Vermont Freight Plan

VTrans Working to Get You There
Vermont Agency of Transportation

May 2012
Revised August 2013 (MAP-21 Compliance)
Revised March 2015 (MAP-21 S.1116 Compliance)
Revised June 2017 (FAST ACT Compliance)

CAMBRIDGE SYSTEMATICS

Vermont Freight Plan

Final Report

prepared for

Vermont Agency of Transportation

prepared by

Cambridge Systematics, Inc.

with

Economic Development Research Group
Fitzgerald and Halliday
Parsons Brinkerhoff

May 2012
Revised August 2013 (MAP-21 Compliance)
Revised March 2015 (MAP-21 S.1116 Compliance)
Revised June 2017 (FAST ACT Compliance)

Vermont Freight Plan

Final Report

prepared for

Vermont Agency of Transportation

prepared by

Cambridge Systematics, Inc.
100 CambridgePark Drive, Suite 400
Cambridge, MA 02140

with

Economic Development Research Group
Fitzgerald and Halliday
Parsons Brinkerhoff

date

May 2012
Revised August 2013 (MAP-21 Compliance)
Revised March 2015 (MAP-21 S.1116 Compliance)
Revised June 2017 (FAST ACT Compliance)

Table of Contents

List of Tables

List of Figures

Executive Summary

Preparation of this report included an inventory of the State' freight transportation infrastructure, identification of emerging economic sectors, quantification of freight flows and description of freight system needs and deficiencies. The report concludes that Vermont's freight system is and will continue to meet the State's needs, if it is properly maintained.

This summary provides a brief overview of the demographic and economic trends, describes the resultant trade and freight demand, assesses the condition of the State's freight network, identifies key needs and deficiencies and spells out appropriate freight transportation performance measures to monitor the system. The summary concludes with recommendations for policy, program and project packages to ensure the continued effectiveness of the freight transportation system.

The passage of the last two pieces of federal surface transportation legislation, **Moving Ahead for Progress in the 21st Century Act** (MAP-21) and **Fixing America's Surface Transportation** (FAST) have spurred a shift to performance- and outcome-based programs at both the National and State level. Vermont is establishing itself as a leader in supporting these goals through this Freight Plan, which lays a foundation for a performance-based system by identifying physical, operational and institutional needs in the freight sector. The assessment of needs in this report serves as a guideline for investing in projects that will enhance the efficiency and effectiveness of the transportation system and serve to further the National freight policy goals of economic competitiveness and efficiency; congestion; productivity; safety, security and resilience of freight movement; infrastructure condition; use of advanced technology; performance, innovation, competition and accountability in the operation and maintenance of the network; and environmental impacts.

DEMOGRAPHICS AND ECONOMY

Home to 622,000 residents in 2009, Vermont is the second smallest state in the nation in terms of population. By 2039, population is projected to increase by 10.3 percent to 686,000, or 0.3 percent per year from 2009 onward, less than half of growth rate of 0.7 percent rate over the last 30 years. The counties in and around Burlington—the state's most populous city—are expected to have the highest growth rates, while the remaining counties will experience low to negative growth rates. Although the total population will grow slowly, the proportion of residents aged 65 and older will increase rapidly. The lower population growth rate and the aging of the population mean relatively less consumption of housing, food, clothing and retail merchandise and a corresponding reduction in the growth rate

of freight demand for these goods relative to business and commercial sector demand.

According to the 2009 Economy.com forecast, which was adopted for this Freight Plan, Vermont's gross domestic product (GDP) is expected to double from an estimated $21 billion in 2009 to $42 billion in 2039. The projected average annual growth rate of 2.4 percent closely tracks the projected growth rate for the U.S. economy as a whole, but it is lower than that experienced over the last 30 years and lower than the rate of growth anticipated before the recession. The current expectation is that the U.S. and Vermont GDPs will grow at rates between 3 and 5 percent annually over the next few years as the national economy recovers from the recession and then settle back to a longer-term compound average growth rate of 2.4 to 2.5 percent.

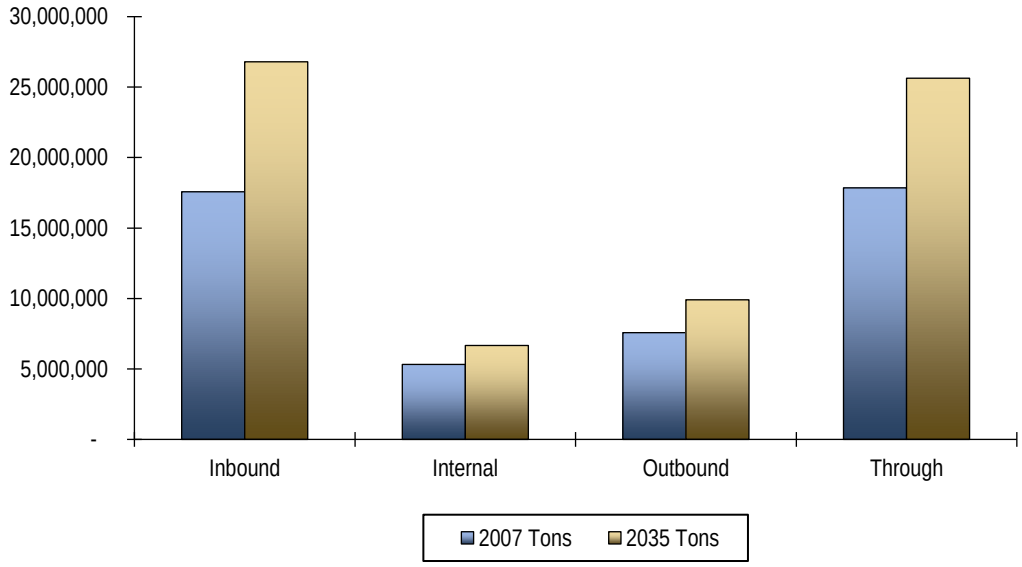
Manufacturing topped the ranks of Vermont's five most important industries in 2009; the five included manufacturing, financial activities, government, education and health and retail trade. By 2039, financial activities and retail trade will top the list, with professional and business services and information climbing into the top five. The number of jobs in Vermont businesses and industries is anticipated to increase from 307,100 in 2009 to 362,900 in 2039, a growth rate of 0.6 percent per year. This is approximately one-half of the growth rate experienced between 1980 and 2009.

TRADE AND FREIGHT DEMAND

In 2007, Vermont handled over 52 million tons of freight worth approximately $58 billion across all modes. By 2035, this volume is expected to grow to 70 million tons, a compound annual growth rate of 1.28 percent compared to the anticipated GDP growth of 2.4 percent. This lower growth rate reflects a continued shift in economic activity away from freight-intensive industries such as lumber and agriculture towards services.

Inbound and through trade each accounted for about one-third of all freight flows in 2007. Outbound flows made up 16 percent of tonnage and internal traffic made up the remaining 10 percent. This split, with inbound flows making up more than twice the volume of outbound goods, highlights the fact that Vermont's economy is primarily service-oriented, importing food, clothing, building materials, consumer goods and business machines. In this respect, Vermont is similar to most of the other Northeast states. In the future, with the service sector taking an even more pronounced role in the economy, this directional split will be accentuated, as shown in Figure ES.1.

Figure ES.1 Forecast of Freight Flows by Direction
2007 and 2035 Tons by All Modes



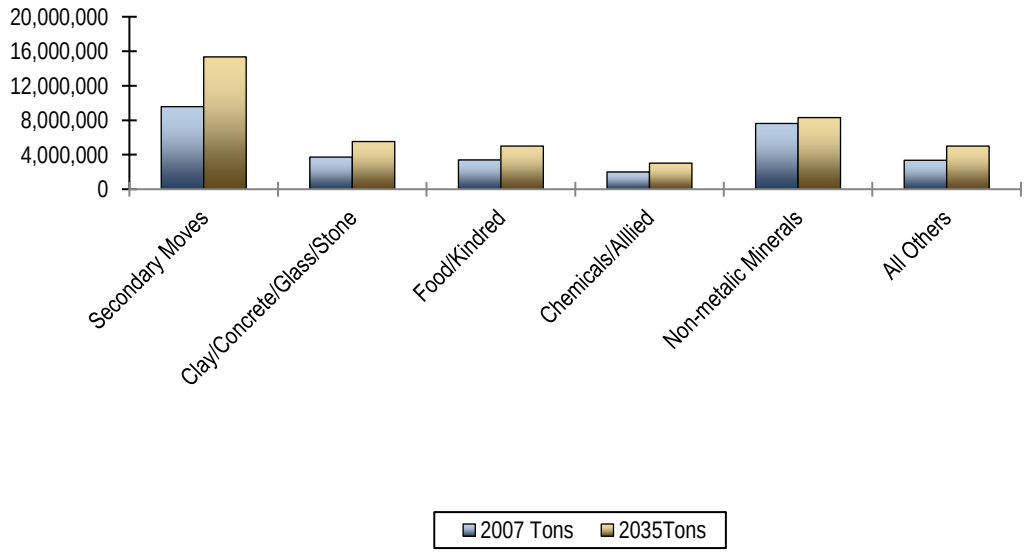
Vermont's strongest trading ties are with New York, New Hampshire, Massachusetts and Canada. Trade with New York accounts for 60 percent of all trade by weight (15 million tons) and over 50 percent by value ($14.7 billion), while trade with New England accounts for 19 percent by weight (4.7 million tons) and 13 percent by value ($3.7 billion). In 2007, 6.5 million tons of goods with a combined value of $7.3 billion crossed Vermont's border with Canada. The total included goods imported and exported by Vermont as well as goods imported and exported between other U.S. states and Canada but transported through Vermont. The vast majority of the freight moving between Canada and the United States in inbound. Inbound trade accounted for 79 percent of the trade by weight (5.1 million tons) and 66 percent by value ($4.9 billion). Given the close proximity of New York, New Hampshire, Massachusetts and Canada to Vermont, over 90 percent of the trade between Vermont and its partners takes place by truck.

Chittenden County is the largest recipient of inbound freight flows (5.2 million tons annually), reflecting the substantial volume of goods needed to feed, cloth, house and supply Vermont's largest metropolitan region. The shipments include 'secondary moves' (a catch-all freight classification that covers a wide variety of consumer retail and service business goods moving from warehouses outside Vermont to retail stores and businesses within Chittenden County), chemicals, food and nonmetallic minerals. At 2.4 million tons, Bennington is the second largest importer of goods in Vermont. Five other Vermont counties each import over one million tons annually. Rutland County is the largest source of outbound flows by weight (4.3 million tons annually). These are shipments of nonmetallic minerals (3.2 million tons) and clay, concrete, glass and stones (670,000 tons). Chittenden County generated 1.2 million tons of outbound shipments of food, nonmetallic minerals and 'secondary moves.'

Correspondingly, the commodities moving over Vermont's freight transportation network include 'secondary moves,' nonmetallic minerals, aggregates for construction and food products. 'Secondary moves,' which consist of mixed shipment of goods in the retail and wholesale trade, make up the single largest commodity group that is transported in the State at nearly 10 million tons. Most of this traffic is imported into Vermont through New York State. At 8 million tons, nonmetallic minerals (sands, gravels, building stones, etc.) are a key source of exports for Vermont. They are shipped to New York State, New Hampshire and in smaller amounts to the rest of New England.

Vermont is dependent on trucking for movement of most of its freight. In 2007, trucks moved 80 percent of the freight tonnage going into, out of, through and within the State, which totaled just over 43 million tons annually. Trucks also handled 88 percent of the commodities transported by value, totaling $51.5 billion. The proportion of freight carried by truck in Vermont is typical of the New England states. (Maine has a lower truck share—70 percent of cargo by weight—because it ships a substantial amount of its forest products by rail.) A very modest volume of freight—less than .03 percent by value—travels through Vermont's airports.

Figure ES.2 Forecast of Freight Flows by Commodity
2007 and 2035 Tons by All Modes (Sorted by Total Growth)



VERMONT'S FREIGHT TRANSPORTATION NETWORK

Highways carry most of Vermont's freight. Interstate highways I-89 and I-91 span the state and provide high-speed, high-capacity routes for trucks and automobile traffic. They are also the main gateways to Vermont's external markets in New

Hampshire, Massachusetts and Quebec. Non-interstate highways serve all the populated areas of the state and provide the major connections to New York State. Outside of urbanized areas, these state highways are typically two-lane roadways. With the exception of U.S. Route 4 between Rutland and Fair Haven (NY), these highways are not access controlled and posted speeds are generally 25 mph to 30 mph in towns and 45 mph or higher in rural areas. The speed limits, recurring congestion in towns and the lack of passing lanes in rural areas slows truck travel on these routes.

Truck traffic is expected to increase by more than 40 percent on many of the state's highway links, including portions of Interstate 91, U.S. Routes 2, 4 and 7; and Vermont Routes 9, 11, 15, 30, 100, 103, 105 and others, as illustrated in Figure ES.3. While this growth may appear alarming, present truck volumes on many of these routes are modest and the impact to the overall volume-to-capacity ratio on most of these routes will generally be minor. Apart from some of the main arteries within the immediate vicinity of Burlington, including I-89, U.S 7 and U.S. 2, the State's highway network has the capacity to accommodate truck freight traffic now and in the future.

Vermont's 578-mile rail network, of which 305 miles are State-owned, serves all regions of the State except Lamoille County. With the exception of three miles of track owned and operated by the Canadian National Railway, all railroads in Vermont are classified as regional or local/short line carriers. Track conditions range from FRA Track Class 1 to FRA Track Class 3, with the former restricting train speeds to 10 mph and the latter supporting freight operations up to 40 mph and passenger operations to 60 mph. Much of the rail infrastructure in Vermont is also weight restricted—limited to carrying loads that are significantly less than the present national standard rail carload weight of 286,000 lbs. The current limits are shown in Table ES.1. VTrans manages an ongoing program to upgrade its rail lines to carry 268,000-lbs. rail cars so that Vermont rail shippers or customers do not need to under-load railcars. In addition, VTrans' Rail Policy Plan calls for all new construction to achieve the 286,000-lbs. standard and, in cases of major structures with a long design life, to achieve the anticipated future carload weight standard of 315,000 lbs.

Figure ES.3 2007-2035 Truck Traffic Growth on Vermont Highway Network
All Commodities

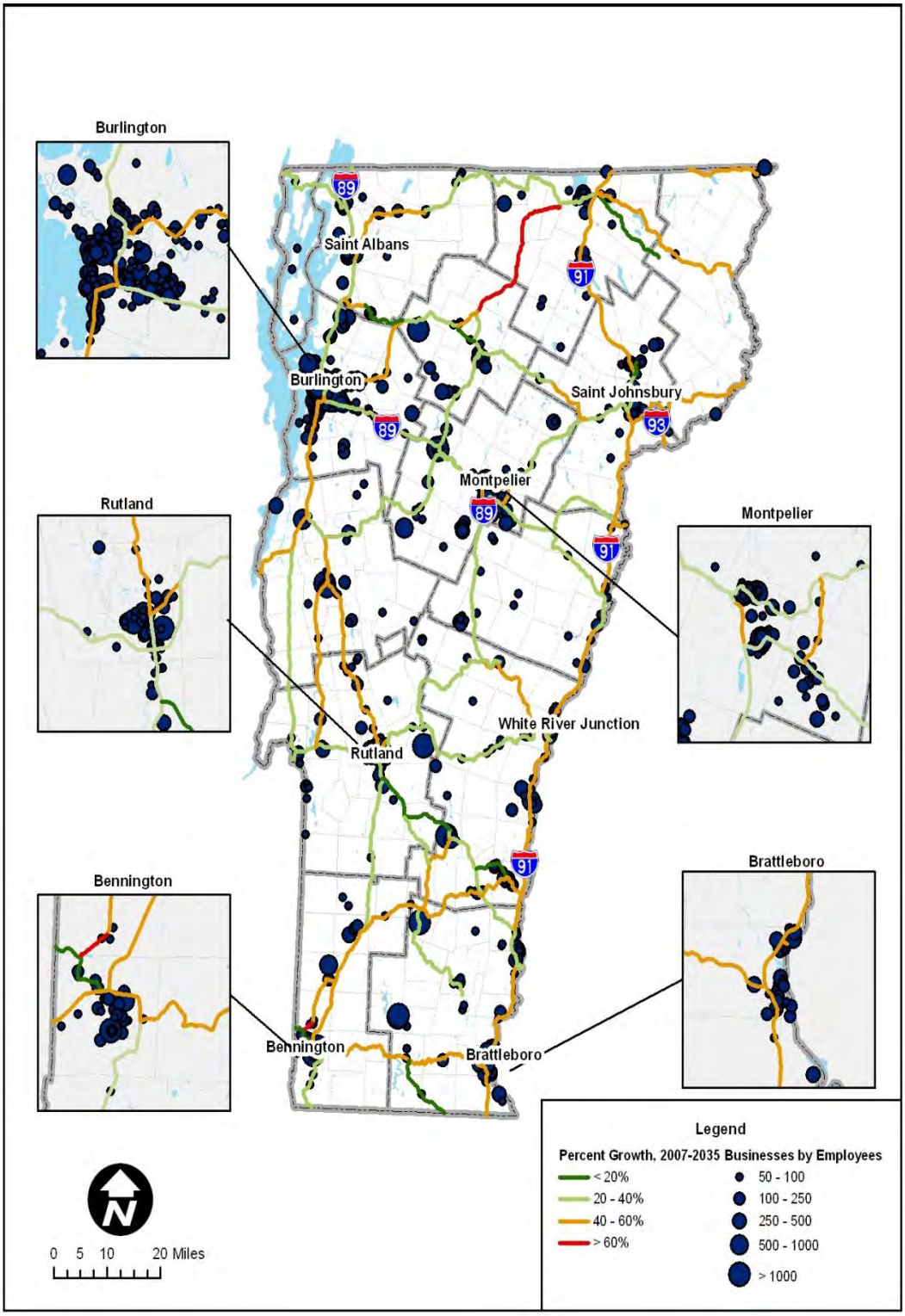


Table ES.1 Existing Railroad Bridge Capacities (2005)

Railroad	Maximum Railcar Loading (Pounds)
New England Central	263,000
Clarendon and Pittsford	286,000
Green Mountain Railroad	263,000
Vermont Railway	263,000
Washington County Railroad	263,000
Washington County Railroad – Connecticut River Division	263,000
St. Lawrence and Atlantic	263,000
Maine, Montreal and Atlantic	263,000

Source: Vermont State Rail Plan Update, 2006.

Vermont received $51 million in American Reinvestment and Recovery Act (AARA) funding for high-speed and intercity passenger rail improvements. The grant funded track and bridge improvements on the New England Central Railroad line between St. Albans and the Massachusetts state line. Separate improvements funded by AARA grants to Massachusetts and Connecticut will increase the carrying capacity of the tracks on the connecting Connecticut River corridor to the south. While the primary aim of these improvements is to decrease travel times and improve the reliability of passenger services, freight operations on the corridor will benefit because increasing the weight limits to 286,000 lbs. ensures the future viability of the line as a local and regional through-freight route.

The Vermont airport network includes 16 airports that are open to public use. Regularly scheduled cargo service is provided at the three National Service Airports: Burlington International, E.F. Knapp (Barre-Montpelier) and Rutland Regional. Intermittent air cargo service is provided at others.

FREIGHT NEEDS AND DEFICIENCIES

Vermont's economic vitality depends on the ability to deliver the goods and services produced in the state to regional and global markets. In an era of increasing economic competition with a growing emphasis on managing costs and greater consciousness of energy conservation and sustainability, Vermont's freight transportation system must efficiently connect its key businesses with regional markets in the Northeast and Mid-Atlantic region, to other major U.S. markets through key regional distribution centers and to global markets through cost-effective access to major air and sea ports. At the same time, the state's freight transportation system must adjust to serving the needs of an aging population and a state economy that depends more on producing services than on producing natural-resource-based or manufactured commodities. These demands will require greater emphasis on reliable and cost-effective connections between the

major regional distribution centers and Vermont's population and business centers.

Freight transportation demand is expected to grow 43 percent between 2007 and 2035, or 1.28 percent per year. This increased traffic will not appear evenly over the entire network, but instead will affect some highway (and other modal) links more than others. However, present truck volumes on many of the State's routes are modest and the congestion impact (measured as overall volume-to-capacity ratio) on most of these routes will generally be minor. Apart from sections of Interstate 89 and U.S. Routes 2 and 7 in the immediate vicinity of Burlington, the State's highway network has the capacity to accommodate freight traffic now and in the future. Similarly, the projected carload increase anticipated on the NECR, VRS, and the other railroads in the state can be accommodated using existing rail capacity. Terminal capacity and landside access are generally adequate at all of Vermont's airports and ferry terminals. Waterborne bulk freight service, which ceased being a significant transportation mode for Vermont in the early 20th Century, completely dried up after 1980 when dredging was discontinued along the Champlain Canal and the Upper Hudson River in New York. The value of restoring this route for freight use was not examined, in part because the affected infrastructure is located beyond the state borders.

To supplement and inform the data analyses, freight-transportation focus groups were conducted in 2010 in Bennington, Brattleboro, Burlington, St. Johnsbury, Rutland and White River Junction. The focus group participants included representatives from businesses that ship and receive freight, rail and motor carriers and economic development and planning agencies. The focus group participants confirmed many of the freight transportation issues identified in the data analyses and prior planning studies, but also identified new and emerging issues. Through data analysis and outreach, the most commonly identified needs were:

- Physical and operational:
  - Highway. Maintain state of good repair; increase weight limits and geometric improvements to handle modern trucks; impose fewer time-of-day and weather-related operating restrictions; and improve oversize/overweight vehicle permitting.
  - Rail. Improve service reliability; upgrade the state's network to fully accommodate 286,000 pound railcars; ensure a general state of good repair; and improve access to rail service either directly or through intermodal transfer.
  - Water. Ensure the continued viability of the Lake Champlain ferry system for freight as well as passenger use.
  - Air. Preserve and expand air freight capabilities
- Institutional and regulatory. Streamline oversize/overweight permitting process; coordinate freight investments with neighboring states; and engage in

dialogues with Vermont communities about the importance of freight and the impact of land-use decisions on the viability of existing and new freight-oriented industry. Many shipper respondents also felt that they would benefit from educational opportunities about shipping logistics, alternatives and optimization.

In summary, the State's freight transportation system should be able to accommodate the projected growth in freight transportation demand if the State:

- Ensures reliable truck travel times between Vermont and its major regional markets such Boston, New York City, Albany and Montreal;
- Keeps highway pavements and bridges in a state of good repair; and
- Maintains rail service that is competitive, economically viable, and preserves the system for future development of medium distance intermodal and rail transload services for Vermont.

FREIGHT TRANSPORTATION PERFORMANCE MEASURES

An inclusive and consistent set of freight transportation system performance measures is an important tool to assess the condition of a transportation system, identify trends and issues and set priorities among potential investments and policies. Performance measures are also beneficial to informing stakeholders, policymakers and the general public about the impacts of transportation on the state's economy and quality of life.

MAP-21 Legislation enacted in 2012 requires states to set performance measure targets based on performance measures to be determined by the USDOT in the areas of Interstate and NHS pavement condition, performance and bridge condition; fatalities and serious injuries; traffic congestion; on-road mobile source emissions; and freight movement on the Interstate system. States must also report periodically on their progress in relation to the targets and how they are addressing congestion at freight bottlenecks.

VTrans has implemented a series of performance measures that monitor the state's transportation infrastructure and operations. While most of these measures address concerns that impact the broad set of system users (such as highway pavement conditions and road safety), only a few measures have been implemented that specifically address freight system performance and these are largely safety and infrastructure related, such as bridge weight limits. To gain a more comprehensive understanding of freight system performance, a broader set of measures should be adopted that illustrate performance at the levels of the economy, logistics/operations and infrastructure across the State's highway, rail and air freight systems. The proposed freight performance measures, which address MAP-21 requirements, are summarized in Table ES.2.

Table ES.2 Proposed Vermont Freight Plan Performance Measures

Level	Category	Highway Freight Measures	Rail Freight Measures	Air Freight Measures
	Economic Activity	Gross State Product (GSP) • major truck-intensive sectors	GSP • major rail-intensive sectors	GSP
	Freight Demand	Truck tons, ton-miles, value • statewide • major truck-intensive economic sectors	Rail tons, ton-miles, value • statewide • major rail-intensive economic sectors	Emplaned tons at VT airports
	Policy, Planning and Management	Stakeholder outreach & communications	Stakeholder outreach & communications	
	Accessibility	Percent businesses within 5 miles of Vermont's primary highway network	Number of businesses with active rail sidings Percent business within 100 miles of IMX or transload facility	% of state served by overnight carriers; No. of carriers providing direct service from VT airports
	Efficiency	Travel time and reliability • major market lanes • border crossings	Travel time and reliability • major market lanes • border crossings	
	Safety	Fatalities and crashes statewide	Fatalities and crashes statewide	
	Environmental Impact	GHG emissions Hazmat spills	GHG emissions Hazmat spills	GHG emissions
	Condition	Volume-to-capacity ratio (LOS) Pavement condition • pavement composite condition measure[1] • structural cracking index[2] • percent miles rated IRI "Good" Bridge condition • number rated structural deficient	Volume-to-capacity ratio (LOS) Track condition • miles under slow orders Bridge condition • number <286K capacity Doublestack capable • percent of total mileage	Runway conditions, adequacy for current operations
	Investment	State of Good Repair • VTrans state HERS $ Actual • VTrans	SOGR estimate Actual • railroads • VTrans owned trackage	SOGR versus actual cond. Estimate
	Security	Evidence of coordination with State Police, U.S. Customs and other agencies on emergency preparedness.	Evidence of coordination with State Police, railroads, U.S. Customs and other agencies on emergency preparedness.	Evidence of coordination with TSA and other agencies on emergency preparedness.

[1] Weighted composite index that combines four pavement condition characteristics including rutting, roughness, structural cracking and environmental cracking.

[2] Index based on raw structural cracking data weighted by pavement area.

RECOMMENDED PACKAGES OF PROGRAMS, POLICIES AND PROJECTS

Drawing upon the findings and conclusions of the analysis and stakeholder feedback, six sets of policy, program and project packages were defined. These packages are:

- Freight policy;
- Trade corridors;
- Highway operations;
- Rail development;
- Air freight; and
- Freight transport performance measures.

Each package outlines the actions that VTrans should take either on its own or in concert with other agencies and freight stakeholders. The recommendations of the packages are summarized in Table ES.3.

These policy, program and project packages are in alignment with the national freight policy goals established under MAP-21 and FAST. For example, the adoption of the Statewide Freight Plan will fulfill the comprehensive plan requirement and allow Vermont to pursue a greater share of federal funding for projects identified under this plan. Measuring freight system performance and developing performance measures provide a baseline for the new requirements to set and report progress on performance targets and integrating these targets into the planning process.

Table ES.3 Summary of Policy, Program and Project Packages

Packages	Goals	Recommendations	VTrans Role
Freight Policy Package	Incorporate freight into VTrans planning, project development and service delivery activities	• Adopt Statewide Freight Plan	Lead
		• Incorporate recommendations into modal plans	Lead
		• Measure freight system performance	Lead
		• Expand communications with stakeholders	Lead
Trade Corridors Package	Facilitate economic development in Vermont by improving transportation infrastructure and operations between Vermont and its trading partners in New York, New England and Canada	• Upgrade VT Route 9 and US Route 2	Lead
		• Provide full domestic doublestack railcar clearances on NECR and Western Corridor	Lead
		• Improve track and bridges along NECR, GMRC and Western Corridor to provide 286K railcar weight capacity	Lead
		• Complete Quebec Autoroute 35 between I-89 in VT and Montreal	Advocate
		• Reduce truck and rail delays at border crossings	Advocate
		• Harmonize OW truck permitting with NYS	Lead
		• Implement one-stop regional OS/OW permitting system	Lead
		• Better coordinate regional transportation planning and economic development activities	Lead
Highway Operations Package	Improve access to major regional suppliers and markets for Vermont shippers and receivers by enacting a series of infrastructure,	• Improve efficiency on major state highways, including US Routes 2, 4 and 7 and Vermont Routes 9, 22A and 103	Lead
		• Keep highways open through prompt and effective snow removal, incident management and clearance	Lead
		• Monitor system performance and communicate traffic and roadway	Lead

Packages	Goals	Recommendations	VTrans Role
	operational and regulatory programs	conditions directly to motor carriers and truck drivers	
		• Maintain level of effort in truck safety monitoring enforcement	Lead
		• Streamline OS/OW permitting website.	Lead
Rail Develop-ment Package	Improve the rail infrastructure, operations and regulatory and institutional frameworks in order to (i) keep rail freight services viable and maintain market competition with trucking, (ii) allow an opportunity for future growth in mid-length intermodal services (distances approximately 500 miles) and (iii) improve the freight rail market share	• Upgrade all lines to 286K weight-bearing capability	Lead and Support
		• Maintain trackage at FRA Track Class 2 or better	Lead and Support
		• Preserve rail siding access to existing industrial sites	Advocate
		• Preserve rail-served industrial sites for new development	Advocate
		• Facilitate development of transload and intermodal terminals in or near Vermont where market warrants	Advocate
		• Encourage more direct and timely interchange between Vermont RRs and the Class I RRs	Advocate
		• Develop quick-response capability to leverage economic development opportunities with transportation investment/improvement	Advocate
		• Participate in multistate rail planning and programming to improve regional rail network	Lead
		• Educate shippers about rail and IMX service options and contracting approaches	Lead
Air Freight Package	Expand air freight and cargo services available to Vermont shippers	• Maintain airport runway surfaces, approaches and instrumentation in state of good repair	Lead
		• Expand runways at Newport, Middlebury and Rutland Airports	Lead

Packages	Goals	Recommendations	VTrans Role
Performance Measures Package	Promote the development and institutionalizing of measures that gauge the performance of the Vermont freight system and support informed and cost-effective investments	• Refine and adopt freight performance measures	Lead
		• Adopt procedure for performance monitoring	Lead
		• Create and publish "dashboard" of VTrans freight performance measures	Lead

1.0 Overview and Background

1.1 INTRODUCTION

Vermont has long been a leader in fully addressing freight issues within its transportation planning and programming process. Through efforts such as the 2001 Vermont Freight Study, the Vermont Long Range Transportation Business Plan of 2009 and a series of mode-specific policy plans, the State of Vermont has achieved a solid understanding of freight system issues and has outlined policies and strategies to address them.

Vermont's freight plan is also in alignment with the MAP-21 and FAST legislation and with many of the national freight goals related to economic competitiveness and efficiency; congestion; productivity; safety, security and resilience of freight movement; infrastructure condition; use of advanced technology; performance, innovation, competition and accountability in the operation and maintenance of the network; and environmental impacts.

However, there are a number of demographic, economic, financial, logistics and supply chain management challenges and opportunities that, individually and collectively, will impact the continued performance of the State's freight system. Understanding and preparing for those challenges and opportunities will best position the State to realize potential economic retention and development and maintain or improve the State's natural environment and quality of life. To achieve that understanding, this updated Vermont Freight Plan was undertaken to accomplish the following goals:

1. Establish a demographic and economic profile of the State that identifies major and emerging industries and recognizes trends and opportunities in trade between Vermont and domestic and international markets;
2. Provide an up-to-date assessment of the condition of the State's freight infrastructure and the impacts of current and future freight traffic;
3. Assemble, through analyses and stakeholder involvement, a comprehensive list of infrastructure, operational, institutional and regulatory needs; and
4. Develop packages of programs, policies and projects that address Vermont's freight needs and position the State's economy to be competitive today and in the future.

The components of this freight plan will allow Vermont to further the national freight goals. The plan includes improvements, both to infrastructure and operations, that strengthen the national freight network, keep Vermont's roadways fluid and allow freight to travel efficiently throughout the state. Vermont continues to maintain a safe, secure and resilient transportation network and the recommended performance measures will allow the state to monitor and

keep the network in a state of good repair. Continued improvements and adoption of advanced technology, particularly ITS deployment and emissions reduction strategies, will further VTrans' goal to demonstrate leadership in advancing a holistic agenda for goods movement. Finally, the performance- and outcome-based focus of this plan incorporates concepts that align well with the shift in national policy towards performance measurement and performance-based management.

1.2 FREIGHT PLANNING ACTIVITIES IN VERMONT

Between 2001 and 2009, Vermont undertook a series of transportation planning studies with the goal of better understanding system performance, needs and deficiencies and opportunities to improve mobility. These studies laid the groundwork for improving the State's understanding of economic, demographic and freight transportation trends; how residents and businesses use the State's transportation infrastructure; the transportation system's needs and deficiencies; and frameworks for evaluating improvement programs. Each of the studies, listed and described below, provided insight into characteristics of each transportation mode and, in greater or lesser detail, freight-related issues and needs. The freight and modal studies completed between 2001 and 2009 include:

- Vermont Statewide Freight Study of 2001 (VSWFS);
- Vermont Highway System Policy Plan of 2004 (VHSPP);
- State Rail and Policy Plan of 2006 (SRPP);
- Vermont Airport System and Policy Plan of 2007 (VASPP); and
- Vermont Long Range Transportation Business Plan of 2009 (VLRTBP).

Vermont Statewide Freight Study, 2001. In 2001, VTrans completed its first multimodal statewide freight study recognizing the need to incorporate freight needs into the statewide transportation planning process. The goals of the study were to develop a better understanding of the State's freight transportation system, acknowledge and address public concerns regarding specific freight movement practices, provide data to support transportation system preservation and improvement, expand the tools available to freight planning activities and identify and prioritize future investments in the freight transportation system. The Study evaluated commodity flows and logistics patterns and offered guidance on issues such as the feasibility of operating rail intermodal facilities in the State, an approach for VTrans to develop a mode diversion model and a methodology for evaluating freight transportation projects. The Study identified performance measures for freight in the context of the state's overall transportation policy goals.

Vermont Highway System Policy Plan of 2004. VTrans developed the Vermont Highway System Policy Plan (HSPP) in response to a number of critical transportation concerns: aging infrastructure; limited financial resources for transportation; increased emphasis on highway operations and management;

recognition of transportation and land use relationships; and the need to balance quality of life, mobility, environmental and economic development concerns throughout the State. The HSPP prepared a profile of the State's highway system and the activities it supports, established a performance evaluation and investment framework, analyzed the tradeoff between investment and system performance, offered policy guidance to VTrans and developed a plan for implementing recommended investment and management actions. Of particular importance to freight, the HSPP suggested that VTrans maintain a state of good repair on the State's highways, support economic development that is consistent with established regional and local growth plans and manage undesirable impacts of truck traffic in downtown areas.

Vermont State Rail and Policy Plan of 2006. VTrans developed the Vermont State Rail & Policy Plan (SR&PP) to provide a strategic policy framework for maintaining and enhancing the State's rail system. The SR&PP identified key trends regarding freight rail, including the increasing importance of 286,000-pound railcar weight capacity infrastructure, increasing volumes of double-stack intermodal traffic and the vertical clearance needed to provide such service and advantages and disadvantages to Vermont shippers of having only short line railroads present in the State. The SR&PP outlined several key goals for the State's freight and passenger rail systems:

- Provide competitive freight and passenger service within the state and connections to the national rail system;
- Provide parallel north-south rail corridors and connecting branch lines to access markets throughout the State and provide redundancy in the event of temporary loss of service;
- Develop programs to assist in major rehabilitation projects and replacement of obsolete bridges, structures and track required to maintain operations;
- Remove current weight and clearance restrictions, as appropriate, to enhance Vermont's competitive position within the industry;
- Strive to maintain the safest possible network of rail infrastructure and operations;
- Develop and maintain passenger stations and freight facilities to support efficient operation of the system and compatibility with the host community;
- Continue to combine state and privately-owned rights-of-way; and
- Generate sufficient revenues and additional public investment to support maintenance and upgrading in an efficient and timely manner.

The SR&PP produced a list of rail system initiatives to help Vermont meet the goals. The initiatives included infrastructure improvements on primary and secondary rail corridors; support for new or expanded transloading facilities; and

a methodology for prioritizing investments and measuring performance of rail projects.

Vermont Airport System and Policy Plan of 2007. The Vermont Airport System and Policy Plan conducted an inventory of the State's commercial, public and private airports, estimated future passenger demand and evaluated current performance. The Plan developed a series of goals related primarily to retaining commercial service, expanding passenger service capacity and options, addressing on-site infrastructure and off-site transportation access needs. Though the plan was not focused on freight issues and needs, it suggested that VTrans work to "encourage additional commercial and cargo services where appropriate."

Vermont Long Range Transportation Business Plan of 2009. The Long Range Transportation Business Plan (LRTBP) set out a comprehensive 25-year plan for the State's multimodal network. The LRTBP identified key challenges facing the State's transportation system: aging infrastructure; changing demographics and economy; land use issues; funding constraints; energy constraints, environmental impacts and climate change; freight movement and trade globalization; and security needs and issues. To address these challenges, the LRTBP established seven policy goals:

1. Secure sustainable funding and finance sources;
2. Optimize transportation system management and operations;
3. Provide a safe and secure transportation system;
4. Preserve, manage and operate the state's existing transportation system to provide capacity, safety, flexibility and reliability in the most effective and efficient manner;
5. Improve and connect all modes of Vermont's transportation system to provide Vermonters with options;
6. Strengthen the economy, protect and enhance the quality of the natural environment, promote energy conservation and improve Vermonters' quality of life; and
7. Support and reinforce Vermont's historic settlement pattern of compact village and urban centers separated by rural countryside.

The LRTBP developed and linked funding, planning and management strategies to each of the goals to enable VTrans to manage the State's transportation system in an efficient, innovative and sustainable manner. Many of the strategies address freight, including calls for the State to facilitate safe and efficient movement of freight and passengers, to integrate transportation planning and investments with state and local economic development strategies and plans and to emphasize long-range planning and the development of new strategies and policies.

In addition to the findings of the previously-completed plans and studies, a number of recent trends warrant evaluation for their anticipated impacts on the State's transportation system and strategies to address them. The trends include:

- **New rail infrastructure investments and operational strategies.** Completion of the Bellows Falls Tunnel to handle modified, double-stack rail cars and modern auto-racks has strengthened an important north-south route for rail movements into and out of the Boston and New York markets. The State of Vermont received an American Reinvestment and Recovery Act (ARRA) grant to fund track improvements along the New England Central Railroad line between St. Albans and the Massachusetts state line. This improvement increased the railcar loading capacity and improved efficiency along one of the State's major rail corridors. In Vermont's state-owned western corridor, recent improvements and additional planned investments will result in a substantially improved railroad that will have the potential to offer more competitive and efficient service. In addition, the Norfolk Southern/Pan Am joint venture (Pan Am Southern Railway) may impact freight movements into, out of and through Vermont.
- **Evolving economic base.** While traditional industries such as mining, manufacturing and forestry remain important components of Vermont's economy, strong growth is occurring in electronics, information technology and specialty agriculture and craft products. The State's employment base is shifting away from the traditional large manufacturers and self-employment rates are high. Home-based businesses are a particular mainstay of Vermont's rural economy. These and other changes in the State's economic structure will continue to influence the ways in which the State's freight system is utilized and will heighten the importance of an efficient, reliable and multimodal freight system that can meet the evolving needs of its users.
- **Fluctuating energy costs.** Because energy is a larger part of the total cost of air and truck transportation than it is of other modes, dramatic increases in energy costs could make rail more cost-effective for shippers than truck or air. In addition, if transportation costs increase significantly, locally produced goods could gain a cost advantage over distant goods. Climate change and variability is another factor that could act to change patterns of production, consumption and transportation. Understanding these trends and how they will influence freight demand and modal shifts (particularly truck to rail) are important elements of this plan.
- **Designation of a National Multimodal Freight Network (NMFN) and National Highway Freight Network (NHFN):** Under the FAST ACT, the Secretary of Transportation is required to designate a network "most critical to the movement of freight." The Interim NFMN has been published and includes I-89 and I-91 in Vermont. The designation of these networks will serve as the foundation for achieving the national policy

goals. To this end, it is likely that future project prioritization and State and national investment will be on maintaining and upgrading these designated routes.

1.3 APPROACH

This study combined an analysis of infrastructure and commodity flows with an understanding of the industry and demographic characteristics that create freight demand. The study collected and analyzed quantitative and qualitative information about Vermont's economic structure, industry logistics patterns, freight infrastructure, traffic flows and organization/public policy issues. It then developed a set of multimodal solution packages to address the critical issues.

The development of the 2011 Vermont Freight Plan was organized around six tasks:

Task 1 – Public Involvement Plan and Data Collection Strategy

A continuous and effective public involvement plan was critical to facilitate participation by the wide variety of Vermont freight, industry and economic stakeholders, to ensure consistency among Vermont and regional freight- and economic-related initiatives and to build support for the Plan's long-range strategies and short-term action recommendations. The project team carried out a stakeholder involvement program that included a Study Advisory Committee, six stakeholder focus groups, a regional roundtable meeting with Vermont state agencies and regular coordination with VTrans staff. In addition, a series of four newsletters were issued around major project milestones.

Primary sources used in the developing the Vermont Freight Plan were:

- Federal Highway Administration's Freight Analysis Framework 2 (FAF2);
- TRANSEARCH freight flow data from IHS Global Insight;
- Macro-economic forecast from Moody's economy.com;
- Commodity Flow Survey from the Bureau of Transportation Statistics;
- Carload Waybill Sample, from the Surface Transportation Board;
- Truck Weight and Vehicle Classifications data from VTrans;
- Freight plans and studies from VTrans; and
- Regional plans and economic development plans developed by RPCs, regional economic agencies and CCMPO.

Task 2 – Economy, Key Industries, Logistics Patterns and Critical Trends

Understanding emerging trends in the economies of Vermont and the states and regions with which Vermont has historically traded and identifying the changing economic environment was vital to the Vermont Freight Plan's goals. Through synthesis and analysis of employment data, econometric forecasts and commodity flow data, Task 2 described the current structure and make-up of the Vermont economy and how that structure and make-up was expected to change in the future. The task explored large and emerging industries and the importance of the State's transportation network to those industries.

Task 3 – Current and Future Freight Systems and Infrastructure

A comprehensive picture of Vermont's multimodal transportation infrastructure and operational characteristics was developed through review of existing literature and stakeholder interviews. The profile contained geographic representations of the State's transportation system, including descriptions of key operational characteristics such as maximum authorized speeds, weight capacities and vertical clearances.

Task 4 – Current and Future Freight Demand

Through analysis of FHWA's Freight Analysis Framework 2 (FAF2) and TRANSEARCH commodity flow data, Task 4 summarized current freight demand in Vermont with geographic and commodity detail that provided a clear picture of industrial and transportation activity within the State and with its key trading partners. Future transportation demand estimates were developed based upon economic forecasts developed in Task 2, which were then translated into demand along key highway and rail corridors and border crossings throughout the State. The existing and future freight demand and impacts on the highway and rail networks were summarized in maps, graphs and tables.

Task 5 – Freight System Performance and Needs and Deficiencies

The transportation system demand and capacity analysis completed in Task 4, combined with the findings from the stakeholder outreach work in Task 2, led to the identification of freight transportation system needs and deficiencies. These fell into three categories: 1) physical, related to the condition or capacity of the transportation infrastructure; 2) operational, related to how the transportation system is being utilized; and 3) institutional, related to the policy and regulatory environment that governs the management and enhancement of the system.

Freight performance measures, which can help assess the condition of the transportation system, identify trends and guide investment strategies, were developed as part of Task 5. The development of freight performance measures began with a review of measures used at the Federal level and by other states and measures VTrans currently uses in its project development and programming

processes. Building on these, a series of freight-specific measures that could be incorporated into VTrans' procedures were developed. The performance measures were reviewed for alignment with National Multimodal Freight Policy Goals[3], which include the following:

- To identify infrastructure improvements, policies, and operational innovations that –
  - Strengthen the contribution of the National Multimodal Freight Network to the economic competitiveness of the United States.
  - Reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network
  - Increase productivity, particularly for domestic industries and businesses that create high-value jobs.
- To improve the safety, security, efficiency, and resiliency of multimodal freight transportation.
- To achieve and maintain a state of good repair on the National Multimodal Freight Network.
- To use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Multimodal Freight Network.
- To improve the economic efficiency and productivity of the National Multimodal Freight Network.
- To improve the reliability of freight transportation.
- To improve the short and long distance movement of goods that
  - Travel across rural areas between population centers.
  - Travel between rural areas and population centers.
  - Travel between the Nation's ports, airports, and gateways to the National Multimodal Freight Network.
- To improve the flexibility of States to support multi-State corridor planning and the creation of multi-State organizations to increase the ability of States to address multimodal freight connectivity.
- To reduce the adverse environmental impacts of freight movement on the National Multimodal Freight Network.
- To pursue the goals described in this subsection in a manner that is not burdensome to State and local governments.

[3] 49 USC 70101(b)

Task 6 – Policies, Programs and Projects

To address the needs and deficiencies identified in Task 5, a set of multimodal solution packages that pinpoint infrastructure, operational and policy-level improvements was developed in Task 6. In addition to aligning with the national freight policy goals to improve the condition and performance of the national freight network, each of the six packages was prepared to achieve a specific strategic goal:

- Freight Policy Package – Incorporate freight into VTrans planning, project development and service delivery activities;
- Trade Corridors Package – Facilitate economic development in Vermont by improving transportation infrastructure and operations between Vermont and its trading partners in New York, New England and Canada;
- Highway Operations Package – Improve access to major regional suppliers and markets for Vermont shippers and receivers by enacting a series of infrastructure, operational and regulatory programs;
- Rail Development Package – Improve the rail infrastructure, operations and regulatory and institutional frameworks;
- Air Freight Package – Expand air freight and cargo services available to Vermont shippers; and
- Performance Measures Package – Promote the development and institutionalizing of measures that gauge the performance of the Vermont freight system and support informed and cost-effective State and Federal investments.

1.4 ORGANIZATION OF THIS REPORT

The 2011 Vermont Freight Plan Report is organized as follows:

- **Chapter 2, Economic and Demographic Trends –** This chapter examines the current structure and makeup of Vermont's economy, its interactions with its trading partners and how they can be expected to change in the future. It also assesses how changes in Vermont's major industries and demographics will affect the future use of the freight transportation system.
- **Chapter 3, Statewide Transportation Infrastructure –** This chapter describes the existing transportation infrastructure that supports the movement of freight and goods in Vermont, whether by truck, rail, water or air.
- **Chapter 4, Freight Demand –** This chapter describes current and future freight demand along Vermont's major transportation corridors and facilities, covering commodity movements, modal use, trading partners, international trade and the impacts of these attributes on the State's highway and rail networks today and in the future. This chapter also links freight generators,

by industry, to the corresponding freight flows on the highway network to illustrate the impact that each of the major industries has on the existing infrastructure.

- **Chapter 5, Needs Assessment –** This chapter provides an assessment of the current and prospective performance of Vermont's freight system and to identified its needs and deficiencies now and in the future. Needs and deficiencies were identified in three key areas: 1) physical, related to the condition or capacity of the transportation infrastructure including pavement management; 2) operational, related to how the transportation system is being utilized; and 3) institutional and regulatory, related to the policy and regulatory environment that governs the management and enhancement of the system.
- **Chapter 6, Performance Measures –** An inclusive and consistent set of performance measures is an important tool to assess the condition of a transportation system, identify trends and issues and set priorities among potential investments and policies. This chapter provides a brief overview of performance measures developed and applied by various states, a discussion of VTrans performance measures relevant to goods movement and an expanded list of proposed freight performance measures for consideration in the Vermont Freight Plan.
- **Chapter 7, Policy, Program and Project Packages and Recommendations –** This chapter recommends a set of packages of policies, programs and projects that Vermont should implement to ensure that the State's freight transportation system serves the current and future freight transportation needs of Vermont's businesses, industries and communities. The chapter concludes with a listing of programmed freight-oriented projects as mid-year 2013.
- **Appendix A –** A list of outreach activities, including Study Advisory Committee (SAC) membership and meeting dates and focus group participants and dates is provided for reference in Appendix A.

2.0 Economic & Demographic Trends

Underpinning a state's current and projected need for goods movement is the composition of its economy. Freight transportation demand is driven by a state's demographic and industrial structure and the characteristics of its trading partners, all of which are closely linked. This chapter examines the current structure and makeup of Vermont's economy, its interactions with its trading partners and how they can be expected to change in the future. It also assesses how changes in Vermont's major industries and demographics will affect the future use of the freight transportation system.

2.1 VERMONT ECONOMY AND DEMOGRAPHICS

Gross Domestic Product

Vermont's gross domestic product (GDP) was $21 billion in 2009. GDP is a measure of the value added to products and services by all Vermont businesses and industries. It is used by businesses and economists as a broad measure of economic activity and economic trends. According to a Q4 2009 Moody's Economy.com forecast that was adopted for this plan, Vermont's GDP is expected to grow from $21 billion in 2009 to $42 billion in 2039, an average compound annual growth rate of about 2.4 percent. At this rate of growth, the Vermont economy will track the projected growth rate for the U.S. economy as a whole, doubling the value of Vermont's economic output over thirty years.

This rate of growth is lower than that experienced over the last 30 years and lower than the rate of growth anticipated prior to the severe 2008-2009 recession. Over the 30 years prior to 2008, the U.S. and Vermont GDPs grew at an annual rate of about 3.0 percent, and projections through 2039 anticipated only slightly lower growth rates of 2.8 to 2.9 percent. Coming out of the recent recession, Economy.com projects U.S. and Vermont GDP to achieve annual growth rates of between 3 and 5 percent and then settle back to a longer-term compound average growth rate of about 2.4 to 2.5 percent.

As shown in Table 2.1, Chittenden County accounted for 35 percent of the state's GDP in 2009 and is projected to contribute 27 percent of GDP in 2039. Chittenden County will continue to grow, but with its large established employment and population base, will experience a relatively lower growth rate (1.5 percent) than other Vermont counties. Counties such as Washington and Rutland that have moderate-size economic bases will grow at rates approaching 2.0 percent and many smaller counties such as Lamoille and Orleans may see rates approaching 3.0 percent. These shifts in GDP growth rates reflect changes in the types of

industries and their location across Vermont. The changes and the accompanying patterns of employment, population and freight demand are described in the next sections.

Table 2.1 Gross Domestic Product by County, 1980, 2009 and 2039
(millions of 2000 dollars)

Geography	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Chittenden County	2,469	7,324	11,420	3.8%	1.5%
Washington County	988	2,183	4,242	2.8%	2.2%
Rutland County	1,072	1,988	3,742	2.2%	2.1%
Windsor County	1,038	1,709	3,528	1.7%	2.4%
Windham County	814	1,541	2,940	2.2%	2.2%
Bennington County	583	1,203	2,412	2.5%	2.3%
Addison County	351	979	2,142	3.6%	2.6%
Franklin County	421	997	1,614	3.0%	1.6%
Lamoille County	252	721	1,583	3.7%	2.7%
Caledonia County	407	751	1,567	2.1%	2.5%
Orleans County	311	636	1,500	2.5%	2.9%
Orange County	223	477	966	2.6%	2.4%
Essex County	71	94	167	1.0%	2.0%
Grand Isle County	20	70	131	4.4%	2.1%
Vermont Total	8,963	21,049	42,293	3.0%	2.4%

Source: Economy.com, calculation by EDR Group.

Major Industries

Vermont's economy grew steadily from 1980 to 2009 and is projected to continue to grow through 2039, but the structure of the economy has changed and will continue to change significantly. In 1980, manufacturing dominated the top five industries in Vermont, which were:

1. Manufacturing;
2. Government;
3. Financial activities;
4. Retail trade; and
5. Education and health services.

In 2009, manufacturing still topped the list, but financial activities and education and health services had moved into the top five:

1. Manufacturing;

2. Financial activities;
3. Government;
4. Education and health services; and
5. Retail trade.

By 2039, financial activities and retail trade will top the list, with professional and business services and information climbing into the top five industries.

1. Financial activities;
2. Retail trade;
3. Manufacturing;
4. Professional and business services; and
5. Information.

Table 2.2 lists the GDP of major Vermont industry sectors for 1980 and 2009 and their projected GDP for 2039. The industries are listed in descending rank by their projected GDP in 2039. Except for the natural resources and mining sector, the output (measured in dollar value) of all industries is projected to increase over the next 30 years. The information and wholesale trade sectors are projected to be the fastest-growing industries in the state. These structural changes in the make-up of the economy will affect the mix of goods and services produced and consumed in Vermont, with direct and appreciable changes in the type and volume of freight moved.

Table 2.2 Gross Domestic Product by Major Industry, 1980, 2009 and 2039
(millions of 2000 dollars)

Major Industry	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Financial Activities	1,223	3,515	6,423	3.7%	2.0%
Retail Trade	769	2,037	5,972	3.4%	3.7%
Manufacturing	1,873	3,525	5,690	2.2%	1.6%
Professional and Business Services	429	1,823	3,944	5.1%	2.6%
Information	415	1,026	3,624	3.2%	4.3%
Government	1,224	2,474	3,583	2.5%	1.2%
Wholesale Trade	391	962	3,210	3.2%	4.1%
Education and Health Services	632	2,360	2,962	4.6%	0.8%
Transportation and Utilities	540	872	2,239	1.7%	3.2%
Leisure and Hospitality	484	1,006	2,131	2.6%	2.5%
Construction	512	669	1,097	0.9%	1.7%
Other Services (except Government)	241	420	440	1.9%	0.2%
Natural Resources and Mining	43	81	80	2.2%	0.0%
Total Nonfarm	8,963	21,049	42,293	3.0%	2.4%

Source: Economy.com, calculation by EDR Group.

Industry Clusters

GDP measures the contribution of an industry to the state's economy in terms of dollar value. Another measure of the importance of an industry in a state's economy is the industry's location quotient (LQ). The LQ measures ratio of industry employment in Vermont relative to the United States as a whole. A LQ of more than one indicates that an industry is more concentrated in a state than in the United States as a whole and relatively more important in the State.

Table 2.3 provides the LQs for commodity- and goods-producing industries in Vermont that are heavily dependent on freight transportation. The table lists the industries by LQ in descending order and within each row shows the Vermont counties by descending order of industry concentration. In the forestry and logging industry, the data show a high concentration of forestry and logging employment in Caledonia, Essex, Franklin, Lamoille, Orange and Orleans counties.

Table 2.3 Location Quotients for Vermont Freight-Generating Industries

Industry	LQ	High-Concentrated Counties						
Forestry and Logging	5.0	Caledonia	Essex	Franklin	Lamoille	Orange	Orleans	
Computer and Electronic Products	2.6	Chittenden						
Animal Production	2.1	Addison	Caledonia	Essex	Franklin	Grand Isle	Orange	Orleans
Wood Products	1.9	Caledonia	Orleans	Rutland	Windham	Windsor		
Furniture and Related Products	1.8	Essex	Orange	Orleans	Rutland			
Nonmetallic Mineral Products	1.7	Bennington	Rutland	Washington				
Electric Equipment and Appliances	1.2	Bennington	Rutland	Windham				
Food Products	1.2	Addison	Franklin	Washington				
Paper Manufacturing	1.1	Caledonia	Essex	Franklin				

Source: EDR-LEAP.

Many of the industry clusters concentrated in Vermont that depend on natural resources (e.g., forestry and logging) are highly interconnected and rely heavily on freight transportation. For example, output from forestry and logging production is used for the manufacture of wood products (e.g., lumber), which are then used to make furniture, paper and paper products. The animal production and food production sectors are also closely connected; for example, farming and dairy products to cheddar cheese and ice cream production.

The computer and electronics products sector, represented primarily by the IBM plant in Essex Junction, has a high LQ and is also the largest employer in the state. However, this industry differs from the others; it is not dependent on indigenous, natural physical resources, but relies on the education, skills and experience of the Vermont workforce. It is particularly reliant on truck and air freight transportation to supply both inputs to the manufacturing processes (primarily by truck) and a means of delivering outputs to subsequent steps in the manufacturing process (trucking in North America and air freight throughout the globe).

Employment

The number of jobs in Vermont businesses and industries will grow from 307,100 in 2009 to 362,900 in 2039, a growth rate of 0.6 percent per year. This rate of growth is about half the rate of growth experienced between 1980 and 2009. Service industries, including education and health services, retail trade, government, leisure and hospitality and professional and business services, will be the largest employers by 2039. Combined with the jobs in finance and other service industries, these sectors will account for 86 percent of all jobs in Vermont in 2039. Table 2.4 shows employment by industry for 1980 and 2009 and projected employment in 2039. The industries are ranked in descending order by total employment in 2039.

A comparison of GDP growth by industry to employment by industry shows several industries—for example, manufacturing—for which GDP is increasing while employment is decreasing. Since GDP is a measure of output value, this means that manufacturing is producing and selling more products and more high-value products with fewer employees. This is generally the result of increasing automation and improving worker productivity. For the Vermont Freight Plan, this means that for industries such as manufacturing, the value of output as well as freight tonnage and number of freight shipments may be increasing while traditional measures of freight activity such as employment are decreasing.

The pattern of output growing more rapidly relative to employment is less pronounced in the services industries, but service industry output is also expected to increase faster than employment as computers, communications and other technologies improve worker productivity. This pattern of growth demonstrates two important points: first, that productivity growth in the service industry is expected to continue and, second, since employment growth in the professional services industry is less than business sector output growth in Vermont, a portion of the increased demand for services will be in the form of net "imports" to the state. For service industries, this means that both high-speed communications and the ability to provide competitive levels of service in these industries relative to similar businesses located elsewhere will be important.

Table 2.4 Employment by Major Industry, 1980, 2009 and 2039
(thousands of jobs)

Major Industry	1980	*2009*	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Education and Health Services	27.7	*60.4*	88.3	2.7%	1.3%
Retail Trade	35.5	*54.6*	67.7	1.5%	0.7%
Government	33.0	*54.2*	57.4	1.7%	0.2%
Leisure and Hospitality	18.7	*30.7*	42.0	1.7%	1.1%
Professional and Business Services	8.5	*20.7*	29.3	3.1%	1.2%
Manufacturing	44.4	*30.5*	21.4	-1.3%	-1.2%
Construction	10.9	*13.0*	19.1	0.6%	1.3%
Financial Activities	9.2	*12.5*	16.1	1.1%	0.8%
Other Services (except Government)	4.9	*9.4*	10.6	2.3%	0.4%
Wholesale Trade	6.2	*9.9*	10.5	1.6%	0.2%
Transportation and Utilities	5.7	*8.5*	7.6	1.4%	-0.4%
Information	4.9	*5.5*	7.3	0.4%	1.0%
Farming	14.3	*8.1*	6.6	-2.0%	-0.7%
Natural Resources and Mining	0.9	*0.8*	0.6	-0.6%	-0.7%
Total Employment	219.7	*307.1*	362.9	1.2%	0.6%

Source: Economy.com, calculation by EDR Group.

Table 2.5 shows employment by county, with the counties ranked in descending order of employment in 2039. Nearly one-third of the state's jobs will be in Chittenden County by 2039, the only county with over 50,000 employees. The employment patterns are consistent with the projections of GDP growth and industry location described in the previous sections because employment generally follows industry.

Table 2.5 Employment by County, 1980, 2009 and 2039
(thousands of jobs)

Geography	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2039-2009)
Chittenden County	59.0	96.7	119.3	1.7%	0.7%
Washington County	23.2	33.5	39.5	1.3%	0.5%
Rutland County	24.4	30.0	33.3	0.7%	0.4%
Windsor County	21.8	24.8	27.1	0.4%	0.3%
Windham County	19.1	22.9	24.3	0.6%	0.2%
Franklin County	11.6	18.0	21.7	1.5%	0.6%
Bennington County	14.5	18.5	20.0	0.9%	0.3%
Addison County	11.4	15.9	18.9	1.2%	0.6%
Lamoille County	6.2	11.6	16.2	2.2%	1.1%
Caledonia County	9.7	12.5	15.1	0.9%	0.6%
Orleans County	8.9	11.0	13.6	0.8%	0.7%
Orange County	6.8	8.6	10.2	0.8%	0.6%
Grand Isle County	0.9	1.4	1.9	1.4%	1.0%
Essex County	1.9	1.5	1.6	-0.8%	0.3%
Vermont Total	219.7	307.1	362.9	1.2%	0.6%

Source: Economy.com, calculation by EDR Group.

Population

Vermont is the second smallest state in the nation in population. Vermont's population was 622,000 in 2009. The population is projected to grow to 686,000 in 2039, an increase of 10.3 percent. The average annual growth in population is projected to be 0.3 percent per year between 2009 and 2039, substantially lower that over the last 30 years when Vermont's population grew at 0.7 percent per year.

Table 2.6 shows population and growth rates by county. The counties in the northwestern region of the state (e.g., Chittenden, Franklin, Lamoille and Grand Isle) are expected to have the highest growth rates. The remaining counties are projected to experience low to negative growth rates. The projected population growth in Vermont is similar to the rates projected for other New England states, which are forecast to grow between 0.2 percent (Maine and Massachusetts) and 0.6 percent (New Hampshire).

A comparison of employment and population growth shows that employment will be growing slightly faster (55,000 jobs, for an annual growth rate of 0.6 percent) than population (64,000, for annual growth rate of 0.3 percent). This

suggests that the labor force participation—the proportion of the population employed full or part-time—will continue to follow the trend set between 1980 and 2009, when employment increased by 90,000 while population went up by 110,000. In the past, the growth in households having two wage earners caused the increase in labor force participation; in the future, it will be driven more by increasing retirement age and the growing prevalence of part-time positions that require individuals to hold more than one position to achieve their desired income level.

Table 2.6 Population, 1980, 2009 and 2039
(thousands of people)

Geography	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change 2009-2039)
Chittenden County	116.0	152.5	182.6	0.9%	0.6%
Rutland County	58.3	63.4	63.8	0.3%	0.0%
Washington County	52.5	59.0	62.7	0.4%	0.2%
Franklin County	34.8	47.9	57.1	1.1%	0.6%
Windsor County	51.2	56.7	56.4	0.4%	0.0%
Windham County	37.0	43.2	41.5	0.5%	-0.1%
Addison County	29.5	36.8	40.4	0.8%	0.3%
Bennington County	33.5	36.4	35.5	0.3%	-0.1%
Caledonia County	25.8	30.6	33.8	0.6%	0.3%
Lamoille County	16.8	25.1	31.8	1.4%	0.8%
Orange County	22.8	29.1	31.8	0.8%	0.3%
Orleans County	23.4	27.3	31.1	0.5%	0.4%
Grand Isle County	4.6	7.8	10.6	1.8%	1.0%
Essex County	6.3	6.5	6.7	0.1%	0.1%
Vermont Total	513.0	622.0	686.0	0.7%	0.3%

Source: Economy.com, calculation by EDR Group.

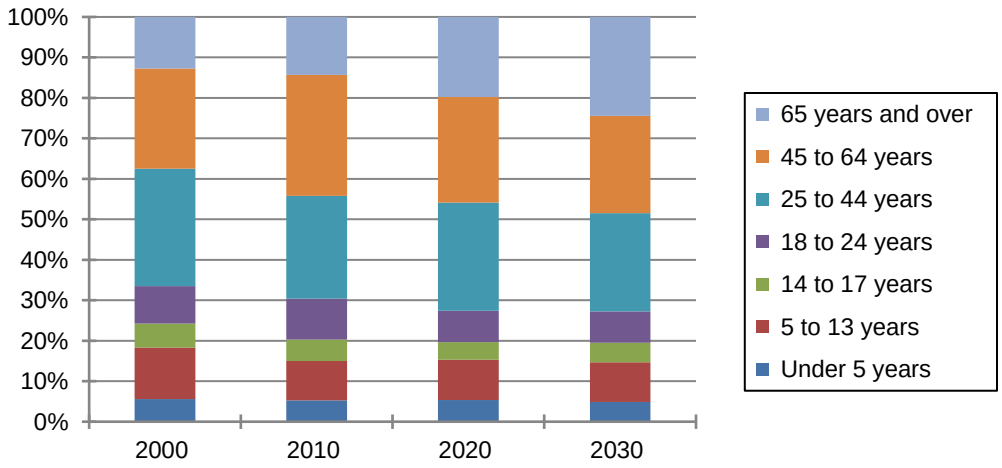
Although the total population will grow slowly, the age distribution of Vermont's population will change quickly over the next 30 years. As the post-World War II "baby boom" generation retires, Vermont will see a significant increase in the number of residents age 65 and older. The pattern is similar to that occurring across the U.S. population as the "baby boom" generation reaches retirement age, but the situation is anticipated to be more pronounced in Vermont than in the rest of the country.[4] As shown in Figure 2.1 (by percentage), the share of Vermont

[4] *VT Long Range Transportation Plan*, Working Paper 4: Demographic and Employment Analysis, April 17, 2007, p.9.

population that is 65 years and older is projected to nearly double from 13 percent to 24 percent between 2000 to 2030. The share of population that is working age (18 to 64 years) is expected to decrease from 63 percent to 56 percent in the same period. As noted previously, a continued trend of increasing retirement age will partially offset the shrinking working age cohort and allow for the projected growth in employment.

The age distribution of the population is not homogeneous throughout the state. As documented in the Vermont Long Range Transportation Business Plan (2009), those counties with the highest "dependency ratios" (that is, the highest number of older and younger residents based on the 2000 Census proportion of population outside of the 18 to 64 year range) included Essex, Bennington, Caledonia and Orleans counties. Areas with colleges and universities, including Chittenden, Addison and Washington counties, have more residents between the ages of 18 and 64 and correspondingly lower dependency ratios.

Figure 2.1 Percentage of Population by Age Group, 2000, 2010, 2020, and 2030



Source: VT Long Range Transportation Business Plan, U.S. Census Bureau.

A lower population growth rate means relatively less consumption of housing, food, clothing and retail merchandise and a corresponding reduction in the growth rate of freight demand related to these goods relative to business and commercial sector demand. The shift in population age distribution will also trigger changes in the mix of housing, food, clothing and retail merchandise transported and sold in Vermont. In general, individuals and couples approaching retirement have different consumption patterns than young adults and couples forming households and starting families. This will be reflected, again, in the types and volumes of goods moved in Vermont. The anticipated effects of slower population growth and changing demand are estimated in Section 4 under the discussion of the outlook for the retail industry in Vermont.

2.2 TRENDS IN INDUSTRY AND TRADE

This section describes the demand for freight generated by production of goods and services by the state's industries and by consumption of food, clothing and other goods by the state's residents. The section focuses on commodity- and goods-producing industries and estimates current and future freight demand in tonnage and value.

GDP and Employment Trends in Commodity- and Goods-Producing Industries

The demand for freight transportation is driven primarily by commodity- and goods-producing industries within the manufacturing, natural resources, transportation, warehousing/distribution and utility sectors reported in the previous section. These industries rely on freight movement to obtain raw materials as inputs for their production and for transportation of final goods to their destinations. Table 2.7 shows the GDP projections for Vermont's commodity- and goods-producing industries. The industries are ranked in descending order by their projected 2030 GDP.

Examination of the data in the table shows the dominance of the computer and electronic products sector as well as considerable volatility in the growth rates of individual subsectors, trends that are not apparent when tracking the numbers for the larger aggregated sector categories. Comparing the annual historical and future growth rates shows dramatic shifts in projected growth and production rates. For example, the output of the paper and chemical manufacturing industries fell between 1980 and 2009, yet both industries are projected to grow in the future—by 1.5 percent and 2.8 percent annually, respectively. The largest manufacturing sector, computers and electronics, is projected to grow, but at a much slower rate than in the past—1.5 percent compared to 7.1 percent historically. These shifts have important implications for freight planning, in that changes in production volumes of bulk manufacturing industries influence the need for both truck and rail system capacity, but computer and electronics production is almost entirely dependent on truck transportation.

Table 2.7 Gross Domestic Product by Commodity- and Goods Producing Industry, 1980, 2009,and 2039
(millions of 2000 dollars)

Freight Industry	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Computer and Electronic Products	250	1,853	2,934	7.1%	1.5%
Machinery Manufacturing	292	153	409	-2.2%	3.3%
Food Products	89	294	352	4.2%	0.6%
Transportation Equipment	136	173	279	0.8%	1.6%
Miscellaneous Manufacturing	89	213	274	3.0%	0.8%
Plastics and Rubber Products	44	64	213	1.3%	4.1%
Nonmetallic Mineral Products	75	105	164	1.2%	1.5%
Paper Manufacturing	143	81	126	-2.0%	1.5%
Wood Products	115	115	112	0.0%	-0.1%
Chemical Manufacturing	72	31	72	-2.9%	2.8%
Furniture and Related Products	60	70	64	0.5%	-0.3%
Mining	23	57	59	3.2%	0.1%
Forestry and Logging	42	48	42	0.4%	-0.4%
Beverage and Tobacco Products	4	29	26	6.8%	-0.3%
Textiles and Leather	79	21	19	-4.5%	-0.3%
Primary Metal Manufacturing	16	14	16	-0.6%	0.6%

Source: Economy.com, calculation by EDR Group.

In contrast to continued growth in output, jobs in the commodity- and goods-producing industries are projected to decline. The projected drop in employment between 2009 and 2039 is smaller than the drop in employment between 1980 and 2009. This suggests that the composition of Vermont's future manufacturing economy, as measured in terms of relative levels of employment, will be similar to today's; however, the employment forecasting methodologies are generally not designed to predict large structural shifts in an economy. Table 2.8 provides data on employment trends in the commodity- and goods-producing industries in Vermont.

Table 2.8 Employment by Commodity-Producing Industry, 1980, 2009 and 2039
(thousands of jobs)

Freight Industry	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Farming	14.3	8.1	6.6	-2.0%	-0.7%
Computer and Electronic Products	11.6	6.6	5.0	-1.9%	-0.9%
Food Products	2.1	3.9	3.4	2.2%	-0.5%
Wood Products	2.9	1.9	1.6	-1.5%	-0.6%
Furniture and Related Products	2.7	1.7	1.6	-1.6%	-0.3%
Transportation Equipment	3.0	2.0	1.4	-1.4%	-1.1%
Machinery Manufacturing	5.2	2.5	1.2	-2.5%	-2.4%
Miscellaneous Manufacturing	0.8	1.9	1.2	2.9%	-1.5%
Nonmetallic Mineral Products	2.0	1.5	1.1	-0.9%	-1.0%
Paper Manufacturing	2.3	1.0	0.7	-2.8%	-1.4%
Mining	0.6	0.6	0.4	-0.1%	-1.1%
Plastics and Rubber Products	0.9	1.0	0.4	0.5%	-3.1%
Chemical Manufacturing	1.0	0.9	0.3	-0.5%	-3.2%
Beverage and Tobacco Products	0.2	0.3	0.2	1.3%	-0.5%
Textiles and Leather	1.8	0.5	0.2	-4.4%	-2.6%
Forestry and Logging	0.2	0.1	0.1	-2.4%	-0.5%
Primary Metal Manufacturing	0.8	0.2	0.1	-5.6%	-2.5%

Source: Economy.com, calculation by EDR Group.

Trade and Freight Transportation

This section describes the importance of freight transportation to Vermont's industries. It looks at the major and emerging Vermont industries that depend significantly on freight transportation, those industries' trading partners (in international markets, in Canada, in the Northeast and other U.S. regions and within Vermont) and how they move freight to and from these trading partners. The section considers how industry growth and economic trends may affect the volume of trade, trading partners and the use of truck, rail, air and waterborne freight transportation.

To provide a general overview of linkage between industries, markets and freight transportation, the discussion focuses on the sectors listed in Table 2.9 and describes their general patterns of activity. The overview is broadly representative of Vermont industries, their trading and their use of truck, rail, air and water transport; however, actual freight movements are considerably more complex

because they are controlled by hundreds of individual businesses and the carriers serving them.

Table 2.9 Vermont Industries, Trading Partners and Freight Transportation

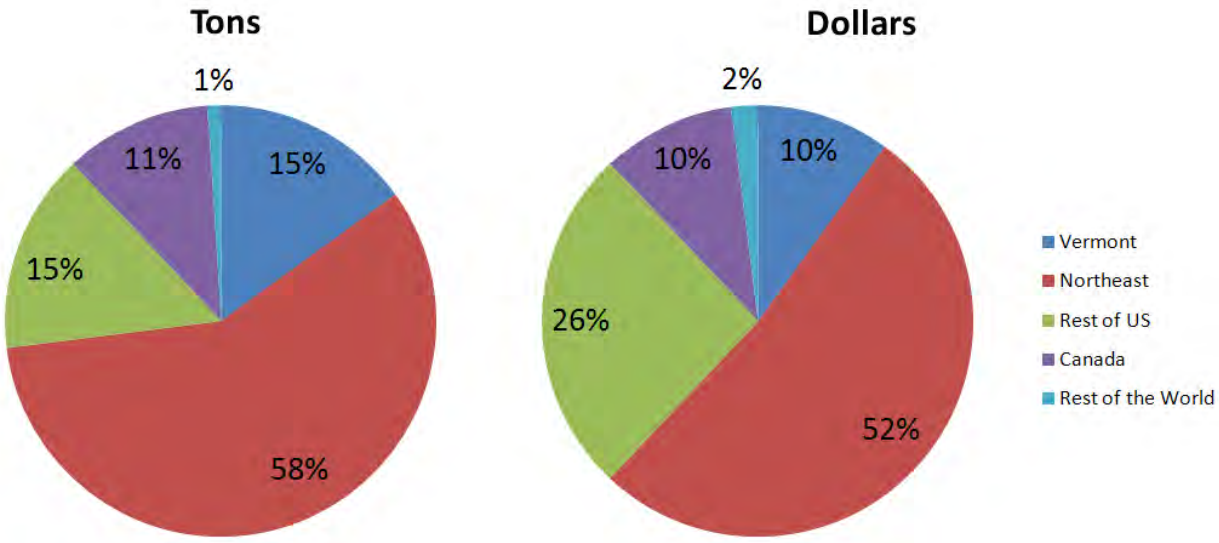
Industry Sector	Trade Area/Partners	Truck	Rail	Air
Computer and electronic industry	International /Canadian markets	X		X
Natural resources industries	Eastern Canada markets	X	X	
Food products and specialty mfg. industries	Northeast and U.S. regional markets	X		
Retail industry	Vermont markets	X		
Tourism and professional services industries	Vermont markets	X		X

Trading Partners

Figure 2.2 shows the proportion of freight movements in tons and value moving within Vermont; between Vermont and the Northeast; between Vermont and the rest of the United States; between Vermont and Canada; and between Vermont and the rest of the world. The data in the figure are for inbound, outbound and internal freight flows only; the data do not include through traffic, which neither originates nor terminates in Vermont. Vermont's primary trading partners are in the Northeast. New York is Vermont's top trading partner among the Northeast states, accounting for almost half of all freight flows. At 10 percent of all freight activity by value, Canada is an important trading partner and, if ranked among the U.S. states, would come in second after New York.

Figure 2.2 Vermont Trading Partners by Freight Tonnage and Value

Source: TRANSEARCH, STB Waybill, Cambridge Systematics, FAF2 (2007).



Computers and Electronic Products Industry and International Trade

In terms of value of output and contribution to the state's GDP, Vermont's economy is dominated by the computer and electronics products industry. The net value (exports minus imports) of computer and electronics exports is estimated to be $724 million annually, which supports 6,634 jobs in Vermont. The computer and electronics exports account for 91 percent of the total value of Vermont's net exports and 87 percent of net export-related jobs, which are presented in Table 2.10 below.

Table 2.10 Net Export-Related Activity and Employment in Vermont, 2007

	Net International Exports (Millions of Dollars)	Regional Jobs Supported by Net International Exports
Computer and Electronic Products	724	6,634
Food Products	51	595
Forestry and Logging	16	310
Printing	2	29
Animal Production	1	21
Total	794	7,589

Source: IMPLAN 2006 VT model, jobs calculations from EDR Group's TREDIS tool.

Almost all the production of computer and electronics products in Vermont is accounted for by one plant, IBM's facility in Essex Junction. The plant produces integrated circuits, importing almost all the subcomponents and chemicals needed for production by truck. Trucks are used because they provide the speed, reliability and flexibility of service required by the production process. Shippers are primarily responsible for the dispatching and routing of these inbound shipments.

Output consists of integrated circuitry products that are shipped by truck to destinations throughout the United States and to major airports, including JFK International Airport in New York (the primary destination), Chicago, Miami and Los Angeles for air shipment to customers around the world. Because the outbound shipments are of high value and part of a complex and tightly integrated global supply chain, rapid and reliable connections to major international airports that have multiple daily trips to key international destinations in Asia, Europe and Latin America and sufficient airplane belly-cargo capacity are critical to the success of the plant and the industry in Vermont.

Although the rate of employment growth in the computer and electronics products industry in Vermont is expected to decline, the value of the industry's output is projected to climb from $1.8 billion in 2009 to $2.9 billion in 2039. For Vermont, this means that maintaining fast and reliable truck access to major airports in the United States and Canada will continue to be critically important.

Agriculture, Food Products, Natural Resources and Manufacturing Industries and Canadian Trade

Vermont's agriculture, food products, natural resources and manufacturing industries trade with Eastern Canada[5]. Excluding energy products, almost all of which is petroleum fuel imported by pipeline (65 percent), trade with Canada accounts for about 10 percent of Vermont's inbound and outbound freight tonnage and value. Table 2.11 provides estimates of the tonnage of imported and exported commodities traded with Canadian companies by mode in 2007.[6] Import tonnage is nearly three times the amount of export tonnage and truck tonnage is more than twice rail tonnage. This pattern means that trucking services, the major highway corridors connecting Vermont to Eastern Canada and the border crossing stations are important facilities for Vermont's agriculture, food products, natural resources and manufacturing industries.

Table 2.11 Vermont and Canada Trade by Commodity and Mode Share, 2007
(in tons)

Commodity Description	Truck	Rail	Air	Water	Pipeline/Other	All Modes
Imports						
Energy Products	756,193	158,661	–	2,357	871,727	1,788,939
Agriculture, Food and Fishing	333,890	142,254	–	12	278	476,434
Manufacturing	244,478	125,607	–	96	477	370,657
Mining	40,743	48,251	–	–	–	88,993
Chemicals	24,488	5,003	185	–	782	30,458
Other	56,566	1,279	–	–	407	58,251
Total Imports	***1,456,357***	***481,055***	***185***	***2,465***	***873,671***	***2,813,732***
Exports						
Manufacturing	312,061	3,189	0	57	1,050	316,357
Mining	66,619	532,689	–	–	–	599,308
Agriculture, Food and Fishing	44,032	–	–	–	57	44,089
Chemicals	17,811	56	–	–	69	17,936
Other	3,681	–	–	57	457	4,195
Energy Products	278	–	–	–	–	278
Total Exports	***444,481***	***535,934***	***0***	***114***	***1,632***	***982,161***
Grand Total	***1,900,838***	***1,016,989***	***185***	***2,578***	***875,303***	***3,795,894***

Source: Freight Analysis Framework 2 (2007).

[5] Eastern Canada includes Ontario, Quebec, Nova Scotia, Newfoundland, Labrador, Prince Edward Island and New Brunswick.

[6] Included in the trade data are shipments moving by ship from Europe and Asia to the Canadian ports at Halifax and Montréal and then trucked across the border to destinations in Vermont and the United States.

Economic projections suggest that this pattern—more imports than exports and more import trucking tonnage than export trucking tonnage—will continue through 2039.[7] Table 2.12 lists the projected growth rates for industries in Eastern Canada from 2009 to 2039. The relatively robust growth of the Canadian agriculture, forestry, wood products and manufacturing industries—compared to their counterparts in Vermont—implies that Vermont industries will continue to import Canadian commodities and products for both consumption by Vermont residents and use in production by Vermont industries. Examples include forestry products used for pulp, paper and wood product manufacturing and chemicals that are used in electronics manufacturing in Vermont.

Rail is used to export non-metallic minerals (primarily building stone) and import coal and petroleum products, animal feed and products, wood products; cereal grains (including seed) and some non-metallic minerals. While rail is cost-effective for shipping such heavy and bulky products, the shipping distances are relatively short, so rail has captured only a modest share of the trade between Vermont and Eastern Canada.

Table 2.12 GDP Growth by Industry in Eastern Canada, 2009-2039

Industry	Atlantic Canada	Quebec	Ontario*
Agriculture	2.3%	2.6%	2.2%
Fish, Hunting and Trapping	2.4%	2.1%	-
Forestry	2.4%	2.7%	2.3%
Oil and Gas	0.5%	0.0%	0.5%
Other Mining	2.6%	4.9%	1.4%
Wood Products	2.7%	2.7%	-
Paper Products	2.0%	1.8%	-
Pharmaceutical Products	3.2%	3.2%	-
Petroleum and Coal	0.4%	-0.1%	-
Primary Metals	2.2%	2.3%	2.1%
Fabricated Metals	2.4%	2.1%	2.6%
Aerospace Products	2.6%	2.6%	-
Other Manufacturing	2.5%	2.3%	2.6%

Source: Center for Spatial Economics, calculations by EDR Group.
*Forecast data for Ontario is suppressed for several industries.

[7] The Northeast CanAm Connections study, which examined the economy of the Northeast states and Eastern Canada provinces and their transportation needs, reached a similar conclusion. See: *Northeast CanAm Connections: Integrating the Economy & Transportation*, (U.S.) National Corridor Planning and Development Program and Coordinated Border Infrastructure Program September 2008.

Manufacturing and Food Products Industries and U.S. Regional Trade

Vermont's major trading partner is New York State. Table 2.13 lists the value of trade in 2007 dollars between Vermont and its neighboring states, Canada and rest of the United States. Freight inbound from New York dominates the trade pattern. Much of this trade is accounted for by relatively high-value food, clothing, equipment and consumer merchandise moving by truck, rail and ship to major distribution centers in New York (primarily in the Albany area), and then reloaded and delivered by truck to stores and businesses in Vermont.

Outbound freight value is about one-quarter of the value of inbound freight, again with New York State the largest trading partner. Computers and electronics products account for much of the value in trade, but patterns revealed in Table 2.14 also indicate trade in a wide range of other manufactured goods. The industries are shown in descending order of growth rate for the overall Northeast and Mid-Atlantic region. The GDP projections show relatively robust rates of growth across several manufacturing industries, many of which are linked to suppliers and manufacturers in Vermont. Because the travel distances are relatively short, the key to realizing growth in these industries will be fast and reliable truck service between Vermont and its neighboring states.

Table 2.13 Vermont Trading Partners By Value
(in millions of 2007 dollars)

Partner	Outbound	Partner	Inbound
NY	1,593	NY	13,061
Canada	1,306	NJ	2,546
NH	512	Canada	2,144
MA	478	NH	875
ME	363	MA	753
PA	196	PA	442
CT	182	ME	302
NJ	143	CT	150
Rest of U.S.	1,609	Rest of U.S.	4,503
Total	6,382	Total	24,776

Source: TRANSEARCH, calculations by CS and EDR Group.

This will also be true if Vermont wants to increase the export of specialty products—everything from agricultural to crafts. With the introduction of Internet-based retailing, the smaller Vermont specialty industries are well-positioned to capture increasing shares of these markets. This is especially true as the U.S and Canadian markets mature and as disposable incomes in developed and developing countries allow for more discretionary purchases. Specialty and Internet-based retailing operations all depend on the ability to move small package shipments quickly and cost-effectively to distribution centers and from

these locations to major airports with international cargo services (both as airplane belly-cargo freight and package shipments).

A potential growth market for Vermont may be in food products. Vermont has traditionally been focused on providing a range of agricultural products for New England and Mid-Atlantic markets. Vermont has also been diligent about developing name and brand recognition for its products, with a regional focus and branding campaign that includes both the "Buy Local – Buy Vermont" and Seal of Quality programs sponsored by the Vermont Department of Agriculture, Food and Markets and several private and non-profit agricultural programs in Vermont.[8]

Buy Local, Buy Vermont
1872 to 2010 "deja vu"

"... the future of Vermont agriculture is in growing and developing high value products that do not compete with the West but that serve the many people in nearby markets....that Vermont could never compete on a commodity basis with the West." Vermont Board of Agriculture Bi-Annual Report, 1872

Source: Vermont Agency of Agriculture, Food and Markets, 2010, http://www.vermontagriculture.com/buylocal/index.html

Agricultural initiatives in the state are focused on categories such as artisanal cheeses, specialty and organic food production and linking local food production to local and regional markets. While many of the early initiatives in these areas, especially "farmers markets," focused on gaining access to county and state farm products, new initiatives throughout New England and the Mid-Atlantic states are focusing on gaining access to farm products from across the Northeast and the Mid-Atlantic. These programs are supported by major foods chains looking to enter this part of the market and by culinary schools such as the New England Culinary Institute in Montpelier, Culinary Institute of America at Hyde Park, and Johnson and Wales University in Providence, RI.

[8] For a list of several organizations and initiatives, see Vermont Department of Agriculture, Food and Markets at: http://www.vermontagriculture.com/buylocal/links/local.html.

Table 2.14 GDP Growth Rate Projections for Vermont's U.S. Trading Partners by Commodity-Producing Industry and State, 2009 to 2039 *(annual percent growth rate)*

Industry	Connecticut	Maine	Massachusetts	New Jersey	New Hampshire	New York	Pennsylvania	Total for Major Trading States
Plastics and Rubber Products	3.6%	3.9%	3.9%	4.9%	3.4%	4.2%	3.5%	4.0%
Chemical Manufacturing	2.8%	3.1%	3.1%	4.0%	2.6%	3.4%	2.7%	3.4%
Machinery Manufacturing	3.3%	3.1%	3.2%	4.2%	2.6%	3.8%	2.7%	3.3%
Transportation Equipment	2.1%	2.5%	1.9%	3.3%	2.1%	5.2%	1.8%	2.9%
Paper Manufacturing	1.5%	1.5%	1.9%	2.1%	2.1%	1.6%	1.1%	1.5%
Nonmetallic Mineral Products	0.8%	1.1%	1.0%	1.6%	0.8%	1.2%	1.4%	1.3%
Computer and Electronic Products	0.8%	1.8%	1.4%	1.6%	1.3%	1.5%	1.0%	1.3%
Miscellaneous Manufacturing	1.3%	1.6%	1.3%	1.4%	0.6%	1.4%	1.0%	1.3%
Mining	0.1%	-0.5%	0.9%	1.4%	-0.3%	-0.1%	1.4%	1.0%
Textiles and Leather	-0.1%	0.1%	0.4%	0.5%	0.9%	-0.3%	-0.4%	0.7%
Food Products	0.2%	0.6%	0.4%	0.8%	0.1%	0.7%	-0.1%	0.4%
Primary Metal Manufacturing	-0.1%	0.2%	0.1%	0.7%	-0.1%	0.3%	0.4%	0.4%
Furniture and Related Products	0.4%	0.7%	0.4%	0.5%	-0.3%	0.5%	0.2%	0.4%
Forestry and Logging	-2.1%	-1.0%	0.0%	-0.2%	-0.2%	-0.2%	0.2%	-0.4%
Beverage and Tobacco Products	-0.8%	-0.3%	-0.5%	-0.2%	-0.8%	-0.2%	-1.0%	-0.4%
Wood Products	-0.6%	-0.6%	-0.2%	0.0%	0.0%	-0.5%	-1.0%	-0.7%

Source: Economy.com, calculations by EDR Group.

Maintaining efficient access to major fresh food markets inside Vermont (e.g., Burlington, Rutland, Middlebury, Waterbury, etc.) and expanding access to the growing local- and fresh-produce markets in major metropolitan markets in large Northeastern markets such as Boston, New York, Harford, Albany and Providence requires a transportation network that supports distribution requirements unique to the food products industry.

However, few of the major specialty food processors in Vermont have yet tapped either the Canadian or other international markets as a source of new business growth. This is due to a variety of factors, such as compliance with non-U.S. food packaging, processing and labeling requirements, obtaining import clearance and the existence of more readily accessible U.S. markets. However, as U.S. markets tighten, the prospect of serving major, nearby Canadian populations and even growing consumer markets in developing countries in Asia and Latin America will become more of a competitive requirement for Vermont businesses.

Many agriculturally-based states in the western United States have successfully developed new international markets in Asia and Canada (e.g., Washington State apple growers) and have developed significant new business that requires large-volume bulk shipments. Serving these kinds of markets will require a transportation infrastructure that supports competitive services to these new markets. For the Canadian market, this will mean improved border crossing and customs procedures and providing sufficient freight capacity at these crossings.

These initiatives all require access to a growing and sophisticated network of food distribution centers, brokers and distributors. Access to markets is the key to maintaining and extending Vermont's market share in this industry. This is especially important if fresh (rather than frozen or pre-packaged) foods intended for local consumption are being transported.

Vermont Retail Sales

Reflecting the slow population growth, Table 2.15 shows that retail sales (after controlling for inflation) are projected to grow slowly. This means there will be relatively limited demand for major new wholesale distribution and retail facilities and related freight transportation services across the state. However, this does not mean that the cost of serving wholesale and retail facilities can be ignored. On the contrary, the high value of retail goods and merchandise means that extra attention should be paid to ensure that freight transportation costs are kept down. This is important because the cost of goods and merchandise affect the cost of living and doing business in Vermont. If the cost of living and doing business go up, so do labor costs and the costs of producing Vermont goods and services for export. If Vermont industry is to be productive and compete cost-effectively in U.S. and international markets, freight costs must be manageable for both industries and households.

Table 2.15 Retail Sales by County, 1980, 2009 and 2039
(in millions of 2000 dollars)

Geography	1980	2009	2039	Annual Percent Change (1980-2009)	Annual Percent Change (2009-2039)
Lamoille County	140	320	427	2.9%	1.0%
Bennington County	456	708	911	1.5%	0.8%
Windsor County	435	628	798	1.3%	0.8%
Washington County	479	883	1,076	2.1%	0.7%
Orleans County	155	336	399	2.7%	0.6%
Caledonia County	226	377	407	1.8%	0.3%
Orange County	134	422	456	4.0%	0.3%
Rutland County	597	997	1,104	1.8%	0.3%
Addison County	198	537	569	3.5%	0.2%
Windham County	404	607	580	1.4%	-0.1%
Franklin County	281	274	219	-0.1%	-0.7%
Chittenden County	1,211	1,359	1,018	0.4%	-1.0%
Grand Isle County	17	19	12	0.2%	-1.4%
Essex County	8	22	10	3.4%	-2.7%
Vermont Total	4,743	7,488	7,985	1.6%	0.2%

Source: Economy.com, calculation by EDR Group.

Note: Adjusted based on CPI (assumed 3 percent annual inflation from 2009 to 2039).

Professional Services and Tourism Industries in Vermont

Professional services and tourism are both highly dependent on the movement of office and business equipment and supplies. These shipments are evident in the secondary shipments originating in regional distribution centers and as mixed loads. Support for tourism industries requires a supply chain that is able to handle a strong seasonality and that operates competitively and at a low enough cost so that suppliers to the various elements of the tourism industry can operate cost-effectively. Cost of service to Vermont is affected by the location and operation of regional distribution centers for food services, beverage supplies (typically bottling and distribution), apparel, supplies and other consumables.

Growth in professional services industries place more demands on the office supplies, small package services and, through the growth of employment and households connected with growing professional service employment, demand for household goods, appliances, food and construction materials. The spatial patterns of growth in these industries in the future is likely to be less centralized than in previous decades as companies rely on broadband communications to conduct business. This means that providing services to businesses in low population density states like Vermont depends on maintaining efficient connections to distribution centers that can supply the daily requirements of small and medium sized professional service organizations and assuring that

transportation costs do not grow disproportionately to other labor and supply costs faced by such businesses.

2.3 SUPPLY CHAIN AND LOGISTICS TRENDS

The preceding sections in this chapter have highlighted Vermont's shift from heavy freight to high-value cargo such as electronics, artisanal foods and other specialty goods manufacturing. This trend is expected to intensify over the forecast period, as cargo by weight is projected to grow at a pace of 1.28% per year, while cargo value is projected to grow by 1.5 percent per year. This translates to an overall increase in dollars traded of 54 percent over the next 30 years ($24 billion), compared to a 45 percent increase in tons (26 million tons).

To support this shift, Vermont will require expanded access to domestic and international markets by developing new distribution and retailing channels that take advantage of on-line shopping/ordering, along with the logistics and transportation systems to support it. In order to nurture these emerging economic sectors, the freight transportation system must maintain fast and reliable truck access to the major consumer markets in the Northeastern U.S. and Canada (mostly through distribution centers in Albany and Montreal) and to major seaports and airports with international cargo services.

Over the past 30 years, supply chains have become increasingly multimodal, a trend that is expected to continue into the foreseeable future. In the past, this trend has been driven by the globalization of trade, which required shippers to optimize modal usage from a cost and service standpoint. Looking ahead, a broadly multimodal system will be even more necessary through a need for flexibility and resilience, whether it be changes in markets, natural and political disruptions, or shifts in modal economics brought about by large factor cost increases such as energy.

Flexibility and speed have historically given a prominent role to air cargo for international trade, at least with higher value goods. Many of Vermont's high value products such as foods and electronics have been and continue to be shipped by air from international gateway airports. While air cargo is expected to remain important for certain industries, unless a breakthrough occurs that brings vastly improved fuel efficiency and/or alternative propulsion systems, the focus must of necessity be on ground-based transportation. The ubiquity of container service across the globe will continue to bring substantial increases in service availability and frequency, if not travel time.

Thus, while the current trends point toward continued reliance on truck and air in Vermont, the volatility of factors affecting trade (such as fuel costs, currency fluctuations and shifts in product sourcing) makes a strategy that relies entirely on motor carriage risky. It will be beneficial to maintain a fully multi-modal transportation system that provides access to a wide variety of markets through all freight modes - rail, air and highway. This will ensure the continued viability

of a broad range of existing and emerging industry in the state and maintain the state's competitive position in the region.

Table 2.16 highlights the disconnect between industry and mode that could be targeted for more widespread adoption of multimodal freight transportation. While highways are accessible to all industries, the wood products, paper, chemicals, plastics and primary metal manufacturing industries – industries with shipment characteristics that are often suitable for rail - do not have the same level of accessibility when it comes to rail. This may be due to a lack of sidings, service or capability to handle 286,000 lbs. rail cars. For smaller volume shippers that could ship by rail, another concern is the general trend towards multi-car, high-volume shipments, with the result that single-car shipments are often not cost-effective and thus end up on the highway. Similarly, for air, access to service is beneficial to a broad range of industries that are often not thought of as regular users of air cargo.

Table 2.16 Barriers for Freight Industries[9]

Industry	Highway	Rail	Air	Water
Animal Production	–	–	●	–
Support for Agriculture and Forestry	–	–	●	–
Wood Products	–	●	–	–
Paper Manufacturing	–	●	●	–
Printing and Related Support Activities	–	–	-	-
Chemical Manufacturing	–	●	●	–
Plastics and Rubber Products	–	●	–	–
Primary Metal Manufacturing	–	●	–	●
Electric Equipment, Appliances, etc.	–	–	●	–
Transportation Equipment	–	–	●	–

Source: EDR-LEAP Model.

[9] Barriers are based on factors of industry usage and sensitivity to each mode of transportation. These factors were developed for the EDR-LEAP model by EDR Group through project experience and empirical research.

3.0 Statewide Freight Infrastructure

This chapter describes the existing transportation infrastructure that supports the movement of freight and goods in Vermont, whether by truck, rail, water or air. It builds upon information presented in prior studies, including the 2009 Long Range Transportation Business Plan, the 2004 Vermont Highway System Policy Plan, the 2007 Vermont Airport System and Policy Plan and the 2006 Vermont State Rail and Policy Plan. Information is also drawn from other recent materials published by VTrans and other sources.

3.1 HIGHWAY NETWORK

The highways and roadways of Vermont provide for the movement of the majority of freight and goods in the State. The State's roadway network supports long- and short-haul routes and serves as the distribution system for goods to local businesses and residents. An estimated 80 percent of the State's freight is carried by truck.

There are 2,707 miles of State-owned and managed highways in Vermont, including the Interstate system and those routes designated as either U.S. or Vermont highways (Table 3.1). These routes serve all parts of the State, providing access to major cities, towns and villages.

Table 3.1 Mileage by Vermont Highway Classification (2009)

Vermont Highway Classification	Statewide Mileage
State Highway	2,704
Town Highways:	12,991
Class 1	*138*
Class 2	*2,753*
Class 3	*8,531*
Class 4	*1,569*

Source: Vermont Town Highway Mapping Section, 2009.

The state highway system is complemented by a system of town highways, which are classified according to importance and function. Class 1 town highways are generally those that form the extension of a state highway route through urbanized areas and maintain the state highway route numbers. Class 2 town highways are those highways selected as the most important highways in each town. They are generally selected with the purposes of securing trunk lines of

improved highways from town to town and to places that have higher amounts of traffic. Class 3 and 4 are more minor roadways and generally do not provide for freight and goods movement other than for local deliveries. Figure 3.1 shows the extent of the state highway network and connecting Class 1 town highways.

Four routes comprise the Interstate highway system in Vermont, traversing approximately 310 miles of the State. These are limited access, high-speed and high-capacity routes with speed limits of 55 mph or higher and two or more travel lanes in each direction. I-91 runs north-south through the entire length of eastern Vermont, connecting Brattleboro, White River Junction, St. Johnsbury and Newport with Quebec, Canada and southern New England. I-89 runs diagonally (southeast to northwest) across central Vermont, connecting White River Junction, Montpelier and Burlington before turning north toward St. Albans. I-89 is a major gateway to Montreal, Quebec to the north and the metropolitan Boston region to the south via I-89's connection with I-93 in New Hampshire. I-93 enters northern Vermont for a short distance, terminating at I-91 near St. Johnsbury. The fourth Interstate route in Vermont is I-189, a short spur from I-89 in South Burlington.

Other state highways are general two-lane routes connecting towns and villages, although sections of divided highway and passing lanes are provided in some locations. Highways that are key to statewide or interstate travel are identified as Principal Arterials, consistent with the Federal Highway Administration's (FHWA) functional classification system. These include U.S. 2, U.S. 4 and U.S. 7, as well as VT 9, VT 78 (west of I-89), VT 103 and portions of other state routes in the Burlington and Montpelier/Barre areas. U.S. 2/VT 78 (I-89 to I-87), U.S. 4, U.S. 7, VT 9, VT 103 and the Interstate highways in Vermont are designated by the United States Department of Transportation as part of the National Highway System (NHS), reflecting their importance to the nation's economy, defense and mobility.

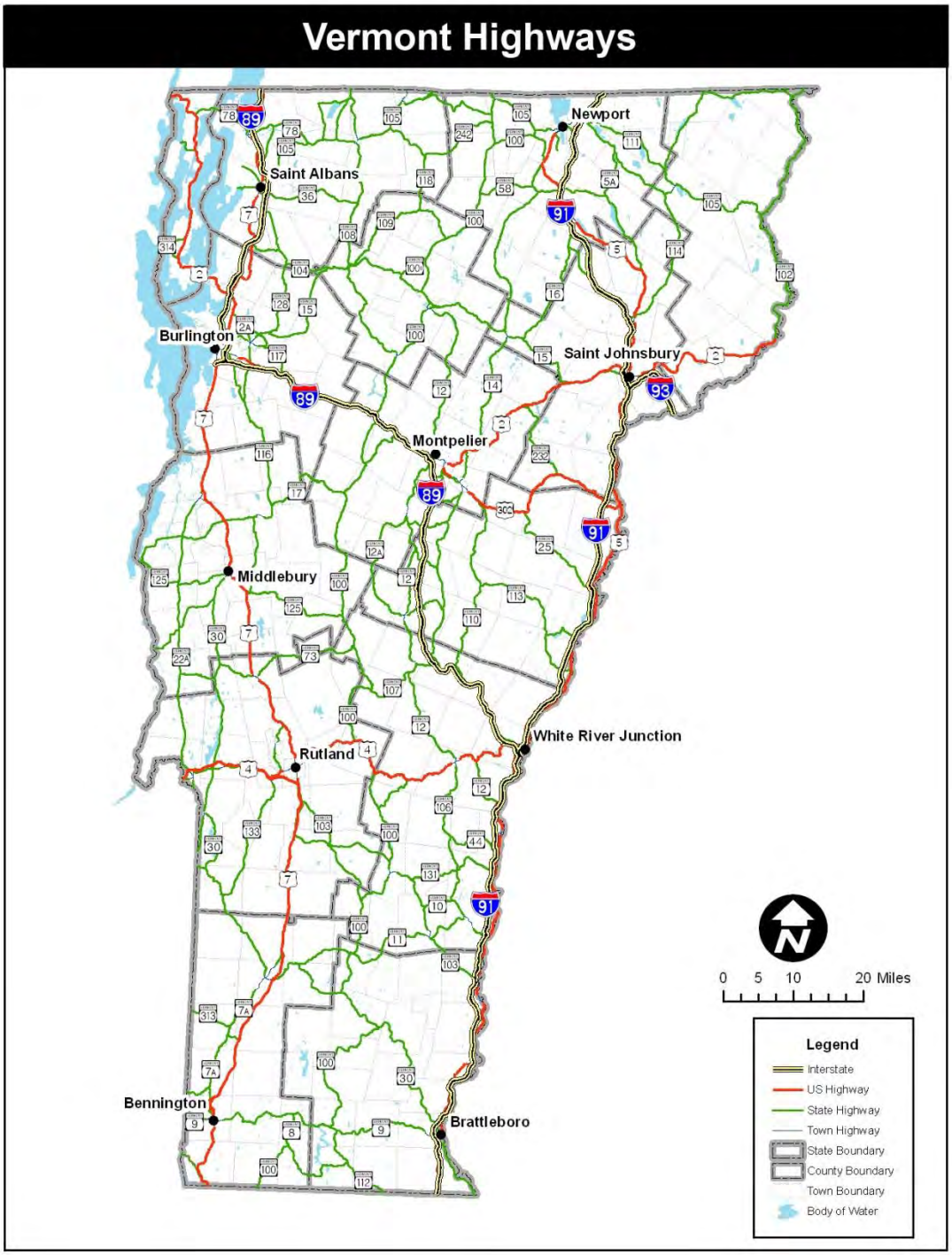
Vermont has two highways (I-89 and I-91) located along the federally-designated National Highway Freight Network (NHFN). The NHFN was developed as part of the FAST Act to strategically direct federal resources and policies toward improved performance of highway portions of the U.S. freight transportation system. The FAST Act allows States to designate Critical Rural Freight Corridors and Critical Urban Freight Corridors to become part of the NHFN (Critical Urban Corridors require MPO permission to designate). Critical corridors must provide access and connections to NHFN routes and Interstates with other important ports, public transportation facilities, or other intermodal freight facilities. VTrans is in the process of evaluating candidate routes for Critical Corridor designation, and will apply to FHWA for designation, as appropriate.

Planned or Programmed Highway Improvements

Recent and planned highway projects to improve truck transportation in Vermont include:

- Bennington Bypass. The Bennington Bypass is a three-phase project that will provide higher-speed and alternate north-south and east-west routes around Bennington. The first stage of the bypass opened in 2004 as VT 279, connecting US 7 to NY 7 north and west of Bennington. The second stage, currently under construction, will link US 7 north of Bennington to VT 9 to the east. A final stage will extend the second stage work, reconnecting US 7 north of Bennington to US 7 south of Bennington. A timeline for completion of the final stage has not been established.

Figure 3.1 Vermont Highways



Source Data: Vermont Center for Geographical Information, 2009.

Note: Only Class 1 Town Highways shown.

- US 7 in Shelburne. Improvements to US 7 in Shelburne are underway. The roadway is being expanded into a boulevard and capacity is being added for

vehicles, bicycles and pedestrians. Reconstruction and widening of US 7 between Pittsford and Brandon is scheduled to begin in 2011 and reconstruction of US 2 in Danville is scheduled to begin next year.

- Champlain Bridge Replacement. VTrans and the NYSDOT jointly developed a replacement for the 80-year-old bridge connecting Crown Point, NY and Chimney Point, VT. The new Lake Champlain Bridge was completed in 2011.
- Autoroute-35. Autoroute-35 in Quebec, Canada will be extended to connect to I-89, effectively replacing the current QC 133 route. Autoroute-35 and I-89 will improve access between Montreal and Vermont and form a more direct and continuous limited-access highway between Montreal, QC and Boston, MA.
- In addition to the specific improvements identified above, VTrans has a comprehensive pavement management system that collects pavement condition data on all state highways every two years, identifies potential pavement resurfacing and rehabilitation needs and sets priorities for pavement improvement projects based on a range of factors including benefit cost analysis.

Regulations Pertaining to the Operation of Trucks and Trailers on State Highways

Length of Trucks

In 2009, the Vermont legislature enacted Act 50, which modified regulations concerning the operation of trucks and trailers on Vermont highways. Under the revised regulations, trailer or semitrailer configurations up to 75 feet long, a three foot increase over previous regulations, are allowed on all Vermont highways unless specifically prohibited on a particular segment. Permits are still required for trucks over 68 feet on U.S. 4 between VT 100 and the New Hampshire line, while trucks over 72 feet are prohibited altogether. There is no overall length limit on the Interstate highway system for most equipment, although the length of individual trailers and semi-trailers is regulated by Federal law. Vermont statutes also generally limit the width of motor vehicles to 8.5 feet and height to 13.5 feet.

Truck Weight

Maximum weight allowances on highways in Vermont are dictated by specific axle load limits as well as overall gross weight limits (vehicle plus load). In 2011, Federal lawmakers passed legislation raising the legal gross weight limit on Interstate Freeways in Vermont for a twenty-year trial period. Allowable gross weight limits for tractor trailer trucks operating on Vermont's Interstates were increased to 99,000 pounds, whereas prior to the legislation trucks exceeding 80,000 pounds were prohibited from traveling on Vermont's Interstate highways unless they were issued a single-use over-dimensional load permit. A maximum gross weight of 80,000 lbs. was also is established for other state highways and Class 1 town highways although a variety of permits are available to allow for

heavier loads. Class 2, 3 and 4 town highways have substantially lower weight limits.

Bridge Conditions and Restrictions

Special restrictions are imposed on certain bridges to prevent damage to vulnerable structures. Bridge restrictions are classified into four categories, as defined by the National Bridge Inspection Standards:

- Closed **–** The structure is closed to all traffic;
- Temporary **–** The structure is open but with a temporary structure in place to carry legal loads while original structure is closed and awaiting replacement or rehabilitation;
- Posted **–** The structure has a reduced maximum allowed weight. Posted structures may include other restrictions such as temporary bridges which are load posted; and
- Restricted – The structure is posted for other load capacity restrictions such as speed, number of vehicles, vertical clearance, etc.

For truck movements, restrictions are defined as impediments to the free flow of all vehicles meeting Motor Carrier Safety Regulations in Vermont. Items that reflect the condition of a structure but do not provide an obvious impediment to the free flow of traffic, such as temporary shoring, temporary bridges, deteriorated steel and concrete, are not included.

The 2010 VTrans Structures Section Annual Report identified the following special designations for 2009:[10]

- **Restricted** – No state bridges and 34 local bridges;
- **Posted** -- Four state bridges and 61 local bridges (weight restrictions);
- **Temporary**—Six state bridges and 8 local bridges; and
- **Closed** – One state bridge and 17 local bridges.

Truck Parking and Support Facilities

In 2000, VTrans completed an inventory of commercial vehicle parking facilities. This inventory categorized legal parking locations by several categories:

- Welcome centers;
- Information centers;
- Rest areas;
- Truck stops;

[10] VTrans Program Development Division – Structures Section, 20010 Annual Report.

- Weigh Stations;
- Paved pull-offs; and
- Unpaved pull-offs.

Information regarding welcome centers, information centers and truck stops is updated here to reflect current conditions. Under Jason's Law, a MAP-21 provision, construction of safety rest areas, truck parking facilities and similar infrastructure are eligible for federal funding.

Truck Parking at Welcome Centers, Information Centers and Rest Areas

The State of Vermont maintains a number of public rest areas, most of which are located on Interstate highways. Rest areas in Vermont are classified by their size and amenities. Welcome centers are the large rest areas with travel and tourist information, vending or other merchandising, water and restrooms and are located on Interstate highways or major state routes near key entry points into Vermont. Information centers provide similar amenities and are located throughout the state on the Interstate Highway system. Rest areas (sometimes designated as "Scenic Outlook" or "Parking Area") provide parking areas, but generally lack other amenities.

Table 3.2 Truck Parking Availability at Welcome Centers and Information Centers (2010)

Rest Area	Locations	Truck Parking Availability
Alburgh Welcome Center	VT 2 in Alburgh	No
Branford Info Center	I-91 northbound	Yes
Capital Region	Downtown Montpelier	No
Derby Line Welcome Center	I-91 Southbound	Yes
Fair Haven Welcome Center	US 4	Yes
Georgia North Info Center	I-89 northbound	Yes
Georgia South Info Center	I-89 southbound	Yes
Hartford South Info Center *	I-91 southbound	Yes
Lyndonville Info Center	I-91 southbound	Yes
Randolph South Info Center	I-89 southbound	Yes
Sharon North Welcome Center	I-89 northbound	Yes
Waterford Welcome Center	I-93 northbound	Yes
Williston North Info Center	I-89 northbound	Yes
Williston South Info Center	I-89 southbound	Yes
White River Jct. Welcome Center	Downtown White River Jct	No

* Hartford South Info Center closed for renovation.

Source: VTrans, 2010

Most welcome centers and information centers provide parking areas for large trucks (Table 3.2). While overnight parking is prohibited at Vermont's rest areas, these facilities do allow truckers to take extended rest breaks and provide access to vending and restrooms.

Truck weigh stations, such as the two located on the north- and south-bound sides, respectively, of I-91 south of White River Junction are also used by trucks as parking areas when not in use for enforcement activities. Occasional paved and unpaved pull-outs are provided along most non-interstate highways in Vermont. While not intended as parking areas, truckers to pull off of the roadway at these locations for safety purposes.

Truck Stops and Truck Servicing Facilities

Privately owned and operated truck stops are located throughout the State. These typically feature large truck parking areas, fueling, maintenance services and restaurants. Large, 24-hour truck stops are located in Wells River (access from I-91 and VT 302), St. Albans (I-89, VT 104), Swanton (I-89, VT 78), Springfield (I-91) and Fairhaven (U.S. 4/VT 22A).

Highway Use - Average Annual Daily Traffic

Figure 3.3 shows typically daily traffic volumes on Vermont's highways. Traffic volumes are highest around urbanized areas, such as Burlington and Rutland. The Interstates typically carry more traffic than other routes. I-89 in the Burlington areas carries in excess of 50,000 vehicles per day on some segments and all of I-89 between Montpelier and the Roosevelt Highway (U.S. 2) north of Burlington carries more than 20,000 vehicles per day. Traffic volumes elsewhere on Vermont's interstates carry fewer than 20,000 vehicles per day except for short segments in White River Junction and Brattleboro and fewer than 10,000 vehicles per day travel on most segments of I-91 north of White River Junction. In general, the capacity of Vermont's interstate system is adequate to meet demand and recurrent congestion is uncommon.

The most traveled non-Interstate highways in Vermont are U.S. 7 in the Burlington, Rutland and Bennington areas and U.S. 4 near Rutland. Traffic volumes on U.S. 7 exceed 30,000 vehicles per day in South Burlington and Rutland and congestion is typical at these locations during peak travel periods.

Truck Traffic

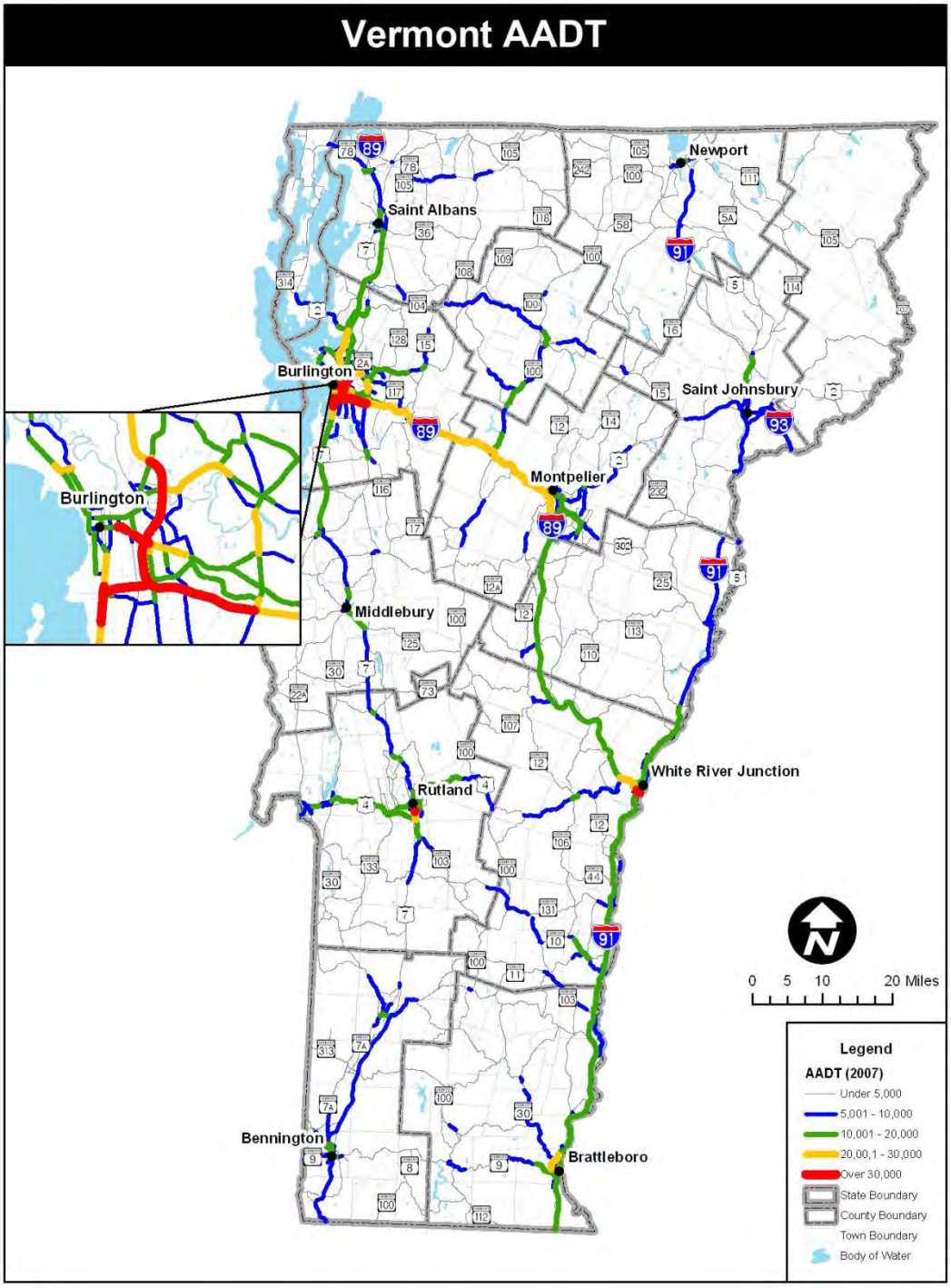
In terms of overall traffic flow, shown in Figure 3.3, I-89 carries the heaviest traffic volumes in the State. Trucks make up a significant percentage of the vehicles that travel on the state and national highway networks in Vermont each year. As shown in Table 3.3, truck traffic accounts for between 4.6 percent and 10.9 percent of traffic on roadways in urban areas and between 4.5 percent and 15.7 percent of traffic on rural roads. Vermont's interstate highways carry particularly high

shares of truck traffic. The heaviest volumes are found along I-89; I-91 near the Massachusetts state line; I-93 near the New Hampshire state line; near the junction of I-93 and I-91 in Waterford; and near the junction of I-89 and I-189 in Burlington.

Vermont's U.S. highways also carry a large percentage of truck traffic. U.S. 2, U.S. 4, U.S. 5 and U.S. 7 are all integral parts of the State's truck network. The route segments that have the highest percentages of truck traffic are near the truck network's designated urban avoidance routes: U.S. 2 in St. Johnsbury, VT 9 in Brattleboro and VT 105 in Newport.

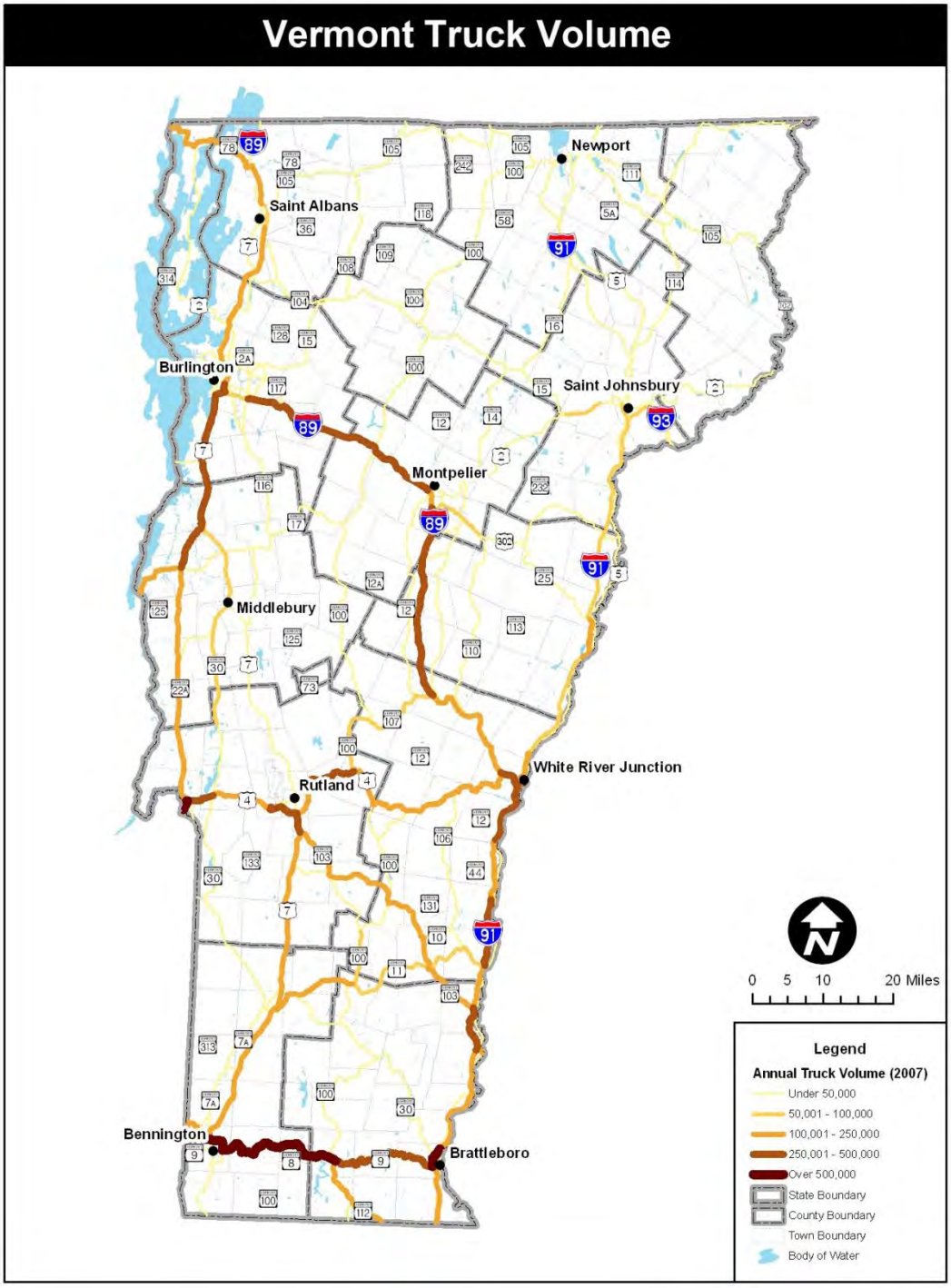
Many State highways support a large percentage of truck traffic as well. Of all State highways, VT 9 supports the largest percentage of truck traffic, particularly near Bennington, Brattleboro, Wilmington and Marlboro. On VT 103, the route segments that contain the largest percentage of truck traffic are located near the cities of Rockingham and Chester and near the New Hampshire state line. On VT 2A, the most heavily used route segments are located near the I-89 ramps in Williston, while on VT 22A, the segments around Addison, Bridgeport and just north of the Shoreham town line have the highest portion of truck traffic. Similarly, on VT 105, the sections with the highest truck percentages are near the cities of Brighton, Ferdinand and Richford.

Figure 3.2 Average Annual Daily Traffic (AADT)



Source Data: Vermont Center for Geographical Information, 2009.

Figure 3.3 Annual Domestic Truck Traffic Flow Map (All Commodities 2007)



Source Data: TRANSEARCH, 2007.

Note: Does not include cross-border (Canada-US) freight flows

Table 3.3 Trucks as Percent of Overall Traffic Stream

Functional Classification	Average Daily Percent – Trucks	Average Peak Hour Percent – Trucks
Urban Areas		
Interstate	10.9%	7.9%
Other Freeways and Expressways	5.8%	4.0%
Principal Arterial	5.9%	5.2%
Minor Arterial	5.1%	4.6%
Collector	4.6%	4.6%
Local	5.2%	4.8%
Rural Areas		
Interstate	15.7%	12.7%
Principal Arterial	10.7%	9.6%
Minor Arterial	8.7%	7.9%
Major Collector	7.3%	7.1%
Minor Collector	6.8%	6.4%
Local	4.5%	6.7%
Interstate Ramps and Rest Areas	9.6%	6.8%

Source: VTrans Policy and Planning Division – Traffic Research Unit, Automatic Vehicle Classification 2008 Report.

The State and town highways whose northern termini are at the Canadian border (e.g., I-89, I-91, U.S. 5 and VT 253) do not support large volumes of traffic, but truck traffic comprises a significant percentage of the traffic stream that flows to and from the border. The TRANSEARCH data used in this report do not report Canadian cross-border freight traffic and, therefore, the segments of I-89 and I-91 near the Canadian border barely register on the map of truck volumes, even though they do handle significant truck traffic.

Heavy Vehicle Use and Pavement Management

VTrans has established a comprehensive pavement management program for all state highways. Detailed condition data including rutting, roughness, environmental cracking and structural cracking are collected annually for all roads on the National Highway System (NHS) including Interstate routes and on a biennial basis on all other state highways. The condition data are used with a commercially available pavement management system (PMS) to identify current pavement deficiencies and to forecast pavement condition over time based on pavement performance models. The PMS is used to identify and prioritize

pavement resurfacing and rehabilitation projects and to forecast future pavement conditions based on assumptions about the budget resources available to address pavement condition needs. In addition to the pavement improvement strategies identified by the PMS, VTrans has established an proactive preventive maintenance program that includes widespread crack sealing and the use of thin overlays to extend pavement life in a cost-effective manner.

The VTrans pavement management program does not explicitly consider truck vehicle volumes when assessing pavement conditions and prioritizing pavement improvement projects. However, the state highway segments with the highest truck volumes—Interstate Highways and high volume NHS segments—have been constructed (or reconstructed over time) with greater structural capacity than other roads on the state highway system. As a result, the highways carrying the highest truck volumes and vehicle weights today and projected to be carrying the highest volumes as a result of future growth in freight activity, are expected to be able to serve these truck movements without experiencing greater deterioration rates than observed today. It is anticipated that existing pavement management policies and practices will be sufficient to identify pavement deterioration trends and maintain pavement conditions at the level required to accommodate truck volumes.

Adoption of Intelligent Transportation Systems Technology

Intelligent Transportation Systems (ITS) can improve the safety and efficiency of the highway system and help align the state with national and regional highway technology goals. Freight-related ITS, in particular, are mentioned as one of the national freight policy goals under MAP-21. Vermont has several ITS technology deployments and planned future initiatives. They are as follows:

- **The Transportation Operations Center** – This is the communications base for VTrans and facilitates radio communications throughout the State. Weather, storm alerts and road conditions are transmitted to the Agency regularly and the media is kept informed of road conditions as well.
- **Road Weather Information System (RWIS)** - VTrans has a number of RWIS stations located throughout the state. They provide information about pavement conditions, such as surface temperature, types of precipitation on the roads, atmospheric weather data. The RWIS installations may also provide camera images of the roads. There are currently 27 RWIS units in operation. VTrans plans to expand the number of RWIS units a total of 60 RWIS.
- **VT511 –** VT511 provides up-to-date reports regarding road conditions, road construction and weather. This system can be accessed via the Internet at www.vt511.com, or by dialing 511 from both landline and cellular phones inside Vermont. A 1-800 number is also available for callers outside of Vermont. While this is currently a State-based 511 system, Vermont is working with New Hampshire and Vermont to deploy a Regional 511 system.

- **ConnectVermont** - ConnectVermont's mission is to provide a comprehensive information system for all travelers. The program's vision is to deliver this information through all available types of media, such as websites, road signs, radio stations and traditional media, and all types of devices, including laptops, PDAs, cellular phones and car radios. Funded by the FHWA through the Intelligent Transportation Systems (ITS) program with matching funds provided by state agency partners, ConnectVermont is responsible for a suite of Vermont's most creative travel and technology projects.
- **Commercial Vehicle Information Systems (CVISN) –** CVISN is a nationwide ITS/CVO program that is managed by the Federal Motor Carrier Safety Administration (FMCSA) and is designed to improve commercial vehicle safety. It is an information-sharing program involving a partnership of government agencies, motor carriers, other stakeholders and third parties. The program establishes an information systems architecture for commercial vehicle operations that streamlines credentials administration; focuses safety enforcement on high risk carriers; reduces motor carrier congestion costs through automated CVO operations; and, enhances intrastate and interstate information exchange. Vermont is planning to deploy elements of the Core CVISN program and thereby become eligible for FY2014 Federal CVISN grant funding.
- **Information Technology Programs –** The State of Vermont published a five-year Information Technology Strategic Plan in January 2013 to modernize critical technologies, ensure the sustainability of IT capabilities, operate IT effectively and enable productivity improvements in state services.[11] The transportation related projects in this plan include:
  - *Activities supporting modernization*
    - » **Maintenance Asset Tracking System (MATS)** - This project is a tri-state effort among Vermont, Maine and New Hampshire and will consist of application software enhancements;
    - » **Real ID –** This project is for a change required to the DMV application to bring VT into compliance with Real ID by implementing facial recognition technology to comply with the Federal mandate;
    - » **Automated Driver License Testing System –** Replacement of the aging and unsupported driver license testing system in the Central Office, five branch offices and two mobile van operations;
    - » **Traffic Monitoring System-** Replacement of vintage multi-state application with a hosted solution in order to manage traffic count information; and

[11] State of Vermont IT Strategic Plan http://www.leg.state.vt.us/reports/2013ExternalReports/285716.pdf and http://vtransoperations.vermont.gov/technical_services/its

» **Project Scheduling -** Evaluation, selection and implementation of a hosted solution to replace the existing Artemis application that tracks all transportation infrastructure improvement.

Supporting these initiatives are scheduled upgrades or replacement of several IT platforms. These include a new **Advanced Transportation Management System** (as part of consortium with New Hampshire and Maine). and a replacement of the ageing **Customer Service Queuing System**.

3.2 RAIL SYSTEM

This section provides a general description of the freight rail system in the State of Vermont. The basis of this section was the 2006 State Rail and Policy Plan, which was updated with new information where it was available and could be confirmed.

Railroad Classification

The Association of American Railroads (AAR) and the Surface Transportation Board (STB) classify railroads based on revenue and mileage. The definitions differ somewhat between the two, with the AAR categorizing railroads as follows:

- **Class I –** These railroads are the largest railroads and are those with an 2008 operating revenue in excess of $401.4 million, or the equivalent in U.S. dollars if it is a Canadian or Mexican Railroad.[12] Nationally these railroads account for 67 percent of the industry's mileage, 90 percent of its employees and 93 percent of its freight revenue.
- **Regional (Class II) –** Regional railroads are line-haul railroads operating at least 350 miles of track or earning revenue of at least $40 million.
- **Short Line/Local (Class III) –** These railroads are line-haul railroads that fall below the regional criteria and include those that perform only local switching and terminal operations.

Table 3.4 lists the track mileage in Vermont owned by each railroad class, as reported by the AAR in 2007.

[12] Surface Transportation Board designation for 2009. Revenue value adjusted annually.

Table 3.4 Vermont Track Mileage by Railroad Class

Railroad Classification	Mileage
Class I	3
Regional (Class II)	30
Short Line (Class III)	539
Total	**569**

Source: Railroads and States, American Assoc. of Railroads, 2007.

The regional railroads operating in the State are the Pan Am Southern (PAS, formerly PAR) and the Montreal Maine & Atlantic (MMA). Ownership and mileage of these forms, along with the short lines that operate the bulk of Vermont's trackage are discussed in the following section.

Mileage and Ownership

Vermont's rail system is made up of both privately and publicly owned railroad rights-of-way and reaches all corners of the State except Lamoille County. The active publicly owned railroad rights-of-way include the Vermont Railway, Washington County Railroad, Connecticut River Division and the Green Mountain Railroad. These publicly owned rights-of-way are leased to private railroads to operate. The ownership, railroad classification and track mileage for each of the active railroad rights-of-way in the State are included in Table 3.5.

Table 3.5 Vermont Active Rail Lines

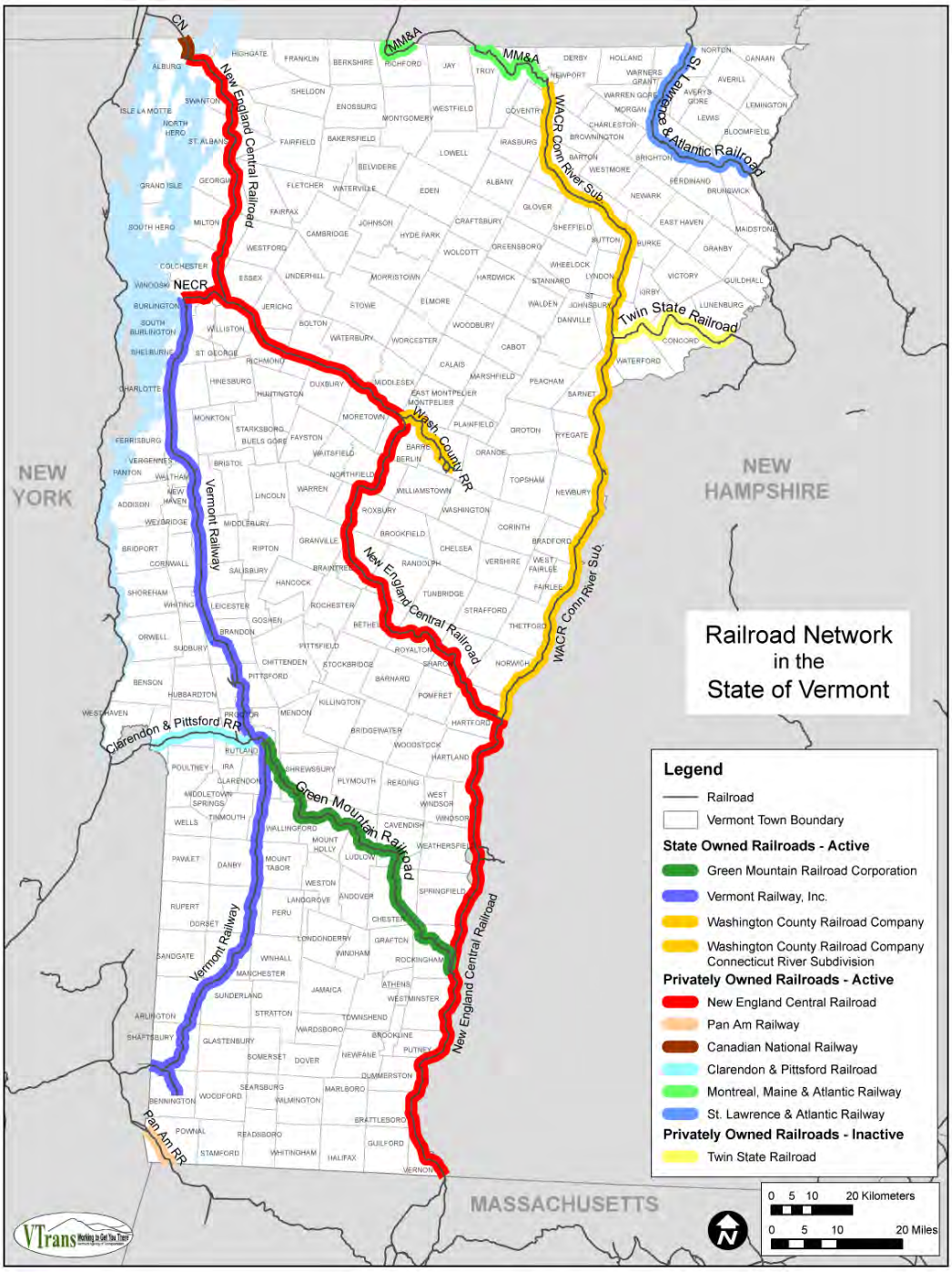
Railroad	Railroad Class	Right-of-Way Ownership	Track Mileage
Canadian National	I	Private	3
Clarendon and Pittsford	III	Private	18
Connecticut River Division	III	State-Owned	102
Green Mountain Railroad	III	State-Owned	50
Montreal, Maine and Atlantic RR	II	Private	24
New England Central RR	III	Private	191
Pan Am Southern	II	Private	6
St. Lawrence and Atlantic Railroad	III	Private	31
Vermont Railway	III	State-Owned	140
Washington County Railroad	III	State-Owned	13
Total Active Mileage			**578**
Total Active Mileage State-Owned			**305**

Source: Vermont State Rail and Policy Plan, 2006.

The railroads currently operating in Vermont are described briefly in the following section and shown on Figure 3.5

- **Canadian National (CN) –** The only major railroad with trackage in Vermont, Canadian National operates an important three-mile segment in Alburg, Vermont that links the New England Central Railroad with the remainder of the CN system, providing access to Montreal and other Canadian destinations. The CN is headquartered in Montreal, Quebec, with extensive operations across Canada and the U.S. Midwest and South.
- **Montreal, Maine and Atlantic Railway (MMA) –** The MMA has 24 miles of track in northern Vermont where its mainline route winds across the Canadian border. It includes track in Newport, Troy and Richford. The MMA was created in 2003 from the former Northern Vermont Railroad, the former Bangor and Aroostook Railroad and other short line railroads in Northern New England and Quebec. The MMA, headquartered in Bangor, Maine is owned by Rail World Inc., a railway management, consulting and investment corporation.
- **New England Central Railroad (NECR) –** NECR operates 325 miles from the Canadian border at East Alburgh, to New London, Connecticut on Long Island Sound. The route through Vermont generally parallels I-91 and I-89 through the communities of Brattleboro, Bellows Falls, Bethel, Montpelier, Essex and St. Albans. In late 2012, the NECR and sister RailAmerica properties were acquired by Genesee and Wyoming, Inc., a publicly traded company headquartered in Darien, Connecticut, that owns and operates 111 railroads located throughout the U.S., Canada, and overseas.
- **Pan Am Southern (PAS) –** PAS came into existence in 2009 as a joint venture between Pan Am Railways and the Norfolk Southern Railway Company. PAS was established with the objective of improving freight rail service along the former 155-mile Boston and Maine corridor between Mechanicville, New York and Ayer, Massachusetts. A 7-mile segment of this line crosses through the southwestern corner of Vermont near Pownal.
- **St. Lawrence and Atlantic (SLR) –** SLR has 165 miles of main-line track in Maine, New Hampshire and Vermont. Its affiliate, the St. Lawrence and Atlantic Railroad (Quebec) Inc., (SLQ), has 94 miles of track in Quebec, which connect with SLR at Norton. SLR operates 32 miles in Vermont , connecting Norton, VT to North Stratford, NH. The SLR is owned by Genesee and Wyoming Inc., a publicly traded company with headquarters in Connecticut, which owns and operates 62 railroads in the U.S., Canada, Australia and the Netherlands.

Figure 3.4 Railroad Network in the State of Vermont



Source: Vermont State Rail and Policy Plan, 2006.

- **Vermont Rail System (VRS) –** The Vermont Rail System is an affiliation of the four Vermont-based short lines, listed below, plus the New York and Ogdensburg. This affiliation was established in 1997 to provide common ownership with the intent to maximize use of resources. In Vermont, VRS operates over state-owned trackage (except the Clarendon & Pittsford).
  - **Clarendon and Pittsford Railroad (CLP) –** The Clarendon and Pittsford Railroad operates 18 miles of track between Rutland and Fairhaven. This route operates as a "bridge line" for commodities coming from the Canadian Pacific Railway Champlain line, which runs along the I-87 corridor in New York and moving to the Vermont Railway or the Green Mountain Railroad. CLP also directly serves Vermont's largest rail shipper, Omya, Inc., at Florence by a branch line off the Vermont Railway.
  - **Green Mountain Railroad (GMRC) –** The GMRC operates 50 miles of state-owned track between Rutland and Bellows Falls. It connects with Vermont Railway and CLP in Rutland and with the New England Central in Bellows Falls.
  - **Vermont Railway (VTR) –** The VTR runs along the state-owned track from Burlington through Rutland to North Bennington, where a spur goes to Bennington and then continues on to Hoosick Junction, New York, where it connects to PAS. VTR operates 127 miles of track in Vermont.
  - **Washington County Railroad (WACR) –** The WACR line runs for 13 miles through Montpelier, Berlin and Barre. The line begins at Montpelier Junction with a connection to the NECR. In addition to the line in Washington County, the WACR also operates along the state-owned Connecticut River Division line from White River Jct., to Newport. The line connects with the MMA in Newport and with other railroads at White River Jct.

FRA Track Classification/Speed

The Federal Railroad Administration (FRA) has established minimum track safety standards requirements and maintenance levels for railroad operations (Title 49 Code of Federal Regulations, Part 213 [49 CFR 213]). The track safety standards identify the minimum track conditions that are allowable for operation at a particular speed for a given class of track and establish maximum passenger and freight train speeds. The standards identify minimum frequencies required for track inspection and define the minimum level of experience needed by rail inspectors.

The FRA track class provides a proxy for the condition of a line segment. Higher levels of maintenance and better track conditions are required for successively higher FRA track classes. If a line is not maintained sufficiently for trains to be operated at the published timetable speeds of the line, then speed reductions ("slow orders") must be placed on the tracks. Slow orders are typically temporary and are removed once the track defects have been corrected. However, it is not

uncommon, particularly among low-density railroads, for slow orders to take on a more permanent and extensive nature, with the result that actual conditions for a given segment are below the stated FRA track class. Over the years, this has been the case with several of Vermont's rail lines. Figure 3.6 maps the track class designations for the rail lines in Vermont.

Intermodal/Transload Facilities

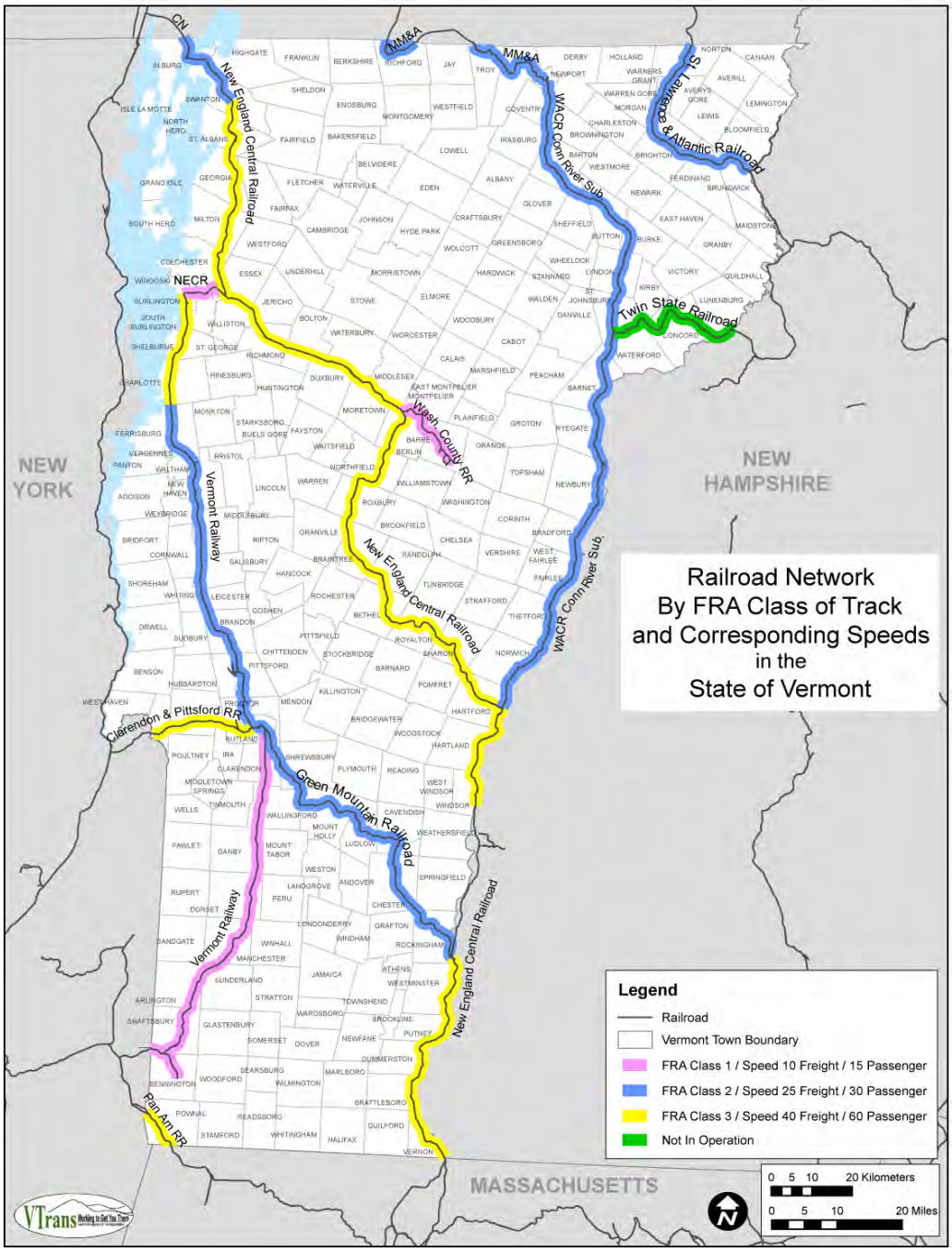
An important component of the rail freight network are the facilities where commodities can be transferred between rail cars or from rail to truck. These facilities, which provide the necessary infrastructure and services to receive, store and ship of products by rail, are divided into two categories: (1) transload, where goods are physically transferred between rail cars and over-the-road vehicles; and, (2) trailer- or container-on-flat-car (TOFC/COFC), where an entire freight carrying container is switched between modes. Typically, transload terminals handle bulk goods such as petroleum products, chemicals, fertilizers, animal feeds and lumber that can effectively utilize the high capacity of rail cars with little risk of damage or product loss from the transloading process.

Vermont does not have any TOFC/COFC terminals, but some form of transload facility is located in many communities throughout the State. The primary locations of transload facilities include:

- St. Albans;
- Burlington;
- Rutland;
- Newport;
- White River Junction; and
- Bellows Falls.

Each of these facilities provides varying degrees of functionality and infrastructure to accommodate the receipt, storage and shipment of goods. Beyond the state borders there are several intermodal facilities that shippers throughout Vermont and New England use to access the national rail network. These include facilities in Albany, New York, Springfield and Worcester, Massachusetts, Auburn, Maine and Montreal, Quebec. In addition, as part of the creation of the Pan Am Southern, an upgraded intermodal and automotive yard is under construction in Mechanicville, New York.

Figure 3.5 Vermont FRA Track Class (2005)



Source: Vermont State Rail and Policy Plan, 2006.

Bridge/Line Carload Capacities

The 286,000-pound weight limit for railcars is becoming the new industry standard for transport of bulk commodities. In order for rail lines to accommodate these cars, which are heavier than the previous 263,000-pound standard, railroad

owners/operators need to ensure that bridges and track structure are capable of accommodating the additional weight. Old lightweight rail, deteriorated ties and poor ballast will diminish, or sometimes completely preclude, the ability to safely and economically handle the heavier cars. It is understood that at least two Vermont customers must "light-load" railcars in order not to exceed current rail infrastructure limits within Vermont. This results in increased transportation costs to these two shippers, which could be avoided with the improvement of the State's rail infrastructure.

The railroad bridges across the State face two problems. One is that many of the bridges are in need of rehabilitation in order to continue to safely accommodate current rail traffic (generally 263,000-pound gross weight railcars). These bridge rehabilitations are typically conducted by the railroad owner (either the State as owner or the private railroad as owner). The other concern is the ability to upgrade the bridges to enable them to carry 286,000-pound carloads and possibly 315,000-pound gross weight railcar traffic (which is becoming more common for some heavy-haul traffic). The maximum allowable weights on railroad bridges in Vermont as identified in 2005 are shown in Table 3.6.

Table 3.6 Existing Railroad Bridge Capacities (2005)

Railroad	Maximum Railcar Loading (Pounds)
New England Central	263,000
Clarendon and Pittsford	286,000
Green Mountain Railroad	263,000
Vermont Railway	263,000
Washington County Railroad	263,000
Washington County Railroad – Connecticut River Division	263,000
St. Lawrence and Atlantic	263,000
Maine, Montreal and Atlantic	263,000

Source: Vermont State Rail Plan Update, 2006.

Clearance Restrictions

The growth of the movement of intermodal containers both nationally and globally has been substantial over the past decade. When containers move by rail it is most efficient to move them stacked two-high, a configuration that requires vertical clearances to be at least 18′6″ for two stacked international (each 8′6″) containers, 19′6″ for a combination international and domestic and 20′8″ inches for two domestic containers (each 9′6″ in height). Tri-level auto-rack cars require 19′6″ clearance. For a route to enjoy fully unrestricted vertical clearance, the Association of American Railroads requires a minimum of 22′6″.

The operation of double-stack intermodal rail freight services in the State of Vermont is inextricably intertwined with the feasibility of such operations throughout New England. At present, double-stack services operate through northeastern Vermont as part of the St. Lawrence and Atlantic Railroad's Auburn-Montreal service corridor. The other route that recently opened up to auto rack traffic is along the New England Central Railroad through Bellows Falls with the 19'6" tunnel clearance project that was completed in 2007.[13] This improvement allows for mixed international/domestic container traffic to move on a regular basis both over the New England Central Railroad and the Green Mountain Railroad. Although rail clearances in the State are restricted on some lines, it has been expressed by the Vermont Rail Council that clearance issues are not as significant an issue for the rail freight network in Vermont as the carload weight capacity constraints. The following are a listing of clearance restrictions identified as part of the 2005 Draft Vermont State Rail Plan:

- **NECR –** For the main line through Connecticut, Massachusetts and as far north as Bellows Falls, the NECR has a stated 19'6" vertical clearance. Beyond Bellows Falls towards St. Albans, clearance is limited to 19'. A noteworthy limitation is the North Burlington tunnel on the Winooski Branch that connects the NECR with the VTR at Burlington;
- **GMRC –** In the 1997 Railway Clearance Survey GMRC had two clearance restrictions;
- **PAS –** The 7--mile portion of PAS freight main line in the southwestern corner of the State does not have any clearance restrictions;
- **VTR –** The 1997 Railway Clearance Survey shows that VTR had nine clearance restrictions;
- **CLP –** The 1997 Railway Clearance Survey shows that CLP had no clearance restrictions;
- **WACR –** The 1997 Railway Clearance Survey shows that the WACR has no clearance restrictions between Montpelier and Barre and two restrictions on the WACR Connecticut River line;

[13] The Bellows Falls tunnel improvement was constructed to permit increasing the vertical clearance to accommodate full domestic double stack service (20' 8") once the elevation of the adjacent bridge over Canal Street is corrected.

- **SLR –** SLR reports that it operates double-stack trains through Vermont. The published clearance on the line in Vermont is 22 feet above top of rail; and
- **MMA –** The 1997 Railway Clearance Survey showed and MMA concurred that there was one clearance restriction at Bridge Number 28.3.

Recently Completed and Planned Rail Improvements

Recently completed and ongoing rail infrastructure initiatives in Vermont include:

- New England Central Railroad track improvements. Vermont received $51 million in American Reinvestment and Recovery Act (ARRA) funding for high-speed and intercity passenger rail improvements. Completed in 2012, the ARRA grant funded track and bridge improvements on the New England Central line between St. Albans and the Massachusetts state line. Between White River Junction and the Massachusetts border, track was upgraded to comply with FRA Class IV standards and improvements funded in Massachusetts and Connecticut will rehabilitate trackage on the connecting Connecticut River corridor to the south (owned by Pan Am Southern and Amtrak). The primary aim of these improvements was to improve operating speeds for passenger services; however, freight rail service will also benefit because the track can now carry 286,000-pound capacity railcars, the de facto national standard and the cost-effective railcar for many bulk shippers. These upgrades help secure the continued use of the NECR's main line as an important regional through route.
- Bellows Falls Tunnel Improvements. This project, completed in 2007, lowered the tunnel foundation and track structures to allow passage of taller railcars (19'7"), specifically to allow first-generation double-stack and auto-rack cars. Further track lowering to accommodate full double-stack height (20'8") can be accommodated in the future without the need for additional foundation work.
- Western Corridor Improvements. The state has had a long-standing initiative to improve the infrastructure along the Western Corridor route between Burlington, Rutland, Bennington and Hoosick Junction. Funded primarily by state funding and federal grants, installation of heavier welded rail, extensive tie replacement, crossings upgrades and bridge strengthening will eventually permit increased weights and higher speeds throughout the corridor.
- Upgraded Weight Standards. VTrans manages an ongoing program to upgrade state-owned rail lines to meet current national weight standards of 286,000 pounds, with the intent of reducing the need for Vermont rail shippers or customers to partially load rail cars in order to not exceed the lower weight limits on Vermont railroads. In addition, VTrans' Rail Policy Plan calls for all new construction to achieve the 286,000 lb. standard and, in cases of major civil structures with a long design life, to a 315,000 lbs. standard.

Planned improvements to rail infrastructure in Vermont include:

- Western Corridor improvements. The State continues to improve the rail lines along the Western Corridor route between Burlington, Rutland, Bennington and Hoosick Junction. The improvements include installation of heavier welded rail, replacement of rail ties, upgrading crossings and strengthening of bridges. The improvements will eventually permit increased weights and higher train operating speeds throughout the corridor.
- General accommodation of 286,000 pound railcars. VTrans manages an ongoing program to upgrade state-owned rail lines so that they can support 286,000-pound rail cars. Today, many state-owned rail lines can only safety support 263,000-pound railcars. This forces Vermont rail shippers or customers to partially load rail cars in order to not exceed the lower weight limit. Upgrading the state-owned rail lines from 263,000 pound capacity to 286,000-pound capacity will reduce the cost of shipping by rail for many Vermont shippers and receivers. Finally, VTrans' Rail Policy Plan calls for all new construction to achieve the 286,000 lb. standard and, in cases of major civil structures with a long design life, to achieve the anticipated future standard of 315,000 lbs.

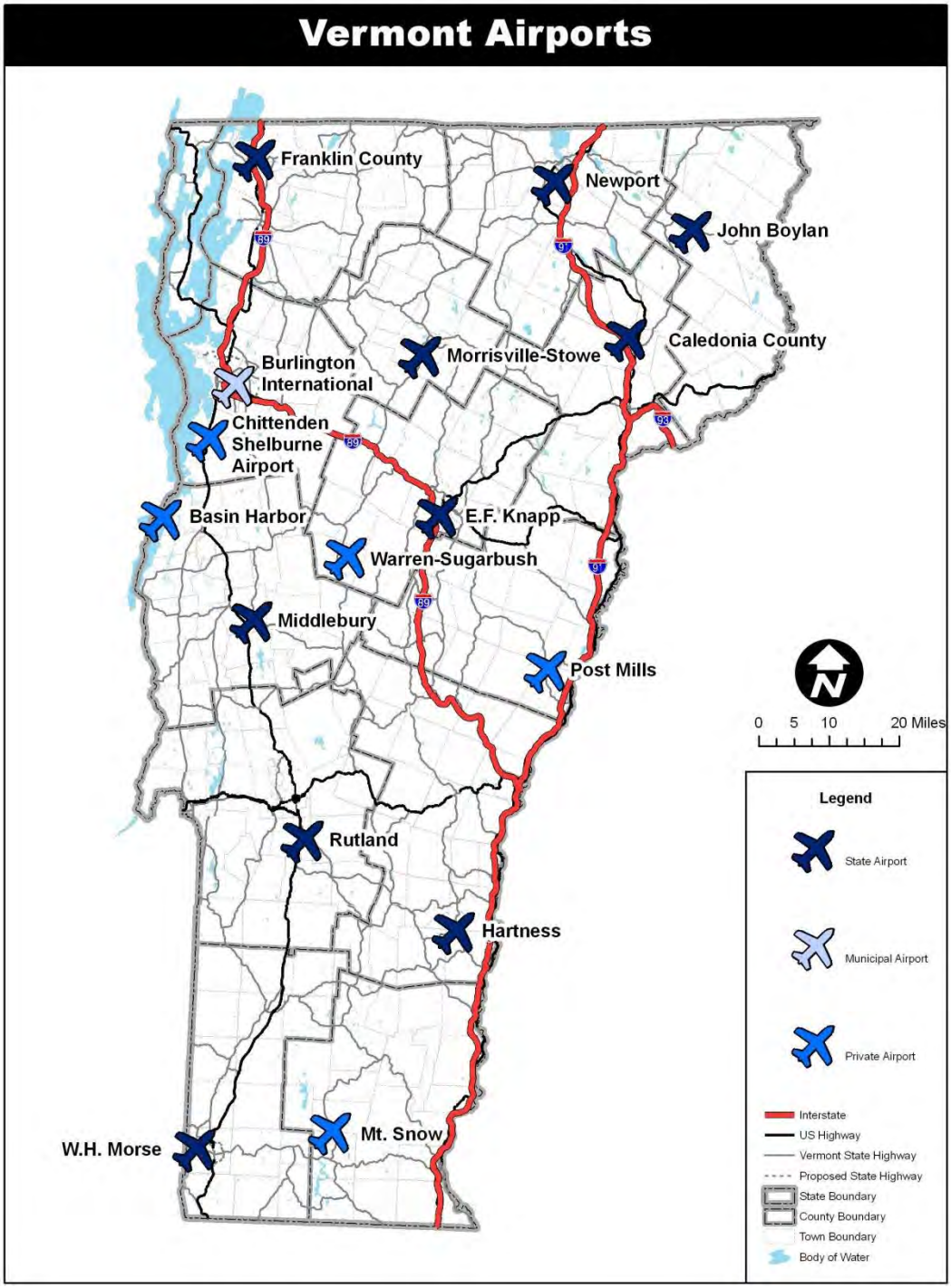
3.3 AIRPORTS

Sixteen airports open to public use are located across Vermont (Figure 3.7, Table 3.7). These airports vary widely in terms of infrastructure, size and types of air traffic accommodated.

The Vermont Airport System Policy Plan (2007) classifies Vermont's public use airports into four categories based on these attributes and their role in the state's air transportation system:

- National Service Airports – Larger airports key to connecting local, regional and state economies to the nation and global economies;
- Regional Service Airports– Focus on small jet and multiengine aircraft and connect local and regional economies to state and national economies;
- Local Service Airports – Primarily serve recreational and personal flying; and
- Specialty Service Airports – serve small single-engine, gliders, balloons, and similar small aircraft and may operate seasonally.

Figure 3.6 Vermont Airport Network



Source: VTrans Operations Division, Airports Program (2010).

Table 3.7 **Vermont's Public Use Airports**

Airport	Location	Ownership	Length/width of longest runway	Functional Role
Burlington Int'l	Burlington	Municipal	8320 ft, 150 ft wide	National
Edward F. Knapp	Barre – Montpelier	State	5002 ft, 100 ft wide	National
Rutland	Rutland	State	5000 ft, 100 ft wide	National
William H. Morse	Bennington	State	3704 ft, 75 ft wide	National
Hartness	Springfield	State	5498 ft, 100 ft wide	Regional
Morrisville-Stowe	Morrisville	State	3701 ft, 75 ft wide	Regional
Caledonia County	Lyndonville	State	3300 ft, 60 ft wide	Local
Franklin County	Highgate	State	3000 ft, 60 ft wide	Local
Middlebury	Middlebury	State	2500 ft, 50 ft wide	Local
Newport	Newport	State	4000 ft, 100 ft wide	Local
Basin Harbor	Vergennes	Private	3000 ft, 90 ft wide (turf)	Specialty
John H. Boylan	Island Pond	State	2650 ft, 120 ft wide (turf)	Specialty
Mount Snow	West Dover	Private	2650 ft, 75 ft wide	Specialty
Post Mills	Post Mills	Private	2900 ft, 80 ft wide (turf)	Specialty
Shelburne	Shelburne	Private	2250 ft, 60 ft wide (turf)	Specialty
Warren-Sugerbush	Warren	Private	2575 ft, 30 wide (turf)	Specialty

Source: Vermont Airport System and Policy Plan (2009)
Federal Aviation Administration (FAA) Master Airport Records (September 2010).

National Service Airports, which are Burlington International, Edward F. Knapp (Barre-Montpelier), Rutland Regional and William H. Morse (Bennington) airports, have infrastructure and physical characteristics that are capable of supporting commercial and cargo service. Each of these airports except for William H. Morse have runways longer of 5,000 feet or greater length and are 100-feet wide, enabling use by the larger jet aircraft that are typically used for parcel and air cargo services. The runway at William H. Morse is 3,704 feet, which limits the type of aircraft that can operate at the airport to smaller jets and multi-engine propeller driven aircraft.

The share of goods moved by air is small, especially in terms of cargo weight or volume. However, air does have a specific and important role in moving high priority or high-value items quickly. Mail and parcel delivery services (such as United Parcel Service, Federal Express, DHL) are the predominant air cargo activities in Vermont, though other cargo services operate as well. Air cargo in

Vermont is handled primarily at Burlington International, E.F. Knapp and Rutland Regional airports. United Parcel Service or local airfreight companies that "interline" with UPS fly into each of these three airports, while Federal Express flies only into Burlington and Rutland. Other charter air cargo carriers utilize Burlington International on a daily basis. In addition to the cargo services listed, some freight service also is provided in passenger aircraft as belly cargo.

Proximity to these airports influences whether air cargo services can be effectively utilized, since goods and parcels need to be transported to/from the airport. Some areas of Vermont are located closer to airports in New Hampshire or New York and thus rely on these facilities for access to air cargo services.

3.4 WATER TRANSPORTATION

Making up approximately half the border with the State of New York, Lake Champlain runs 110 miles along the western side of Vermont. Only 12 miles across at its widest, this body of water has played a large part in the movement of people and goods throughout Vermont's history.

The lake forms part of a navigable water route, hosts a ferry system connecting New York and Vermont at various locations and is crossed by two bridges. In 2010, only one of the bridge crossings, Route 2 between Alburgh, Vermont and Rouses Point, New York in the northwest corner of the state, was operational. The other bridge, located in the southern portion of the lake between Chimney Point, Vermont and Crown Point, New York was closed in October 2009 and subsequently demolished due to the dangerously deteriorated condition of the bridge piers. The loss of the bridge imposed substantial hardship on its former users, requiring time-consuming detours. As a result, a replacement Champlain Bridge was constructed in only two years, opening to traffic in November 2011. The following sections discuss the Lake Champlain ferries as well as the commercially dormant New York to Quebec water route that links the Hudson River with the St. Lawrence.

The Lake Champlain Ferry System

There are four commercial ferry services that operate across Lake Champlain, whose locations are shown in Figure 3.8. Those services are as follows:[14]

- Grand Isle, Vermont to Plattsburgh, New York;
- Burlington, Vermont to Port Kent, New York;

[14] From February 1, 2010 to November 2011, a fifth temporary ferry service was initiated between Chimney Point and Crown Point while a replacement bridge was constructed.

- Charlotte, Vermont to Essex, New York; and
- Shoreham, Vermont to Ticonderoga, New York.

Together, the Grand Isle-to-Plattsburgh, Burlington-to-Port Kent and Charlotte-to-Essex ferry services transported nearly 56,000 commercial vehicles between October 1, 2009 and October 1, 2010. Commercial vehicle data for the Shoreham-to-Ticonderoga service were not available.

Figure 3.7 Vermont Ferry Routes

Grand Isle, Vermont to Plattsburgh, New York

The ferry service that operates between Grand Isle and Cumberland Head, near Plattsburgh, runs year round, 24 hours a day and is operated by the Lake Champlain Transportation Company. The lake crossing trip itself takes about 12

minutes. This service can reduce the 1.5-hour (80-mile) highway-only trip between Burlington and Plattsburgh to approximately 1 hour over about 30 miles.

The maximum weight per vehicle permitted on the ferries operating on this route is 40 tons. The maximum vehicle height permitted on the ferries is 13 feet 6 inches. The maximum width for the ramps is 13 feet 4 inches although any vehicle that is more than 8 feet 6 inches wide is charged an extra fee. The rate for a trip is based on a vehicle length of over 19 feet. The Grand Isle-Cumberland Head ferry transported more commercial vehicles than any other ferry crossing between October 2009 and October 2010. During that period, 48,913 commercial vehicles were transported via this crossing.

Burlington, Vermont to Port Kent, New York

Burlington Harbor encompasses approximately 100 acres and serves as a receiving port for petroleum products. A ferry service also operates between Burlington and Port Kent, and runs only in the summer between late May and mid-October. This trip, which operates on a limited daytime schedule takes approximately one hour. Due to the time of the crossing, use of this ferry does not significantly minimize travel times across the lake but could reduce mileage depending on trip origin and destination.

The maximum weight per vehicle permitted on the ferries operating on this route is typically 40 tons, with one vessel, the M/V Adirondack, limited to 20 tons; however the ramp at Port Kent is limited to 30 tons thereby limiting the effective weight that is possible on this route to either 20 or 30 tons. The maximum vehicle height permitted differs based on the particular vessel ranging from 11 feet 3 inches to 13 feet 6 inches. The maximum width for the ramps is 13 feet 4 inches although any vehicle that is more than 8 feet 6 inches wide is charged an extra fee. The rate for a trip is based on a vehicle length over 19 feet. Between October 2009 and October 2010, 71 commercial vehicles were transported via this crossing.

Charlotte, Vermont to Essex, New York

The ferry service that operates between Charlotte and Essex runs year round although it does not operate 24 hours a day. The lake crossing itself takes about 20 minutes, and the travel time and mileage savings of this route are highly dependent on the trip origin and destination. For example, this route can provide up to 45 minutes of travel savings between Burlington and Lake Placid, New York with the closure of the Crown Point bridge and if the Burlington-Port Kent ferry is not operating.

The maximum weight per vehicle permitted on the ferries operating on this route is 40 tons. The maximum vehicle height permitted on the ferries is 13 feet 6 inches. The maximum width for the ramps is 13 feet 4 inches although any vehicle that is more than 8 feet 6 inches wide is charged an extra fee. The rate for a trip is based on a vehicle length over 19 feet. The Charlotte-Essex ferry service carried 6,864 commercial vehicles during the period between October 2009 and October 2010.

Shoreham, Vermont to Ticonderoga, New York

The ferry service connecting Shoreham and Ticonderoga operates May through October between the hours of 8:00 a.m. and 6:00 p.m. or 7:00 p.m. A lake crossing takes approximately seven minutes, with frequencies of up the three trips per hour. The maximum weight per vehicle permitted on the ferries operating on this route is 15 tons. The volume of commercial vehicles using this ferry service was not available for this report.

The Hudson River to St. Lawrence Route

Lake Champlain serves as a link in a continuous navigable water route connecting the Hudson River at Albany with the St. Lawrence River in Sorel Quebec (see Figure 3.9). The Champlain Canal connects the southern end of Lake Champlain at Whitehall, New York with the Hudson River north of Albany. To the north, the Richelieu River, through the Canal-de-Chambly and the Canal-de-Saint-Ours, provides the connection to the St. Lawrence River. Once a major freight artery, the route is now used for recreational purposes; there is little to no freight vessel service. Operational constraints such as lengthy seasonal closures, daytime operations, limited barge capacity because of physical constraints and deferred maintenance have greatly diminished the attractiveness of the route for commercial haulage.

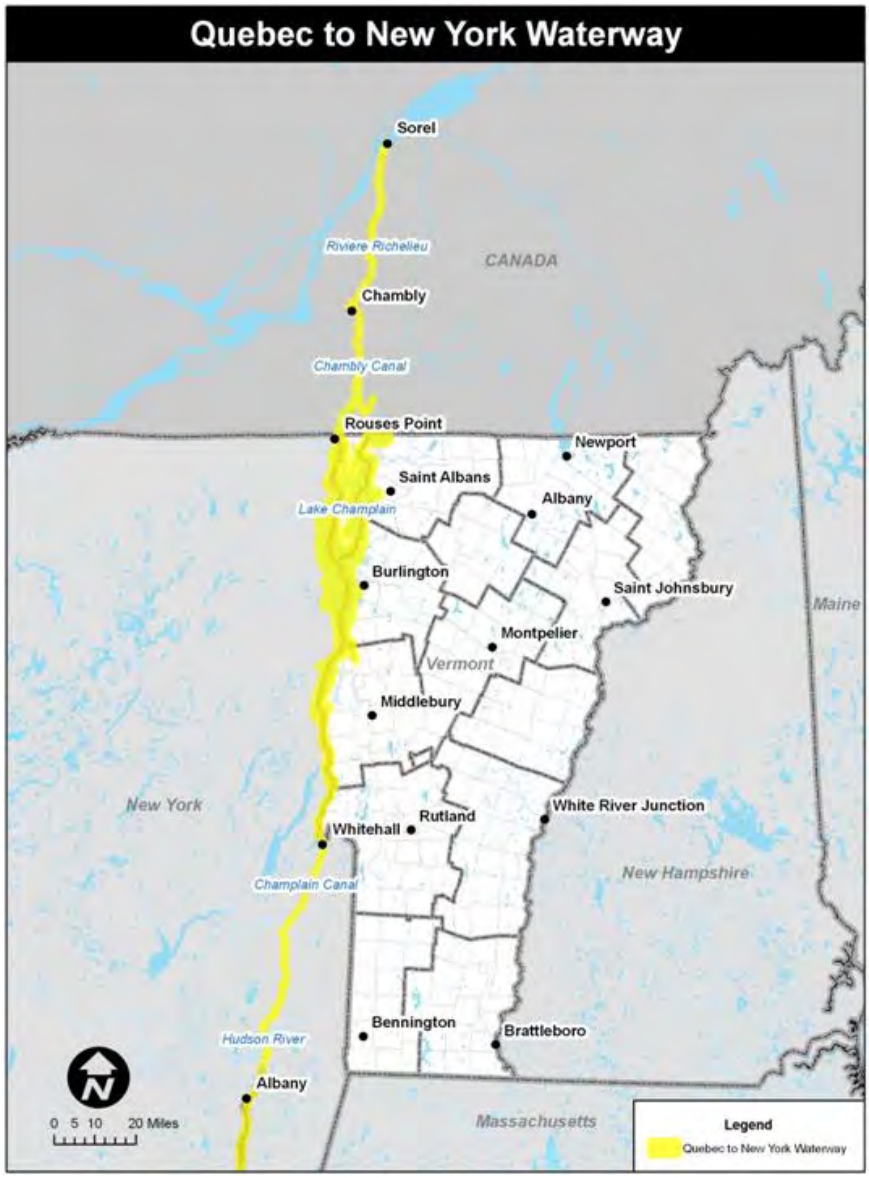
However, the greatest impediment to commercial traffic is that portions of the Upper Hudson River and the Champlain Canal have not been dredged for navigational purposes to the nominal design depth of 12 feet since the early 1980s. This is due to the extensive contamination of the upper Hudson's river bed from Polychlorinated Biphenyls (PCB), the toxic effluent of two General Electric capacitor manufacturing plants in Fort Edward and Hudson Falls, New York. Since the cessation of dredging, silting has caused the canal depth to drop to as little as 3.5 feet, making passage wholly unsuitable for commercial vessels as well as larger recreational craft. Although remediation dredging is currently underway, there is no agreement among the parties to re-establish navigation depths along this route due to the substantial cost.[15] Absent resumption of navigational dredging along the Champlain Canal, the likelihood of any significant commercial shipping along any part of the route, including Lake Champlain, is minimal at best.[16]

---

[15] See http://www.canals.ny.gov/corporation/environaware/lebrun-article.pdf and http://www.canals.ny.gov/corporation/commercial-shipping.html.

[16] Between 1980 and 2009, the tonnage handled by the Champlain Canal dropped from 700,000 to fewer than 1,000 tons (except in 2008). While substantial reductions in volume would likely have occurred since 1980 even without the cessation of dredging due to major shifts in the regional economy, this volume nevertheless provides an indication of substantial Canal use when it was available for commercial navigation (http://www.timesunion.com/news/article/PCB-cleanup-extension-sought-565557.php).

Figure 3.8 Quebec to New York Waterway



4.0 Freight Demand

This chapter describes current and future freight demand along Vermont's major transportation corridors and facilities, including commodity movements, mode use, trading partners, international trade and the impacts of these attributes on the State's highway and rail networks today and in the future. It further links freight generators, by industry, to the corresponding freight flows on the highway network in order to illustrate the impact that each of the top industries has on the existing infrastructure.

Primary data for this effort was drawn from a variety of sources, most notably Global Insight's TRANSEARCH for domestic truck and air flows, the U.S. Surface Transportation Board's Carload Waybill Sample for rail traffic and the Federal Highway Administration's Freight Analysis Framework 2 for Canadian and overseas trade. Data from the three sources was grouped together for a 2007 base year and projected to 2035 using the Moody's Economy.com forecast which was described in Chapter 2. These results were compared with prior studies, including the 2009 Long-Range Transportation Business Plan, the 2004 Vermont Highway System Policy Plan and the 2006 Vermont State Rail and Policy Plan.

4.1 CURRENT VERMONT FREIGHT FLOWS

This section characterizes current freight volumes that move along Vermont's rail and highway corridors, air cargo facilities and border crossings. Data for the year 2007 has been used throughout, as it is the most recent year for which complete data on goods movement was available. It provides an indication of the level of use during the last pre-recession year; subsequent to 2007, traffic volumes declined in the range of 15 to 50 percent, depending on location and mode, reaching the lowest level during the first half of 2009.

Overall Commodity Movements

Over 52 million tons of freight, worth approximately $58 billion, were transported into, out of, within and through Vermont via highway, railroad and air in 2007. A brief description of freight flows by direction is provided below and summarized in Table 4.1.

- Inbound movements accounted for 18.5 million tons with a value of $24.4 billion;
- Outbound movements accounted for 8.1 million tons with a value of $6.2 billion;
- Intrastate movements (entirely within Vermont) accounted for 5.3 million tons with a value of $3.4 billion;

- Through movements destined for/originating in Canada accounted for 4.7 million tons with a value of $4.5 billion; and
- Domestic Through movements accounted for 15.4 million tons with a value of $19.7 billion.

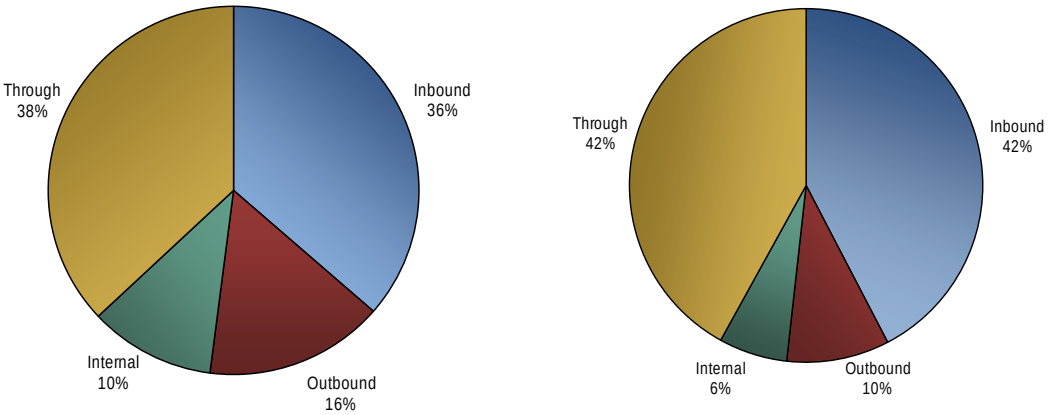
Table 4.1 Freight Flows in Vermont by Direction of Travel
2007

Direction	Tons (Millions)	Dollars (Billions)
Inbound	18.5	$24.4
Outbound	8.1	$6.2
Internal	5.3	$3.4
Through Border Trade	4.7	$4.5
Through trade, U.S.-U.S.	15.4	$19.7
Total	52.0	$58.2

Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Figure 4.1 shows the percentages by weight and value. Inbound and through shipments make up the largest portions of the overall freight shipments in the State with 36 percent and 38 percent of the tonnage respectively. Inbound flows consist primarily of secondary moves originating from locations in New York State and are made up of mixed goods sent to distribution facilities (in this case mostly in New York) from other locations, which are then sorted, reloaded and delivered throughout Vermont. Other key products being imported include food, chemicals and construction products.

Figure 4.1 Total Freight Flows by Type of Movement
By Weight (Left) and Value (Right)



Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Domestic through flows are 70 percent by truck and 30 percent by rail, primarily going to and from New Hampshire, New York, Massachusetts, Maine and the East North Central region. The top origin-destination (OD) pairs for domestic through traffic are listed in Table 4.2. The top commodities moving through Vermont include nonmetallic minerals, paper, food, petroleum products and chemicals.

Table 4.2 Top Through-Freight Domestic OD Pairs by Weight
2007

Region Pair	Tons (Thousands)
New Hampshire and East-North Central	3,159
New York and New Hampshire	2,581
New York and Massachusetts	1,984
New Hampshire and West North-Central	1,058
Massachusetts and East North-Central	905
Pennsylvania and New Hampshire	800
Maine and East North Central	592
New Hampshire and South Atlantic	480
Maine and East South-Central	358

Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Outbound shipments account for 16 percent of total shipments by weight and 12 percent by value. Over 70 percent of these shipments are destined for New York, Massachusetts and New Hampshire. The primary export is nonmetallic minerals, followed by clay/concrete/glass/stone and food.

Intrastate shipments are comprised almost entirely of nonmetallic minerals, clay/concrete/glass/stone, secondary moves and food. These make up 10 percent of all shipments by weight and six percent by value.

As Table 4.3 shows, Chittenden County is the largest recipient of inbound flows (5.2 million tons annually), reflecting the goods needed to serve its population base. These shipments are made up of secondary moves, chemicals, food and nonmetallic minerals. Bennington is the second largest importer of goods in Vermont with 2.4 million tons imported, while five other counties each import over one million tons annually.

Rutland County represents the largest source of outbound flows by weight (4.3 million tons annually); these shipments are composed primarily of nonmetallic minerals (3.2 million tons) and clay/concrete/glass/stones (2.7 million tons). Chittenden County also plays a key role in outbound shipments, with over 1.2 million tons of food, nonmetallic minerals and secondary moves.

Table 4.3 Domestic Commodity Flows by County
Thousands of Tons

County	Inbound	Outbound	Internal	Total
Addison	736	195	371	1,302
Bennington	2,435	64	422	2,920
Caledonia	519	97	503	1,119
Chittenden	5,235	1,228	3,211	9,674
Essex	219	7	30	255
Franklin	1,222	570	1,131	2,924
Grand Isle	229	0.8	94	323
Lamoille	342	15	190	547
Orange	454	104	104	661
Orleans	497	53	224	775
Rutland	1,629	4,251	1,991	7,871
Washington	1,315	517	1,394	3,227
Windham	1,542	233	299	2,074
Windsor	1,198	240	678	2,116
Total	17,572	7,575	10,642	35,788

Source: TRANSEARCH (2007).

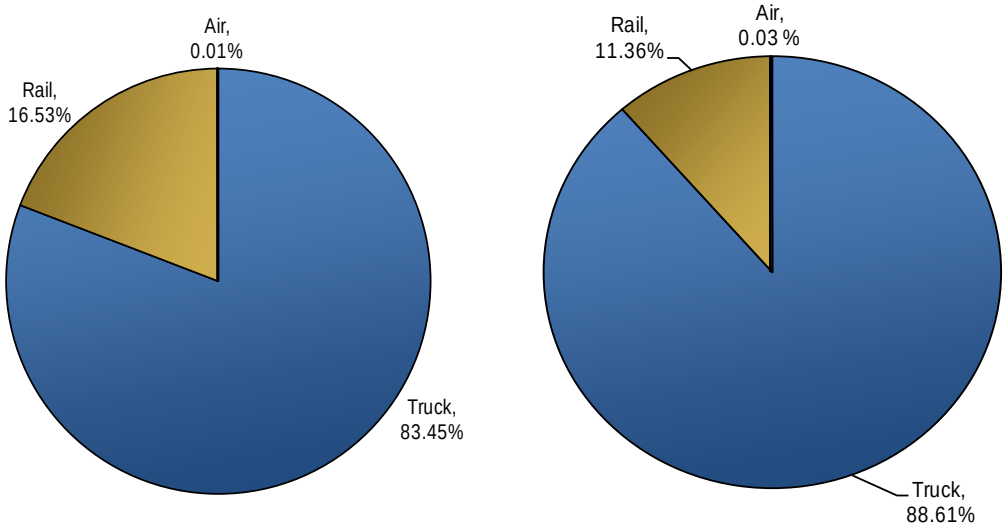
Note: Excludes Canadian Trade data, which was not available at the county level.

The internal column covers double counting of: 1) intracounty traffic by including it twice in the same county; and 2) intrastate traffic by including it in two different counties.

Volumes by Mode

Vermont is dependent on motor carriage for transportation of the vast majority of its freight. Trucks provide the last link in the transportation chain, carrying all types of commodities from intermediate destinations, such as seaports, rail terminals and distribution facilities to their final destinations. As shown in Figure 4.2, trucks moved 80 percent of the tonnage and 88 percent of the value of freight going into, out of, through and within the State. This amounted to just over 43 million tons and $51.5 billion in 2007. The modal share for truck in Vermont is typical for the New England states. The exception is Maine, where the truck modal share is 70 percent of cargo by weight, reflecting the substantially greater presence of rail-oriented industry in Maine.

Figure 4.2 Mode Split by Weight (Left) and Value (Right)
2007



Source: TRANSEARCH, STB Waybill, Cambridge Systematics, FAF2 (2007).

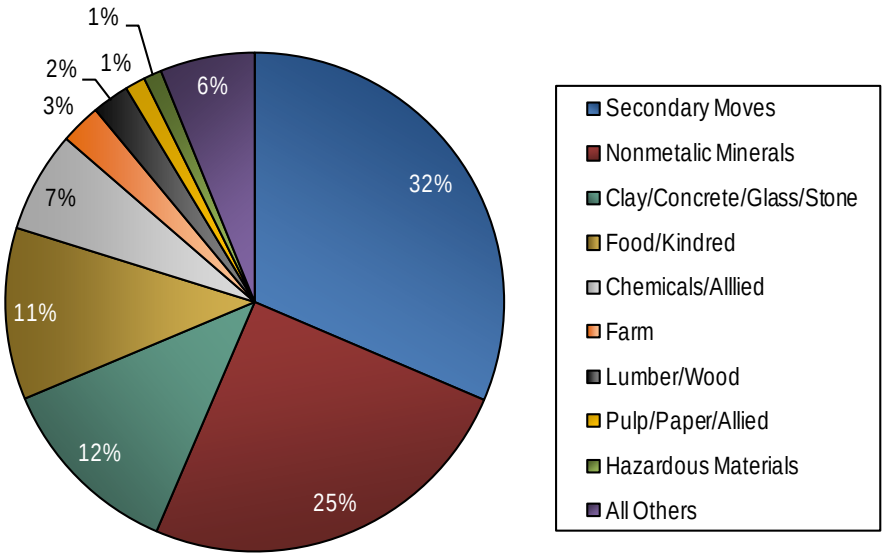
Rail movements accounted for 9.3 million tons valued at $8.6 billion, representing approximately 17 percent of all the freight moving into, out of, within and through the State by weight. Nonmetallic minerals, hazardous materials and food are the top commodities transported by rail.

Air movements from and to Vermont air fields amounted to 0.01 percent or 5,200 tons of all the freight moving in Vermont by weight, and 0.03 percent or $17.9 million by value. This disparity between shipment weight and shipment value highlights the high-value, low-weight nature of air freight shipments, which consist primarily of chemicals and electrical machinery. While Vermont's airports may handle very modest freight volumes, a large volume of Vermont's commerce moves by air through the major nearby gateway airports of New York and Boston. This pattern is likely to continue into the future, with growth in Vermont-related air-freight volume occurring beyond the State's borders and appearing as highway traffic within Vermont.

Top Commodities

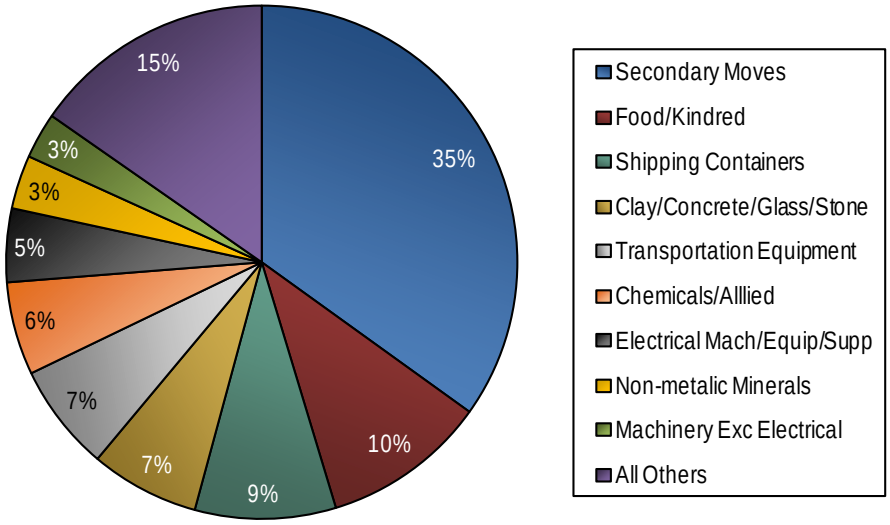
Figures 4.3 and 4.4 illustrate the top commodities moving into, out of and within the State of Vermont in 2007 by both weight and value. The top five commodity groups in 2007 accounted for 86 percent of the total flows and 26 million tons by weight.

Figure 4.3 Top Commodities (Inbound Plus Outbound Plus Internal) *By Weight*



Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Figure 4.4 Top Commodities (Inbound Plus Outbound Plus Internal) *By Value*



Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

These commodity groups consisted of:

- Secondary moves, 9.6 million tons (31 percent);
- Nonmetallic minerals, 7.6 million tons (25 percent);
- Clay/concrete/glass/stone, 3.7 million tons (12 percent);

- Food, 3.4 million tons (11 percent); and
- Chemicals, 2.0 million tons (7 percent).

Each of these commodities accounted for at least two million tons.

When shipment value is considered, secondary moves accounted for an even more significant portion of shipments with 38 percent of all freight, or $12.0 billion. The remaining top five commodities accounted for 33 percent of all shipments by value, or $10.3 billion, including:

- Food, $3.6 billion (11 percent);
- Clay/concrete/glass/stone, $2.4 billion (8 percent);
- Transportation equipment, $2.3 billion (7 percent); and
- Chemicals, $2.0 billion (6 percent).

Each of these commodities exceeded $2 billion in value.

Although the top five commodities make up the majority of the freight transported by weight, Vermont's transportation network handles a wide array of goods. In fact, each of the top seven commodities by weight accounted for over 700,000 tons and each of the top eight commodities by value accounted for over $1 billion. That said, particular attention must be paid to secondary moves and nonmetallic minerals which make up over 55 percent of all commodities transported by weight. The impact of these two commodities on Vermont's transportation system is quite different though. Secondary traffic, which moves largely by highway, is more broadly distributed across the State, while traffic associated with the production of nonmetallic minerals is concentrated in specific geographic locations and corridors and is more multimodal in nature.

Secondary moves account for approximately one-third of all commodities transported in Vermont, representing 9.6 million tons and over 465,000 trucks in 2007. The bulk of these flows (7.3 million tons and 354,000 trucks) are inbound shipments from New York that are distributed throughout the State. These shipments cover a broad range of commodities, many of which did not originate in New York, but instead were redistributed into Vermont from a warehouse or distribution center located outside the State. The actual origins of these commodities are not specified in the databases, but many come from other states and foreign countries.

Figures 4.5 and 4.6 present the breakdown of the top 10 domestic commodities by direction of flow that moved throughout Vermont in 2007, first by value (Figure 4.5) and then by tonnage (Figure 4.6). Most commodity moves are inbound and through trips. A majority of paper and pulp, fabricated metal and primary metal shipments in the State are through traffic, while a majority of chemicals and transportation equipment are inbound. Nonmetallic minerals, stone and electrical equipment show significant proportions of outbound shipments (over 25 percent). In general, the distribution of inbound and through shipments is more balanced than outbound shipments. Vermont's proximity to

major northeastern and Canadian markets results in considerable through traffic, while Vermont exports are heavily concentrated among only a few commodities.

Figures 4.7 and 4.8 provide a view of Vermont's modal usage for the top 10 commodity groups, first by tons and then by value. Beyond the prevalence of secondary traffic, there are substantial differences among the commodities that appear in the two figures. For example, electrical and transportation equipment appear as a top 10 commodity in the value chart, while nonmetallic minerals come in second after secondary moves by tonnage. On a value basis, these are in 11th place, below fabricated metals.

Figure 4.5 Top 10 Domestic Commodities by Direction of Flow
2007, By Value

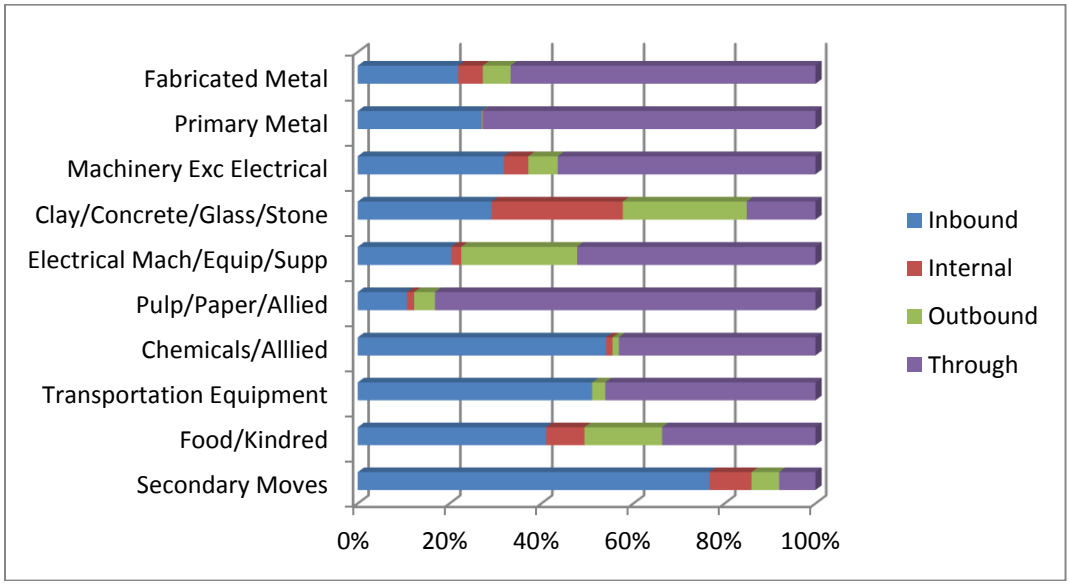


Figure 4.6 Top 10 Domestic Commodities by Direction of Flow

2007, By Tons

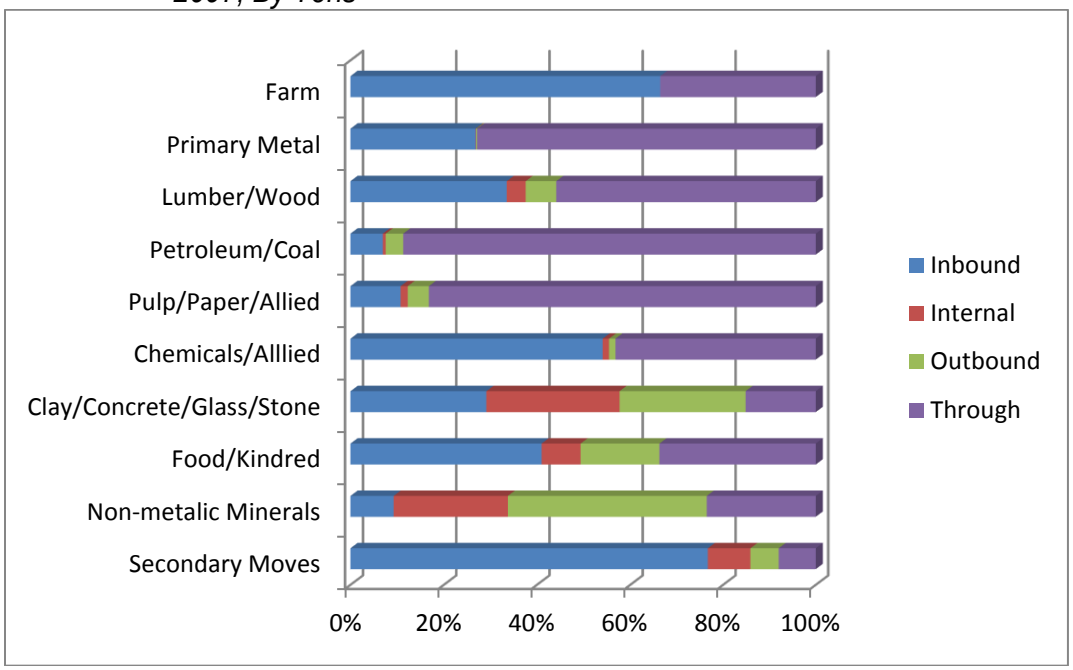


Figure 4.7 Top 10 Domestic Commodities by Mode
2007, Tons

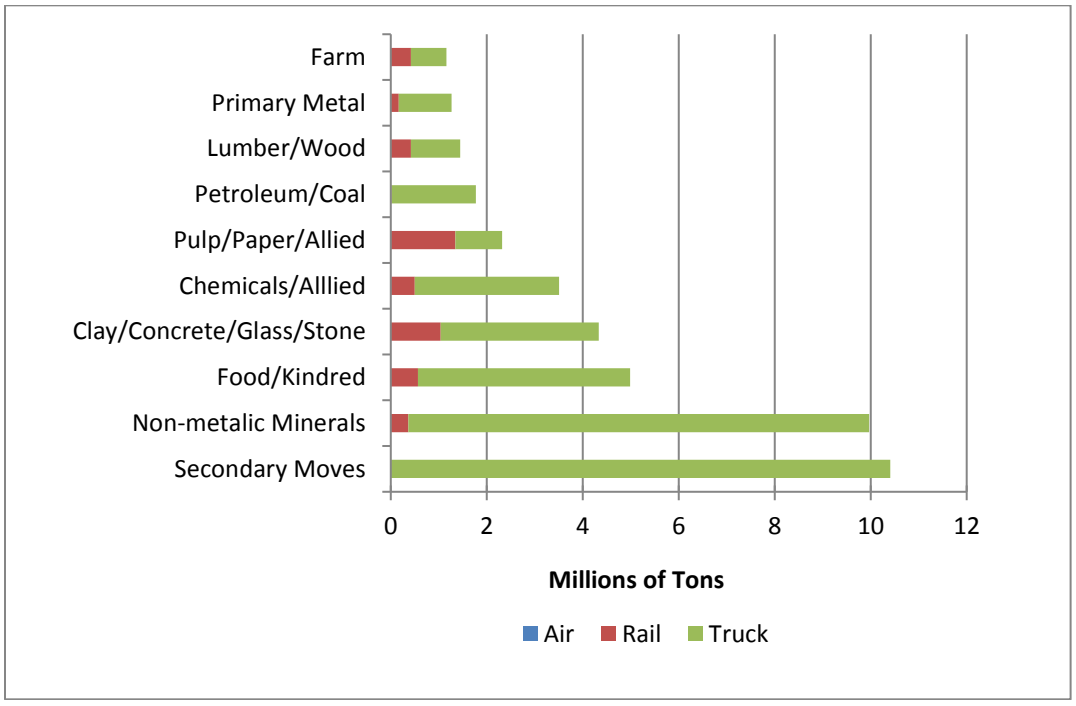
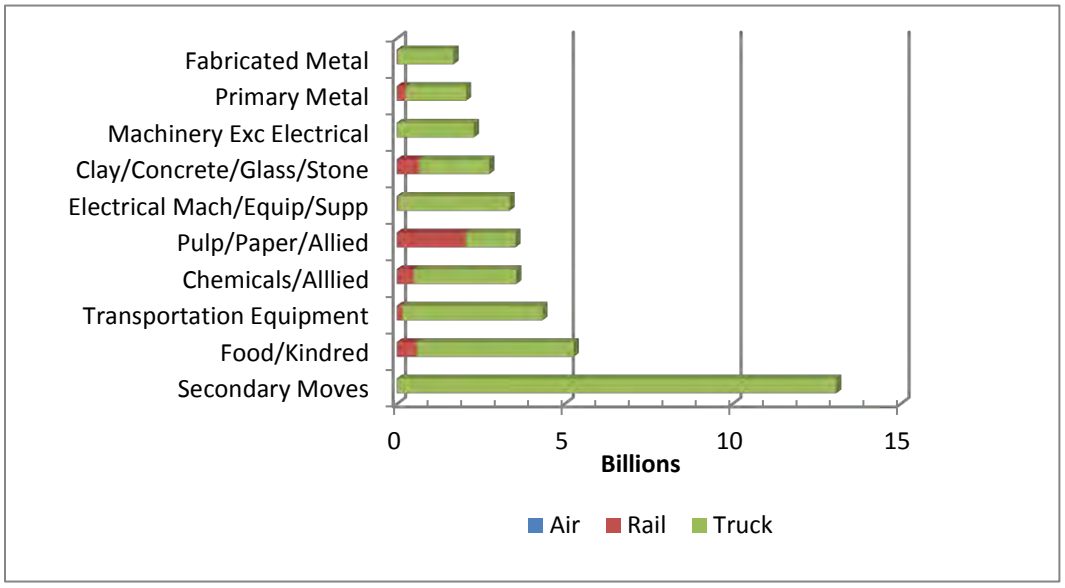


Figure 4.8 Top 10 Domestic Commodities by Mode
2007, Value



Similarly, when examining modal usage across the two charts, the degree to which rail volumes are driven by bulk commodities is evident. Pulp/paper and allied products generate the highest rail volumes, followed by clay/concrete/glass/stone, etc. Even among commodities that move by rail, only pulp/paper, etc., is predominantly handled by rail, with the others largely being transported by road. Whether by value or tonnage, transport by air represents such a small share of total volume that it does not appear in the charts.

Top Trading Partners

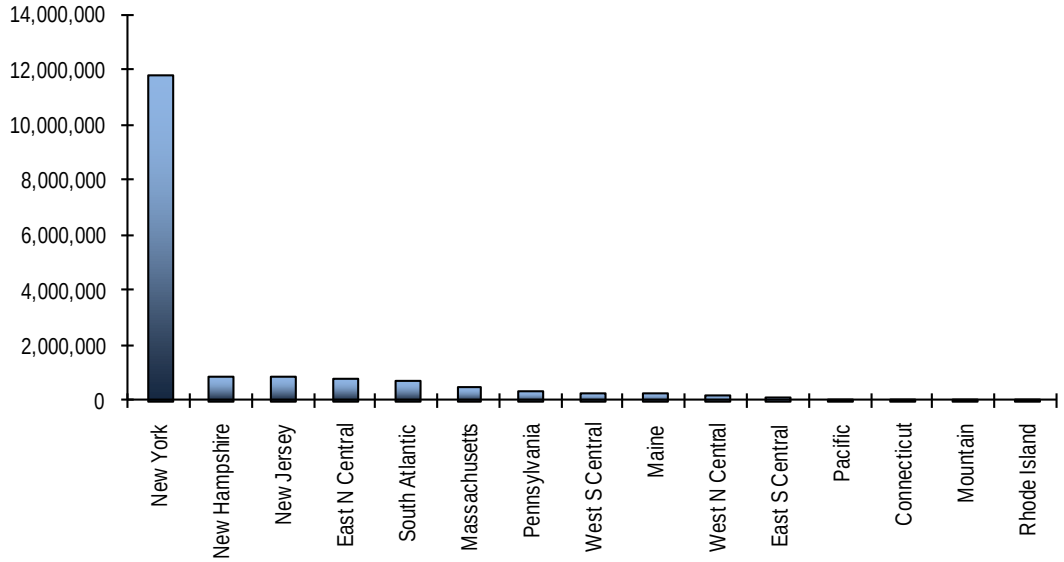
In addition to the commodity flows reported above, it also is important to identify Vermont's key trading partners, i.e., where the State's freight traffic is originating and terminating beyond the State's borders. It provides essential insights into the characteristics of the freight being handled such as length of haul, market penetration, route selection and modal preference and suitability.

In 2007 Vermont imported 17.6 million tons of freight valued at $22.9 billion (see Figure 4.9). New York again is the primary trade partner for inbound goods, accounting for over two-thirds of all shipments by weight and 56 percent by value. The primary driver of these shipments is secondary moves, as discussed in the previous section. The remaining New England states accounted for 1.8 million tons and $2.1 billion.

In 2007 the State of Vermont exported over eight million tons, valued at $6.1 billion. As can be seen in Figure 4.10, New York is the primary receiver of Vermont's outbound shipments, accounting for 3.2 million tons valued at $1.6 billion. The rest of New England combined for 2.9 million tons and an additional $1.6 billion. The primary outbound partners in New England are New Hampshire and

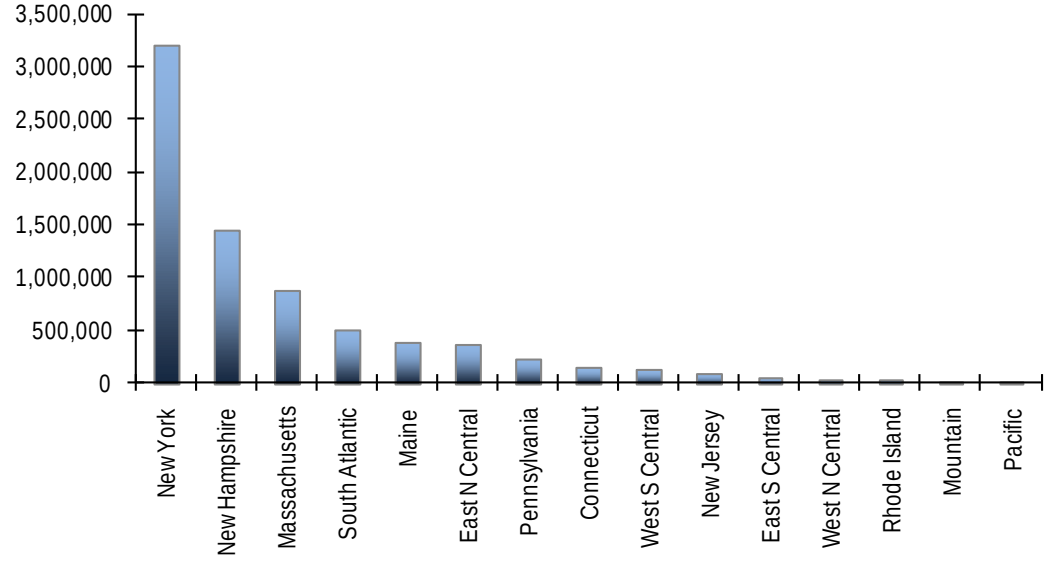
Massachusetts. Other key targets include the South Atlantic and the East North Central regions.

Figure 4.9 Top Trading Partners
Inbound by Weight, Tons per Year



Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Figure 4.10 Top Trading Partners
Outbound by Weight, Tons per Year



Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

An analysis of Vermont's trading partners reveals its strong ties to the surrounding region, primarily New York, New Hampshire and Massachusetts. As

Table 4.4 illustrates, New York accounts for 60 percent of all trade by weight (15 million tons) but over 50 percent by value ($14.7 billion), while New England accounts for 19 percent by weight (4.7 million tons) and 13 percent by value ($3.7 billion).

Table 4.4 Vermont's Trade with New York and New England

Trade Partner	Tons (Millions)	Percent Share	Dollars (Billions)	Percent Share
New York	15.1	60%	$14.6	52%
New England	4.7	19%	$3.6	13%
All Other	5.4	21%	$9.7	35%
Total	25.1	100%	$30.4	100%

Source: TRANSEARCH, STB Waybill, Cambridge Systematics (2007).

Cross-Border Trade

This section summarizes the commodity flows between Vermont and Canada as well as trade between the United States and Canada through ports of entry/exit in Vermont. The section summarizes the domestic portion of these international trips, including the mode used and the origin and/or destination.[17]

Cross-Border Trade by Direction

In 2007, 10.4 million tons of goods with a combined value of $10.3 billion crossed Vermont's borders with Canada, including goods imported and exported by Vermont as well as trade between other U.S. states and Canada through Vermont. As Table 4.5 illustrates, the vast majority of these goods were inbound to the United States from Canada, with these shipments accounting for 67 percent of the trade by weight (6.97 million tons) and 71 percent by value ($7.3 billion).

[17] The data for this section was drawn from a TRANSEARCH dataset licensed by VTrans that focused exclusively on cross-border trade. Only summary information was provided, and thus the data could not be combined with the domestic TRANSEARCH data used elsewhere in this chapter.

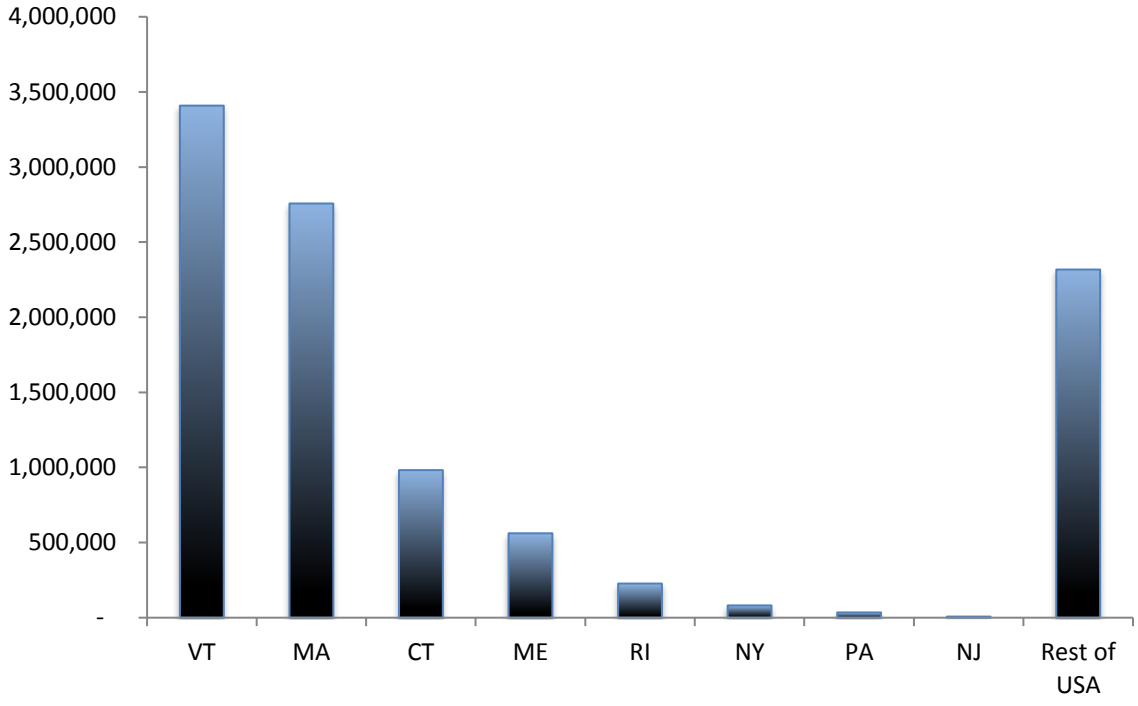
Table 4.5 Cross-Border Flows by Direction of Travel

Trade	Tons (Millions)	Dollars (Billions)
VT-Canada	1.28	$ 1.77
US-Canada	2.13	$ 1.17
Northbound Sub-Total	*3.41*	*$ 2.94*
Canada-VT	-	$ -
Canada-US	6.97	$ 7.31
Southbound Sub-Total	*6.97*	*$ 7.31*
Total	**10.38**	**$ 10.25**

Source: TRANSEARCH, 2007.

As with domestic trade, the majority of goods moving through Vermont's gateways to and from Canada originated or terminated in the Northeast region. Vermont, the rest of New England and New York account for over 77 percent of these shipments by weight, representing 8.0 million tons. The distributions are charted in Figure 4.11 and mapped in Figure 4.12.

Figure 4.11 Top U.S. States Using Vermont's Border Crossings
Annual Tons Shipped



Source: TRANSEARCH, 2007.

Figure 4.12 shows flows by highway segment for shipments using Vermont's border-crossing facilities. Most of the traffic that leaves the Northeastern United States travels to the Mid-Atlantic, Atlanta, Miami, Houston, Chicago, Phoenix, Los Angeles and San Francisco. On the Canadian side, most of the shipments originate or terminate in the western portion of Canada, primarily Vancouver, Calgary, Victoria and Edmonton.

Mode Split for Cross-Border Trade

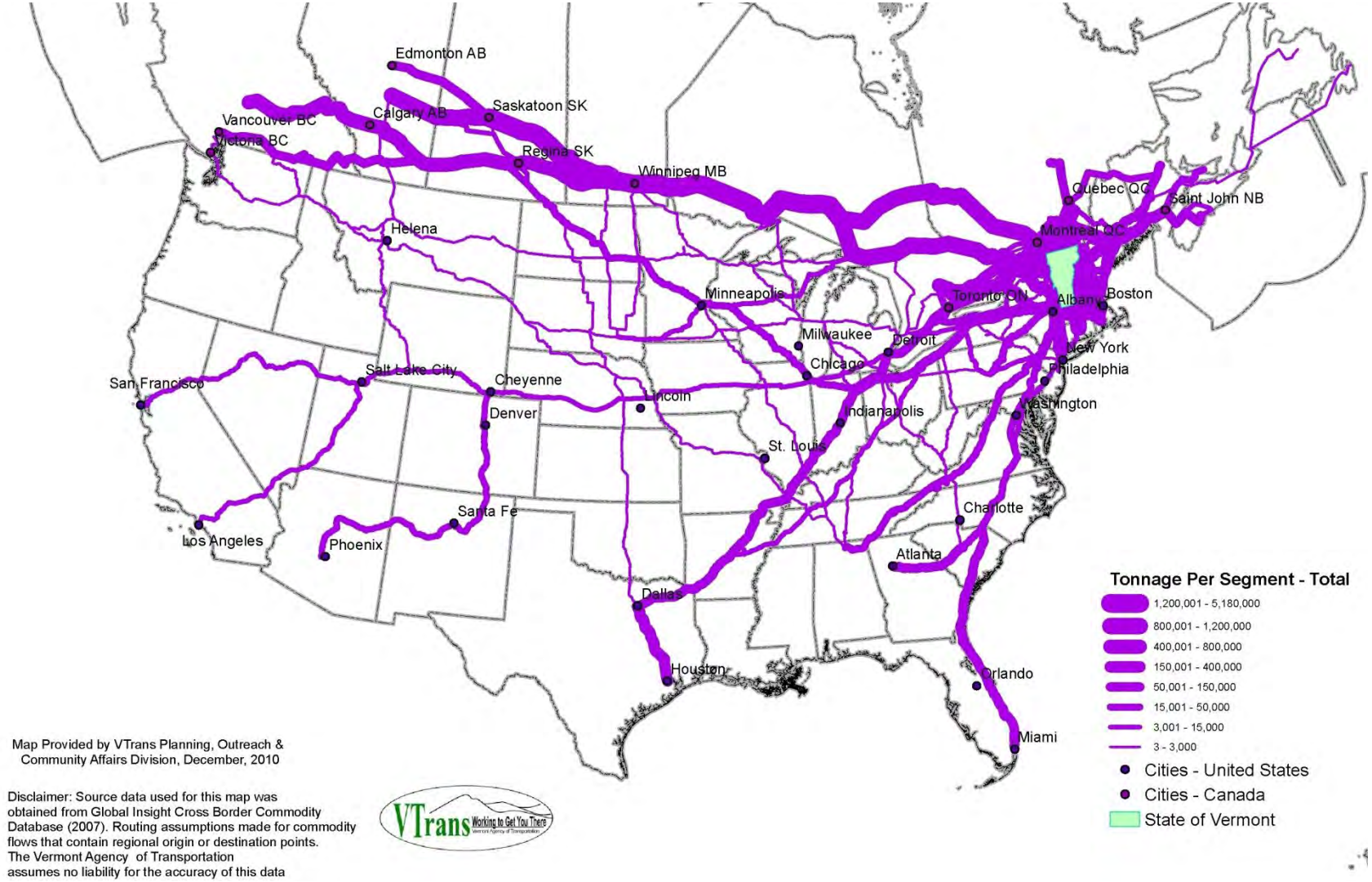
As is the case with domestic flows, trucks are the dominant mode of transportation for freight shipments across Vermont's borders. As Table 4.6 illustrates, trucks handled approximately 65 percent of all shipments by weight, representing 6.7 million tons of goods. Most of the remaining traffic is transported by railroad, which accounted for 23 percent of all goods by weight (2.4 million tons). TRANSEARCH'S "Other" mode is a category that reports primarily rail intermodal shipments.

Table 4.6 Mode Split for Shipments on Vermont's Border Crossings
By Weight

Mode	Tons	% Share
Truck	6,738,886	64.9%
Rail	2,408,853	23.2%
Air	10,745	0.1%
Other	1,219,397	11.7%
Total	**10,377,881**	**100.0%**

Source: TRANSEARCH, 2007.

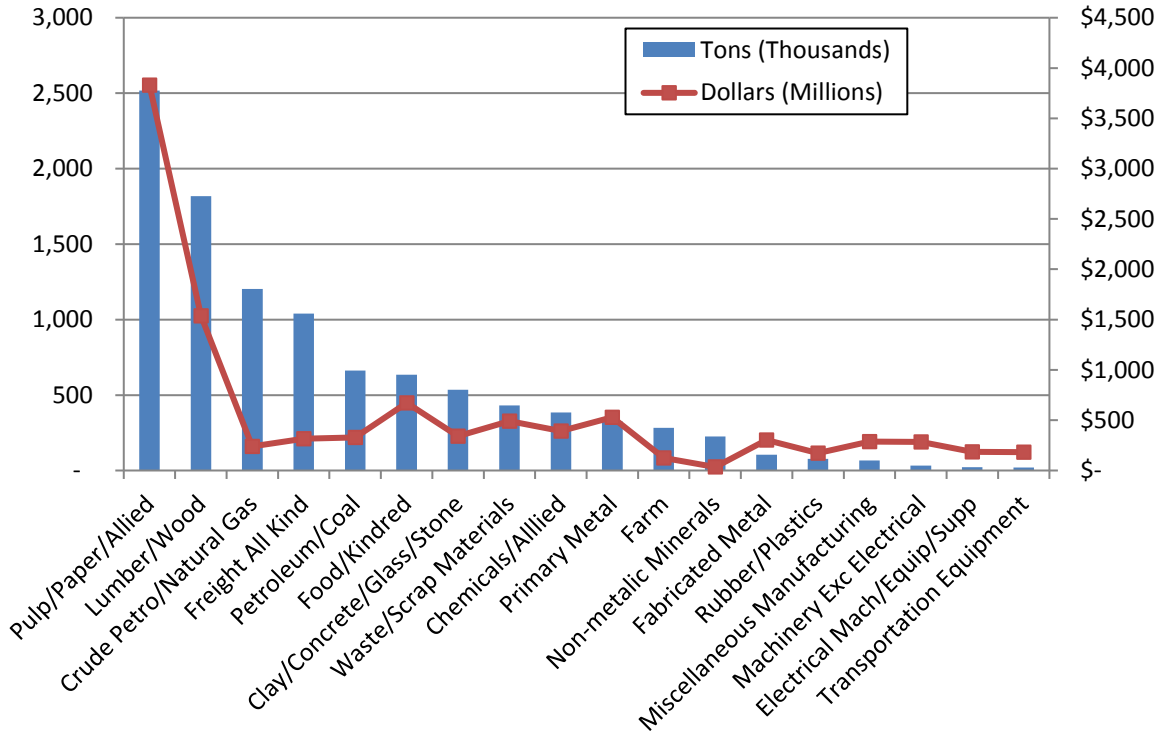
Figure 4.12 US-Canada Cross-Border Traffic (to, from and through Vermont)
Annual Tons Shipped


Edmonton AB
Saskatoon SK
Calgary AB
Vancouver BC
Victoria BC
Regina SK
Winnipeg MB
Quebec QC
Saint John NB
Montreal QC
Helena
Minneapolis
Toronto ON
Albany
Boston
Milwaukee
Detroit
New York
Chicago
Philadelphia
Salt Lake City
Cheyenne
San Francisco
Lincoln
Denver
Indianapolis
Washington
St. Louis
Charlotte
Santa Fe
Los Angeles
Phoenix
Atlanta
Dallas
Houston
Orlando
Miami
Tonnage Per Segment - Total
1,200,001 - 5,180,000
800,001 - 1,200,000
400,001 - 800,000
150,001 - 400,000
50,001 - 150,000
15,001 - 50,000
3,001 - 15,000
3 - 3,000
Cities - United States
Cities - Canada
State of Vermont
Map Provided by VTrans Planning, Outreach & Community Affairs Division, December, 2010
Disclaimer: Source data used for this map was obtained from Global Insight Cross Border Commodity Database (2007). Routing assumptions made for commodity flows that contain regional origin or destination points. The Vermont Agency of Transportation assumes no liability for the accuracy of this data
VTrans
Working to Get You There

Cross-Border Trade Volumes by Commodity

Figure 4.13 charts traffic volumes across VT's borders by commodity in terms of tons and dollars. The largest commodity traded, by both metrics, is paper, which accounted for 2.5 million tons and $3.8 billion. Most of this traffic (90 percent by weight) consisted of through flows from the US to Canada. Other key commodities included lumber (1.8 million tons) and crude petroleum (1.2 million tons).

Figure 4.13 US-Canada Cross-Border Commodity Flows (to, from and through Vermont)
Annual Tons and Dollars Shipped

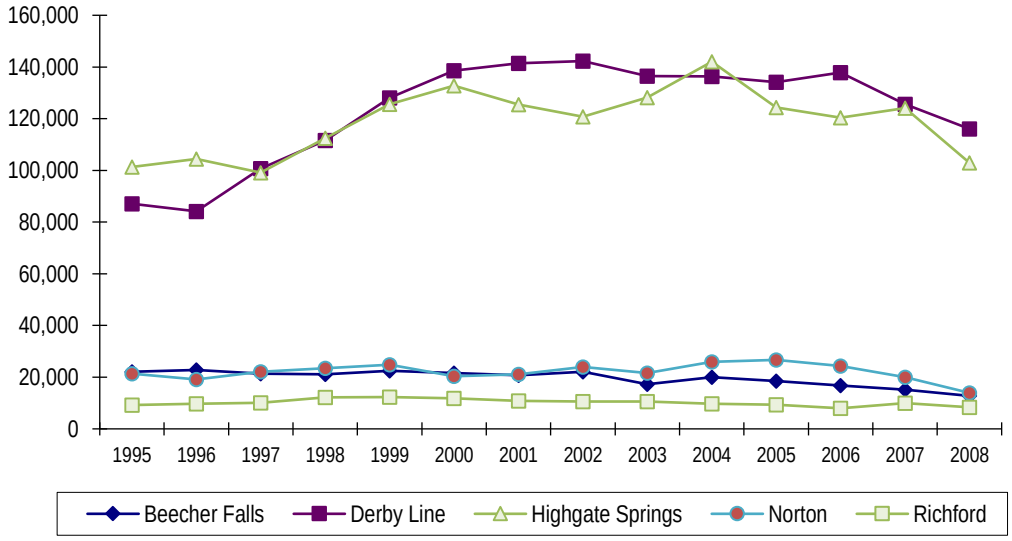


Cross-Border Trade Volumes by Location

Figures 4.14 and 4.15 show the volume of trucks and rail containers across Vermont's borders from 1995 through 2008 as recorded in the Bureau of Transportation Statistics' Transtats Database. The State has five commercial border crossings: Beecher Falls, Derby Line, Highgate Springs, Norton and Richford. Highgate Springs and Richford are located on the Western Corridor. The highest crossing volumes occur at Highgate Springs, which is located closest to the Montreal metropolitan region, and serves as the crossing point for I-89, U.S. 7 and the New England Central Railroad (NECR). Richford is located farther

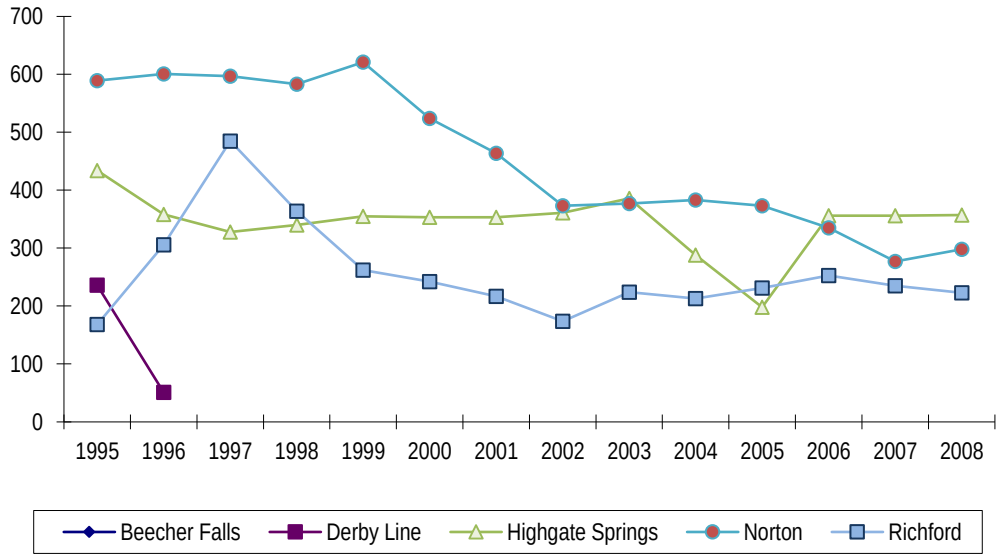
east, serving VT 105 and also the Montreal, Maine and Atlantic Railway (with links to eastern Vermont rather than the Western Corridor).

Figure 4.14 Border Crossing Volume Trends by Location
Trucks



Source: Bureau of Transportation Statistics, TranStats (2008).

Figure 4.15 Border Crossing Volume Trends by Location
Trains



Source: Bureau of Transportation Statistics, TranStats (2008).

As illustrated, the Highgate Springs and Derby Line (I-91) locations handle the great majority of truck crossings, with 103,000 and 116,000 trucks respectively

during 2008. Volumes at the three remaining locations amounted to a combined 35,000 trucks during the same year. Truck trade experienced a significant increase from 1996 to 2000, growing from 240,000 to 325,000 trucks per year. Subsequently, traffic reached a peak in 2004 of 334,000 trucks, after which it declined every year through 2008. In 2008 this decline reached 13.8 percent compared to 2007, with only 254,000 trucks crossing the Canadian border through Vermont facilities.

Rail lines cross into Canada at Highgate Springs, Norton and Richford, which handled 357, 298 and 223 trains in 2008, respectively. Between 1995 and 2000, traffic registered between 1,100 and 1,400 trains per year for all rail crossings located in the State. After 2000, decreased volumes have fluctuated between the high 800s and low 1,000s.

The causes of the flat to declining cross-border volumes in the first decade of the 2000s include:

- Major shifts and contraction in the region's traditional natural resource-based industries and markets;
- New border security regimes imposed by the 2001 World Trade Center attacks;
- Generally increasing value of the Canadian versus the U.S. dollar; and
- Recessions in 2001 and 2008-2009 (with the drop-off in freight traffic starting in late 2006).

If economic growth continues at the levels indicated by the forecast, then cross-border traffic growth should resume as well, but at modest rates. An impetus for more substantial crossing volume growth will be the completion of Autoroute 35 in Quebec between Highgate Springs (I-89) and the Montreal region. Cross-border rail volumes rely heavily on a few extractive industries, which have been in decline for many years. A resumption of growth in cross-border volumes is mostly contingent on the development of new business (such as double stack intermodal) and a resumption of growth in those traditional rail-oriented industries

4.2 NETWORK USAGE

This section illustrates how the freight traffic identified by TRANSEARCH and the STB Waybill Sample flows across Vermont's highway and rail networks. Aggregate information shows overall freight volumes by network segment, while mapping of the flows for most significant of Vermont's freight-oriented sectors – previously identified in Task 2 of this study – show how each individually utilizes the network. Furthermore, for highway traffic, the linkage between the location of Vermont's major freight-handling businesses and the transportation network is examined.

Highway Network Volumes

Figure 4.16 illustrates truck flows on Vermont's highway network along with business establishments, with the number of employees indicated by the size of

the blue circles. Not surprisingly, most employers are clustered along the State's primary highway arterials and urban regions. Similarly, the bulk of truck traffic in Vermont takes place along the Interstate Highways (91 and 89) and U.S. Routes (4, 7 and 2). State Route 9 also sees a significant volume of truck traffic from Bennington to Brattleboro, primarily from through shipments moving to and from eastern New England (e.g., New Hampshire, Massachusetts and Maine). The map shows trucks moving to and from the major employment centers in Burlington, Rutland, Montpelier, St. Johnsbury, Bennington, Brattleboro and St. Albans.

Figures 4.17 through 4.23 break down the traffic by the seven most freight-intensive industries and the commodities that they produce. The maps for each of these industries – manufacturing, agriculture and food, construction, wholesale and retail trade, forest products, mining, and energy - provide a clearer picture of how and why freight traffic moves in Vermont along particular corridors and highways. For the forest products, mining and energy sectors, the available data on business establishments was incomplete and/or could not be verified, and thus is not included in the maps.

Figure 4.17 shows the impact of the Manufacturing sector on freight flows in the State. The largest concentration of establishments is located around Burlington, Brattleboro, St. Johnsbury and Bennington, which also generate/attract the largest amount of freight traffic for the corresponding commodities.

These firms cover a wide range of manufacturing subsectors including computer equipment, apparel, healthcare equipment, automobile parts, fiber materials and furniture. They all produce high-tech/high-value commodities that typically require the speed and flexibility provided by trucks. The projected future economic growth of the manufacturing sector indicated in Task 2 will be driven by high-technology firms of this type, even though the level of employment is not projected to increase significantly.

Figure 4.18 illustrates the flow of agriculture and food products on the network. These flows are concentrated primarily on I-89, I-91 and the Route 7 corridor (trucks along County Route 9 between Bennington and Brattleboro are primarily through moves). The number of establishments in the map is very low compared to manufacturing (17), but this is in large part due to the nature of the data being used, which only includes establishments with more than 50 employees. Many of the firms in this sector are small operations that are not included in the InfoUSA data. Primary employers include Ben and Jerry's Homemade in Waterbury and South Burlington, Cabot Creamery in Montpelier, Barry Callebaut in St. Albans and Spring Hill Poultry in Morrisville.

The construction sector is heavily concentrated in the Burlington area, which has the State's largest population and therefore the most construction activity (Figure 4.19). Burlington is also the headquarters location for the largest firms, with construction activities being more broadly distributed beyond the Burlington region. Most shipments originate or terminate in the Burlington area and are composed mainly

of clay, concrete, glass and stones. The largest employer in the State is Pizzagalli Construction Company in South Burlington with over 1,000 employees.

The forest products sector, consisting of timber production is shown Figure 4.20. Given the presence of forest cover throughout the State, traffic flows are distributed throughout the State's highway network as well. More concentrated volumes are found on I-91 from St. Johnsbury south to the Massachusetts border, and on I-89 between Montpelier and Burlington.

Figure 4.21 displays highway traffic associated with the mining of non-metallic minerals. At one time, one of Vermont's largest industries was the mining of natural stone for construction and memorials. Activity in this sector has dwindled, but some mining continues along the Western Corridor and around Barre. Presently, mining-related traffic arises largely from the haulage of sand and gravel for construction and processed limestone (calcium carbonate) for industrial uses. This latter product is mined and refined by Omya in Florence (located north of Rutland), with outbound product shipped by highway and rail. As a result, the highest volumes of mining traffic take place on US-4 from the New York border to White River Junction, with its access to I-89 and I-91. Significant volumes of mining products travel over VT-9 between Bennington and Brattleboro.

The transport of energy products by highway, shown in Figure 4.22, consists of transportation fuels, heating oil, and liquefied propane gas (LPG) that enter Vermont for distribution either in the State or in its neighbor to the east. The nearest major distribution points for oil products are in Albany and Montreal. The traffic from the Albany region is evident through the flows along VT Route 9, as well as I-91 from Massachusetts. Local distribution within Vermont takes place from a number of locations, including Burlington and Rutland. Trucks fan out throughout the state from those locations, making deliveries to businesses and private residences.

Traffic flows generated by the wholesale and retail trade and shown in Figure 4.23, are distributed throughout the State in all of the population centers. Made up largely of finished goods that are to be sold wholesale or retail, the primary flows are associated with the larger population centers of Burlington, Montpelier, Rutland and White River Junction. Most of these goods are brought in from distribution centers in New York, with the result that some of the State's non-Interstate highways handle freight volumes as high as or higher than are handled on some Interstate segments. This situation occurs along Vermont's western corridor, where the most direct route from Burlington to Albany goes south along Route 7 and State Route 30 or 22A to U.S. 4, which connects to Glens Falls, New York and I-87.

Figure 4.16 2007 Truck Flows on Vermont's Highway Network
All Commodities

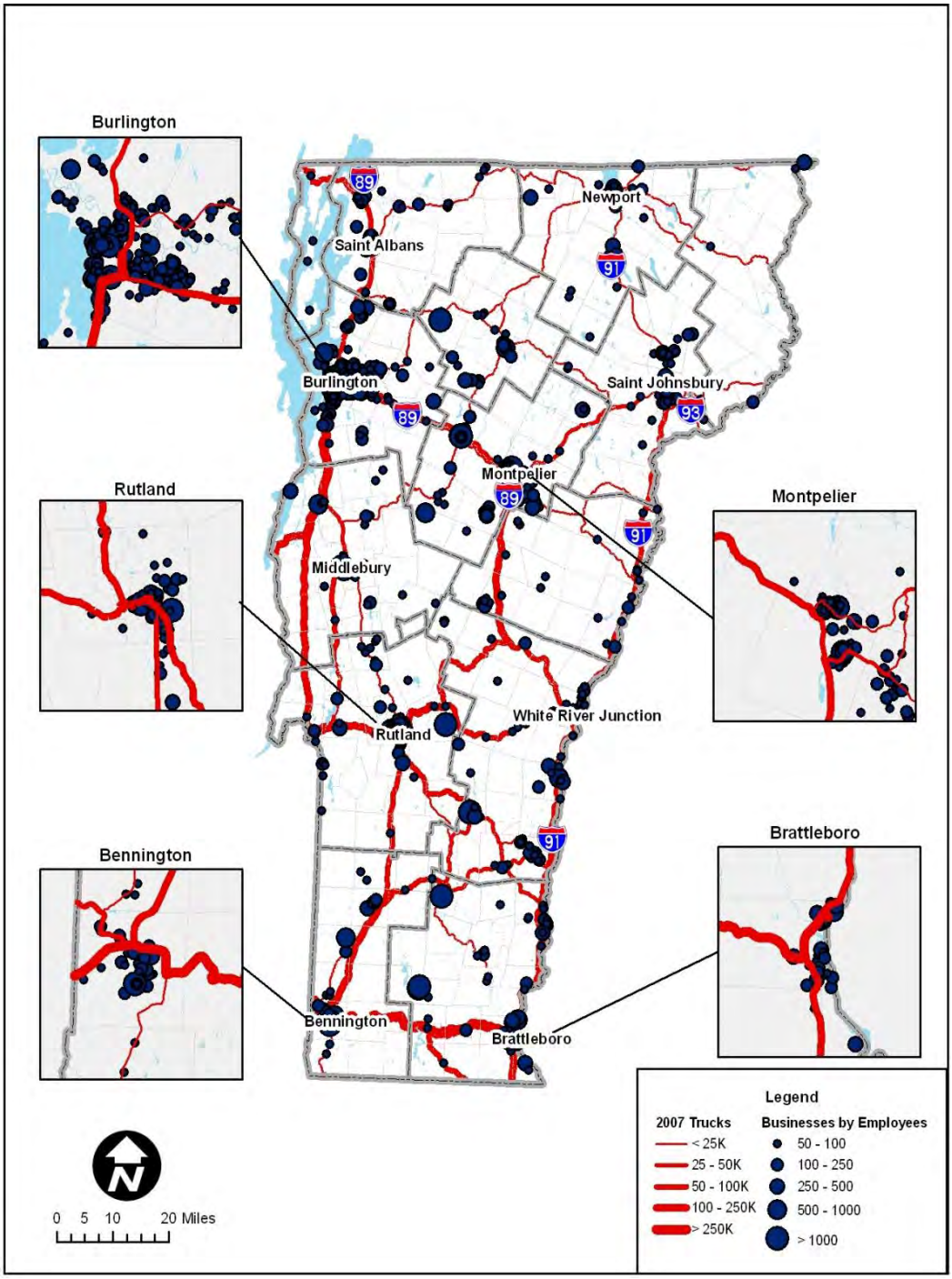


Figure 4.17 2007 Truck Flows on Vermont's Highway Network
Manufacturing

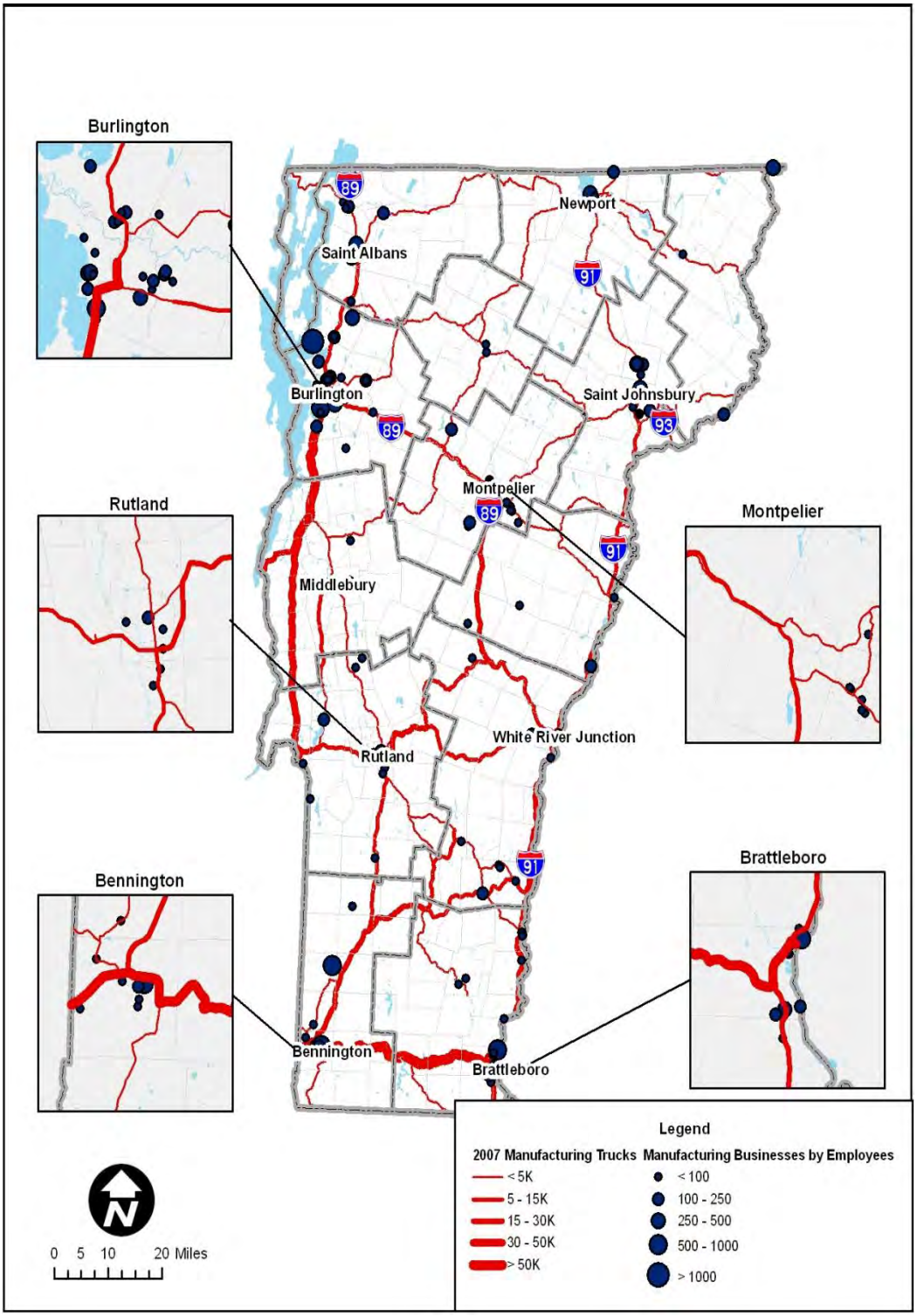


Figure 4.18 2007 Truck Flows on Vermont's Highway Network
Agriculture and Food

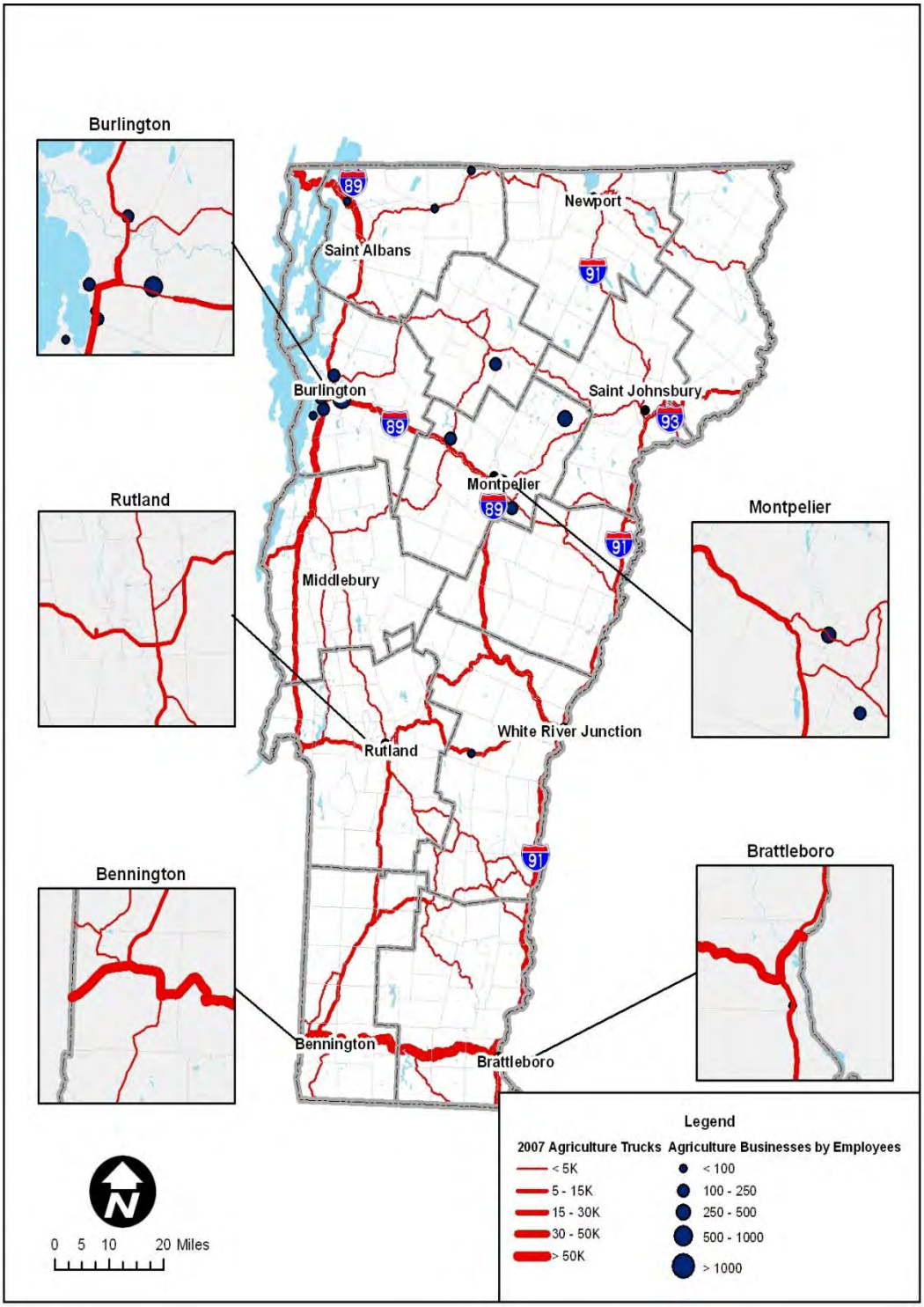


Figure 4.19 2007 Truck Flows on Vermont's Highway Network
Construction

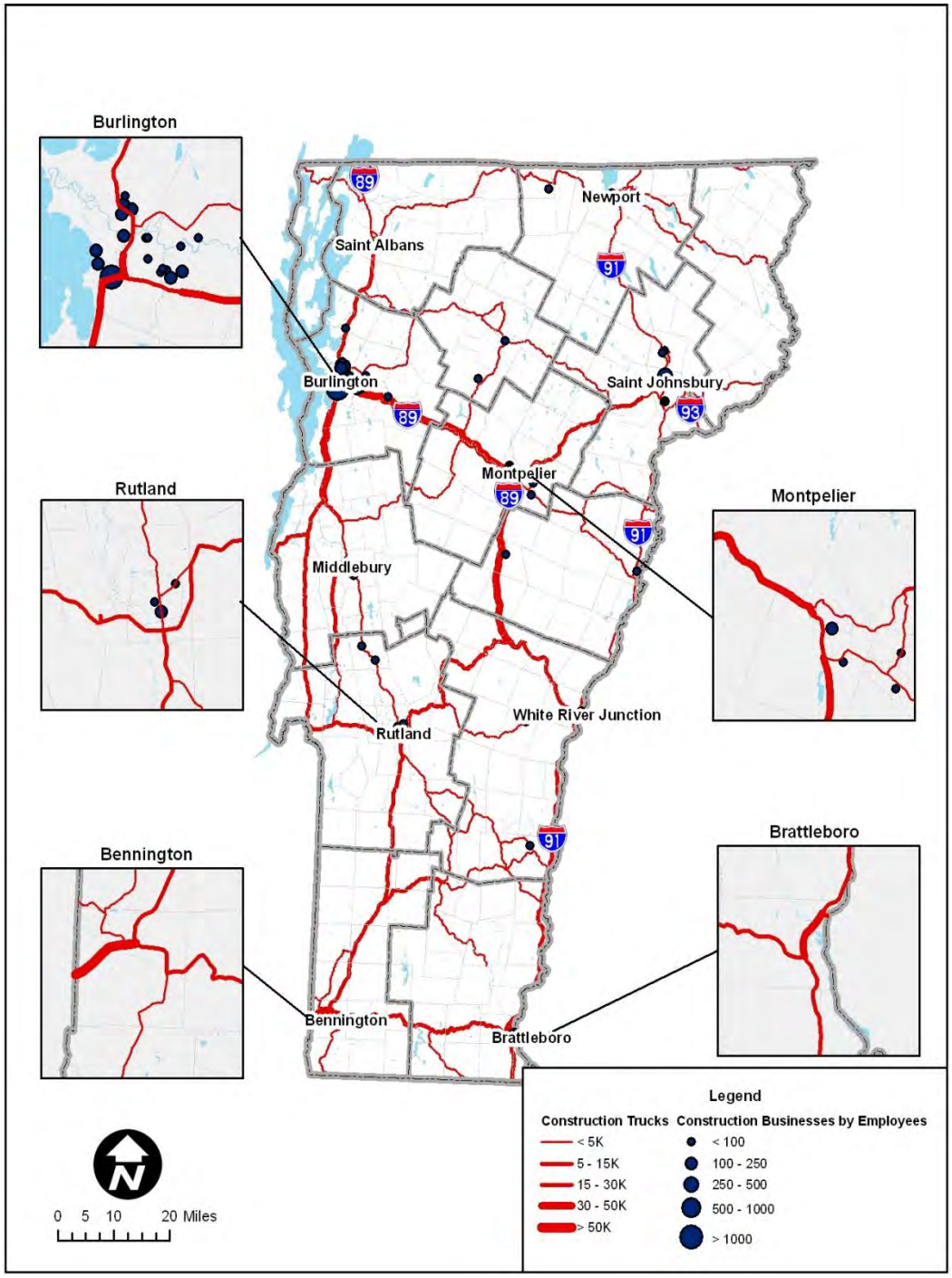


Figure 4.20 2007 Truck Flows on Vermont's Highway Network
Forest Products

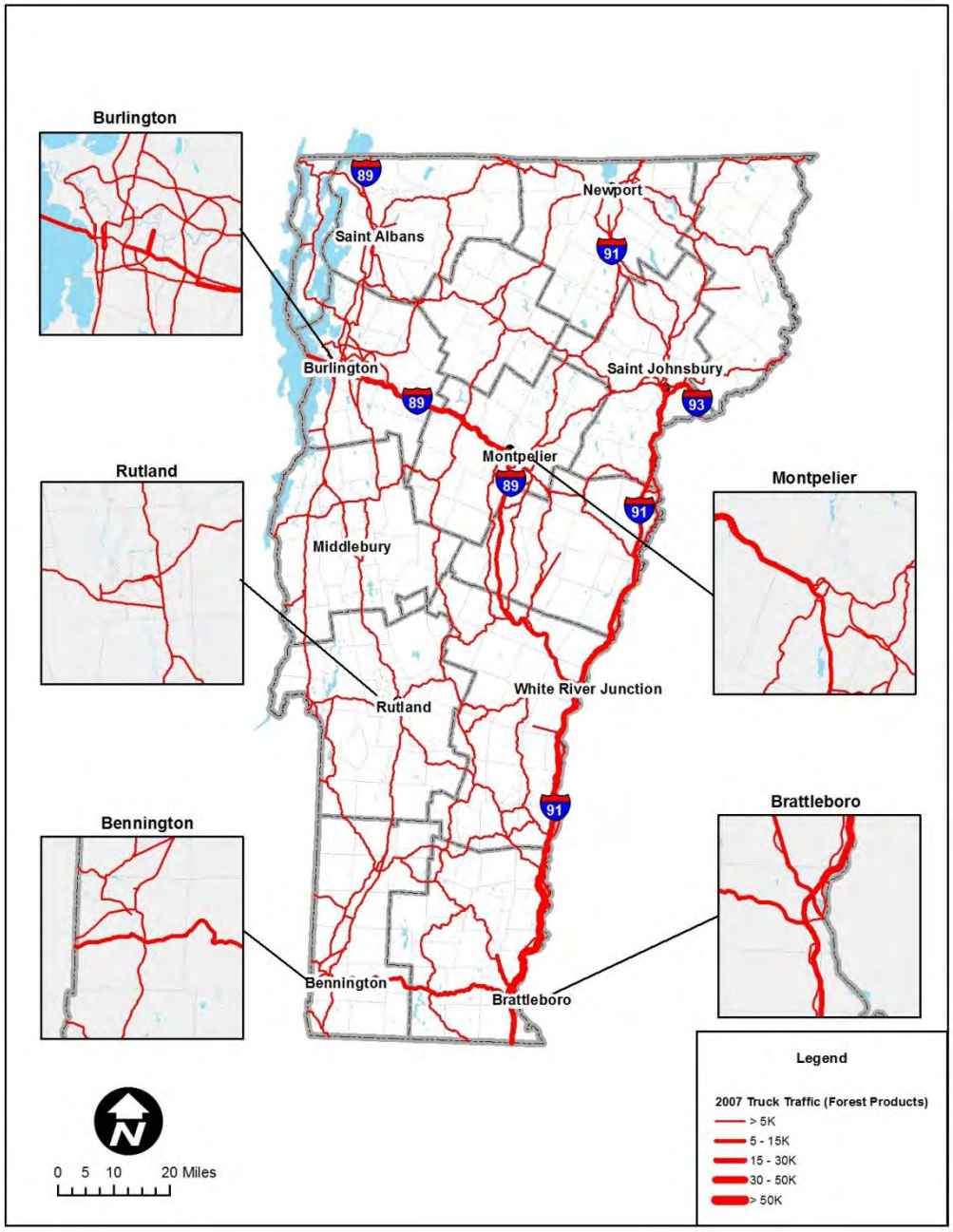


Figure 4.21 2007 Truck Flows on Vermont's Highway Network
Mining

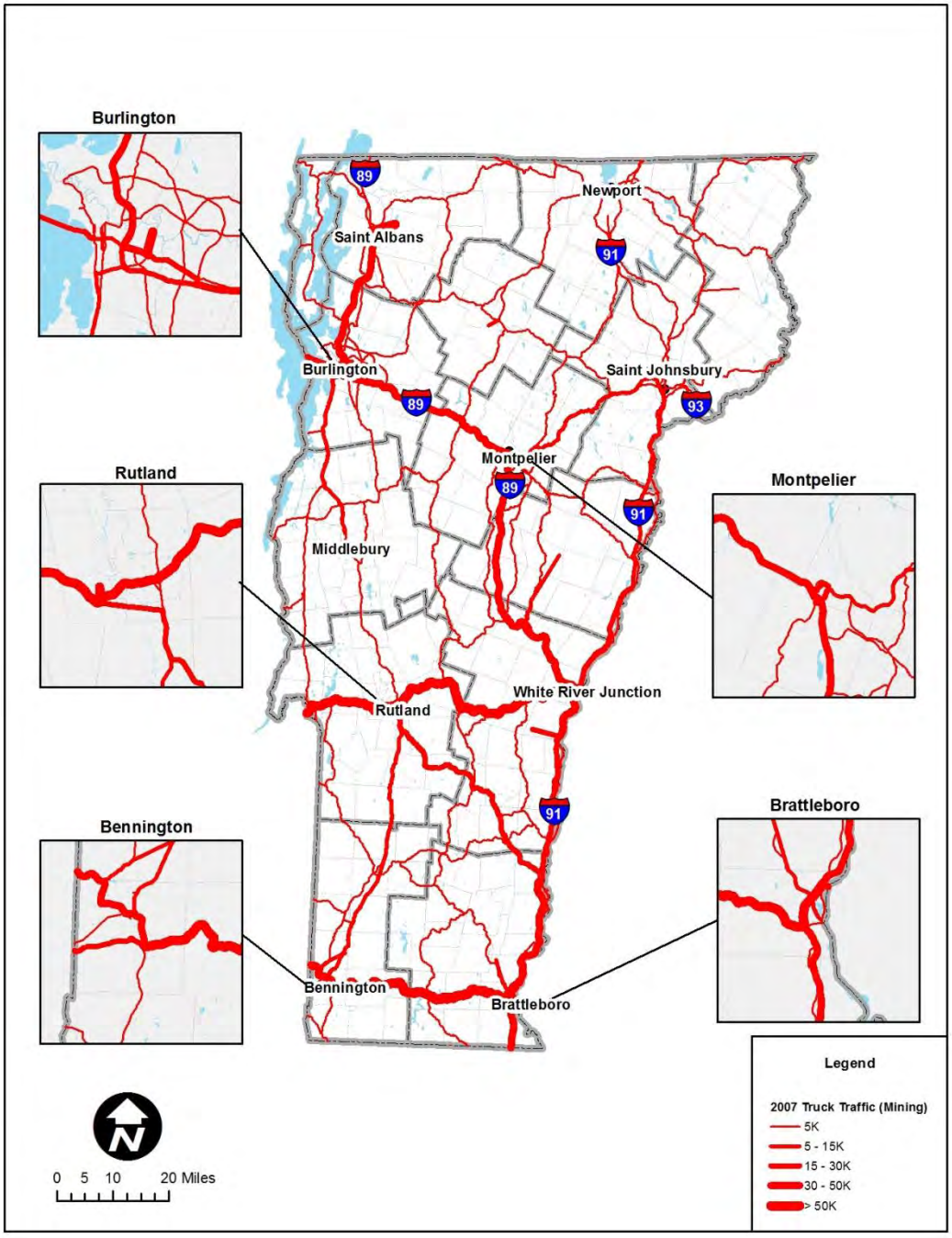


Figure 4.22 2007 Truck Flows on Vermont's Highway Network
Energy

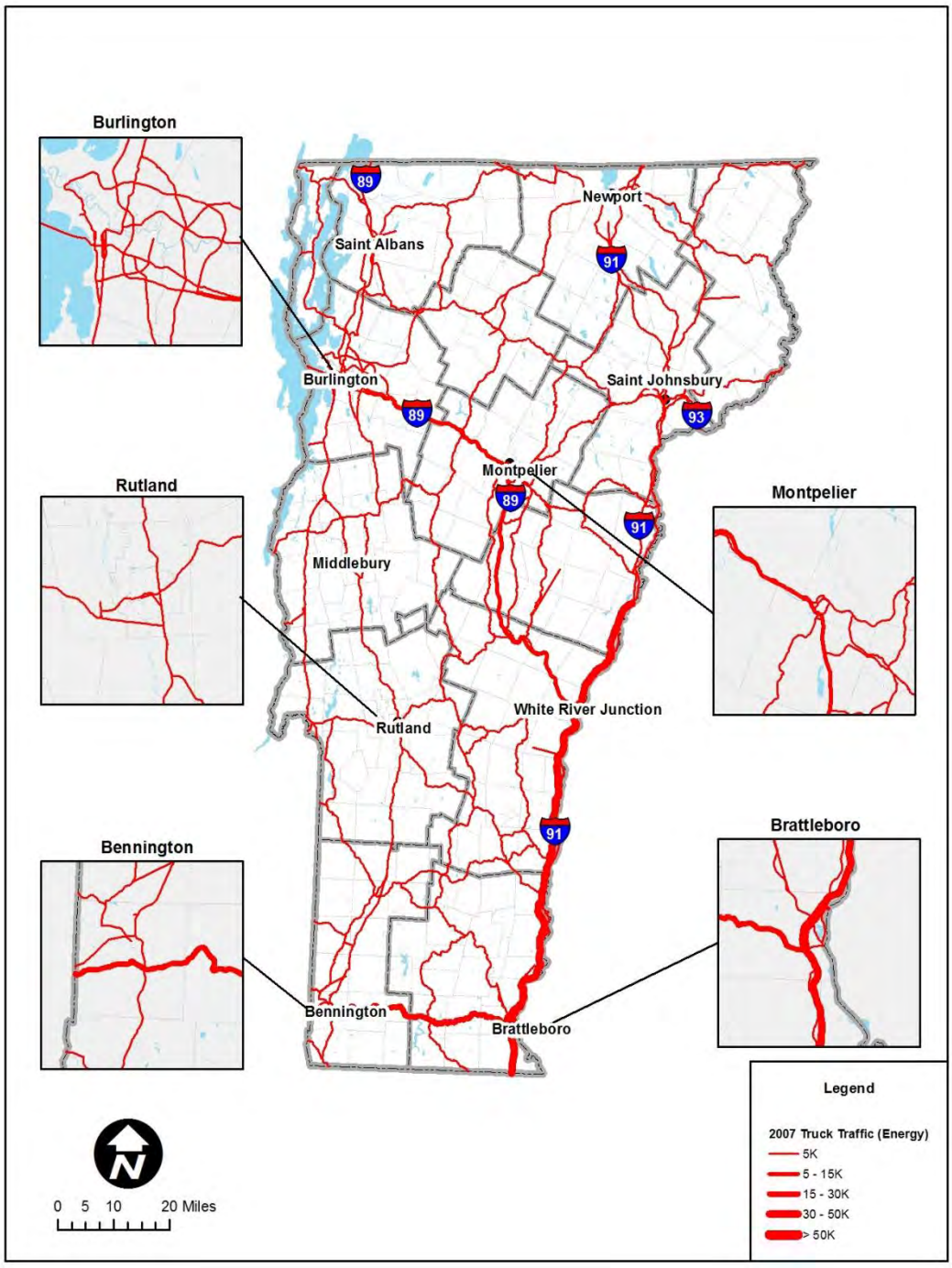
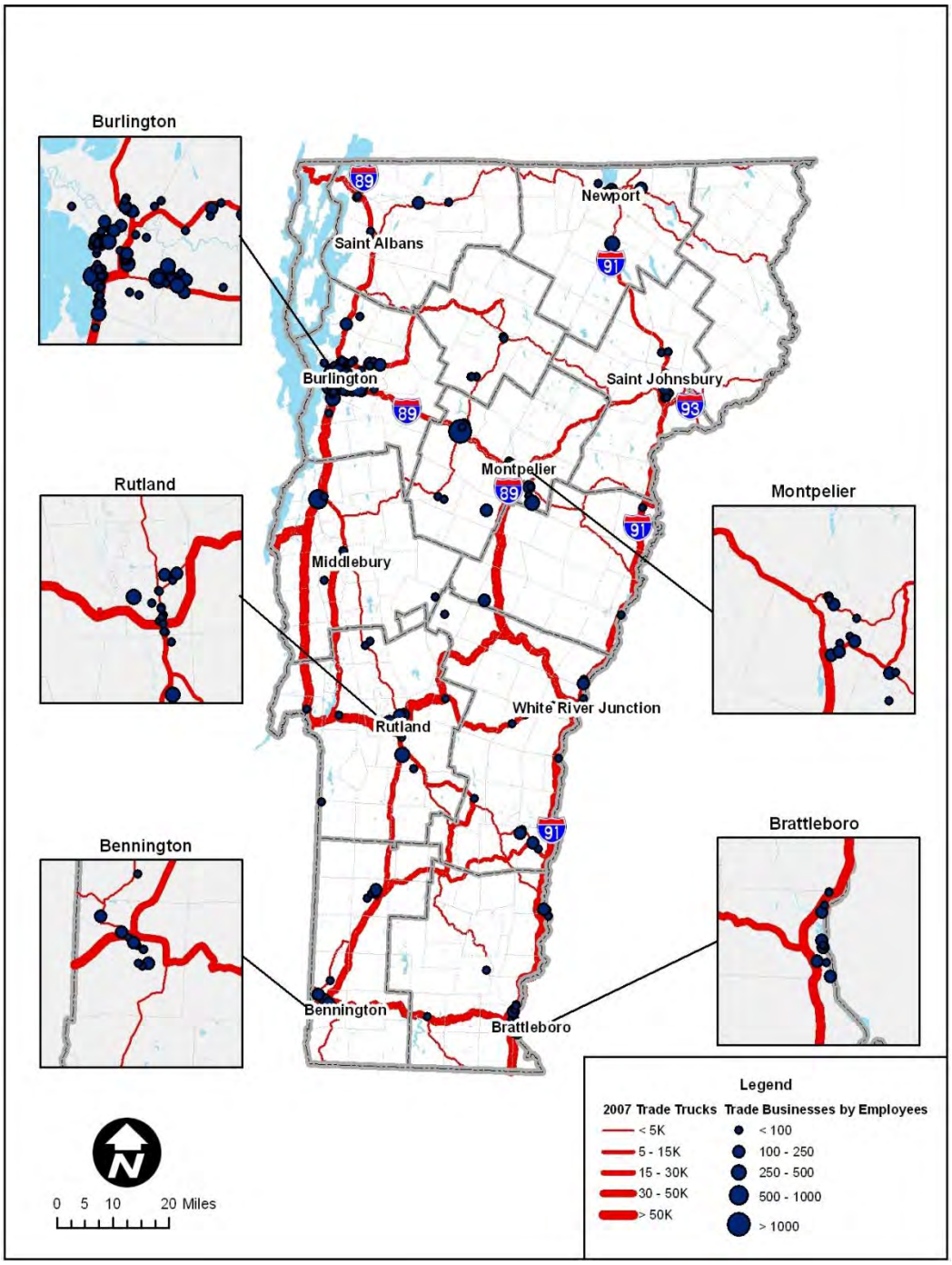


Figure 4.23 2007 Truck Flows on Vermont's Highway Network
Wholesale and Retail Trade



Rail Network Volumes

Figure 4.24 shows rail traffic on Vermont's network in annual carloads. Most of the rail volume traversing the state is through traffic, of which the greatest volumes flow along the Pan Am Southern line across the southwestern tip of the state between eastern Massachusetts and New York. Similarly, the St. Lawrence and Atlantic line, which traverses across the northeastern part of the state, handled close to 40,000 carloads in 2007 on its through route between Maine and Canada.

The largest volume rail line in Vermont is owned by the New England Central Rail (NECR). The NECR mainline runs diagonally across the state from the southeast to the northwest corner where it links with CN, one of the seven, North American Class I railroads. With this direct connection to the large CN network, the bulk of the traffic moving along the NECR corridor is through traffic that neither originates nor terminates in Vermont. This corridor handled over 35,000 cars across the state in 2007.

Other routes handling less but still significant traffic were the Clarendon and Pittsford, with its connection to the CP at Whitehall, NY and the VTR, which serves Vermont's western border.

4.3 FUTURE FREIGHT VOLUMES

The previous sections provided a perspective on current traffic volumes and flows over Vermont's transportation system. This section provides freight transportation demand projections to 2035. A brief overview of the methodology is presented, followed by breakdowns of the projected flows by county, direction, commodity and the impact of these flows on the highway and rail networks.

Counties

Freight flows in Vermont are projected to increase from 48 million tons in 2007 to 70 million tons by 2035. This results in an overall growth of 43 percent and an annualized growth of 1.28 percent. This number lies between the projected growth in population (0.3 percent per year) and Gross State Product (2.4 percent per year), which are the two main drivers of the forecast, and is consistent with other published forecasts showing future traffic volume growth at lower levels than U.S. GDP growth.

Figure 4.25 illustrates the projected growth in freight demand for each of the 14 counties in Vermont. Most of the growth in freight traffic takes place in the counties with the largest amount of traffic: Chittenden, Rutland, Bennington, Windham and Windsor. The highest growth rate is projected to be in Lamoille (68 percent or 1.88 percent per year), Bennington (62 percent or 1.75 percent), Caledonia (50 percent or 1.46 percent), Addison (48 percent or 1.42 percent) and Orleans (48 percent or 1.40 percent) counties.

Figure 4.24 2007 Rail Flows on Vermont's Network
All Commodities

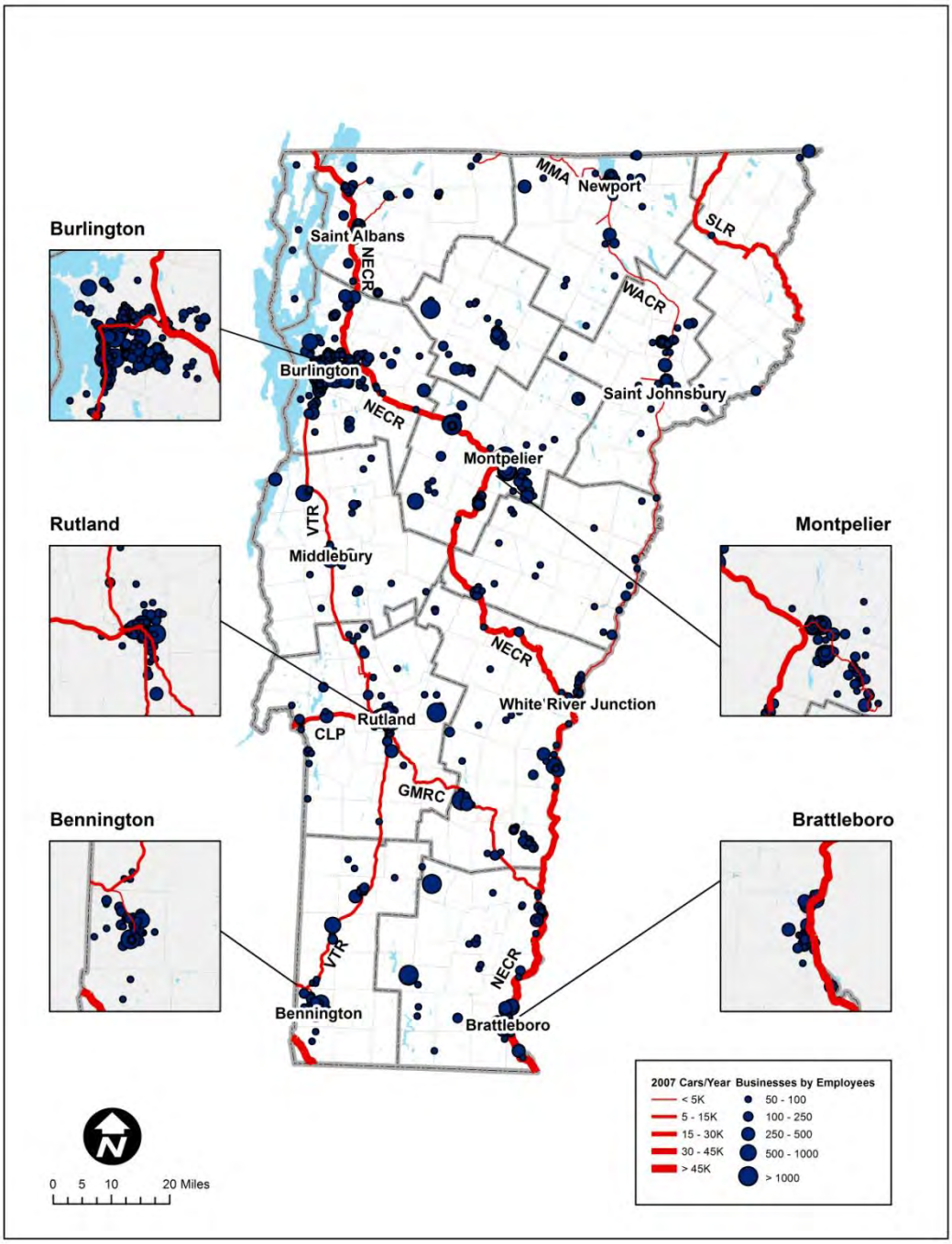
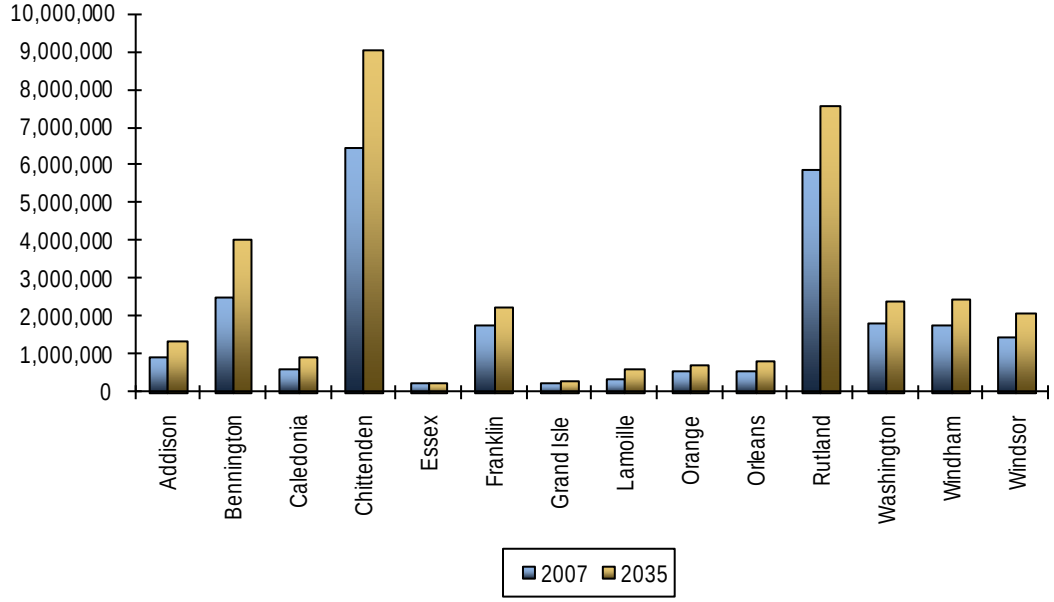


Figure 4.25 Forecast of Freight Flows by County
2007 and 2035 Tons by All Modes (Inbound Plus Outbound Traffic)



Direction

When analyzed by direction, the forecast shows Vermont becoming even more reliant on imports. Inbound moves shows the largest growth with an increase of 1.52 percent per year, followed by through moves (1.30 percent), outbound flows (0.96 percent) and internal flows (0.81 percent), as shown in Figure 4.26. The result is an overall increase in the share of goods traveling inbound by approximately three percentage points (36 percent to 39 percent), while the share of both internal and outbound moves drops by two percentage points each. Through moves are projected to retain the same share of flows as today (37 percent). This trend reflects the anticipated decrease in manufacturing activity in the State and the increased reliance on services as the primary driver of the economy.

Commodity

The top five commodities of 2007 are expected to account for 84 percent of the growth in tonnage by 2035. These goods, consisting of secondary moves, clay/ concrete/glass/stone, food, chemicals and nonmetallic minerals), are projected to grow by a combined 10.9 million tons. Food, clay and chemicals are projected to grow at a much quicker pace than nonmetallic minerals, which are projected to increase by only 0.36 percent per year. Growth by commodity is illustrated in Figure 4.27

Since secondary moves are not a specific commodity but rather an unknown mix of commodities transported primarily out of distribution centers, a growth rate was not produced for this commodity. Instead, the average of all commodities for each individual county was used.

Figure 4.26 Forecast of Freight Flows by Direction
2007 and 2035 Tons by All Modes

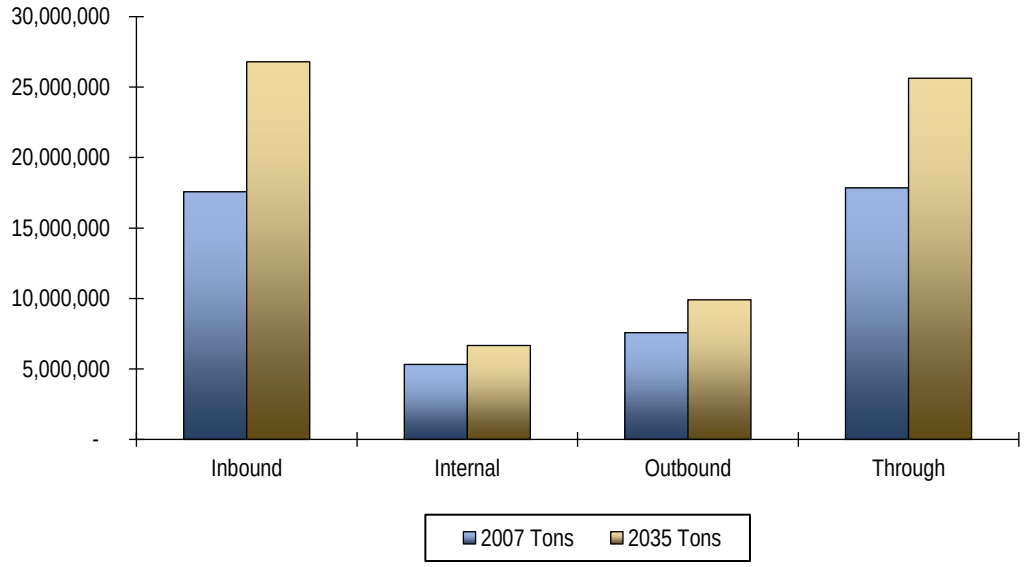
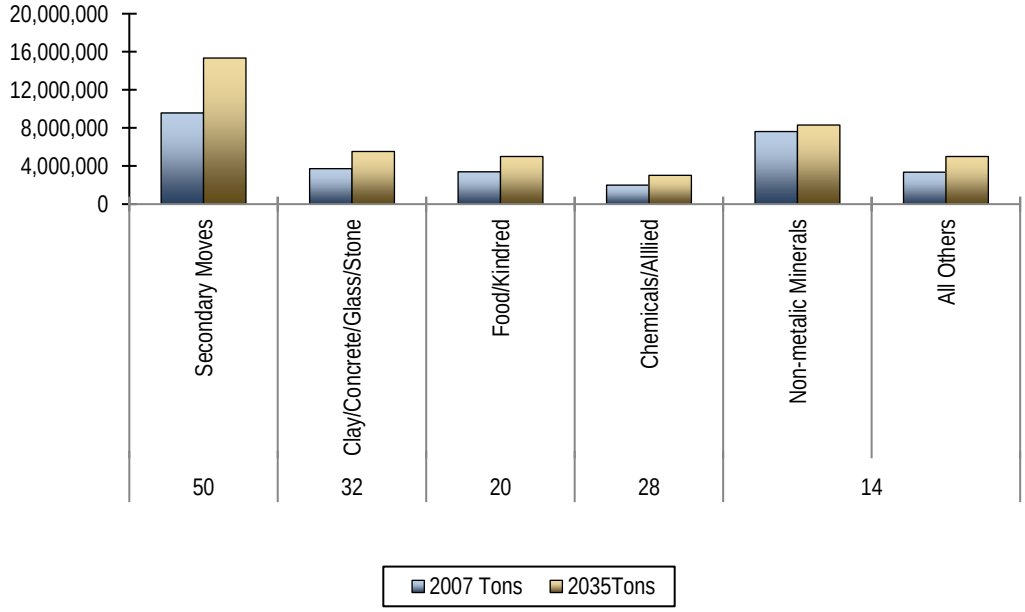


Figure 4.27 Forecast of Freight Flows by Commodity
2007 and 2035 Tons by All Modes (Sorted by Total Growth)



The prevalence of secondary traffic remains clear under any scenario, but it also illuminates the variation in relative significance of commodities across the direction of traffic. This is most apparent with transportation equipment and chemicals, where the majority is through traffic.

Mode

The mode shares are expected to remain stable over the forecast period, with a slight overall shift from truck to rail of just under 1 percent. Substantial changes in Vermont's economic development and the relative difference in costs between rail and highway could result in significant changes in mode share. For example, construction of a high volume industrial facility for which rail-oriented logistics are attractive, such as a coal-fired power plant, could significantly shift the tonnage-based modal share for Vermont towards rail by several percentage points.

Impact on Highway Network

Figure 4.28 depicts the projected truck flows on Vermont's highway network in 2035, while Figure 4.29 shows the growth rate by highway segment. Most roads are projected to see increases of 20 to 40 percent in overall truck traffic from 2007 to 2035, while volumes on I-91, U.S. Route 7 and State Routes 9 and 11 are projected to increase between 40 and 60 percent. This reflects the continued strong trading relationship with New York State. This trade is served entirely by non-Interstate highways. One significant link, between Hyde Park and Newport is expected to see increases in truck traffic in excess of 60 percent, but starting from a very low volume of fewer than 25,000 annual vehicles.

Impact on Rail Network

Figure 4.30 shows the projected flows on Vermont's rail network in 2035. The map illustrates growth across all major lines in the State, with an average annual growth rate of 1.38 percent, which is slightly below the growth rate for truck traffic (1.57 percent). The highest growth is expected to occur on the NECR main line, which is projected to handle over 50,000 cars per year (up from approximately 35,000). North of Burlington, traffic is expected to increase from 44,000 to 64,000 cars per year. The St. Lawrence and Atlantic Railroad (SLR), which operates in the northeastern corner of the State, is also projected to see significant increases.

Figure 4.28 2035 Truck Flows on Vermont Highway Network
All Commodities

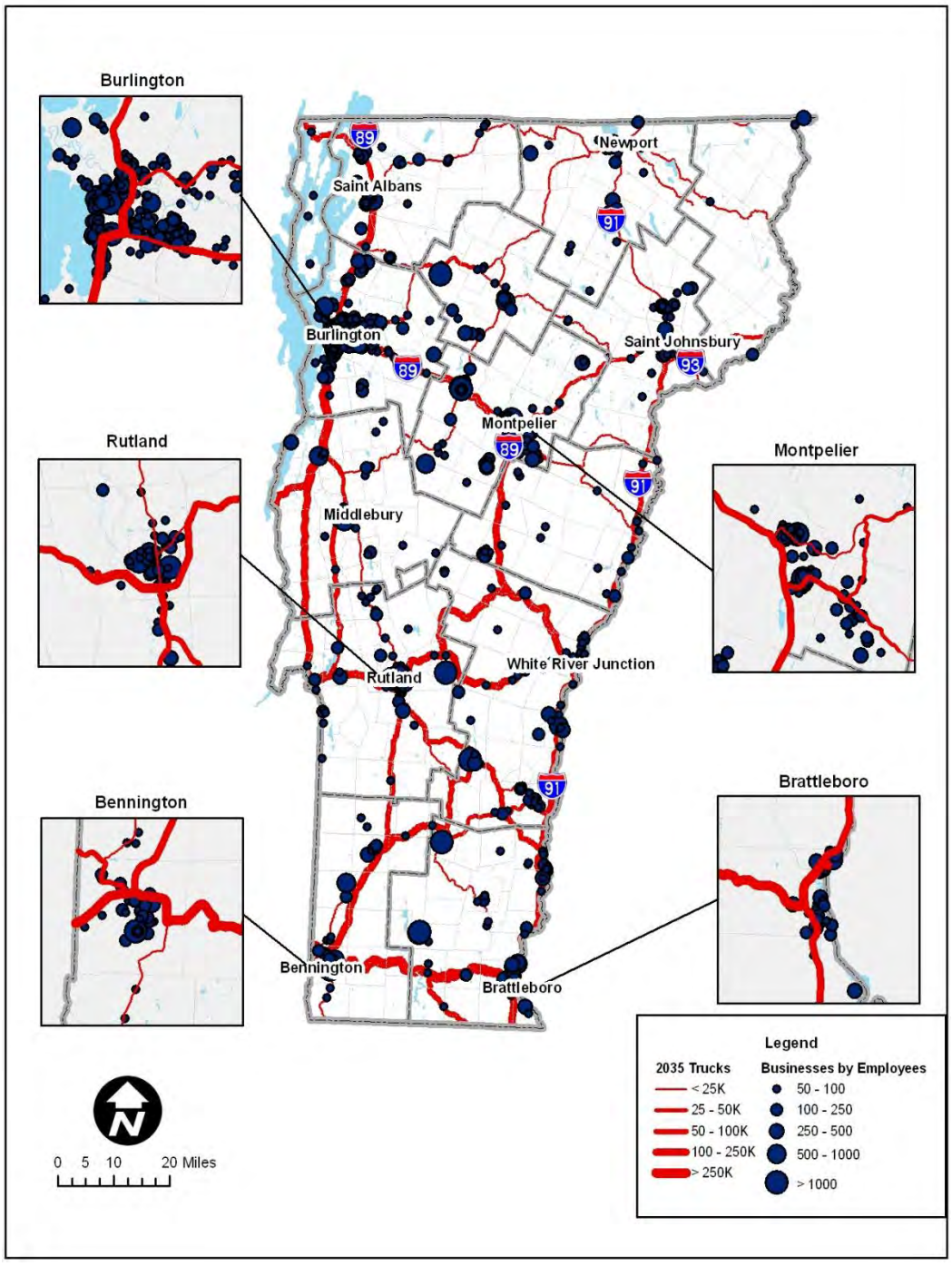


Figure 4.29 2007-2035 Truck Traffic Growth on Vermont Highway Network
All Commodities

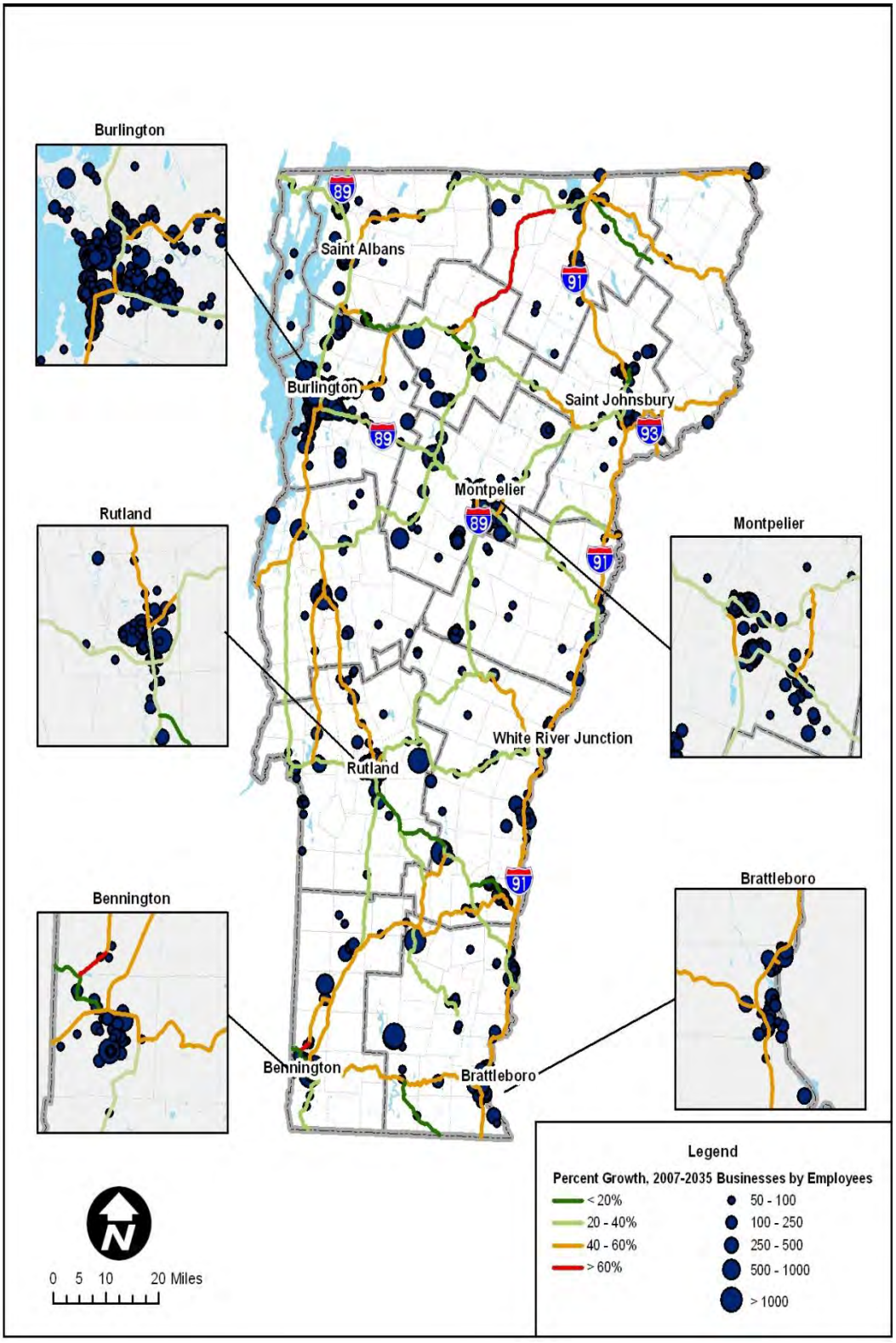
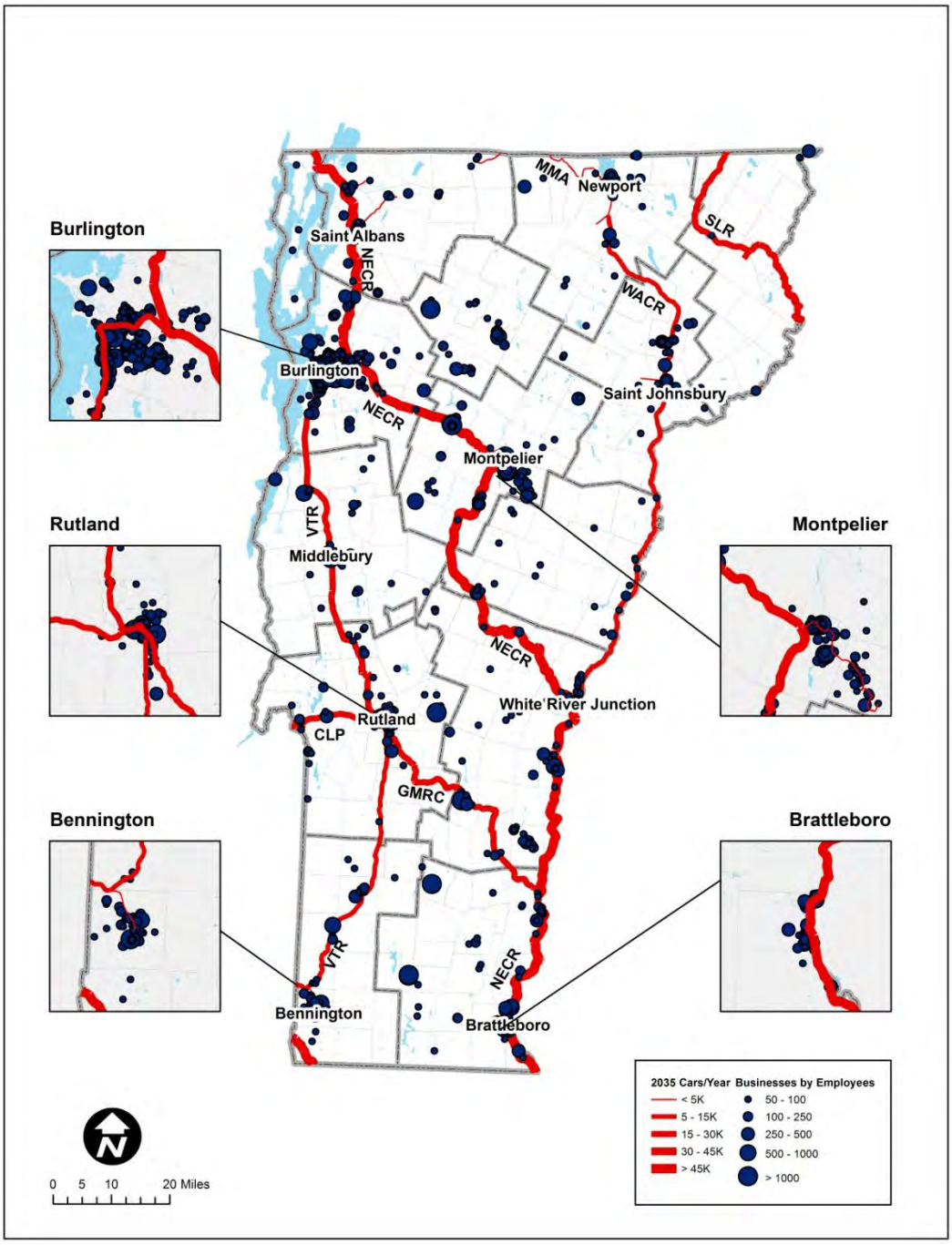


Figure 4.30 2035 Rail Carloads on Vermont's Network
All Commodities



5.0 Needs Assessment

5.1 INTRODUCTION

This chapter provides an assessment of the current and prospective performance of Vermont's freight system to identify its needs and deficiencies. Needs and deficiencies are grouped in three areas: 1) physical, related to the condition or capacity of the transportation infrastructure; 2) operational, how the transportation system is being utilized; and 3) institutional and regulatory, the policy and regulatory environment that governs the management and enhancement of the system. Each of these areas is aligned with the the national performance goals and freight policy goals specified in MAP-21. [

The assessment is based on the technical reviews reported in chapters 2, 3 and 4, supplemented by six freight-transportation focus groups conducted in 2010 and 2011. The focus groups were held in Bennington, Brattleboro, Burlington and St. Johnsbury, Rutland and White River Junction to understand how freight transportation needs varied across the State. The focus group participants included representatives from businesses that ship and receive freight, rail and motor carriers and economic development and planning agencies. Attendees confirmed many of the freight transportation issues identified in the Technical Memoranda and prior planning studies, but also identified new and emerging issues.

This chapter consists of three parts and a concluding discussion of the implications:

- **Adequacy of Vermont's freight system to meet current and future needs**. Recognizing current logistics trends and planned infrastructure improvements, this section offers a perspective on the Vermont's ability to handle current and projected traffic from the standpoint of physical capacity but also considering other quantitative and qualitative attributes that affect system performance.
- **Discussion of needs and deficiencies.** This section summarizes current and anticipated freight transportation needs and deficiencies. The needs and deficiencies are grouped into three categories: physical; operational; and institutional/regulatory.
- **Goods movement and greenhouse gas emissions (GHG).** Vermont adopted an ambitious plan in 2005 that called for reducing GHG emissions by up to 75 percent from 1990 levels by 2050. This section provides a context for future GHG emissions from the transport of freight in Vermont, comparing existing and projected future emissions from both truck and rail transport, based on the freight traffic forecasts developed for this plan.

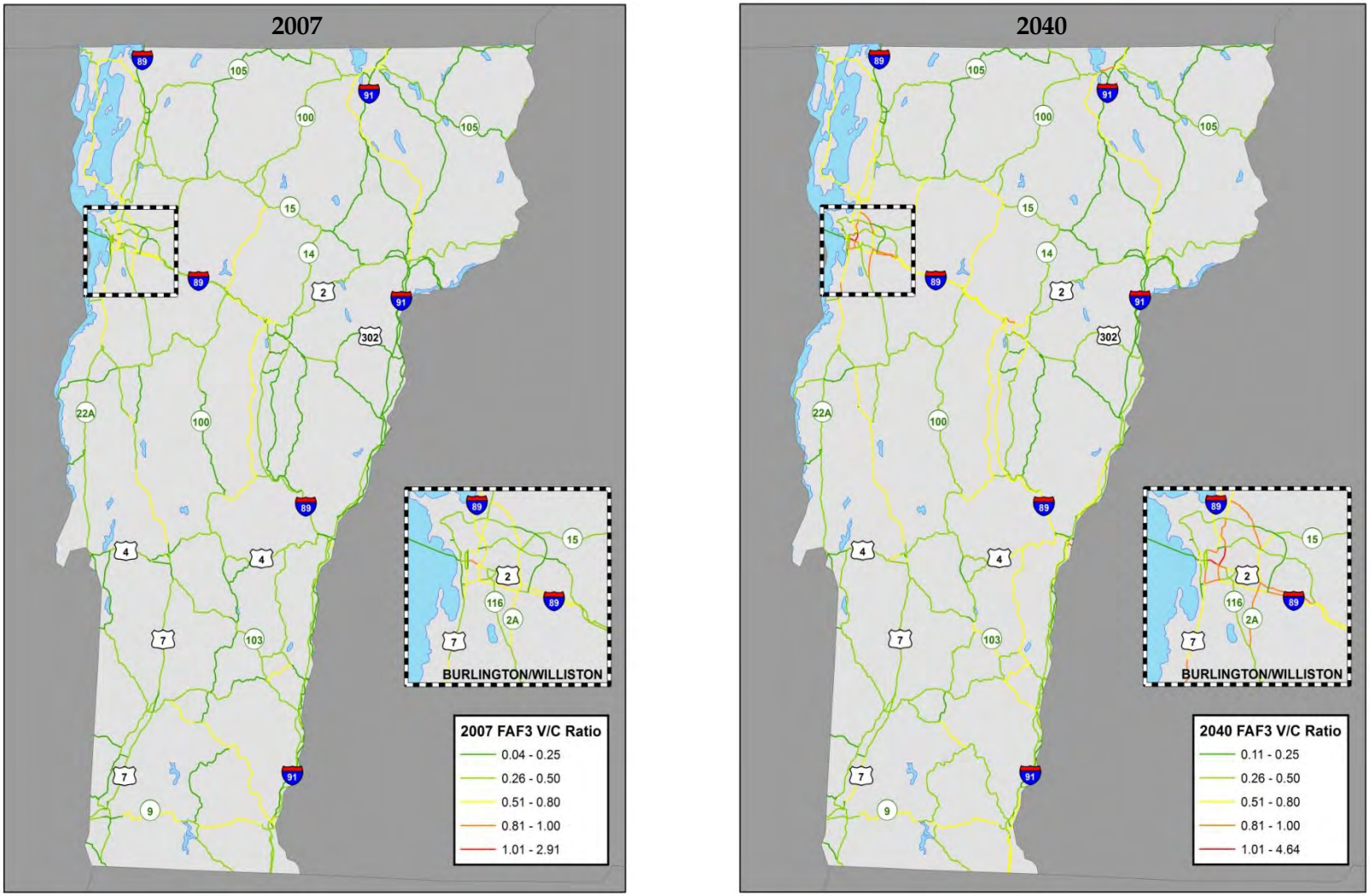
5.2 How Well Does Vermont's Freight Transportation System Meet Present and Future Needs?

The State's freight network is generally adequate for current and future freight travel demand, although there are a number of issues that create inefficiencies that result in added time and cost for Vermont shippers and receivers and influence business location (or relocation) decisions. These issues are introduced in the following paragraphs and are addressed in the discussion of identified needs in Section 5.3.

Chapter 4 showed that freight travel demand is expected to grow 43 percent between 2007 and 2035, or 1.28 percent per annum. As a result, truck traffic will increase by more than 40 percent on many of the state's highway links, including portions of Interstate 91, U.S. Routes 2, 4 and 7 and Vermont Routes 9, 11, 15, 30, 100, 103, 105 and others, as illustrated in Figure 4.5 in Chapter 4. While this growth may appear alarming, present truck volumes on many of these routes are modest and the impact to the overall volume-to-capacity ratio on most of these routes will generally be minor. Figure 5.1 illustrates the anticipated change in volume-to-capacity ratio on Vermont highways between 2007 and 2040 according to the U.S. DOT Freight Analysis Framework 3 (FAF3) model network. Apart from some main arteries within the immediate vicinity of Burlington, including I-89 and U.S. 2 and 7, the State's highway network has the capacity to accommodate freight traffic now and in the future, thereby supporting the continued efficiency of industries that rely on Vermont's highway network.

The highway system is generally in good condition and the State's program to replace or rehabilitate weight and clearance restricted bridges will eliminate many state of good repair issues, contributing to the goal of a well maintained highway system and freight network. Highway geometries present challenges to tractor-trailer operations in some rural and mountainous areas and in urban areas, although the network overall is adequate. Improvements in information technology are facilitating the movement of freight. Notably, the State's oversize/overweight permitting process has been expanded to include an online application program, although some stakeholders have identified a need to further simplify the process. Truck parking and rest areas are generally sufficient for present demand; however, growth in truck traffic could result in limited available capacity in future years.

Figure 5.1 Vermont Highway Congestion, 2007 and 2040



Source: U.S. DOT Freight Analysis Framework 3 (FAF3)

As with the highway network, Vermont's rail system provides sufficient capacity to handle existing and forecast traffic volumes. However, the rail system faces several critical challenges: maintaining a state of good repair, ensuring that vertical clearances and weight handling capacities meet modern rail industry standards, improving access for Vermont shippers and receivers to the rail system and the competitive threat of potential increases in higher truck sizes and weights beyond Vermont's borders. Since the 1960's, VTrans has played a key role in ensuring the continued relevance and viability of the State's railroads. Present traffic densities and ownership structures require continued public and private sector involvement if these railroads are to remain a competitive modal option for Vermont industry.

The benefits of maintaining quality rail service to Vermont are significant. Rail is generally the most cost-effective mode for shipping bulk and heavy commodities. A number of Vermont industries fit this profile and would cease to be competitive if rail service was to decline or cease outright. Similarly, the presence of rail service enhances the ability to attract new industry, a relationship that has been found to exist in studies of rail service and economic development in other regions.[18] Furthermore, maintaining infrastructure at levels sufficient to retain and attract through traffic increases density and helps ensure the continued availability of rail service to businesses located in the state.

For air cargo and waterborne freight, critical issues include the operation of nodes (airports and ferry terminals) and landside access. Findings from this study suggest that terminal capacity and landside access issues are not presenting significant adverse impacts to air cargo and ferry operations. Waterborne transport of bulk freight has not been available since the cessation of dredging along the Champlain Canal over thirty years ago. Even if the Canal is restored to full navigable depths, it is not evident that it would have a significant future role in Vermont's freight system.

Table 5.1 provides a scorecard of the key issues for each mode, the affected stakeholder groups, current conditions in the State of Vermont and anticipated future conditions. This assessment assumes the pursuit of a "business as usual" strategy, whereby no significant investments or initiatives are undertaken beyond what is described in the list of planned and programmed projects presented in Chapter 3. Present and anticipated "Status/Condition" for each issue is depicted with an arrow. An upward pointing arrow indicates that the condition is "good or adequate," a horizontal arrow indicates "marginal or indifferent," and a downward arrow indicates "inadequate or in need of significant investment or correction."

---

[18] See, for example, National Association of Development Organizations (NADO) Research Foundation Center for Transportation Advancement and Regional Development, **Short Line Railroads: Saving an Endangered Species of Freight Transport. Case Studies, Experiences and Lessons Learned from Regional Development Organizations** (available at http://www.nado.org/pubs/shortline.pdf)

Table 5.1 Freight System Adequacy by Mode and Issue

Mode	Issue	Stakeholder Group(s)	Status/Condition – Today	Status/Condition – Future
Highway	Congestion	VTrans, motor carriers, shippers, receivers	↑	↑
	State of good repair	VTrans, motor carriers, shippers, receivers	→	↑
	Geometric Issues	VTrans, motor carriers, shippers, receivers	→	→
	Oversize/overweight permitting	VTrans, motor carriers, shippers, receivers	→	↑
	Truck parking and rest areas	VTrans, motor carriers	↑	→
Rail	System capacity	VTrans, railroads	↑	↑
	State of good repair	VTrans, railroads	→	→
	286K railcar weight capacity	VTrans, railroads	→	→
	Vertical clearances	VTrans, railroads	↑	→
	Shipper/receiver access	VTrans, railroads, shippers, receivers	→	→
Air	Airport capacity	VTrans, City of Burlington, air shippers and receivers	↑	↑
	Landside access	VTrans, motor carriers, shippers, receivers	↑	↑
Waterborne	Ferry terminal operations	VTrans, ferry operators, motor carriers	↑	↑
	Landside access	VTrans, motor carriers	↑	↑
	Bulk freight access	VTrans, shippers	↓	↓

5.3 IDENTIFIED NEEDS AND DEFICIENCIES

To support the anticipated growth in the State's service economy and in the manufacturing specialty goods sectors, the State must have a highway system that is built to modern geometric standards, is safe and provides quick and reliable access to airports, distribution centers and consumer markets in Vermont and the surrounding region. To support the State's traditional industries, including the lumber and construction materials industries, and accommodate intermodal traffic, the State must have a rail system that can accommodate heavy railcars, is double-stack cleared and is free of operational and institutional bottlenecks. The

current highway and rail systems require continued improvements to meet these requirements.

This section describes the major freight transportation system needs and deficiencies identified in the current Vermont Freight Plan of 2010 (VFPU) and the following prior studies:

- Vermont Statewide Freight Study of 2001 (VSWFS);
- Vermont Highway System Policy Plan of 2004 (VHSPP);
- State Rail and Policy Plan of 2006 (SRPP);
- Vermont Airport System and Policy Plan of 2007 (VASPP); and
- Vermont Long Range Transportation Business Plan of 2009 (VLRTBP).

Table 5.2 summarizes the needs and deficiencies. The needs are categorized as physical, operational, or institutional/regulatory needs and then as highway, rail, water or air needs. The table provides a brief description of each need, lists the State study or studies that document the need and indicates the agency with lead responsibility to address the need. Needs that have been identified in multiple studies indicate ongoing and complex problems that require renewed attention. Where VTrans has jurisdiction under State and Federal law to address the need, VTrans is listed as the lead agency. Where VTrans has very limited or no jurisdiction, VTrans is listed as a supporting agency. However, even as a supporting agency, VTrans may be able to provide leadership, coordination and technical assistance to address the needs.

Subsequent sections of this chapter provide a more detailed discussion of each of the needs and deficiencies along the three primary categories: physical, operational and institutional/regulatory.

Table 5.2 Freight Needs and Deficiencies

Category	Mode	Description of Need or Deficiency	Source	VTrans Role		Other Party Lead
				Lead	Support	
		Maintain state of good repair statewide	VHSPP, VLRTBP, VFPU	Yes		
		Remove of bridge restrictions	VHSPP, 2009 VTrans Structures Section Annual Report	Yes		
		Improve highway geometries to safely accommodate trucks	VHSPP, VFPU	Yes		
		Enhance east-west connectivity by improving Routes 2, 4, 9 and 103	VSWFS, VHSPP, VLRTBP, VFPU	Yes		
		Enhance north-south connectivity by improving Routes 7 and 22A.	VSWFS, VHSPP	Yes		

Category	Mode	Description of Need or Deficiency	Source	VTrans Role		Other Party Lead
				Lead	Support	
		Facilitate border-crossing movements	VFPU		Yes	US Customs, Canada Border Services Agency
		Upgrade track and bridges to maintain and improve weight ratings	VSWFS, SRPP, VLRTBP, VFPU	Yes		Private railroads
		Remove vertical clearance constraints	VSWFS, SRPP, VLRTBP, VFPU	Yes		Private railroads
		Improve terminals and access	SRPP, VFPU	Yes		Private railroads
		Preserve service and rights of way statewide	VSWFS, SRPP, VFPU	Yes		Private railroads
		Maintain state of good repair statewide	VSWFS, SRPP	Yes		Private railroads
		Remove slow orders	VFPU			Private railroads
	Water	Preserve waterborne freight capabilities	VFPU			Ferry operators, New York State Canal Corporation
	Air	Preserve and expand air freight capabilities	VSWFS, VASPP		Yes	VTrans, City of Burling-ton
		Increase or harmonize weight limits	VFPU	Yes		
		Remove or harmonize operating restrictions	VFPU		Yes	Local jurisdic-tions
		Deploy ITS for incident management (e.g., incident detection and notification) and enforcement (e.g., weigh-in-motion)	VHSPP	Yes		
		Improve speed and travel time reliability	SRPP, VFPU		Yes	Private railroads
		Increase shipment visibility	VFPU			Private railroads
		Reduce delays in interchange of shipments between carriers	SRPP, VFPU			Private railroads, U.S. Surface Transportati on Board
		Streamline oversize/overweight permitting	VSWFS, VFPU	Yes		

Category	Mode	Description of Need or Deficiency	Source	VTrans Role		Other Party Lead
				Lead	Support	
		Review need for Vermont truck route network	VFPU	Yes		
		Educate communities about the economic value of freight transportation	VSWFS, VLRTBP, SRPP, VFPU		Yes	EDAs, local jurisdictions, advocacy groups
		Expand freight transportation options for shippers, carriers and communities	VSWFS, VFPU			EDAs, local agencies, advocacy groups, academic institutions
		Improve communication about freight needs and solutions among government agencies, carriers and shippers	VFPU		Yes	MPOs, EDAs, local agencies and advocacy groups
		Balance trade flows to and from Vermont to reduce freight transportation costs	VSWFS, VFPU			Motor carriers, shippers, EDAs
		Better coordinate freight transportation planning and investment among New England states, New York State and Canadian provinces.	VLRTBP, VFPU	Yes		Neighboring states and provinces
		Expand State outreach to industry on economic development and freight transportation issues and opportunities	VSWFS, VFPU		Yes	MPOs, EDAs, Local agencies, Advocacy groups
	Funding	Pursue additional Federal grants and public-private partnerships to fund freight projects	VHSPP, SRPP, VLRTBP	Yes		Rail carriers, Other public agencies, Private entities
	Economic development considera-tions	Attract rail business that currently terminates elsewhere	VFPU		Yes	EDAs, Freight railroads
		Better link economic development and transportation policies, programs and investment to compete more effectively as a region in national and global markets	VLRTBP, VFPU	Yes		EDAs, Neighboring states and provinces

Physical Needs and Deficiencies

Highway

- **Maintain state of good repair statewide.** As the highway infrastructure ages, it is continuously exposed to freezing and thawing during the winter season and as traffic volumes render more wear and tear, maintaining a state of good repair becomes increasingly important and expensive. According to the Vermont Long Range Transportation Business Plan, one-third of Vermont's State highways were in poor or very poor condition in 2003, and the majority of bridges in the State were more than 50 years old. Several focus group participants argued that the State should make better efforts to maintain a state of good repair on State highways. Some participants further indicated that highway maintenance is inconsistent from region-to-region within Vermont and in some cases inferior to highway maintenance in neighboring states. However, more recent indications are that Vermont has made progress in improving the conditions of its roads. According to the Reason Foundation's 2013 Annual Highway Report.[19], Vermont has moved from 42nd to 28th in overall performance and cost effectiveness. Maintaining highway infrastructure, particularly that designated as part of the national freight network, in a state of good repair is a crucial component of the national performance and policy goals established under MAP-21.
- **Improve highway geometries, especially in rural and mountainous areas.** Vermont is a state with an extensive and scenic rural highway network, but many of the State's rural roads have sharp turns, steep grades and narrow intersections that challenge truck drivers and limit their ability to serve Vermont shippers and receivers. Improving highway geometries will contribute to the national freight policy goal of improving the safety of freight transportation.
- **Enhance east-west connectivity by improving Routes 2, 4, 9 and 103.** East-west connectivity generally and the lack of an east-west limited-access highway across the southern tier of the State were identified as a significant freight mobility issue in the 2001 Statewide Freight Study and again in the 2009 Vermont Long Range Transportation Business Plan. In the focus group sessions held for this study, Routes 2, 4, 9 and 103 were cited by motor carriers as the only usable truck routes for east-west trips across Vermont. Route 9 was cited as the only direct cross-state route in the southern tier.

  These routes are two-lane rural highways along most of their courses through the State. Routes 2 and 9 encounter steep terrain in sections, particularly through Mary Stark State Park on Vermont Route 9 and in the Northeast

[19] Reason Foundation, 2013. *Annual Highway Report.* http://reason.org/news/show/1013441.html and *http://reason.org/studies/show/20th-annual-highway-report*

Kingdom along Route 2. Along Vermont Route 9, traffic slows in historic town centers in Wilmington and West Brattleboro and in Montpelier and St. Johnsbury along Route 2. Numerous curb cuts and traffic signals also inhibit traffic flow in South Burlington. The Bennington Bypass project will help, but additional improvements, in highway modernization, reduction of curb cuts in towns and villages and additional truck climbing lanes, should be considered. These projects will contribute to the national freight policy goals of improving the safety, resilience and efficiency of the transportation system and potentially, the national freight network.

- **Improve select north-south highways in the western region.** U.S. Route 7 and State Route 22A are major north-south routes in the western side of the State. These routes carry significant volumes of freight and passenger traffic, but traffic on these routes is slowed where the routes go through congested town centers and over steep grades. Capacity improvements are needed on these and parallel routes. These improvements will contribute to the national freight policy goals of reducing congestion and improving the efficiency of the transportation system and the national freight network.
- **Facilitate border crossing moves.** Construction of the extension to Autoroute 35 in Quebec will bring more traffic to the I-89 corridor in Vermont. The I-89 corridor can accommodate additional traffic, but motor carriers are concerned that additional traffic will create longer delays at border crossings. At present, no additional capacity is planned at the I-89 border crossing. Carriers recommended that VTrans work with U.S. and Canadian customs and immigration officials to ensure that the movement of goods across the border by truck remains safe and secure without incurring lengthy delays and lost productivity.

Rail

- **Upgrade track and bridges to maintain and improve weight rating.** The need to improve the State's freight rail network to accommodate 286,000-pound railcars has been a recurring theme across the State's transportation plans and was confirmed among focus group participants as the most critical issue facing the State's rail system. Much of the rail infrastructure in Vermont cannot accommodate 286,000 pound rail cars, which have become the de facto national standard. Improvements are being made on the NECR (through the ARRA grant) and on portions of the Vermont Railway along the Western Corridor to handle 286,000-pound railcars, but a much more aggressive and timely program is needed to keep rail service in Vermont compatible and competitive with national rail service.

  Many of the existing railroad bridges in the State must be rehabilitated to safely accommodate current rail traffic (generally 263,000-pound gross weight railcars). These bridge rehabilitations are typically conducted by the railroad owner (either the State as owner or the private railroad as owner) as part of their general ownership responsibilities. Many of these same bridges must

eventually be upgraded to enable them to carry 286,000-pound carloads (and 315,000-pound gross weight railcar traffic on lines carrying high-volume bulk traffic). The maximum allowable weights by railroad as identified in 2005 are shown in Table 5.3. Only one railroad, the Clarendon and Pittsford, has bridges rated to safely carry 286,000-pound railcars.

Table 5.3 Existing Railroad Bridge Capacities (2005)

Railroad	Maximum Railcar Weight (Pounds)
New England Central	263,000
Clarendon and Pittsford	286,000
Green Mountain Railroad	263,000
Vermont Railway	263,000
Washington County Railroad	263,000
Washington County Railroad – Connecticut River Division	263,000
St. Lawrence and Atlantic	263,000
Maine, Montreal and Atlantic	263,000

Source: Draft Vermont State Rail Plan Update, 2005.

- **Remove vertical clearance constraints.** Increasing track weight-bearing capacity was the number-one rail priority among focus group participants and providing sufficient overhead clearance on rail lines to accommodate doublestack containers was the number-two priority. Vermont railroads must have doublestack capacity if the State wants intermodal terminals and service for Vermont shippers and carriers. The Statewide Freight Study of 2001, the State Rail and Policy Plan (2006) and Vermont Long Range Transportation Business Plan (2009) call for the future development of doublestack rail service, but acknowledge that State does not have the critical mass of shippers and receivers needed to justify the development of intermodal terminals and services. However, doublestack capacity is also needed if the State wants to ensure the continued viability of the rail network for through traffic, which is necessary to maintain its economic viability. The capability will allow an eventual shift of freight traffic from truck to rail to reduce truck traffic and truck wear and tear on State bridges and pavements.

  Doublestack intermodal service requires a minimum clearance of 20′8″ feet for domestic containers. To serve through traffic or develop intermodal terminals within Vermont, the following deficiencies must be corrected:

  - **NECR**. For the main line through Connecticut, Massachusetts and as far north as Bellows Falls, the NECR has a stated 19′ 6" vertical clearance. Beyond Bellows Falls towards St. Albans, clearance is limited to 19′. A noteworthy limitation is the North Burlington tunnel on the Winooski Branch that connects the NECR with the VTR at Burlington. Providing adequate overhead clearance will be a costly undertaking.

  - **GMRC.** In the 1997 Railway Clearance Survey GMRC had two clearance restrictions.
  - **VTR.** The 1997 Railway Clearance Survey shows that VTR had nine clearance restrictions.
  - **WACR.** The 1997 Railway Clearance Survey shows that the WACR has two restrictions on the WACR Connecticut River line.
  - **MMA –** The 1997 Railway Clearance Survey showed and MMA concurred that there was one clearance restriction at Bridge Number 28.3.

- **Improve terminals and access.** The Vermont State Rail and Policy Plan (2006) stated that many of the freight facilities in the State do not fully meet the needs of the railroad or the community. In particular, capacity constraints at the Rutland Rail Yard, community impacts at the Burlington Rail Yard and access to the rail yard in St. Albans need of attention. Planning for improvements to the Rutland Rail Yard are well underway as evidenced by the release of the Environmental Assessment for that project in November 2009.

  Shipper representatives participating in the focus groups called for improved access to rail statewide through industry sidings and public transloading facilities. Several publicly accessible bulk transloading facilities are located in the State, including Manchester, Middlebury, Shaftsbury and North Bennington (Whitman Feeds), but additional points of access with transloading and staging capabilities are needed.

- **Preserve service and rights of way statewide.** During the latter half of the twentieth century, a time referred to as the "retreat period" in the Statewide Freight Plan of 2001, the number of railroad sidings were reduced, services were terminated and lines were abandoned. When freight rail lines are abandoned and the rights of way are lost, they cannot be restored easily. Shippers, receivers and railroad industry stakeholders recognize the need to retain existing sidings, lines and services, but also to preserve rights of way so that reactivation or repurposing of transportation corridors can occur in the future.

- **Maintain state of good repair statewide.** Maintaining a state of good repair on Vermont's railroads is essential for keeping the system operable and reliable. The industry focus groups identified lines that need better maintenance, including the Montreal, Maine and Atlantic's (MMA) rail line between Richford and Newport, which is in poor condition and cannot be used effectively in its current condition; and the Twin State Line between St. Johnsbury, VT and Whitefield, NH, which needs to be rehabilitated and reactivated to provide access to New Hampshire and Portland, Maine.

- **Remove slow orders.** Although related to general maintenance of a state of good repair, slow orders have taken on a life of their own. Typically temporary, slow orders are enacted when track defects prevent operation at the full permissible speed over a specific rail line. On some lines, slow orders

have become so prevalent and persistent that they have significantly reduced the level of rail service. Repairing the track defects and removing the slow orders on lines throughout the State could significantly improve the efficiency of the rail system.

Water and Air

- **Preserve waterborne freight transportation capabilities.** The Lake Champlain ferry system is an important component of the State's freight transportation network, especially given the temporary removal of the Crown Point Bridge. Also, the formerly navigable Champlain Canal that connects Lake Champlain with the Hudson River is an asset that scould be restored to functional use to provide system redundancy. Ensuring that the locks remain operable and channel depth is re-established to the intended levels would benefit Vermont bulk shippers. However, the locks and channels are in New York State, just beyond the Vermont border, so regional cooperation will be needed to identify balancing improvements within Vermont that might benefit New York State shippers and receivers.
- **Preserve and expand air freight capabilities.** Anticipated growth in high-value and time-sensitive commodities and the expansion of service industries point to a need for more and better air freight services for Vermont. The 2001 Statewide Freight Study suggested that the Burlington, Montpelier and Rutland airports have sufficient physical capacity to accommodate regular freight traffic and that enhancements to an airport in the Northeast Kingdom would bring guaranteed overnight parcel delivery to that region of the State. Subsequent to the 2001 Freight Study, both UPS and FedEx, the two largest express carriers, expanded their guaranteed overnight service to cover the entire state including the Northeast Kingdom.

Operational Needs and Deficiencies

Highway

- **Increase or harmonize weight limits.** The request to increase or harmonize truck weight limits was advanced in 2011 when Federal legislation authorized a twenty-year trial of an increase in the maximum allowable truck weight on Interstate highways to 99,000 pounds. Proposals have been made to make the increase permanent. Motor carriers suggest that increasing maximum truck weights and permitting the operation of tandem trailers on more of the State's highways would reduce shipping costs and greenhouse gas emission. However, as previously noted, the changes may also reduce the volume of freight shipped by rail and thereby further degrade the economic viability of the State's railroads.
- **Remove or harmonize operating restrictions.** Many of the focus group participants found operating restrictions, such as wet weather or localized weekend restrictions, to be overly restrictive and inconsistent with restrictions

in other adjacent jurisdictions. Also, time-of-day restrictions, such as prohibition of nighttime truck traffic in Bennington, require that trucks operate during peak traffic times. Members of the freight community recommended a reevaluation of local and State operating restrictions. Implementing these or similar operational changes that increase efficiency of goods movement will also contribute to the national freight policy goals laid out in MAP-21 legislation.

- **Broaden deployment of ITS for incident management (e.g., incident detection and notification) and enforcement (e.g., weigh-in-motion).** To better manage the transportation system in the event of emergencies, intelligent transportation systems (ITS) technologies such as variable message signs and web-based portals can be deployed to alert travelers of travel conditions and suggest alternate routes. Weigh-in-motion systems, which can estimate truck weights while vehicles are traveling at highway speeds, can be installed to reduce delays at weigh stations and the risk of secondary crashes at truck queues at the stations. VTrans is deploying ITS technologies along a section of I-89 between Sharon and Colchester. This program should be expanded to provide real-time information on border crossing queues and travel information along other corridors in the State such as I-91 and U.S. 7.

Rail

- **Improve speed and reliability.** A truck can transport goods from California to Vermont in four days, yet a similar trip by rail takes two weeks. Many of the bottlenecks occur outside of the State, but within Vermont, operating speeds are indeed slow. Shippers argue that rail is not effective in meeting the "just-in-time" logistics demands of customers. Addressing the physical needs of the rail system will allow the railroads to increase their operating speeds and provide capacity for expanded service frequencies in some areas. The ARRA grant for the NECR corridor has brought substantial improvements to one of the major freight lines traversing the state, but initiatives are needed to improve speed and reliability of service on other freight lines such as the MMA and the VTR services.
- **Increase shipment visibility.** Many existing and potential rail customers are frustrated by the lack of visibility of shipments in transit by rail. Most motor carriers can provide their customers frequent and timely updates on the location and progress of shipments. Although the Class I railroads have substantially improved shipment visibility, frequency, timeliness and accuracy continues to be inferior to that of motor carriers. Status updates occur only 1-2 times per day and are often nonexistent for shipments that are being handled by short line railroads. Shippers and receivers participating in the focus groups recommended that both Class I and short line railroad adopt improved tracking systems that allow customers to readily check the progress of shipments and provide rerouting instructions to carriers if needed.

- **Reduce delays in interchange of shipments between carriers.** The need to interchange railcars, particularly between short lines and the Class I carriers, results in a loss of service reliability and increases costs. Since Vermont is not served by Class I carriers, by necessity almost all carload rail traffic must be interchanged. When interchanging results in lengthy delays, customers are discouraged from using rail. This problem can be addressed by increasing rail carload traffic to generate higher revenues and justify more frequent and better coordinated service. However, the Class I railroads' business model has been evolving to emphasize long-haul, hub-to-hub or point-to-point, service in high density corridors, sometimes at the expense of carload traffic. The Class I railroads have shifted the business of providing "last mile" service to short line railroads. The short line railroads are often better attuned to the needs of their shippers and receivers, but may not be able to generate the volume of business needed to satisfy the operating needs of the Class I railroads. As a result, service deteriorates for shippers, short lines and the Class I railroads.

Institutional/Regulatory Needs

Highway

- **Streamline oversize/overweight permitting.** Focus group participants identified several concerns with oversize/overweight permitting in Vermont. Although the VTrans web portal for oversize/overweight truck permitting has streamlined the process, motor carriers and shippers recommended that the State issue annual permits to further simplify the process, accept credit card payment of permit fees in lieu of an escrow account and provide more information and more accessible information on the permitting process, routes and requirements. The requirement that oversize/overweight haulers notify each town along their intended route is regarded as onerous. Implementing these types of operational and regulatory changes that increase efficiency of goods movement will also contribute to the national freight policy goals laid out in MAP-21.

Education

- **Educate communities about the economic value of freight transportation.** Although the movement of goods sustains local businesses and the broader economy, there are few advocates in local and State government for better freight operations and land use policies that preserve land for industrial and freight uses. In many communities, freight operations and industrial and freight land uses are seen as undesirable, creating noise, vibration, pollution, parking problems, etc. If the State wants to preserve rail lines and rail sidings to carry future freight traffic, it must be more aggressive in working with local communities to preserve rail-served sites and encourage rail-compatible shippers and receivers to locate on rail lines.

- **Expand freight transportation options for shippers, carriers and communities.** Many shippers, particularly managers of smaller firms, may not be aware of the full range of shipping options available to them within Vermont. There is a need to improve the knowledge base of these business managers; utilizing more cost-effective solutions could make them more competitive. Providing information can serve as a low-cost tool to strengthen the productivity and efficiency of U.S. producers, aligning with national freight policy goals.
- **Improve communication about freight needs and solutions among government agencies, carriers and shippers.** The focus groups and prior studies note that, in addition to being unfamiliar with the range of shipping options, many Vermont shippers (and even carriers) are not aware of the roles and responsibilities of the State agencies involved in economic development and freight transportation. A continuing outreach program is needed to ensure that the agencies hear about and understand the problems of small shippers and carriers and conversely small shippers and carriers know where to look for information and assistance.

Coordination

- **Balance trade flows to and from Vermont to reduce freight transportation costs.** Over the past several decades, traffic volumes inbound to Vermont have greatly exceeded outbound traffic. When motor carriers must run full in one direction and empty in the other, they charge more for service to cover the cost of the total trip. This increases the cost to Vermont shippers and receivers compared to other shippers and receivers in regions that have more balanced traffic flows, making Vermont businesses less competitive in reaching national and global markets. More opportunities to balance loads would benefit shippers, as would incentives to share equipment and coordinate backhauls. These are issues that must be tackled by the private sector, although VTrans and other State agencies could facilitate discussions.
- **Better coordinate freight transportation planning and investment among the New England states, New York State and Canadian provinces.** Carriers, shippers and prior studies report the need for better coordination of freight transportation policies, regulations, restrictions, capital improvements and partnering with the railroads among New England states, New York State and Canadian provinces.
- **Expand State outreach to industry on economic development and freight transportation issues and opportunities.** Shippers, carriers and government representatives expressed a need to continue the dialogue begun during the focus group sessions—either through a continued focus group program or another forum—especially to study the feasibility of using alternative modes and find more efficient strategies for moving freight.

Funding

- **Pursue additional Federal grants and public-private partnerships to fund freight projects.** Funding for capital programs is always in short supply, and the recession and subsequent drop in State and local revenues has exacerbated the problem. VTrans has been very successful at capturing Federal grants from the American Recovery and Reinvestment Act of 2009 and has worked effectively with the private industry to produce compelling cases for funding capital projects such as with the NECR track improvements project. These cooperative relationships to secure funding and to develop public-private partnerships should continue.

  Additionally, MAP-21 legislation has authorized the U.S. DOT to increase the maximum Federal share for projects identified in a State freight plan to improve the efficiency of freight movement. This provision increases the level of national project funding to a maximum of 95% for projects on the Interstate system and 90% for non-Interstate system projects. Focusing on the priority projects identified in this plan will allow VTrans to maximize state dollars on infrastructure improvements to the freight system.

Economic Development

- **Attract rail business that currently terminates elsewhere.** Some freight destined for Vermont customers travels to out-of-state locations by rail and is then trucked into the State. Traffic is routed this way because Vermont is not served by Class I carriers and the vast majority of the State's rail network does not support industry-standard 286,000 pound railcars. Improvements to rail infrastructure and service could bring increased transloading activity into Vermont, thereby reducing the number of truck-miles of travel on Vermont roads and the related wear-and-tear on pavements and bridges. However, transload centers located along Class I main lines are often able to offer superior service compared to transload center services offered by short line railroads because the Class I railroads handle more trains more frequently and can avoid delay-prone interchanges. More reliable and timely interchange of traffic between Class I carriers and their connections would help short lines compete for transload business and maximize the potential for transloading services in Vermont.
- **Better link economic development and transportation policies, programs and investment to compete more effectively as a region in national and global markets.** As a relatively small state, Vermont must compete against many larger, less costly places to do business. Working together, the New England states could be more competitive.

5.4 VERMONT'S FREIGHT TRANSPORTATION SYSTEM AND GREENHOUSE GAS EMISSIONS

Reducing the environmental impacts of freight transportation, including greenhouse gas (GHG) emissions, is one of the goals of the national freight policy established under MAP-21. Vermont has taken a leadership role in reducing greenhouse gas emissions to respond to the challenge of climate change and achieving environmental sustainability. Executive Order 07-05 (December 2005) and Act No. 168 (passed in 2006) set a goal of reducing the state's GHG emissions by 25 percent from 1990 levels by 2012; 50 percent by 2028; and, if practical, 75 percent by 2050. The October 2007 *Report of the Governor's Commission on Climate Change* includes as one of six major recommendations to "reduce emissions in a renewed transportation system within and between vibrant town centers" through compact growth and investments in highway, rail and public transportation systems. Recognizing that transportation makes up 44 percent of Vermont's GHG emissions, VTrans developed its own Climate Change Action Plan in 2008, which includes a number of specific GHG reduction strategies. The plan addresses freight travel, including investing in rail infrastructure, providing intermodal transfer facilities and working with municipalities to plan and regulate land use to accommodate rail infrastructure and service. The plan also proposes greater use of biofuels, including biodiesel and increased vehicle fuel efficiency.

This section provides a context for future GHG emissions from the transport of freight in Vermont, by comparing existing and projected future emissions from both truck and rail transport, based on the freight traffic forecasts developed for this plan. The forecast also accounts for the effect of anticipated Federal heavy-duty vehicle fuel efficiency standards. In October 2010 the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) announced proposed GHG and fuel efficiency standards for heavy-duty trucks.[20] The proposed standards would reduce energy consumption and GHG emissions by 7 to 20 percent for new combination tractors, heavy-duty pickups and vans and vocational vehicles by model year 2019, compared to a model year 2010 baseline.

The truck emissions inventory includes truck VMT within the State of Vermont as estimated based on the commodity flow data included in the 2008 TRANSEARCH database that was obtained for this study. This database focuses on long-distance goods movement and likely does not include some amount of VMT by smaller trucks for local goods movement as well as for other heavy-duty vehicle uses (e.g., utility, garbage and construction trucks). Therefore, it does not represent a complete inventory of freight GHG in Vermont, although it should include the large majority of freight GHG emissions.

[20] U.S. EPA and NHTSA (2010). " EPA and NHTSA Propose First-Ever Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles: Regulatory Announcement." EPA-420-F-10-901, October 2010.

Truck GHG emissions are estimated to be about 317,000 metric tons in 2008, increasing to 424,000 metric tons in 2035. Fuel efficiency improvements are more than outweighed by the forecast increase in truck traffic volumes. Key assumptions for the truck emissions inventory are shown in Table 5.4.

Table 5.4 Vermont GHG Emissions for Highway Long-Haul Freight

	Class 3-6 Gasoline	Class 3-6 Diesel	Class 7-8 Diesel	Inventory Total
Percent of long-haul truck VMT	4%	4%	92%	100%
Average mpg, 2007	7.90	7.25	4.99	
Percent improvement for 2035 vs. 2008 fleet	6.6%	8.5%	11.0%	
Average mpg, 2035	8.17	7.65	5.34	
2007 VMT (thousands)	6,438	6,438	148,071	160,947
2007 CO2 emissions (metric tons)	7,220	9,010	301,127	317,358
2035 VMT (thousands)	9,643	9,643	221,789	241,075
2035 CO2 emissions (metric tons)	10,101	12,349	401,429	423,879

Data sources and assumptions for this table are as follows:

- Percent of truck VMT – According to VTrans traffic count data, about 92 percent of trucks on Interstate highways are 4+ axle trailer trucks. These correspond with the vehicles most likely to be included in the TRANSEARCH database. For smaller trucks, national data from the 2010 U.S. Department of Energy Annual Energy Outlook (AEO) show an approximate split of half gasoline and half diesel.
- Average miles per gallon (mpg), 2007 – From 2010 AEO Table 67.
- Percent improvement for 2035 vs. 2007 fleet – EPA's proposed fuel economy standards would reduce fuel consumption by 11.4 percent for new trucks, from 20.2 gal/100 mi for model years (MY) 2010-13 to 17.9 gal/100 mi for MY 2018 for combination trucks. For smaller vocational trucks, fuel economy would be improved by 6.1 percent for gasoline trucks and 8.8 percent for diesel trucks. However, the full benefits would not be realized by 2035 because some vehicles from before introduction of the standards would still be on the road. The weighted percent improvement is based on Cambridge Systematics analysis using fleet data from DOE's VISION model.
- Truck VMT – Cambridge Systematics estimates based on TRANSEARCH commodity flow data assigned to the road network.
- Carbon content of fuel: 8.86 kg/gal gasoline, 10.15 kg/gal diesel.

- Rail GHG emissions are much smaller than truck GHG emissions due to both the smaller volume of freight that moves by rail (about 35 percent of rail and truck ton-miles in 2007) and the higher energy efficiency of movement by rail. The estimated rail emissions of 25,600 metric tons in 2007 and 33,450 metric tons in 2035 are about 8 percent of total truck plus rail emissions. Rail GHG emissions estimates and assumptions are shown in Table 5.5.

Table 5.5 Freight Rail GHG Emissions in Vermont

	2007	2035
ton-mi/1000BTU	3.13	3.21
Total ton-mi (millions)	1,095	1,468
Metric tons CO2	25,590	33,450

Efficiency as measured in ton-miles per 1,000 British Thermal Units (BTU) is taken from AEO 2010, Table 67 (average efficiency for U.S. freight rail). Total ton-miles were estimated computing rail network distances between origin-destination pairs and multiplying by total tonnage moved for each origin-destination pair based on the TRANSEARCH data.

Finally, Table 5.6 shows total emissions from truck and rail freight as well as the change in emissions for 2035 compared to 2007. The estimated total is about 343,000 metric tons in 2007 increasing to 457,000 metric tons in 2035, an increase of 33 percent.

Table 5.6 Total Long-Haul Freight GHG Emissions in Vermont

	2007	2035	% Change
Truck	317,358	423,879	34%
Rail	25,590	33,450	31%
Total	342,948	457,332	33%

These totals do not paint an optimistic picture about freight transportation being able to contribute to GHG reductions in Vermont. However, broader strategies could be implemented at a Federal, multi-state regional, or state level that would reduce these emissions. In particular, GHG emissions could be reduced from these levels if the Northeast and Mid-Atlantic states adopt proposed low-carbon fuel standards (LCFS). Eleven northeast states and the Northeast States for Coordinated Air Use Management (NESCAUM) have been working to address design and implementation issues for an LCFS that would be modeled after California's adopted LCFS, which requires fuel suppliers to reduce the average carbon content of fuel by 10 percent by 2020. GHG emissions could also be reduced if the Federal government were to take additional actions to increase heavy-duty vehicle efficiency standards beyond 2019. Pricing policies implemented at a Federal level (such as a carbon price) or substantially higher fuel

prices due to market forces would also tend to reduce freight travel from forecast levels and increase the efficiency of freight vehicles. Finally, investment in rail and intermodal infrastructure could potentially shift some volume of freight from truck to rail.

5.5 DISCUSSION

While it is clear that Vermont's freight transportation system and its operators, infrastructure and institutions are capable of meeting current demands, the ability to meet future needs requires continued improvement and change. Findings from the Vermont Statewide Freight Study, Vermont Long Range Transportation Business Plan, the modal policy plans, as well as the data collection and industry focus groups conducted as part of this Plan show a need for investment in highway, rail, air and water transportation infrastructure, for operational adjustments to improve system efficiencies, and for institutional and regulatory policy frameworks that better promote goods movement and economic development. The issues identified here represent an extensive collection of needs and deficiencies that directly increase the cost of freight transportation in Vermont and indirectly increase the cost of doing business and living in Vermont. But these needs also represent opportunities for VTrans and other agencies and private sector partners to develop a program of policies, programs and projects to improve goods movement and to assist in the preservation and growth of Vermont industries.

Achieving greater efficiencies in truck and air transportation through infrastructure and operational improvements will assist specialty agriculture, electronics and other emerging industries in Vermont that require speedy and reliable transportation services to major consumer markets. Addressing needs associated with rail will help secure existing rail-oriented markets through a more reliable system and potentially expand opportunities to divert some commodities from truck to rail as well as eventual development of intermodal service from a terminal located within Vermont.

While many of the needs do not represent issues or opportunities under the direct jurisdiction or responsibility of VTrans (private railroads own much of the rail assets in the State, for example), it is important to recognize these issues and identify opportunities for other agencies and partners to be involved in the State's freight transportation program. Public and private sector partners will also be instrumental in developing a means of evaluating the needs and tracking the performance measures that will be used to monitor them. Performance measures proposed to evaluate factors related to these needs are presented in Chapter 6 of this report.

Concurrent with the need to address the direct concerns of the freight community, proposed improvements to the state's freight system should take into account the collateral impacts, including the state's GHG reduction goals and other efforts to maintain its high environmental quality. As it now stands, current trends in GHG

emissions from freight transportation will run counter to GHG reduction goals. While the impact on GHG emissions of the various suggested changes and improvements are beyond the scope of this study, it must be understood that future freight planning activities ranging from analyses of specific projects to comprehensive statewide plans need to consider these effects.

MAP-21 and FAST have spurred a shift to performance- and outcome-based programs at both the National and State level. Although many of the freight policy and performance goals are set at the national level, States play a vital role in supporting these goals by developing programs and policies and making infrastructure investments that align with these national goals. This Freight Plan lays a foundation for a performance-based system by identifying physical, operational and institutional needs in the freight sector. The assessment in this section serves as a guideline for investing in projects that will enhance the efficiency and effectiveness of the transportation system and serve to further the National freight policy goals, as well as those of Vermont. Performance measures, discussed in the next section, add another link in this process and will allow Vermont to continue to regularly assess the transportation system, document trends and prioritize projects in alignment with the freight policy goals.

6.0 Performance Measures

An inclusive and consistent set of performance measures is an important tool to assess the condition of a transportation system, identify trends and issues and set priorities among potential investments and policies. More broadly, they are beneficial to informing stakeholders, policymakers and the general public about the impacts of transportation on the state's economy and quality of life. Additionally, MAP-21 legislation enacted in 2012 requires states to set performance measure targets based on performance measures to be determined by a set of USDOT Rulemaking in 2017, including measures of freight movement and system performance.

VTrans has implemented a series of performance measures that monitor the state's transportation infrastructure and operations. While most of these address concerns that impact the broad set of system users, only a few measures have been implemented that specifically address freight system performance and these are largely safety and infrastructure related, such as bridge weight limits.

The value of effective performance measures for transportation systems and freight has received increasing attention by planners and policymakers, both as a tool to measure the cost-effectiveness of transportation expenditures, as well as measure a broader set of impacts on a region's economy, competitiveness and quality of life. Measures that address the latter concerns often must encompass institutions that reach far beyond state transportation departments, giving them little control over the consistency and validity of such data sources. For this plan, the primary focus is on performance measures for functions over which VTrans has direct responsibility.

The organization of this chapter is as follows:

- **Development and purpose of performance measures.** A brief overview of how performance measures have been developed and applied by state transportation agencies as they relate to goods movement.
- **Application of performance measures by VTrans**. VTrans has implemented performance measures on a range of elements that impact the freight industry indirectly. The relevance and application of these measures from the perspective of freight are reviewed.
- **Proposed performance measures**. Building on the prior two sections, an expanded set of measures are proposed for consideration in the Freight Plan.

The performance measures serve as direct inputs to the set of strategies that address the freight needs and deficiencies presented in Chapter 7. The performance measures will permit evaluation of the effectiveness of each strategy.

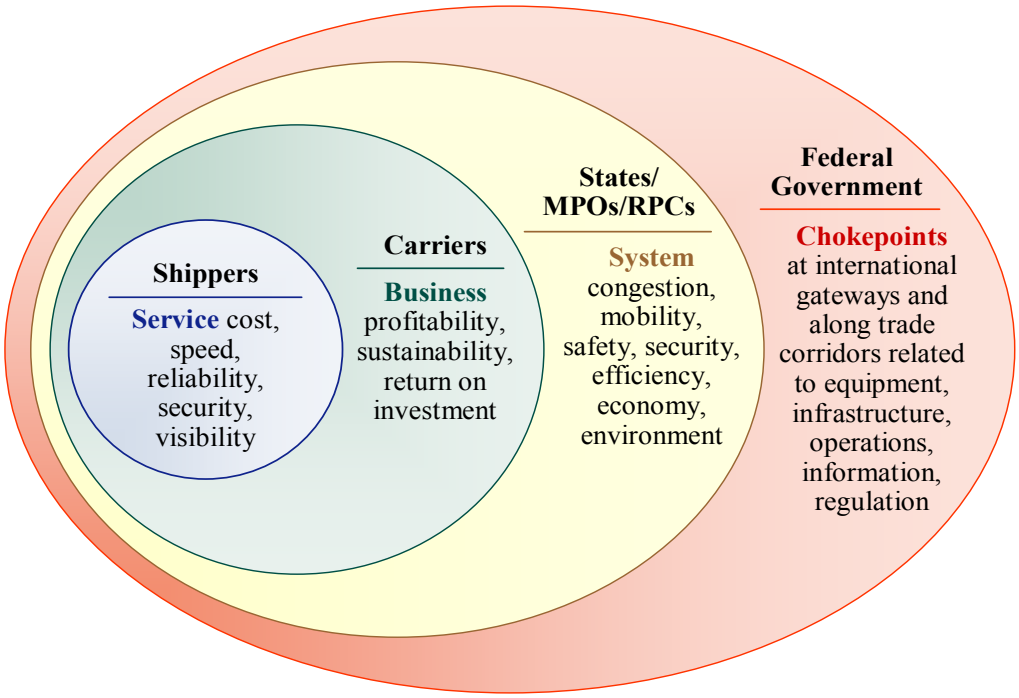
6.1 FREIGHT PERFORMANCE MEASURES INTRODUCTION

Only recently have policymakers turned their attention towards developing and applying performance measures for freight transportation that encompass a broad range of impacts. In support of building performance- and outcome- based transportation programs at the national level, MAP-21 provisions require the establishment of performance goals and measures and require states to set performance targets in each of these areas. These national transportation performance measures are relatively straightforward; however developing a set of performance measures that encompass the many aspects of Vermont's transportation system is a significant undertaking. In particular, the institutional complexity of freight transportation, consisting of millions of shippers engaged in private commerce with tens of thousands of transportation service providers operating over publicly and privately owned guideways, has greatly complicated the development of suitable measures and the data that goes along to support them.

Freight performance measures can be categorized by their key constituencies: shippers, carriers, state and local agencies and the federal government. These are illustrated as a series of four nested circles in Figure 6.1, with the shipper – the actual user of the service – at the center, then the carrier physically moving the goods, the state and local governments having primary responsibility for infrastructure and, at the outermost level, the federal government providing policy guidance, oversight and other functions that transcend state borders. Each of these four constituent groups has different perspectives on system performance and needs.

- For shippers, the critical performance measures are the cost of shipping freight, the speed and reliability of delivery to external and internal customers, speed and reliability in receiving inbound goods, en-route shipment visibility and assurance that goods will arrive safe and undamaged.
- For carriers, performance measures are related primarily to factors that influence their ability to do business, including the profitability of the service they provide, how sustainable the business is from an operating and maintenance cost perspective, and the potential return on investments in maintaining, improving and expanding infrastructure and rolling stock. Safety is also an important factor for carriers, as an operation in compliance with safety regulations operates efficiently and reliably.

Figure 6.1 Primary Areas of Concern to Freight Stakeholders



- State and regional government agencies are concerned with the operation of the transportation system and its impacts on the mobility of the population; safety and security; economic development; and environmental stewardship and quality of life. Performance measures such as peak-period travel times and traffic volume-to-capacity ratios as a measure of mobility, population and industry within an acceptable accessible distance to transportation infrastructure, crash frequency and severity, job creation potential and environmental quality measures allow agencies to track progress on these issues.
- The Federal government's interest focuses on ensuring a level on consistency across the U.S.; safe and secure freight movement at international trade nodes such as border crossings; and efficient operation along significant international and interstate trade corridors. The Federal government also has regulatory responsibility for interstate commerce, governing rates and service provided by railroads and, to a far lesser degree, other surface modes. Condition and performance measures, particularly of the National Highway System and Interstate Systems, as well as safety, emissions and freight movement measures, are mandated at the federal level by MAP-21. Therefore, measures of mobility, safety, infrastructure condition on interstate highways and other modes of interstate commerce, operations, security capabilities and delay at international border crossings are important performance metrics.

Individually, each of these four groups has developed measures that apply directly to them and that they have the potential to manage. Shippers and carriers are in a position to monitor key service and financial metrics for the activities in

which they participate. Likewise, for transportation agencies, the focus has been on the areas over which they have direct jurisdiction, typically physical conditions on the highways and safety. For modes over which public agencies have little control, particularly railroads, only a few high-level measures are available to the public. However, an increasingly multi-modal outlook by policymakers has made apparent the need for a set of performance measures that permit monitoring and analysis across all of the major modes – highway, rail, waterway and air. This provides the means to group potential projects covering multiple modes into similar categories and make "apples to apples" comparisons among them. Once this has been done, broader prioritization and funding decisions can be made among project and modal categories.

The shipper and carrier constituent measures cited above encompass a range that is neither required nor possible to produce within the scope of a state transportation agency. Detailed motor carrier and freight performance data in general is very difficult to obtain due to its proprietary nature. Some states have begun developing their own data sources to address particular issues, such as prioritization of freight bottlenecks, measurement of typical trip times and variance between particular markets and quantifying the benefits of freight projects using actual data.[21]

However, alternative measures that address some shipper and carrier concerns in meaningful ways can be produced using available data. Some have existed in a context of overall system performance, such as capacity, pavement conditions and safety, etc., while others can be arrived at indirectly. For example, traffic volumes can provide indirect as well as direct indications of freight system performance and usage. Freight carriers rarely provide detailed data on shipments, but overall volumes are generally reported. Thus, a simple measure for monitoring the vitality of a state's railroads is to regularly compile data on traffic volumes. By monitoring volume trends, particular issues can be identified that otherwise may not be apparent. Steady downward volumes could indicate problems with service and infrastructure as well as economic shifts. Comparing this data to similar volume data on other modes can expose trends and identify issues that may require attention.[22]

Developing freight performance measures is a key part of complying with MAP-21 legislation, which requires states to set performance measure targets based on performance measures to be determined by the USDOT in the areas of Interstate

[21] See for example, **The Gray Notebook**, Washington State Department of Transportation, March 31, 2009 edition, page 18.

[22] The Transportation Research Board' s National Cooperative Freight Research Program Report 10 recommends standard measures to gauge the performance of the freight transportation system. The report addresses freight performance measures for efficiency, effectiveness, capacity, safety, security, infrastructure condition, congestion, energy and environment.

and NHS pavement condition, performance and bridge condition; fatalities and serious injuries; traffic congestion; on-road mobile source emissions; and freight movement on the Interstate system. States must also report periodically on their progress in relation to the targets and how they are addressing congestion at freight bottlenecks.[23] Additionally provisions are included to move the freight planning process, at both the state and national level, to develop and improve data and tools to support outcome-oriented, performance-based approaches to evaluating proposed transportation projects.

From the perspective of this freight plan, the following sections emphasize the elements that are the direct responsibility of VTrans and are useful in guiding VTrans' policy directions, evaluation and prioritization.

6.2 PROPOSED FREIGHT PERFORMANCE MEASURES

Freight performance measures developed for this study are intended to support investment and policy decisions within VTrans' purview. However, they incorporate the perspectives of a range of public and private stakeholders with experience and expertise in local, regional and global supply chains and thus must take a broader view. Additionally, as federal guidance is issued, the performance measures should be reviewed to determine whether they meet the requirements established by the USDOT for State performance reporting.

The proposed performance measures were developed in a series of three steps that build on the preliminary findings from NCFRP Report 10, a national review of freight-related performance measures for public sector decision-makers and national performance measures prescribed in MAP-21. The three steps entailed:

- Review of performance measures established in VTrans' previous freight and modal transportation plans;
- Adaptation of existing performance measures and identification of new ones; and
- Engagement of the freight community through the series of focus groups, described in Chapter 5.

The performance measures developed here build upon the measures established in the previous studies to encompass multi-modal and statewide issues relevant to all stakeholder groups. Some new measures have been developed in response to stakeholder needs not covered in previous studies and feedback received during the freight focus groups. Both new and existing modified measures were created with two key principles in mind. First, measures should be supported by data and information that are available and relatively easy to collect, analyze and

[23] As of July, 2013 the Federal Highway Administration has proposed that the reporting requirements become effective on October 1, 2016, with updates required every 2 years thereafter. See http://www.fhwa.dot.gov/tpm/about/freight.cfm

update. Second, measures should be regionally significant (i.e., they should measure the overall performance of the State's freight transportation system), reflecting more than just the performance of individual elements of the system. The result is a set of measures that can be applied across modes. Performance measures that would be specific to individual modes could be designed to support those developed for this plan.

The involvement of the private sector is particularly important in the development of freight performance measures. This input was provided through the series of freight-stakeholders focus groups, at which physical and operational issues, data and information availability and institutional roles and issues were discussed. This outreach helped to identify relevant performance measures and pinpoint data and information sources available to evaluate performance.

The proposed performance measures, listed in Table 6.1, are presented across "levels," performance categories and transportation modes (highway, rail and air). Within each level, performance categories represent aspects of each level that are critical to VTrans' planning activities. Within the economy level, critical performance categories include economic activity, freight demand and policy/planning/management. Performance categories indicative of logistics and operations performance include business accessibility to the freight transportation system, transportation system efficiency, safety and environmental impacts of freight activity. Infrastructure performance categories include monitoring of the physical condition of the infrastructure, the level of investment in maintenance and repair and security of transportation infrastructure from threats such as natural disasters and terrorism. Each performance category contains a series of mode-specific measures which VTrans can use to monitor performance. Measures that may be used to support national performance measures required under MAP-21 are marked.

Table 6.1 Proposed Vermont Freight Plan Performance Measures

Level	Goal	Highway Freight Measures	Rail Freight Measures	Air Freight Measures
	Maximize the economic benefit of the transportation system	Gross State Product (GSP) • major truck-intensive sectors	GSP • major rail-intensive sectors	GSP
	Support the movement of goods into, out of and within Vermont	Truck tons, ton-miles, value* • statewide • major truck-intensive economic sectors	Rail tons, ton-miles, value • statewide • major rail-intensive economic sectors	Emplaned tons at VT airports
	Ensure the effective and efficient delivery of projects, maintenance, incident management and snow removal	Stakeholder outreach & communications	Stakeholder outreach & communications	Stakeholder outreach & communications
	Support the economy through statewide rail and highway access	Percent businesses within 5 miles of Vermont's primary highway network	Number of businesses with active rail sidings	% of state served by overnight carriers; No. of

			Percent business within 100 miles of IMX or transload facility	carriers providing direct service from VT airports
	Promote efficient operation of the transportation system	Travel time and reliability* ・ major market lanes ・ border crossing delays	Travel time and reliability ・ major market lanes ・ border crossing delays	
	Maximize safety on the transportation system	Fatalities and crashes Statewide*	Fatalities and crashes statewide	
	Promote environmental stewardship	GHG emissions* Hazmat spills	GHG emissions Hazmat spills	GHG emissions
	Maintain existing infrastructure, preserve pavements and structures	Volume-to-capacity ratio (LOS) * Pavement condition* ・ pavement composite condition measure[24] ・ structural cracking index[25] ・ percent miles rated IRI "Good" Bridge condition* ・ number rated structural deficient	Volume-to-capacity ratio (LOS) Track condition ・ miles under slow orders Bridge condition ・ number <286K capacity Doublestack capable ・ percent of total mileage	Runway conditions, adequacy for current operations
	Invest in the maintenance of and improvements to the transportation system	State of Good Repair ・ VTrans state HERS $ Actual ・ VTrans	SOGR estimate Actual ・ railroads ・ VTrans owned trackage	SOGR versus actual cond. estimate
	Promote a safe and secure transportation system	Evidence of coordination with State Police, U.S. Customs and other agencies on emergency preparedness.	Evidence of coordination with State Police, railroads, U.S. Customs and other agencies on emergency preparedness.	Evidence of coordination with TSA and other agencies on emergency preparedness.

* Indicates Vermont freight performance measures that may be used to support national performance measures established under MAP-21

Data and Information Sources

Monitoring the performance of the freight transportation system and the policies implemented to support it requires the collection of data and information from a variety of public and private sources. VTrans already develops some of these measures, although not always on a recurring basis. While the data and information for some of these measures should be updated at regular intervals to identify trends, others may need to be updated only sporadically, in conjunction with statewide planning studies and analyses for particular projects. A list of data and information sources needed to monitor each performance measure is

[24] Weighted composite index that combines four pavement condition characteristics including rutting, roughness, structural cracking and environmental cracking.

[25] Index based on raw structural cracking data weighted by pavement area.

provided in Table 6.2. Highlights of the data and information sources needed for the performance measurements include:

- Statewide Travel Demand Forecast (TDF) model – To the extent that the TDF model can derive volume-capacity ratios it serves as a helpful tool in identifying the effects of investments on congestion, travel time and delay on the highway network;
- Third-Party Traffic Data – Traffic data and analysis tools from third-party sources, can offer a supplement to the TDF model and provide estimations of vehicle speed, travel time and travel time reliability.
- VTrans crash data - Crash data from VTrans or national sources such as the National Highway Traffic Safety Administration (NHTSA) can assist in tracking the number of crashes and the severity, including persons injured or killed and property damaged;
- VTrans infrastructure data – VTrans warehouses data on roadway condition, bridge condition and other attributes of the highway and rail systems in the State;
- Industry location data – From state economic data or a third party industry location data source, such information will provide insight into industry accessibility to the transportation system and identify industry clusters and growth areas;
- Employment data by industry - Available from the U.S. Bureau of Labor Statistics, can measure the growth of freight-intensive economic sectors;
- Econometric models – Econometric models can be a valuable tool in determining the impact that a transportation investment will have on business expansion and retention and job creation. Typically, this modeling is only performed on a project-level basis;
- Environmental Protection Agency - The Environmental Protection Agency (EPA) monitors air quality and enforces air quality standards through "non-attainment" penalty designations;
- US Customs - The United States Customs and Border Protection, housed within the Department of Homeland Security, can serve as a partner through which the State is able to acquire data or qualitative information on the impacts of border crossing protocols on traffic operations;.
- Industry outreach - Industry groups such as focus groups and committees provide valuable feedback on the impact of regulations on the operation of motor and rail carriers; and
- Project documentation – Where the aforementioned datasets require supplement, documentation supporting a project in question, such as NEPA documentation or engineering reports, could supply additional relevant information.

Table 6.2 Performance Measures Data and Sources

Highway		Rail		Air	
Performance Measure	Data Source(s)	Performance Measure	Data Source(s)	Performance Measure	Data Source(s)
Gross State Product (GSP) • major truck-intensive sectors	U.S. Bureau of Economic Analysis U.S. Bureau of Labor Statistics	GSP • major rail-intensive sectors	U.S. Bureau of Economic Analysis U.S. Bureau of Labor Statistics	GSP	U.S. Bureau of Economic Analysis
Truck tons, ton-miles, value* • statewide • major truck-intensive economic sectors	U.S. DOT Freight Analysis Framework	Rail tons, ton-miles, value • statewide • major rail-intensive economic sectors	U.S. DOT Freight Analysis Framework	Emplaned tons at VT airports	U.S. DOT Freight Analysis Framework Airport data
Stakeholder outreach & communications	VTrans	Stakeholder outreach & communications	VTrans	Stakeholder outreach & communications	VTrans
Percent businesses within 5 miles of Vermont's primary highway network	Industry location data	Number of businesses with active rail sidings Percent business within 100 miles of IMX or transload facility	Industry location data	% of state served by overnight carriers; No. of carriers providing direct service from VT airports	Industry outreach
Travel time and reliability* • major market lanes • border crossing delay	3rd party travel time index and reliability data	Travel time and reliability • major market lanes • border crossing delay	Information from railroads		
Fatalities and crashes Statewide*	National Highway Traffic Safety Administration data, State Police data	Fatalities and crashes statewide	State Police data		
GHG emissions* Hazmat spills	US EPA data	GHG emissions Hazmat spills	US EPA data	GHG emissions	US EPA data
Volume-to-capacity ratio (LOS) * Pavement condition*	Travel demand forecast model, VTrans data on pavement and bridge condition	Volume-to-capacity ratio (LOS) Track condition • miles under slow orders Bridge condition • number <286K capacity Doublestack capable • percent of total mileage	Data from railroads	Runway conditions, adequacy for current operations	Data from airports

• pavement composite condition measure[26] • structural cracking index[27] • percent miles rated IRI "Good" Bridge condition* • number rated structural deficient					
State of Good Repair • VTrans state HERS $ Actual • VTrans	VTrans data	SOGR estimate Actual • railroads • VTrans owned trackage	VTrans and railroad data	SOGR versus actual cond. estimate	VTrans and airport data
Evidence of coordination with State Police, U.S. Customs and other agencies on emergency preparedness.	VTrans	Evidence of coordination with State Police, railroads, U.S. Customs and other agencies on emergency preparedness.	VTrans and railroad information	Evidence of coordination with TSA and other agencies on emergency preparedness.	VTrans and airport information

[26] Weighted composite index that combines four pavement condition characteristics including rutting, roughness, structural cracking and environmental cracking.

[27] Index based on raw structural cracking data weighted by pavement area.

7.0 Policy, Program, and Project Packages and Recommendations

This concluding chapter recommends a set of packages of policies, programs and projects that Vermont should implement to ensure that the State's freight transportation system serves the current and future freight transportation needs of Vermont's businesses, industries and communities, and aligns with the national freight policy goals established under MAP-21.

A key conclusion of the Freight Plan is that Vermont's freight system is and will remain adequate to the State's needs if the State advances the following three meta-goals:

- Ensures reliable truck travel times between Vermont and its major regional markets such Boston, New York City, Albany and Montreal;
- Keeps highway, rail, aviation and water transportation infrastructure in a state of good repair; and
- Maintains viable rail service to ensure competitive truck services and preserves the capacity for future development of mid-length intermodal and transload rail services for Vermont.

Drawing upon the findings and conclusions of the Freight Plan, six sets of policy, program and project packages were defined as follows:

- Freight Policy Package;
- Trade Corridors Package;
- Highway Operations Package;
- Rail Development Package;
- Air Freight Package; and
- Freight Transport Performance Measures Package.

Each package outlines the actions that VTrans should take either on its own or in concert with other agencies and freight stakeholders. The recommendations of the packages are summarized in Table 7.1 and the details of each are discussed in the sections that follow.

Table 7.1 Summary of Policy, Program and Project Packages

Packages	Goals	Recommendations	VTrans Role
Freight Policy Package	Incorporate freight into VTrans planning, project development and service delivery activities	• Adopt Statewide Freight Plan*	Lead
		• Incorporate recommendations into modal plans	Lead
		• Measure freight system performance*	
		• Expand communications with stakeholders	Lead
			Lead
Trade Corridors Package	Facilitate economic development in Vermont by improving transportation infrastructure and operations between Vermont and its trading partners in New York, New England and Canada	• Upgrade VT Route 9 and US Route 2	Lead
		• Provide full domestic doublestack railcar clearances on NECR and Western Corridor	Lead
		• Improve track and bridges along NECR, GMRC and Western Corridor to provide 286K railcar weight capacity	Lead
		• Complete Quebec Autoroute 35 between I-89 in VT and Montreal	
		• Reduce truck and rail delays at border crossings	Advocate
		• Harmonize OW truck permitting with NYS	
		• Implement one-stop regional OS/OW permitting system	Advocate
		• Better coordinate regional transportation planning and economic development activities	Lead
			Lead
			Lead
Highway Operations Package	Improve access to major regional suppliers and markets for Vermont shippers and receivers by enacting a series of infrastructure, operational and regulatory programs	• Improve efficiency on major state highways, including US Routes 2, 4 and 7 and Vermont Routes 9, 22A and 103	Lead
		• Keep highways open through prompt and effective snow removal, incident management and clearance	Lead
		• Monitor system performance and communicate traffic and roadway conditions directly to motor carriers and truck drivers	Lead
		• Maintain level of effort in truck safety monitoring enforcement	
		• Streamline OS/OW permitting website.	Lead
			Lead
Rail Develop-ment Package	Improve the rail infrastructure, operations and regulatory and institutional frameworks in order to (i) keep rail freight services viable and maintain market competition with trucking, (ii) allow an	• Upgrade all lines to 286K weight-bearing capability	Lead and Support
		• Maintain trackage at FRA Track Class 2 or better	Lead and Support
		• Preserve rail siding access to existing industrial sites	Advocate
		• Preserve rail-served industrial sites for new development	

Packages	Goals	Recommendations	VTrans Role
	opportunity for future growth in mid-length intermodal services (distances approximately 500 miles) and (iii) improve the freight rail market share	• Facilitate development of transload and intermodal terminals in or near Vermont where market warrants	Advocate
		• Encourage more direct and timely interchange between Vermont RRs and the Class I RRs	Advocate
		• Develop quick-response capability to leverage economic development opportunities with transportation investment/improvement	Advocate
		• Participate in multistate rail planning and programming to improve regional rail network	Advocate
		• Educate shippers about rail and IMX service options and contracting approaches	Lead
			Lead
Air Freight Package	Expand air freight and cargo services available to Vermont shippers	• Maintain airport runway surfaces, approaches and instrumentation in state of good repair	Lead
		• Expand runways at Newport, Middlebury and Rutland airports	Lead
Performance Measures Package	Promote the development and institutionalizing of measures that gauge the performance of the Vermont freight system and support informed and cost-effective investments	• Refine and adopt freight performance measures*	Lead
		• Adopt procedure for performance monitoring*	Lead
		• Create and publish "dashboard" of VTrans freight performance measures	Lead

* Indicates recommendations that align with USDOT requirements and encouraged practices under MAP-21.

7.1 FREIGHT POLICY PACKAGE

The demand for freight transportation will grow apace with Vermont's economy and somewhat faster than the State's projected population growth. The demand for additional freight transportation must be met by making effective use of the State's existing highways, rail lines, airports and waterways. However, Vermont's transportation infrastructure is aging and funding for transportation improvements will be in short supply over the next years. These trends underscore the importance of integrating freight policy, planning, programming and project development into VTrans' existing highway, rail, air and water transportation programs.

The Freight Policy Package recommends actions to fully incorporate freight into VTrans' policy making, programming and project and service delivery. The package recommends adoption of the Statewide Freight Plan and enunciation of a state freight policy that identifies needs, goals and

performance measures. The policy would serve as a guideline for VTrans line departments and for other agencies that may be cooperating with VTrans on projects. The policy would define VTrans' intent and means of engaging freight stakeholders in VTrans' planning and project development processes. And finally, it would communicate rules, regulations and other relevant information that will facilitate safe, efficient and reliable freight transportation operations. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.2.

Table 7.2 Freight Policy Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Adopt statewide freight plan	Lead	Low	High	Mid	Mid	Mid
Incorporate recommendations into modal plans	Lead	Low	High	Mid	Mid	Mid
Measure freight system performance	Lead	Low	High	High	High	Mid
Expand communications with stakeholders	Lead	Low	High	High	High	High

Freight Policy Package Recommendations

Adopt Statewide Freight Plan. The first step in integrating freight into VTrans' planning and project development activities is to adopt a state freight policy in the form of the Vermont State Freight Plan. A comprehensive state freight plan is encouraged by USDOT under MAP-21, and required by FAST in order to obligate Freight Formula Funds, and adoption of the plan by VTrans would meet this directive. By adopting the Vermont State Freight Plan, VTrans will formalize its freight policy and its commitment to addressing freight needs and impacts in agency programs and activities. Adopting the Plan is a low-cost strategy and provides a high level of benefit to VTrans as well as benefits freight stakeholders such as shippers, carriers and communities by formalizing the State's freight transportation policy. In addition, some of the projects identified in a State freight plan that increase freight movement efficiency may be eligible for an increased 90-95 percent Federal share of costs.

Incorporate recommendations into modal plans. Between 2004 and 2009, VTrans completed plans for each transportation mode, including the Vermont Highway System Policy Plan of 2004, the State Rail and Policy Plan of 2006, the Vermont Airport System and Policy Plan of 2007 and the Vermont Long Range Transportation Business Plan of 2009. While each of the plans identifies needs and action to maintain and improve the State's transportation systems, not all of the plans take freight needs fully into account. The Vermont State Freight Plan, serving as the State's freight transportation policy document, should be used to enrich the modal plans by incorporating freight needs and recommendations. The primary beneficiary of this recommendation will be

VTrans, whose line departments will have clearer freight-related directives. Freight stakeholders will also benefit from a clearer set of mode-specific freight policies.

Measure freight transportation system performance. The value of effective performance measures for transportation systems and freight has received increasing attention from policymakers, both as a tool to measure the cost-effectiveness of transportation expenditures and as a measure of the broader impacts on transportation on a region's economy, competitiveness and quality of life. Condition and performance measures, particularly of the National Highway System and Interstate Systems, as well as safety, emissions and freight movement measures, are now mandated at the Federal level by MAP-21. VTrans should develop and implement performance measures for the State's freight transportation system. The Freight Transportation Performance Measures Package recommends an initial set of measures for consideration by VTrans. These build on readily available data that can be assembled to provide an overview of the performance of the systems and the patterns of change of over time. The information will help ensure that Vermont can meet any future obligation to set performance traget and report progress towards achieving those targets. The level of effort to assemble and maintain the measures is modest, but the value to VTrans and the State's freight stakeholders is high.

Expand communications with freight stakeholders. The Vermont State Freight Plan took a step toward engaging public and private sector freight stakeholders through a series of focus groups held throughout the State. VTrans should continue a program of stakeholder outreach, which might include topical focus groups and a regularly-published freight stakeholder newsletter to inform stakeholders of current VTrans activities and solicit feedback. Conducting meetings with freight stakeholders requires the commitment of staff time, but the total level of investment required is low and the political and programmatic benefits are high.

7.2 TRADE CORRIDORS PACKAGE

Vermont's opportunities for economic growth, development and competitiveness depend on reliable and cost-effective freight transportation connections between businesses in Vermont and production and consumption markets beyond the State's borders. Vermont has strong economic ties to its surrounding states. Trade with New York State accounts for 60 percent of Vermont's total trade by weight; trade with the New England states accounts for 19 percent; and 6.5 million tons of freight crossed Vermont's border with Canada in 2006.

The Trade Corridors Package recommends actions that facilitate economic development in Vermont by improving freight transportation infrastructure and operations between Vermont and its trading partners in New York State, New England and Canada. The actions include maintaining and operating a safe and efficient core network of highways and rail lines; and ensuring that

truck size and weight regulations and permitting requirements governing the use of the State's highways are in reasonably harmony with the regulations and requirements of surrounding jurisdictions. If trucking regulations are significantly different, it drives up the cost of providing truck services to Vermont business and industry. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.3.

Table 7.3 Trade Corridors Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Infrastructure						
Upgrade VT Route 9 and US Route 2	Lead	High	High	High	High	Mid
Provide full domestic double-stack railcar clearances on NECR and Western Corridor	Lead and Support	High	Mid	High	High	Low
Improve track and bridges along NECR and Western Corridor to provide 286K railcar weight capacity	Lead and Support	High	Mid	High	High	Low
Complete Quebec Autoroute 35 between I-89 in VT and Montreal	Advocate	Low (for Vermont)	Low	High	High	Low
Operations						
Reduce truck and rail delays at border crossings	Advocate	None	Mid	Mid	High	Low
Regulations						
Harmonize OW truck permitting with NYS	Lead	Low	Mid	High	High	Low
Implement one-stop regional OS/OW permitting system	Lead	Low	Mid	High	High	Low
Institutions/Organization						
Better coordinate regional transportation planning and economic development activities	Lead	Low	High	Low	Low	High

Trade Corridors Package Recommendations

Infrastructure

Upgrade Vermont Route 9 and U.S. Route 2 to improve east-west highway connectivity. The plan recommends modernizing Vermont Route 9 and US Route 2 and adding truck climbing lanes along these key east-west routes to improve east-west travel and connections between Vermont and its major trading partners in New York and New England. Improving these highways will require the relocation of access points and the addition of truck climbing lanes. The cost of implementing these recommendations will be significant, although the benefits to shippers and carriers could be substantial. Because the communities located on or near these routes could experience increased

noise and air pollution from induced truck travel demand (i.e., additional new trips made possible because of improved access and travel times), the next step should be to conduct corridor studies for the Vermont Route 9 and US Route 2, analyzing travel times, the occurrences and circumstances of delay, incident records and growth and development (planned and desired) in each corridor to determine when and where infrastructure improvements are warranted.

Provide full domestic doublestack railcar clearance (22'6") along the NECR and the Western Corridor. Doublestack intermodal service requires a minimum clearance of 22'6" for domestic containers. To best serve through traffic and trade with Vermont's trading partners, elimination of clearance constraints on all of the State's railroads is recommended; however, top priority should be given to removing the clearance constraints on the NECR, GMRC and Western Corridor lines:

- NECR. For the main line through Connecticut, Massachusetts and as far north as Bellows Falls, the NECR has a stated 19'6" vertical clearance. Beyond Bellows Falls toward St. Albans, clearance is limited to 19'. A noteworthy limitation is the North Burlington tunnel on the Winooski Branch that connects the NECR with the VTR at Burlington.
- VTR. The 1997 Railway Clearance Survey shows that VTR had nine clearance restrictions.

Eliminating the vertical clearance constraints will be a costly undertaking, particularly on the NECR. However, the benefits of securing doublestack clearance on Vermont's major rail lines will accrue to both the public sector and private sectors. The State will be able to compete for rail-based industries and perhaps an intermodal rail terminal. The railroads will be able to provide improved, modern rail service and to maintain and develop their customer bases in Vermont and beyond.

Complete track and bridge improvements along the NECR, GMRC and the Western Corridor to support 286,000 lbs. railcars. The recommendation of this plan is for VTrans (the agency responsible for state-owned rail lines) and private railroad owners to continue advancing the programs to upgrade track and bridges to safely accommodate 286,000 lbs. railcars along the NECR and Western Corridor lines. With a core system of 286,000 lbs.-capable lines, Vermont will be re-connected to North America's primary freight rail network and rail will become a more competitive option for many of Vermont's shippers and receivers. VTrans and the private railroads are expected to take the lead on advancing upgrade programs on their respective infrastructure.

Complete Quebec Autoroute 35 between I-89 in VT and Montreal. Autoroute 35 in Quebec, Canada will be extended to connect to I-89, effectively replacing the current QC 133 route. This route will bring more traffic to the I-89 corridor in Vermont, but the highway can accommodate the additional traffic. This plan recommends that VTrans work with U.S. and Canadian customs and immigration officials to ensure that roadway and plaza capacities at the Highland Springs border crossing are sufficient to ensure that freight

movement remains safe and secure without incurring lengthy delays and lost productivity.

Figure 7.1 Quebec Autoroute 35 Project Area

Source: Transports Quebec

Operations

Reduce truck and rail delays at border crossings. This plan recommends that VTrans continue work with the Department of Homeland Security (DHS) on pre-clearance and vehicle screening methods and procedures that will allow CBP to complete its mission with as minimal an impact on transportation system performance as possible. It is recommended that VTrans and the Federal agencies focus on the Highgate Springs crossing.

Regulations

Harmonize regional truck weight limits. Work toward increasing or harmonizing truck weight limits was advanced in 2011 when Federal legislation authorized a twenty-year trial of an increase in the maximum allowable truck weight on Interstate highways in Vermont and Maine to

99,000 lbs. Although the increase in maximum allowable weight limits has not become a permanent part of Federal Highway Administration or VTrans policy, Vermont motor carriers have requested that Vermont's weight limits be harmonized with weight limits in neighboring states. VTrans should work with New York State, New Hampshire, Maine and Massachusetts to explore options for harmonizing regulations among the states.

Implement one-stop regional oversize/overweight (OS/OW) permitting system. VTrans has streamlined its oversize/overweight permitting process by developing an online web portal. Motor carriers and shippers have recommended that the Northeast states implement a one-stop regional oversize/overweight permitting program that also offers on-line processing. The states, with support from the Federal Highway Administration, the Federal Motor Carrier Safety Administration, AASHTO and I-95 Corridor Coalition have intermittently explored such programs; that effort should be renewed and a program implemented.

Institutions/Organization

Continue to coordinate freight transportation planning and investment among the New England states, New York State and the Canadian provinces. Coordination of transportation planning and investments among the states and provinces is important to ensure that issues impacting regional trade are identified and addressed strategically, such that one state's investment does not simply shift a problem "downstream" to the state. Multi-state coordination is especially important in the New England region where many states may incur benefits or costs as a result of one state's action (or inaction). Vermont officials participate in many regional coordination organizations, including the I-95 Corridor Coalition, the Coalition of Northeastern Governors (CONEG), the New England-New York Transportation Compact and others. Continued involvement in regional organizations such as these will allow the region's officials to develop a collaborative regional vision for freight and prioritize investments. Vermont and its neighboring states should also seek to establish a stronger link between economic development and transportation priorities to allow the region's industries to compete more effectively in national and global markets.

7.3 HIGHWAY OPERATIONS PACKAGE

Highways carry more than 70 percent of the State's total freight volume by tonnage and nearly 89 percent by value. They are the critical component of the State's freight transportation infrastructure. The State's highway network is generally rated as adequate to meet freight demand now and in the future. However, it is important that reliable highway travel times between Vermont and regional markets are maintained and that highway pavements and bridges are kept in a state of good repair. In addition, truck climbing lanes are needed on a number of strategic truck routes, real-time incident and travel information should be more widely available and the State's oversize/overweight

permitting process can be further streamlined. Addressing these deficiencies would improve system efficiency and the reliability of truck access to and from Vermont businesses. The Highway Operations Package recommends specific infrastructure, operations and regulatory actions to maintain and improve reliable access to major regional suppliers and markets. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.4.

Table 7.4 Highway Operations Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Infrastructure						
Improve efficiency on major state highways, including US Routes 2, 4 and 7 and Vermont Routes 9, 22A and 103.	Lead	High	High	High	High	Mid
Maintain a state of good repair (SOGR) on the state's highway network.	Lead	High	High	High	High	High
Operations						
Keep highways open through prompt and effective snow removal, incident management and clearance	Lead	Mid	High	High	High	High
Monitor system performance and communicate traffic and roadway conditions directly to motor carriers and truck drivers	Lead	Mid	High	Mid	High	High
Maintain level of effort in truck safety monitoring and enforcement	Lead	Low	High	Mid	High	High
Regulations						
Streamline truck OS/OW permitting website	Lead	Low	Mid	High	High	Low

Highway Operations Package Recommendations

Infrastructure

Improve efficiency on major state highways, including US Routes 2, 4 and 7 and Vermont Routes 9, 22A and 103. The primary existing travel routes across the state, such as US Route 2, US Route 4 and US Route 7 and Vermont Routes 9, 22A and 103, offer occasional truck climbing and passing lanes, but are primarily two-lane rural highways. The efficiency and reliability of these routes can be improved by adding truck climbing lanes where steep grades exist, reducing curb cuts in commercial districts and coordinating signal phases in urban areas. The cost of investing in highway infrastructure will be significant, especially when access management or widening require property takings or result in impacts that require mitigation, so strategies to improve

these routes should be studied carefully and the full range of benefits, costs and risk evaluated.

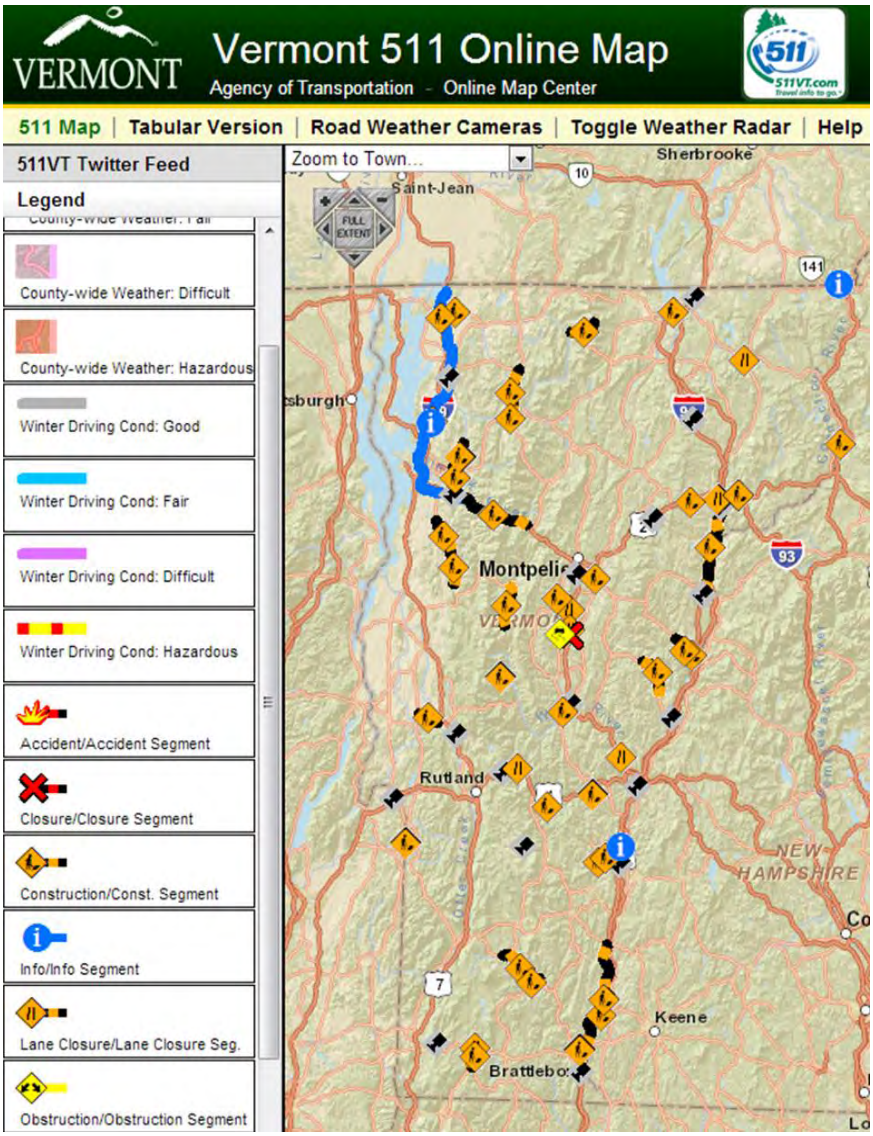
Maintain state of good repair (SOGR) on the state's highway network. The highway system is in good condition. The State has made significant investments to replace or rehabilitate weight- and clearance-restricted bridges. This will eliminate many state-of-good-repair issues, contributing to the MAP-21 goal of a well maintained national freight network and highway system. A SOGR on the highway network ensures that the network can safely and efficiently accommodate trucks with minimal potential for disruption due to bridge failures or other forms of deterioration. Going forward, continued monitoring and maintenance of pavement and bridges will be required to sustain a state of good repair on the state's highway system.

Operations

Keep highways open though prompt and effective snow removal, incident management and clearance, etc. Of critical importance to the State's economy is the ability to move freight into and out of the State efficiently and reliably, regardless of incidents related to weather or vehicular crashes. In a world of just-in-time manufacturing and retailing, prompt clearance of snow and ice from road surfaces, removal of downed trees and effective management and clearance of highway incidents can mean the difference between winning and losing business for motor carriers and their clients. Extended highway closures can result in loss of revenues and contribute to industry decisions to relocation. This plan recommends that VTrans maintain its commitment to clearing roadways of obstacles created by weather or incidents and to keep highways open and operable for the benefit of freight and passenger traffic.

Monitor system performance and communicate traffic and roadway conditions directly to motor carriers and truck drivers. To better manage the transportation system in the event of emergencies, intelligent transportation systems (ITS) technologies such as variable message signs, web-based portals (including the State's 511 website shown in Figure 7.2) and smart phone messaging should be deployed to alert travelers of travel conditions and suggest alternate routes. VTrans is currently deploying ITS technologies along a long section of I-89 between Sharon and Colchester. This program should be expanded to provide real-time information on border-crossing queues and travel information along other corridors such as I-91, US 7 and VT 9. Information targeted to truckers should be made available on variable message signs along the routes and through media outlets such as the VTrans website and text and e-mail alerts. The Washington State Department of Transportation has developed an extensive program of alerts for motor carriers and could serve as a model for similar efforts in Vermont. The deployment of ITS technologies represents a moderate level of investment, but the benefits can be significant if motor carriers are offered early warnings of incidents and closures and information on alternate routes.

Figure 7.2 Vermont 511 Website



Maintain level of effort in truck safety monitoring and enforcement. The ITS program should be expanded to include weight-in-motion systems, which estimate truck weights while vehicles are traveling at highway speeds. For a relatively low level of capital investment, the loss of carrier productivity and the risk of crashes occurring at conventional weigh station queues can be substantially reduced.

Regulation

Streamline truck OS/OW permitting website. VTrans has streamlined its oversize/overweight permitting process by developing an online web portal. Motor carriers and shippers have suggested further improvements to the online oversize/overweight permitting process and recommended that

VTrans consider issuance of annual permits, acceptance of credit card payment of permit fees in lieu of an escrow account and provision of information on the permitting process, routes and requirements.

In addition, motor carriers regard the requirement that oversize/overweight haulers notify each town along the carrier's intended route as onerous. VTrans should take steps to simplify this process by allowing motor carriers to create a profile on the permitting web portal, into which they can enter their travel information for one-time or recurring trips. The web application could then automatically generate notices to the affected communities when oversize/overweight are approved by VTrans.

7.4 RAIL DEVELOPMENT PACKAGE

Most of Vermont's rail infrastructure is aging and cannot carry railcars loaded to 286,000 lbs., the de facto national standard. This forces Vermont rail shippers and customers to under-load rail cars. Moreover, most tracks are maintained to FRA Class 1 or Class 2 standards because of the age of the infrastructure and limited maintenance funds. Freight trains are limited to traveling at 10 miles per hour on FRA Class 1 tracks and limited to 25 miles per hour, FRA Class 2 tracks. Rail operations in Vermont are further complicated by the fact that the regional and short line railroads operating within the state must interchange railcars with the national Class I railroads at terminals outside Vermont. This is often time-consuming and inefficient, making rail service even less competitive with trucking. Finally, the Vermont rail system cannot accommodate doublestack intermodal trains, deriving shippers and railroads of the economies of scale afforded by doublestack rail service. All of these constraints drive up transportation costs for rail customers in Vermont.

The Rail Development Package recommends actions to keep rail freight services viable and maintain market competition with trucking; allow for future growth in mid-length intermodal services (distances approximately 500 miles); and improve the freight rail market share. The actions include advancing projects that bring the State's rail network infrastructure up to current national standards; pursuing programs and policies that improve and bring rail service to Vermont shippers; and bringing shippers to rail by retaining and recruiting rail-served industries to Vermont. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.5.

Table 7.5 Rail Development Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Infrastructure						

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Upgrade all lines to 286K weight-bearing capability.	Lead and support	High	High	High	High	Mid
Maintain trackage at FRA Track Class II or better.	Lead and support	Mid	High	High	High	Mid
Preserve rail siding access to existing industrial sites.	Advocate	Low	Mid	High	High	Mid
Preserve rail-served industrial sites for new development.	Advocate	Low	Mid	High	High	Mid
Facilitate development of transload and intermodal terminals in or near Vermont where markets warrant.	Advocate	Low	Mid	High	Mid	Mid
Operations						
Encourage more direct and timely interchange between Vermont RRs and the Class I RRs .	Advocate	Low	Mid	High	High	Low
Institutions/Organization						
Develop quick-response capability to leverage economic development opportunities with transportation investment/improvement.	Lead	Low	High	Mid	Low	Mid
Participate in multistate rail planning and programming to improve regional rail network.	Lead	Low	High	Mid	Mid	Mid
Educate shippers about rail and IMX service options and contracting approaches.	Lead	Low	Low	High	High	Low

Rail Development Package Recommendations

Infrastructure

Upgrade all lines to 286K weight-bearing capability. The recommendation of this plan is for VTrans (the agency responsible for the State-owned rail lines) and private railroad owners to advance programs to upgrade track and bridges to safely accommodate 286,000 lbs. railcars. With a 286,000 lbs.-capable rail system, Vermont will be better connected to North America's primary freight rail network, making rail a more competitive option for many of Vermont's shippers and receivers. VTrans and the private railroads are expected to take the lead on advancing upgrade programs on their respective infrastructure. The cost of upgrading all of the freight rail lines in the State would likely exceed $100 million, a significant share of which would be the State's responsibility. The State will benefit from increased economic competitiveness; private railroads will gain competitive advantages and increased business; rail-dependent shippers and receivers in Vermont will have an improved level of rail service; and other shippers and receivers may find rail to be a more attractive alternative mode than it is today.

Figure 7.3 New England Central Railroad Rail Replacement Project, 2011

Maintain trackage at FRA Track Class II or better. Most main line trackage in the State of Vermont meets the Federal Railroad Administration (FRA) Class 2 and Class 3 track criteria. Freight trains are permitted to travel at speeds up to 25 miles per hour on Class 2 track and 40 miles per hour on Class 3 track. However, several segments of rail in the State are classified as Class 1, on which freight trains may not exceed speeds of 10 miles per hour. The Class 1 segments in Vermont include the Vermont Railway south of Rutland, the Washington County Railroad and the NECR Winooski Branch. Slow train speeds result in longer travel times and lengthier delays at grade crossings. It is recommended that VTrans assume the lead role in upgrading Class 1 track on the Vermont Railway and Washington County Railroad and maintaining all State-owned trackage at FRA Class 2 standard or better. Moving freight at 25 miles per hour will keep travel times and transportation costs reasonable and allow Vermont shippers to consider rail as a viable alternative.

Preserve rail siding access to existing industrial sites. When rail sidings are lost due to lack of maintenance or change of use, shippers lose their access to the rail network. Shippers must then transport goods by truck to an off-site transload facility or the goods may be shipped by truck for the entirety of the trip. There are several accessible sidings in the State, including locations in Manchester, Middlebury, Shaftsbury and North Bennington (Whitman Feeds), but additional points of access with transloading and staging capabilities are needed. This plan recommends that VTrans identify rail siding access to industrial sites where rail customers currently exist or where rail shippers may develop new facilities and advocate for their preservation. Such a program would maintain rail as a viable transportation option for the State's shippers. The investment in maintaining existing sidings is small relative to the cost of rebuilding sidings that have fallen into a state of disrepair.

Preserve rail-served industrial sites for new development. Rail-served industrial sites in the State of Vermont are a limited and precious resource and should be preserved for continued use by rail freight-generating or rail-freight receiving businesses. When a rail-served industry closes its doors, many local governments look to redevelop the sites as retail centers or truck-oriented industrial parks, essentially eliminating the opportunity for new rail-served industries to move in at a later date. In order for rail to increase its mode share of Vermont freight, shippers must have access to the rail network. It is recommended that VTrans assume an advocacy role, working with local economic development authorities and planners, to communicate the importance of preserving rail-served industrial land.

Facilitate development of transload and intermodal terminals in or near Vermont where market warrants. Both Norfolk Southern and CSX are investing in improved rail service to New York State and the New England; however, neither railroad serves Vermont directly. VTrans should explore near-or mid-term opportunities to develop transload and intermodal terminals and service within Vermont. The availability of transload and intermodal terminal will generate cost savings for some Vermont shippers and receivers and lay the groundwork for growth in intermodal rail services and eventual development of facilities within Vermont.

Operations

Encourage more direct and timely interchange between Vermont RRs and the Class I RRs. The delays incurred in the interchange of railcars between Vermont's railroads and the Class I railroads results in a loss of service reliability and increased costs. VTrans should advocate on behalf of Vermont shippers for operating agreements between Vermont's shortline railroads and the Class I railroads that improve the efficiency of interchanging to reduce delays and associated costs.

Institutions/Organization

Develop quick-response capability to leverage economic development opportunities with transportation investments and improvements. In order to take advantage of Vermont's rail system assets, State and local transportation and economic development agencies must share a common understanding of the linkages between freight transportation, economic development and land use decisions. VTrans should take a lead role in developing collaborative working relationships with state and local economic development agencies and tools that planners can use to track the location decisions of emerging industries and spot opportunities to bring new shippers to rail service. Such tools might include GIS databases of available rail-served industrial sites linked to economic development agency marketing campaigns; and spreadsheets that allow VTrans, economic development agencies, local governments and prospective industries to quickly calculate the public and private benefits of locating at existing or developing new rail-served sites.

Participate in multistate rail planning and programming to improve regional rail network. Coordination of transportation planning and investments among pairs or groups of states is important to ensure that issues impacting regional trade are identified and addressed strategically. Vermont officials participate in many regional coordination organizations, including the I-95 Corridor Coalition, the Coalition of Northeastern Governors (CONEG), the New England-New York Transportation Compact and others. While many of these organizations' activities are focused on passenger rail strategies, it is important to consider and plan for freight rail needs and opportunities. Continued involvement in regional organizations such as these will allow the region's officials to develop a collaborative regional vision for freight rail, establish a stronger link between economic development and rail investments and prioritize rail investments in the region.

Educate shippers about rail and intermodal service options and contracting approaches. Many shippers, particularly managers of smaller firms, may be not aware of the full range of shipping options available to them within Vermont. There is a need to improve the knowledge base of these business managers; utilizing more cost-effective solutions could make them more competitive. VTrans should, through continued outreach to Vermont's shippers and receivers, provide information regarding how freight rail works, who the rail operators are and the potential benefits that can be realized by shipping by rail.

7.5 AIR FREIGHT PACKAGE

Air freight provides transportation for high-value and extremely time-sensitive cargo. While air freight tonnage is low compared to the tonnage carried by truck and rail, air transport serves businesses shipping high-value electronics, business parcels and exotic food products. The Burlington, Montpelier and Rutland airports now offer regularly scheduled air cargo service and FedEx recently opened service to the Northeast Kingdom. Nevertheless, the number of air cargo carriers and the range of air freight services available in Vermont are limited. The Air Freight Package recommends actions to expand the air freight and cargo services such as maintaining airport infrastructure and expanding the runway at Newport to accommodate larger planes. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.6.

Table 7.6 Air Freight Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Maintain airport runway surfaces, approaches and instrumentation in state of good repair	Lead	Low	Mid	High	High	Low

Expand runways at the Newport, Middlebury and Rutland airports	Lead	High	Mid	High	High	Low

Air Freight Package Recommendations

Maintain airport runway surfaces, approaches and instrumentation in state of good repair. To keep the current levels of air freight service, VTrans must maintain state-owned airport runway surfaces, approaches, hangars and instrumentation in a state of good repair and up to current standards as dictated by the Federal Aviation Administration and air cargo industry standards. By maintaining the infrastructure, Vermont airports can better retain their current air cargo carriers and shippers and attract new carriers and shippers. This will help ensure competition on service price and quality that will benefit Vermont shippers.

Expand runways at Newport, Middlebury and Rutland Airports. Although Newport State Airport is capable of accommodating limited air cargo service, the airport could provide regular freight services and host more air cargo carriers. However, at 4,000 feet, the existing runway is too short to accommodate the turbo-prop cargo airplanes used by air freight carriers. It is recommended that VTrans expand the two runways at Newport State Airport to 5,000 feet. The benefits of this project include increased reliability in air cargo service to the Northeast Kingdom region and potential investment by air cargo carriers in Newport. Implementation issues include the proximity of residences along Coventry Station Road, approximately ¾-mile to the south of the existing runway. Middlebury State Airport is similarly hampered in accommodating freight flows with a runway length of 2,500 feet and should be extended to 3,900 feet. A mechanical resting system should also be installed at Rutland Southern Vermont Regional Airport.

Figure 7.4 Middlebury (top), Newport (center) and Rutland (bottom) Airports

Source: VTrans

7.6 PERFORMANCE MEASURES PACKAGE

An inclusive and consistent set of performance measures is an important tool for assessing the condition of a transportation system, identifying trends and issues and setting priorities among potential investments and policies. Condition and performance measures, particularly of the National Highway System and Interstate Systems, as well as safety, emissions and freight movement measures, are mandated at the Federal level by MAP-21. These measures can help Vermont achieve the MAP-21 requirement to set targets and report on progress towards achieving them. The measures can also help inform stakeholders, policymakers and the general public about the impacts of freight transportation on the state's economy and quality of life.

The Performance Measures Package recommends development and use of measures that gauge the performance of the Vermont freight transportation system and support informed and cost-effective investments. The recommendations cover measures of direct value to VTrans and are consistent with the VTrans Strategic Plan. It also includes measures that are useful to shippers, carriers and communities. The expected levels of effort to implement the recommendations and the allocation of anticipated benefits are shown in Table 7.7.

Table 7.7 Performance Measures Package Recommendations

Recommendation	VTrans Role	Estimated Level of State Investment	Allocation of Anticipated Benefits			
			VTrans	Shippers	Carriers	Communities
Refine and adopt freight performance measures	Lead	Low	High	Mid	Mid	Mid

Adopt procedure for performance monitoring	Lead	Mid	High	Mid	Mid	Mid
Create and publish "dashboard" of VTrans freight performance measures	Lead	Low	High	High	High	High

Performance Measures Recommendations

Refine and adopt freight performance measures. By adopting a fuller set of freight-specific performance measures and applying them to the State's modal planning activities, VTrans will acquire a more comprehensive understanding of the performance of the transportation system as it relates to cost, speed and reliability affecting public and private sector stakeholders. The measures will also serve as a tool to measure the cost-effectiveness of investments in each of the transportation modes. The development of freight performance measures and the application of those measures to VTrans' planning, project development and service delivery activities must be done by VTrans, but public and private stakeholder groups should be given an opportunity to review and provide comments on their validity and reliability. In addition, the performance measures should be reviewed to determine whether they meet the requirements to be determined by USDOT for state performance reporting under MAP-21.[28] The recommended freight system performance measures are listed in Table 6.1

Adopt procedures for performance monitoring. Once performance measures are defined, VTrans should identify procedures for conducting an on-going performance monitoring program. The program will require the collection and warehousing of data and information from a variety of public and private sources. The data and information must be collected on a regular basis and assembled for comprehensive analysis so that trends may be identified. The data collection cycles should coincide with MAP-21 reporting requirements and the regular updates to the Vermont Freight Plan, which have typically occurred every 5 to 7 years. Tending the database will require regular updating and maintenance by one or more VTrans staff with the pay-off to VTrans measured in capital, operating and safety savings.

Create and publish "dashboard" of VTrans freight performance measures. A critical step in establishing a freight transportation performance measurement system is to make it visible. The preferred approach is to develop a "dashboard" that can be displayed on the VTrans website. The dashboard would show the past history, current levels and anticipated trends in key freight performance measures. As one example, the dashboard might show the deterioration or improvement of truck travel times along major trade corridors between Burlington and Boston or Burlington and Montreal. The visibility of a dashboard has two important effects: first, it will impose a measure of accountability on the VTrans. It VTrans collects, posts and tracks

[28] As of July, 2013 the Federal Highway Administration has estimated that the reporting requirements will begin by October 1, 2016 with updates required every 2 years after. See http://www.fhwa.dot.gov/tpm/about/freight.cfm

its performance data publicly, it will be compelled to pay attention to the trends and consider adjusting policies, programs and projects accordingly. Second, the visibility of the dashboard will educate and inform shippers and carriers, imposing a level of accountability on them as well to understand and support VTrans freight policies, programs and projects.

7.7 PROGRAMMED FREIGHT PROJECTS

The following projects have been identified as critical freight needs, based on truck volumes and their importance to intra and interstate freight flow movements. The project list is limited to highway projects and includes defined short to medium term projects contained in VTrans' capital program. Other sections in this plan include longer-range recommendations for the state's highway system.

I-89 Freight Projects

INTERSTATE BRIDGES	BERLIN IM DECK(42)	I-89	REPLACEMENT OF DECK AND MINOR RELATED WORK ON BRIDGE 37N ON I 89 IN BERLIN OVER TH 40
INTERSTATE BRIDGES	BERLIN IM DECK(43)	I-89	REPLACEMENT OF DECK AND MINOR RELATED WORK ON BRIDGE 37S ON I 89 IN BERLIN OVER TH 40
INTERSTATE BRIDGES	BERLIN IM DECK(44)	I-89	REPLACEMENT OF DECK AND MINOR RELATED WORK ON BRIDGE 38N ON I 89 IN BERLIN OVER VT 62
INTERSTATE BRIDGES	BERLIN IM DECK(45)	I-89	REPLACEMENT OF DECK AND MINOR RELATED WORK ON BRIDGE 38S ON I 89 IN BERLIN OVER VT 62
INTERSTATE BRIDGES	BOLTON IM 089-2(45)	I -89	SCOPING TO EVALUATE ALTERNATIVES FOR BR51-3 ON I-89 IN BOLTON, OVER TH4.
PAVING	BROOKFIELD-MONTPELIER IM 089-1(61)	I -89	RESURFACE I-89 IN BROOKFIELD, WILLIAMSTOWN, BERLIN AND MONTPELIER, BEGINNING APPROX. 6 MILES NORTH OF EXIT #4 AND EXTENDING NORTHERLY 15.565 MILES, IN THE SOUTHBOUND LANE ONLY.
ROADWAY PROJECTS	BURLINGTON MEGC M 5000(1)	I-I89	ADDITIONAL PRELIMINARY ENGINEERING FUNDS TO COMPLETE DESIGN ON THE ENTIRE SO. CONNECTOR PROJECT
INTERSTATE BRIDGES	COLCHESTER IM 089-3(69)	I-89	REPLACE DECK AND RAILING ON BRIDGE NOS. 76 N&S AND 77 N&S ON I-89 IN COLCHESTER
INTERSTATE BRIDGES	COLCHESTER IM 089-3( )	I-89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 75 ON I-89 IN COLCHESTER, TH9 OVER I-89
INTERSTATE BRIDGES	COLCHESTER IM 089-3(69)	I-89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NOS. 76 N&S AND 77 N&S ON I-89 IN COLCHESTER.
INTERSTATE BRIDGES	GEORGIA IM 089-3( )	I -89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 85-1 (SHORT) ON I-89 IN GEORGIA.
ROADWAY PROJECTS	GEORGIA-ST. ALBANS IM IR 089-3(15)	I-89	REHAB PAVEMENT, SHOULDERS, DITCHES, DRAINAGE AND ADJUST GUARDRAIL AS NECESSARY, RESURFACE OR REHAB INTERCHANGE RAMPS. UPGRADE EXISTING SIGNS, ROW FENCES, DI.'S AND OTHER SAFETY RELATED ITEMS. MM 106.90 SB TO MM 117.85 N&SB.
INTERSTATE BRIDGES	LEBANON-HARTFORD IM A001(154)	I-89	REHABILITATION AND WIDENING OF I-89 BRIDGES SHARED WITH NEW HAMPSHIRE, OVER THE CONNECTICUT RIVER. NH BRIDGE NUMBERS 044/103 AND 044/104.

INTERSTATE BRIDGES	MIDDLESEX IM 089-2(50)	I-89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 45-1 (SHORT) ON I-89 IN MIDDLESEX.
INTERSTATE BRIDGES	MIDDLESEX IM 089-2(41)	I-89	REPLACEMENT OF BR44 ON I-89 IN MIDDLESEX, US2 OVER I-89 AND THE NEW ENGLAND CENTRAL RAILROAD.
INTERSTATE BRIDGES	RICHMOND IM 089-2( )	I -89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 55S ON I-89 IN RICHMOND, OVER TH4 (FAS 0209).
INTERSTATE BRIDGES	RICHMOND IM 089-2( )	I -89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 53N IN RICHMOND, OVER US2 (JONESVILLE).
INTERSTATE BRIDGES	ROYALTON IM 089-1(63)	I-89	REHAB OR REPLACE BR26N&S ON I-89.
INTERSTATE BRIDGES	SHARON IM 089-1(64)	I-89	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 17N&S ON I-89 IN SHARON, OVER VT14 AND THE WHITE RIVER.
ROADWAY PROJECTS	SOUTH BURLINGTON IM 089-3( )	I-89	ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION OF A NEW INTERCHANGE ON I-89, AT VT116 IN SOUTH BURLINGTON.
ROADWAY PROJECTS	SWANTON IM 089-3( )	I-89	PROJECT IS FOR REPAIR AND/OR REPLACEMENT OF GUARDRAIL, SIGNS, ROW FENCE, AND DRAINAGE ALONG I-89 IN SWANTON, BEGINNING APPROX. AT THE ST. ALBANS-SWANTON TOWN LINE AND EXTENDING NORTHERLY 2.3 MILES.
ROADWAY PROJECTS	SWANTON-HIGHGATE IM 089-3( )	I -89	PROJECT IS FOR SAFETY IMPROVEMENTS ALONG I-89 IN SWANTON AND HIGHGATE, BEGINNING APPROX. AT EXIT #21 AND EXTENDING NORTHERLY TO THE CANADIAN BORDER. WORK INCLUDES: REPLACE TRAFFIC SIGNS, DRAINAGE IMPROVEMENTS, REPAIR/REPLACE R.O.W. FENCE, IMPROVE GUARDRAIL, REPAIR BRIDGE DECKS, CURB AND RAILING.
PAVING	WATERBURY-RICHMOND IM SURF(58)	I-89	Resurface I-89 NB & SB, beginning in Waterbury at MM 66.0 and ending in Richmond at MM 79.0.
ROADWAY PROJECTS	WILLISTON-SOUTH BURLINGTON IM 089-3(35)	I-89	SCOPING AND ENVIRONMENTAL ASSESSMENT FOR CONSTRUCTION OF A FULL INTERCHANGE ATEXIT #13 IN SOUTH BURLINGTON, AND POSSIBLE IMPROVEMENTS TO THE I-89 MAINLINE BETWEEN EXIT #12 IN WILLISTON AND THE WINOOSKI RIVER BRIDGE (BR70).

I-91 Freight Projects

INTERSTATE BRIDGES	BARNET IM 091-2( )	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BR77S ON I-91 IN BARNET, OVER US5 AND THEPASSUMPSIC RIVER.
PAVING	GUILFORD-BRATTLEBORO IM SURF(60)	I-91	Resurfacing I-91 NB from mm 0.00 to mm 12.0.
PAVING	GUILFORD-BRATTLEBORO IM SURF(61)	I-91	Resurfacing along I-91 SB beginning at MM 0.00 and continuing to MM 12.0.
INTERSTATE BRIDGES	HARTLAND IM 091-1(68)	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BR37 ON I-91 IN HARTLAND, TH41 OVER I-91.
INTERSTATE BRIDGES	NORWICH IM 091-2( )	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 48S ON I-91 IN NORWICH, OVER VT10A.
INTERSTATE BRIDGES	ROCKINGHAM IM 091-1(66)	I-91	REHABILITATION OF BRIDGE NOS. 24 N&S ON I-91 IN ROCKINGHAM, OVER THE GREEN MOUNTAIN RAILROAD AND THE WILLIAMS RIVER.
INTERSTATE BRIDGES	SPRINGFIELD IM 091-1( )	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 28N&S ON I-91 IN SPRINGFIELD, OVER US5.
INTERSTATE BRIDGES	SPRINGFIELD IM 091-1(74)	I-91	REHAB OR REPLACE BR26 N&S ON I-91.
INTERSTATE BRIDGES	WEATHERSFIELD IM 091-1(69)	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BR30 N&S ON I-91 IN WEATHERSFIELD, OVER VT131.
INTERSTATE BRIDGES	WESTMINSTER IM 091-1(70)	I-91	SCOPING TO EVALUATE ALTERNATIVES FOR BR21 N&S ON I-91 IN WESTMINSTER OVER TH1

U.S 2 Freight Projects

ROADWAY PROJECTS	CABOT-DANVILLE FEGC F 028-3(26)C/2	US-2	RECONSTRUCTION OF US2 IN CABOT, BEGINNING 2.80 MILES EAST OF THE MARSHFIELD-CABOT T/L EXTENDING EASTERLY 1.49 MILES
ROADWAY PROJECTS	CABOT-DANVILLE FEGC F 028-3(26)C/3	US-2	RECONSTRUCTION OF US2 IN CABOT AND DANVILLE, BEGINNING 5.29 MILES EAST OF THE MARSHFIELD-CABOT T/L AND EXTENDING EASTERLY 1.29 MILES.
INTERSTATE BRIDGES	COLCHESTER NH 028-1(31)	US-2	Project is for improvements to the US Route 2 and US Route 7 intersection and the US Route 2 and Interstate 89 Exit 17 intersections. Project also includes bridge replacement and corresponding roadway improvements.

STATE HIGHWAY BRIDGES	COLCHESTER BF 028-1(29)	US-2	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 18A ON US2 IN COLCHESTER, OVERI-89.
STATE HIGHWAY BRIDGES	LANCASTER-GUILDHALL BHF A001(159)	US-2	REHABILITATION AND PAINTING OF BR127 ON US2, OVER THE CONNECTICUT RIVER BETWEEN LANCASTER, NH AND GUILDHALL, VT. NH BRIDGE NUMBER 111/129.
STATE HIGHWAY BRIDGES	NORTH HERO BF 028-1(30)	US-2	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 5 ON US2 IN NORTH HERO, OVER ALBURGH PASSAGE.
STATE HIGHWAY BRIDGES	NORTH HERO-GRAND ISLE BHF 028-1(26)	US-2	REHABILITATION OF BRIDGE NO. 8 ON US2 BETWEEN NORTH HERO AND GRAND ISLE, OVER LAKE CHAMPLAIN.
ROADWAY PROJECTS	PLAINFIELD-CABOT NH 028-3(37)SC	US-2	PROJECT SCOPING FOR 3-R IMPROVEMENTS TO US2 IN PLAINFIELD, MARSHFIELD AND CABOT, BEGINNING AT THE EAST MONTPELIER-PLAINFIELD TOWN LINE AND EXTENDING EASTERLY 9.767 MILES.
Paving	PLAINFIELD-DANVILLE NH PS19(1)	US-2	Resurfacing along US 2 from Plainfield MM 0.987 to Danville MM 1.755.
INTERSTATE BRIDGES	RICHMOND IM 089-2(52)	US-2	Scoping to evaluate alternatives for bridge no. 29 on US-2 in Richmond over I-89.
PAVING	RICHMOND-BOLTON STP 2924(1)	US-2	RESURFACE US2 IN RICHMOND AND BOLTON, BEGINNING AT THE WILLISTON-RICHMOND TOWN LINE AND EXTENDING EASTERLY 8.239 MILES.
STATE HIGHWAY BRIDGES	WATERBURY BF 0284( )	US-2	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 44 ON US2 IN WATERBURY, OVER THE LITTLE RIVER.
ROADWAY PROJECTS	WATERBURY FEGC F 013-4(13)	US-2	RECONSTRUCTION OF MAIN ST IN VILLAGE OF WATERBURY BEGINNING 0.04 MILE EAST OF VT100 NO. INTERSECTION EXTENDING EASTERLY 0.98 MILE.
ROADWAY PROJECTS	WILLISTON STP M 5500(7)S	US-2	RECONSTRUCTION OF THE INTERSECTION AT INDUSTRIAL AVE AND RESURFACING OF US2 IN WILLISTON, BEGINNING AT THE SO. BURLINGTON-WILLISTON T/L AND EXTENDING EASTERLY 1.05 MILES.

Vermont I-189 Freight Projects

ROADWAY PROJECTS	BURLINGTON MEGC M 5000(1)	I-I89	ADDITIONAL PRELIMINARY ENGINEERING FUNDS TO COMPLETE DESIGN ON THE ENTIRE SO. CONNECTOR PROJECT

U.S 4 Freight Projects

PAVING	HARTFORD NH 2927( )	US-4	RESURFACE US4 IN HARTFORD, BEGINNING 5.78 MILES EAST OF THE HARTLAND-HARTFORD TOWN LINE AND EXTENDING EASTERLY 0.83 MILES TO THE US5 INTERSECTION. ALSO INCLUDES THE QUECHEE STATE HIGHWAY (0.123 MILE).
ROADWAY PROJECTS	HARTFORD NH SCRP(1)	US-4	REHABILITATION/REPLACEMENT OF 12 SMALL CULVERTS UNDER US4 IN HARTFORD, BEGINNING APPROX. 0.70 MILE EAST OF THE HARTLAND-HARTFORD TOWN LINE AND EXTENDING EASTERLY 0.60 MILE. PROJECT ALSO INCLUDES ONE BOX AT MM 7.63. WORK INCLUDES SLOPE AND DRAINAGE IMPROVEMENTS.
PAVING	HARTFORD STP 2951( )	US-4	RESURFACE US4 IN HARTFORD, BEGINNING 6.610 MILES EAST OF THE HARTLAND-HARTFORDTOWN LINE AND EXTENDING EASTERLY 2.744 MILES TO THE US5 INTERSECTION.
STATE HIGHWAY BRIDGES	KILLINGTON BF 020-2(42)	US-4	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 33 ON US4 IN KILLINGTON, OVER THE OTTAUQUECHEE RIVER.
ROADWAY PROJECTS	RUTLAND TOWN-RUTLAND CITY NH 020-2( )	US-4 / US-7	THIS PROJECT REPRESENTS THE NEXT SCHEDULED IMPROVEMENTS TO START AS IDENTIFIED IN THE NH 020-1(20)SC SCOPING REPORT, FOR US4 AND US7 IN RUTLAND.
TOWN HIGHWAY BRIDGES	WOODSTOCK VILLAGE BF 020-2(43)	US-4	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 51 ON US4 IN WOODSTOCK VILLAGE, OVER KEDRON BROOK.

U.S 5 Freight Projects

ROADWAY PROJECTS	BRATTLEBORO STP 2000(23)	US-5	RECONSTRUCTION OF US5 (PUTNEY RD.) IN BRATTLEBORO, BEGINNING 0.83 MILE NORTH OF THE VT30 JCT. AND EXTENDING NORTHERLY 1.25 MILES TO THE INTERSECTION OF VT9EAST (KEENE TURN).
ROADWAY PROJECTS	COVENTRY STP 0113(66)	US-5	LEDGE REMOVAL ALONG US5 IN COVENTRY, BEGINNING APPROX. 2.66 MILES NORTH OF THEVT14 NORTH INTERSECTION AND EXTENDING NORTHERLY 0.113 MILE. ALSO INCLUDES DITCHING, DRAINAGE AND STREAMBANK STABILIZATION.

INTERSTATE BRIDGES	DERBY IM 091-3(49)	US-5	DECK REHABILITATION AND PREVENTIVE MAINTENANCE ACTIONS ON BRIDGE NO. 1 ON THE US5 CONNECTOR IN DERBY LINE (CASWELL ST.).
ROADWAY PROJECTS	LYNDON STP 0113(65)	US-5	RECONSTRUCTION OF US5 IN LYNDON, BEGINNING 1.87 MILES NORTH OF THE ST. JOHNSBURY TOWN LINE AND EXTENDING NORTHERLY 0.77 MILE.

U.S 7 Freight Projects

TOWN HIGHWAY BRIDGES	BRANDON BHF 019-3(58)	US-7	REHABILITATION OF BRIDGE NO. 114 ON US7 IN BRANDON, OVER THE NESHOBE RIVER.
ROADWAY PROJECTS	BRANDON-LEICESTER NHEGC F 019-3(29)	US-7	RECONSTRUCTION OF US7, BEGINNING BY THE BRANDON TRAINING SCHOOL AND EXTENDING NORTHERLY 7.29 KM TO THE INTERSECTION OF TH5 IN LEICESTER. OMIT 484 METERS IN BRANDON AND 2.13 KM IN
ROADWAY PROJECTS	COLCHESTER STP 5600(9)S	US-7 / VT-2A / VT-127	PROJECT IS FOR NECESSARY IMPROVEMENTS TO THE US7/VT2A/VT127 INTERSECTIONS IN COLCHESTER.
ROADWAY PROJECTS	NEW HAVEN NH F 019-3(38)	US-7	RECONSTRUCTION OF US7 IN NEW HAVEN, BEGINNING 2.6 MILES NORTH OF THE MIDDLEBURY-NEW HAVEN TOWN LINE AND EXTENDING NORTHERLY 0.72 MILE.
STATE HIGHWAY BRIDGES	PITTSFORD BF 019-3(59)	US-7	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 108 ON US7 IN PITTSFORD, OVER FURNACE BROOK.
ROADWAY PROJECTS	PITTSFORD NH 019-3(491)	US-7 SEGMENT 1	RECONSTRUCTION OF US7 IN PITTSFORD, SEGMENT 1: BEGINNING 2.203 KM NORTH OF THE RUTLAND PITTSFORD TOWN LINE AND EXTENDING NORTHERLY 2.205 KM. WORK INCLUDES GRADING AND DRAINAGE.
ROADWAY PROJECTS	PITTSFORD NH 019-3(492)	US-7 - Segment 2	RECONSTRUCTION OF US7 IN PITTSFORD, SEGMENT 2: BEGINNING 4.413 KM NORTH OF THERUTLAND-PITTSFORD TOWN LINE AND EXTENDING NORTHERLY 2.515 KM. WORK INCLUDES GRADING AND DRAINAGE.
ROADWAY PROJECTS	PITTSFORD NH 019-3(493)	US-7 - Segment 3	RECONSTRUCTION OF US7 IN PITTSFORD, SEGMENT 3: BEGINNING APPROX. 2.395 KM NORTH OF THE VT3 INTERSECTION AND EXTENDING NORTHERLY 3.694 KM. WORK INCLUDES WIDENING, FULL SUBBASE RECONSTRUCTION, DRAINAGE, ETC.

ROADWAY PROJECTS	PITTSFORD-BRANDON NH 019-3(494)	US-7 - Segment 4	RECONSTRUCTION OF US7 IN PITTSFORD AND BRANDON.

U.S 302 Freight Projects

STATE HIGHWAY BRIDGES	BERLIN BF 026-1(43)	US-302	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 3 ON US302 IN BERLIN, OVER THE STEVENS BRANCH.
PAVING	GROTON-NEWBURY STP PS19(2)	US-302	This project is to resurface US 302 in Groton, Ryegate and Newbury, starting at MM 4.714 in Groton and extending easterly to Newbury MM 4.629.
STATE HIGHWAY BRIDGES	ORANGE BF 026-1(45)	US-302	Scoping to evaluate alternatives for bridge no. 18 (short) on US-302 in Orange over Brook

VT 2A Freight Projects

ROADWAY PROJECTS	COLCHESTER STP 5600(19)	VT-2A	Project is for improvements to the VT Route 2A corridor and corresponding intersections in the Town of Colchester.
ROADWAY PROJECTS	ESSEX JCT. STP 5300(13)	VT-2A / VT-117	CONSTRUCTION OF A NEW ROAD (CRESCENT CONNECTOR) BETWEEN VT2A AND VT117, AND IMPROVEMENTS TO RAILROAD ST. BETWEEN VT117 AND VT15, IN ESSEX JCT.
ROADWAY PROJECTS	WILLISTON NH 5500(18)	VT-2A	Project is for improvements to the Interstate 89 Exit 12 and VT Route 2A intersections, in combination with corridor and intersection improvements to VT Route 2A between the VT Route 2A intersections with Town Highway 77 (Hurricane Lane) and US Route 2 (Williston Road) in the Town of Williston.
ROADWAY PROJECTS	WILLISTON STP HES 5500(12)	VT-2A	SAFETY IMPROVEMENTS ALONG VT2A IN WILLISTON, BEGINNING 5.220 MILES NORTH OF THE ST. GEORGE TOWN LINE AND EXTENDING NORTHERLY 0.470 MILE. WORK INCLUDES TWO-LANE LEFT TURN LANE FROM TH6 TO EASTVIEW CIRCLE, TRAFFIC SIGNAL AT TH54 (JAMES BROWN DRIVE), AND SIDEWALK BETWEEN TH46 AND EASTVIEW CIRCLE.

VT 9 Freight Projects

TOWN HIGHWAY BRIDGES	BENNINGTON BF 1000(20)	VT-9	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 6 ON VT9 IN BENNINGTON, OVER THE WALLOOMSAC RIVER.
TOWN HIGHWAY BRIDGES	BRATTLEBORO BF 2000( )	VT-9	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 54 ON VT9 IN BRATTLEBORO, OVERWHETSTONE BROOK.
STATE HIGHWAY BRIDGES	SEARSBURG BF 010-1(50)	VT-9	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 20 ON VT9 IN SEARSBURG.
PAVING	WILMINGTON-BRATTLEBORO NH 2971(1)	VT-9	Resurfacing along VT 9 from Wilmington MM 7.077 to Brattleboro MM 4.178.
STATE HIGHWAY BRIDGES	WOODFORD BF 010-1(52)	VT-9	REHAB OR REPLACE BRIDGE NO. 18 ON VT9 IN WOODFORD.

VT 100 Freight Projects

STATE HIGHWAY BRIDGES	DOVER BF 013-1(20)	VT-100	REPLACEMENT OF BRIDGE NO. 59 ON VT100 IN DOVER, OVER THE NORTH BRANCH OF THE DEERFIELD RIVER.
PAVING	EDEN-LOWELL STP 2933( )	VT-100	RESURFACE VT100 IN EDEN AND LOWELL, BEGINNING AT THE VT118 INTERSECTION IN EDEN AND EXTENDING NORTHERLY 8.381 MILES.
STATE HIGHWAY BRIDGES	JOHNSON BF 0248(7)	VT-100C	REPLACEMENT OF BRIDGE NO. 4 ON VT100C IN JOHNSON.
STATE HIGHWAY BRIDGES	JOHNSON BF 0248(4)	VT-100C	REHABILITATE BRIDGE NO. 2 ON VT100C IN JOHNSON, OVER THE GIHON RIVER.
ROADWAY PROJECTS	KILLINGTON-STOCKBRIDGE ER STP 022-1(25)	VT-100	REHABILITATION OF VT100 IN KILLINGTON, PITTSFIELD AND STOCKBRIDGE, BEGINNING AT THE US4 INTERSECTION AND EXTENDING NORTHERLY 10.713 MILES TO THE VT107 INTERSECTION, INCLUDING IMPROVEMENTS TO AREAS DAMAGED AS A RESULT OF TROPICAL STORM IRENE.
STATE HIGHWAY BRIDGES	LOWELL BF 029-2( )	VT-100	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 234 ON VT100 IN LOWELL, OVER EAST BRANCH.
PAVING	LOWELL-TROY STP 2934( )	VT-100	RESURFACE VT100 IN LOWELL, WESTFIELD AND TROY, BEGINNING 3.595 MILES NORTH OF THE EDEN TOWN LINE AND EXTENDING NORTHERLY 8.728 MILES TO THE VT101 INTERSECTION.

STATE HIGHWAY BRIDGES	MORETOWN BF 0167(16)	VT-100B	Scoping to evaluate alternatives for bridge no. 2 on VT-100B in Moretown over Mad River
PAVING	MORRISTOWN STP PC19(3)	VT-100	Class 1 paving in Morristown along VT 100 from MM 4.851 to MM 6.188, VT 12 from MM 2.181 to MM 3.307 and along VT 15A from MM 0.0 to MM 0.36
STATE HIGHWAY BRIDGES	PITTSFIELD BHF 022-1(24)	VT-100	REHABILITATION OF BRIDGE NO. 126 ON VT100 IN PITTSFIELD, OVER THE WEST BRANCH OF THE TWEED RIVER.
STATE HIGHWAY BRIDGES	PLYMOUTH BF 013-3(13)	VT-100	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 115 (SHORT) ON VT100 IN PLYMOUTH, OVER RESERVOIR BROOK.
STATE HIGHWAY BRIDGES	READSBORO BF 0102(16)	VT-100	REPLACEMENT OF BRIDGE NO. 25 ON VT100 IN READSBORO, OVERTHE WEST BRANCH OF THE
PAVING	WATERBURY-STOWE STP 2945(1)	VT-100	RESURFACE VT100 IN WATERBURY AND STOWE, BEGINNING AT THE US2 INTERSECTION AND EXTENDING NORTHERLY 9.688 MILES.
PAVING	WILMINGTON-STRATTON STP PS19(7)	VT-100	Resurfacing VT 100 beginning in Wilmington at MM 2.469 through Dover, ending in Stratton at MM 1.337.

VT 103 Freight Projects

STATE HIGHWAY BRIDGES	CHESTER BF 025-1( )	VT-103	Scoping to evaluate alternatives for bridge no. 16 on VT-103 in Chester over Williams River
STATE HIGHWAY BRIDGES	CHESTER BF 025-1( )	VT-103	SCOPING TO EVALUATE ALTERNATIVES FOR BRIDGE NO. 14 ON VT103 IN CHESTER, OVER THE WILLIAMS RIVER AND THE GREEN MOUNTAIN RAILROAD.
STATE HIGHWAY BRIDGES	ROCKINGHAM NH 025-1( )S	VT-103	REPLACEMENT OF BR4 (CULVERT) ON VT103 IN ROCKINGHAM.
PAVING	ROCKINGHAM-CLARENDON NH SURF(49)	VT-103	RESURFACE VT 103 IN ROCKINGHAM, CHESTER, CAVENDISH, LUDLOW, MT. HOLLY, WALLINGFORD, SHREWSBURY, AND CLARENDON BEGINNING AT THE US 5/VT 103 INTERSECTION IN ROCKINGHAM AND EXTENDING NORTHERLY 42.036 MI. TO THE VT 103/US 7 INTERSECTION IN CLARENDON. OMIT CHESTER CLASS I (1.667 MI.) AND LUDLOW CLASS I (1.573 MI.).

VT 105 Freight Projects

PAVING	ENOSBURG-RICHFORD STP 2939(1)	VT-105 / VT-108 / VT-139	RESURFACE CLASS I ROUTES. ENOSBURG: VT105 - FROM MM 0.464 TO 1.501; VT108 - FROM MM 4.533 TO 5.902; RICHFORD: VT105 - FROM MM 1.546 TO 2.529; AND VT139 - FROM MM 0.000 TO 1.822.
PAVING	RICHFORD STP 2916(1)	VT-105A	RESURFACE VT105A IN RICHFORD, BEGINNING AT THE VT105 INTERSECTION AND EXTENDING NORTHERLY 1.799 MILES TO THE CANADIAN BORDER.
PAVING	RICHFORD-JAY STP 2914(1)	VT-105	RESURFACE VT105 IN RICHFORD AND JAY. BEGINNING 2.529 MILES
STATE HIGHWAY BRIDGES	RICHFORD-SUTTON, PQ BHF 0814(1)	VT-105A	REHABILITATION OF BRIDGE NO. 3 ON VT105A, OVER THE MISSISQUOI RIVER BETWEEN RICHFORD, VT AND SUTTON, QUEBEC.
PAVING	ST. ALBANS-SHELDON STP 2941( )	VT-105	RESURFACE VT105 IN ST. ALBANS, SWANTON AND SHELDON, BEGINNING 0.023 MILE EAST OF THE ST. ALBANS CITY LINE AND EXTENDING EASTERLY 7.833 MILES.

VT 119 Freight Projects

TOWN HIGHWAY BRIDGES	BRATTLEBORO-HINSDALE,NH BRF 2000(19)SC	VT-119	THIS PROJECT REPRESENTS VERMONT'S SHARE OF THE $31.5M VERMONT-NEW HAMPSHIRE PROJECT.

VT 191 Freight Projects

ROADWAY PROJECTS	NEWPORT CITY STP 134-3(22)	VT-191	STABILIZATION OF A LARGE SIDESLOPE ALONG VT191 IN NEWPORT CITY, BEGINNING 0.25 MILE EAST OF THE DERBY-NEWPORT TOWN LINE AND EXTENDING EASTERLY 0.30 MILE.
ROADWAY PROJECTS	NEWPORT CITY STP 134-3(22)	VT-191	STABILIZATION OF A LARGE SIDESLOPE ALONG VT191 IN NEWPORT CITY, BEGINNING 0.25MILE EAST OF THE DERBY-NEWPORT TOWN LINE AND EXTENDING EASTERLY 0.30 MILE.

VT 30 Freight Projects

RAIL PROJECTS	MIDDLEBURY WCRS(23)	VT 30 and Merchants Row, Vermont Railway	LOWER GRADE OF THE VERMONT RAILWAY IN MIDDLEBURY TO ACCOMMODATE 21-FT. VERTICAL CLEARANCE, AND REPLACEMENT OF THE VT30 AND MERCHANTS ROW BRIDGES AT THEIR CURRENT LOCATIONS.

VT 78 Freight Projects

ROADWAY PROJECTS	SWANTON NH 036-1(9)	VT-78	PROJECT IS FOR RECONSTRUCTION OF VT78 IN SWANTON, BEGINNING 729 METERS EATS OF THE ALBURGH-SWANTON TOWN LINE AND EXTENDING EASTERLY 9.482 KM (5.892 MILES) TO THE SWANTON VILLAGE LINE.

Intermodal Freight Projects

ROADWAY PROJECTS	BURLINGTON BREP( )	Railyard Enterprise	DESIGN, ROW AND CONSTRUCTION FOR THE BURLINGTON RAILYARD ENTERPRISE PROJECT.

7.8 USE OF SECTION 167 FREIGHT FORMULA FUNDS

VTrans has identified the following projects for the use of Section 167 Freight Formula funds:

	FFY2016	FFY2017	FFY2018(est)	FFY2019(est)	FFY2020(est)	FFY2021	Total
FHWA National Freight Program (NFP) Apportionment	$5,780,058	$5,493,074	$6,154,454	$6,923,761	$7,693,067		$32,044,414
NFP Obligation Plan:							
Rutland-Burlington VTRY(9)/TIGER VII (transfer to FRA)					$3,200,000		$3,200,000
Rockingham IM 091-1(66)		$7,500,000	$8,184,827.40	$6,231,385	$5,928,202		$27,844,414
Westminster IM 091-1(70)					$500,000	$500,000	$1,000,000
Total		$7,500,000	$8,184,827	$6,231,385	$9,628,202	$500,000	$32,044,414

Project Funding Profiles:	Federal TIGER VII	FHWA Section 130	FHWA NFP Section 167	Other FHWA Annual Formula Funds	VT State Match	Total
Rutland-Burlington VTRY(9)/TIGER VII (transfer to FRA	$10,000,000	$3,528,000	$3,200,000	$0	$9,732,000	$26,460,000
Rockingham IM 091-1(66)	$0	$0	$27,844,414	$18,555,986	$5,155,600	$51,556,000
Westminster IM 091-1(70)	$0	$0	$1,000,000	$9,338,203	$1,148,689	$11,486,892

*Estimated FFY18-FFY20 funding does not include set-asides

A. List of Outreach Activities and Committees

STUDY ADVISORY COMMITTEE

The Study Advisory Committee consisted of representatives from government agencies and key private sector industry representatives. The Committee was convened four times over the course of the study and was charged with reviewing preliminary findings and providing guidance regarding the course of project work. Members of the Study Advisory Committee included:

- Chris Barbieri, Vermont Chamber of Commerce
- Roland Bellavance, Vermont Truck and Bus Association/Bellavance Trucking
- Michele Boomhower, Chittenden County MPO
- Joan Goldstein, Green Mountain Economic Development Corporation
- Jennifer Hoare, Green Mountain Coffee Roasters
- Charles Hunter, New England Central RR/Rail America, Inc.
- Jim McMillan, U.S. Customs and Border Protection
- Costa Pappis, Vermont Agency of Transportation
- Ali Sarafzade, Vermont Department of Economic Development
- Matt Walker, A.N Deringer

FREIGHT FOCUS GROUPS

In 2010 and 2011, six focus group meetings were held in locations throughout the State. The focus groups were an opportunity for the study team to discuss economic development opportunities, freight needs and deficiencies and potential improvement strategies with public sector planning and economic development officials and private sector stakeholders, including several of the State's major shippers and receivers, motor carriers and railroads. The agencies and companies that participated in each of the focus group meetings are listed below.

Focus Group Meeting 1, June 24, 2010, St. Johnsbury

- Mobile Medical International Corporation
- Morrison Grain
- Pellets Now
- Ryegate Power
- Ralston Mills
- Town of Lyndon
- City of Newport
- Quest Transportation Services

- Northeastern Vermont Development Association

Focus Group Meeting 2, July 8, 2010, Brattleboro

- FiberMark
- Fleming Oil
- Fulflex
- Grafton Cheese
- New Chapter
- Pepsi
- Suburban Propane
- Vermont Bread
- Riverside Reload
- Vermont Circuits
- Southern Regional County Regional Planning Commission
- Springfield Economic Development Commission
- Brattleboro Development Credit Corporation
- Windham Regional Planning Commission

Focus Group Meeting 3, July 13, 2010, Burlington

- Greater Burlington Chamber of Commerce
- Burlington Electric Department
- Vermont Businesses for Social Responsibility
- City of St. Albans
- Chittenden Solid Waste District
- Chittenden County Metropolitan Planning Organization
- City of Burlington
- Gobeille Hospitality, Inc.
- Vermont Rail System

Focus Group Meeting 4, July 14, 2010, Bennington

- Bennington Iron Works
- R.K. Miles, Inc.
- Southwestern Vermont Rail Corridor Committee
- J & T Trucking
- VRS-Connect
- Wm E. Dailey/Peckham Industries
- NSK Steering Systems
- Pembroke Landscaping
- Bennington County Industrial Corporation
- Bennington County Regional Commission

Focus Group Meeting 5, March 17, 2011, Rutland

- Vermont Rail System
- Gobeille Hospitality, Inc.
- Chittenden County Metropolitan Planning Organization
- NSK Steering Systems
- Wm. E. Dailey/Peckham Industries
- RK Miles, Inc.
- Bennington County Industrial Corporation
- Pembroke Landscape Contractors
- IDK
- Southwestern Vermont Rail Corridor Committee
- Rutland Chamber of Commerce
- Westminster Crackers Company
- Rutland Regional Planning Commission
- Omya

Focus Group Meeting 6, March 18, 2011, White River Junction

- Quest Transportation Services
- Southern Windsor County Regional Planning Commission
- Windham Regional Commission
- Riverside Reload
- Fibermark
- New England Central Railroad
- Two Rivers-Ottauquechee Regional Commission
- Cushman Lumber
- RSD Leasing
- Justin Excavation and Demolition
- Town of Woodstock