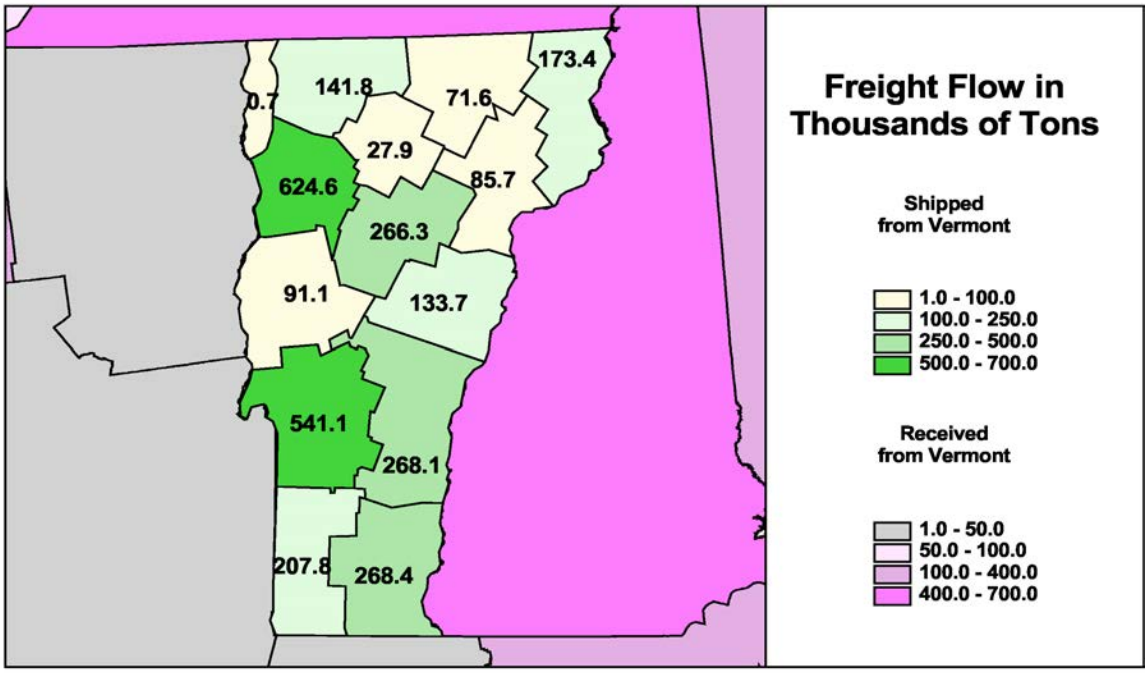
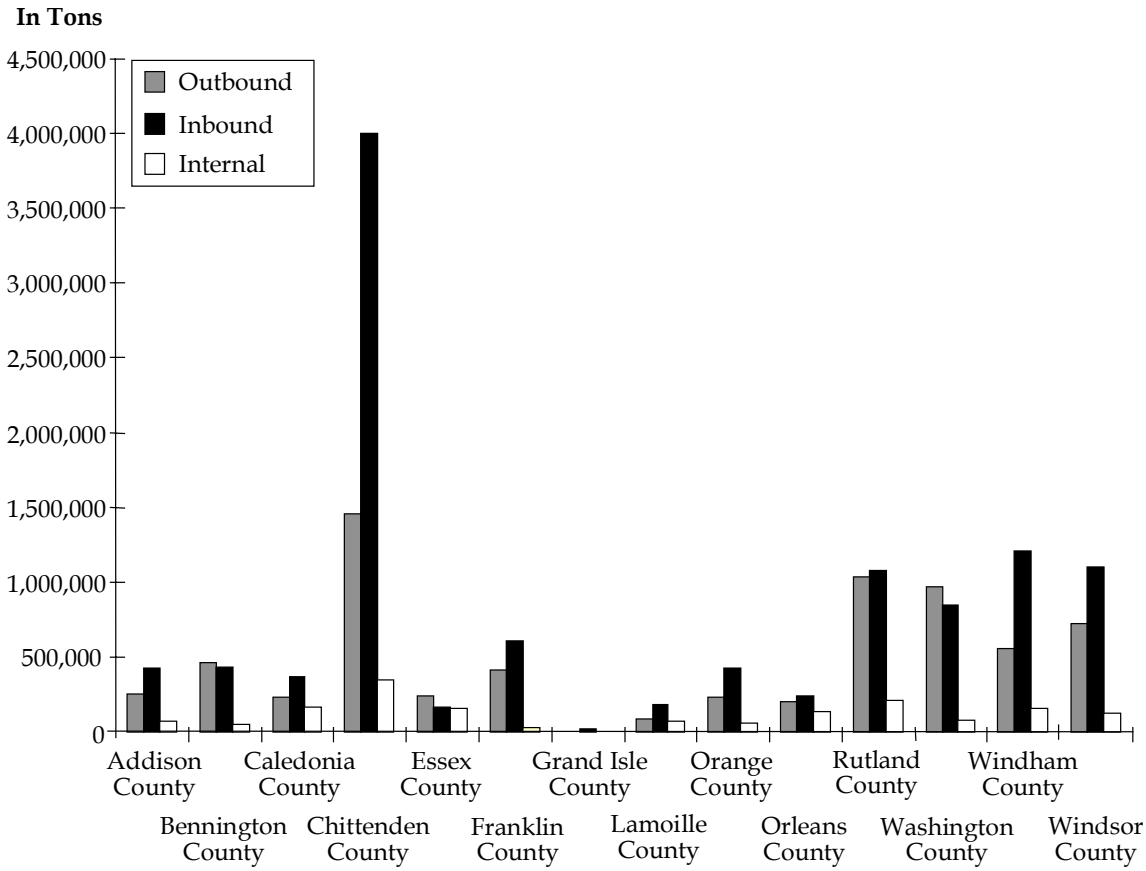


Figure ES.13 Commodity Flows by County



- New Hampshire and Quebec are the two largest origins of through moves, representing 79 percent; New Hampshire and Massachusetts are the two largest destinations of through trips, also representing 79 percent.

A secondary component of the commodity flow analysis consisted of an evaluation of the value of products moving in Chittenden County. This has become increasingly important as heavy industry manufacturing has continued to decline nationally and regionally, and replaced by high-tech and service industries. The TRANSEARCH commodity flow database purchased for this study did not include the value component. However, the 1993 Commodity Flow Survey product, provided by the Bureau of Transportation Statistics, provides estimates of value per ton by commodity. This data was used to develop a comparison for Chittenden County between weight and value. Figure ES.14 illustrates the comparison between weight and value. It shows that there are several types of products that have an inverse relationship between their value and the tonnage hauled in Chittenden County.

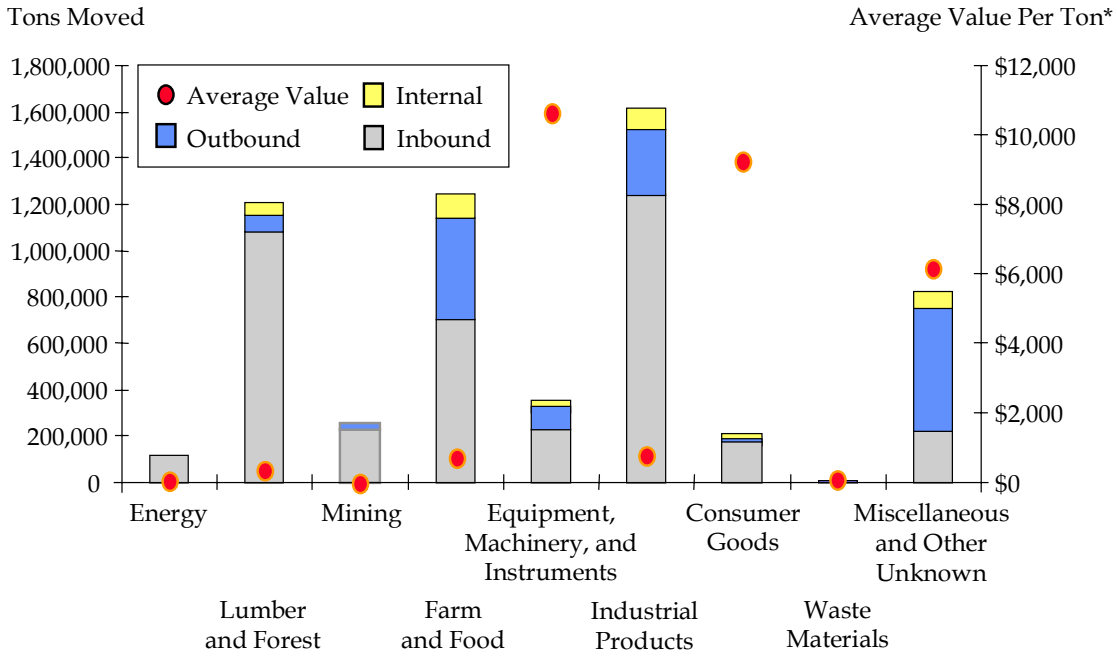
For example, electrical machinery and instruments has a relatively low volume but a very high value per ton. The opposite example would be industrial products, which have a very low value per ton, but a large volume is moved in the county. These comparisons are

important when determining the economic importance of certain flows to a region or state. The importance of light, high value goods will become better recognized when value is incorporated into the analysis.

The commodity flow data have several limitations. Many practitioners ask questions relating to volume, intermodal trip reporting, specific corridors, and point to point shipments. In responding to these questions, commodity flow analysts are left to explain the idiosyncrasies of the data. The data is only as good as the source. It depends on how industry reports the data, which in many instances is restricted by concerns of competitiveness and confidentiality.

Figure ES.14 Chittenden County Freight Flows

Comparison of Weight and Value by Commodity



Source: Average value represents a national average based on the 1993 Commodity Flow Survey.

Logistics Patterns of Vermont Shippers and Receivers

Key shippers, receivers, and transportation service providers that serve Vermont were interviewed to provide anecdotal explanations of why the commodities move the way they do, what service characteristics are most important, and what types of transportation improvements would be beneficial to shippers and receivers. By interviewing the region's shippers, a story can now be told to augment the commodity flow patterns. Key data attributes can be extracted for a given commodity type and mapped in concert with the logistics patterns of a shipper moving that commodity.

For example, a commodity flow analysis for a given product provides a description of the origins, destinations, volumes, and modes of this commodity as it moves into the region. Although it encompasses the total shipments for the commodity group, it does not illustrate the specific logistics patterns used by related shippers and receivers to move their products. The evaluation of a shipper's supply chain adds significant value to understanding freight movements in Vermont. Table ES.1 provides a detailed description of an ice cream manufacturer's operation. The data provided in this example illustrates the value of this analysis. In developing freight transportation policies, it is important to recognize the reason behind companies' transportation decisions and work with these companies to ensure a more balanced transportation system in the future.

4.0 Development of the Freight Demand Modeling Tool

The Vermont Statewide Truck Model has been developed to provide an analytical basis for evaluating the benefits of transportation investments that impact the movement of goods throughout the state. The truck model defines a truck based on relative weight classes and separates medium and heavy trucks for analysis purposes. Medium and heavy trucks are defined to match the definitions used for collecting truck counts by the VAOT.

The development of the truck model was based on using different forecasting methods for internal and external truck trips, because the factors that influence these truck trips are very different. In the case of the external trips, defined as those truck trips that begin and end outside the state, truck trips are affected by economic factors beyond the state borders. In the case of the internal trips, defined as those truck trips that begin and end within the state, truck trips are affected by economic factors within the state borders. Truck trips that have either an origin or destination outside the state and an origin or destination inside the state are affected by both external and internal factors. These three types of truck trips are therefore estimated separately using unique methods for each type.

The Vermont Statewide Truck Model was developed using a base year of 1998 and a forecast year of 2020. Interim-year forecasts between 1998 and 2020 can also be developed in the future as VAOT develops land use and network data for these interim years. The truck model is developed to be consistent with the Vermont Statewide Travel Demand Model (for passenger travel) by using the same land use and network input data and similar software for implementation (TRANPLAN and ArcView). The following assumptions regarding these input data have been used:

- The 1998 truck model uses the 1994 statewide model network as input and land use data that has been interpolated between 1994 and 2015 to represent 1998. In addition, the land use data has been stratified to provide additional information on employment categories.
- The 2020 truck model uses the 2015 statewide model network as input and land use data that has been developed using a straight line trend analysis from 1994 to 2015 to represent 2020. Again, the land use data has been stratified to provide additional information on employment categories.

A complete documentation of this model is provided under separate cover. In addition, the use of the truck model is described in a separate report, called the *User's Guide*.

Table ES.1 Description of an Ice Cream Manufacturer's Operations

Operations	• Operates three ice cream manufacturing sites in Vermont. • Operates a distribution center in southern Vermont, with an outsourced overflow warehouse in MA.
Markets	• Primary inbound freight is cream and condensed milk, which is supplied from northern Vermont. • Other ingredients and packaging material are supplied from 20 other states, with major suppliers in MD, CA, NY, NE, and TX. • Outbound products are destined for 44 states domestically and internationally to the U.K., Japan, Israel, Peru, and Singapore.
Modal Dependence	• All inbound freight is hauled in truckload quantities by one of eight contact carriers. • All outbound shipments pass through the distribution center. • Operates an internal shuttle that provides drop-offs and pick-ups to/from each manufacturing site through the distribution center. • Rail is used for shipments in Canada because of the Canadian railroads' ability to control and maintain car temperature. • Air is used when necessary for emergency shipments and to ship samples; air is also used to send ice cream by mail directly to customers. • Headquarters distributes promotional gifts and goods to all franchises via parcel service.
Service Requirements	• Company's belief in social justice dictates that all shipment be in truckload quantities to maximize fuel efficiency and minimize road wear. • Shelf life of ingredients dictate how long they can be stored. For example, cream has a shelf life of 48-72 hours. • Most inbound freight is ordered for just-in-time delivery because of the lack of storage space at the manufacturing sites. • System will pre-build its inventory to prepare for the peak season.
Future Modal Diversion	• There is no expectation that the current modal balance will change. • Rail service in the U.S. has proved to be unreliable for both consistent temperature control and reliability; cost has not been an issue. There are no plans to use domestic rail in the future.
Comments	• Operations have had good fortune of being located in the I-89/I-91 corridor. • Operation used to have a storage facility in Albany, NY; this site was closed due to poor East/West highway service.

5.0 Development of Additional Modeling Capabilities

As part of this study, specific tasks were undertaken to develop a methodology for evaluating freight transportation projects, to define the data needs and methodology for a modal diversion analysis, and to determine the feasibility of developing and expanding intermodal terminals in Vermont. The following section presents an overview of these three tasks.

5.1 Methodology for Evaluating Freight Transportation Projects

The needs of freight transportation have typically not been well-addressed in statewide and metropolitan transportation planning processes. Planning methods are mostly heavily focused on mobility, safety, and other benefits and impacts related to passenger travel. Yet a strong economy is based on the efficient movement of goods as well as people. Access to good freight transportation is an important factor in the locational decisions of many businesses and industries. In addition, efficient freight transport strengthens existing businesses and reduces the cost of goods to consumers. Growing awareness of the importance of freight movement is leading to increasing consideration of freight-related needs nationwide.

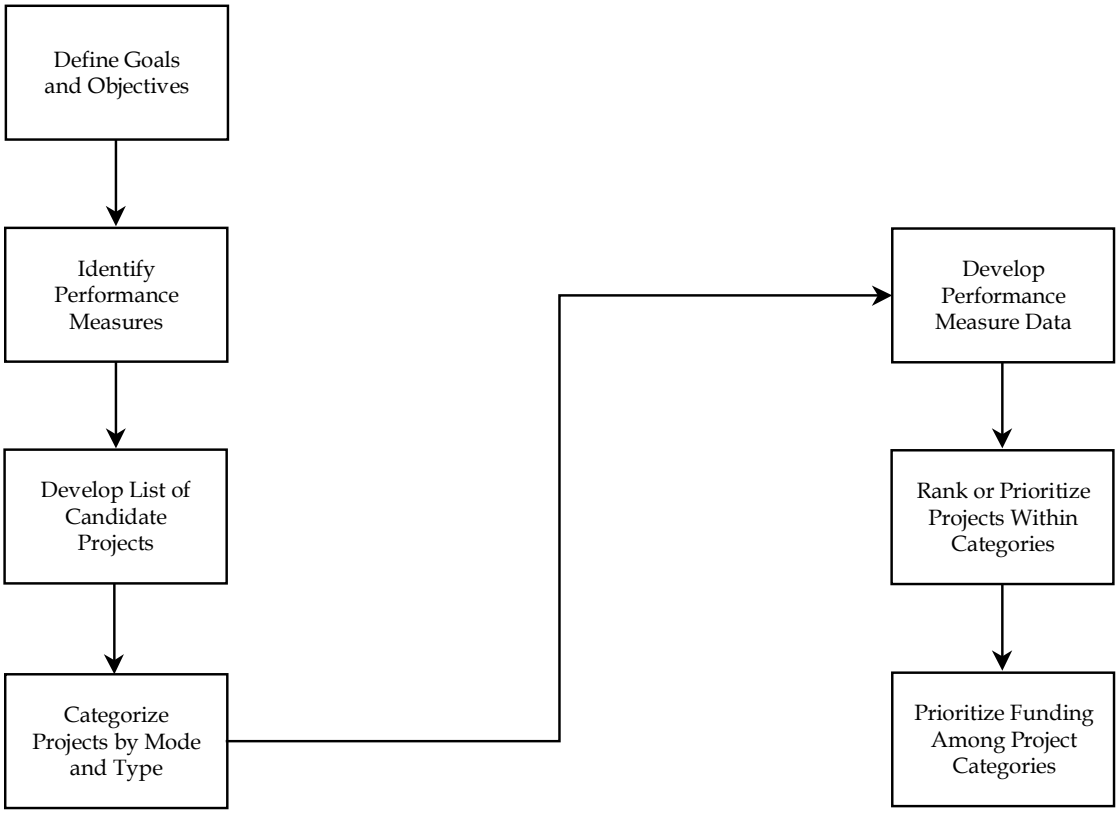
Figure ES.15 outlines a generic approach to evaluating and prioritizing projects, which can be applied to freight as well as passenger-related projects.

This process is based on the principle that *performance measures* are used to describe the various benefits and costs of a project. These measures are directly related to overall goals and objectives for transportation. Table ES.2 shows a sample list of transportation goals and associated performance measures. While the best performance measures relate directly to the goal being achieved, related or "proxy" measures (e.g., benefiting traffic volumes) must often be used because of limitations in data and analysis methods. Measures can also be expressed in terms of cost-effectiveness (e.g., cost per crash reduced). Measures for some factors, such as community impacts, will necessarily be subjective.

Table ES.2 Sample Goals and Performance Measures

Goal	Performance Measure
Preserve and maintain the system	Life-cycle cost savings
Enhance safety	Reduction in crashes
Minimize environmental and community impacts	Emissions of criteria pollutants
Foster economic development	Cost savings to businesses

Figure ES.15 Evaluation and Prioritization Approach



Once performance measure data have been assembled, projects can be selected or prioritized for inclusion in the Statewide Transportation Improvement Plan (STIP). A multi-stage prioritization process can be used to address the fact that performance data among different modes and for different goal areas may not be directly comparable. (For example, mobility benefits for rail and truck traffic may be expressed in different terms.) In this multi-stage process, projects are first grouped into similar categories by mode and/or project type (e.g., reconstruction, rehabilitation, or preservation for highways). Projects within each category are likely to have similar goals and available data. Projects can then be ranked within each category based on performance or cost-effectiveness expressed in common units. A qualitative overall priority may also be assigned (i.e., high, medium, low) based on the overall benefits versus costs for each project. This process can be assisted by establishing a "project impact matrix." Candidate projects are listed in rows, with columns corresponding to various impacts (project cost, mobility/economic benefits, community impacts, etc.)

The prioritization (allocation of funding) *among* categories and modes is then performed separately, based on broader policy decisions and information about program-level effects (e.g., cost to maintain pavement in acceptable condition.) The process of allocating funding to categories will likely be iterative. The list of projects from an initial allocation

should be evaluated to determine whether high-priority projects from each category are included. If not, funding allocations and/or priorities may need to be re-evaluated.

The generic approach described above can be used in conjunction with existing prioritization systems or applied separately. Vermont has already adopted prioritization systems specifically directed at rail capital investments and airport capital investments, as well as a "uniform methodology" primarily used to evaluate highway projects. Prioritization of highway projects is also assisted by input from the Regional Planning Commissions (RPC). The adopted modal investment criteria can be utilized within the above framework, to help prioritize projects statewide within project or modal categories. Decision-makers can also use the above process, including the project impact matrix, to check the reasonableness of the outcomes of existing prioritization systems. For example, projects with high cost-effectiveness ratings and no fatal flaws should be expected to emerge as candidates from the prioritization process.

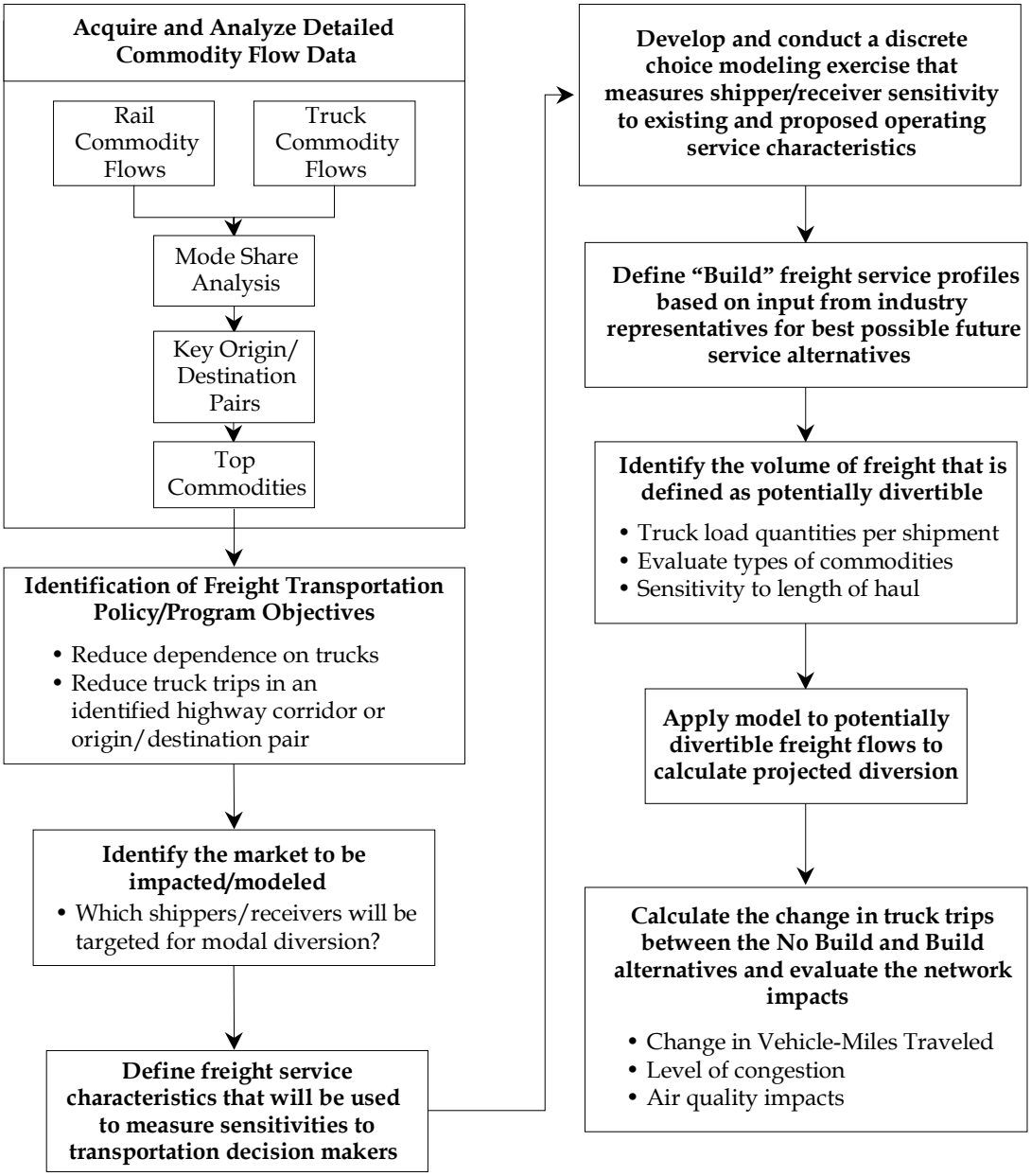
In most cases, transportation projects will benefit both passenger and freight travel to varying degrees, rather than only benefiting one or the other. The freight evaluation process outlined above is not meant to be distinct from a passenger-project evaluation process. Instead, it is meant to be a generic framework that includes all projects, regardless of their focus. Within this process, however, performance measures specifically relevant to freight (e.g., economic development) as well as appropriate data sources and measurement methods (e.g., time and cost savings to truck traffic) should be explicitly included. If it is found that some types of beneficial projects are systematically overlooked with existing criteria, it may be desirable to revise the selection criteria to consider these projects or to set aside separate funding for these types of projects.

5.2 Data Needs and Methodology for a Modal Diversion Analysis

A key finding of this study is that Vermont is heavily dependent on trucks for the movement of freight. Trucks represent over 90 percent of the tons of freight moved on an annual basis into, out of, and within Vermont. This is of great concern to the VAOT and the general public. It is for this reason that the VAOT included as part of this study a task to look specifically at identifying what would be necessary to develop a truck-to-rail diversion model. The objective of this section is to outline the basic methodology for constructing a modal diversion model and to define the data elements required to conduct a detailed analysis.

In order to effectively develop and implement a modal diversion model, four key elements must be addressed. They consist of market definition, data requirements and data collection, development and application of the diversion model, and application of the model outputs to a network analysis tool. Although each of these components may separately provide some benefit to the VAOT, it is necessary to address all of them to complete a thorough modal diversion analysis. Figure ES.16 illustrates the steps in developing and applying a truck-to-rail modal diversion and transportation system impact model. The following describes the sequence of analytical steps that should be employed to complete this type of analysis.

Figure ES.16 Truck-to-Rail Diversion and Transportation System Impact Model Development and Application



The first step in a modal diversion analysis is to identify a specific corridor or market to be tested. This type of analysis cannot be undertaken in a general, non-specific way. A type of movement/operation must be defined. Data is then collected and analyzed to address the selected scenario. This is critical because the stated-preference survey will be designed to estimate the shippers'/receivers' sensitivities to specific transportation service alternatives.

For example, to measure the potential diversion of granite shipments from Barre to a Canadian port from truck to rail, the analysis would need to be designed to define existing truck and rail service characteristics in that corridor, identify potential rail improvements (service, infrastructure, etc.), and then identify shippers/receivers currently moving granite between these two points. Users would then be engaged in a stated-preference survey exercise to identify sensitivities to service characteristics. These preferences will populate a stated-preference model. Specific future alternatives then will be developed with service characteristics. The stated-preference model will then be applied to these specific service options and the potential market to calculate diverted freight flows.

The second step of the analysis is to identify the data requirements necessary to build the models and develop a data collection plan to accommodate these needs. Table ES.3 provides an overview of the data requirements. The commodity flow data purchased by VAOT from Reebie Associates provides base data with three future years. These data sets represent current and future freight flows under anticipated economic and demographic growth forecasts. Thus they would represent "no-build" conditions as they do not account for any major infrastructure enhancements or modal shifts. Other data components would include detailed transportation service characteristics for no build and build alternatives, conversion factors to go from tons to units, stated-preference survey data, and truck trip tables for use in the statewide travel demand model. The stated-preference survey data would be used to estimate sensitivity to rail/truck level of service and forecast changes in truck market share in response to improvements in travel time, reliability, and cost for freight transportation alternatives. The truck trip tables developed as part of the truck freight model would be used as the base against which the impact of diverted tons/trips would be analyzed.

The third step of the analysis is to develop a mode choice model. This is developed from the stated-preference survey data and is the core of the modal diversion analysis. The models should be sensitive to all policy-related factors (i.e., time, cost, reliability, etc.) expected to differ between the no-build and build alternatives. The model's level of service defined for both the no build and build alternatives also will need to be produced at the desired level of origin and destination (O-D) detail.

Table ES.3 Data Needs for Truck-to-Rail Modal Diversion Modeling

Definition of Market

- Origin/ destination pairs
- Types of commodities
- Size of shipment load

Market

- Commodity flow data for defined market area
- Conversion factors for tons to units calculation (i.e., Vehicle Inventory and Use Survey)

Service Sensitivities

- Stated-preference survey results for defined market
  - This will consist of data intensive surveys with shippers/receivers that meet the market definition

Alternative Levels of Service

- Level of service matrices for each defined alternative
  - Development of new/future service alternatives should be based on private sector expertise, ideally from the transportation service providers
  - Future alternatives should be based on desired goals/ objectives of transportation policy

Impacts

- Truck trip tables for each alternative to model highway impacts and other secondary impacts such as air quality

A choice survey presents respondents with a series of future choices (in this case, the transportation mode they would use to ship their products) in which service attributes such as travel time, cost, and reliability are systematically varied. The results are input to a mathematical model which determines the tradeoff points among the attributes where the respondents will change mode.

This technique is used to forecast consumer response to products and services which do not presently exist. Typical applications include new public transportation services, such as a rapid transit system in a region with only bus service today, or innovative consumer products such as cellular telephones and paging devices. The advantage of this approach compared to standard survey techniques is that it does not simply rely on what a respondent says they might do, but quantitatively tests these responses against a defined set of service attributes. In these choice surveys, different shipping alternatives would be described in terms of the attributes that describe the alternative – travel time, cost, reliability, frequency of service, delivery window, destination in the defined Vermont region, and any physical changes to the infrastructure impacting route selection. In the choice surveys, the values of each of these attributes are systematically varied, asking the shipping decision-makers to choose an alternative under varying levels of service. This information is then estimated to identify how shipping decision-makers tradeoff the attributes when making their shipping decision. Finally, these models are applied to estimate how shippers would make their decisions for the actual proposed new freight transportation alternatives.

The fourth and final step of the analysis is to incorporate the output data from the mode choice model into the travel demand model. The Vermont truck freight model consisting of truck trip tables created as part of this study are the most reliable source to assess changes in demand forecasts. The freight model uses the accepted statewide travel demand model developed for all vehicles. Using this model ensures consistency among the planning practices in Vermont and will facilitate more rigorous analyses, such as congestion and air quality impacts. This will allow VAOT to measure the impact of the build alternatives as they relate to vehicle-miles of travel, levels of congestion (V/C ratios), and secondary impacts such as the change in vehicle emissions.

5.3 Evaluate the Feasibility of Operating Intermodal Facilities

Intermodal transportation is considered an efficient method for moving freight because it maximizes the service strengths of each mode. While some intermodal service exists in Vermont today, there is a strong desire to expand its use to achieve a better modal balance and to mediate existing truck traffic on Vermont highways. Therefore, this study included an assessment of the feasibility of enhancing rail/truck intermodal services in Vermont. It identified specific issues associated with intermodal service, considered the benefits of improved intermodal service, and evaluated the role the state in promoting and implementing new and improved intermodal services. This section describes rail/truck intermodal service and its application to Vermont shippers and receivers, and presents recommendations for new and improved service opportunities.

"Intermodal freight" was first defined as trailers moved on rail flatcars or containers moved on rail flatcars (TOFC/COFC). The original study was limited to the evaluation of TOFC/COFC freight movements of rail cars to and from intermodal terminals and the corresponding pickup and delivery by truck. This is the traditional definition of intermodal, but at the outset of the study it was deemed useful to expand the definition to include a full range of rail/truck transfer operations, including transload, warehousing, and bulk transfer facilities. A non-traditional intermodal business also included in the evaluation is the movement of express freight by Amtrak, using its existing passenger train service. The decision to expand the definition was based on a cursory overview of traditional intermodal markets, which typically are high density urbanized areas with large consuming or producing markets. It also was based on interviews with shippers and railroads who reported a need for transload facilities throughout the state.

TOFC/COFC Intermodal

TOFC/COFC intermodal service is an important topic for Vermont. It represents a combination of rail and truck services primarily in longer-haul markets where the strengths of each mode can be maximized. Existing TOFC/COFC is currently carried on Vermont rail lines; although there currently are no termination or origination of this freight in the state. These shipments primarily include the movement of products from the U.S. Midwest to and from Canada. The principle route is via the NECR line from its current connection to Canadian National (CN) at East Alburgh to the southeastern corner of the state. This traffic continues to terminal points on New England Central Railway (NECR) at Palmer, MA and New London, CT. A large portion of this traffic terminates on the Massachusetts

Central Railroad (MCER) at Palmer from which the containers are unloaded and distributed to the metropolitan areas of New England. Other routes of TOFC/COFC traffic utilize the Clarendon & Pittsford Railroad (CLP)/Green Mountain Railroad Corporation (GMRC) from the Whitehall, NY connection with Canadian Pacific (CP) and Northern Vermont Railroad (NVR) with its system connection to Maine. As such, Vermont is functioning as an intermodal gateway for certain markets.

Vermont shippers and receivers use regional terminals to access TOFC/COFC service. The closest ramps are located in New York, Quebec, and Massachusetts. This study has analyzed the available data to describe the existing service options and define what Vermont should do in the upcoming years to improve the TOFC/COFC service opportunities.

Since intermodal moves are typically long haul, access to the North American intermodal rail system is critical. Figures ES.17 and ES.18 provide North American and regional views of the existing east/west intermodal network. They show that Vermont railroads have connections to the network at several locations. The sale and division of Conrail to the Norfolk Southern and CSX Corporation railroads has impacted the connections of Vermont railroads with national carriers. The connections to Vermont's rail systems are now increased with the ability to directly move traffic to these two national carriers. Prior to the Norfolk Southern and CSX purchase, the connection of Vermont railroads to the national rail system was primarily via the single carrier, Conrail. The benefit of this is increased options for the railroads of Vermont to negotiate with the connecting railroads. This always affords an advantage over negotiations with a single carrier.

Vermont's rail system also provides multiple rail gateways to the Canadian National and Canadian Pacific systems. These systems connect with the east and west coasts, as well as the major terminal points in the Midwest. The movement of overseas containers through the Canadian ports of Halifax and Vancouver has the potential to provide significant intermodal opportunities for Vermont's rail operations.

The market for TOFC/COFC intermodal service has experienced a strong growth trend since its introduction more than three decades ago. This has occurred based on several factors, including: fuel efficiency, convenience and partnerships; improved air quality; the need for reduced highway congestion; innovative technologies such as double-stack; changing patterns in truck delivery; and consolidation of overseas shipping rates. Figure ES.19 illustrates the growth in intermodal traffic from 1965 through 1999.

TOFC/COFC movements in Vermont are limited to single-stack operations by clearance restrictions on rail lines in Vermont and in New Hampshire and Massachusetts. The height restrictions preclude the movement of double-stacked containers over Vermont lines. Considering that the majority of TOFC/COFC traffic moves in double-stack configuration this is a major obstacle that needs to be overcome. For instance, the clearance restrictions prevent COFC movement on CN and CP lines to connect to existing intermodal terminals via Vermont rails. Elimination of these restrictions will provide Vermont lines substantial opportunities for movement of TOFC/COFC traffic to terminals in Massachusetts and New England. As such, the establishment of a double-stacked clearance route utilizing Vermont rail lines has the potential to divert trucks that currently transport trailers and containers from the Montreal area to metropolitan New England through Vermont.

Figure ES.17 Existing East-West Intermodal Connections from West Coast Ports

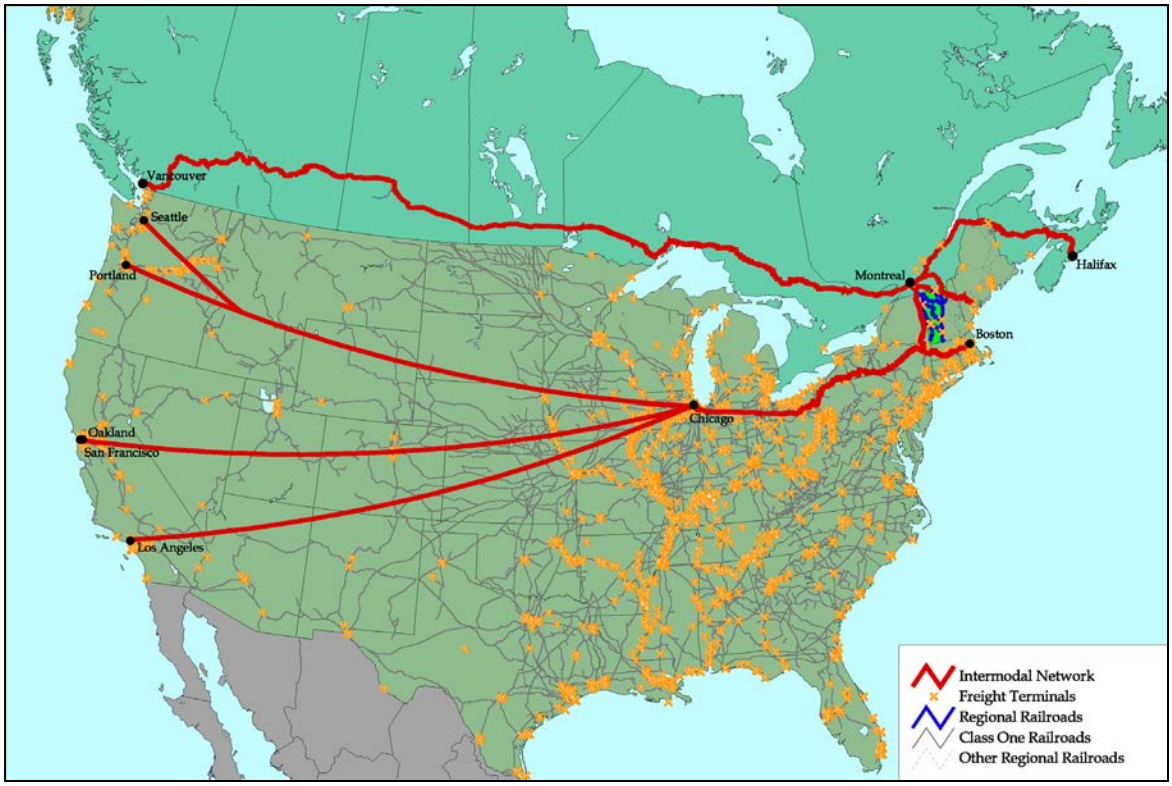


Figure ES.18 Regional View of Existing East-West Intermodal Connections

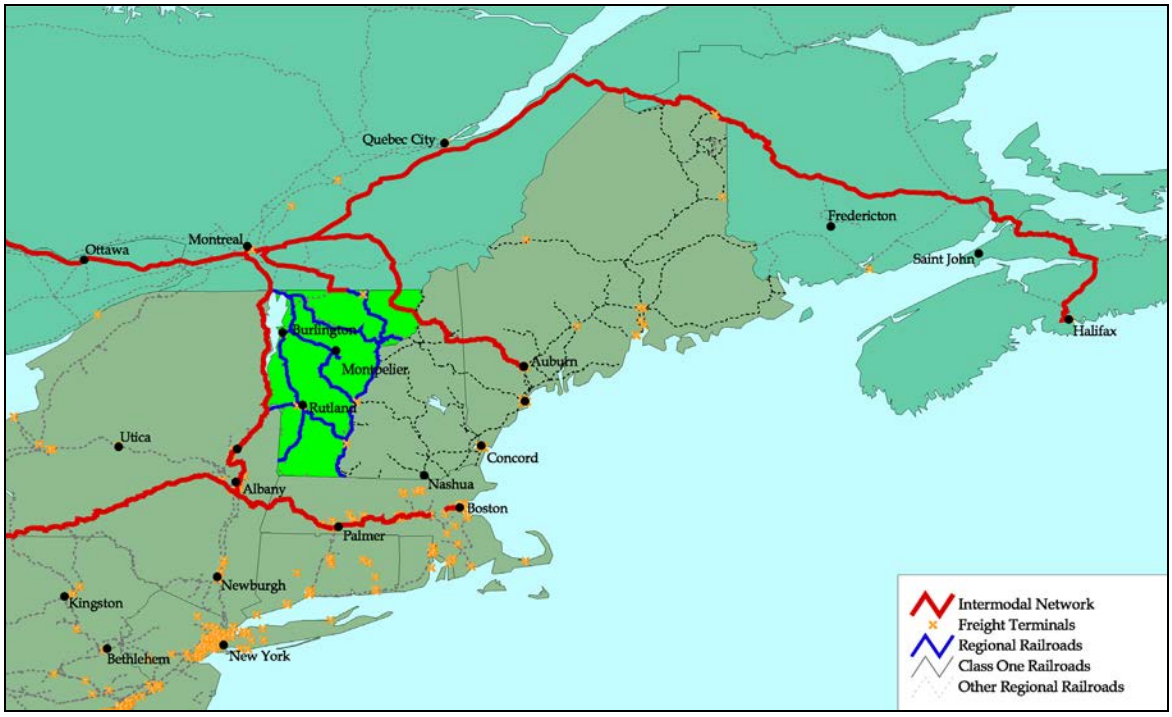
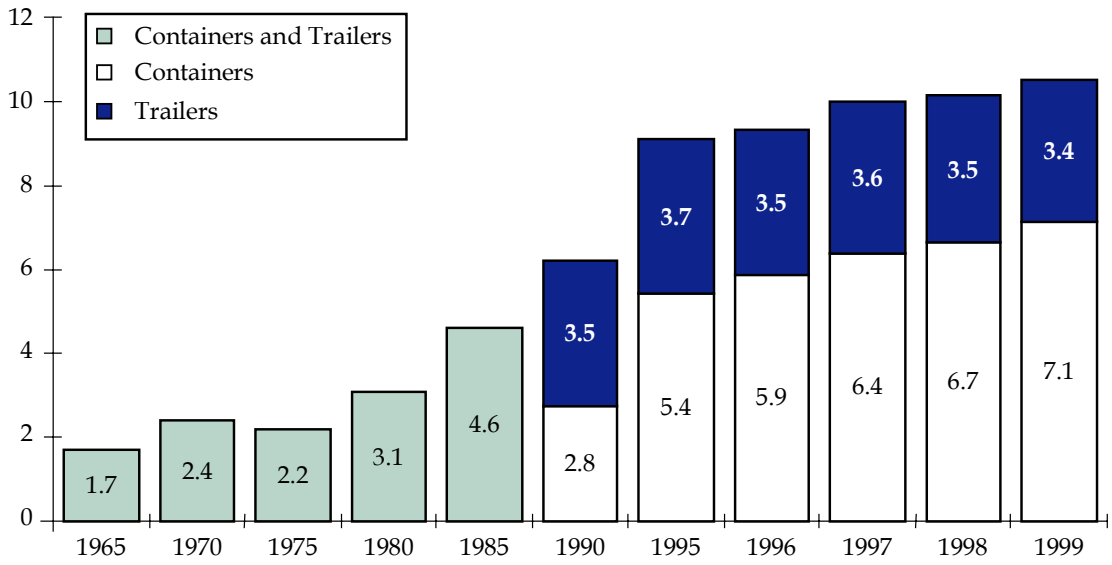


Figure ES.19 Rail Intermodal Growth



In 1997 the state of Vermont completed a study of railroad clearance restrictions for double-stacked trains. The report concluded that there are 30 obstructions within the state. The obstructions included 24 roadway bridges, two tunnels, and four thru-truss railroad bridges. To effectively expand the TOFC/COFC movements on Vermont rail lines, double-stacked clearance improvements must be made. The principle opportunity for double-stacked container movements is from the Vermont rail system connection to the Canadian rail lines. The main lines of both Canadian National and Canadian Pacific have double-stacked clearances connecting to the Midwest and the Canadian Ports on east and west coasts. The Vermont rail system connects to both of these carriers. The possible routes include the lines of New England Central, Clarendon and Pittsford with Green Mountain Railroad, and the Northern Vermont. Each of these potential routes converge in the Bellows Falls area, north of the Bellows Falls Tunnel, located on the New England Central line. The tunnel's existing clearance is 17-6". The structure has been deemed the most critical restriction to developing double-stack intermodal service. Currently, as part of the Vermont Rail Capital Policy Plan, Vermont is evaluating clearance improvements for the Bellows Falls Tunnel.

Expansion of the TOFC/COFC intermodal rail service in Vermont is prevented by the current overhead clearance restrictions. It is therefore recommended that the state implement a clearance improvement program. To provide a complete double-stack clearance route will require bridge improvements in Vermont, as well as in New Hampshire and Massachusetts. Therefore, a multistate, regional approach is critical to this improvement program. With the establishment of a high volume overhead TOFC/COFC route, there could be an opportunity to establish a "satellite" intermodal terminal in Vermont. A terminal of this type would initially attract existing intermodal business using out-of-state

ramps. Longer term, the goal would be to build new business. The Class I railroads usually resist opening small terminals due to small load centers and schedule penalties. However, VAOT may decide to support such a development to better manage truck vehicle-miles of travel from a policy perspective.

Transload Intermodal

There are a number of facilities in Vermont that provide transload services from rail to truck and truck to rail. The facilities are principally related to the handling of bulk material. Significant commodities include lumber, fuel oil, gasoline, propane, steel products, bricks, plastics, and chemicals. The types of facilities are generally classified by their functions: bulk transfers, transload, and warehousing.

Bulk transfers are generally movements of a single product to a terminal. The product, such as fuel oil, is unloaded either into storage facilities or transferred directly from one mode to another.

Transload facilities are consolidation and distribution points for outbound and inbound commodities. A typical transload facility will include rail tracks for spotting rail cars for loading and unloading, laydown areas for storage of commodities, covered storage areas, warehousing for maximum weather protection, security fencing, and office facilities. Additional facility features may include cranes, forklifts undertrack unloading equipment, conveyors, truck and rail car scales, and rail moving equipment to expedite placement of rail cars for loading and unloading.

The principle advantage of a transfer facility is that it can be used by customers who have neither direct access to a rail siding nor the storage capacity to handle the larger rail cars. The warehousing function of the transfer facility also allows shippers or receivers to consolidate material at a single point for distribution as their business requirements dictate. This can enable a local business supplier to purchase a rail car load of product with a price advantage. It also can be used by several customers to split "car load" deliveries. The local placement of the transload facility also reduces the need for a shipper or receiver to move product to or from a distant site via truck, thus reducing the number and distance of truck trips within the state

Warehousing is the third type of non-TOFC/COFC multimodal movement. Warehousing refers simply to commodities that are stored at a warehouse facility for continued movement via rail or truck. A warehouse can be used for inbound or outbound activities, and the building may be heated, unheated, or refrigerated. The principle difference between a warehouse and a transfer site is that the latter includes open storage and indoor facilities that may be limited and less secure. Warehousing can be used for a variety of commodities. Most warehousing is done for finished products requiring specific weather protection and higher security. Typical products include consumer goods, manufactured building materials, food and beverages, and parts and equipment.

One of the principle reasons that shippers utilize trucks is that all business can be accessed by trucks via the highway system. This does not apply to railroads. Therefore, greater access to the rail system is needed to encourage expanded use of rail. The means to accomplish this can generally be viewed as implementing policies that support

connections to the rail system. An example would be to encourage industrial park development to be located adjacent to rail lines and include track design, and possibly construction, in the implementation of industrial park development. Encouragement of rail siding construction to existing or future development sites will increase the use of rail facilities. Currently, there is a state program that provides matching funds for construction of sidetracks for business. This program could be expanded and promoted to support increased rail usage. Specific programs include highway-rail grade crossing improvements, bridge improvements to support newer 286,000 car weights, and a double-stack clearance program.

Amtrak Freight Service

The active use of Vermont rail lines for passenger service provides additional revenue that can be complementary with freight service. This commitment to passenger rail service has provided a means to obtain substantial federal funds for capital rail improvements. Shared freight and passenger operations allows the freight operations on the lines an opportunity to lower fixed costs which in turn has allowed the railroads to market freight operations more successfully. The corresponding revenues increases the ability of the railroad to maintain the track structure to a level that supports efficient passenger and freight operations.

In Vermont, Amtrak has two routes that provide interstate service connections to the Amtrak Rail system. One service is known as the "*Vermonter*." This service originates in St. Albans, Vermont and travels on the NECR line to Palmer, MA. It continues to Springfield, MA, New Haven, CT, and New York City. The second service is the *Ethan Allen* train that operates from Rutland to Whitehall on the CLP then over the existing *Adirondack* train route from Saratoga, Schenectady, Albany, and New York City.

To develop additional services of revenue to assist with their mandate to become self-sufficient, Amtrak began to evaluate adding freight service. Using existing passenger routes, Amtrak developed a business plan to move time sensitive and high value freight traffic with its passenger trains. The targeted commodities are principally those that move by truck. Having obtained concurrence from the Surface Transportation Board to provide this specific freight-related business, Amtrak is seeking to expand its freight-related business. The available Amtrak routes serving Vermont present possible opportunities to provide freight service to specific business interests in Vermont.

Amtrak is developing a national business plan that targets movements of freight across the continental U.S. The significant item to note for Vermont is the main connections to Albany and Springfield/Boston. This provides connection opportunities to both of Vermont's Amtrak trains.

If the impact to Vermont for Amtrak freight service is only viewed in terms of freight diverted from truck to rail, it would be easy to conclude that the benefits will be negligible. However, as discussed above the vitality of the railroad system is largely dependent on the total volume of traffic moved. For the Vermont railroads, increased Amtrak revenue resulting from freight traffic will result in decreased operating costs to the railroads, increased service opportunities for rail served customers, and greater utilization of the railroad infrastructure. A second benefit would be the increased viability of Amtrak passenger services.

The development potential for the Amtrak freight business in Vermont will depend significantly on the success of Amtrak to create a national traffic base. Amtrak has confirmed that freight business is a priority. While specific Vermont business opportunities for Amtrak are currently undefined, areas of potential freight business include rail services, perishable food products, high value shipments such as electronic components, and U.S. mail and courier materials. Amtrak officials noted that excellent relations with Vermont will greatly enhance their ability to market this service.

6.0 Findings, Conclusions, and Recommendations

This section presents the key findings, conclusions, and recommendations of the Vermont Statewide Freight Study. The findings and conclusions are based on the analyses completed for each task. The recommendations have been developed in support of the findings and conclusions.

6.1 Findings and Conclusions

The findings and conclusions are organized around five areas. These areas consist of the economy, the transportation infrastructure, freight flows, intermodal transportation, and institutional issues.

Economy

The Vermont economic trends are favorable compared to national and regional trends.

- Unemployment rates have continued to decline over the last decade, following the national trend, although unemployment rates in Vermont are lower than the U.S. average. These rates fluctuate by county. With the exception of the Northeast Kingdom, the state is at four percent or less.
- Vermont's population is growing slower than the U.S., but faster than the Northeast.
- Manufacturing employment as a percent of total employment has continued to decline and is lower than the U.S. as a whole. Chittenden County and the western and southern counties in general have the highest density of manufacturing employment.
- In addition, Vermont's average wage is one of the lowest in the Northeast.
- Although the relative importance of manufacturing in Vermont has decreased, total manufacturing contributions to GSP have grown.

Based on these trends, Vermont is well positioned to maintain it's position as a positive contributor to the regional, national, and international economy. These will be dependent to a certain degree on its ability to maintain and improve the transportation infrastructure. This will be necessary to support continued economic prosperity and growth.

Transportation Infrastructure

The transportation infrastructure in Vermont has met the needs of the businesses based here, but not without creating some inefficiencies, additional costs to shippers and receivers, and restricted modal selection.

Due to the rural character and mountainous topography of Vermont, the highway system does not provide trucks with efficient access to all parts of the state. Specifically, there are no east/west limited access highways. Industry representatives agree that there should be improvements to the existing east/west highway corridors in Vermont. These consist of U.S. 2 in the north, U.S. 4 in central Vermont, and VT 9 in the south. There is a related problem for the north/south corridor along the western border. This corridor consists of U.S. 7 and VT 22A. These highways pass through small community centers, have narrow segments, and steep inclines. VAOT has been working with local communities and industry stakeholders to balance the desire of businesses for better access to plants and markets with citizens concerns about diminishing quality of life resulting from noise and air pollution from increased truck traffic. In addition to in-state efforts, VAOT has been working with the states of Maine, New Hampshire, and New York to improve multi-state east/west corridors.

The expanded truck network defined by the Legislature in 2000 improved the system by designating a statewide truck network with overall truck lengths less than 72 feet (including 53' tractor trailer combinations) can travel without permits. The only exception is the segment of U.S. 4 through Woodstock where a permit is required. Major successes for the business community included the elimination of permits for specific vehicles on the designated network and the opening of key highway segments to larger trucks, such as U.S. 4. Another key issue for truck movements is the variations in local road postings. To access some areas a trucking company must acquire multiple permits, which can be an extremely time consuming and costly activity.

The rail system provides good geographic coverage. This was recently improved upon by the reactivation of the Wells River section along the eastern border. However, the rail system has weight and clearance limits that impact its ability to function effectively in the regional, national, and North American rail system. The maximum weight limit for almost all of the system is 263,000 pounds per car. This is an issue as Class I railroads are typically operating at 286,000 pounds or above. This creates operational problems for interline traffic destined for or moving through Vermont from other railroads. In addition, there are no routes in the state that are double-stack cleared. There are no TOFC/COFC terminals in Vermont, however, there are through train moves currently carrying trailers and containers on flat car. A double-stack cleared route could create a niche market for Vermont railroads.

Another factor impacting rail service in Vermont is the reduced number of direct rail sidings and the limited number of transload facilities. The railroads downsized their systems over the years in response to reduced traffic. In a time of limited capital, these sidings cannot realistically be put back. As a result, there is a demand today for a greater number of transload facilities for the transfer of bulk commodities between truck and rail. This is a market still served by the short lines in Vermont and represents an area the state should consider in future investment decisions.

The airport system consists primarily of state and municipality-owned airports. A limited amount of freight is moved into and out of Vermont by air. It represents less than 0.1 percent by weight. There are three major airports currently involved in freight operations. They consist of the airports in Burlington, Rutland, and Montpelier. These airports serve a critical link in the overnight parcel and mail network. The courier companies must transport their goods by air to ensure next-day service. In fact, VAOT has been looking at the possibility of improving an airport in the Northeast Kingdom for just this reason. In addition, Federal Express is looking to expand its operation in Burlington. Future use of the airport system in Vermont will continue to be for niche markets like overnight service and some limited use by high-tech companies and companies shipping light, perishable products.

The water system in Vermont consists of ferry service across Lake Champlain. There are multiple locations where truck can access this service, although not all facilities accommodate trucks. This service exists to address the geographic barrier created by Lake Champlain. It provides carriers with the opportunity to take more direct routes for some corridors. The other component of the water system that needs to be recognized is the location of major ports in proximity to Vermont shippers and receivers. There are several ports that provide Vermont shippers and receivers with service. They include Montreal, Quebec, Halifax, Boston, and New York/New Jersey. Each of these facilities involves a dray move by truck. West Coast ports can be accessed via intermodal rail for Pacific markets. This port infrastructure consists of multiple competing facilities and provides Vermont with good access to international markets.

Freight Flows

In 1997 there were about 23 million tons of freight moving on the Vermont transportation infrastructure. About 90 percent of this tonnage moved by truck. Rail consisted of about seven percent. These two modes basically carry the freight into, out of, within, and through the state. Through moves are the single largest type of movement representing 35 percent of all tons moved. This is characterized by moves to/from Quebec, New Hampshire, and Massachusetts. Also, Vermont receives significantly more freight than it ships (7.1 versus 2.9 million tons annually). Within Vermont, Chittenden County is by far the largest receiver of freight. Chittenden and Rutland counties are the largest shippers of freight. The freight flow patterns closely follow the economic and population centers.

The commodity flow analysis was originally intended to include data gathered during the Canadian National (Truck) Roadside Survey (NRS) conducted during 1999 and 2000. The Vermont Agency of Transportation, as a member of the Eastern Border Transportation Coalition (EBTC), contributed funds to this effort to capture additional data specific to U.S./Canadian border crossings. This data was not available prior to the analysis and preparation of the freight flows completed as part of this study. However, it will be made available in the spring of 2001 and an addendum to this report will be prepared to summarize the cross-border data that impacts the Vermont transportation infrastructure.

Intermodal Rail Transportation

The intermodal analysis completed for this study was originally intended to explicitly explore the potential for developing traditional truck/rail terminals to serve TOFC/COFC markets. The data collected early in the project suggested that the effort should also address other truck/rail transfer services, such as transload facilities for the transfer of bulk commodities between truck and rail. This was an important component because, as described above, many direct rail sidings have been eliminated over the years resulting in the need for additional transload facilities. In addition, this could potentially represent a shorter-term improvement opportunity.

The existing TOFC/COFC service operating in Vermont consists of through trains. There is no intermodal ramp located in Vermont. The Vermont Railway tested an intermodal service several years ago, but was unable to make it profitable. This is due to two key variables. First, Vermont does not have a single base load shipper. For any intermodal ramp, there needs to be a single customer providing the majority of loads required to make the service profitable. Second, Vermont is surrounded by several large, successful intermodal ramps that can be accessed with a relatively short dray by Vermont shippers/receivers. These consist of Albany, NY, Syracuse, NY, Palmer, MA, and Montreal. The major network of terminals located in Northern New Jersey is also accessible. Therefore, any terminal based in Vermont will need to compete with these established facilities. It is unlikely that a new ramp will be able to attract enough freight from the existing sites to be efficient.

The existing transload service operating in Vermont consists of a network of terminals and yards operated by the railroads serving Vermont. The service has grown in importance as the rail system has been consolidated over the years, resulting in the elimination of rail spurs and direct rail sidings. This service is heavily marketed by the railroads today. Transload facilities provide shippers/receivers with access to rail transportation and storage capacities that otherwise would be unavailable. This enables a local business to purchase a rail car load of product at a lower price per unit, and it provides opportunities for several shippers/receivers to consolidate their freight to take advantage of the economies offered by rail. This translates into lower costs and reduced dependence on trucks.

Institutional Issues

Vermont is a state characterized by beautiful landscapes, quaint old towns and villages, and a quality of life that attracts many. This environment is not conducive for the development of large industrial operations or large trucks moving on substandard highways through small villages. However, in order for Vermont residents to earn a living and serve the tourism industry, it is necessary to have an adequate transportation system. These conflicting goals have been the center of conflicts between the public and private industry. VAOT and the Legislature has been left to mediate these conflicts and work to create a system that addresses the concerns of both groups. The practices of retention and attraction of businesses in and to Vermont are impacted by the desire throughout the state to maintain the quality of life while working to create a strong base of employment opportunities.

This Statewide Freight Study is an important first step for Vermont. It provides data and analyses that explain what is moving, how much is moving, why it is moving the way it is, and what can be done to facilitate future movements. The 2000 truck network created by the Legislature has already addressed some of industry's concerns.

6.2 Recommendations and Next Steps

A series of recommendations and next steps have been developed to assist VAOT in improving the freight transportation system in Vermont in the coming years. These recommendations and next steps address policy decisions, outreach activities, educational exercises, and development and use of new freight planning and modeling tools. The following recommendations and next steps have not been prioritized.

Recommendations

- **Continued monitoring of the designated truck highway network in Vermont.** The existing truck highway network is a very positive advancement in the infrastructure, however, this will need to continuously be reviewed to match economic development, as well as citizen's concerns regarding safety, and noise and air pollution.

- **Continued emphasis on key freight highway corridors, specifically east/west and north/south corridors.** The issue of north/south routes on the western border of Vermont, as well as east/west highways throughout the state continue to be significant factors for efficient freight transportation. VAOT should continue to work towards a viable solution for these corridors.

- **Development of freight-specific projects.** Freight-specific projects should be developed, prioritized, and included in the State Transportation Improvement Plan (STIP). This is the funding mechanism for transportation projects, so the inclusion of freight-specific projects will be critical for addressing improvements to meet the needs outlined in the report.

- **Use of the methodology for prioritizing projects.** The methodology for evaluating freight transportation projects developed as part of this study should be incorporated into the VAOT's planning activities. This will require buy in from VAOT staff and acceptance of the importance freight transportation as a separate goal.

- **Investigation of possible modal diversion analyses.** This study outlines the data needs and methodology for conducting modal diversion analyses. This material should be reviewed and VAOT should consider possible applications of this approach.

- **Develop an outreach program that communicates the findings of this study to the general public to build consensus for freight system improvements.** It is critical to educate the public about the importance of freight transportation in Vermont. The goal of this outreach should be to educate the public as well as provide opportunities for comments with the ultimate objective being the building of consensus regarding freight planning initiatives and project development and implementation.

- **Prepare an action plan to develop double-stack-cleared routes in Vermont.** The future of intermodal rail service in Vermont is directly related to the ability of Vermont to provide double-stack capabilities through the state. A critical element of this plan should be coordination with the surrounding states in the development of cleared routes serving the Northeast.

Next Steps

- **Develop action plan for development of expanded intermodal network.** Regardless of the decision regarding model diversion opportunities, VAOT should continue to work to improve the intermodal infrastructure serving Vermont. Within the state this would likely include transload facilities in the short term. Regionally, this would likely include consideration of joint efforts with surrounding states and provinces regarding TOFC/COFC terminals. Questions to be addressed would be things like what can improvements to weight and clearance limits to Vermont's rail system do for the regional intermodal opportunities.

- **Incorporate the recommendations developed as part of the Vermont Rail Capital Investment Policy Plan and the Long-Range Transportation Plan.** These plans will be completed in early 2001. These findings should be incorporated into the freight planning activities.

- **Incorporate the Canadian National (Truck) Roadside Survey data.** This data will be incorporated as an addendum to this study. The results of this subsequent analysis should be incorporated into these recommendations.

- **Develop a stakeholders forum for industry representatives to provide input and expertise to freight projects.** Data collected from the industries in Vermont were a critical part of this study. An ongoing forum should be developed that provides VAOT staff with access to the freight industry, as well as the industry representatives access to the transportation planning staff. This should also include involvement of the general public.