5.0 Development of Additional Modeling Capabilities

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

5.1 Methodology for Evaluating Freight Transportation Projects

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

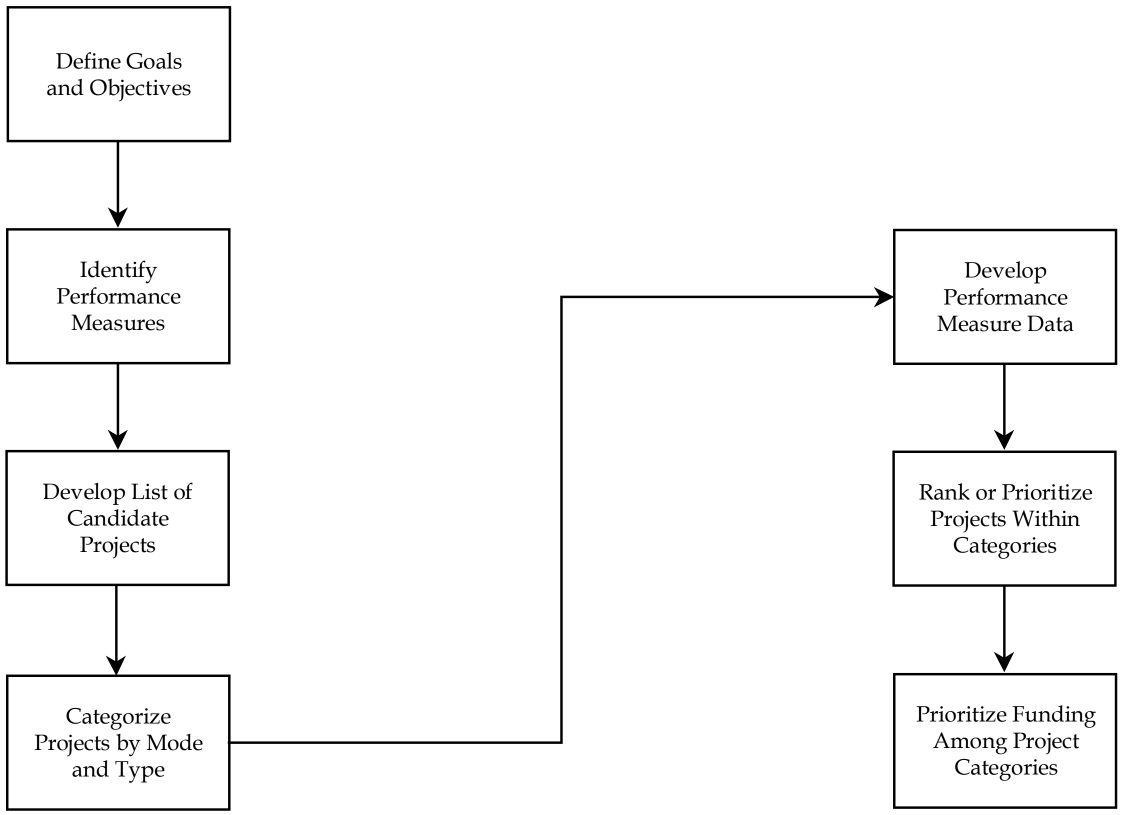
Figure ES.15 outlines a generic approach to evaluating and prioritizing projects, which can be applied to freight as well as passenger-related projects.

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

Table ES.2 Sample Goals and Performance Measures

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

Figure ES.15 Evaluation and Prioritization Approach



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

The prioritization (allocation of funding) *among* categories and modes is then performed separately, based on broader policy decisions and information about program-level effects (e.g., cost to maintain pavement in acceptable condition.) The process of allocating funding to categories will likely be iterative. The list of projects from an initial allocation should be evaluated to determine whether high-priority projects from each category are included. If not, funding allocations and/or priorities may need to be re-evaluated.

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

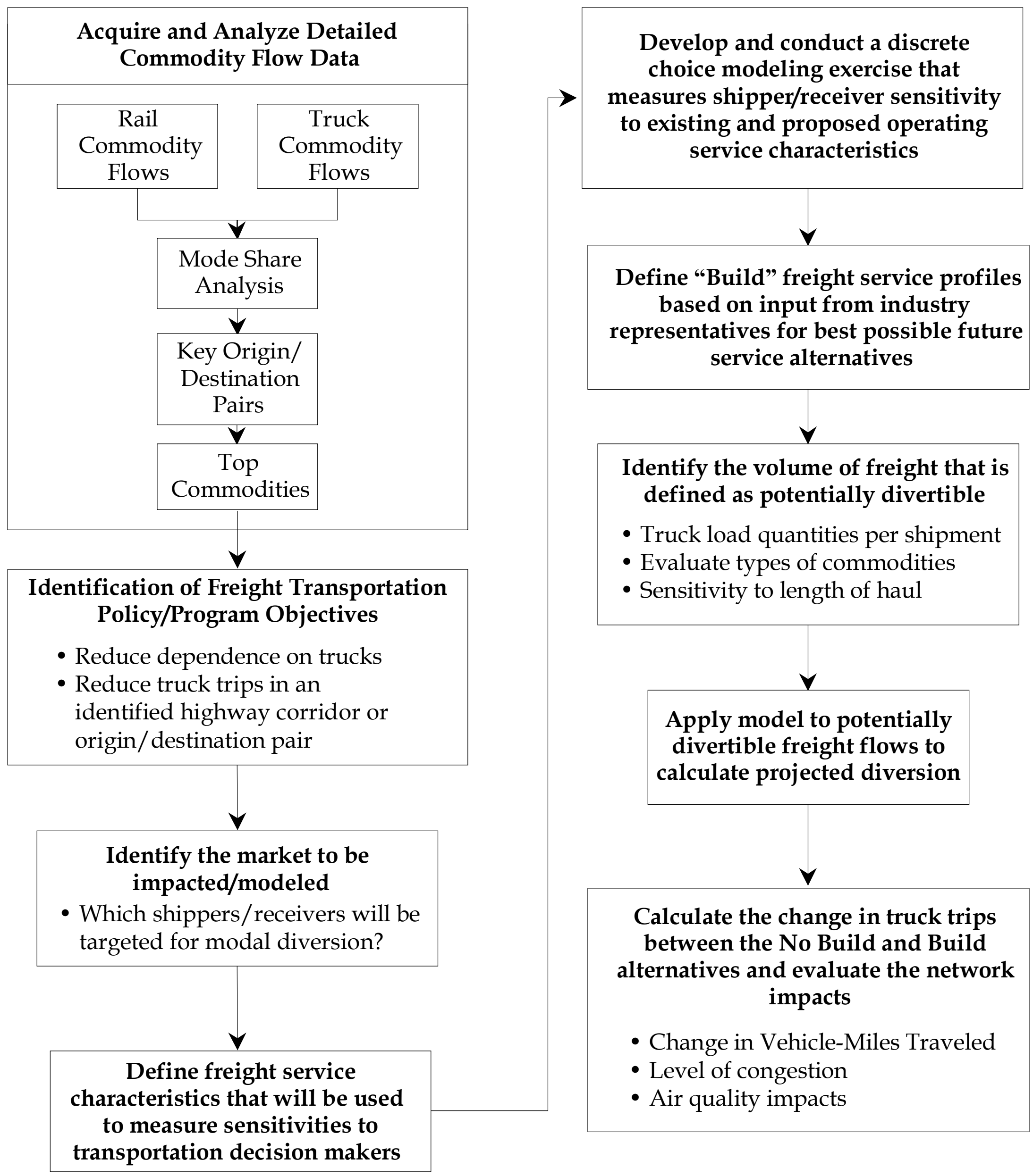
In most cases, transportation projects will benefit both passenger and freight travel to varying degrees, rather than only benefiting one or the other. The freight evaluation process outlined above is not meant to be distinct from a passenger-project evaluation process. Instead, it is meant to be a generic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

5.2 Data Needs and Methodology for a Modal Diversion Analysis

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

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

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



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

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

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

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

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

Definition of Market

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

Market

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

Service Sensitivities

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

Alternative Levels of Service

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

Impacts

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

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

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

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

5.3 Evaluate the Feasibility of Operating Intermodal Facilities

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

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

TOFC/COFC Intermodal

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

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

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

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

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

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

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

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

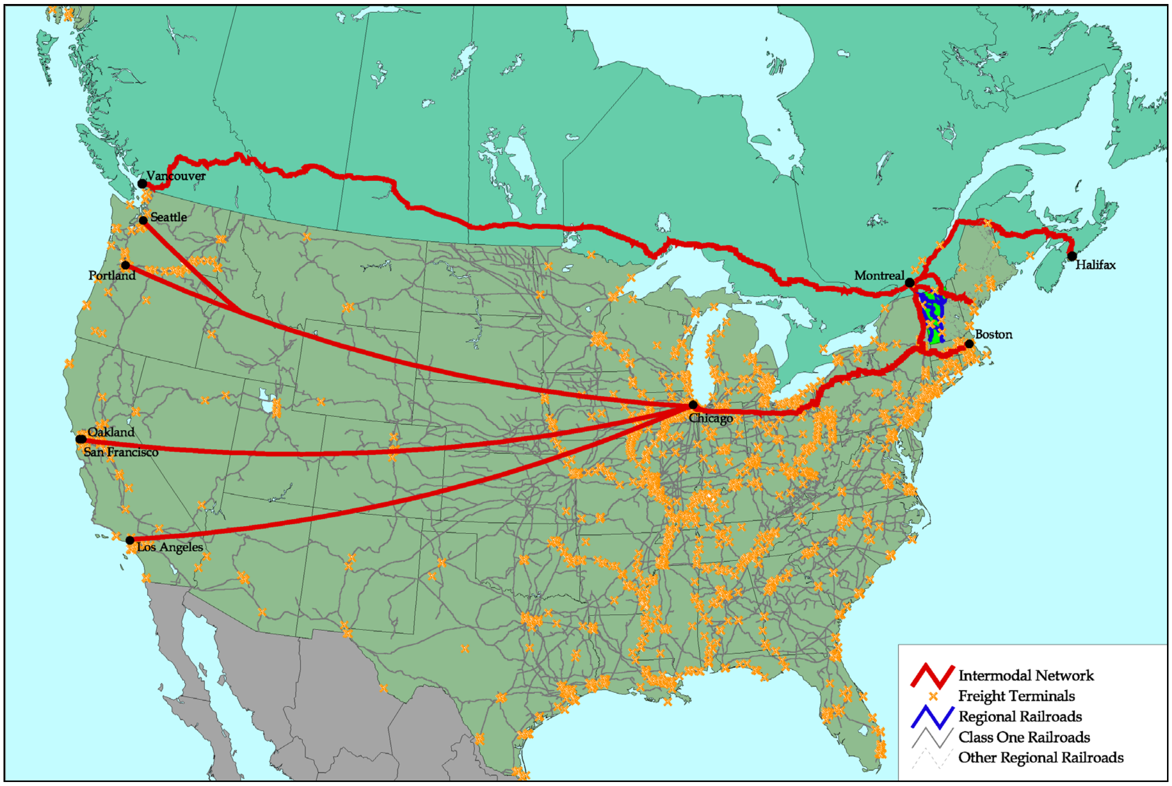


Figure ES.18 Regional View of Existing East-West Intermodal Connections

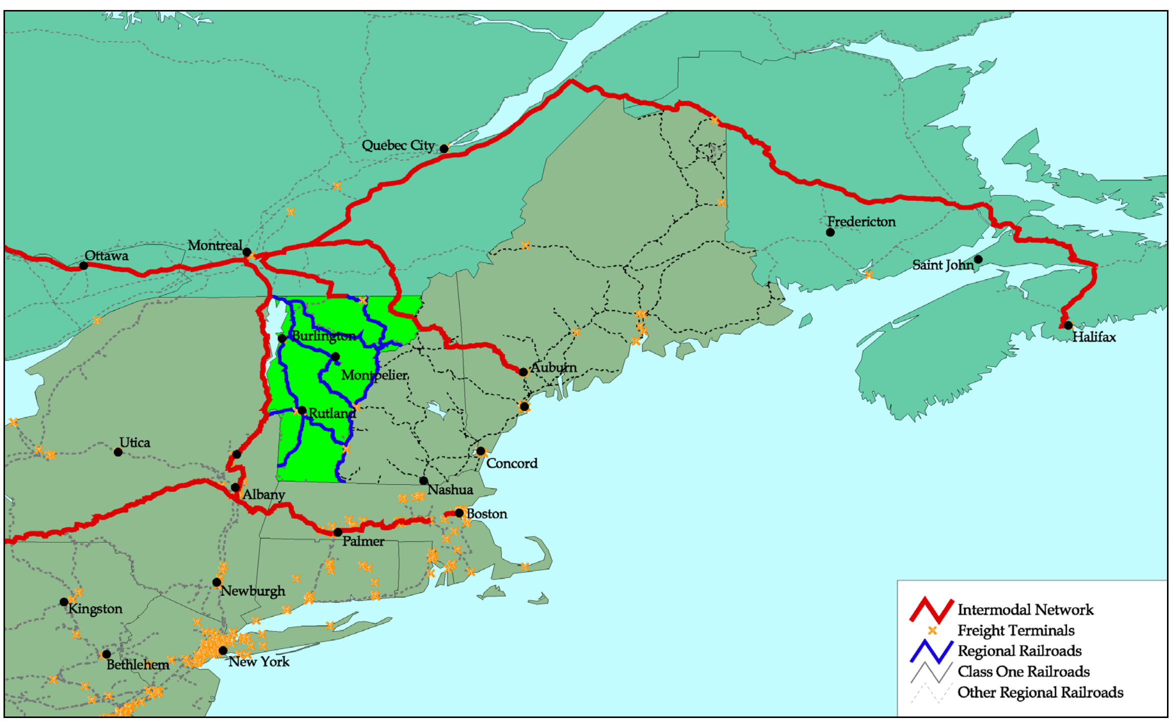
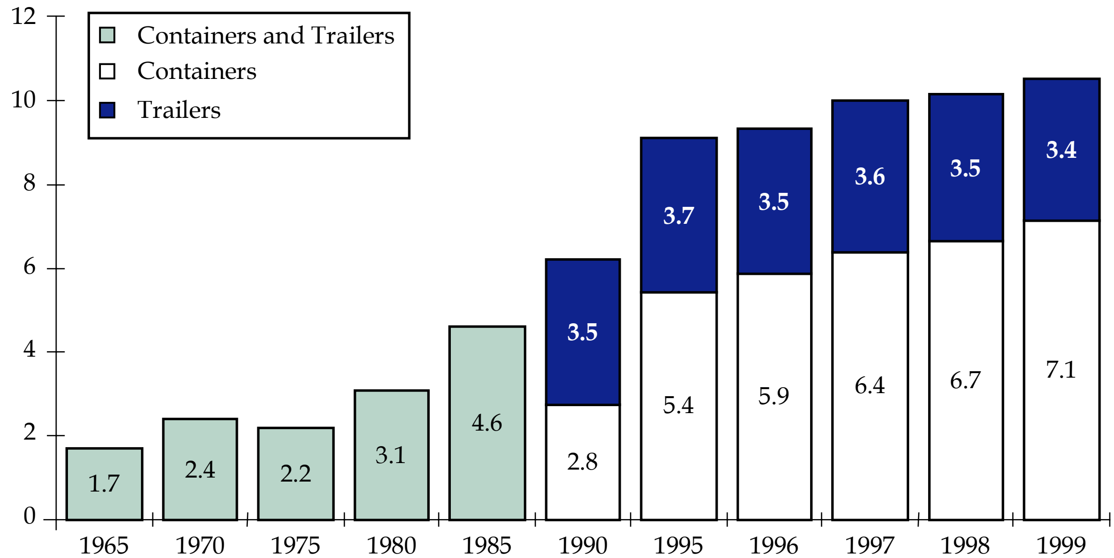


Figure ES.19 Rail Intermodal Growth



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

Expansion of the TOFC/COFC intermodal rail service in Vermont is prevented by the current overhead clearance restrictions. It is therefore recommended that the state implement a clearance improvement program. To provide a complete double-stack clearance route will require bridge improvements in Vermont, as well as in New Hampshire and Massachusetts. Therefore, a multistate, regional approach is critical to this improvement program. With the establishment of a high volume overhead TOFC/COFC route, there could be an opportunity to establish a "satellite" intermodal terminal in Vermont. A terminal of this type would initially attract existing intermodal business using out-of-state ramps. Longer term, the goal would be to build new business. The Class I railroads usually resist opening small terminals due to small load centers and schedule penalties. However, VAOT may decide to support such a development to better manage truck vehicle-miles of travel from a policy perspective.

Transload Intermodal

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

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

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

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

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

One of the principle reasons that shippers utilize trucks is that all business can be accessed by trucks via the highway system. This does not apply to railroads. Therefore, greater access to the rail system is needed to encourage expanded use of rail. The means to accomplish this can generally be viewed as implementing policies that support connections to the rail system. An example would be to encourage industrial park development to be located adjacent to rail lines and include track design, and possibly construction, in the implementation of industrial park development. Encouragement of rail siding construction to existing or future development sites will increase the use of rail facilities. Currently, there is a state program that provides matching funds for construction of sidetracks for business. This program could be expanded and promoted to support increased rail usage. Specific programs include highway-rail grade crossing improvements, bridge improvements to support newer 286,000 car weights, and a double-stack clearance program.

Amtrak Freight Service

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

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

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

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

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

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

6.0 Findings, Conclusions, and Recommendations

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

6.1 Findings and Conclusions

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

Economy

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

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

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