VERMONT
AGENCY OF TRANSPORTATION

VERMONT FREIGHT & RAIL PLAN

FINAL DATA COLLECTION & EXISTING CONDITIONS

SUBMITTED BY
CAMBRIDGE SYSTEMATICS
VANASSE HANGEN BRUSTLIN, INC.
FITZGERALD & HALLIDAY INC.

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LIST OF ACRONYMS

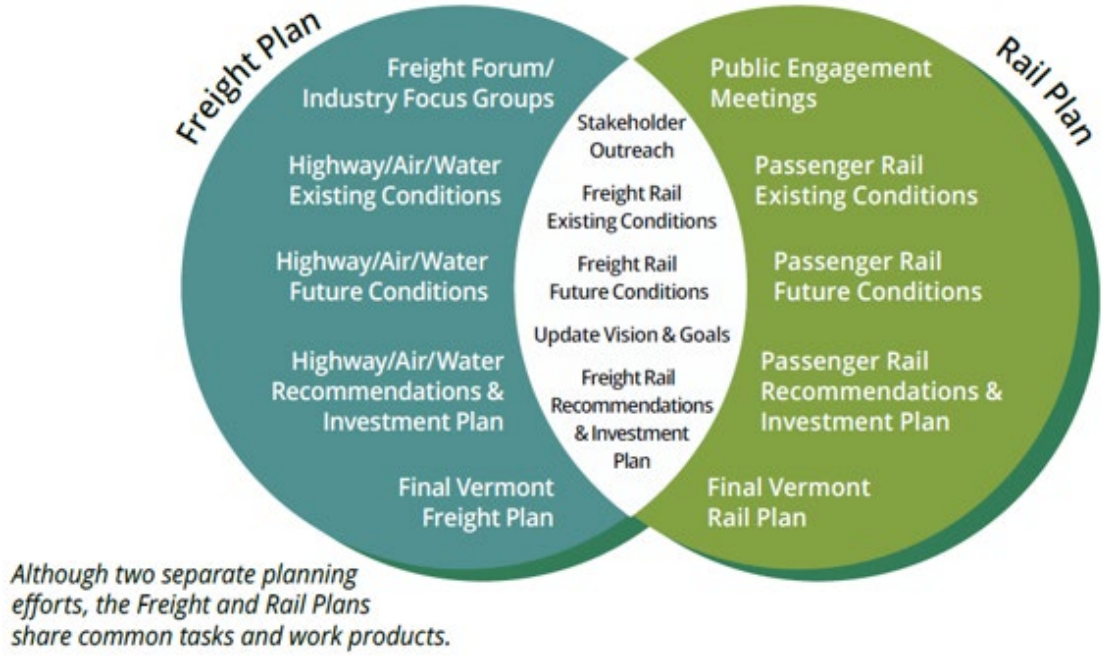
AADTT	Annual Average Daily Truck Traffic
AAR	Association of American Railroads
AOT (VTrans)	Vermont Agency of Transportation
AV/CV	Automated Vehicle/Connected Vehicle
BTS	Bureau of Transportation Statistics
BUILD	Transportation's Better Utilizing Investments to Leverage Development
CAV	Cargo Air Vehicle
CCRPC	Chittenden County Regional Planning Commission
CLP	Clarendon & Pittsford Railroad
CMAQ	Congestion Mitigation and Air Quality
CN	Canadian National
COFC	Container-on-Flat-Car
COMP	Composite Pavement Condition
COVID-19	Coronavirus Disease 2019
CP	Canadian Pacific
CRFC	Critical Rural Freight Corridors
CRISI	Consolidated Rail Infrastructure and Safety Improvements
CUFC	Critical Urban Freight Corridors
DHS	(U.S.) Department of Homeland Security
DMV	Department of Motor Vehicles
DOD	(U.S.) Department of Defense
EJ	Environmental Justice
ELD	Electronic Logging Device
EPCRA	Emergency Planning and Community Right-to-Know Act
FAST	Fixing America's Surface Transportation Act
FFY	Federal Fiscal Year
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GMRC	Green Mountain Railroad
HFT	High Frequency Train
HOS	Hours of Service
HSIP	Highway Safety Improvement Program
HTF	Highway Trust Fund
IRS	Internal Revenue Service
ITS	Intelligent Transportation Systems
LRTP	Long Range Transportation Plan
MAP-21	Moving Ahead for Progress in the 21st Century
MNRR	Metro-North Railroad
MPH	Miles per hour

MPO	Metropolitan Planning Commission
MSDSs	Material Safety Data Sheets
NAICS	North American Industry Classification System
NECR	New England Central Railroad
NHFN	National Highway Freight Network
NHS	National Highway System
NPMRDS	National Performance Measure Research Data Set
NS	Norfolk Southern
OS/OW	Oversize/Overweight
PAR	Pan Am Railways
PAS	Pan Am Southern
PCB	Polychlorinated biphenyls
PRIIA	Passenger Rail Investment and Improvement Act
PTC	Positive Train Control
ROW	Right of way
RPC	Regional Planning Commission
RRIF	Rail Rehabilitation and Improvement Financing
RSIA	Rail Safety Improvement Act
SAE	Society of Automotive Engineers
SFY	State Fiscal Year
SIB	State Infrastructure Bank
SLR	St. Lawrence & Atlantic
SRP	State Rail Plan
STRACNET	Strategic Rail Corridor Network
TIB	Transportation Infrastructure Bonds
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investment Generating Economic Recovery
TIP	Transportation Improvement Program
TMC	Traffic Message Channel
TOFC	Trailer-on-Flat-Car
TTTR	Truck Travel Time Reliability
VMS	Variable Message Signs
VMT	Vehicles Miles Travelled
VRS	Vermont Rail System
VTR	Vermont Railway
WACR	Washington County Railroad
WIM	Weigh in motion

1.0 INTRODUCTION

In April 2020, the Vermont Agency of Transportation (AOT or VTrans) contracted with Cambridge Systematics to update its State Rail Plan (2015) and State Freight Plan (2012 with minor revisions in 2013, 2015 and 2017) to meet with Federal regulations under the Passenger Rail Investment and Improvement Act (PRIIA) and Fixing America's Surface Transportation (FAST) Act. Although two separate documents, there is a significant amount of overlap between the efforts as shown in Figure 1.1.

FIGURE 1.1 VERMONT FREIGHT AND RAIL PLAN ELEMENTS



Source: Cambridge Systematics, 2020.

The State Rail Plan provides a framework for maintaining and enhancing the state rail system. It is important to note that the State Rail Plan focuses on rail freight and intercity passenger service provided by Amtrak. Commuter rail is a form of public transit that is addressed as part of public transit plans.[1]

The State Freight Plan provides a framework for maintaining and enhancing all modes of freight movement in Vermont—rail, highway, air, and water.

This Technical Memo is the first of five which will provide the background material and information necessary to complete the final State Rail Plan and State Freight Plan:

- Technical Memo 1 – Data Collection and Existing Conditions.

[1] https://vtrans.vermont.gov/planning/PTPP

- Technical Memo 2 – Commodity Flow and Economic Futures.
- Technical Memo 3 – Vision, Goals, Strategies, and Implementable Actions.
- Technical Memo 4 – Passenger Rail Elements (passenger rail forecasting).
- Technical Memo 5 – Prioritization, Recommendations, and Impact
- Final Vermont Rail Plan and Vermont Freight Plan

Extensive public outreach will inform development of both plans and will meet Federal Railroad Administration (FRA) requirements for the Vermont Rail Plan.

The remainder of this Technical Memo contains the following Sections:

- Section 2 – The Role of Rail in Statewide Transportation (Chapter 1 of the Vermont Rail Plan).
- Section 3 – Vermont's Rail System – Existing Conditions (Part of Chapter 2 of the Vermont Rail Plan).
- Section 4 – Highway Modal Profile (Vermont Freight Plan).
- Section 5 – Air Modal Profile (Vermont Freight Plan).

The next Technical Memo will include information on commodity flows for all modes including projections for future flows as well as an overview of current and projected socio-economic factors that impact the movement of freight and profiles of representative freight supply chains in Vermont.

2.0 THE ROLE OF RAIL IN STATEWIDE TRANSPORTATION

Vermont's rail system is a vital component of the state's multi-modal transportation system. This State Rail Plan (SRP) provides a framework for maintaining and enhancing the state rail system. It represents an update to the State Rail & Policy Plan, completed in 2015, and has been prepared to conform to the requirements for State Rail Plans as specified by the Passenger Rail Investment and Improvement Act of 2008 (PRIIA), and the guidance subsequently issued by the Federal Railroad Administration (FRA) in September 2013.

The United States Congress passed PRIIA for the purpose of improving passenger rail service throughout the U.S. PRIIA requires states to have a FRA accepted SRP—updated at minimum every four years—as a condition for qualifying for future federal passenger rail funding. The Vermont SRP will be developed to comply with the requirements of PRIIA, including 12 essential content areas:

- Inventory of existing rail transportation network, rail services and facilities within the state and an analysis of the role of rail transportation within the state's surface transportation system.
- Review of all rail lines within the state, including proposed high-speed rail corridors and significant rail line segments not currently in service in the state.
- A statement of the state's passenger rail service objectives including minimum service levels, for rail transportation routes in the state.
- General analysis of rail's transportation, economic and environmental impacts in the state. This includes congestion mitigation, trade and economic development, air quality, land use, energy use, and community impacts.
- A long-range investment program for current and future freight and passenger rail infrastructure in the state.
- Discussion of public financing issues for rail projects and services in the state, listing current and prospective public capital and operating funding resources, public subsidies, state taxation, and other financial policies relating to rail infrastructure development.
- Identification of rail infrastructure issues within the state that reflects consultation with all relevant stakeholders.
- Review of major freight and passenger intermodal rail connections and facilities and prioritized options to maximize service integration and efficiency between rail and other modes of transportation within the state.

- Review of publicly funded projects that improve rail-related safety and security, including all major projects funded under Section 130 Title 23.
- Performance evaluation of passenger rail services operating in the state, including possible improvements to those services, and a description of strategies to achieve those improvements.
- Compilation of studies and reports on high-speed rail corridor development within the state not included in a previous state rail plan and a plan for funding any recommended development of such corridors in the state.
- Statement that the SRP complies with Title 49 United States Code Section 22102 requirements.

2.1 Multimodal Transportation System Goals

Rail is a major mode of transportation in Vermont, and the goals identified within this plan align with those in the State's Long Range Transportation Plan (LRTP) which identifies goals, objectives, and strategies across all modes in the State. The 2018 LRTP has six goals:

- Improve safety and security across all transportation modes;
- Preserve and improve the condition and performance of multimodal transportation system;
- Provide mobility options and accessibility for all users of the transportation system;
- Leverage transportation investments to increase Vermont's economic vitality;
- Practice environmental stewardship; and
- Support livable, healthy communities.

Specific to rail transportation, Vermont adopted the following goals as part of the 2015 Rail Plan:

- Maintain the State's Rail System in a State of Good Repair
  - Maintain all bridges to the 263,000 pound carload standard
  - Maintain track to appropriate FRA track class
  - Remove slow orders – with priority along passenger rail routes
  - Upgrade rail to continuously welded rail along passenger routes
  - Rehabilitate passenger rail stations
- Expand the Rail System's Capacity to Accommodate Growth Objectives

  - Upgrade all bridges to the 286,000 pound carload standard
  - Upgrade to a minimum 115 pounds/yard rail
  - Eliminate vertical clearance obstacles
  - Install platforms at new passenger stations
- Expand the Rail System's Use
  - Increase the use of rail by shippers and receivers currently using rail
  - Attract new rail shippers and receivers to locate along rail lines
  - Preserve inactive rail corridors
  - Implement new intercity passenger rail service along western corridor (Burlington, Vergennes, Middlebury, Rutland, Manchester, Bennington) and extend *Vermonter* to Montreal
  - Exceed FRA Intercity Passenger Rail Performance and Service Quality indicators
  - Increase existing and planned passenger routes to a minimum of FRA Class 4 Track in order to allow operating speeds to 79 miles per hour (mph)
- Provide a Rail System that is Financially Sustainable
  - Examine other passenger rail service providers in order to reduce operating subsidies
  - Pursue federal grant opportunities to rehabilitate the rail network
- Improve Intermodal Connectivity
  - Integrate rail stations with local and intercity bus transportation
- Improve the Rail System to Support Economic Development
  - Coordinate rail and economic development efforts
  - Provide incentives for new and existing businesses to use rail
  - Support the development of transload facilities
- Enhance Safety of the Rail System
  - Reduce rail-highway grade crossing collisions

- Participate in disaster planning with local, state, federal authorities Rail Transportation's Role within the State's Transportation System

These goals align with those presented in Vermont's LRTP[2] and were presented to the State's Rail Advisory Council for comment and potential additions or edits in September, 2020. The Council agreed that these goals are still valid and therefore will remain the same for this Rail Plan update.

2.2 Rail Transportation's Role within the State's Transportation System

Vermont's rail assets serve a number of important roles within the overall State transportation system. These include:

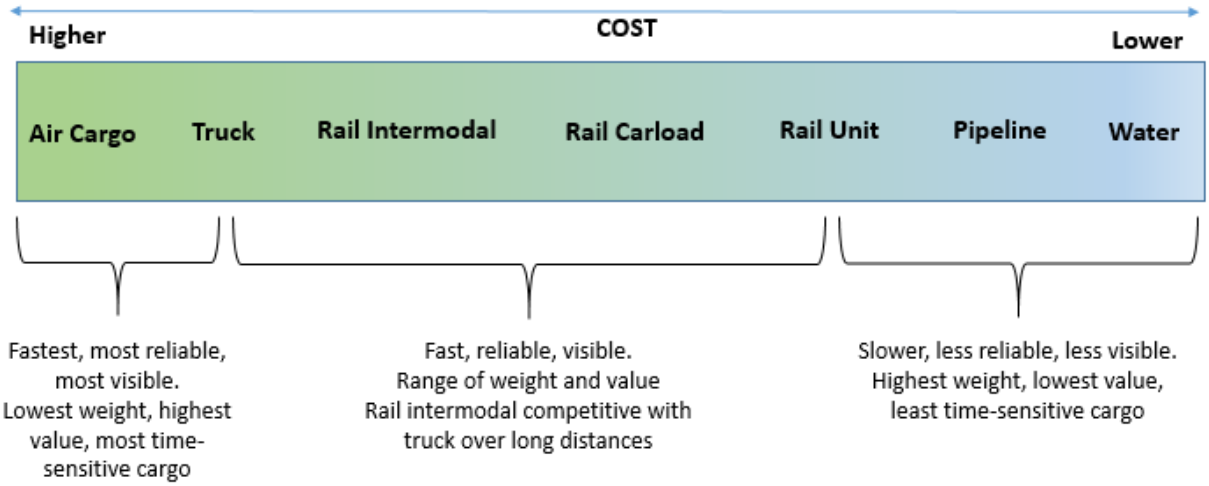
- Providing access, economic development support, and mode choices to local industries;
- Providing an environmentally friendly transportation choice for passengers and freight; and
- Integrating Vermont with regional and national passenger and freight rail transportation systems.

For freight movement, 154,300 rail cars carried just less than 7 million tons of freight in interstate and intrastate (in to, out of, within, and through the state) commerce in 2018.[3] Rail carload shipments offers an important option for shippers and receivers, especially for goods that are less time sensitive, have a lower cost and a higher weight as shown in Figure 2.1. Vermont has a number of transload facilities (Section 3.1.5) that facilitate efficient multi-modal transportation of bulk commodities such as rock salt, lumber, and grain using rail and highway. Rail intermodal, which allows for the quick transfer of containers and trailers between rail and truck modes, provides a higher level of service but at a higher cost. Vermont does not have any rail intermodal facilities in the State meaning shipments utilizing this method need to be trucked to locations in Massachusetts, New York, and Quebec before moving via rail.

[2] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/2040_LRTP_%20Final.pdf

[3] STB Confidential Waybill Sample, 2018.

FIGURE 2.1 GOODS MOVEMENT SERVICE SPECTRUM



Source: Cambridge Systematics, Inc.

By tonnage, rail accounts for approximately 15 percent of the 46.67 million tons of freight that touch the State (intrastate, interstate, and through). While this is well below the share of goods moved by truck (84 percent), it represents an important option for shippers. In addition, through rail traffic accounts for the majority of shipments by weight (58 percent). These trips do not directly serve Vermont's businesses or residents though they help bolster the regional and national economy.

Without Vermont's rail network, the 6.7 million tons of freight moved by rail that originated, terminated, or travelled through the State in 2017 would have required approximately 373,000 additional trucks.[4] With slightly higher volumes in 2018 (6.9 million tons), the total number of trucks needed would rise to approximately 384,000. Of these, 58 percent or more than 222,000 trucks would be needed to carry through cargo. These estimates to not include empty moves on return trips. By allowing these goods to move via rail, these shipments stay off Vermont's roads, reducing congestion and limiting wear and tear Vermont's bridges and highways.

Passenger rail also serves a vital role in the State's passenger transportation system. In Federal Fiscal Year (FFY) 2019, Vermont's 12 Amtrak stations (including one in Claremont, NH) saw a total of just more than 95,000 passenger trips. Intercity passenger rail often serves intermediate distances (less than 500 miles) where rail travel times can be comparable with driving or flying and where population density and associated congestion make rail travel more attractive.[5] Vermont's rail services link the State to heavily congested destinations along Northeast Corridor, with the Ethan Allen terminating in New York City and the *Vermonter* terminating in Washington, D.C. At just over 600 miles in length, the *Vermonter Vermonter*

[4] Association of American Railroads, https://www.aar.org/wp-content/uploads/2019/01/AAR-Vermont-State-Fact-Sheet.pdf

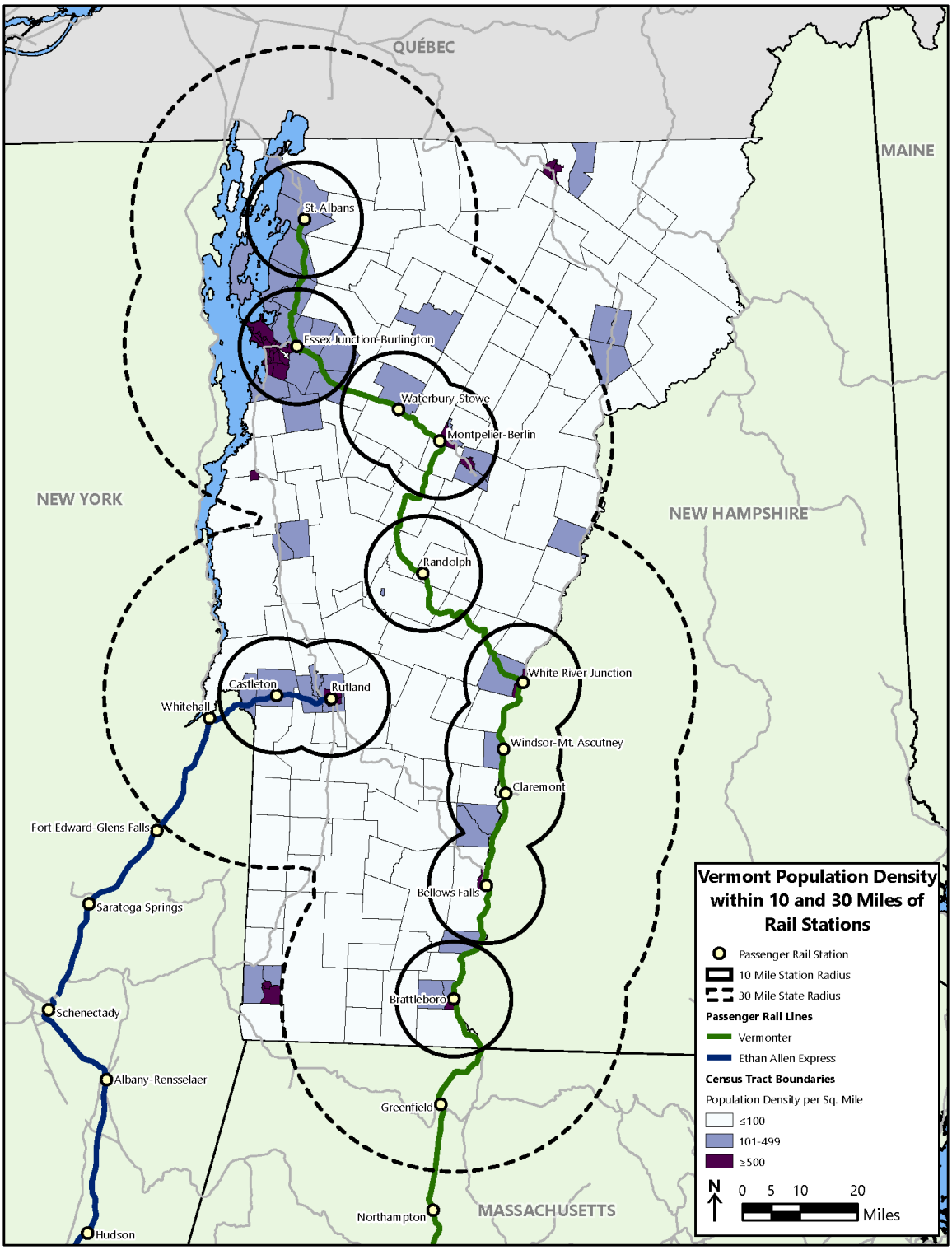
[5] https://fas.org/sgp/crs/misc/R45783.pdf

directly serves the largest markets along the Northeast Corridor, with the exception of Boston and Providence, The *Ethan Allen Express* at approximately 240 miles in length, primarily provides access to New York's Capital and New York metropolitan regions. These routes provide travelers with an alternative option to driving or flying into these dense areas, as well as connectivity to Amtrak's national network.

Given the number of Amtrak stations and the geographic size of Vermont, most *Vermonter*s do not live far from a train station. With a population of approximately 624,000 in 2018, most of the population lives in a Census Tract within 30 miles from a train station (87 percent), and slightly more than half (54 percent) can access a train station within ten miles of their homes (Figure 2.2).[6]

[6] Population within a Census Tract is counted if it is partially within the 10/30 mile limit. Esri Business Analyst Online, 2020. For purposes of this SRP, the Claremont, NH Amtrak station is included in mapping and statistics.

FIGURE 2.2 VERMONT POPULATION WITHIN 10 MILES AND 30 MILES OF AN AMTRAK STATION (2020)



Source: ESRI Business Analyst Onlne; Analysis by VHB, 2020.

2.3 Institutional Governance Structure of State's Rail Programs

Within VTrans' Policy, Planning and Intermodal Development Division, the Rail and Aviation Bureau manages state-owned rail assets in Vermont and serves as a steward of the State's rail network. The Rail Program is also responsible for improving highway-rail at-grade crossings, including safety improvements funded under the Railway-Highway Crossing improvements Program, specified by 23 U.S. Code 130. This Bureau is led by Dan Delabruere and consists of four sub-groups:

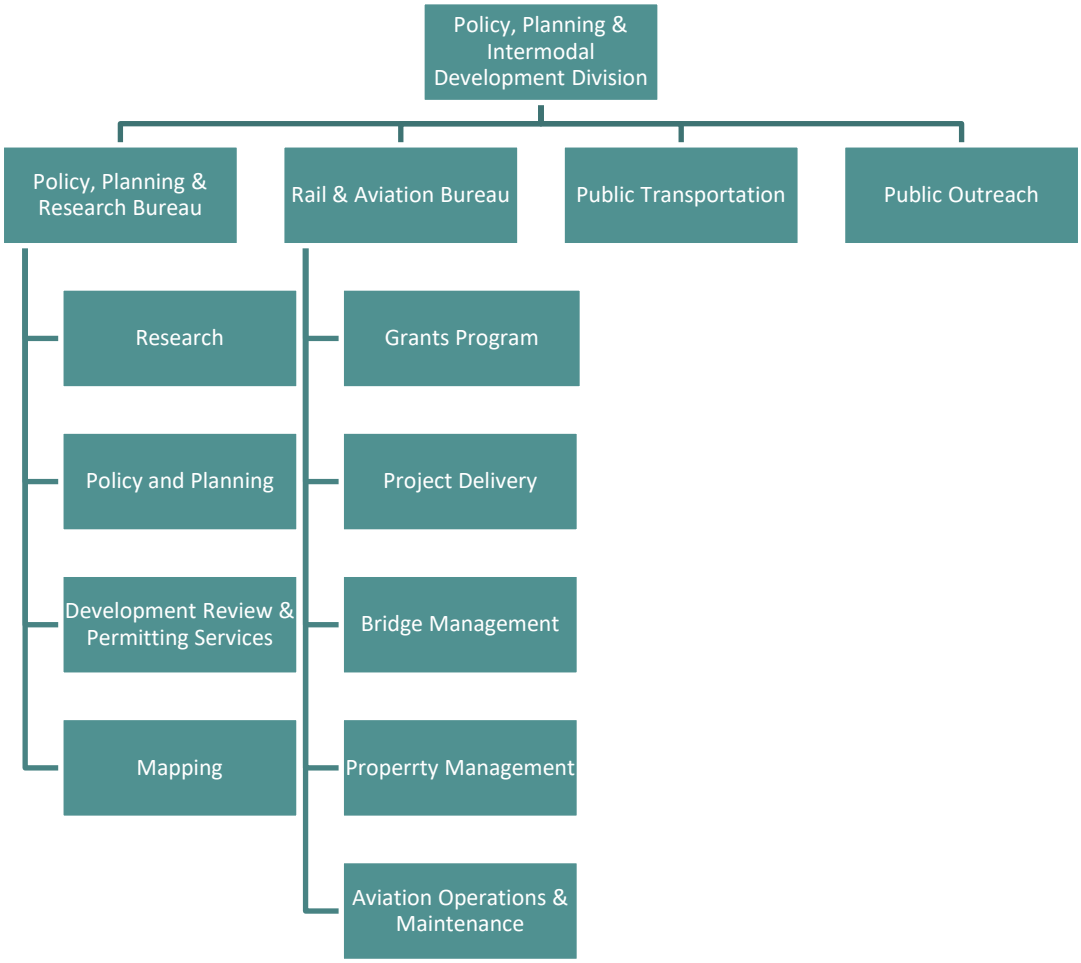
- **Project Delivery** – responsible for project management and oversight within the Bureau and as mapping and geospatial needs.
- **Bridge Management** – collect and maintain an inventory of rail bridges, their condition, and making recommendations on repairs, strengthening or replacement of components or entire structures.
- **Property Management** – manage rail property database with lease agreements, manages requests for temporary access and work in the railroad right of way (ROW).
- **Aviation Operations and Maintenance** – promote a vibrant air transportation system in Vermont by assuring a safe, well-maintained system of public use airports, while also promoting aviation to develop sustainability in Vermont's aviation industry and at our airports.

Figure 2.3 displays the organization of the Vermont Agency of Transportation's Policy, Planning and Intermodal Development Division. This document is being developed under the Policy and Planning Group of the Policy, Planning, and Research Bureau.

The Vermont Rail Council was originally created in 1993 to advise the Governor and the Agency of Transportation on rail policy matters. Executive Order #13-03 dated August 5, 2003, established the Vermont Rail Advisory Council and designated its membership and duties anew. Membership is drawn from private rail operators, operators on state-owned railroads, freight shippers, environmental and economic development organizations, regional chambers of commerce, regional planning commissions, the House and Senate transportation committees, and travel and recreation organizations. The council meets quarterly.

In addition to VTrans and the Rail Council, a number of state and local agencies have an interest in the performance of the Vermont rail system in carrying out their responsibilities. Vermont's 11 regional planning commissions (RPCs) are tasked with developing regional plans, and coordinating regional activities across member municipalities. Among the planning issues addressed by these organizations is transportation, including rail. The Chittenden County RPC also serves as the Metropolitan Planning Organization (MPO) for Burlington and surrounding areas. MPOs are policy-making organizations that are funded in part by the federal government and are required for urban areas with populations over 50,000. They are required to maintain LRTPs as well as Transportation Improvement Programs (TIP), which include projects to be funded using federal as well as other sources.

FIGURE 2.3 VTRANS POLICY, PLANNING AND INTERMODAL DEVELOPMENT DIVISION ORGANIZATIONAL CHART



Source: https://vtrans.vermont.gov/about/org-charts

2.4 State's Authority

VTrans was designated the state's rail planning agency by the Vermont legislature in 1973. Vermont Statutes Annotated (VSA) Title 5 describes the AOT's powers in a number of areas including rail. Overall, Chapter 20 authorizes AOT to supervise and direct execution of all laws and Transportation Board orders relating to public transportatoin corporations, firms, and individuals. Chapter 56 gives AOT the power to receive, manage, use, or expend federal and State funds to promote or develop intercity passenger rail service or facilities, contract with Amtrak or other railroads, and acquire land (amongst other powers) and Chapter 58 deals specifically with AOT powers for State Acquisition of Railroads.[7]

[7] https://legislature.vermont.gov/statutes/title/05

Executive Order #13-03 dated August 5, 2003 by Governor James Douglas established the Vermont Rail Advisory Council and established its membership and duties.[8]

Subsequent legislation has provided VTrans with the authority to contract with Amtrak and obtain property for the purposes of supporting intercity passenger rail. Since 2015:

- An Act in 2016 repeals an existing railroad trespassing law and replacing it with an updated law that creates a civil traffic violation that prohibits trespassing on specific railroad properties.[9]
- Act in 2018 authorizes towns or VTrans to apply to the Transportation Board for an order requiring railroads to carry out vegetation control work at setting a civil monetary penalty.[10]

PRIIA requires that states designate a "State Rail Transportation Authority" which is responsible for preparing, maintaining, coordinating, and administering the State Rail Plan. PRIIA also requires that states establish a "State Rail Plan Approval Authority" with responsibility for review and approval of the State Rail Plan. In the case of Vermont, VTrans serves both roles.

2.5 Freight and Passenger Rail Services, Initiatives and Plans – Summary

This section details ongoing activity relating to freight and passenger rail service in Vermont, focusing on actions taken since the completion of the last SRP in 2015. This section includes summaries of completed plans and conceptual studies, as well as ongoing and upcoming initiatives and projects to enhance service and upgrade rail infrastructure within the state.

2.5.1 Projects Since 2015 Vermont Rail Plan

Studies

Since the completion of the last SRP in 2015, Vermont has undertaken a series of transportation planning studies with the goal of better understanding system performance, needs and deficiencies along with opportunities to improve mobility. Brief summaries of rail-related work are included in the below sections.

Living With Rail

In 2016, the Vermont Transportation Board submitted *Living With Rail* to the Vermont Legislature's House and Senate Transportation Committees.[11] This report details how *Vermonter*s perceive the current

[8] This Executive Order superseded a 1993 order which created the Vermont Rail Council.

[9] Vermont General Assembly Act No. 158, 2016.

[10] Vermont General Assembly Act No. 158, 2018.

[11] https://tboard.vermont.gov/sites/transboard/files/T-Board%202016%20Report_Web.pdf

conditions of the state's rail services and outlines what *Vermonter*s think of the state's future plans. Feedback from the public was collected at seven forums held in "rail towns" throughout the state. Topics discussed in these forums included Expansion of Passenger Rail, Establishing Commuter Rail, Rail Safety, and Railside Economic Development. Key suggestions elicited from forum participants regarding passenger rail included adjusting the timing of local Amtrak trains to achieve better connections to hubs in Springfield and Albany and increasing the frequency of trains on both the *Ethan Allen Express* and *Vermonter* beyond one train in each direction per day. Participants from communities abutting active freight railroads encouraged the state to work with the railroads to identify, and find ways to fund, quiet zones. Participants also suggested that the Legislature develop some kind of financial incentive that would help motivate landowners and their host community to support rail-side development. Finally rail safety was a topic of great concern among participants across the states. Many called for more collaboration between local governments, the state, and the railroads to cooperatively create safe crossings and multi-use paths within railroad ROW, especially in ROWs near town and village centers. Forums were held in the following locations:

- Brattleboro
- Burlington
- Newport
- Rutland
- St. Albans
- Vergennes
- White River Junction

Northern New England Intercity Rail Initiative Study (2016)

This study, completed in 2016, outlines plans to expand higher-speed rail service between cities in Connecticut, Massachusetts, Vermont and Montreal, Canada. The study established three main goals: to increase intercity train to optimal levels, to reduce travel time between cities in the corridor and to lessen passenger rail interference with freight. According to the study, high-speed rail expansion is necessary to boost the regional economy, expand travel options and provide a cost-competitive and convenient alternative to car travel. Two corridors were examined in details—a Boston-to-Montreal Route via Springfield and the current *Vermonter* corridor and an Inland Route between Boston and New Haven, CT. The study recommended adding one new daily round trip between New Haven and Montreal (that would complement existing *Vermonter* service), one new round trip between Boston and Montreal, and eight new round trips between Boston and New Haven. Corridor-wide infrastructure improvements proposed in the plan include installation of traffic control systems where they do not presently exist, improvements to existing traffic control systems, grade crossing upgrades, and new track and turnouts, along with multiple

siding extensions in Vermont's share of the corridor. A Tier I Environmental Assessment returned a Finding of No Significant Impact for the recommendations.[12]

Montpelier - St. Albans Commuter Rail Service Feasibility Study (2017)

In 2017, VTrans was directed by the Legislature to examine the feasibility of implementing two commuter rail services, one service connecting Burlington with St. Albans, and one connecting Burlington and Montpelier. The St. Albans Line would operate from Burlington Union Station via the Winooski Branch and New England Central Railroad (NECR) Mainline to St. Albans.[13] The Montpelier Line would operate from Burlington Union Station via the Winooski Branch, NECR Mainline, and Washington County Railroad (WACR) to Montpelier. The study examined currently operating commuter rail programs in the United States, existing conditions on the Corridor, evaluated transportation demand in the corridor region, created conceptual schedules and operations conditions, determined conceptual capital costs, and finally created a path for implementing the service. The study outlined four implementation scenarios, with capital costs between $164 and $363 million, and a seven-year project timeline for each option.

WACR M&B Freight Corridor Commuter Rail Study (2019)

This 2019 study analyzes the cost of upgrading the state-owned WACR Montpelier and Barre (M&B) Division between Montpelier and Barre to commuter rail standards. The study identified proposed infrastructure improvements to the track, grade crossings, and bridges along the 8-mile section of track. Additionally, the study evaluated the future installation of positive train control (PTC) and replacement of rail materials for a siding track. The study estimated the cost for these infrastructure improvements at approximately $67 million without PTC and approximately $96.4 million with PTC, using an assumed design and construction schedule of approximately 5 years.[14]

Burlington Amtrak Servicing and Storage Facility Assessment (2019)

In June 2019, the Chittenden County Regional Planning Commission (CCRPC) released a study, in collaboration with the City of Burlington and VTrans to evaluate potential overnight storage and servicing locations in Burlington for the planned arrival of the Amtrak *Ethan Allen Express* passenger train in 2021 or 2022. The study evaluated and ranked five different potential sites for overnight train storage in Burlington. This study found that the Vermont Rail System (VRS) yard at Maple Street was the least cost effective option,

[12] https://www.mass.gov/info-details/massdot-completed-studies#northern-new-england-intercity-rail-initiative-%E2%80%93-2016-

[13] https://vtrans.vermont.gov/sites/aot/files/Montpelier-St.%20Albans%20Commuter%20Rail%20Study%20Revised.pdf

[14] https://legislature.vermont.gov/assets/Legislative-Reports/WACR-MB-Freight-Corridor-Commuter-Rail-Study.pdf

with storage at Burlington's Union Station scoring as the most cost effective alternative.[15] However, in March 2020, nine months after the release of the study, VTrans and the City of Burlington announced that they had found a more cost effective solution to storing trains at the VRS yard, and would thus be moving forward with the VRS yard as the permanent location for Amtrak overnight storage in Burlington.

On-Going Projects and Initiatives

Since the completion of the last rail plan in 2015, Vermont has undertaken a number of projects and initiatives to improve the effectiveness and condition of Vermont's rail network. Some notable projects are highlighted below.

2015 TIGER Grant

Vermont received $10 million in Transportation Investment Generating Economic Recovery (TIGER) Grant funding in 2015 to help improve service on the state-owned rail line between Rutland and Burlington, VT. Work included replacing approximately 11 miles of track with new rail, ballast, and ties; rehabilitating the Rutland Wye; adding new gates for several public crossings; a new passing siding; a passing lane for trains in Pittsford and crossover in Leicester to allow for operational flexibility. The project also includes installing new passenger platforms in Middlebury, Vergennes, and Burlington, which are necessary to enable the extension of Amtrak's *Ethan Allen Express* service from Rutland to Burlington.[16]

As of July 2020, the rail upgrades allowing for 286,000 pound rail cars are complete. Station work in Middlebury, Vergennes, and Burlington is expected to be completed by the end of 2020.[17]

2018 BUILD Grant

VTrans received a $20 million federal award from the US Department of Transportation's Better Utilizing Investments to Leverage Development (BUILD) grant program in 2018. The funding supports the rehabilitation or replacement of 31 rail bridges along 53 miles of the Vermont Railway's Western Corridor. The work will be undertaken on the southern section of the state-owned rail line that runs in Vermont between Rutland and Bennington, continuing on to Hoosick, NY and allow use of 286,000 pound rail cars once complete. The project is projected to cost $31 million. The State of Vermont and Vermont Rail Systems will invest $11 million toward the upgrades.[18]

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[15] https://www.ccrpcvt.org/wp-content/uploads/2019/07/Burlington-Amtrak-Servicing-and-Storage-Facility-Assessment-FINAL-20190624.pdf

[16] https://www.transportation.gov/sites/dot.gov/files/docs/TIGER%202015%20Project%20Fact%20Sheets_0.pdf

[17] https://www.wcax.com/content/news/Burlington-Amtrak-passenger-train-extension-to-be-completed-by-2021-561215801.html

[18] https://vermontbiz.com/news/2018/december/06/vermont-scores-20-million-investment-rail-infrastructure

Ethan Allen Extension to Burlington

Planned for 2021, Amtrak's *Ethan Allen Express* train, which currently travels from New York City to Rutland, VT via Albany, NY, and Castleton, VT, will extend service beyond the current line's terminus in Rutland and continue north to Burlington, with new planned stops in Middlebury and Vergennes. This project has been in development for nearly two decades and will encourage tourism, allow Vermonters to make important intercity travel connections, and result in economic development opportunities near the new stations. The 2015 Rail Plan estimated that the extension would attract between 60,000 and 121,000 additional riders by 2035.[19] Necessary upgrades to rail infrastructure, estimated at approximately $100 million, have been fully funded.

Middlebury Grade Reduction and Tunnel

VTrans, in collaboration with the Town of Middlebury, is in the concluding phase of a project to replace two nearly 100 year old rail bridges in the center of Middlebury with a tunnel. The two bridges were about 300 feet apart, with one located on Main Street/VT 30 and the other on Merchants Row. Both bridges were demolished in the summer of 2017 due to their deteriorated condition, and were replaced with temporary structures prior to construction of the tunnel during the summer of 2020. Construction of the rail tunnel addresses several deficiencies facing the railroad. Principally, the bridges did not have sufficient vertical clearance for double-stack rail cars. By lowering the rail bed approximately four feet, clearance was increased to 21 feet without impacting the grade of the road and sidewalks above.[20]

The tunnel also enabled the alignment of the track to be improved by reducing a curve, thereby allowing better horizontal clearance for trains. Furthermore, drainage improvements and covering of the track through the center of Middlebury reduces the risk of icing problems that have been severe in some winters as well as ponding. Construction of the new tunnel is scheduled to be completed in 2021.

During tunnel construction, trains were re-routed via the Green Mountain Railroad (GMRC) to Bellows Falls. Thence, using temporary trackage rights over the NECR, detour trains operated through White River Junction on to Essex Junction and Burlington.[21]

Vermonter Extension to Montreal

Following the completion of an immigration and customs preclearance facility in Montreal's Central Station, the *Vermonter* will be able to run service directly to Montreal. Both the United States and Canadian federal governments have completed the necessary approval process for preclearance, as of 2019. In March 2020, an Amtrak representative announced that environmental review processes for the facility would be

[19] Range of ridership due to range of growth forecasts used in projection. Note that ridership at a Vergennes station was not modelled. https://vtrans.vermont.gov/sites/aot/files/rail/VT%20State%20Rail%20Plan_Final.pdf

[20] https://vtrans.vermont.gov/projects/middlebury

[21] Vermont Rail Action Network. Email, June 18, 2020.

completed in 2020, with construction scheduled to commence in 2021. No estimated commencement of cross-border service date is available as of July 2020.[22] In addition to completion of the customs facilities in Montreal, some track improvements will be necessary on CN's route from the Canada/US border at Alburgh, VT towards Montreal.

Erosion Control Measures on NECR Near Northfield

Following the 2015 derailment of an Amtrak *Vermonter* train near Northfield, work was initiated to prevent further rock slides and erosion in the area. Vermont received up to $2.1 million in a Consolidated Rail Infrastructure and Safety Improvements (CRISI) grant to conduct slope stablization measures along an 80-mile stretch of the NECR. This work will both improve safety and help eliminate slow orders which result in delay for both passenger and freight trains.[23]

Improvements on WACR

VRS work to rehabilitate a ½ mile of WACR track parallel to Barre St. in Barre is scheduled to be completed by September 2020. Trains will use this segment to avoid two bridges which would have required substantial and expensive rehabilitation.[24]

Hoosac Tunnel Repairs

On February 12, 2020 the Hoosac Tunnel on Pan Am Southern (PAS) in western Massachusetts was closed due to a "partial wall collapse." This nearly 5-mile long tunnel is a key link in PAS' route between Mechanicville, NY and Ayer, MA and handles 8-10 trains on a normal day carrying intermodal, automotive, and general merchandise shipments. The closure required multiple detours with some trains utilization VRS track to Rutland, Green Mountain Railroad track to Bellows Falls, and NECR track back to Massachusetts. The tunnel remained out of service until early April, 2020 though repair work continues.[25]

2.5.2 Rail Projects in 2020-2023 State Transportation Improvement Program

In addition to a number of highway grade crossing projects (discussed in more detail in Section 3.1.9), funding for Western Corridor projects (see above), and funding for replacement of the Middlebury bridges,

[22] https://trainsinthevalley.org/*Vermonter*-extension-to-montreal/

[23] https://railroads.dot.gov/newsroom/us-department-transportation-announces-more-56-million-grants-improve-rail-safety

[24] https://montpelierbridge.org/2020/04/vermont-rail-systems-to-open-traffic-on-rehabbed-railbed-in-june/

[25] https://www.progressiverailroading.com/short_lines_regionals/news/Hoosac-Tunnel-reopens-to-rail-traffic--60149

the 2020-2023 State Transportation Improvement Program (STIP) identifies several bridge replacement projects which span rail lines. These projects include[26]:

- IM 091-1(66) VTrans # 12A566 – Replace I-91 bridges in Rockingham over Green Mountain Railroad (SFY2020,2021)
- BF 025-1(45) VTrans # 12B580 – Replace bridge No.14 on VT103 in Chester over Green Mountain Railroad (design SFY 2020 and 2021, construction SFY2023)
- BO 1443(54) VTrans # 12B596 – Replace bridge on TH 11 in Proctor over VRS (SFY2021-2022)

These projects utilize funds from FHWA or the Federal Transit Administration. Additional rail projects undertaken using FRA grant funds or state funds are highlighted in the following section.

2.5.3 Rail Projects in VTrans Capital Programs

Additional projects funded through federal grant programs, state transportation funds, and bond or local funding (See Section 3.1.8) are included in the State's Transportation Capital Program.[27] For SFY 2020, this totalled nearly $36 million in projects, though this amount was projected to decrease to $27 million in FY 2021, $24 million in FY 2022, and $27 million in FY 2023. Projects include bridge and track rehabilitation, at grade rail crossing upgrades or pavement resurfacing, passenger rail platform construction or improvements, and funding for rail passenger marketing, administration, bridge inspections, and other similar programmatic needs.

2.5.4 Review of Rail Plans from Neighboring States

Surrounded by three states and sharing an international border with Canada, Vermont's passenger and freight rail needs frequently reflect similar conditions and initiatives in adjacent states given the multi-state nature of these corridors. The importance of Vermont's rail network is recognized in these state rail plans, mentioning projects in Vermont that would have positive impacts in their own states, along with useful examples of rail funding and other programs in Vermont that could similarly be adopted in their own states.

For passenger rail, expansion of Amtrak's *Vermonter* to Montreal and new Western Corridor service through Bennington requires cooperation with the Province of Quebec and the State of New York, respectively. The addition of a second daily *Vermonter* frequency would also provide benefit to multiple states in the Northeast including the District of Columbia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, and Massachusetts. Currently, the *Vermonter* service is supported financially off the Northeast Corridor by agreement between the States of Vermont, Massachusetts, and Connecticut.

[26] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Final%20FY20%20STIP%20Amend1.pdf

[27] https://vtrans.vermont.gov/sites/aot/files/portal/documents/aboutus/capprog/20a/11RAIL.pdf

State rail plans for New York, Massachusetts and New Hampshire similarly describe needed freight-related improvements to achieve 286K track, higher load capacities on bridges, and rail replacement projects that are multi-state in nature. Specifically, the 2009 New York State Rail Plan introduces the then recently announced joint venture between Norfolk Southern (NS) and Pan Am Railways (PAR) to create Pan Am Southern (PAS), which included projects to upgrade the PAS main lines from Rotterdam, NY east through Mechanicville into Vermont and Massachusetts to achieve 286K capability. Multi-state freight rail project investments and their estimated return on investment are quantified for the specific state benefits in the New York State Rail Plan.

The following sections outline rail plans developed by the three states surrounding Vermont as well as studies from the Canadian province of Quebec.

New York

While New York last updated its rail plan in 2009, New York State DOT staff indicate that most of the projects identified in the document have not been completed yet, so it remains a "current" view of needed improvements in the State.[28] In addition, Governor Cuomo in his 2020 State of the State agenda that he would convene a panel of experts to bring high-speed rail to New York, with a focus on the Empire Corridor, connecting New York City, Albany, and Buffalo. According to the Governor's press release, this panel of experts will "review past studies, and strategies that countries all over the world have used to build thousands of miles of high-speed rail, to ask every question and find the best way to build high-speed rail in New York."[29] This would build on work completed in 2014 that examined five high-speed rail options for the Empire Corridor between New York City and Niagara Falls, NY.[30] Options range from a no-build which would maintain current conditions only to an option which would allow speeds up to 125 mph in some sections of the line, with the majority of the work needed west of Schenectady, NY. The Ethan Allen travels the Empire Corridor between New York City and Schenectady, NY so any additional work that increases speed or reliability along that segment would improve conditions for Vermont. A 2nd main track between Albany and Schenectady was completed in 2017 at a cost of approximately $91 million alleviated congestion between Albany-Rensselaer and Schenectady.[31]

While not included in the New York State Rail Plan, the New York-Vermont Bi-State Intercity Passenger Rail Study is an important initiative to provide intercity passenger rail services to parts of these two states that are currently underserved or unserved by rail. Completed in 2012, the final study documents outline the investments needed for track, grade crossings, bridges and new stations to implement this service, with

[28] October 22, 2019 meeting with NYSDOT Rail Office.

[29] https://www.governor.ny.gov/news/remarks-prepared-governor-cuomo-outlines-2020-agenda-making-progress-happen

[30] https://railroads.dot.gov/environment/current-environmental-reviews/empire-corridor

[31] https://dailygazette.com/article/2017/07/12/2nd-railroad-track-open-between-schenectady-albany

parallel investments in both states. The project would allow for new intercity passenger rail service between Rutland, VT and Albany, NY via Manchester, North Bennington, and Mechancville, NY.[32]

In addition, New York State committed $2.5 million in grant funding in 2017 to improve an interchange at Hoosick Junction by constructing two interchange tracks, switches and signal upgrades, and a yard air plant.[33] A second round of grant funding worth $2.7 million was awarded in 2018 to build a second mainline track past the interchange to allow for a train to use the mainline while switching is occurring between Vermont Railway (VTR) and PAS.[34] Both of these projects improve operations on the VTR. New York State DOT submitted a letter of support for the 2018 BUILD Grant submission which awarded $20 million for the rehabilitation or reconstruction of 31 bridges on the VTR, including 3 bridges located in New York.[35]

Massachusetts

The 2018 Massachusetts State Rail Plan identifies the NECR Western Massachusetts Freight Rail Upgrade Project as a high priority project. The project involves upgrading more than 31 miles of rail and twenty bridge structures on the NECR freight line running from Connecticut to Canada. $9.6 million in private funding was committed to this project in addition to $9.6 million in State funds. Federal funds of $10.8 million were awarded in December 2018, fully funding the improvements needed to upgrade this line to the national weight limit standard of 286K (286,000 pounds from its current 263,000 pound weight limit). Scheduled for completion in 2021, this added capacity will open the entirety of NECR's main line from its connection with CN at Alburgh to New London, Connecticut to fully loaded 286K cars. According to the Massachusetts SRP, the lack of a 286K rail line forces Massachusetts rail customers into a practice that is inherently not cost effective or competitive.

The Massachusetts Plan also notes collaboration with VTrans on the Northern New England Inter-city Rail Initiative that examined the opportunities and impacts of adding more frequent and higher speed inter-city passenger rail service on two major rail routes, the Inland Route and the Boston-to-Montreal Route. Additionally, the Plan describes collaboration between the Massachusetts DOT, VTrans, and Amtrak on the Knowledge Corridor project, which restored Amtrak's inter-city passenger train service to its original route by relocating the *Vermonter* from the NECR mainline to its former route on the Connecticut River Line (from Springfield to East Northfield.[36]

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[32] https://railroads.dot.gov/environment/completed-environmental-reviews/new-york-vermont-bi-state-intercity-passenger-rail

[33] https://www.troyrecord.com/news/local-news/hoosick-junction-interchange-receives-million-in-state-funding/article_00ab4030-edf7-11e8-b2d5-07a4c5cc86a3.html

[34] https://www.troyrecord.com/news/local-news/hoosick-junction-interchange-receives-million-in-state-funding/article_00ab4030-edf7-11e8-b2d5-07a4c5cc86a3.html

[35] https://vermontbiz.com/news/2018/december/06/vermont-scores-20-million-investment-rail-infrastructure

[36] https://www.mass.gov/lists/rail-plan-documents

The U.S. Department of Transportation awarded MassDOT $70 million in the first round of the competitive High Speed Intercity Passenger Rail Program for final design and construction of the Knowledge Corridor in 2010. Since then, nearly 50 miles of track have been acquired and rehabilitated and new stations have been added to support the *Vermonter* train service in Massachusetts. Stations have been built in Northampton (former Amtrak station location), Greenfield, and Holyoke, Massachusetts.

In addition, MassDOT released a draft "East-West Passenger Rail Study Final Report" in October 2020 which explores options for enhanced passenger rail connections between Western Massachusetts (Pittsfield) and the Boston region.[37] A number of alternative routes were identified, with the two most critical being the existing Boston-Albany Mainline and a potential new alignment along I-90. Three final alternatives are recommended for additional study:

- Alternative 3: Utilize the existing alignment with upgrades (double-track, signal upgrades, etc.).
- Alternative 4: Utilize existing freight/passenger track west of Springfield, a new passenger-only track between Springfield and Worcester, and a shared corridor with MBTA east of Worcester.
- Hybrid Alternative 4/5: Utilize existing freight/passenger track west of Springfield, a new passenger-only track between Springfield and Worcester with additional high-speed shortcuts, and a shared corridor with MBTA east of Worcester.

The three alternatives are projected to generate between 922 and 1,554 passengers per weekday. All three alternatives would intersect with *Vermonter* service in Springfield, providing additional travel options to/from Boston for Vermont riders.

New Hampshire

The 2012 New Hampshire State Rail Plan is the most recent available. Of direct relevance to Vermont, it describes the improvements to the New England Central Railroad's route between St. Albans Vermont and the Massachusetts state line that were advanced by Vermont and funded by federal ARRA grants in 2009 and 2010. As part of one freight rail investment scenario, the New Hampshire State Rail Plan also discusses a project for improvements to the St. Lawrence & Atlantic Railroad, which includes a 3.6-mile section in Vermont. The investment would provide the line with 286K-compatible rail, improving rail corridor connectivity through unrestricted movement of fully-loaded rail cars to the national and international rail networks. Vertical clearance projects also involve neighboring states, with Container-on-Flatcar (COFC) and Trailer-on-Flatcar (TOFC) projects that would impact Vermont identified each of the surrounding states' rail plans. The New Hampshire SRP specifically recommends coordination with other New England states to develop a region-wide approach to eliminating vertical constraints to New England main lines.

In 2014, New Hampshire DOT completed the "New Hampshire Capitol Corridor Rail and Transit Alternatives Analysis", a study of potential rail and bus transit investments in the NH Capitol Corridor, which connects the major population centers of New Hampshire to metropolitan Boston, and the development of a service

[37] https://www.mass.gov/lists/east-west-passenger-rail-study-documents#east-west-study-draft-report-

development plan and related documents for intercity passenger rail between Boston, MA and Concord, NH.[38]

Quebec

In 2018, the Québec Ministère des Transports published its "Sustainable Mobility Policy to 2030" which includes a "Rail Transportation Innovation Framework. " This Framework provides an overview of the Province's rail network and outlines interventions to improve connectivity and promote sustainability. The Framework mentions the potential extension of the *Vermonter* to Montreal, but does not include any specific provincial investments relating to the extension.[39] However, VIA Rail, Canada's national passenger rail corporation, has promoted a high-frequency train (HFT) plan to improve service on the Windsor-Quebec City corridor, the nation's most utilized passenger rail corridor. The Canadian federal government has since appropriated over $11 million to assess HFT feasibility. The implementation of HFT on the Windsor-Quebec City corridor could allow for expanded travel options for Vermont residents travelling to Canada following the completion of the *Vermonter* Montreal extension, allowing easier connections to major Canadian destinations like Toronto, Ottawa, and Quebec City.

[38] https://www.nh.gov/dot/org/aerorailtransit/railandtransit/

[39] https://www.transports.gouv.qc.ca/en/Documents/rail-transportation-intervention-framework.pdf

3.0 THE STATE'S RAIL SYSTEM – EXISTING CONDITIONS

3.1 The State's Existing Rail System: Description and Inventory

This section provides an overview of existing conditions for Vermont's freight and passenger rail networks.

3.1.1 Overview

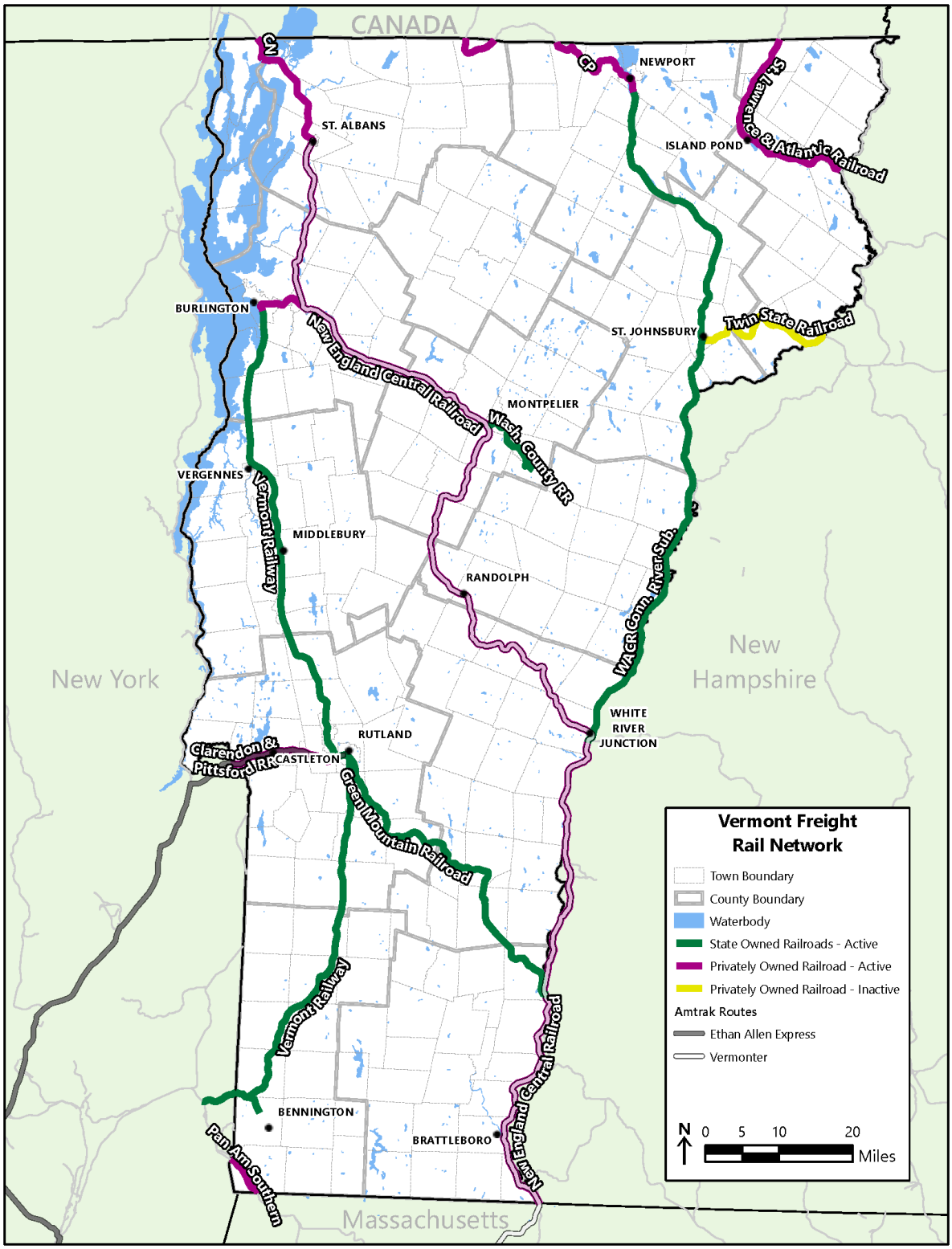
With approximately 580 miles of active rail lines split nearly equally between private and state ownership, Vermont's rail network encompasses much of the State as shown in Figure 3.1. The majority of lines run in a north-south direction due to terrain, though rail links exist in all directions including to Quebec, Canada to the north, Massachusetts to the south, New York to the west, and New Hampshire to the east. All of the lines are used for freight service, while two routes are used for intercity passenger rail service.

Intercity rail passenger service operates on 200 miles of track in Vermont, serving 11 stations with one additional station in Claremont, NH located directly over the New Hampshire border. Vermont's passenger network is illustrated in Figure 3.2 including pending extensions to Burlington (*Ethan Allen Express*) and Montreal (*Vermonter*). Intercity passenger rail services are operated by Amtrak, with the State of Vermont contributing to funding and service planning in partnership with neighboring states through which the trains operate. Connections to larger regional railroads and to the national rail system are available at several locations outside Vermont including Washington, D.C., New York-Penn Station, Albany, NY, Schenectady, NY, New Haven, CT, and Springfield, MA. All passenger rail service in Vermont in inter-city; there is no commuter rail service currently available within the State.

Figure 3.3 illustrates the regional freight network. The rail owners and operators are made up almost entirely of short lines and regional railroads with two Class I operators controlling small sections in the northwest (Canadian National) and northern (Canadian Pacific – formerly the Central Maine & Quebec Railroad) portions of the State. Class I railroads have an annual operating revenue in 2018 dollars above $489.9 million, Class II railroads have an operating revenue above $39.1 million (up to the Class I limit), and Class III railroads have an annual operating revenue of less than $39.1 million. [40]

[40] See: https://www.aslrra.org/web/About/Short_Line_Definitions.aspx

FIGURE 3.1 VERMONT FREIGHT RAIL NETWORK



Source: VHB, 2020.

FIGURE 3.2 VERMONT PASSENGER RAIL LINES

Source: VHB, 2020.

FIGURE 3.3 REGIONAL FREIGHT RAIL NETWORK

Source: VHB, 2020.

Vermont is home to a number of active freight lines both public and privately owned. There are approximately 580 active miles of active freight rail lines in Vermont, approximately half of which is state owned. The active rail lines are listed in Table 3.1 and illustrated in Figure 3.1 above.

TABLE 3.1 VERMONT ACTIVE FREIGHT RAIL LINES

Active Rail Line	Ownership	Track Mileage
New England Central Railroad (NECR)	Private	190.9
Vermont Railway (VTR)	Public-State	139.8
Connecticut River Division (WACR)	Public-State	102.2
Green Mountain Railroad Corp (GMRC)	Public-State	50
St. Lawrence & Atlantic Railroad (SLR)	Private	30.7
Canadian Pacific (CP)	Private	24.4
Clarendon & Pittsford (CLP)	Private	17.9
Washington County Railroad (WACR)	Public-State	13.1
Pan Am Southern (PAS)	Private	6.3
Canadian National (CN)	Private	3.0
Total Active Mileage		**578.3**
Total Active Mileage Public-State Owned		**305.1**

Each of the active railroads is described below:

- **Pan Am Southern (PAS)** – PAS began in 2009 as a joint venture between New England's largest regional railroad, Pan Am Railways, and the Norfolk Southern Railway Company with the objective of improving freight rail service along the former Boston and Maine corridor between Mechanicville, NY and Ayer, MA. The full route is 286K capable, with the portion in Vermont consisting of a seven mile segment that crosses through southwestern Vermont near Pownal. In addition, PAS also holds trackage rights over the NECR along the Connecticut River between Miller's Falls, MA and White River Junction. During the summer of 2020, privately held Pan Am Railways was reportedly available for sale.[41]
- **Canadian National (CN)** – CN, North America's fifth largest railroad with $14.9 billion (Canadian) in 2019 revenues, operates an important three mile segment in Alburgh, Vermont that links the New England Central Railroad with the remainder of the CN rail system in Canada.
- **Vermont Rail Systems (VRS)** – Privately owned, VRS operates freight and passenger service over 350 miles of primarily state owned track in Vermont and New York that is a mixture of 263,000 pound and 286,000 pound capable. VRS' operations in Vermont consist of five properties of varying history, location, and ownership. However, they are operated in a seamless fashion as a single railroad.
  - **Clarendon & Pittsford Railroad (CLP)** – CLP operates 18 miles of track between Rutland, Fairhaven, and Whitehall, New York. At Whitehall, the route connects with Canadian Pacific's

[41] https://www.railjournal.com/financial/pan-am-railways-up-for-sale/.

Champlain line which runs along the I-87 corridor between Montreal and Albany, while at Rutland connections are provided to VRS' Vermont Railway and Green Mountain Railroad. Owned by VRS, this line hosts Amtrak's *Ethan Allen Express* service. Presently, this is the only component of VRS' operartions that are fully 286K capable.

- **Washington County Railroad (WACR)** – WACR runs through Montpelier, Berlin, and Barre between Montpelier Junction and NECR.
- **Connecticut River Subdivision of the WACR** - WACR also operates along the state owned Connecticut River Division line from White River Jct., to Newport where it connects to CP. PAS operates over the southern portions of the Connecticut River Line from White River Junction to East Deerfield, MA.
- **Green Mountain Railroad (GMRC)** – GMRC operates 50 miles of state-owned track between Rutland and Bellows Falls. GMRC connects to VTR and CLP in Rutland and with the New England Central Railroad (see below) in Bellows Falls.
- **Vermont Railway (VTR)** – Through a partnership dating back to 1964, VTR operates Vermont's state-owned Western Corridor between Burlington, North Bennington, and Hoosick Junction, NY where it connects with PAS. At North Bennington, a spur goes to Bennington. VTR hosts Amtrak's *Ethan Allen Express* at Rutland. VTR track has been the target of substantial upgrades over the past five years through multiple federal grant awards. Between Rutland and Florence, the route has been handling 286K capacity railcars for some time, a capability that was recently expanded north to Burlington.

- **Canadian Pacific (CP)** – With 2019 gross revenues of $5.87 billion (Canadian), CP is the sixth largest Class I railroad, operating track all across Canada and into the United States. CP's operations in Vermont consist of an approximately 24 mile segment that provides access to Brookport, Quebec and CP's main line between Montreal and Searsport, ME. The line wends its way from Quebec into Vermont to serve Richford, re-enters Quebec, and crosses back into Vermont near Troy, VT and thence terminates at Newport, where it connects with the Connecticut River Subdivision of the WACR. CP gained this route in early 2020 as part of its acquisition of the Central Maine & Quebec Railway, which represented CP's return to New England and Vermont following a 25-year absence.
- **Genesee and Wyoming (GW)** – As the world's largest short line holding company, GW owns or leases 116 railroad properties located in North America, Europe, and Australia, of which 113 are based in North America. Headquartered in Darien Connecticut, the firm reported gross annual revenues of $2.3 billion in 2018, of which $1.36 billion was generated by its North American properties. In December 2019, G&W was acquired and taken private for $8.4 billion by Brookfield Infrastructure and GIC, the sovereign fund of Singapore. A limited partnership, Brookfield Infrastructure is controlled by Brookfield Asset Management Company, a publicly held portfolio asset manager domiciled in Canada with a market capitalization of approximately $76 billion as of December 2019. Thus far it is too early to tell whether there will be any significant changes in how the firm acquires and manages its railroad portfolio. In the New England states, GW operates four railroads, of which two are active in Vermont: the New England Central and St. Lawrence & Atlantic.

- **New England Central Railroad Company (NECR)** – NECR operates throughout New England including 228 miles in Vermont that links Alburgh (connection to CN) and White River Junction, Bellows Falls, and points south to Massachusetts and Connecticut. This line hosts Amtrak's *Vermonter* service between St. Albans and East Northfield, Massachusetts.
- **St. Lawrence & Atlantic (SLR)** – SLR travels between Canada (connection with CN at Richmond, QC) to Auburn Maine passing through the northeast corner of Vermont. SLR operates on approximately 31 miles of track in Vermont from Norton to North Stratford, NH.

Impact from COVID

The COVID-19 pandemic has impacted most aspects of life in the US through early 2020 including rail freight movement. Pandemic-related reductions in commuting and other travel have reduced demand for fuel oils, automobiles, and other key rail freight commodities. Import/export traffic has also declined, leading to a reduction in domestic transportation of international freight. As of June 2020, rail freight traffic in Vermont is down approximately 25-30 percent from prior years with some railroads decreasing shipping frequency as a result.[42] In comparison, freight vehicle miles traveled in Vermont was down approximately 10 percent through April 2020 and down nine percent across the northeast.[43]

The potential long-term impacts of this pandemic on freight rail traffic are difficult to predict, and will be affected by the nation's recovery from the pandemic and economic recession.

3.1.2 Existing Passenger Services

Vermont is served by two regularly scheduled passenger rail services, the *Vermonter* and the *Ethan Allen Express*. Both services are operated by Amtrak with financial support provided by the State. There are also a number of privately-operated tourist trains that operated seasonally in Vermont.

Vermonter Service

The *Vermonter* operates daily between Washington, D.C. and St. Albans, VT taking 13 hours and 45 minutes to cover the approximately 600 mile distance. Trains depart Washington, D.C. at 8 AM and St. Albans at 9:15 AM. Between Washington, D.C. and New Haven, CT the train utilizes the Northeast Corridor and intersects with services on that route. The train also shares a route between New Haven and Greenfield, MA with the Valley Flyer service (and with Hartford Line Amtrak and commuter service between New Haven and Springfield, MA). The train also connects with the Boston-Chicago Lake Shore Limited in Springfield, MA.

The *Vermonter* makes 30 stops between Washington and St. Albans, including 10 in Vermont (from south to north):

[42] Vermont Rail Action Network email, June 18, 2020. Interviews with Vermont rail operators.

[43] https://www.cmap.illinois.gov/documents/10180/1127382/Long+Haul+Freight+trends+COVID-19.pdf/7ea3d114-029a-c78c-8d86-39a4da8d8b57

- Brattleboro
- Bellows Falls
- Claremont, NH (3 miles from VT, financed in part by Vermont)
- Windsor-Mt. Ascutney
- White River Junction
- Randolph
- Montpelier-Barre
- Waterbury-Stowe
- Essex Junction
- St. Albans

In Vermont, the *Vermonter* covers approximately 185 miles using track owned by NECR. Cleaning of the trainsets is performed during layover at St. Albans, while maintenance and servicing of trainsets is performed at the southern terminal in Washington, DC. Since this route no longer runs via Palmer, MA where the train had to reverse direction, trains no longer must have a double-end configuration. Additional work on the *Vermonter* route since 2015, particularly in Connecticut, has increased reliability and station accessibility.

Ethan Allen Express Service

The *Ethan Allen Express* connects Rutland and Castleton, VT to New York City via Albany, NY. The train covers approximately 241 miles, fifteen of which are in Vermont over tracks owned by the Clarendon & Pittsford Railroad. The train leaves southbound from Rutland by 8 AM, with departure from New York City around 6 PM. Connections to multiple other Amtrak routes are available including the Adirondack, Empire Service, Lake Shore Limited, Maple Leaf, and all trains on the Northeast Corridor in New York City.

Trainsets are cleaned in Rutland during layovers with maintenance and servicing performed in New York City.

Both the *Vermonter* and the *Ethan Allen Express* are operated using standard Amtrak Northeast Corridor intercity rolling stock, consisting of single level Amfleet coaches and P40/P42 diesel (*Vermonter*) or P32ACDM dual-mode (*Ethan Allen Express*) locomotives which run on electric near New York Penn Station and on diesel everywhere else. The Amfleet equipment dates from the mid-1970's, and is thus approaching 50 years in age. There are two state-sponsored maintenance facilities in the State, one in Rutland and one in St. Albans to service the two trains.

Vermont is working with Amtrak, Massachusetts, and Connecticut to procure new rolling stock for the *Vermonter*. Vermont is also working with Amtrak and New York State to procure new rolling stock for the *Ethan Allen Express*. At this time, offerors have submitted proposals that are being evaluated by Amtrak and its State partners, with a decision expected in the near future.

As described in Section 2.5.1 above, work north of Rutland to extend service to Burlington's Union Station with stops in Middlebury and Vergennes is anticipated to be completed by the end of 2021. Trains would be stored overnight in a VRS railyard just south of Maple St. in Burlington with a morning southbound departure to New York City.[44] More than $100 million has been spent to upgrade to continuously welded track and upgrade crossings and bridges between Rutland and Burlington to allow passenger train speeds of up to 59 miles per hour (40 mph for freight).[45] An additional $72 million has been spent to replace two rail bridges in downtown Middlebury with a concrete tunnel that will provide 21 feet of clearance, enough for future double-stack freight service on the line.[46]

A full list of Vermont's Amtrak stations and their amenities (including Americans with Disability Act status) is provided in Table 3.2.

[44] https://vtdigger.org/2020/03/13/when-amtrak-arrives-trains-will-be-stored-in-burlington-rail-yard/

[45] https://addisonindependent.com/news/midd-vergennes-prepare-passenger-rail

[46] There are other structures along the *Ethan Allen Express* route that do not currently allow double-stack clearance.

TABLE 3.2 VERMONT AMTRAK STATION AMENITIES

Station	Amenity									
	PLATFORM	WAITING AREA	WHEELCHAIR LIFT	RESTROOMS	PAYPHONE	WIFI	ATM	VENDING MACHINE	SAME DAY PARKING	OVERNIGHT PARKING
Rutland	ADA	ADA	No	ADA	Yes	No	No	No	ADA	ADA
Castleton	ADA	ADA	Yes	ADA	No	No	No	No	ADA	ADA
St. Albans	ADA	Yes	No	Yes	No	No	No	Yes	ADA	ADA
Essex Junction	ADA	ADA	Yes	No	Yes	No	No	No	ADA	ADA
Waterbury-Stowe	ADA	ADA	Yes	ADA	Yes	No	No	No	ADA	ADA
Montpelier-Barre	ADA	Yes	Yes	ADA	Yes	No	No	No	ADA	ADA
Randolph	ADA	No	Yes	No	No	No	No	No	ADA	ADA
White River Junction	ADA	ADA	Yes	ADA	No	No	No	Yes	ADA	ADA
Windsor-Mt. Ascutney	ADA	No	Yes	No	Yes	No	No	No	ADA	ADA
Claremont, NH	ADA	No	Yes	No	No	No	No	No	ADA	ADA
Bellows Falls	ADA	ADA	Yes	No	Yes	No	No	No	ADA	ADA
Brattleboro	ADA	ADA	Yes	ADA	No	No	No	No	Yes	No

Source: Amtrak.com; ADA = Amenity is Americans with Disabilities Act accessible.

ADA-related work completed in 2019 includes:

- Castleton – waiting room and bathroom improvements.
- Brattleboro and Essex Junction – Planning and design for multiple ADS projects
- Windsor – ADA compliant platform, parking and accessible pathways.[47]

COVID-19 Impact

The Coronavirus (COVID-19) which arrived in the United States in January 2020 has had a significant impact on intercity passenger rail service in Vermont. Starting March, 26, 2020 Amtrak suspended service into Vermont, with the *Ethan Allen Express* terminating at Albany, NY and the *Vermonter* terminating at New Haven, CT.[48] Valley Flyer service between New Haven, CT and Greenfield, MA is operating on a reduced schedule.[49]

3.1.3 Vermont's Tourist Trains

Green Mountain Railroad operates tourist train trips from Burlington and Chester, VT. From Chester, trains run to Rockingham Falls (1 or 2 hour round trips available) or Rutland (4 hour trip, 2 hours in Rutland) during September and October. 3-4 trips per week are operated. There is also a pumpkin-themed trip (1 hour round trip) in October. From Burlington, Green Mountain Railroad offers a dinner train, a murder mystery train, a wine tasting train which travel through the Champlain Valley as far as Middlebury (up to 3 hour round trip), as well as specialty trips for Columbus Day, after the Burlington City Marathon (typically Memorial Day weekend) and for children.[50]

3.1.4 Abandoned, Out of Service, Rail-Banked, and Embargoed Lines

In September 2018, the Surface Transportation Board accepted a notice of interim trail use request by the Town of Bennington. This request will allow a portion of the VTR Benninngton Branch from MP 57.35 (River St. in Bennington) to MP 58.93 (bridge over Furnace Brook) on which service was terminated by VTR to be used as an interim trail subject to future restoration of rail service.[51]

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[47] https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/statefactsheets/VERMONT19.pdf

[48] https://www.mynbc5.com/article/vermont-gov-suspends-amtrak-service-because-of-covid-19/31935541

[49] https://www.amtrak.com/alert/nec-modified-schedule.html

[50] https://www.rails-vt.com/

[51] https://www.stb.gov/decisions/readingroom.nsf/UNID/38B617351FBEEB1685258308005A278F/$file/46598.pdf

No additional rail lines in Vermont have been abandoned, placed out of service, or rail-banked since the 2015 SRP. The Lamoille Valley Railroad ceased operations in 1994[52] and is in the process of being converted to a rail trail. The Twin State Railroad remains closed since the passing of Clyde Forbes in 2011.

3.1.5 Multimodal Connections

Freight Rail

The ability to transfer freight between rail and other modes (chiefly truck) is an important part of the freight system. Trucks are needed in most cases to move goods the "last mile" to and from freight facilities such as warehouses, stores, and manufacturing facilities. For rail-truck transfers, there are two common methods. First, intermodal facilities allow for easy transfer between rail and truck for containers, automobiles, and other packaged material. Containers or other packaged goods are moved beween modes without breaking down the cargo into smaller pieces, increasing speed and reducing cost. There are no intermodal container facilities located in Vermont, although numerous facilities exist nearby in Western Massachusetts (Ayer, Palmer, Worcester, West Springfield) and New York (Mechanicville) as well as Canada (Montreal).

Second, transload facilities provide locations for the transfer of non-containerized shipments between rail and truck (or rail and pipeline in some cases). While this allows for a wider range of goods to be transferred, it is most suitable for bulk and break-bulk commodiites where the risk of product damage is modest. All of Vermont's transload facilities are operated by private customers to move their goods between modes. These facilities are listed in Table 3.3 and shown in Figure 3.4.

TABLE 3.3 VERMONT RAIL TRANSLOAD FACILITIES

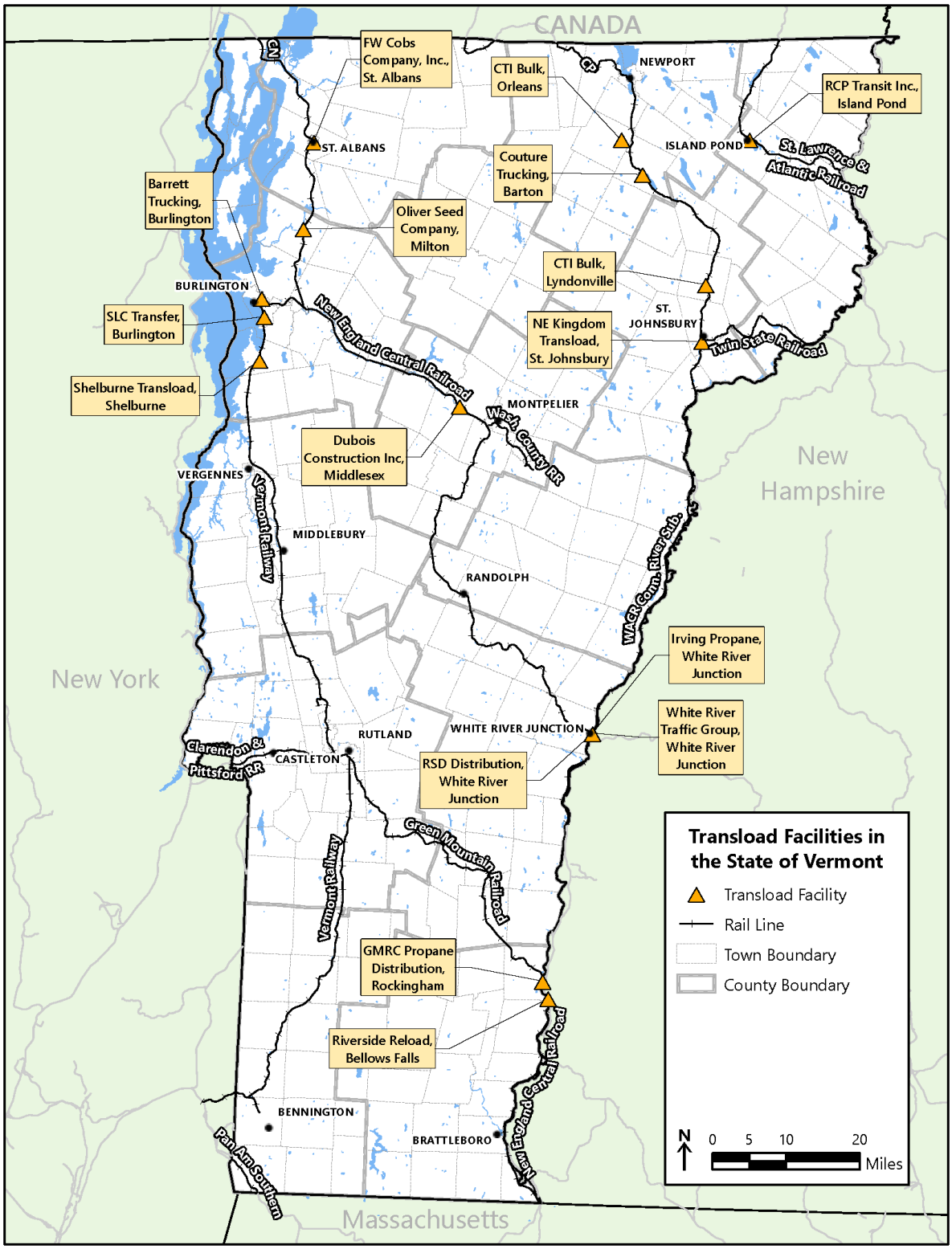
Company	Location	Railroad	Key Goods/Services
Green Mountain Railroad	Rockingham	GMRC	Propane
Riverside Reload	Rockingham	GMRC	Forest products, metals, building material
Dubois Construction Inc	Middlesex	NECR	Construction material
Irving Propane	White River Junction	NECR	Heating fuel
Oliver Seed Company	Milton	NECR	Agricultural products
FW Cobs Company, Inc.	St. Albans	NECR	Agricultural products
RSD Distribution	White River Junction	NECR	Food grade warehouse space
RCP Transit, Inc	Island Pond	SLR	
Barrett Trucking	Burlington	VTR	Dry bulk, salt, oversize/overweight shipments

[52] This section is being transitioned to a rail trail with planned completion of the 93 mile project in 2022 after additional funding was approved in August 2020. See: https://www.burlingtonfreepress.com/story/news/2020/08/12/vermont-rail-trail-project-secures-millions-funding-phil-scott/3356138001/

Company	Location	Railroad	Key Goods/Services
Shelburne Transload	Shelburne	VTR	Salt, animal feed, heating fuel
SLC Transfer	Burlington	VTR	Dry bulk, agricultural limestone
Couture Trucking	Barton	WACR Conn. River	Malted barley
CTI Bulk	Orleans, Lyndonville	WACR Conn. River	Dry bulk, chemicals, fertilizer, petroleum
Northeast Kingdom Transload	St. Johnsbury	WACR Conn. River	Logs/lumber, cement, consumer and retail goods
White River Traffic Group	White River Junction	WACR Conn. River	Crossdocking, warehousing

Source: http://www.vrs.us.com/vrs_connect/SLCtransfer.html; Interviews with railroads.

FIGURE 3.4 VERMONT TRANSLOAD FACILITIES



Source: http://www.vrs.us.com/vrs_connect/SLCtransfer.html; Interviews with railroads

Passenger Rail

Amtrak stations are located in close proximity to bus service at nine of the eleven Amtrak stops in Vermont, providing an intermodal connection for travelers. Stations in Montpelier-Barre, Windsor-Mt. Ascutney, and Claremont, NH lack this option. Intercity bus service through Greyhound connects White River Junction to New York City with stops in Bellows Falls and Brattleboro (Buses 2033 and 2010).[53]

TABLE 3.4 VERMONT AMTRAK STATIONS - MULTIMODAL CONNECTION

Station	Scheduled Local Bus Connections	Scheduled Intercity Bus Connections	Sources
Castleton	Marble Valley Regional Transit District Fair Haven Route		.3 miles from Amtrak Station to bus stop https://www.thebus.com/fair-haven-route/
Rutland	Marble Valley Regional Transit District North, South Extension, and West Routes across parking lot. Multiple additional routes located from Marble Valley Regional Transit Center .4 miles from Amtrak station		.4 miles from Amtrak Station to Marble Valley Regional Transit Center https://www.thebus.com/routes/
St. Albans	Green Mountain Transit Bus 96 (Weekdays only), 110, 115 (Commuter), 116 (Commuter)		.3 miles from Amtrak Station to City Hall stop https://ridegmt.com/regions/franklingrand-isle-counties/
Essex Junction	Green Mountain Transit Blue Line, Orange Line, Orange-Silver Line, Silver Loop		https://ridegmt.com/gmt-schedules/
Waterbury-Stowe	Green Mountain Transit Bus 83 (Commuter), 100 (Commuter). Bus 86 (Weekday only) .1 miles away		https://ridegmt.com/regions/stowelamoille/
Montpelier-Barre			2.7 miles to GMT Bus 83 https://ridegmt.com/wp-content/uploads/83.pdf
Randolph	Stagecoach 2nd Friday Shopper, 89er, 89er North, Berlin Shopper, Woodstock, Hancock Route, Randolph Area Circulator, Randolph Shopper, Saturday Shopper, Chelsea Route, Royalton Route.		https://stagecoach-rides.org/

[53] https://bustracker.greyhound.com/routes/2010/I/New_York_NY-White_River_Jct_VT/GLI_2010/06-11-2020

Station	Scheduled Local Bus Connections	Scheduled Intercity Bus Connections	Sources
White River Junction	Stagecoach 89er. Advance Transit Orange and Yellow Lines.	Greyhound	https://stagecoach-rides.org/; https://advancetransit.com/service-map/;
Windsor-Mt. Ascutney			
Claremont, NH			http://www.scshelps.org/transportation.htm
Bellows Falls	Connecticut River Transit Authority Routes 2, 53, 55, 57	Greyhound	.3 mile walk from Amtrak to local bus routes
Brattleboro	The Current Brattleboro White Line (Weekends) and Blue Line (Weekdays)	Greyhound	https://crtransit.org/bus-schedules/brattleboro/brattleboro-bus-service-maps/

Source: See table.

Finally, Vermont Shires Connector provides bus service beteween the Albany International Airport, Albany's Greyhound Bus Terminal, Albany-Rensselaer Amtrak Station (connections to New York, Niagara Falls, and Chicago) and several stops in Manchester.[54] Service has been disrupted due to COVID-19 but service changes are planned to expand this connection north to Rutland, including a stop in Wallingford. The Connector also provides service along Rt. 7 from Colchester through Burlington, Middlebury, Brandon, Rutland, and Castleton to Albany with the intent to promote direct service between Albany and Rutland.

3.1.6 Intercity Passenger Service Objectives

This section to be developed as part of the "Objectives for Passenger Rail Service" in the "Vision, Goals, Needs, and Gaps" Tech Memo.

3.1.7 Intercity Passenger Rail Performance Evaluation

Evaluating passenger rail performance can take many different forms. One of the simplist categories to understand is total ridership.

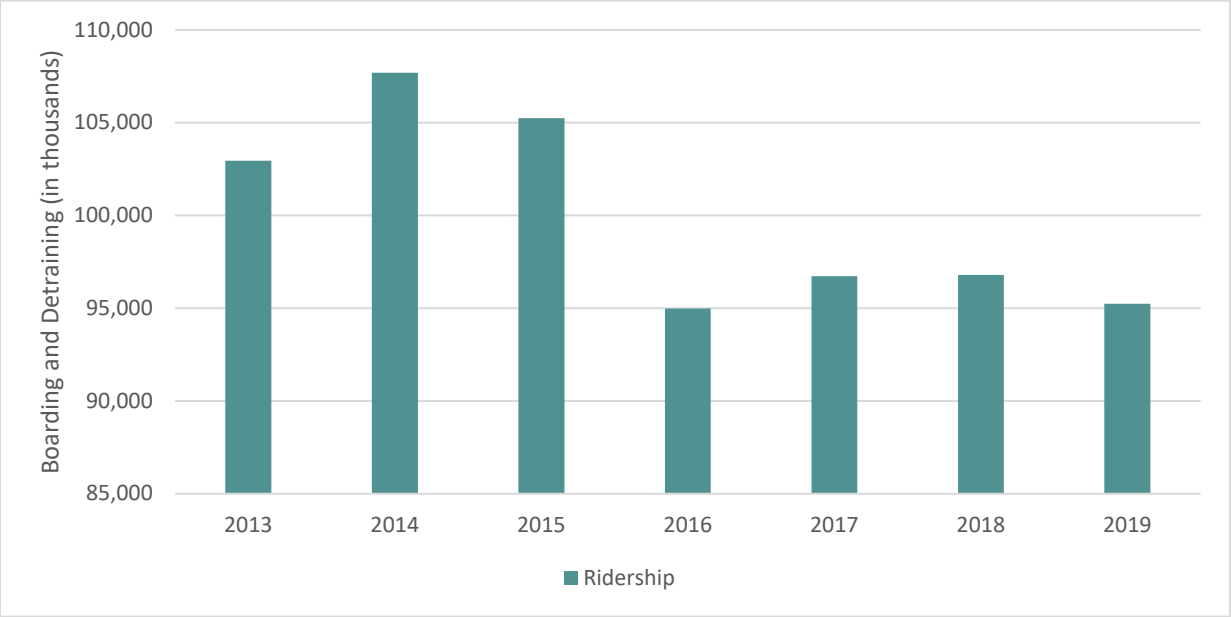
Amtrak ridership on the *Ethan Allen Express* and *Vermonter* has decreased from a high in FFY2014, as shown in Figure 3.5. In comparison, ridership in NY and MA has risen consistently from FFY2013-2019, while NH has seen a growing ridership since a low in FFY2015. Nationally, Amtrak ridership is up slightly to 32.5 million passengers in FFY2019 from 31.7 million in FY2018, with a similar low in FFY2016 with 31.3 million

[54] https://www.vttranslines.com/vermont-shires-connector/

passengers.[55] During outreach, stakeholders noted that recently completed projects in Connecticut and Massachusetts may have contributed to a decline in ridership due to service interruptions or delays.

It should be noted past ridership trends may be a poor indication of ridership in 2020 and future years given the continuing COVID-19 situation.

FIGURE 3.5 AMTRAK RIDERSHIP (FFY2013-2019)



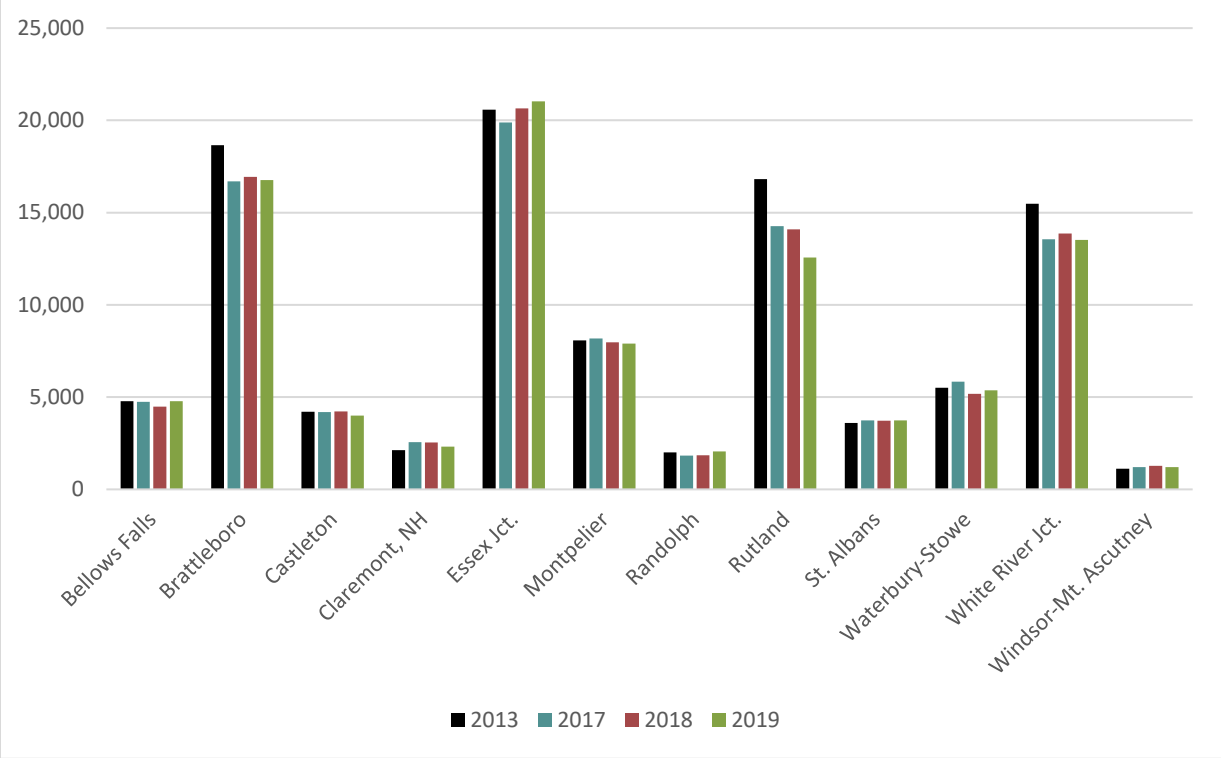
Source: Amtrak, 2014 data from Vermont Transportation Board. Note, ridership includes the Claremont, NH stop.

By station, Essex Junction (closest stop to Burlington), Brattleboro, Rutland, and White River Junction generate the most Amtrak ridership, as Figure 2 shows. Those four stops (out of 11 total in Vermont) account for nearly 69% of all ridership in FFY2019 (67% if ridership at Claremont, NH is included). Rutland is served by the *Ethan Allen Express*, the other three stops by the *Vermonter*.

Ridership from FFY2013 is included (black bars) to provide historical reference. Of the top four stations, ridership at Brattleboro, Rutland, and White River Junction has declined since FFY2013 with a slight increase at Essex Junction, consistent with the overall decline in Amtrak ridership between FFY2013 and FFY2019.

[55] Amtrak Ridership and Revenue Fact Sheets.

FIGURE 3.6 AMTRAK RIDERSHIP BY STATION (FFY2013, 2017-2019)



Source: Amtrak.

In FFY2019, the average trip length was 259 miles, in large part driven by a set of top city pairs, shown in Table 1. The top 7 pairs by both ridership and revenue were the same.

TABLE 3.5 VERMONT TOP CITY PAIRS BY AMTRAK RIDERSHIP AND REVENUE (FFY2019)

Rank	Top City Pairs by Ridership (2019)	Top City Pairs by Revenue (2019)
1	Rutland – New York, NY	Rutland – New York, NY
2	Brattleboro – New York, NY	Brattleboro – New York, NY
3	Essex Junction – New York, NY	Essex Junction – New York, NY
4	White River Junction – New York, NY	White River Junction – New York, NY
5	Castleton – New York, NY	Castleton – New York, NY
6	Montpelier – New York, NY	Montpelier – New York, NY
7	Waterbury-Stowe – New York, NY	Waterbury-Stowe – New York, NY
8	Bellows Falls – New York, NY	White River Junction – Washington, DC.
9	Brattleboro – Essex Junction	Essex Junction – Washington, DC.
10	Essex Junction – Philadelphia, PA	Essex Junction – Philadelphia, PA

Source: Amtrak for Top City Pairs by Ridership, Rail Passengers Association for Top City Pairs by Revenue and average trip length.

PRIIA Section 207 requires that Amtrak report certain performance metrics for train routes in order that Amtrak, elected officials, and other policy makers may work together to improve the national passenger rail network.[56] The Section 207 performance metrics for the *Ethan Allen Express* are reported in Table 3.6 while performance measures for the *Vermonter* are reported in Table 3.7. These results are the average of the four most recent quarterly reports from FFY2018 Q4 through FFY2019 Q3. The Section 207 performance metrics are organized into categories: financial, on-time performance, train delays, and customer service. The financial metrics are measured the basis of continuous year-over-year improvement over the prior eight quarters, a rolling metric, while other metrics are measured against standards. The latest information, including current and past Section 207 reports is available from the FRA Rail Service Metrics and Performance website at https://railroads.dot.gov/passenger-rail/amtrak/rail-service-metrics-and-performance-reports.

Neither service met all PRIIA-defined goals over the last four quarters, with continous financial improvement being a concern for the *Ethan Allen Express* and delay a concern for the *Vermonter*. Both routes received mixed customer service indicator scores, with on-board food service scoring lowest of the categories monitored.

TABLE 3.6 *ETHAN ALLEN EXPRESS* PRIIA SECTION 207 PERFORMANCE

Category	Metric	PRIIA Section 207 Standard	Last Four Quarters Average (2018 Q4-2019 Q3)	Met PRIIA Goals?
Financial	Percentage of operating costs recovered by passenger related revenue (last 8 quarters)	Continuous Improvement	83%	No (was 83% in 2013-2014)
	Passengers per train mile (last 8 quarters)	Continuous Improvement	144	No (was 164 in 2013-2014)
On-Time Performance	Change in effective speed from FFY2008 baseline (mph)	>=0	4.4	Yes
	End point on time performance	80%	92.6%	Yes
	All stations on time performance	80%	89.0%	Yes
Train Delays	Host Responsible Delays – minutes per 10,000 train miles (by each host railroad)	<=900	MNRR* – 1,635.8	No
			Amtrak – 93.8	Yes
			CP** – 690.5	Yes
	Amtrak Responsible Delays – minutes per 10,000 train miles for off-NEC corridors	<=325	208.3	Yes
	Overall Service	82	85.0	Yes
	Amtrak personnel	80	84.5	Yes

[56] The latest information, including current and past Section 207 reports is available from the Federal Railroad Administration Rail Service Metrics and Performance website at https://railroads.dot.gov/passenger-rail/amtrak/rail-service-metrics-and-performance-reports

Category	Metric	PRIIA Section 207 Standard	Last Four Quarters Average (2018 Q4-2019 Q3)	Met PRIIA Goals?
Customer Service Indicators	Information given	80	76.8	No
	On-board comfort	80	82.5	Yes
	On-board cleanliness	80	74.0	No
	On-board food services	80	67.8	No

Source: *https://railroads.dot.gov/passenger-rail/amtrak/rail-service-metrics-and-performance-reports*

**MNRR – Metro-North Railroad. **CP – Canadian Pacific*

TABLE 3.7 *VERMONTER* PRIIA SECTION 207 PERFORMANCE

Category	Metric	PRIIA Section 207 Standard	Last Four Quarters Average (2018 Q4-2019 Q3)	Met PRIIA Goals?
Financial	Percentage of operating costs recovered by passenger related revenue (last 8 quarters)	Continuous Improvement	103%	Yes (was 49% in 2013-2014)
	Passengers per train mile (last 8 quarters)	Continuous Improvement	145	Yes (was 134 in 2013-2014)
On-Time Performance	Change in effective speed from FFY2008 baseline (mph)	>=0	3.5	Yes
	End point on time performance	80%	85.0%	Yes
	All stations on time performance	80%	76.2%	No
Train Delays	Host Responsible Delays – minutes per 10,000 train miles (by each host railroad)	<=900	MADOT* – 2,468.5	No
			MNRR** – 2,801.5	No
			NECR*** – 1,142.0	No
	Amtrak Responsible Delays – minutes per 10,000 train miles for off-NEC corridors	<=325	334.3	No
	Amtrak Responsible Delays – minutes per 10,000 train miles for the NEC	FFY2018: 475 FFY2019: 475	412.3	Yes
Customer Service Indicators	Overall Service	82	80.0	No
	Amtrak personnel	80	81.8	Yes
	Information given	80	75.8	No
	On-board comfort	80	81.0	Yes
	On-board cleanliness	80	73.0	No
	On-board food services	80	64.3	No

Source: *https://railroads.dot.gov/passenger-rail/amtrak/rail-service-metrics-and-performance-reports*

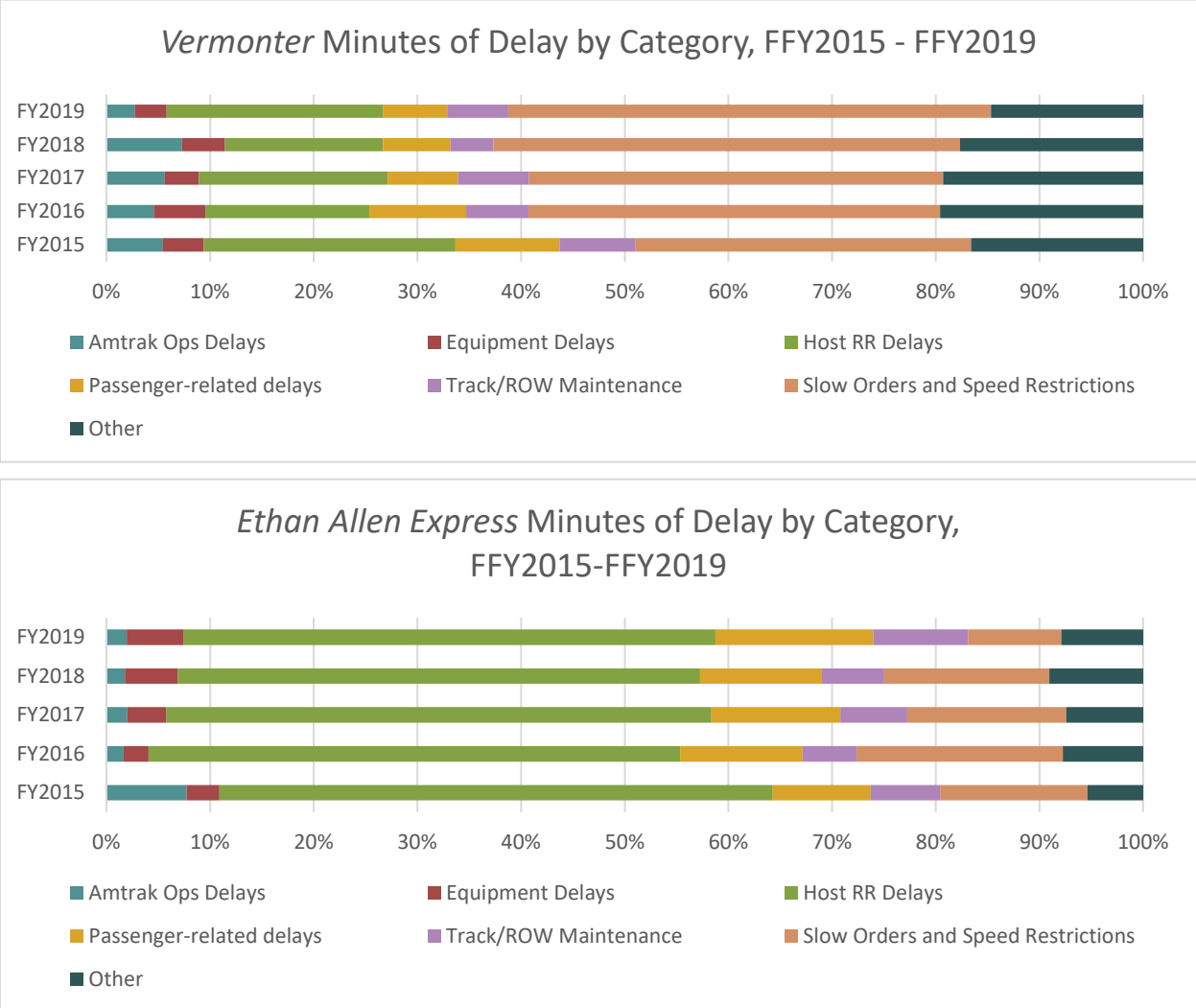
**MADOT – Massachusetts DOT. **MNRR – Metro-North Railroad. ***NECR – New England Central Railroad.*

Amtrak defines On-Time Performance as the total number of trains arriving on-time at a station divided by the total number of trains operated on that route. A train is considered on-time if it arrives at the final destination within an allowed number of minutes, or tolerance, of its scheduled arrival time.

Causes for Amtrak train delays can be attributed to a number of reasons including the host railroad, Amtrak itself, or other delays such as law enforcement actions. The delay profile reported by Amtrak for the *Ethan Allen Express* and the *Vermonter* for FFY215-2019 is provided in Figure 3.7.

Slow orders and speed restrictions are responsible for the vast majority of delay minutes on the *Vermonter*. While slow orders also play a role in delays for the *Ethan Allen Express*, the largest contributing factor is host railroad delays which account for more than 50 percent of the total minutes lost. Note that these figures do not reflect any outright service cancellations.

FIGURE 3.7 CAUSES OF DELAY FOR *VERMONTER* AND *ETHAN ALLEN EXPRESS*, Q3 FFY2019



Source: Amtrak

3.1.8 Public Financing of Rail

Federal

Until the 2008 passage of PRIIA and the American Recovery and Reinvestment Act in 2009, federal funding for rail projects beyond the FHWA's Section 130 grade crossing program was very limited, sporadic and largely advanced through earmarks sponsored by congressional representatives. Since then, multiple grant programs have been established that can be tapped for freight and passenger rail programs. In 2012, the Moving Ahead for Progress in the 21st Century (MAP-21) succeeded SAFTEA-LU, the previous surface transportation bill. MAP-21 did not make any changes to potential funding sources for intercity passenger rail service, and actual appropriation levels dropped substantially from those of FFYs 2009 and 2010.

Successor legislation to MAP-21 did not arrive until December 2015, when Congress approved the FAST Act. This Act authorized $305 billion in funding for federal surface transportation programs for FFY2016 through FFY2020. A first for a Federal surface transportation authorization, the Act contained a rail title that defined a program for passenger and freight rail investment, along with policy guidance. The Act is far more prescriptive for passenger rail funding than for freight opportunities. However, funds for these programs must be appropriated annually from general revenues rather than dedicated surface transportation funds. Freight rail funding eligibility is included under broader, surface transportation elements of the bill, offering opportunities for Vermont carriers and communities. These are described in the following section.

Railway-Highway Grade Crossings (Section 130) Program

This program provides funds for the elimination of hazards at railway-highway crossings. Approximately $230 to $245 million in funding is set aside by the FAST Act on an annual basis, which is allocated to states from the Highway Safety Improvement Program (HSIP) apportionment. Projects funded through the Section 130 program are eligible for 90 percent federal funding Projects may include, but are not limited to, crossing closures, grade separations, crossing surfaces, and installation or improvements to warning devices (flashing lights and gates). Projects must be located at one of Vermont's roughly 400 public crossings.

At least half of a State's Section 130 funds have to be used on improvements related to warning devices at highway-railroad crossings. Vermont's 2020 STIP Section 130 spending includes spending on a range of projects such safety improvements, crossing improvements, and resurfacing.[57] This information is presented in more detail in Section 3.1.9.

Projects under the Section 130 program are selected on a statewide, competitive basis. A Diagnostic Review of the crossing is held to determine the appropriate level of traffic control at a crossing. If the crossing is determined to need flashing lights and gates, it is placed on a list. This list is used to prioritize potential projects using metrics that include crash history, vehicle volumes (annual average daily traffic - AADT), train volumes, train speeds and the associated required sight distance, among other items.

[57] Vermont Statewide Transportation Improvement Program, SFY2020-2023.

The amount of funds available through the Section 130 program varies from year to year. Nationally in FFY2020, $245 million was made available to states, with Vermont receiving just over $1.2 million for this program.[58]

Better Utilizing Investments to Leverage Development (BUILD) Grant Program

In 2018, the BUILD Transportation Discretionary Grants program replaced the TIGER Discretionary Grants program. BUILD, like TIGER, is focused on surface transportation infrastructure investments that make a positive impact throughout the country. Funds may be requested for capital projects that include, but are not limited to: passenger and freight rail transportation projects; public transportation projects; intermodal projects; highway, bridge, or other road projects; and port infrastructure investments. Up to $15 million may be awarded as grants for the planning, preparation or design of eligible projects.

In Vermont, a 2018 BUILD Grant for approximately $20 million was awarded to rehabilitate and replace 31 rail bridges along 53 miles of Vermont Railway track between Rutland and Bennington. The State and VRS are contributing $11 million to the project.[59] The project will allow loads up to 286,000 pounds to travel the line, providing additional options to businesses along the corridor and improving track and bridge conditions to allow for any future passenger service.

Nationally Significant Freight and Highway Projects (NSFHP)

Renamed to Infrastructure for Rebuilding America from FASTLANE in 2018, this competitive grant program authorizes $4.5 billion over five years for projects that will result in improved goods movement, of which up to 20 percent and $500 million of the authorized amount is available for port, rail, and intermodal projects. For projects exceeding $100 million in estimated cost, grant requests must be at least $25 million. Ten percent of funding is set aside for projects under $100 million in total cost, in which case the minimum grant amount is $5 million. In addition, rural set-asides are specified to be a minimum of 25 percent; in reality, they have been closer to 45 percent over the life of the program through FFY2019.[60]

Consolidated Rail Infrastructure and Safety Improvements (CRISI)

This FRA discretionary program was established in Section 11301 of the FAST Act, and thus far has disbursed $628 million through three cycles for projects that improve passenger and freight rail transportation systems in terms of safety, efficiency, or reliability. A number of project types are eligible, including safety technology and PTC, congestion-reducing capital projects, corridor service development plans, and at-grade rail crossing improvement projects. Program guidelines require that at least 20 percent of proceeds be dedicated to rural projects.

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[58] FFY2020 Computational Tables, USDOT. Online at: https://www.fhwa.dot.gov/fastact/funding.cfm

[59] https://vermontbiz.com/news/2018/december/06/vermont-scores-20-million-investment-rail-infrastructure

[60] https://www.enotrans.org/article/dot-announces-20-more-infra-grants-for-fy19/

Vermont received just over $2 million in 2018 for slope stabilization projects along an 80-mile stretch of NECR to improve *Vermonter* service following a 2015 *Vermonter* derailment due to a rock slide.[61]

Federal-State Partnership for State of Good Repair Grant Program

Defined in Section 11302, this FRA-administered grant program provides funding for intercity passenger rail capital projects that replace existing assets to increase capacity, bringing to a state of good repair, and maintaining service while assets are brought to a state of good repair. This includes capital projects to replace existing assets in-kind, replacement of existing assets with assets that increase capacity or provide a higher level of service, or projects that bring existing assets into a state of good repair. Vermont has not received any of the $668 million disbursed under this program.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The FAST Act provides from $2.3 to almost $2.5 billion in congestion mitigation and air quality improvement (CMAQ) funding for each year of the authorization - 2016 through 2020. The CMAQ program provides funding to projects that will improve the nation's air quality and reduce traffic congestion. Funding is focused on areas whose air quality does not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (non-attainment areas) and for former non-attainment areas that are now in compliance (maintenance areas). Funds may be used for transportation projects likely to contribute to the attainment or maintenance of a national ambient air quality standard, with a high level of effectiveness in reducing air pollution. Eligible projects should be included in the MPO's current transportation plan and TIP or the current STIP in areas without an MPO. Eligible activities include projects that shift traffic demand to non-peak hours or other transportation modes, increase vehicle occupancy rates, or otherwise reduce demand. Vermont's apportionment of CMAQ funding for FFY2019 was $12.5 million.[62]

Surface Transportation Block Grant Program - 23 USC 133

This grant program offers flexible funding to best address State and local transportation needs. Eligible projects include highway and transit safety infrastructure improvements and programs, including railway-highway grade crossings. Estimated funding under the FAST Act ranges from $11.5 to $12.1 billion each year allocated to states under the authorization from 2016 through 2020.

[61] https://railroads.dot.gov/newsroom/us-department-transportation-announces-more-56-million-grants-improve-rail-safety

[62] https://www.fhwa.dot.gov/fastact/comptables2019/table7p1.cfm

Metropolitan and Statewide and Non-Metropolitan Transportation Planning Grants (Sec. 5303, 5304, 5305)

This formula funding program, administered by the Federal Transit Administration (FTA), provides funding and procedural requirements for multimodal transportation planning in metropolitan areas and states. Funds are available for planning activities that:

- Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
- Increase the safety of the transportation system for motorized and nonmotorized users;
- Increase the security of the transportation system for motorized and nonmotorized users;
- Increase the accessibility and mobility of people and for freight;
- Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;
- Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
- Promote efficient system management and operation; and
- Emphasize the preservation of the existing transportation system.

Funds are apportioned to states by a formula that includes each state's urbanized area population in proportion to the total urbanized area population for the nation, as well as other factors. States can receive no less than 0.5 percent of the amount apportioned. These funds, in turn, are sub-allocated by states to MPOs by a formula that considers each MPO's urbanized area population, their individual planning needs, and a minimum distribution.

Federal Loan Programs and Tax Credits

Federal loan programs and tax credits available to railroads include the Rail Rehabilitation and Improvement Financing (RRIF), Transportation Infrastructure Finance and Innovation Act (TIFIA), and Internal Revenue Service (IRS) Tax Credits.

- **RRIF:** U.S. DOT is authorized to provide direct loans and loan guarantees up to $35.0 billion to finance development of railroad infrastructure. Not less than $7.0 billion is reserved for projects benefiting freight railroads other than Class I carriers. Direct loans can fund up to 100 percent of a railroad project with repayment periods of up to 35 years and interest rates equal to the cost of borrowing to the government. A new pilot program called RRIF Express seeks to reduce the time and costs associated

with securing loans for short line and regional railroads to modernize aging freight rail infrastructure. Since the Program's inception in 2002, Vermont has not received any loans.[63]

- **TIFIA:** The TIFIA program provides federal credit assistance to eligible surface transportation projects, including highway, transit, intercity passenger rail, some types of freight rail, and intermodal freight-transfer facilities on terms acceptable to U.S. DOT. There is a rolling application process with significant requirements. The three types of credit assistance are: 1) secured loans; 2) loan guarantees; and, 3) lines of credit to fill market gaps and leverage substantial private co-investment by providing supplemental or subordinate debt. The loans are repaid through dedicated revenue sources that secure the project obligations. Projects eligible for assistance under USC title 23 or chapter 53 of USC title 49, international bridges and tunnels, intercity passenger bus and rail facilities and vehicles, public freight rail projects, private freight rail projects that provide public benefit for highway users, modification projects to facilitate transfer and access into and out of a port. A TIFIA line of credit may cover up to 33 percent of the total project cost. TIFIA loans may cover up to 49 percent of the total project cost.

- **Internal Revenue Service (IRS) Tax Credit:** Section 45G of the Internal Revenue Code created an incentive for short line railroads to invest in track rehabilitation by providing a tax credit of 50 cents for every dollar the railroad spends on track improvements. The maximum credit amount allowed is $3,500 per mile of track. The program was renewed for two years in 2018. American short line railroad advocacy groups are working to convince Congress to continue the program going forward.

State and Local Funding Options

PRIIA changed the structure by which passenger rail in the United States is funded. The 1970 Rail Passenger Service Act, which created Amtrak, established a basic system of routes over which Amtrak was required to operate intercity passenger trains. However, under Section 403(b) of the Act, states could request additional service if they covered a portion of the costs. This cost sharing arrangement was revised several times until PRIIA fundamentally altered the relationship between states and intercity passenger rail service. Section 209 of PRIIA required Amtrak, in consultation with the U.S. DOT and states, to develop a uniform methodology for allocating the operating and capital costs to states of providing intercity rail service that are either state requested, on designated high-speed rail corridors outside of the Northeast Corridor, short distance corridors, or routes less than 750 miles in length. Following a lengthy and complex series of negotiations, an initial round of new agreements consistent with Section 209 were implemented between all 19 affected states and Amtrak by late 2013. With these agreements, states are paying approximately 85 percent of the operating costs attributed to state-supported routes, as well as capital maintenance costs on Amtrak equipment, and support costs such as for safety and marketing, while Amtrak pays approximately 15 percent for costs such as centralized dispatching and services. Given the nature of the Amtrak routes in Vermont, VTrans' agreements to fund Amtrak routes are made in conjunction with other states that share those routes, principally Massachusetts, Connecticut, and New York. In recent years, total operating funding

[63] https://www.transportation.gov/buildamerica/financing/rrif/railroad-rehabilitation-improvement-financing-rrif

total operating funding paid by Vermont for both services have amounted to approximately $8.1 million annually.[64]

Private Activity Bonds

A private activity bond is a bond issued by or on behalf of local or state government for financing the project of a private user. These bonds enjoy the same tax-exempt status as other state and local bonds. Up to $15 billion can be used for transportation infrastructure, and freight transfer facilities, such as rail-truck facilities, qualify among the types of private activities for which these bonds may be issued. At least 95 percent of the net proceeds of bond issues must be expended within five years of issue date.

Vermont State Infrastructure Bank (SIB)

The Vermont State Infrastructure Bank (SIB) program, operated by the Vermont Economic Development Authority in conjunction with the Vermont Agency of Transportation and the Federal Highway Administration, is available to assist in the construction or reconstruction of highways, roads and bridges, as well as certain facilities related to rail transit. Municipalities, political subdivisions of the state, regional development corporations and private companies that have entered into a contract with a public authority to carry out a qualified project are eligible for SIB funding. All state and federal environmental permits and other approvals are required as a loan condition. The Vermont SIB loan rates and terms are:

- 3 percent fixed rate for private sector borrowers
- 1 percent fixed rate for municipal-type borrowers
- Equity contribution of between ten - 20 percent.
- Term of up to 30 years, but repayments must begin no later than five years after project completion.

Construction or reconstruction of highway, roads, bridges, and pedestrian facilities; construction of some rail transit and public transit facilities; and construction and/or installation of electric vehicle charging stations and natural gas refueling stations available for public use are eligible. In FFY2019, the SIB loaned nearly $88 million throughout the State, and has provided more than $2.5 billion in loans since 1974.[65]

Other Financing and Funding Options

Revenue from Leasing Railroad Rights-of-Way (ROW)

Vermont owns 305 of the roughly 580 active route-miles of railroad in the State and 145 miles of railbanked lines. The State has an active leasing program and collects fees and rents for the use of its rail property. The annual revenue accruing to Vermont from its railroad property leases, including fees and rents for utility

[64] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/2040_LRTP_%20Final.pdf

[65] https://www.veda.org/hubfs/VEDA.FY19.Annual.Report.pdf

crossings as well as rentals from operating railroads, is approximately $1 million per year. VTrans is updating its inventory of State-owned railroad property, and plans to use modern electronic technology and convert existing paper valuation maps into electronic form in order to more productively manage its rail assets. At present only old, paper maps are available. As of August 2020, this process is still underway. Additional work has been completed to update the Rail Property Management database used to track lease agreement information. This included reports that indicate action items (lease renewals, rate increases, insurance information updates). Changes also include effort to digitize agreements and other lease-related documents.

In addition, VTrans has begun to identify and resolve instances of illegal encroachments on all State-owned rail lines. VTrans is reviewing the fee schedule (regarding utility crossings, or co-linear use of the railroad right of way by a utility or fiber optic line) and updating it to reflect fair market value.[66] In 2019, Vermont also completed a review of master license agreements (MLAs) that cover multiple occupations of the railroad ROW in a single document. AOT and VRS have over 50 MLAs with municipalities and municipal utilities, as well as with private entities in response to Section 30 of Vermont General Assembly Act 60, passed in June 2019 which directed AOT to conduct a study of use of rail MLAs.

Funding Challenges

In general, over half of Vermont's $641 million annual transportation budget is derived from federal funding sources, primarily from the Highway Trust Fund (HTF). The HTF collects taxes on gasoline and diesel sales. Due to inflation, (the federal gas tax has not been raised since 1993), better vehicle mileage, and slow growth of vehicle miles traveled the HTF continues to face solvency concerns. State transportation fund revenues account for the second largest share of Vermont's annual transportation budget at approximately $262 million with smaller amounts from other sources including local matches, and Transportation Infrastructure Bonds (TIB) funds. State transportation fund revenues encompass a diverse combination of gas and diesel taxes, purchase and use taxes, motor vehicle fees, and TIB funding.[67] The gasoline tax risks associated with federal funding are also applicable to state funding. Mirroring national trends, Vermont has witnessed a decline in gasoline consumption as residents drive less and shift to more fuel-efficient vehicles. A 2016 study by AOT acknowledged this trend and reviewed a wide range of potential alternatives for raising additional revenue that could be explored in future years.[68]

[66] https://dec.vermont.gov/sites/dec/files/permit-handbook/sheet64.pdf

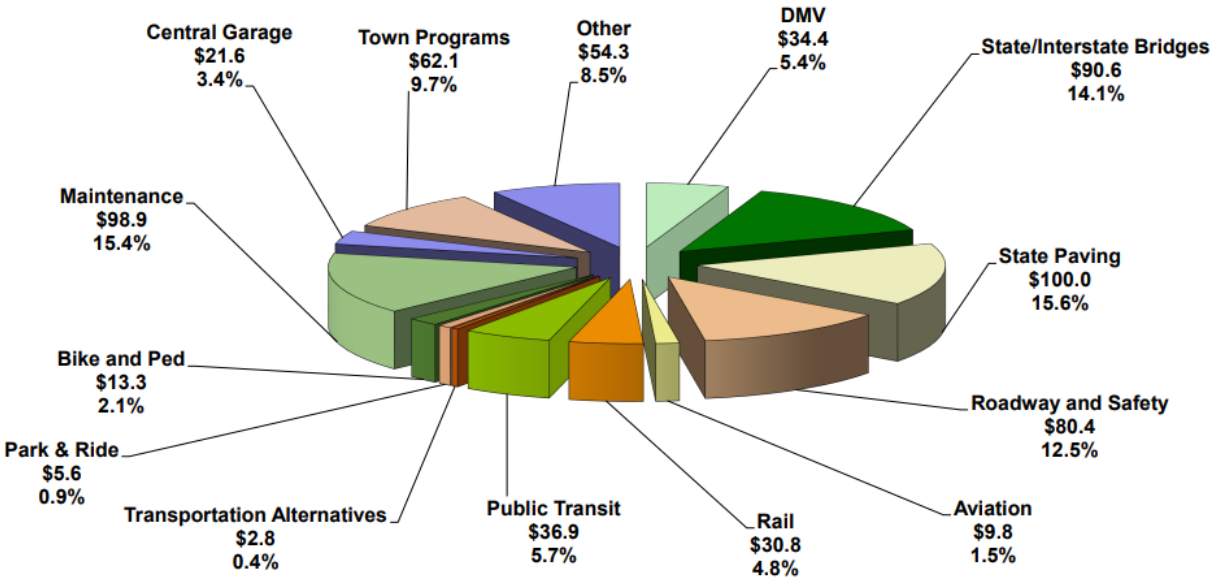
[67] https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Transportation/VTrans/VTrans%20Budget%20FY21/W~Joe%20Flynn~FY%2021%20Budget%20Presentation~1-22-2020.pdf

[68] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Vermont%20Transportation%20Funding%20Options%20%282016%29.pdf

Vermont's rail budget in SFY2021 totals approximately $31 million with funding split approximately 50/50 between state and federal sources.[69] Figure 3.8 shows the State's expenditure plan for the entire $641.3 million total budget.

The outlook for transportation funding under the current revenue mechanisms is not particularly positive for the reasons presented above. If trends continue, the gap between system needs and funding generated by the primary revenue sources will widen.[70]

FIGURE 3.8 VERMONT TRANSPORTATION BUDGET EXPENDITURE PLAN



Source:
https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Transportation/VTrans/VTrans%20Budget%20FY21/W~Joe%20Flynn~FY%2021%20Budget%20Presentation~1-22-2020.pdf

3.1.9 Safety and Security Programs and Projects

Rail safety and security is a high priority for both rail carriers and public agencies due to potential impacts on the general public and the efficiency of rail operations. Rail safety requirements are provided through a combination of federal and state laws. Most safety-related rules and regulations fall under the jurisdiction of the FRA, as outlined in the Rail Safety Act of 1970 and other legislation, such as the most recent Rail Safety Improvement Act of 2008.

[69] https://vtrans.vermont.gov/sites/aot/files/portal/documents/aboutus/capprog/21/2AGENCYOFTRANSPORTATIONSUMMARY.pdf

[70] Vermont 2040 Long Range Transportation Plan.

Passenger rail operations are subject to the same FRA safety standards with regard to track conditions, operating practices, and other areas as are freight railroads. In addition, FRA has specific regulations regarding passenger equipment safety standards and passenger train emergency preparedness. FRA's Railroad Safety Advisory Committee makes recommendations to FRA for proposed improvements to continually upgrade existing safety standards.

Rail safety issues generally fall into the following broad categories:

- Employee safety;
- Inspection and maintenance of track, signals, bridges and infrastructure;
- Inspection of locomotives and cars;
- Operating rules and operating practices;
- Radio communications;
- Control of drug and alcohol use;
- Accident reporting;
- Rail-highway grade crossing safety;
- Passenger equipment safety standards;
- Passenger train emergency preparedness;
- The movement of hazardous materials;
- The development and implementation of new technology; and
- Other areas specific to the rail industry.

The FRA is the primary agency responsible for enforcement of these federal regulations, but state agencies are heavily involved in efforts to improve the safety of the rail system.

Federal and Vermont state agencies, along with the State's rail operators, continue to make progress with regard to rail safety and security. The following is a summary of these issues and activities on-going in in the State.

Rail Safety Incident History

Railroad incidents for the last 10 years (2010-2019) in Vermont are summarized in Table 3.8. Reportable incidents include highway-rail grade crossing accidents or incidents as well as train derailments, collisions, and any accident involving railroad employees or trespassers that occur on railroad property and result in

fatalities, injuries, or property damage exceeding an amount established by FRA. Because property damage-only crashes are included, there is no direct correlation between the number of fatalities/non-fatalities and the total number of incidents.

As shown in Table 3.8 total incidents in Vermont have remained relatively low but have seen a small increase over the 10-year period while train incidents and highway-rail incidents have remained fairly steady. The spike in train incident injuries in 2015 is largely attributable to an October incident when a *Vermonter* train traveling southbound in Northfield derailed after striking rocks on the track due to a rock slide. Four passengers and three crew members suffered injuries.[71]

Other incidents (incidents other than train or crossing incidents that cause physical harm to persons) is up slightly from 2010 but down from the high in 2015. In total, incidents in Vermont represent between 0.2 and 0.3 percent of all incidents in the U.S. with a slight spike in 2015 due to the incident noted above.

TABLE 3.8 FRA REPORTABLE RAILROAD INCIDENTS 2010 – 2019 IN VERMONT

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Incidents	**20**	**19**	**21**	**26**	**29**	**34**	**32**	**32**	**28**	**30**
Deaths	1	0	1	2	1	5	1	1	0	2
Injuries	15	17	18	21	26	40	28	24	22	22
Train Incidents	**3**	**1**	**1**	**1**	**2**	**3**	**0**	**3**	**3**	**4**
Deaths	0	0	0	0	0	0	0	0	0	0
Injuries	0	0	0	0	0	13	0	0	0	0
Highway-Rail Incidents	**4**	**3**	**2**	**4**	**2**	**1**	**4**	**6**	**4**	**6**
Deaths	1	0	1	0	0	0	0	1	0	2
Injuries	2	2	0	2	2	0	1	1	1	2
Other Incidents	**13**	**15**	**18**	**21**	**25**	**30**	**28**	**23**	**21**	**20**
Deaths	0	0	0	2	1	5	1	0	0	0
Injuries	13	15	18	19	24	27	27	23	21	20

Source: FRA Office of Safety Analysis, 10-Year Accident/Incident Overview. Retrieved June 18, 2020.
https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/TenYearAccidentIncidentOverview.aspx

Comparing the total number of incidents between 2010 and 2019 to the total miles of track in Vermont, New Hampshire, Massachusetts, New York, and nationally, Vermont's rate of 0.46 incidents per mile of track 2nd lowest to New Hampshire (0.11), with both Massachusetts (1.98) and New York (4.03) substantially

[71] https://abcnews.go.com/US/amtrak-passenger-train-derails-northfield-vermont/story?id=34258647

higher. Nationally, the total incidents per mile of track over this period was 0.83.[72] The relatively rural nature of both Vermont and New Hampshire along with less expansive service in those states (New York and Massachusetts both have substantial commuter rail service for example) likely play a role in the lower rate of incidents.

The United States as a whole has experienced a fairly stable incident rate across the board, although there were some notable increases, as shown in Table 3.9. Although total incidents have fallen slightly, there has been a 23% increase in fatalities compared to 2010. While deaths due to train incidents is lower, the increase comes from a 13 percent rise in highway-rail incident fatalities and a 30 percent increase in "other" incidents resulting in fatalities, which are categorized as anything other than train or crossing incidents that cause physical harm to persons (trespasser incursion on railroad rights of way). The number of "other" incidents is down slightly even though the number of fatalities has risen.

TABLE 3.9 FRA REPORTABLE RAILROAD INCIDENTS 2010 – 2019 IN UNITED STATES

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Incidents	**11,631**	**11,535**	**11,079**	**11,655**	**12,260**	**11,851**	**11,480**	**11,973**	**11,752**	**11,545**
Deaths	735	681	669	702	767	749	760	818	816	904
Injuries	8,379	8,455	8,462	8,752	8,805	9,130	8,701	8,876	8,258	7,853
Train Incidents	**1,902**	**2,032**	**1,766**	**1,853**	**1,886**	**1,930**	**1,724**	**1,784**	**1,943**	**1,869**
Deaths	8	6	9	11	5	11	7	7	7	5
Injuries	110	217	465	328	140	563	433	317	205	57
Highway-Rail Incidents	**2,052**	**2,064**	**1,988**	**2,104**	**2,296**	**2,080**	**2,050**	**2,124**	**2,229**	**2,200**
Deaths	261	246	231	232	262	237	255	271	260	294
Injuries	888	1,048	971	977	870	1,048	853	846	845	812
Other Incidents	**7,677**	**7,439**	**7,325**	**7,698**	**8,078**	**7,841**	**7,706**	**8,065**	**7,580**	**7,456**
Deaths	466	429	429	459	500	501	498	540	549	605
Injuries	7,381	7,190	7,026	7,447	7,795	7,519	7,415	7,713	7,208	6,984

Source: FRA Office of Safety Analysis, 10-Year Accident/Incident Overview. Retrieved June 18, 2020.
https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/TenYearAccidentIncidentOverview.aspx

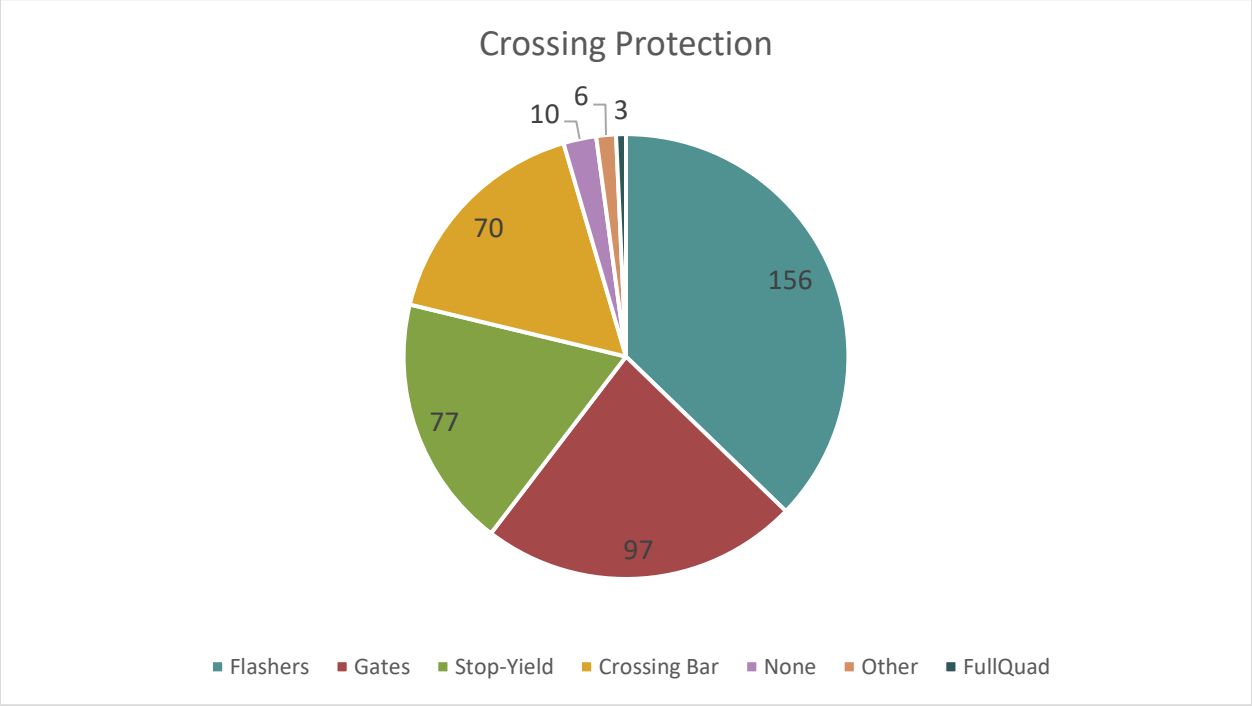
[72] Miles of track from State Rail Plans and https://www.aar.org/wp-content/uploads/2020/08/AAR-Railroad-101-Freight-Railroads-Fact-Sheet.pdf. Rail incident data from FRA.

At-Grade Rail/Highway Crossing Safety

As discussed in Section 4.4, there were more than 51,600 crashes in Vermont between 2015 and August 2019. Rail-highway grade crossing incidents represent a tiny fraction of these overall incidents (less than 1 percent) but are the most visible rail-related incidents to the general public and for which the public is most exposed to potential harm from rail operations. They also impact goods and passenger movement on both the rail and highway network, increasing the level of disruption to both transportation systems.

There are 433 public at-grade highway-rail crossings in Vermont, with 410 located on public roadways and 14 pedestrian only crossings. Various types of protection are used to control the interaction and awareness between rail and non-rail traffic at these public at-grade rail crossings. Protection can either prevent non-rail traffic from using a crossing at the same time as rail traffic or simply increase awareness of non-rail traffic to the presence or possibility of rail traffic. As shown in Figure 3.9, the most common crossing protection is flashers, followed by gates. Only 10 locations were listed as having no protection.

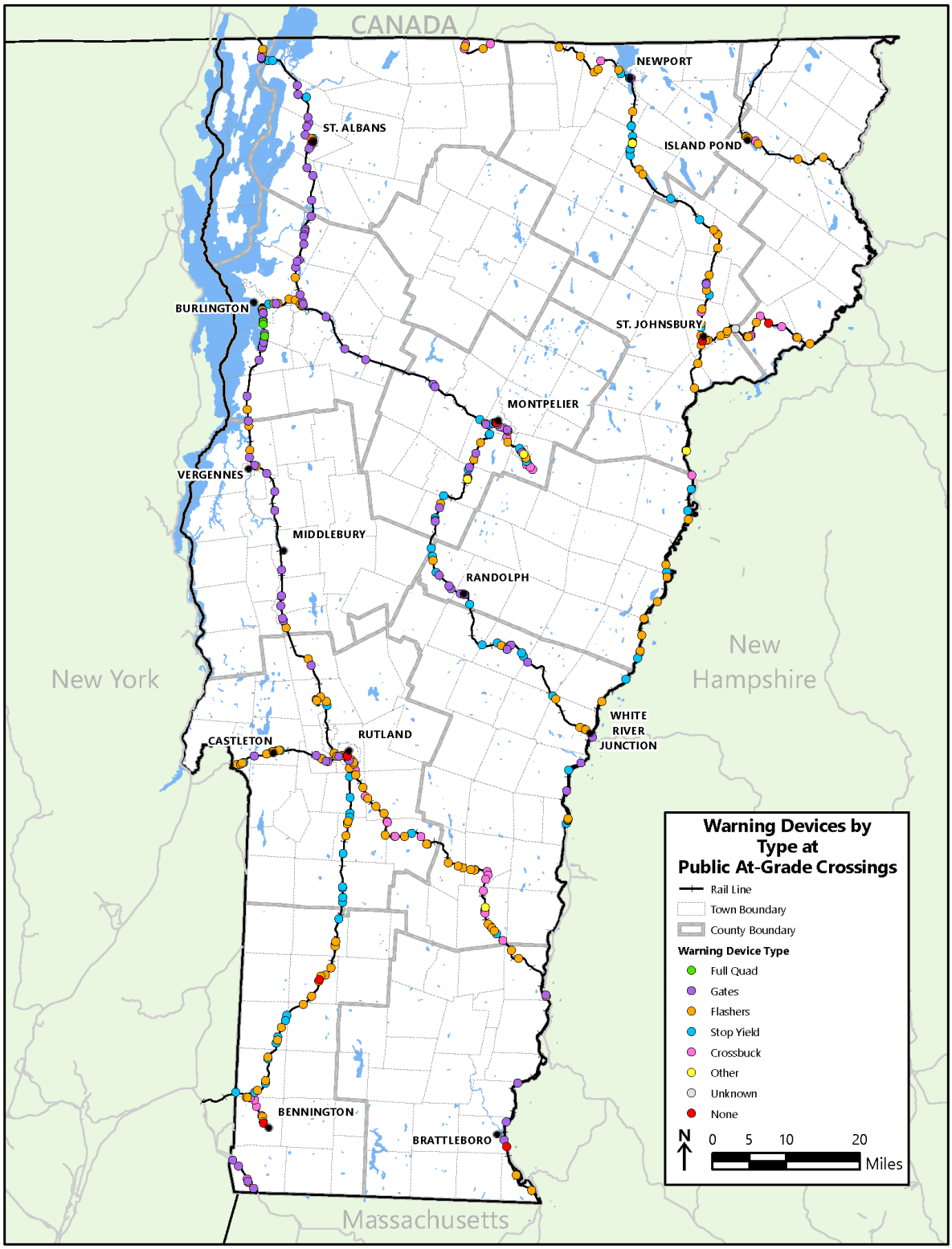
FIGURE 3.9 VERMONT AT GRADE CROSSING PROTECTION CATEGORIES



Source: FRA; Analysis by VHB, 2020.

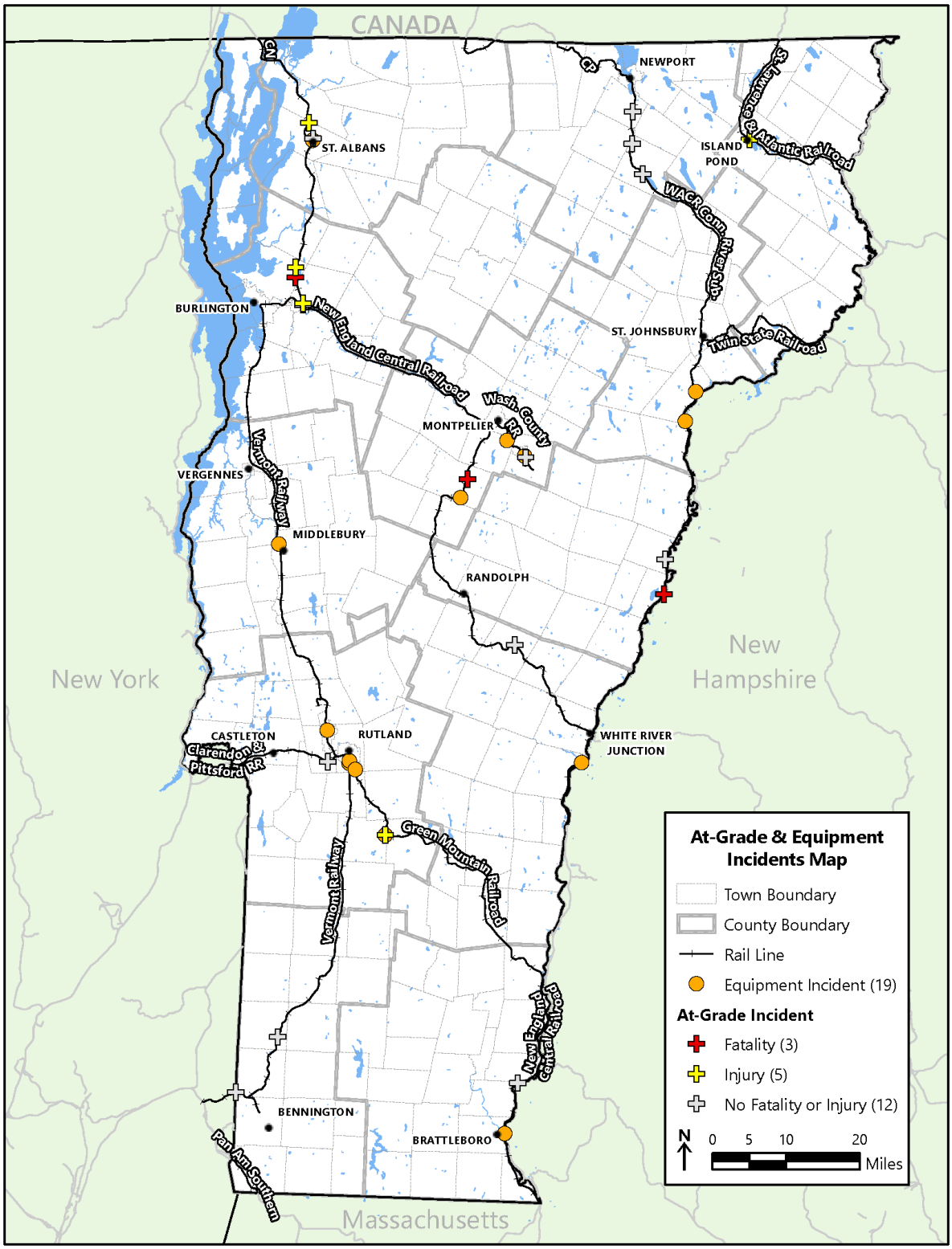
The public roadway crossing locations are shown in Figure 3.10 color coded for the type of crossing protection available. Figure 3.11 illustrates the locations of at-grade crossing and equipment incidents in Vermont between 2015 and 2019. These incidents were spread around the state with three fatalities reported.

FIGURE 3.10 VERMONT HIGHWAY-RAIL CROSSINGS



Source: VTrans, analysis by VHB, 2020.

FIGURE 3.11 VERMONT AT-GRADE CROSSING AND EQUIPMENT INCIDENTS (2015-2019)



Source: FRA; Analysis by VHB, 2020.

As discussed in Section 3.1.8, projects under the Section 130 program are selected on a statewide, competitive basis. The 2015 SRP set a goal of completing three at-grade crossing projects per year. Table 3.10 belows shows the 25 grade crossing projects to be funded through Section 130 in the 2020-2023 STIP, showing achievement of that performance metric.

TABLE 3.10 VERMONT FHWA SECTION 130 PROJECTS: SFY2020-2023

VTrans STIP #	Municipality	Location	Railroad	State Fiscal Year of Completion	Total Cost
17G100	Alburgh	Rt. 78/NECR MP 15.8	NECR	2020	$110,330
17G122	Alburgh	E. Alburgh Rd./NECR MP 15.9	NECT	2023	$211,111
18G267	Barre City	Berlin St.	WACR	2021	$416,667
16G038	Brandon	Union St. and VTR MP 70.66	VTR	2021	$449,742
15G153	Burke	Hayden Crossing and WACR MP 27.85	WACR Conn. River	2020	$295,000
18G269	Castleton	Mill St.	CLP	2023	$211,111
15G154	Cavendish	Densmore Rd. and GMRC MP 20.69	GMRC	2023	$400,000
15G158	Chester	First Ave. and GMRC MP 13.65	GMRC	2023	$211,111
18G270	Dorset	US 7	VTR	2022	$1,943,532
15G163	Fairlee	Mallary Rd. and WACR MP 15.43	WACR Conn. River	2023	$1,000,000
16G040	Ferrisburgh	Little Chicago Rd. and VTR MP 102.36	VTR	2020	$409,333
17G297	Ferrisburgh	Long Point Rd. and VTR	VTR	2020	$387,048
17G300	Ferrisburgh	Morkton Rd. and VTR	VTR	2020	$391,780
17G117	Middlesex	Cross Rd. and NECR MP. 77.56	NECR	2023	$261,111
05G022	Montpelier	Pioneer St.	WACR	PE only in 2023	$385,000*
18G274	Montpelier	Green Mountain Dr.	WACR	2023	$420,000
19G261	Montpelier	US 2 and WACR MP 3.23	WACR	2020	$1,230,000
11G240	Pittsford	Kendall Hill Rd. and VTR	VTR	2021	$774,429
16G039	Pittsford	Depot Hill Rd. and VTR MP 64.08	VTR	2020	$242,527
18G275	Rutland City	West St.	CPR	2022	$616,667
18G276	Rutland City	Forest St.	CPR	2020	$350,000
15G187	Rutland Town	VT Rt. 3 and VTR MP 56.62	VTR	2021	$401,848
17G101	St. Albans Town	Industrial Park Rd. and NECR MP 130.95	NECR	2020	$113,777
17G119	Swanton	Tabor Rd. NECR MP 14.17	NECR	2023	$650,000

VTrans STIP #	Municipality	Location	Railroad	State Fiscal Year of Completion	Total Cost
17G120	Swanton	Lakewood Dr. and NECR MP 14.79	NECR	2023	$650,000
Total					**$12,532,124**

*Source: Vermont 2020-2023 STIP. Note: *Only PE costs are included, construction year pending.*

At least one additional highway-rail grade crossing project is identified in the STIP with funding under the paving section. This project will install an active signal warning system for a rail crossing in Barre City where VT 14 crosses the WACR (MP 8.11) and is scheduled for construction in SFY2022.[73]

Operation Lifesaver

Operation Lifesaver, Inc. is a nationwide non-profit organization with a mission to end collisions, injuries, and fatalities at, on, and around railroad tracks and at highway-rail grade crossings. To accomplish its mission, Operation Lifesaver promotes 3 E's of safety:

- **Education:** Operation Lifesaver strives to increase public awareness about the dangers around the rails. The program seeks to education both drivers and pedestrians to make safe decisions at crossings and around railroad tracks.
- **Enforcement:** Operation Lifesaver promotes active enforcement of traffic laws relating to crossing signs and signals and private property laws related to trespassing.
- **Engineering:** Operation Lifesaver encourages continued engineering research and innovation to improve the safety of railroad crossings.

The program coordinates a nationwide network of volunteers who work to educate people about rail safety. Operation Lifesaver, Inc. partners with federal transportation agencies, national transportation organizations, railroads, and safety engineering and rail supply companies to achieve its mission. Free programs are presented to schools, businesses and civic organizations as well as specialized programs for school bus drivers, professional drivers, law enforcement and emergency responders. In addition, Vermont provides funding for specialized grade crossing collision investigation courses which are design to help officers more effectively investigate incidents.[74]

[73] VTrans #16V185. Vermont STIP, 2020-2023. https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Final%20FY20%20STIP%20Amend1.pdf

[74] https://vtrans.vermont.gov/rail/oli

Rail Safety Inspection

The FRA enforces federal regulations and standards that apply to track, signal, train control, motive power, equipment, operating practices, and hazardous materials. The federal Rail Safety Act of 1970 authorized states to work with FRA to enforce railroad regulations at their expense. Rail safety in the State is led by VTrans' Rail Program unit.

Hazardous Materials

Federal common carrier obligations mandate that railroads are required to transport hazardous materials. The U.S. Department of Transportation received the authority to regulate the transportation of hazardous materials through the Hazardous Materials Act. Federal hazardous material regulations apply to all interstate, intrastate, and foreign carriers by rail, air, motor vehicle and vessel.

The FRA administers a safety program that oversees the movement of hazardous materials including dangerous goods such as petroleum, chemical, and nuclear products throughout the nation's rail transportation system. FRA's role in the safety program also extends to shipments transported to and from shippers in Canada or Mexico. The FRA also has authority to oversee the movement of shipments marked hazardous so that transportation of these shipments complies with U.S. and international standards even if the shipment does not contain hazardous materials. The FRA's current hazardous materials safety regulatory program includes the following components:

- Hazardous Materials Incident Reduction Program;
- Tank Car Facility Conformity Assessment Program;
- Tank Car Owner Maintenance Program Evaluations;
- Spent Nuclear Fuel and High-Level Nuclear Waste Program;
- Railroad Industrial Hygiene Program;
- Rulemaking, Approvals, and Exemptions;
- Partnerships in Domestic and International Standards-Related Organizations (e.g., AAR, American Society of Mechanical Engineers, Transportation of Dangerous Goods/Canadian General Standards Board; and
- Education, Safety Assurance, Compliance, and Accident Investigation.

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 was created to help communities plan for emergencies involving hazardous substances. Developed in response to concerns regarding environmental and safety hazards associated with storage and handling of toxic chemicals, EPCRA requires public and private organizations to develop hazardous chemical emergency plans. EPCRA also requires private industry to report on the storage, use and releases of hazardous chemicals to appropriate government agencies.

EPCRA increases the public's knowledge and access to information on the disposition of chemicals at specific facilities. States and communities can use the information to improve chemical safety and protect public health and the environment. Key provisions of EPCRA include:

- **Sections 301 to 303. Emergency Planning** - Local governments are required to prepare chemical emergency response plans, reviewed at least annually. State governments are required to oversee and coordinate local planning efforts. Locations where Extremely Hazardous Substances (EHS) are kept in quantities above a threshold are required to participate in emergency plan preparation.
- **Section 304. Emergency Notification** - Facilities must immediately report accidental releases of EHS chemicals and hazardous substances in quantities greater than corresponding Reportable Quantities defined under the Comprehensive Environmental Response, Compensation, and Liability Act to state and local officials. Information about accidental chemical releases must be available to the public.
- **Sections 311 and 312. Community Right-to-Know Requirements** - Facilities manufacturing, processing, or storing certain hazardous chemicals must make Material Safety Data Sheets (MSDSs) available to state and local officials and local fire departments. MSDSs describe the properties and health effects of these chemicals. Facilities must also report to state and local officials and local fire departments inventories of all on-site chemicals for which MSDSs exist. Information about chemical inventories at facilities and MSDSs must be available to the public.

At the state level, the Vermont Department of Environmental Conservation regulates the generation, transportation, storage, treatment, recycling and disposal of hazardous material including waste. [75] VTrans' Operations Division has a program to address hazardous material issues associated with transportation projects.[76]

Vermont also utilizes a HAZMAT Response Team, housed within the Division of Fire Safety in the Department of Public Safety. This group was created in 1994 to assist all fire departments in the State with managing hazmat incidents. The State maintains three hazmat response vehicles, a trained Response Team, and has placed 18 hazmat trailers in local fire departments to assist responders.[77] The State also maintains a State Emergency Operations Plan to outline the coordination of capabilities in compliance with state and federal guidelines.[78]

Since 2013, the Pipeline and Hazardous Materials Safety Administration recorded a single rail hazmat incident in Vermont. In May 2013, a GMR train carrying liquified petroleum gas was inspected by the FRA.

[75] https://dec.vermont.gov/waste-management/hazardous

[76] https://vtrans.vermont.gov/operations/technical-services/environmental/hazardous-materials

[77] https://firesafety.vermont.gov/emergency/hazmat

[78] https://www.animallaw.info/sites/default/files/Vermont%20Emergency%20Operations%20Base%20Plan.pdf

During the inspection, a leak in a valve plug was detected. The leak was fixed by an employee of the Dead River Company facility in Bellows Falls where the car was stopped.[79]

Positive Train Control

PTC technology is capable of preventing train-to-train collisions, over-speed derailments and casualties or injuries to roadway workers (e.g., maintenance of way workers, bridge workers, and signal maintainers). The technology combines GPS locating of trains, infrastructure, speed restrictions, and traffic conditions with real-time wireless communications between locomotives and other operating equipment, dispatchers and work crews. The Rail Safety Improvement Act of 2008 (RSIA) mandated the widespread installation of PTC systems on all lines handling passenger trains or hazardous materials, a network totaling approximately 80,000 miles.[80]

Progress on fulfilling this requirement has been slower and more expensive than originally envisioned due to limited development of standards and technical work necessary for large-scale deployment of PTC when RSIA was passed. Additional administrative challenges such as permitting of antenna sites and procurement of radio spectrum unexpectedly delayed deployment. As a result, in November 2015 Congress extended the deadline to December 31, 2018, with some further leeway to 2020 for full implementation.

At present, no trackage located in Vermont is required to have PTC installed, nor are there any completed or planned PTC installations. However, some concerns have been raised about the safety of intericty passenger train operations where PTC is not required. An Amtrak analysis of the *Vermonter* and *Ethan Allen Express* routes identified a number of mitigation measures such as warning signs for upcoming speed restrictions, additional speed restrictions as deemed necessary, and enhanced communication rules between crew member which will enhance safety without the need for PTC.[81]

Table 3.11 below shows systemwide PTC implementation as of March 2020 for Class I railroads with a presence in Vermont (CN, CP) or with which Vermont lines interchange (CSXT, NS).

All four railroads have all track segments in PTC operation, locomotives that are fully equipped and PTC operable, full completion of radio towers installed, and full completion of employee training. Interoperability However, none of the four railroads has achieved full interoperability which allows any railroad's PTC equipped locomotive to operate over any PTC equipped tracks. Due to differences in implementation between the railroads, interoperability is made between host railroads and their tenant railroads.

[79] PHMSA Yearly Incident Summary Report. Accessed June 23, 2020. Online at: https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics

[80] FRA, 49 CFR 236.1005.

[81] https://vermontbiz.com/news/2019/january/01/amtrak-keep-rolling-vermont-now

Class I railroads and regional passenger operators have borne most of the burden associated with installing PTC. However, some Class II and III railroads also are affected by the mandate, although none operate in Vermont.

TABLE 3.11 SYSTEMWIDE PTC IMPLEMENTATION PROGRESS REPORT BY RAILROAD AS OF MARCH 31, 2020

	CN	CP	CSXT	NS
Locomotives Equipped and PTC Operable	1,143	732	1,800	2,900
% Complete	100%	100%	100%	100%
Track Segments Completed	35	24	133	145
% Complete	100%	100%	100%	100%
Radio Towers Installed	1,646	904	423	3,719
% Complete	100%	100%	100%	100%
Employees Trained	6,870	2,649	22,922	18,645
% Complete	100%	100%	100%	100%
Route Miles in PTC Operation	3,107.2	2,122.1	Approx. 9,674	8,008.7
% Complete	100%	100%	100%	100%
Interoperability	11	1	16	9
% Complete	78.6%	10.0%	76.2%	32.1%

Source: FRA, PTC Implementation Status by Railroad, Q1 Jan. 1 – March 31, 2020. https://railroads.dot.gov/train-control/ptc/positive-train-control-ptc

Freight/Passenger Train Crash Response Plan

Vermont has developed a State Emergency Management Plan (SEMP), with the most recent plan from 2019. While this plan does not specifically address rail, it does address transportation more generally. The State Emergency Operations Center has two activation levels in response to incidents—Partial Activation and Full Activation— depending on the scope and scale of the event. The SEMP used an example of an incident requiring Partial Activation might be a passenger train derailment. The reasoning was that this type of incident "could require several mutual-aid resources beyond what neighboring municipalities can provide or may include a request for state-owned special response assets loaned to the local response."[82]

Rail Security

Effective rail security entails a multi-faceted, cooperative, and unified approach marked by constant vigilance that taps a wide range of capabilities in the private and public sectors to assure preparedness and respond

[82] https://vem.vermont.gov/sites/demhs/files/SEMP/SEMP%20Response%20Mission%20Area%20Plan.pdf

to security threats. The following addresses specific rail security issues and Vermont's involvement in rail security procedures.

Federal and State Roles in Rail Security

The primary agencies responsible for security related to transportation modes in Mississippi are the U.S. Department of Homeland Security (DHS), VTrans, and the Vermont Department of Public Safety.

The Transportation Security Administration, which is housed within the DHS, is responsible for protecting the nation's transportation systems to ensure freedom of movement for people and commerce. The DHS addresses rail system security through the following means:

- Training and deploying manpower and assets for high risk areas
- Producing security actions, procedures, and informational materials for the rail industry
- Developing and testing new security technologies
- Performing security assessments of systems across the country
- Providing funding to state and local partners

The Association of American Railroads (AAR), working with the DHS and other federal agencies, has organized a Rail Security Task Force. This task force developed a comprehensive risk analysis and security plan for the rail system that includes:

- A database of critical railroad assets
- Assessments of railroad vulnerabilities
- Analysis of the terrorism threat
- Calculation of risks and identification of countermeasures

The private railroad sector maintains communications with the U.S. Department of Defense (DOD), the U.S. DHS, the U.S. Department of Transportation, the Federal Bureau of Investigation, and state and local law enforcement agencies on all aspects of rail security.

The Vermont Department of Public Safety's Vermont Emergency Management Office acts as the state's lead agency for emergency response. This agency, with the assistance of VTrans, addresses security and emergency response issues related to rail within the state. VTrans coordinates with the U.S. Department of Homeland Security in conducting special joint enforcement details involving railroad police departments and security, along with local law enforcement offices.

Local emergency plans must address coordination of action for emergency release of hazardous substances at sites and facilities such as shipping terminals and rail yards.

Military Strategic Rail Corridor Network (STRACNET)

The U.S. Army's Transportation Engineering Agency, the Railroads for National Defense Program (RND), in conjunction with the FRA, established the Strategic Rail Corridor Network (STRACNET) to ensure DOD's minimum rail needs are identified and coordinated with appropriate transportation authorities.[83] The RND program has identified over 36,000 miles of key railroad corridors serving 126 defense installations as being vital for the movement of military supplies and personnel. There are no STRACNET corridors in Vermont. In neighboring states, STRACNET connects to the following facilities:

- Camp Edwards (MA).
- Portsmouth Naval Shipyard (NH).
- Fort Drum (NY).
- NNPP Kesselring Site (NY).

3.1.10 Economic and Environmental Impacts

Public investment in rail offers Vermont's businesses and residents cost effective and environmentally friendly means to move people and goods. Passenger rail transportation is a reliable and efficient alternative to reach destinations in crowded, congested corridors. Freight rail transportation offers a cost-effective means to move heavy, lower value cargo, while diverting trucks from highways.

The rail system in Vermont provides service to population centers industries including forest products, agriculture, quarrying, and manufacturing. By providing services to many important industries in the state, the railroads support employment in the industries they serve while also directly providing jobs to Vermont's residents.

According to the AAR, in 2017 Class I freight rail in the United States supported 1.1 million jobs, $71 billion in wages, and nearly $220 billion in economic activity, leading to nearly $26 billion in federal, state, and local tax revenue.[84] Vermont's eight mostly Class II and Class III freight railroads supported more than 200 employees, with an average of $92,970 in wages and benefits per freight rail employee in 2017. In addition,

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83 https://www.sddc.army.mil/sites/TEA/Functions/SpecialAssistant/RND%20Publications/STRACNET%202018_Reduced.pdf

84 "Freight Rail Fast Facts". https://www.aar.org/wp-content/uploads/2019/01/AAR-Freight-Rail-Fact-Sheet-2019.pdf

Vermont had 678 railroad retirement beneficiaries, with approximately $15 million in railroad retirement benefits paid in 2017.[85]

For freight, diverting truck shipments to rail results in savings in shipping costs, pavement deterioration (i.e. wear and tear on roads), congestion delay (travel time impacts for other vehicles based on the number of trucks on the road), and reducing collision and accident potential between trucks and cars. Shifting freight from truck to rail also contributes not only to fuel cost savings but to environmental quality as well.

For passenger rail, diverted ridership from auto travel results in impacts such as more direct rail operator jobs, increased purchases of goods and services, and increased tourist spending, as well as increased safety, congestion relief, and emissions reductions. Passenger rail similarly produces lower greenhouse gas emissions per passenger mile than automobile travel.

Congestion Mitigation

Railroads help reduce the economic costs of highway congestion. One train has the potential to carry as much freight as several hundred trucks, depending on the size and weight of the cargo being transported. In 2017, the 6.7 million tons of freight moved by rail that originated, terminated, or travelled through Vermont would have required approximately 373,000 additional trucks.[86] Rail's ability to divert freight and passengers away from the roadway results in less congestion as well as less highway wear and tear and the pressure to build costly new highways.

Freight and passenger rail facilities across the state provide opportunities for products and people to be transported by train instead of truck. The availability of rail results in a reduction in truck and passenger vehicle miles traveled (VMT) on Vermont's local and interstate routes that, in turn, benefits the remaining users by reducing the marginal cost of congestion born by those vehicles.

The Federal Highway Administration (FHWA) Cost Allocation Study 2000 Addendum[87] estimates the marginal congestion costs per VMT to be $0.47 (2019$) for a 60kip 4 axle US truck on urban interstates and $0.05 (2019$) for a 60kip 4 axle U.S. truck on rural interstates. Similarly, congestion savings total $0.01 for every auto mile diverted to rail on both urban and rural highways.

Safety Impacts

When auto and truck traffic is diverted to rail the diversion reduces the likelihood of crashes and the associated deaths, injuries, and property damage on the state's roadways. Generally, railroads experience a significantly lower incident rate than highways. Figure 3.12 compares the fatality rates on a per-mile basis

[85] "AAR State Rankings 2017". https://www.aar.org/wp-content/uploads/2019/01/AAR-Vermont-State-Fact-Sheet.pdf

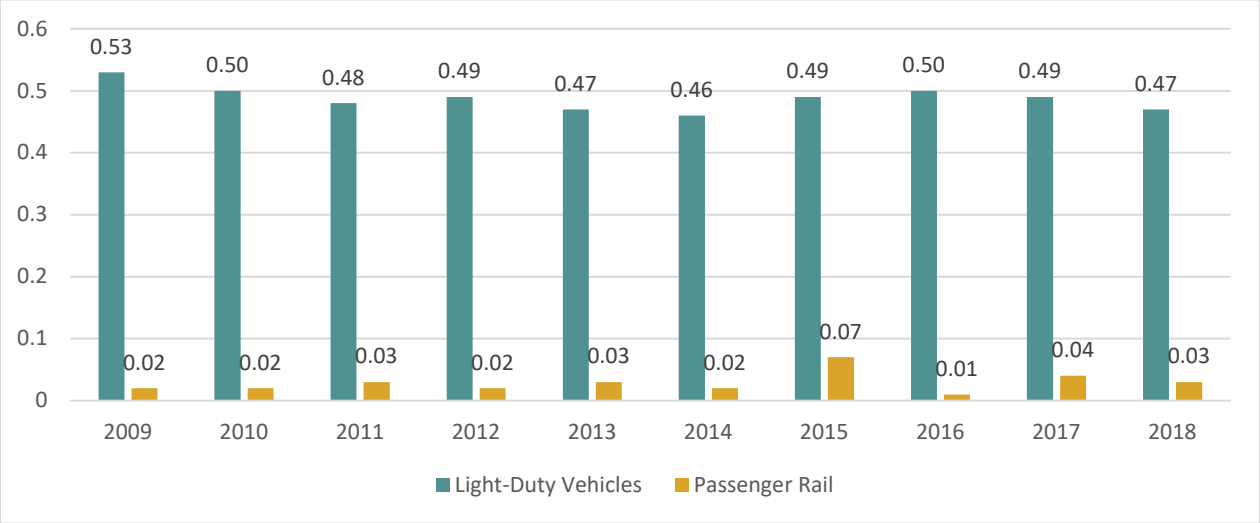
[86] Association of American Railroads, https://www.aar.org/wp-content/uploads/2019/01/AAR-Vermont-State-Fact-Sheet.pdf

[87] FHWA Cost Allocation Study, 2000 Addendum, Table 13, https://www.fhwa.dot.gov/policy/hcas/addendum.cfm

for passenger rail and personal light-duty vehicles between 2009 and 2018. Over that time, the fatality rate per 100 million passenger miles for light duty vehicles was 0.49 compared to 0.03 for passenger rail. Encouraging diversion to rail therefore improves transportation safety overall by lowering the overall fatality rate.

This lower risk of incidents is also true for the transportation of hazardous material (hazmat). Per the AAR, more than 99.999 percent of rail hazmat shipments completed their trip without a release caused by a train accident. Compared to trucks, the railroad incident rate for hazmat is about 1/10th of the rate for trucks, despite roughly similar ton-mileage handled.[88] Reasons for this far lower incident rate include more stringent physical equipment standards for rail, fewer origins/destinations (highest risk is during loading/unloading) due to longer lengths of haul, and the vertical integration of rail systems in North America which limits interchange issues. Rail also faces very high liability risks with hazmat transportation including strong public reactions to any incident, creating strong incentives to mitigate risk to the greatest extent possible. Since even a minor event can have significant impacts, limiting these incidents is critical.

FIGURE 3.12 PASSENGER FATALITY RATES 2009-2018 – FATALITIES PER 100 MILLION PASSENGER MILES



Source: 2020 National Safety Council. Highway passenger deaths – Fatality Analysis Reporting System data. Railroad passenger deaths and miles – Federal Railroad Administration. Available at: https://injuryfacts.nsc.org/home-and-community/safety-topics/deaths-by-transportation-mode/

Notes: Light-duty vehicles include passenger cars, light trucks, vans, and SUVs, regardless of wheelbase. Includes taxi passengers. Drivers of light-duty vehicles are considered passengers.

[88]Association of American Railroads, "Why Freight Rail is the Safest Mode for Hazmat". Available at https://www.aar.org/article/freight-rail-safest-mode-hazmat/

Trade and Economic Development

Railroads haul roughly 33 percent of U.S. exports, allowing U.S. industries to compete abroad while providing consumers access to a greater variety of goods. Global commerce is directly tied to 42 percent of rail traffic and 50,000 domestic rail jobs, worth $5.5 billion in annual wages and benefits.[89]

The 2015 Vermont Rail Plan noted that shipper/receiver diversity was one of the most critical issues for Vermont. Similarly, the 2018 BUILD Grant request for funding to replace or rehabilitate 31 state owned bridges between Hoosick, NY and Rutland noted the need for improved rail conditions (especially weight limits) in order to retain and attract customers.[90] With limited Class I trackage, Vermont's Class III network will need to continue to reduce weight limits and other impediments to the full movement of freight in order to attract and retain rail-served businesses.

Air Quality, Energy Use and Climate Change Impacts

Increasing sources of renewable energy while reducing overall energy use is a key goal of the 2016 Vermont Comprehensive Energy Plan. Transportation is responsible for 47% of all greenhouse gas (GHG) emissions in the State. Specific to transportation, the Plan identifies a goal of 10% of energy in the sector being renewable by 2025 and 80% by 2050. One of the strategies noted to meet that goal is to shift transportation away from single-occupancy vehicles.[91] By 2030, the Plan calls for raising Vermont-based passenger rail trip to 400,000 annually and doubling the freight rail tonnage in the State.

On average, railroads are four times more fuel-efficient than trucks, moving a ton of freight more than 470 miles on a gallon of fuel—the distance from Burlington to Baltimore, MD.[92] GHG emissions are directly related to fuel consumption, so moving goods by rail instead of truck lowers GHG emissions by up to 75 percent, on average.[93]

In terms of energy use by passenger modes, long-distance service provided by Amtrak is much more efficient per passenger-mile, as shown in Figure 3.13.

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[89] Association of American Railroads, "Freight Rail Works for America" Freight Rail Fact Sheet, 2019. Available at https://www.aar.org/wp-content/uploads/2019/01/AAR-Freight-Rail-Fact-Sheet-2019.pdf.

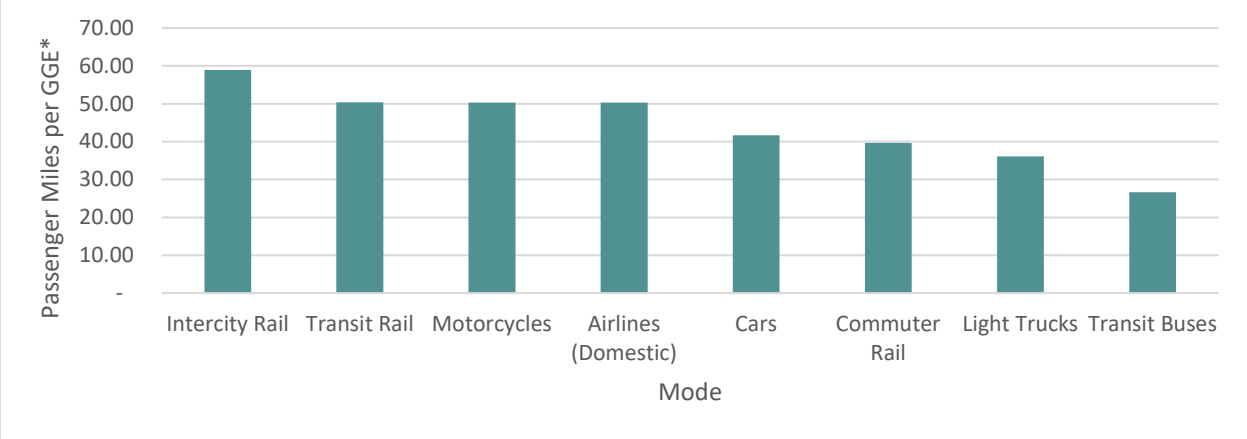
[90] https://www.progressiverailroading.com/federal_legislation_regulation/news.aspx?id=56272

[91] https://outside.vermont.gov/sov/webservices/Shared%20Documents/2016CEP_Final.pdf

[92] https://www.aar.org/wp-content/uploads/2018/05/AAR-Economic-Impact-US-Freight-Railroads.pdf

[93] Association of American Railroads, "The Environmental Benefits of Moving Freight by Rail," July 2019. Available at: https://www.aar.org/wp-content/uploads/2018/07/AAR-Environmental-Benefits-Movig-Freight-by-Rail.pdf

FIGURE 3.13 AVERAGE PER-PASSENGER FUEL ECONOMY BY TRAVEL MODE



Source: https://afdc.energy.gov/data/10311 Note: Gasoline-Gallon Equivalents (GGE) used to compare gasoline, diesel, and electricity on a level basis.

Beyond emissions and energy use, noise and vibration from trains are potential environmental impacts of rail service. This includes noise from the mandatory use of locomotive horns approaching at-grade crossings. While it is a federal requirement for trains to blow their horns at at-grade crossings, there are some instances where alternative safety measures can be put in place to waive this requirement and reduce noise pollution. The required measures are site-specific and vary per intersection, but can include measures such as four quadrant gates or median barriers. Communities can apply for "quiet zone designations", but are responsible for all costs to make their crossings qualify.

As of June 2020, Vermont has established a single quiet zone on VTR trackage between Shelburne and Burlington.[94]

Land Use and Community Impacts

Vermont has eleven RPCs including one in Chittenden County which serves as a the region's MPO. These agencies provide land use and transportation planning guidance for member municipalities. It is important to note that specific land use decisions such as zoning and permitting is conducted at the local (eg., town, village, city) level. Figure 3.14 shows the locations of each RPC.

Vermont's LRTP calls for providing mobility options and accessibility for all users of the transportation system. On the freight side, this includes increasing connections between freight rail and other modes. On the passenger side, partnerships with regional public transit providers, intercity bus carriers, Amtrak, VT Tourism and Marketing Department and collaboration with advocacy groups and municipalities can be used

[94] https://railroads.dot.gov/elibrary/quiet-zone-locations-city-and-state-1

to improve intermodal connections at stations and ensure adjacent land uses are conducive to passenger rail needs. Both approaches will aid progress towards this goal.[95]

Freight Rail & Land Use

Sustainable freight movement is one that maximizes the positive features of freight movement (jobs, economic development, shipper choices, etc.) while minimizing the negative impacts to communities and the natural environment. Freight-generating land uses such as agriculture, natural resources and mining, construction, warehousing, and manufacturing can bring many benefits to a region. These benefits include direct and indirect employment associated with freight activity; business and income tax benefits to local, regional, and state economies; additional economic output; and lower costs for goods and services.

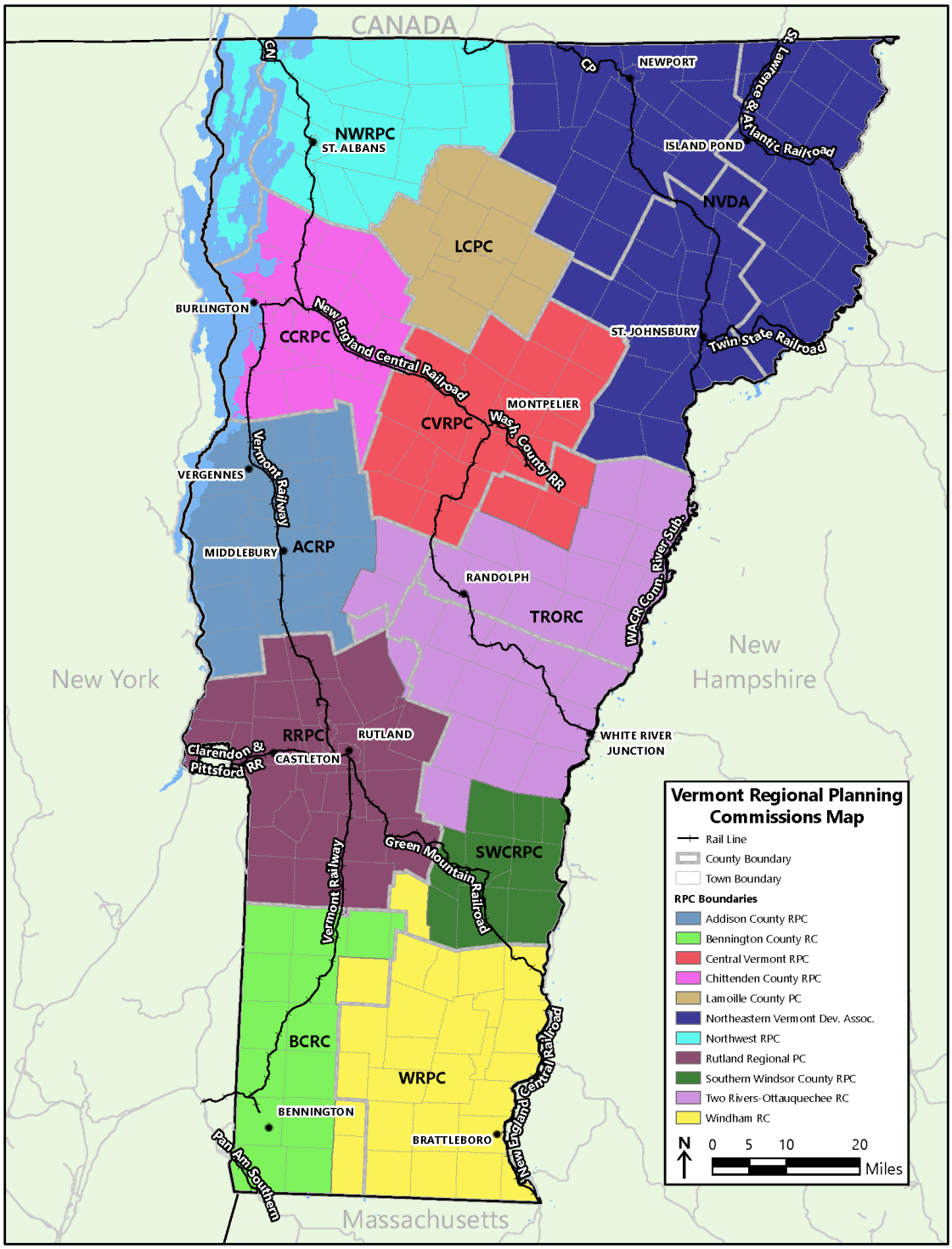
On the other hand, freight-generating industries can also produce undesirable impacts, such as noise, vibration, odor, and light pollution, and they may have a negative impact on a region's air quality. Regions need to plan appropriately to accommodate freight-generating industries while protecting the health, safety, and quality of life of residents. The goal is to find a balance between economic activity and external impacts associated with the freight industry.

Throughout the State, there is a general acknowledgment by the MPOs and RPCs that future industrial uses should be located near already built-up areas having easy access to existing highways and railroads. Educating public officials and the public at large about freight benefits and assisting freight-generating businesses to understand and mitigate potential impacts can foster a common understanding among all stakeholders. The Windham RPC Regional Plan offers an example of this, stating that "When feasible, businesses and industries with high freight demands should locate within the rail corridor, improving moibility of goods by rail."[96]

[95] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/2040_LRTP_%20Final.pdf

[96] http://windhamregional.org/images/docs/regional-plan/2014_Windham%20Regional%20Plan_complete.pdf

FIGURE 3.14 VERMONT REGIONAL PLANNING COMMISSIONS



Source: VCGI Open Data:
https://maps.vcgi.vermont.gov/arcgis/rest/services/EGC_services/OPENDATA_VCGI_BOUNDARIES_SP_NOCACHE_v1/MapServer/36

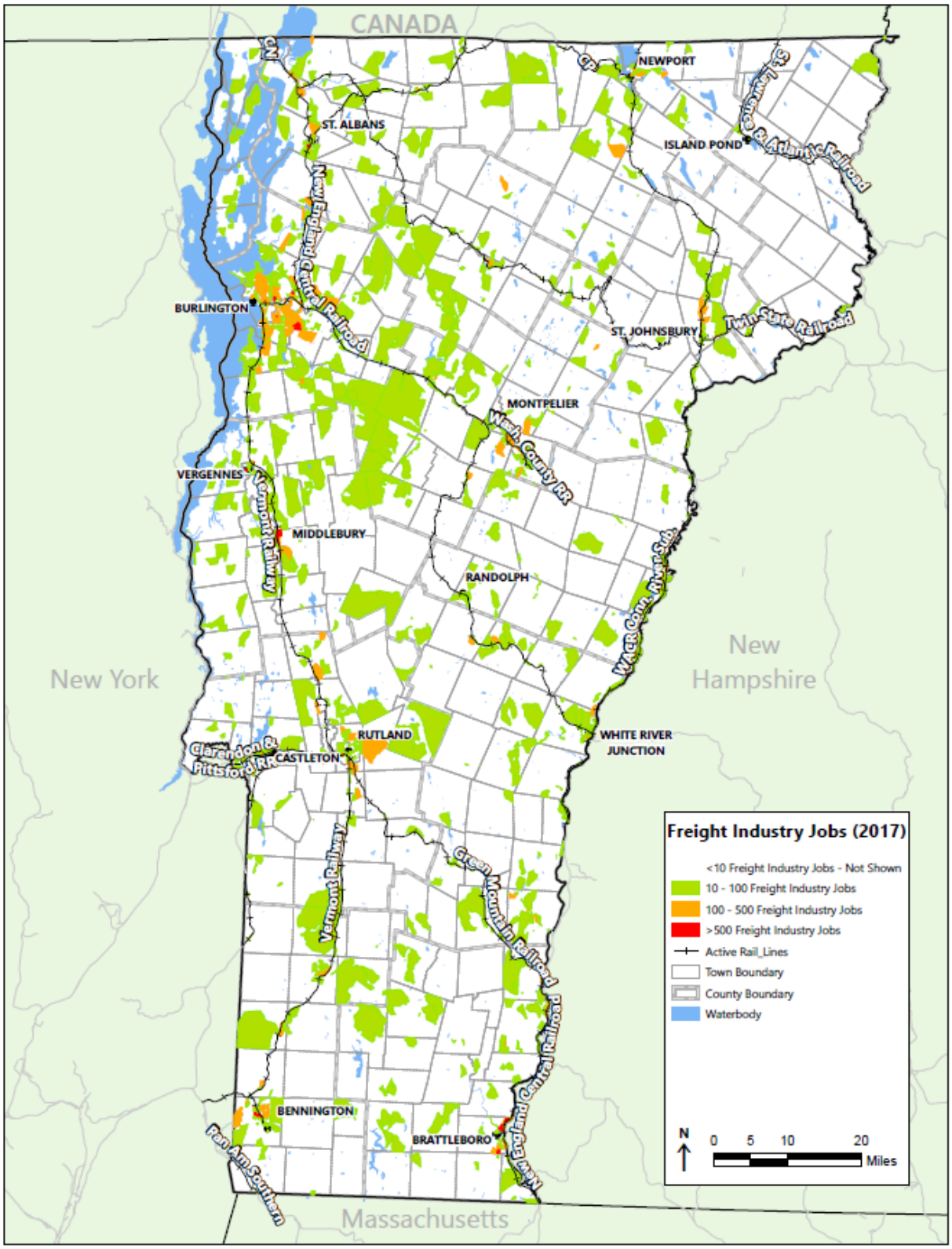
Based on the North American Industry Classification System (NAICS) classification system, there are a number of industries that generally produce or attract a large amount of freight and for which freight movement is a critical part of their business. These industries include:

- Agriculture, Forestry, Fishing and Hunting (NAICS 11);
- Mining (NAICS 21);
- Utilities (NAICS 22);
- Construction (NAICS 23);
- Manufacturing (NAICS 31-33);
- Wholesale Trade (NAICS 42);
- Retail Trade (NAICS 44-45); and
- Transportation and Warehousing (NAICS 48-49).

Census blocks with at least 10 jobs in these categories as of 2017 are shown in Figure 3.15. Throughout most of the State, these areas are adjacent to or close by a freight rail line with higher concentrations in the Burlington/Essex Junction, Middlebury, Rutland, Bennington, St. Johnsbury, and Brattleboro areas. Of the approximately 102,500 private-sector jobs within these categories in Vermont in 2017, approximately 95 percent are located within 10 miles of an active freight rail line and 63 percent are within 1 mile.[97]

[97] US Census LEHD Origin-Destination Employment Statistics (LODES), Workplace Area Characteristics (WAC), 2017. Online at: https://lehd.ces.census.gov/data/

FIGURE 3.15 FREIGHT INDUSTRY JOBS BY CENSUS BLOCK (2017)



Source: US Census LODES WAC Data, 2017; VTrans; Analysis by Cambridge Systematics, 2020.

Passenger Rail & Land Use

Passenger rail both benefits from and can help promote symbiotic land uses. In Vermont, most stops are located in the heart of small villages or towns where passenger rail can provide transportation alternatives to a higher number of people living in a dense area. This density also typically promotes walking and bicycling infrastructure. For example, the Amtrak station in Brattleboro is shown in Figure 3.16. According to Walkscore.com which rates locations on a 0-100 scale based on the number of businesses within a 30 minute walk, with fewer "points" awarded to destinations further away, this station has a score of 90, indicating the surrounding area is "Walker's Paradise." [98] This station has the highest Walkscore of any location in Vermont. Figure 3.16 shows an aerial image of the station and surrounding land uses and Table 3.12 provides a Walkscore for each of Vermont's Amtrak stations.

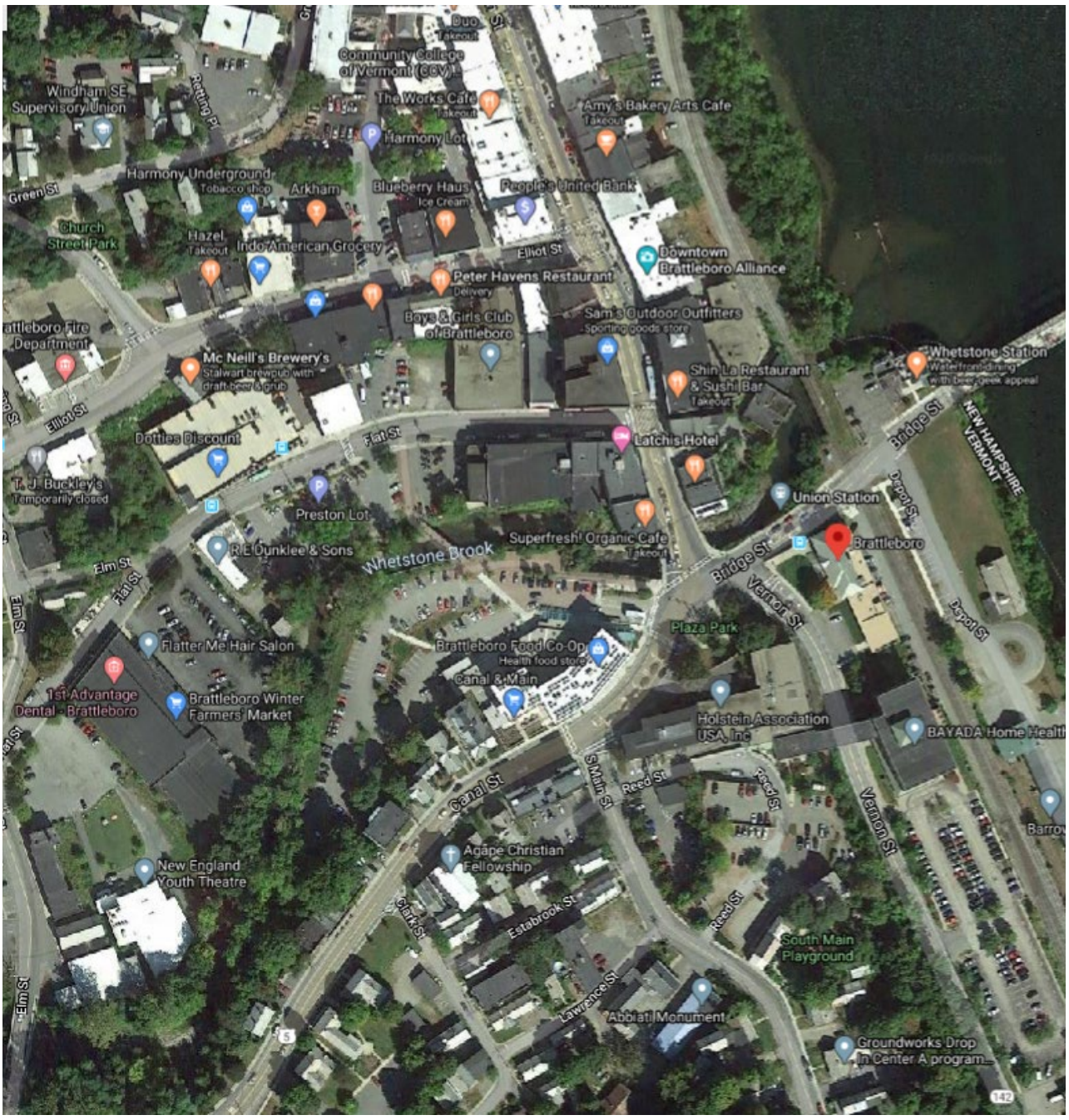
TABLE 3.12 WALKSCORE FOR VERMONT AMTRAK STATIONS

Amtrak Station	Walk Scores
Rutland	78 – Very Walkable
Castleton	30 – Car Dependent
St. Albans	85 – Very Walkable
Essex Junction	66 – Somewhat Walkable
Waterbury-Stowe	61 – Somewhat Walkable
Montpelier-Barre	0 – Car Dependent
Randolph	53 – Somewhat Walkable
White River Junction	69 – Somewhat Walkable
Windsor-Mt. Ascutney	59 – Somewhat Walkable
Claremont, NH	18 – Car Dependent
Bellows Falls	60 – Somewhat Walkable
Brattleboro	90 – Walker's Paradise

Source: Walkscore.com

98 https://www.walkscore.com/methodology.shtml#:~:text=Walk%20Score%20measures%20the%20walkability,validated%20by%20leading%20academic%20researchers.

FIGURE 3.16 BRATTLEBORO AMTRAK STATION AND SURROUNDING AREA



Source: Google Maps.

Most jurisdictions with passenger rail service are supportive of the service and include provisions for the service and for growth opportunities in their local land use plans. The Windham RPC Regional Plan (2014) which includes the Brattleboro station in Figure 3.16 as well as a stop in Bellows Falls identifies those two

areas a "regional centers" which should have higher levels of development (including infill) with a mix of residential, commercial, institutional, light industrial, and public spaces.[99]

Passenger rail can contribute to healthier communities by having stations in mixed-use environments that promote walking and transit, as well as contribute to economic vitality by providing destinations for visitors to the area. It can also help meet the State's land use goal of maintaining historical settlement patterns with compact centers surrounded by rural countryside by providing additional transportation options, thereby keeping VMT per capita down.[100]

Environmental justice (EJ) is an important consideration in the design and implementation of rail projects. VTrans defines three fundamental EJ principals:

- To avoid, minimize, or mitigate disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority populations and low-income populations.[101]

In 1994, Executive Order 12898 defined Environmental Justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative consequences resulting from industrial, municipal, and commercial operations. Many freight facilities are located in communities which have a large number of minority or lower-income residents, and which often receive significant environmental impacts from those facilities. Strategies to reduce or mitigate these impacts must be taken into consideration when expanding freight operations or infrastructure into these communities.

3.2 Trends and Forecasts

To be discussed as part of the Commodity Flow and Economic Futures Technical Memo and Passenger Rail Forecasting Memo.

[99] http://windhamregional.org/images/docs/regional-plan/2014_Windham%20Regional%20Plan_complete.pdf

[100] https://outside.vermont.gov/sov/webservices/Shared%20Documents/2016CEP_Final.pdf

[101] https://vtrans.vermont.gov/civil-rights/compliance/titlevi/environmental-justice

3.3 Rail Service Needs and Opportunities

Existing conditions for the freight rail network are highlighted in the below sections. Additional information including identification of gaps will be part of Vision, Goals, Need, and Gaps Technical Memo.

3.3.1 Infrastructure

Track Conditions

The FRA has established minimum track safety standards requirements and maintenance levels for railroad operators, which dictate the minimum track conditions that are allowable for train operations at given operating speeds. Track classes and allowable speeds are shown in Table 3.13.

Rail lines of higher FRA track classification are typically in better condition than rail lines with lower FRA track classification. Track that is rated "Excepted" is considered to be in poor state of repair, while track rated Class 1 is at the bottom of FRA standards. While FRA standards set minimum requirements for operations at given speeds, as a practical matter, railroads must maintain their tracks above the FRA standards to routinely operate at those speeds.

If a line is not maintained sufficiently for trains to operate at the class of track associated with published timetable speeds, then slow orders must be placed on the tracks. If maintenance is not performed over a period of time, permanent slow orders must be imposed on those sections of track.

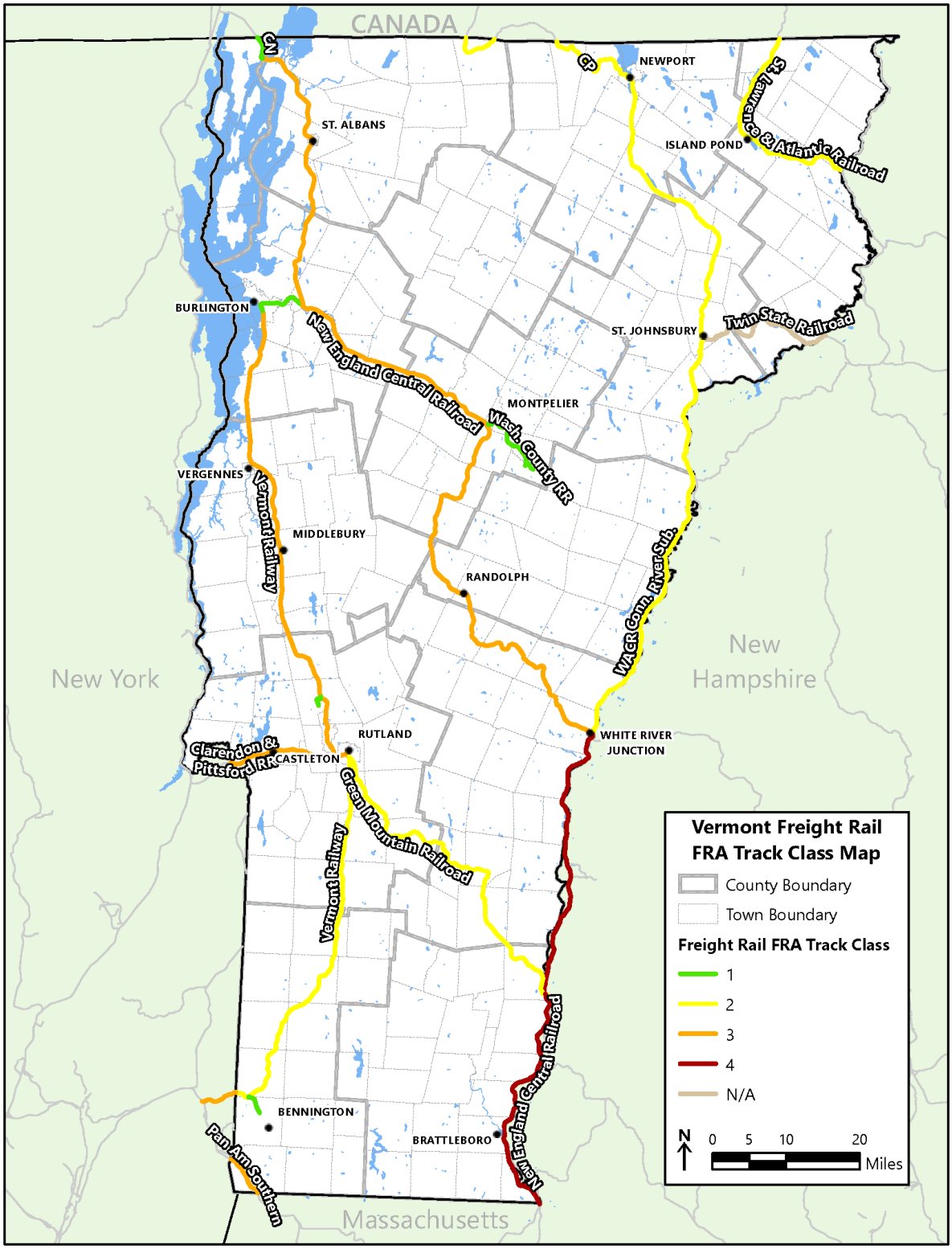
Figure 3.17 shows the Track Class for rail lines in Vermont and Table 3.14 provides additional details. Work on the NECR south of White River Junction to upgrade to FRA Track Class 4 is a major change since 2015.

TABLE 3.13 VERMONT TRACK CLASS AND ALLOWABLE OPERATING SPEEDS

Track Class	Maximum Allowable Operating Speed (mph)	
	FREIGHT TRAINS	PASSENGER TRAINS
Excepted Track	10	Not Allowed
Class 1	10	15
Class 2	25	30
Class 3	40	60
Class 4	60	80
Class 5	80	90

Source: Vermont State Rail Plan, 2015.

FIGURE 3.17 FRA TRACK CLASS



Source: VTrans, Interviews with railroads. Analysis by VHB, 2020.

TABLE 3.14 VERMONT FREIGHT RAIL FRA TRACK CLASS

Railroad	Line	FRA Track Class
Clarendon & Pittsford	Main Line	3
Clarendon & Pittsford	Florence Branch	1
Pan Am Southern	Main Line	3
Green Mountain Railroad	Main Line	2
Canadian Pacific (former CMQ)	Newport Subdivision	2
Canadian Pacific (former CMQ)	Lyndonville Subdivision	2
Canadian National	Rouse's Point Sub	1
New England Central	Palmer Subdivision	4
New England Central	Roxbury Subdivision	3 (4 from Windsor to White River Junction)
New England Central	Swanton Subdivision	3
New England Central	Winooski Branch	1
St. Lawrence & Atlantic	Sherbrooke Subdivision	2
St. Lawrence & Atlantic	Berlin Subdivision	2
Vermont Railway	Bennington Branch	1
Vermont Railway	Hoosick Main	3
Vermont Railway	N. Bennington – Manchester Main	3
Vermont Railway	Manchester – Rutland Main	2
Vermont Railway	Northern Subdivision	3
Washington County Railroad	Montpelier & Barre Division	1
Washington County Railroad	Connecticut River Subdivision	2

Source: VTrans, Interviews with railroad, 2020.

Rail Line Weight Capacity

The national standard weight for a loaded railcar in the United States is 286,000 pounds. In recent years, many of the Class I railroads have improved their infrastructure to allow for 315,000 pound cars. Heavier axle railcars can carry ten or 11 percent more freight per carload. For many car types, a 263,000-pound car can carry around 100 tons of freight, whereas a 286,000-pound car can carry around 110 to 112 tons of freight. Not only are the railcars bigger, but the ratio of railcar equipment weight (tare) to payload weight is more favorable.

In Vermont, many of the railroads are still limited to a previous standard of 263,000 pound cars. This severly limits the ability of these railroads to interchange with larger carriers and reduces the efficiency of freight movement on those lines.

The maximum weight each railroad can carry in Vermont is shown in Table 3.15 and mapped in Figure 3.18. The upgrade of VRS track north of Rutland (and on-going work south of Rutland) to allow for 286,000 pound cars is a key change since 2015 and an outcome of TIGER and BUILD Grant funding.

It should also be noted that these show weight limits in Vermont only and do not account for restrictions outside Vermont that in practice limit weights in the State. For example, the NECR line is in reality limited to 263,000 pounds through Vermont due to weight limits in Massachusetts and on the CN line that it connects to. Work to improve the Massachusetts portion of the line to allow for 286,000 pounds is planned to be complete by the end of 2021. Similarly, the SLR is limited to 263,000 pounds due to track in New Hampshire and Quebec,[102] and the CP line is limited to 263,000 pounds due to limits in Quebec.[103]

TABLE 3.15 VERMONT FREIGHT RAILROAD MAXIMUM CAR WEIGHT

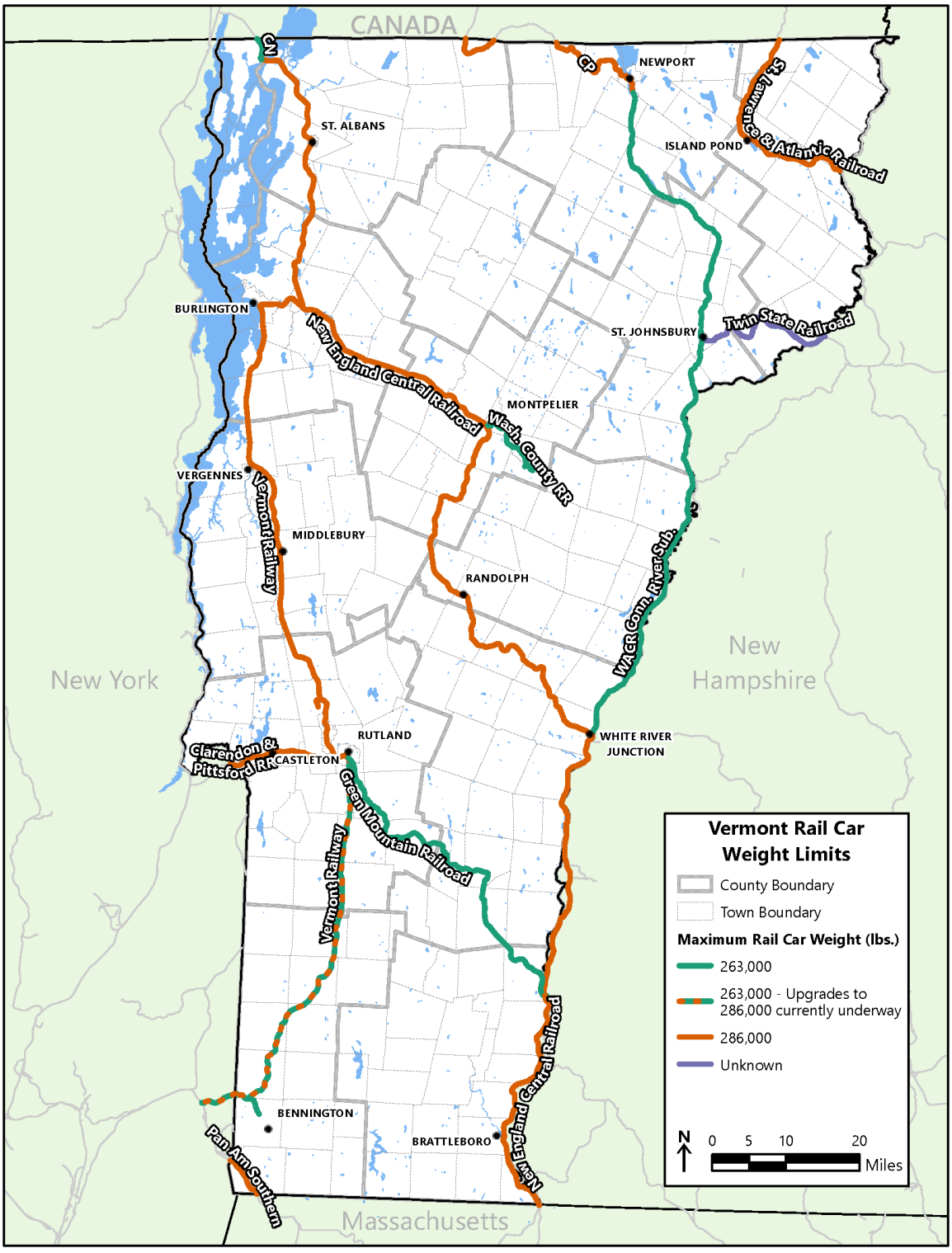
Railroad	Maximum Railcar Weight (Pounds) in Vermont
New England Central Mainline	286,000
New England Central Burlington Branch	286,000
Canadian National	263,000
Clarendon & Pittsford	286,000
Green Mountain Railroad	263,000
Vermont Railway	286,000 (north of Rutland); 263,000 (south of Rutland)*
Washington County Railroad (M&B)	263,000
Washington County Railroad – Connecticut River Division	263,000
St. Lawrence & Atlantic	286,000
Canadian Pacific	286,000
Pan Am Southern	286,000

Source: Rail company websites and interviews with VRS and Genesee and Wyoming, 2020.
**Note: Vermont Railway south of Rutland will be 286,000 pound capable pending completion of 2018 BUILD Grant related work*

[102] Interview with NECR July 7, 2020.

[103] Interview with CP October 3, 2020.

FIGURE 3.18 VERMONT RAIL CAR WEIGHT LIMITS



Source: Rail company websites and interviews with rail operators, 2020. Note that work is currently underway on the VRS segment between Rutland and Hoosick Junction to allow for 286,000 pound cars.

Bridges are often the limiting factor for rail car weight. Rail bridges are often old—57 bridges which were identified for railroad use by the National Bridge Inventory with an average age of approximately 93 years.[104]

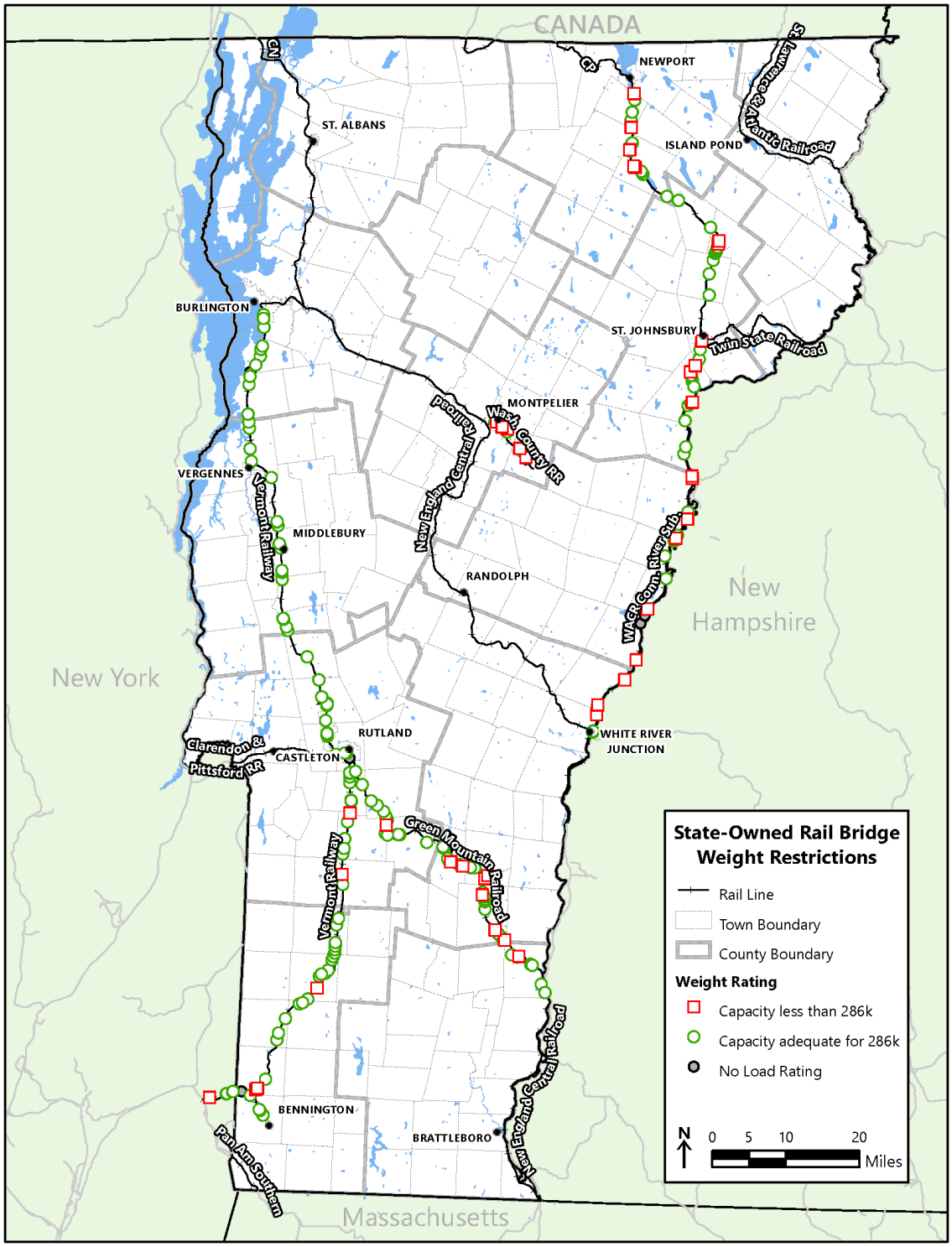
Vermont is actively working to improve this for state-owned structures. On lines owned by the State, per operating agreements, VTrans is responsible for bridges ten feet of length or longer over waterways and all bridges over roads and highways. The State has agreed to maintain, replace, repair and install non-track elements on these longer structures. For example, federal funding was secured in 2018 to renovate or rehabilitate 31 bridges along 53 miles of the Vermont Railway, between Hoosick, NY to Rutland, VT. This will increase the capacity of the rail line from 263,000 lbs. to the national carload standard.[105] Funding was secured through the BUILD Grant, discussed in Section 3.1.10.

Figure 3.19 shows the locations of state-owned rail bridges with load ratings less than 286,000 pounds. Of the 217 bridges shown, 61 (28 percent) cannot carry 286,000 pound rail cars).

[104] https://data.vermont.gov/Transportation/National-Bridge-Inventory-Vermont-2012/c37g-h6m6

[105] https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/327856/build-fact-sheets-121118-355pm-update.pdf

FIGURE 3.19 STATE-OWNED RAIL BRIDGE WEIGHT RESTRICTIONS



Source: VTrans; Analysis by VHB, 2020. Note that bridges on the VTR between Hoosick Junction, NY and Rutland, VT are currently being upgraded to allow 286,000 pound cars.

In addition to limits imposed by bridges, track condition may limit rail car weight. Table 3.16 below displays the ability of rail lines to accommodate 286,000 pound railcars as a function of freight density as measured in million gross tons per mile (MGT), operating speeds in miles per hour (MPH) and rail weight as measured in pounds per yard.[106]

TABLE 3.16 TRACK RAIL WEIGHT AND SPEED IMPACTS ON RAIL CAR WEIGHT LIMITS

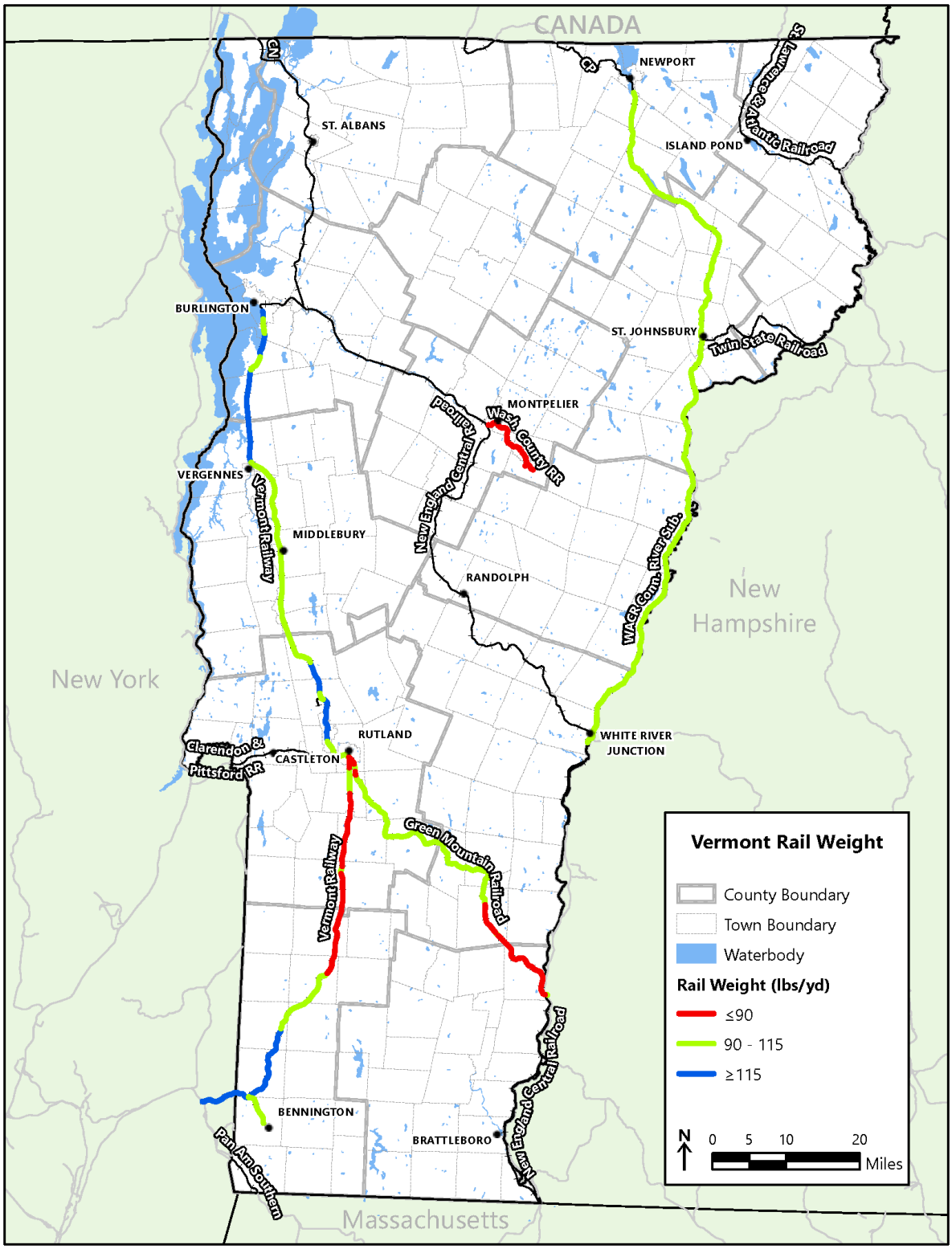
Rail Weight	< 1 MGT	1-10 MGT
10-25 MPH		
100+	OK	OK
90-99	OK	Marginal
> 25 MPH		
≥115	OK	OK
100 – 114	OK	Marginal
90-99	Replace	Replace

Source: Vermont State Rail Plan, 2015.

Most rail in Vermont has a weight of 100 pounds per yard or higher, except for sections of the Green Mountain Railroad, as well as the Vermont Railway south of Rutland, which have 90 pound rail. The Montpelier-Barre subdivison of the Washington County Railroad has the lowest pound rail at 85 pounds. Figure 3.20 below displays rail weights on the Green Mountain Railroad and the Vermont Railway, identifying areas of 90 pound rail. These areas of lighter rail would not be able to accommodate 286,000 pound railcars whether the bridges could or not. Beyond upgrading the 90 pound rail, of which 8 segments are at or below, it is a long-term goal of Vermont to ensure that all rail within the State is at least 115 pound, which would require upgrade of an additional 12 segments.

[106] An Estimation of the Investment in Track and Structures Needed to Handle 129,844 kg (286,000 lb.) Rail Cars on Short Line Railroads, by ZETA-TECH Associates, Inc. for the FRA and American Short Line and Regional Railroad Association

FIGURE 3.20 VERMONT STATE OWNED LINES RAIL WEIGHT



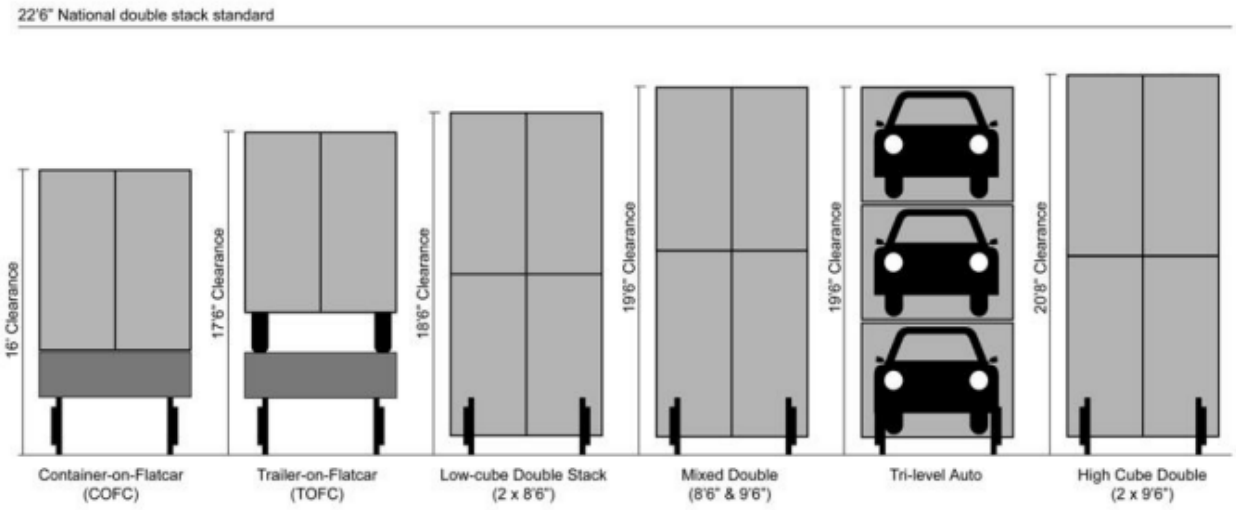
Source: VTrans; Analysis by VHB, 2020.

Vertical Clearance

When most rail lines were built in the United States, railcars were no higher than 15 feet, six inches. However, new types of railcars have necessitated greater clearance over rail lines. For example hicube boxcars are 17 feet high. Most intermodal containers shipped in the United States are now shipped in "double stack" where one container is stacked on the other. This is the most efficient configuration, since railroads can fit more containers on each railcar and on each train. High cube containers are nine feet six inches high, while low cube containers are eight foot six inches high.

The AAR has established "plates" that provide the standard dimensions for railcars (called plates because of the diagrams that describe the dimensions). Trains with mixed high and low cubed containers fall under the AAR "Plate J" standard which has a height of 19 feet 0 inches over tracks. If one assumes a six inch buffer, the required clearance to accommodate these railcars is 19 feet six inches. This is also the typical requirement for multi-level flat cars which are used for shipping automobiles. Unrestricted intermodal operations, where two high cube containers can be stacked on top of the other fall under the AAR "Plate H" standard and have a height of 20 feet two inches over the track. If one assumes a buffer of six inches, the required clearance to accommodate these trains is 20 foot eight inches. Double stacked rail cars allows freight carriers to move more goods on high traffic lines. The AAR has established a standard of 22 foot six inches for unrestricted rail operations. These clearance requirements are shown in Figure 3.21.

FIGURE 3.21 RAIL VERTICAL CLEARANCE STANDARDS



Source: VTrans State Rail Plan, 2015.

Intercity passenger routes in Vermont currently have a clearance of 19' 6". These routes are owned by New England Central Railroad (*Vermonter*) and Clarendon & Pittsford (*Ethan Allen Express*). Construction is

currently underway in Middlebury, Vermont to increase the vertical clearance at two former bridges in town to a minimum of 21 feet via a new tunnel.[107]

However, as shown in Table 3.17, most rail lines in Vermont do not meet the AAR standard of 22 feet six inches and could not accommodate unrestricted double stack operations. Since Vermont does not have any intermodal facilities capable of handling this traffic, increasing vertical clearances to 22 feet six inches will improve the ability of the State to handle through traffic but will have a limited impact on direct imports/exports by rail.

TABLE 3.17 VERMONT VERTICAL CLEARANCE RESTRICTIONS

Railroad	Obstructions to Unrestricted Double Stack Operations
New England Central Railroad	Lowest clearance is 19'6" (US 5 in Hartland and US 7 in Georgia)
Clarendon & Pittsford Railroad	Lowest clearance is 19'2" in Rutland Center
Vermont Railways	17'8" bridge clearances in Proctor, VT (projects in design phase)
Green Mountain Railroad	Lowest clearance is 19'2" in Proctorsville
Washington County Railroad (Conn River)	Lowest clearance is 18'10" in Fairlee
Pan Am Southern	None in Vermont
St. Lawrence & Atlantic	None
Canadian National	
Canadian Pacific	One clearance restriction

Source: Interviews with rail operators, 2020.

At-Grade Crossings

As discussed in Section 3.1.10, there are approximately 400 public highway-rail grade crossings in Vermont. Vermont uses a variety of warnings for rail crossings. These approaches include gates, flashers and more. Figure 3.10 above displays public roadway crossing locations and the warning devices by type at those locations.

3.3.2 Equipment

Both the *Vermonter* and the *Ethan Allen Express* are operated using standard Amtrak Northeast Corridor intercity rolling stock, consisting of single level Amfleet coaches and P40/P42 diesel (*Vermonter*) or P32ACDM dual-mode (*Ethan Allen Express*) locomotives which run on electric near New York Penn Station and on diesel everywhere else. The Amfleet equipment dates from the mid-1970's, and is thus approaching 50 years in age. There are two state-sponsored maintenance facilities in the State, one in Rutland and one in St. Albans to service the two trains.

[107] https://vtrans.vermont.gov/projects/middlebury/middlebury-bridge-rail-project-faqs

Amtrak's 2019 Equipment Asset Line Plan notes that acquisition of dual power propulsion would eliminate electric-deisel engine changes on a number of routes including the *Vermonter*, reducing trip time by 15 to 30 minutes. A dual-mode solution to replace P32ACDM units on the *Ethan Allen Express* is also envisioned in partnership with New York State DOT. Approximately 20 units would be needed to cover Adirondack, Maple Leaf, and extended Ethan Allen Express service to Burlington.[108]

As discussed in Section 3.1.2, Vermont is working with Amtrak, Massachusetts, and Connecticut to procure new rolling stock for the *Vermonter*. Vermont is also working with Amtrak and New York State to procure new rolling stock for the *Ethan Allen Express*. At this time, offerors have submitted proposals that are being evaluated by Amtrak and its State partners, with a decision expected in the near future.

[108] https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/businessplanning/Amtrak-Equipment-Asset-Line-Plan-FY20-24.pdf

4.0 HIGHWAY MODAL PROFILE

The United States relies heavily on trucks to move goods across the country and for trade between the U.S., Mexico, and Canada. In 2017, trucks moved approximately 10.8 billion tons of goods (about 30 pounds for every person in the U.S.), representing approximately 71% of all goods moved around the country.[109] Vermont is no different, and the State's highway network serves as arteries for the State's goods, residents, and visitors. Trucks carried approximately 84% of all goods moving in, out, within, and through the State by weight in 2018.[110]

Vermont's location on the U.S.-Canada border also makes international trade a key component of the State's economy. In 2017, trucks carried $721 billion dollars worth of goods, which accounted for two-thirds of the goods moved across Northern American borders. U.S.-Canada freight was carried by trucks 57.7% of the time, amounting to $331 billion dollars.[111] Vermont exported $1.3 billion dollars in goods to Canada that year, which represented 43% of Vermont's exported goods for the year.[112]

In addition to freight movement, highways play an important role in general mobility throughout of the State. Due to the rural nature of the state, many *Vermonter*s rely on personal vehicles to travel. Vermont ranked 13th highest among all states in terms of per capita vehicle miles travelled in 2017.[113]

4.1 Inventory

Across the country, there are approximately 4.18 million miles of public road, excluding Puerto Rico. Vermont has 15,801 miles of public highway (0.34%) miles of public highway, including both state and local highways, but over half of these highways, 8,650 miles worth, are classified as unpaved.[114] [115]

The State-owned portion of these roads consist of the Interstate highway system, U.S. routes, and state routes and totals 3,870 miles. The breakdown by mileage between these three classes is shown in Figure 4.1 and mapped in Figure 4.2. Figure 4.2 also shows the rail system in the State.

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[109] https://markets.businessinsider.com/news/stocks/trucking-industry-facts-us-truckers-2019-5-1028248577#

[110] FAF and STB Waybill Sample, 2018.

[111] https://www.bts.gov/newsroom/2017-north-american-freight-numbers

[112] https://ustr.gov/map/state-benefits/vt

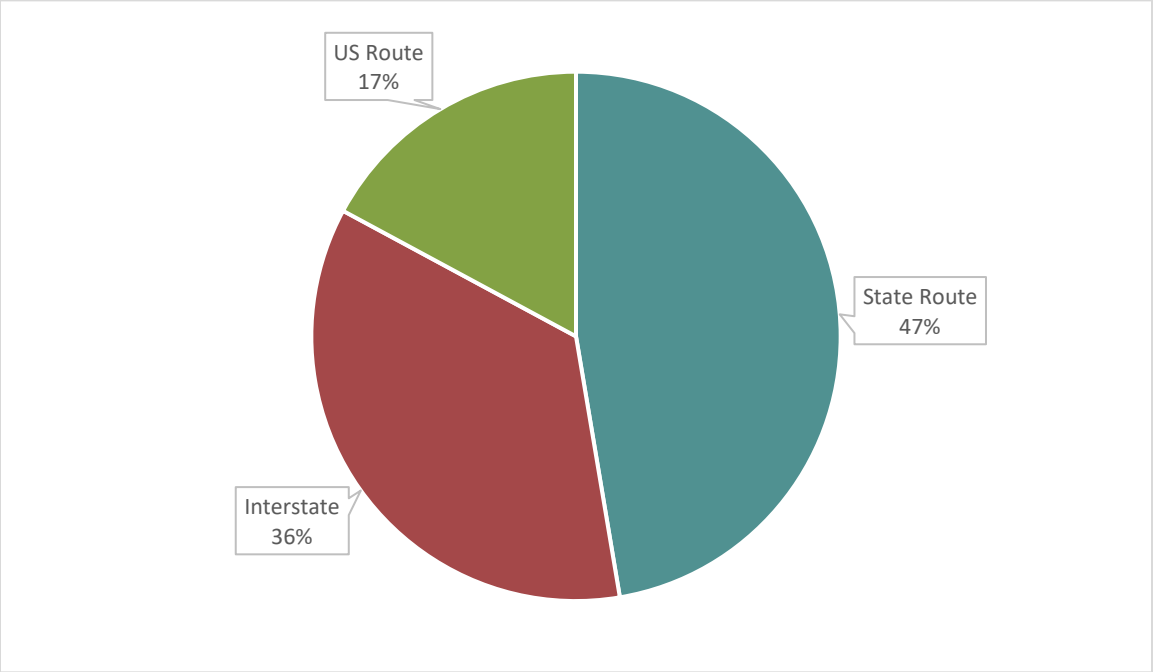
[113] https://www.enotrans.org/wp-content/uploads/2019/06/VMT-per-capita-by-state-1981-2017-1.pdf

[114] https://vtrans.vermont.gov/planning/maps/stats

[115] https://www.fhwa.dot.gov/policyinformation/statistics/2018/pdf/hm20.pdf

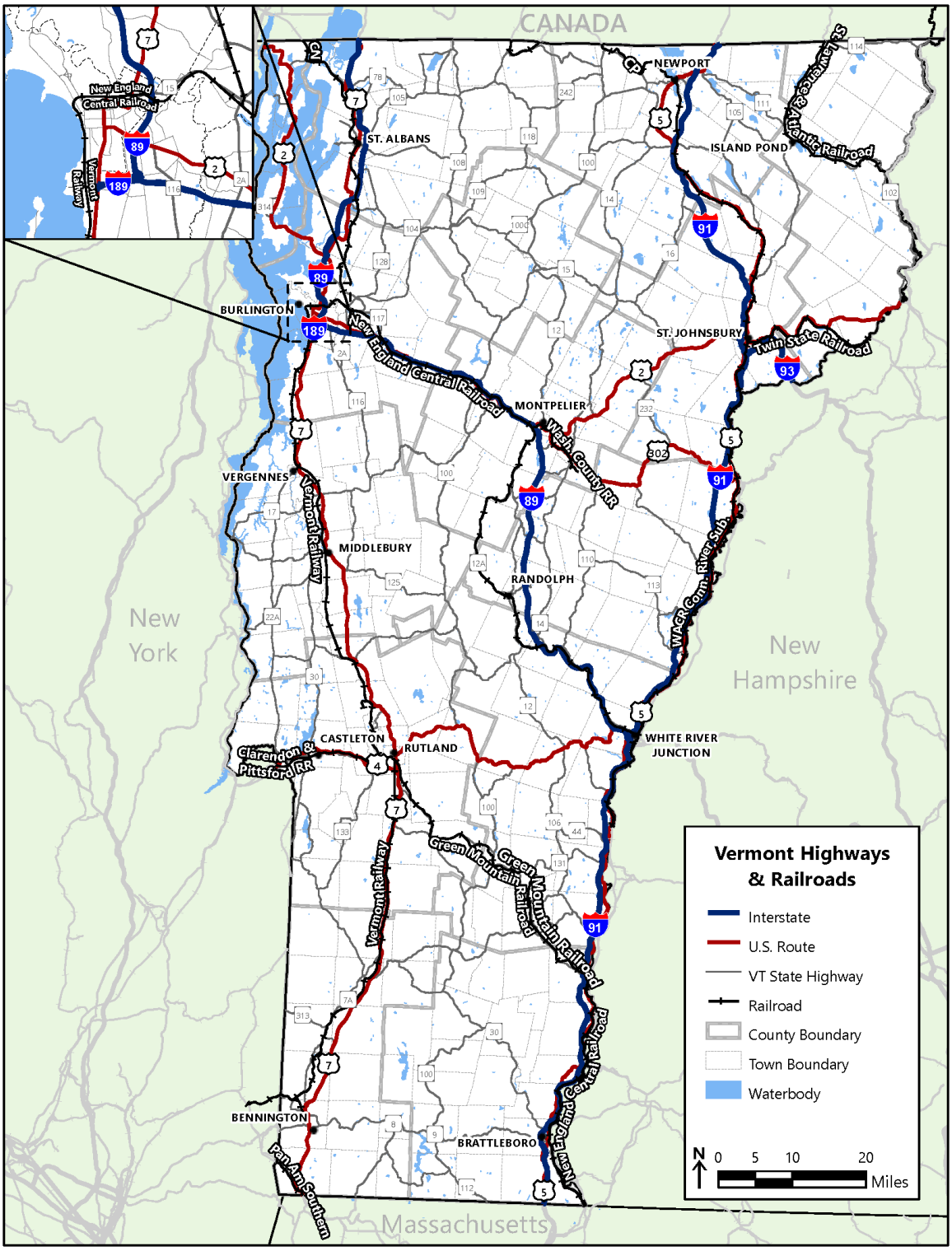
Note that these two figures shown route miles, not lane miles. Lane miles includes the pavement associated with each lane, so a four-lane highway would have double the lane miles of a two lane highway.

FIGURE 4.1 VERMONT STATE OWNED HIGHWAY MILEAGE BY ROAD TYPE



Source: VTrans; Analysis by VHB, 2020.

FIGURE 4.2 VERMONT HIGHWAY AND RAIL NETWORKS



Source: VTrans

The State's highway network contains a number of further classifications, discussed in the sections below.

4.1.1 National Highway System

The National Highway System (NHS) is composed of Interstates, other principle arterials, the strategic highway network, major strategic highway network connectors, and intermodal connectors that make up the National Transportation Network. Those highways and roads included in the NHS are vital for the economic stability, national defense, and overall health of the United States as a whole.[116] The National Highway System is illustrated in Figure 4.2.

Intermodal Connectors provide critical last-mile connections between the highway system and intermodal facilities. Table 4.1 provides a list of all intermodal connectors in the State, those that are specific to freight movement are **bolded**. Those locations are illustrated in green in Figure 4.3. and are mostly located in Chittenden County.

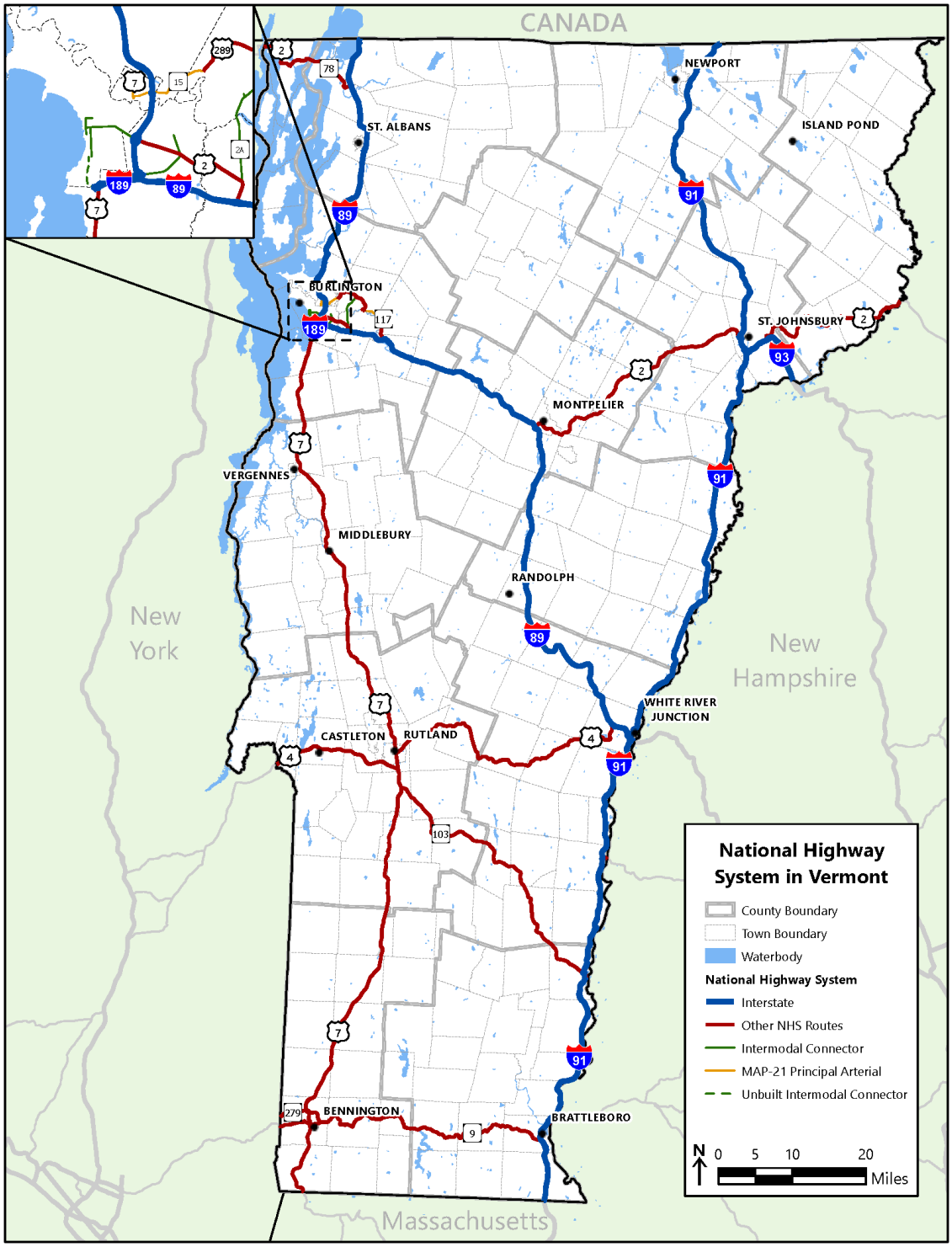
TABLE 4.1 VERMONT NATIONAL HIGHWAY SYSTEM INTERMODAL CONNECTORS

Facility	Type	Connector Description/Route	Connector Length (Miles)
Amtrak Station, Essex Junction	AMTRAK Station	VT 15, between Station and Circumrential Hwy (I-289)	1.68
Amtrak Station, White River Junction	AMTRAK Station	Railroad Row, Bridge St, N Main St, US 5 between the Station and I-91	1.25
Burlington International Airport	**Airport**	**Airport Dr, between the airport entrance and US 2**	**0.45**
Burlington International Airport	**Airport**	**Airport Dr, Kennedy Dr between the airport entrance and I-189**	**1.96**
Greyhound Bus Terminal, White River Junction	Intercity Bus Terminal	US 5 between the Terminal and I-91	0.13
Vermont Railway Rail Yard, Burlington	**Truck/Rail Facility**	**Battery St, Main St, US 2 between the Vermont Rail Yard and I-89**	**2.1**
Vermont Railway Rail Yard, Burlington	**Truck/Rail Facility**	**Southern Connector between the Vermont Railway Rail Yard and I-189 (projected)**	**2.3**

Source: FHWA Intermodal Connectors.

[116] http://www.fhwa.dot.gov/planning/national_highway_system/.

FIGURE 4.3 NATIONAL HIGHWAY SYSTEM IN VERMONT



Source: FHWA, Analysis by VHB, 2020.

4.1.2 National Highway Freight Network

In the fall of 2015, Congress passed and the President signed the FAST Act, ending the period of extensions of the past Federal surface transportation act and creating a new, long-term funding program for the nation's transportation system.

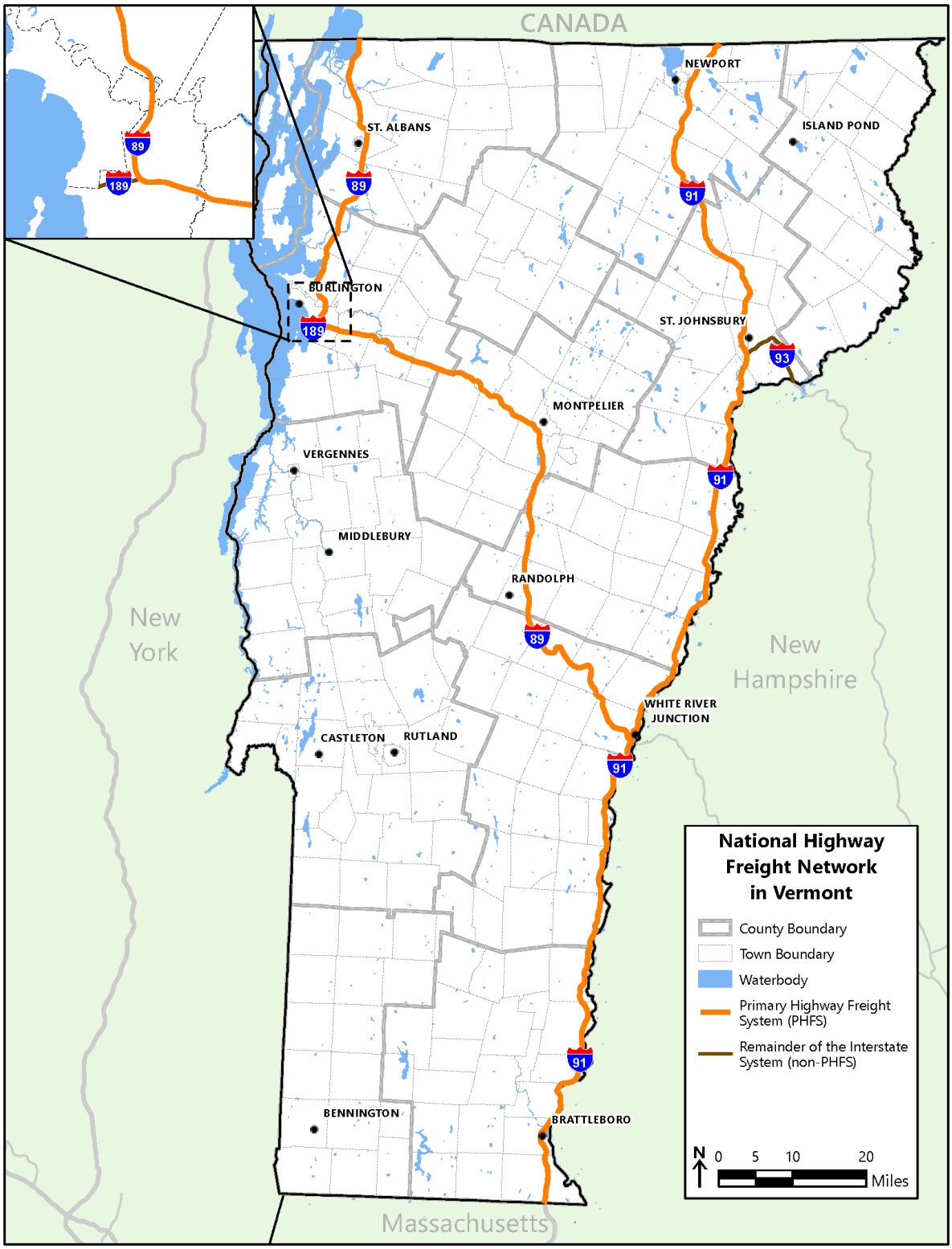
One key element of the FAST Act is the creation of a National Highway Freight Network (NHFN) that has four components:

- The Primary Highway Freight system – Identified as the Draft Comprehensive Primary Freight Network under MAP-21, approximately 41,518 miles. In Vermont, this includes approximately 308 miles of I-89 and I-91;
- The remainder of the Interstate Highway System – In Vermont, this includes I-189 and I-93 (approximately 12.7 miles);
- Critical Urban Freight Corridors (CUFC) – 75 miles or 10 percent of State's Primary Highway Freight System, whichever is greater. Vermont may designate up to 75 miles; and
- Critical Rural Freight Corridors (CRFC) – Up to 150 miles or 20 percent of the Primary Highway Freight System, whichever is greater. Vermont may designate up to 150 miles.[117]

As of June 2020, Vermont has not formally identified any CUFC or CRFCs. The NHFN in Vermont is shown in Figure 4.4. States with Primary Highway Freight System (PHFS) mileage greater than or equal to 2 percent of the total PHFS mileage in all States may obligate funds for projects on the PHFS, the Critical Rural Freight Corridors (CRFCs) and the Critical Urban Freight Corridors (CUFCs). States with PHFS mileage of less than 2 percent may obligate funds for projects on all portions of the National Highway Freight Network (NHFN), including any portion of the Interstate Highway System in that State.

[117] https://ops.fhwa.dot.gov/freight/infrastructure/nfn/maps/nhfn_mileage_states.htm

FIGURE 4.4 NATIONAL HIGHWAY FREIGHT NETWORK IN VERMONT



Source: FHWA; Analysis by VHB, 2020.

4.1.3 Oversize/Overweight Trucks and Permits

All vehicles cause wear and tear on Vermont's infrastructure. Trucks, with their larger size and heavier weight can accelerate that damage, particularly if they operate above legal limits. Trucks operating in Vermont must adhere to a number of size and weight regulations for normal operations. Table 4.2 below highlights these limits.

TABLE 4.2 VERMONT COMMERCIAL VEHICLE SIZE AND WEIGHT LIMITS

Dimension	Interstates	State Routes
Maximum Weight (gross)	80,000	80,000
Maximum Width	8'6"	8'6"
Maximum Height	13'6"	13'6"
Maximum Length	No limit	75' for combination vehicles, 26' for single vehicles
Special Configurations	Tractor/Semi-trailer, trailer combination allowed on National Network. No semi-trailer/trailer may exceed 28'.	Tractor/Semi-trailer, trailer combination allowed on National Network. No semi-trailer/trailer may exceed 28'.

Source: https://dmv.vermont.gov/sites/dmv/files/documents/VN-166-Motor_Carrier_Safety_Regs_0.pdf
National Network includes I-89, I-91 and segments of US 4, US 7, and VT 9. See:
https://ops.fhwa.dot.gov/freight/infrastructure/national_network.htm

To operate above these limits, a vehicle must obtain an oversize/overweight (OS/OW) permit from the Department of Motor Vehicles (DMV).[118] Permits are available both in single-trip and annual versions, and in special configurations for various vehicle types and for certain highways such as US Route 4 from the New Hampshire State line to the junction of VT Route 100 South. For vehicles carrying gross weights over 80,000 pounds, there are differentiations based on whether the load is considered "divisible,"[119] and whether the state's laws predate federal legislation.

Blanket permits for statewide operation must conform to the following guidelines:

1. Maximum width of 12'6" when length does not exceed 75'
2. Maximum width of 10'6" when the length is greater than 75' and less than 100'
3. Maximum height of 14'
4. Maximum weight for nondivisable loads only:

[118] https://dmv.vermont.gov/CVO

[119] Can the load be divided into smaller portions without impacting the value or use of the load and without requiring an undue amount of time to divide.

a. 108,000 pounds

b. 12,000 pounds allowed on the steering axle, twenty thousand pounds on all other axles:

   i. Five axle combo vehicle – 92,000 pounds

   ii. Six axle combo vehicle – 108,000 pounds

5. Vehicle must be registered to the maximum allowed for the vehicle's configuration.
6. Maximum length for vehicles without a trailer or semi-trailer: 46'

In SFY2019 and 2020, the DMV issues approximately 26,000 and 25,000 permits respectively, with total revenue from those permits exceeding $3.5 million annually. Nearly half of the permits issues are for single-trip OS/OW moves, though more than 82% of the total revenue is generated by Special Excess Weight Permits (CVO-109). Special Excess Weight Permits is an annual permit that allows a truck carrying a divisible load to travel at higher-than-normal weights (depending on number of axles and spacing). The maximum is 99,000 pounds on six or more axles.[120] Permit staff note that mobile homes using a single-trip permit are a key generator of activity. Most of these trips travel between NY and NH with US 4 – US 7 – VT 103 and NY/VT 279 – VT 9 – I 91 being common corridors.[121]

This issue has taken on increased importance in recent months following the passage of VT S0339 Section 26 in June 2020.[122] This law requires the DMV to design and develop an online permitting system to improve the efficiency and effectiveness of OS/OW permitting. VTrans is tasked to identify safety and financial implications to infrastructure and coordinate with the DMV to provide online maps with size and weight limitations that are compatible with the OS/OW permitting system.

One lingering concern for OS/OW permitting is that travel on roads that are not part of the State system requires a permit from each municipality along the route. Contacting the right person in each (sometimes small) municipality and obtaining a permit in a reasonable amount of time is a challenge to industry.

4.1.4 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) technologies integrate advanced communications technologies into transportation infrastructure and vehicles, leading to enhanced safety, mobility, and productivity.

Highway Intelligent Transportation System Technology

The majority of Vermont's ITS infrastructure are in place on the highway system. Components include variable message signs (VMS),[123] Road Weather Information Systems, advanced traffic signal technologies,

[120] https://dmv.vermont.gov/sites/dmv/files/documents/CVO-110-Oversize_Permit_Rules.pdf

[121] Information from Vermont DMV. Email 7/16/2020.

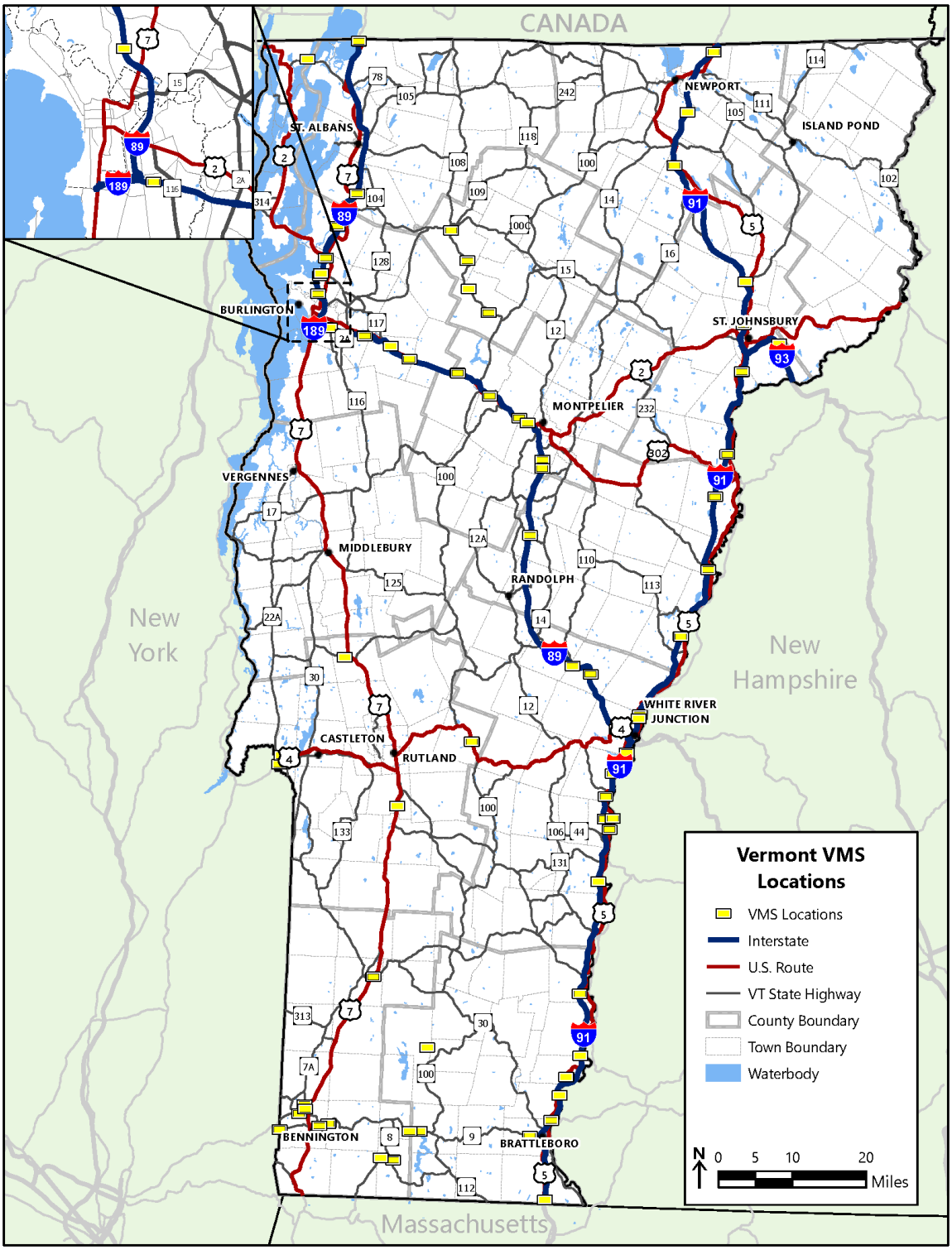
[122] https://legiscan.com/VT/text/S0339/2019

[123] Also called dynamic message signs or changeable message signs.

and advanced traffic management systems. This infrastructure allows for traffic volume, work zone and weather monitoring and the ability to share the conditions immediately with the traveling public. This infrastructure results in better service for all users, including trucks. In addition, this infrastructure continuously collects data for more detailed planning for future changes.

The locations of 77 VMS in Vermont are shown in Figure 4.5. These signs can serve a multitude of purposes, warning drivers of crashes or other events, broadcasting information about weather, directing trucks during a detour, or could be used to help disseminate truck parking or other freight-specific information.

FIGURE 4.5 VERMONT VMS LOCATIONS



Source: VTrans; Analysis by VHB, 2020.

Weigh Stations and Safety Inspections

To ensure that vehicles follow the size and weight limits discussed above, the DMV operates a number of weigh stations throughout the State. These facilities help ensure that trucks operate according to the rules, thereby protecting the State's infrastructure, reducing the likelihood of incidents, and improving economic competitiveness by ensuring that all vehicles play by the same set of rules. The Fairhaven and I-91 SB Putney sites have a permanent scale used to weigh vehicles—the other locations use portable scales carried in an officer's vehicle to weigh trucks. Commonly used weighing locations include:

- Fairhaven off of US Route 4
- Putney on I-91 (SB permanent scale in testing as of September 2020)
- Bennington on VT 279
- Guilford off of I-91
- Hartford/White River Junction I-89 SB/I-91 NB
- Sharon on I-89
- Waterbury on I-89
- Colchester on I-89
- Newport on I-91

Weigh-in-motion (WIM) is a commonly deployed ITS approach which allows a truck to be weighed while moving at highway speeds. This has applications both for transportation planning and for enforcement. Althought weight citations cannot be issued directly from a WIM (the level of accuracy is not precise enough), the technology can be used to screen traffic. By identifying a limited number of trucks that are more likely to be overweight, enforcement personnel can more efficiently use permanent or portable scales to obtain a precise reading and take enforcement action. Even if an officer is not nearby to act on the WIM data, the information can be used to identify patterns and plan future enforcement activity. This technology can also be combined with vehicle identification technology (for example using an optical camera, a license plate reader or U.S. DOT number reader) to help officers better identify a specific vehicle that may be overweight, identify habitual offenders even if enforcement is not in the area, and even screen vehicles for safety or credentialing issues in addition to weight. These sites are commonly referred to as Virtual WIM or VWIM locations.

The DMV also conducts inspections of trucks at the roadside to identify vehicle and driver infractions that could make vehicle operations unsafe. In 2019, the State conducted more than 7,400 inspections. Of these,

more than 5,000 found a violation of which approximately 1,400 were severe enough for the driver or vehicle to be placed out of service which means they legally cannot operate until the issue is resolved.[124]

When in the field, inspectors often deploy at or near weigh stations or rest areas which provide them with space to safely pull over vehicles for an inspection. Carriers with a good safety history that are current on their credentials can join a bypass program that reduces the chances their vehicles will be stopped for an inspection. In Vermont, Drivewyze operates this bypass program at 39 locations. Using a geo-fence, enrolled carriers are identified as they approach one of these locations and are informed via a cellphone application if they can bypass the site or if they must pull in. Carriers that are not part of the program must pull in when the site is open.[125]

Intelligent Transportation System Planning

Vermont is beginning work on an ITS operations plan to better integrate and plan for ITS needs in the State. This work will build on a 2016 "Vermont ITS Architecture Update and Strategic Plan"[126] by updating inventory information, considering new issue areas and technology options, and recommending strategic inititatives.

4.1.5 Truck Parking

Nearly every item we buy, from clothes to food to electronics, at some point ends up in the back of a truck. Trucks provide the main transportation mode for freight in Vermont, and a constant demand for goods means more trucks on the road and with it an increased demand for safe, reliable places to park.

Truck drivers typically need to park for one of four reasons, each of which comes with a challenge:

1. Long-haul: They are on a long-distance stretch of their trip, and need to find a parking location which maximizes their driving distance for the day but will not be full when they arrive.
2. Staging: They are at an origin or destination and have to wait for access to facility where they are loading or unloading, and the facility does not provide a truck staging area.
3. Emergency: They are in the middle of their driving period but an incident in front of them has either closed or severely congested the highway, and they need a place to park for either a short period until the road opens, or longer if they need to reset their Hours of Service (HOS) status.
4. Time off: They are done with their work week and need a place to park their truck while off-duty, but do not have access to a lot (often impacts independent owner-operators).

[124] FMCSA A&I data. Retrieved July 27, 2020. Online at: https://ai.fmcsa.dot.gov/SafetyProgram/spRptRoadside.aspx?rpt=RDAS

[125] Drivewyze.com

[126] Cambridge Systematics, October 2016.

Source: Eastern Transportation Coalition Truck Parking Primer.

In addition to these longer stops, drivers are also required to stop for at least 30 minutes within the first 8 hours of driving time.

This need to park is driven by a number of factors. First, the Federal Motor Carrier Safety Administration (FMCSA) regulates HOS (see Table 4.3) which have a significant impact on truck parking because they require drivers to carefully time deliveries and schedule adequate rest, making sufficient parking critical on their routes and deliveries.[127]

TABLE 4.3 SUMMARY OF FEDERAL HOURS OF SERVICE REGULATIONS

HOS Provision	Description
11-Hour Driving Limit	Drivers may drive a maximum of 11 hours after 10 consecutive hours off duty. All time spent at the driving controls of a commercial motor vehicle (CMV) in operation is considered driving time.
14-Hour Driving Limit	Property-carrying drivers may not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty.
Rest breaks	Drivers must take a minimum 30-minute break after 8 hours of driving time and allows on-duty/not driving period to qualify as the required break.
60-/70-Hour Limit	Drivers may not drive after 60/70 hours on duty in 7/8 consecutive dates. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.
Sleeper Berth Provision	Drivers using the sleeper berth provision must take at least seven consecutive hours in the sleeper berth, plus a separate period either in the sleeper berth or off duty. The two periods must total at least 10 hours.

Source: Federal Motor Carrier Safety Administration. Includes Hours of Service Drivers Final Rule, revised 5/1/2020.

Note that starting September 29, 2020 changes to these above rules are scheduled to go into effect. The changes include:

[127] "Jason's Law Truck Parking Survey Results and Comparative Analysis." http://www.ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm.

1. Expanding the short-haul exception to 150 air-miles and allowing a 14-hour work shift as part of the exception;[128]
2. Expands the driving window during adverse driving conditions by an additional 2 hours (total of 4 hours)[129];
3. Requires a 30-minute break after 8 hours of driving time (instead of on-duty time) and allows on-duty/not driving period to qualify as the break; and
4. Modifies the sleeper berth exception to meet the 10-hour minimum off-duty requirement by spending at least 7, rather than 8 hours in the sleeping berth and a minimum off-duty period of at least 2 hours spent inside or outside the berth as long as the two periods total at least 10 hours. The shorter rest period counts against the 14-hour driving window.[130]

The HOS rules are designed to eliminate the type of drowsiness that can lead to crashes. HOS regulations are strongly enforced by State agencies, and fines for non-compliance can be high. To avoid the steep fines, drivers are under pressure to find parking as quickly and efficiently as possible to avoid violating HOS regulations while trying to meet stringent delivery schedules.

Second, the mandatory use of electronic logging devices (ELD) in most commercial vehicles as of April 2018 is adding to the parking demand concern.[131] The adoption of ELDs does not change any existing FMCSA regulations, but it does make it more difficult to "game the system." For example, with paper logs, drivers recorded their activities in 15-minute increments and were provided a grace period to find a parking space, once their HOS were up. The grace period did not count towards driving time. ELDs erase that grace period and can track a truck's location. This means that drivers either need to search for and find parking before their HOS are up (thus sacrificing driving time and decreasing productivity) or park immediately once their time is up, regardless of location.

[128] Vehicles that report and return to a reporting location within 12 hours, log books are not required.

[129] Extension for unknown weather or traffic conditions. Additional driving time must fall within 14-hour driving window.

[130] https://www.federalregister.gov/documents/2020/06/01/2020-11469/hours-of-service-of-drivers

[131] Certain drivers are exempt from this requirement including those that operate within a 100-mile radius of work and those that use paper records for less than 8 days in a 30 day period. See: https://www.fmcsa.dot.gov/hours-service/elds/implementation-timeline. Accessed May 24, 2018.

Jason's Law was passed in 2012 following the murder of a truck driver who was parked in an unauthorized location to provide a national prioirty on addressing the shortage of long-term parking for commercial motor vehicles. Specifically, Jason's Law required the USDOT to conduct a survey and assessment of the parking which was completed in 2015.

Vermont was ranked among the highest states for providing public truck parking spaces per 100,00 daily truck VMT and for providing public truck parking spaces per 100 miles of the NHS. However, Vermont also fell in the lowest quartile in survey results for public truck spaces, private truck stops, and total spaces in the assessment. This suggests that the parking spaces provided at highway rest stops/visitor centers may not be where the drivers are looking for parking spaces.[132] An update to the Jason's Law survey is underway as of July 2020.

Figure 4.6 shows the locations and number of truck parking spcaes available at the State's public facilities. In total, the State has 38 publicly owned facilities with a total of approximately 236 spaces. While a full inventory including privately owned locations is unknown, public truck parking typically accounts for 10% or less of a State's total inventory.[133] It is also important to note that due to COVID-19, some rest areas in the State remain closed as of July 2020 which may limit the number of available truck parking spaces statewide.[134]

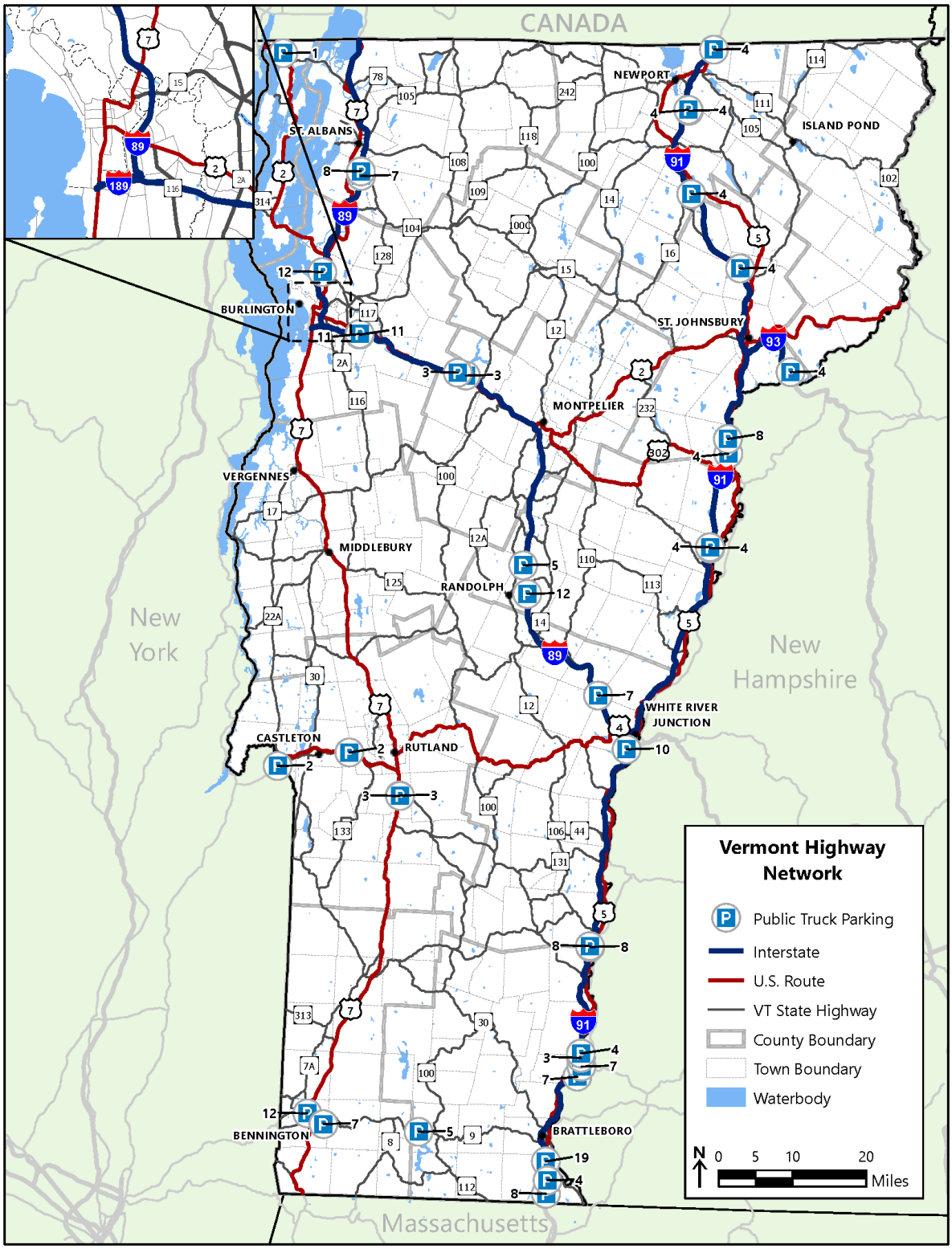
Vermont is currently beginning a study of the Visitor Information Centers that will include consideration of truck parking needs at these facilities.

[132] https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/index.htm

[133] Based on recent truck parking studies for Texas, North Carolina, & Nevada.

[134] https://vtdigger.org/2020/07/27/vermont-rest-areas-reopen-with-visitors-following-rules/

FIGURE 4.6 VERMONT PUBLIC TRUCK PARKING LOCATIONS



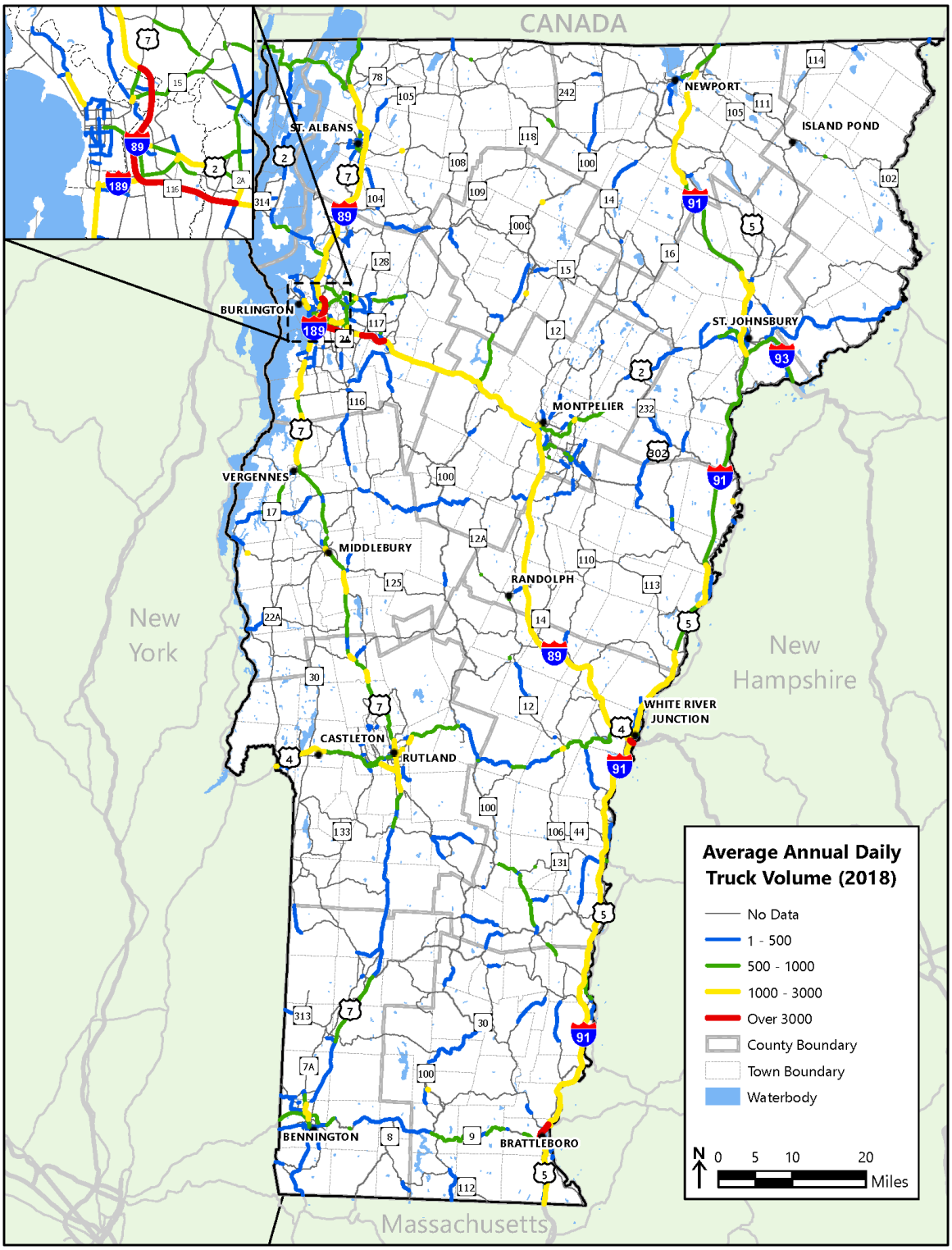
Source: VTrans, AmericanTruckParking.com; Analysis by VHB, 2020.

4.2 Volumes and Users

Figure 4.4 illustrates annual average daily truck traffic (AADTT) on Vermont's highways. As shown, the truck volumes are highest on the Interstates, especially I-89 near Burlington and I-91 near Brattleboro, followed by US Route 7, US Route 9, US Route 4 and portions of US Route 2. There are smaller segments of a number of other routes that experience heavy truck volumes as well.

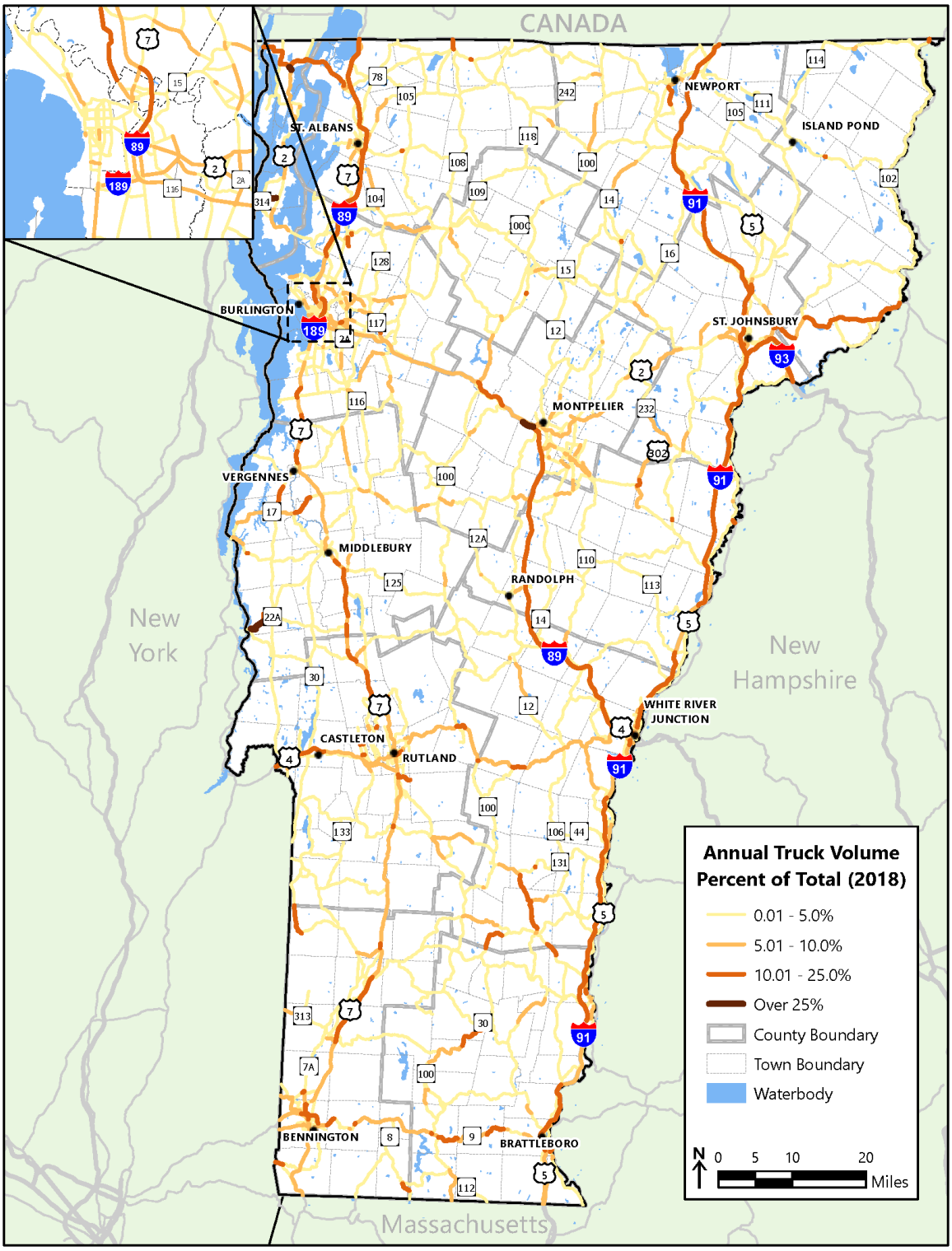
Figure 4.5 shows the truck percent of all traffic volume on these roadways. Although the interstates continue to have higher truck percentages, once the truck volume is put into the perspective of a percentage of all traffic, some segments of the state numbered routes are in the same range as the interstate for truck percentages.

FIGURE 4.7 TRUCK VOLUMES IN VERMONT (2018)



Source: HPMS; Analysis by VHB, 2020.

FIGURE 4.8 TRUCK PERCENT OF TOTAL TRAFFIC VOLUME (2018)



Source: HPMS; Analysis by VHB, 2020

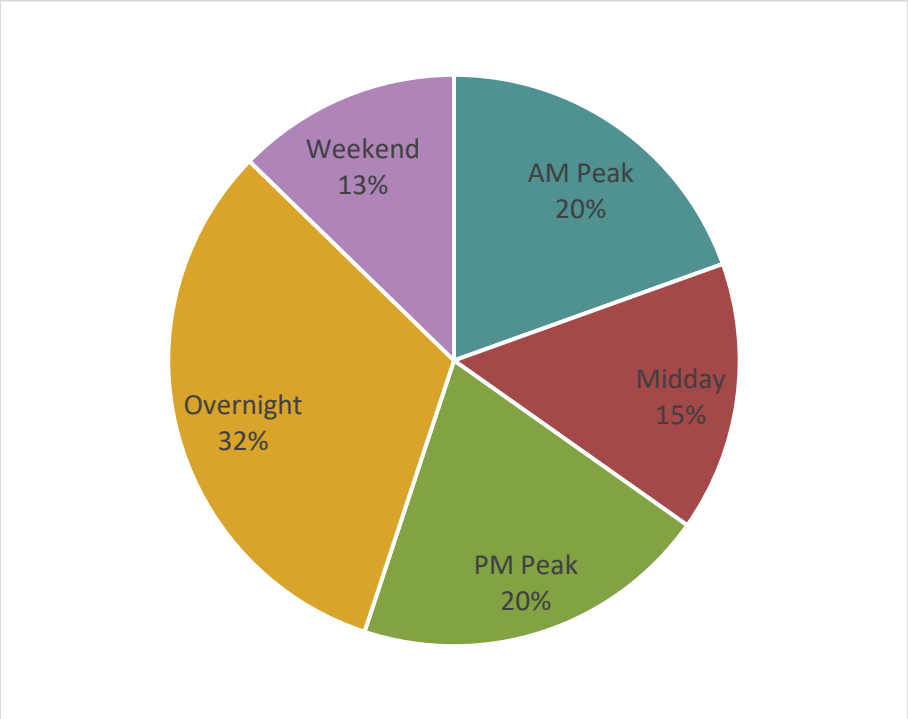
Another critical measure of highway freight travel is compiled from the National Performance Measure Research Data Set (NPMRDS) data. NPMRDS data represents segments of roadways called Traffic Message Channel (TMC) links. The travel time for all vehicles, passenger vehicles, and freight trucks is recorded for each of these TMC segments.

FHWA has established measures to assess performance in freight movement on the Interstate. States must set and report a Truck Travel Time Reliability (TTTR) Index which measures variability in travel times on the TMCs by reviewing the 50th percentile travel time and the 95th percentile travel time over a number of different periods of the day/week.[135]

Figure 4.9 shows the distribution of maximum TTTR by reporting periods across all road types measured:

- AM Peak (6-10 AM).
- Midday (10 AM – 4 PM).
- PM Peak (4 – 8 PM).
- Overnight (8 PM – 6 AM, all days).
- Weekend (6 AM – 8 PM).

FIGURE 4.9 VERMONT (JAN. 2019 – APRIL 2020)



Source: NPMRDS; Analysis by VHB, 2020

[135] For details on calculating TTTR, see slides 28 and 29 here: https://www.fhwa.dot.gov/tpm/rule/170601pm3.pdf

Figure 4.10 shows the highest TTTR across the five reporting periods with higher numbers representing areas with more volatility in travel times. Overall, truck travel times in Vermont are relatively consistent, with areas of concern including VT 9 west of Bennington[136], I-89 and I-91 approaching the Canadian border (likely due to border crossing wait times), and some roads in the Burlington region. In particular, the Highgate Springs – St. Armand Border Crossing on I-89 which connects Montreal to Boston is the busiest in Vermont and one of the top-15 busiest in the United States.[137] Although trucks and passenger vehicles have separate lanes in both directions, high traffic volumes can create a large amount of variability in travel time to/through the border. The I-91 crossing at Derby-Stanstead also shows a high TTTR. Interestingly, the highest TTTR is spread throughout the five reporting periods rather than having a larger number during the AM and PM Peak. This may indicate the role that weather and geography play in Vermont, especially on non-interstate routes, compared to heavy traffic volumes that are encountered in more urban states.

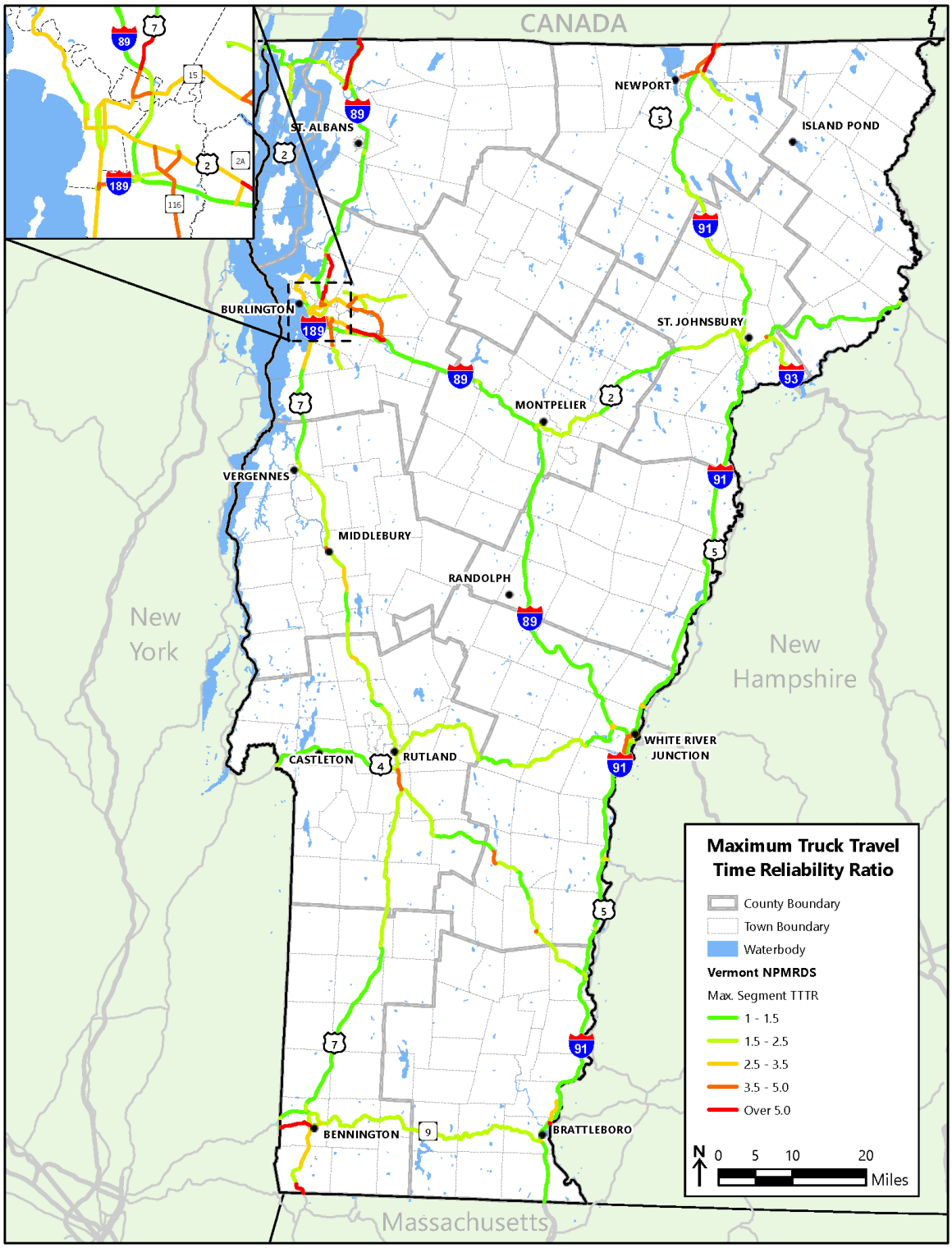
The freight performance measure associated with the FAST Act requires states to set and meet TTTR Index goals for the interstate system only. Vermont had a target TTTR Index of 1.75 in 2018 and met that goal with a TTR Index of 1.67.[138] Vermont is using the same goal of 1.75 for the 2020 report. Between January 2019 and April 2020, Vermont had a TTTR Index on the interstate system of 1.61, meeting their goal. Figure 4.11 shows the TTTR Index separately for each interstate (note that although I-189 is above the goal, the measure is reported to FHWA for the entire interstate system, not any individual component).

[136] As shown in Figure 4.7, VT 279 is a heavier volume bypass route around Bennington.

[137] https://recordsfinder.com/driving/usborder/border-crossings/vt/highgate-springs-st-armand/

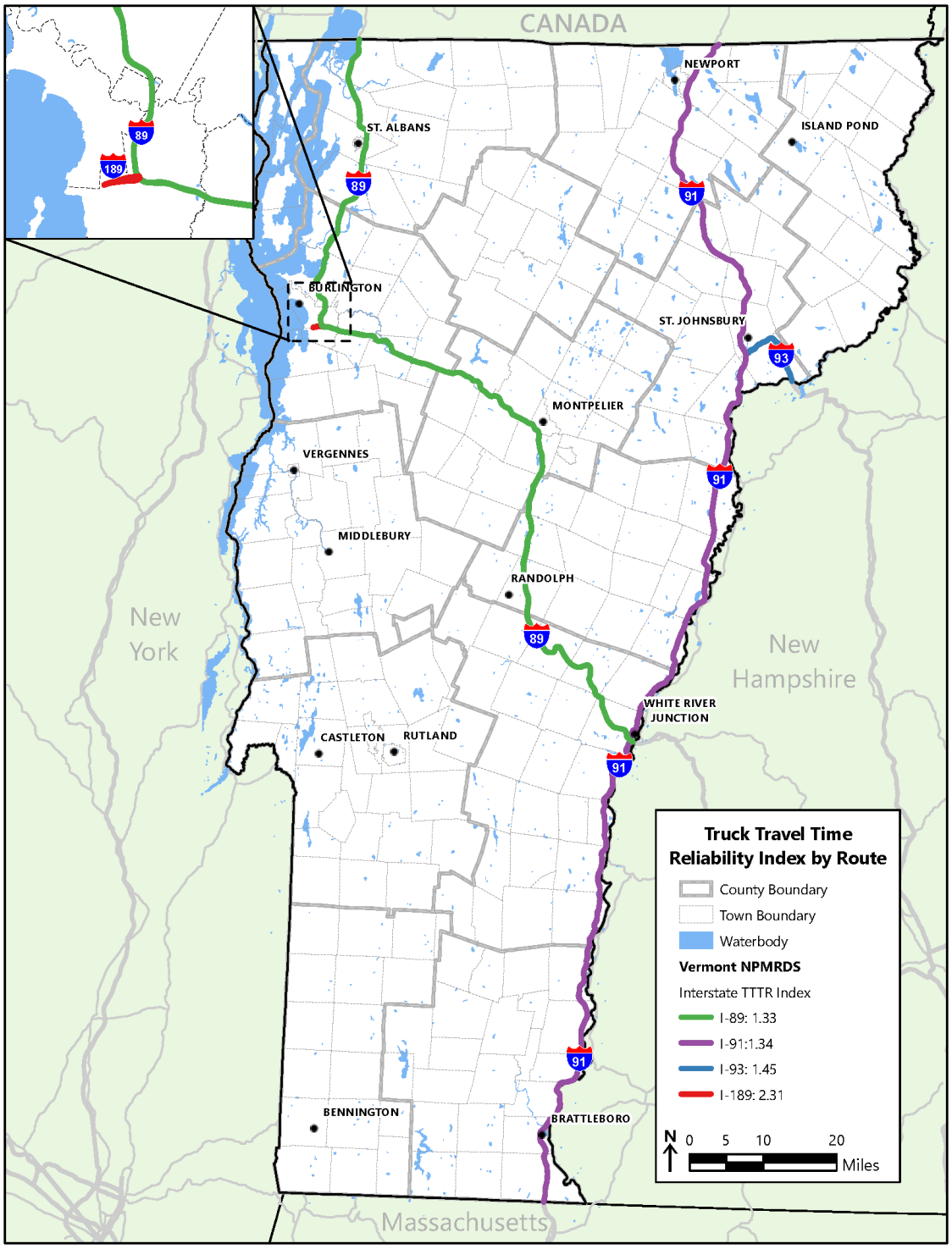
[138] https://www.fhwa.dot.gov/tpm/reporting/state/reliability.cfm?state=Vermont

FIGURE 4.10 VERMONT TRUCK TRAVEL TIME RELIABILITY (JAN. 2019 – APRIL 2020)



Source: NPMRDS; Analysis by VHB, 2020

FIGURE 4.11 VERMONT TTTR INDEX BY INTERSTATE (JAN. 2019 – APRIL 2020)



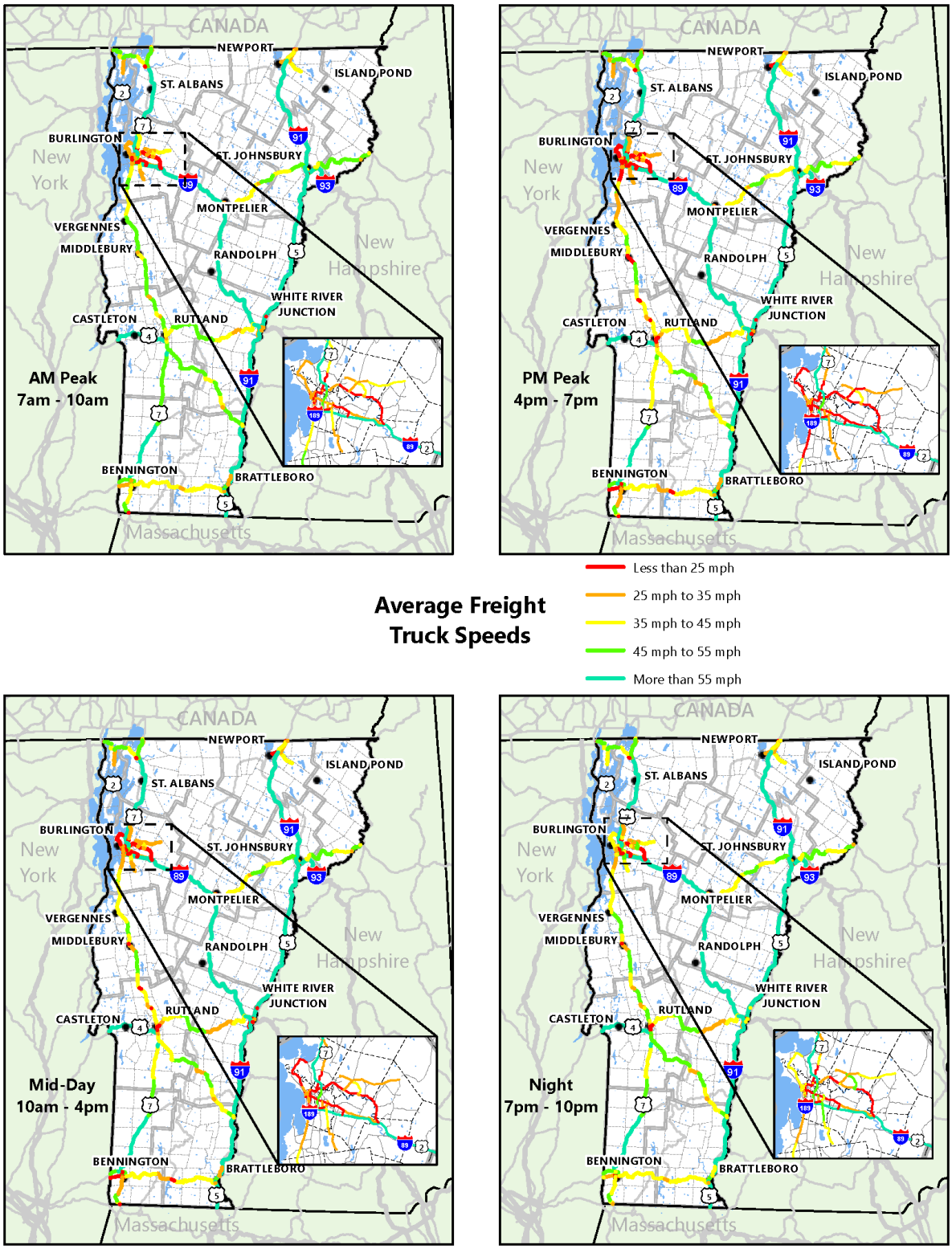
Source: NPMRDS; Analysis by VHB, 2020.

Another way to look at truck movements is by speed. Figure 4.12 shows the average truck speeds on each of the TMCs during the AM Peak, PM Peak, Midday, and Overnight periods. Especially in a mountainous state like Vermont with a number of small towns and villages, speed can be influenced by factors beyond just traffic, but identifying areas with significant changes in speed between the different periods can help identify potential issue areas. As shown, the speeds on the interstates typically are over 55 miles per hour with the exception of some congestion in Chittenden County and a few isolated locations. The travel speeds along a number of non-interstate numbered routes, such as US Route 7 vary by time period.

The American Transportation Research Institute annually identifies a list of top 100 truck bottlenecks in the United States.[139] While none of Vermont's roads appear on this list, there are locations that experience congestion, especially during the peak hour. I-89 and I-189 through Chittenden County present the largest bottleneck to traffic including trucks. Vermont's only MPO, the CCRPC, adopted the same TTTR goal (1.75) as Vermont.

[139] https://l8r.63b.myftpupload.com/wp-content/uploads/2020/02/ATRI_Bottlenecks2020_Brochure.pdf

FIGURE 4.12 VERMONT TRUCK SPEEDS (JAN. 2019 – APRIL 2020)



Source: NPMRDS; Analysis by VHB, 2020.

4.3 Infrastructure Condition

4.3.1 Pavement Condition

Smoothness is a measure of the level of comfort expereienced by the traveling public while riding over pavement. There are a number of indices that assist Transportation Departments in evaluating pavement construction in order to ensure smoothness. The International Roughness Index (IRI) is measurement of rougness obtained from lognitundinal road profiles. The RUT indeex is a measure of the severity of longitundinal depsressions in the wheel paths. STRC Index is a measurement of the longitunidal cracking parallel to the dierction of travel and is used to evaluate new pavement construction. TRAN Index is a measure of transverse cracking (perpendicular to the direction of travel. VTrans uses these indices to develop an index that combines these indices into a Composite Pavement Condition (COMP) to determine pavement condition ranging from Good to Fair to Poor to Very Poor as shown in Figure 4.13. The data for one mile pavement condition indicates that only 10 percent of roadways are in Very Poor condition. An additional 21 percent are in poor condition and the remainder are in Fair or Good condition. A review of interstate one mile data reveals that only six percent is ranked as Poor and none are ranked as Very Poor.

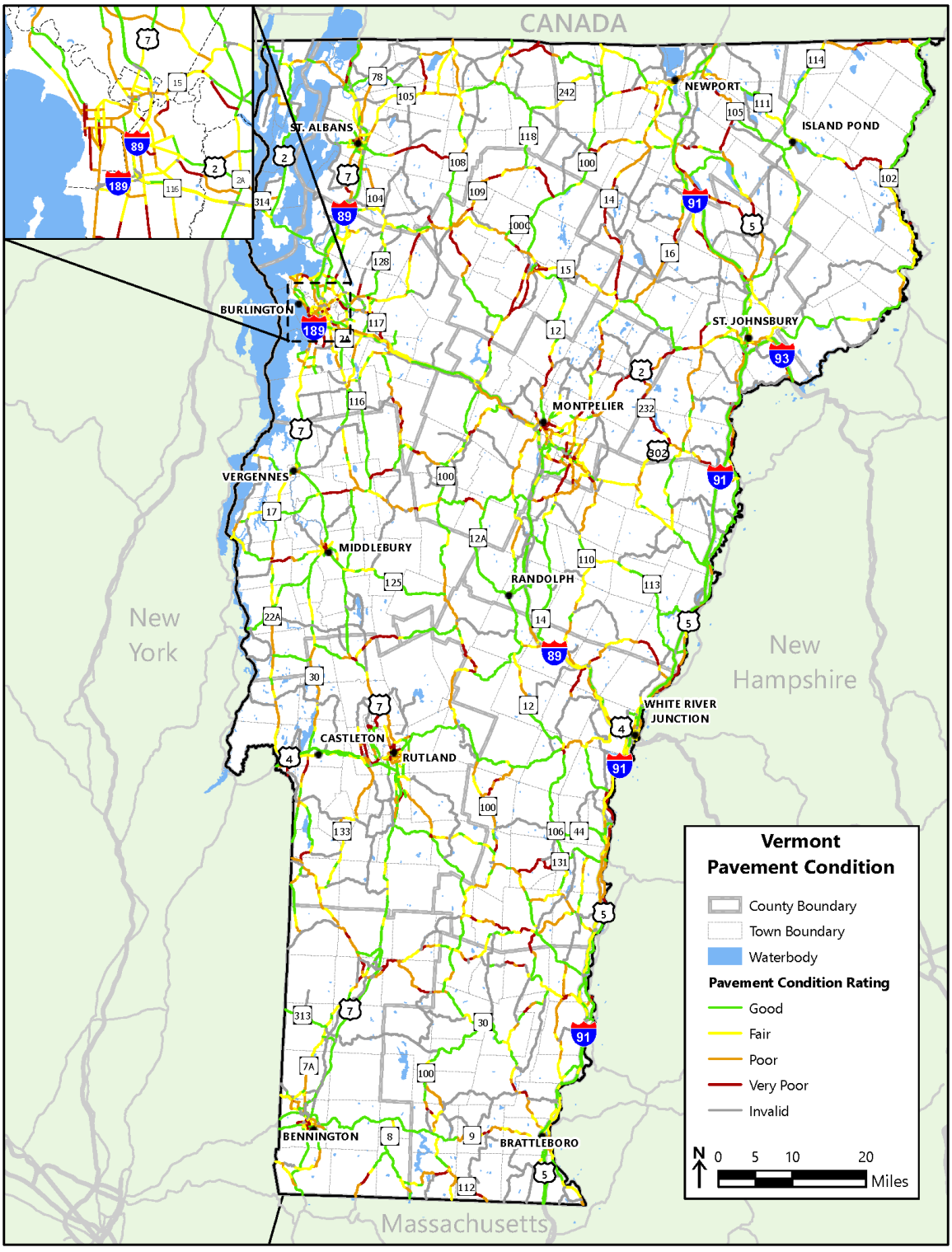
The poor pavement conditions are not typically locations with heavier truck traffic. The interstates and locations that experience heavy truck volumes are more typically in Good condition.

Pavement Conditions have improved significantly over time. A review of data between 2009 and 2019 reveals that the percentage of roads in very poor or poor condition was reduced from over 50 percent to approximately 30 percent during that period.[140]

In 2018, VTrans, in collaboration with USDOT and FHWA, conducted a study regarding how the traveling public public rated roadway conditions and compared the traveling public's ratings to those given by VTrans. The respondents acceptability ratings correlated well with VTrans' Pavement Condition Indices.

[140] 2020 VTrans Factbook. Online at: http://factbook.vtrans.vermont.gov/sites/aot/files/AOT%20Fact%20Book%202020%20-%20web.pdf

FIGURE 4.13 VERMONT COMPOSITE PAVEMENT CONDITIONS (2019)



Source: VTrans; Analysis by VHB, 2020.

4.3.2 Bridge Conditions

Vermont's roadway inventory includes 2,791 long structures (greater than 20 feet in length and located on public roads)[141] and 1,260 state owned short structures (bridges having a span length of greater than six feet up to and equal to 20 feet and located on public roads).[142] The 2020 VTrans Factbook indicates that almost 13 percent of these structures are on an interstate and almost 47 percent on a state highway. The Factbook also indicates that 17 percent of bridges have an age of over 90 years and an additional 36 percent have an age of over 50 years.

On all roadway types, VTrans is ahead of the target for addressing structurally deficient bridges. Only 2 percent of interstate bridges were structurally deficient, 4 percent of state highway system bridges were structurally deficient and only 2 percent of town highway system bridges were structurally deficient. The targets for these were 6, 10 and 12 percent, respectively. These structures are shown in Figure 4.14 along with AADTT.

The bridge inventory was also reviewed to identify posted structures (those that cannot carry 80,000 pound trucks). There are 149 bridges in the state (longer than 20') that are posted. However, the vast majority of these structures are maintained by towns and are located on town highways which are generally posted for a legal load of 24,000 pounds and not intended to carry 80,000 pound trucks.

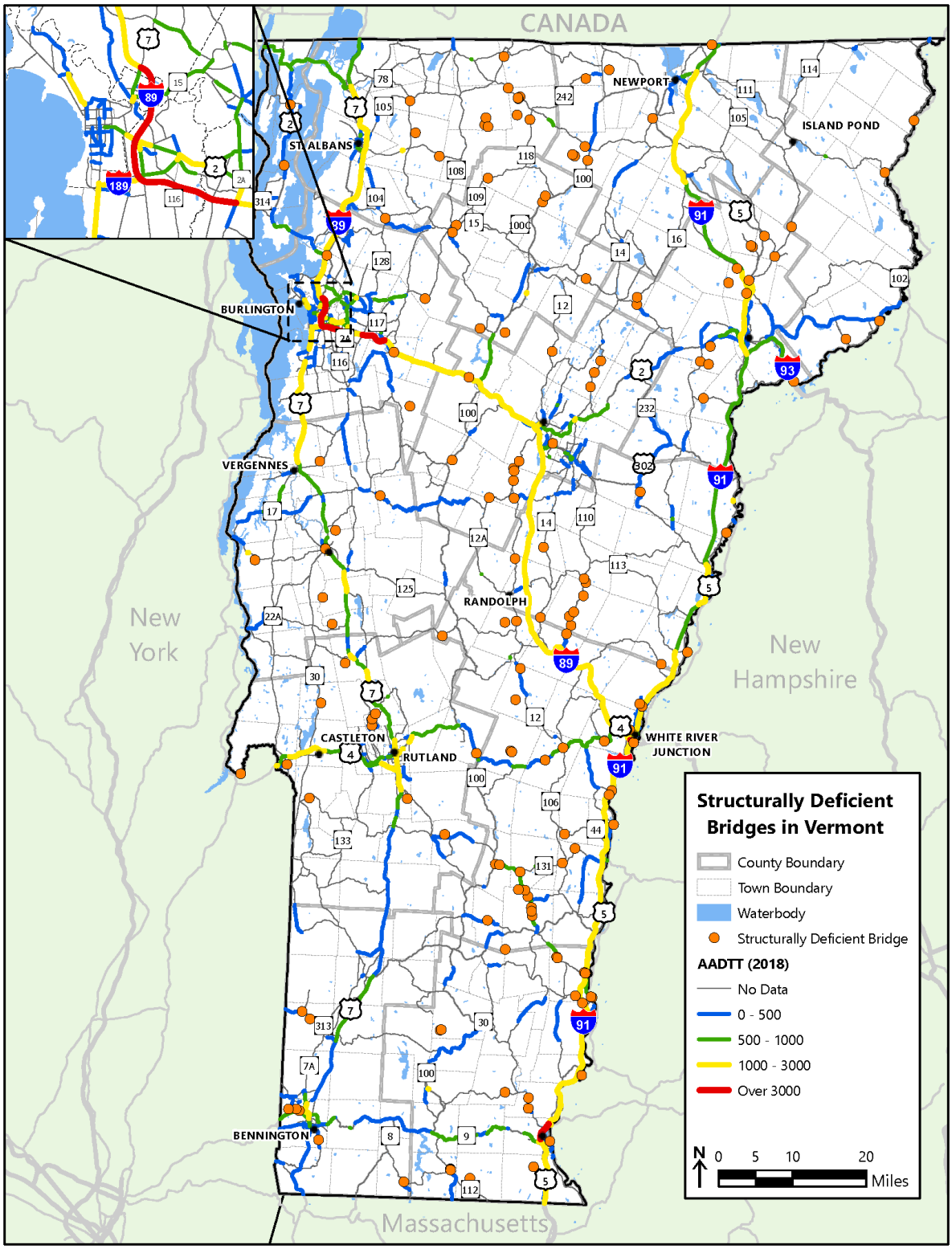
There are seven structures with posted weight limits where maintenance responsibility falls to the State. These include:

- Cornish-Windsor Covered Bridge in Windsor;
- VT 933 over the Connecticut River in Maidstone;
- East Thetford Bridge in Thetford (VT 113);
- C3029 over the WACR Conn River line in Hartford;
- C3060 over the Lamoille Valley Railroad (abandoned) in Danville;
- VT 65 over Sunset Lake in Brookfield; and
- VT 12 over Lulls Brook in Hartland.

[141] https://geodata.vermont.gov/datasets/VTrans::vt-long-structures-bridges-and-culverts (2020)

[142] https://geodata.vermont.gov/datasets/VTrans::vt-short-structures-bridges-and-culverts (2018)

FIGURE 4.14 STRUCTURALLY DEFICIENT BRIDGES IN VERMONT



Source: VTrans; Analysis by VHB, 2020.

4.4 Safety

4.4.1 Highway Safety Overview

Highway safety is of the utmost importance to VTrans. VTrans' Strategic Highway Safety Plan outlines critical emphasis areas for the state. The number of major reported crashes has reduced significantly since 2011. 275 major crashes were reported in 2019 in the VTrans network, down from 390 major crashes in 2010, a reduction of thirty percent. The number of fatalities has remained relatively constant at about seventy fatalities over the same time period.

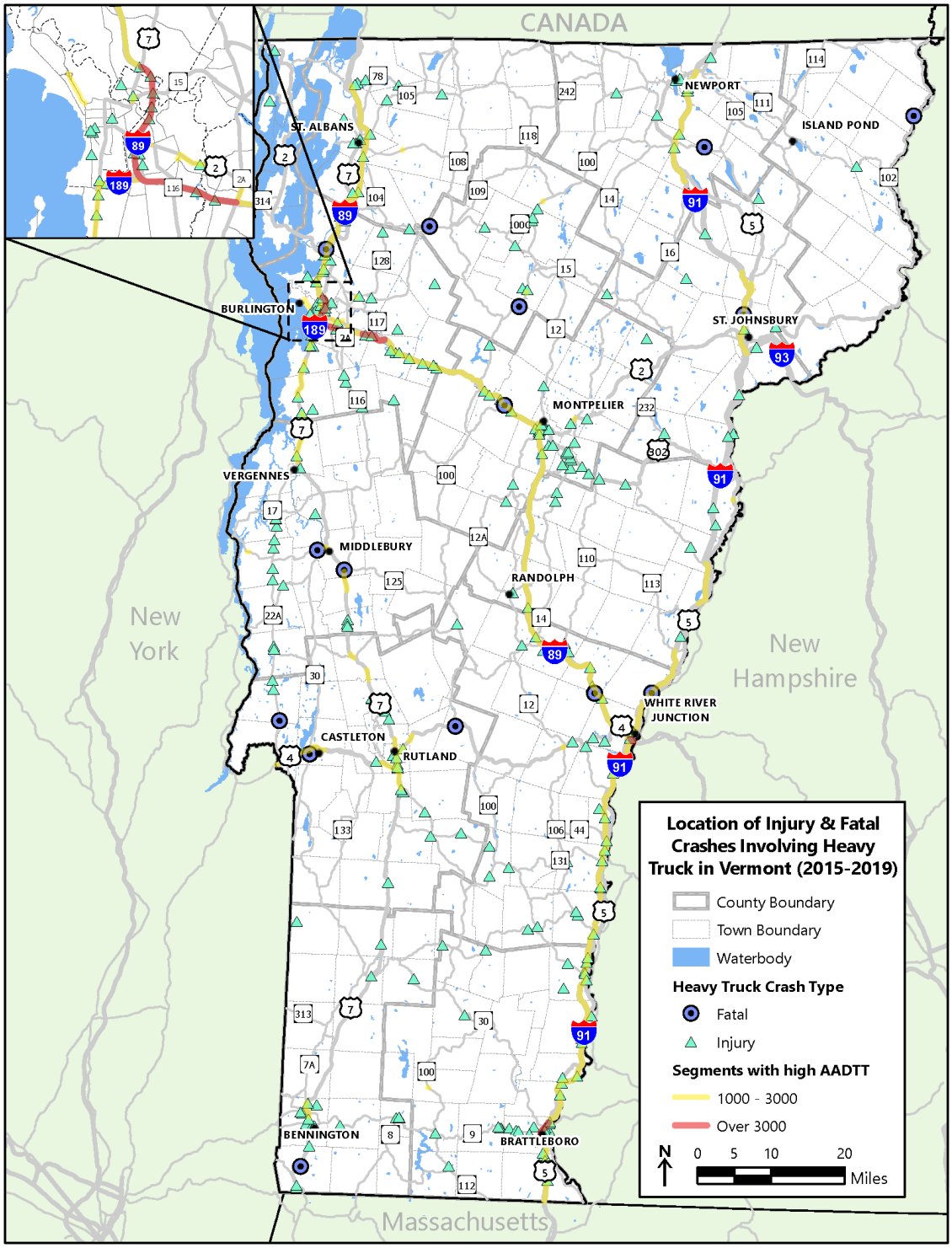
4.4.2 Truck Involved Crashes

An investigation of the VTrans Crash Query Tool Overview feature for Crashes involving a Heavy Truck[143] yields approximately three thousand crashes over the period from 2015 through August 2019 (most recent data available). A total of 51,621 crashes involving all vehicles were reported during that same time period. Crashes are logged on the interstates, state highway and town highways and include any reportable crashes (typically crashes involving injury or fatality or over $1,000 in property damage).

The most common crash type involving a heavy truck is property damage only at 2,605 crashes (86%), followed by 393 injury crashes at 13% and 25 fatal crashes involving a heavy truck (less than 1%). Figure 4.15 shows the locations of fatal and injury crashes involving a heavy truck, along with roads with an AADTT over 1,000. Although there is much overlap between these areas with higher truck volumes and truck crashes, there are corridors including VT-22A, US-302, and VT-9 west of Brattleboro with lower truck volumes but concentrations of crashes.

[143] This category includes Truck Tractor (Bobtail), Tractor/Trailer, Tractor with Twin Trailers, Logging Truck, Logging Tractor/Truck, Single Unit Truck, Panel Truck, Bus, Truck Towing House Trailer, or Farm or Construction Equipment. http://apps.vtrans.vermont.gov/CrashPublicQueryTool/

FIGURE 4.15 LOCATIONS OF INJURY AND FATAL CRASHES INVOLVING A HEAVY TRUCK IN VERMONT (2015-2019)



Source: VTrans; Analysis by VHB, 2020.

Bridge Strikes

Trucks striking a bridge can cause significant economic impacts, not including the potential for injury or death to the driver or other road users. Drivers are responsible for following posted limits, but the proliferation of mapping/routing applications that do not show routes based on a vehicle's height can lead to issues. Table 4.4 below shows the cost of a single bridge strike in Lancaster County, PA including immediate detour and delay costs as well as the need to repair the bridge itself.

TABLE 4.4 ECONOMIC IMPACTS OF A BRIDGE STRIKE – US 222 IN LANCASTER COUNTY, PA

Description	Duration and Scope	Estimated Economic Impact
Residual delays and secondary crashes	Day of incident	$1,900,000
Residual delays due to detour routes and delays during bridge repair	3 weeks (full detour) to 9 months (one lane detour), Bridge repair detour - 5 days, single lane	$6,150,000
Bridge Repair Costs	3-4 Months	$570,000
	Total	**$8,620,000**

Source: Presentation to AASHTO Committee on Transportation System Operations Working Group on Freight Operations, December 18, 2018.

Vermont does not include information specific to bridge strikes as part of its online crash query tool so it is difficult to know how prevalent this problem is in the state. However, numerous recent press stories highlight this as issue, especially on Town highways and with historic covered bridges with lower clearances than normal. For example, in May 2020, a covered bridge in Lyndon was struck for the second time in less than a year causing significant damage. The truck was over the posted height and weight for the bridge.[144]

Highway-Rail Grade Crossing Safety

As outlined in the Section 3.1.10, there are over 400 public highway-rail crossing locations in Vermont. Of these, only 10 have no warning provided. Over the past five years (2015-2019) there have been three fatalities and five injuries reported at these locations.

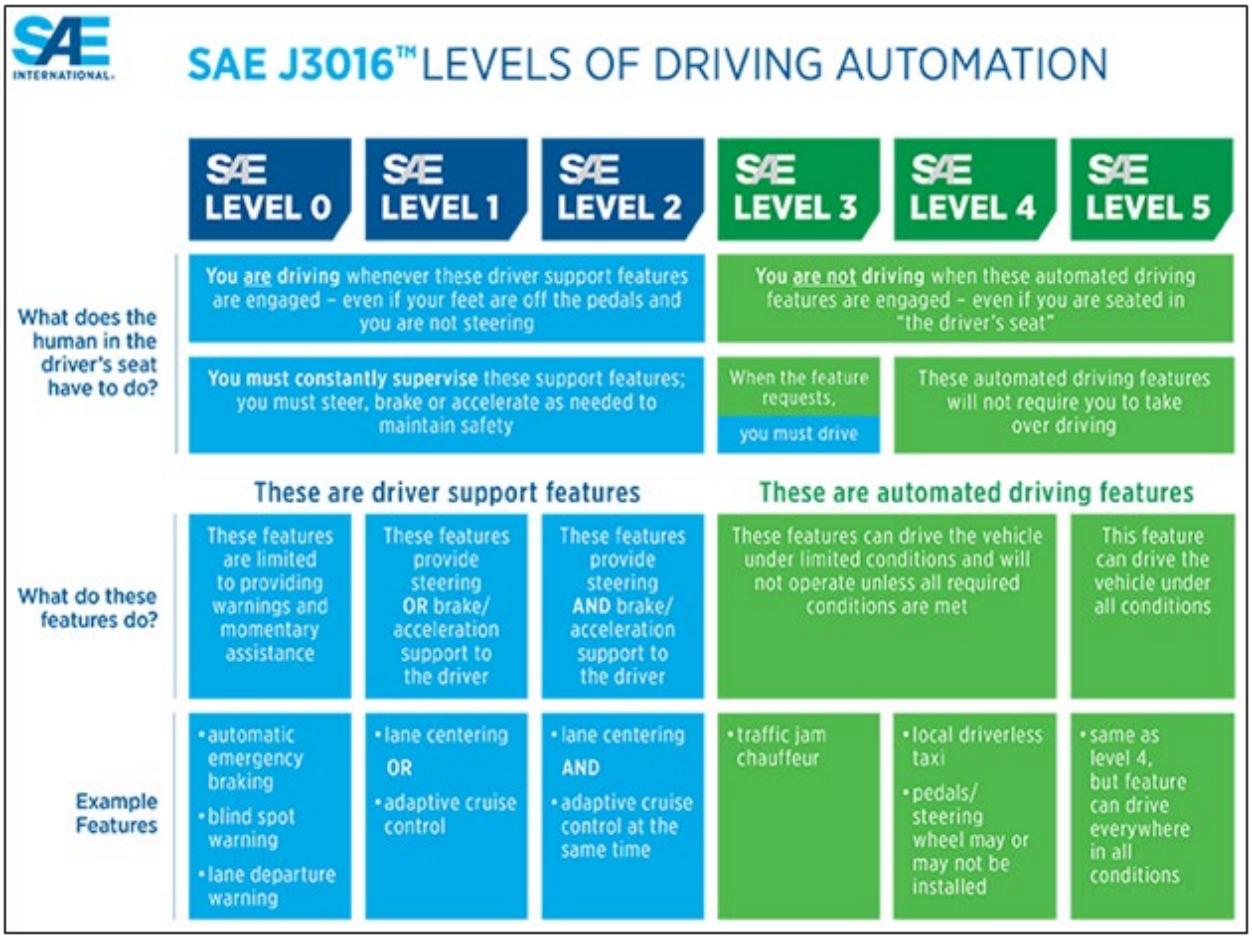
4.4.3 Autonomous Vehicles

A notable emerging technology is the use of automated vehicle/connected vehicle (AV/CV) systems that either assist the driver while operating a vehicle or control the vehicle outright. The degree of automation

[144] https://www.caledonianrecord.com/news/truck-causes-major-damage-to-covered-bridge-in-lyndon/article_df3b7468-77dc-11e9-b88c-0be85c8431b5.html

has been classified by the Society of Automotive Engineers (SAE) between Level 0 (no automation) and Level 5 (complete automation) as shown in Figure 4.16 below.

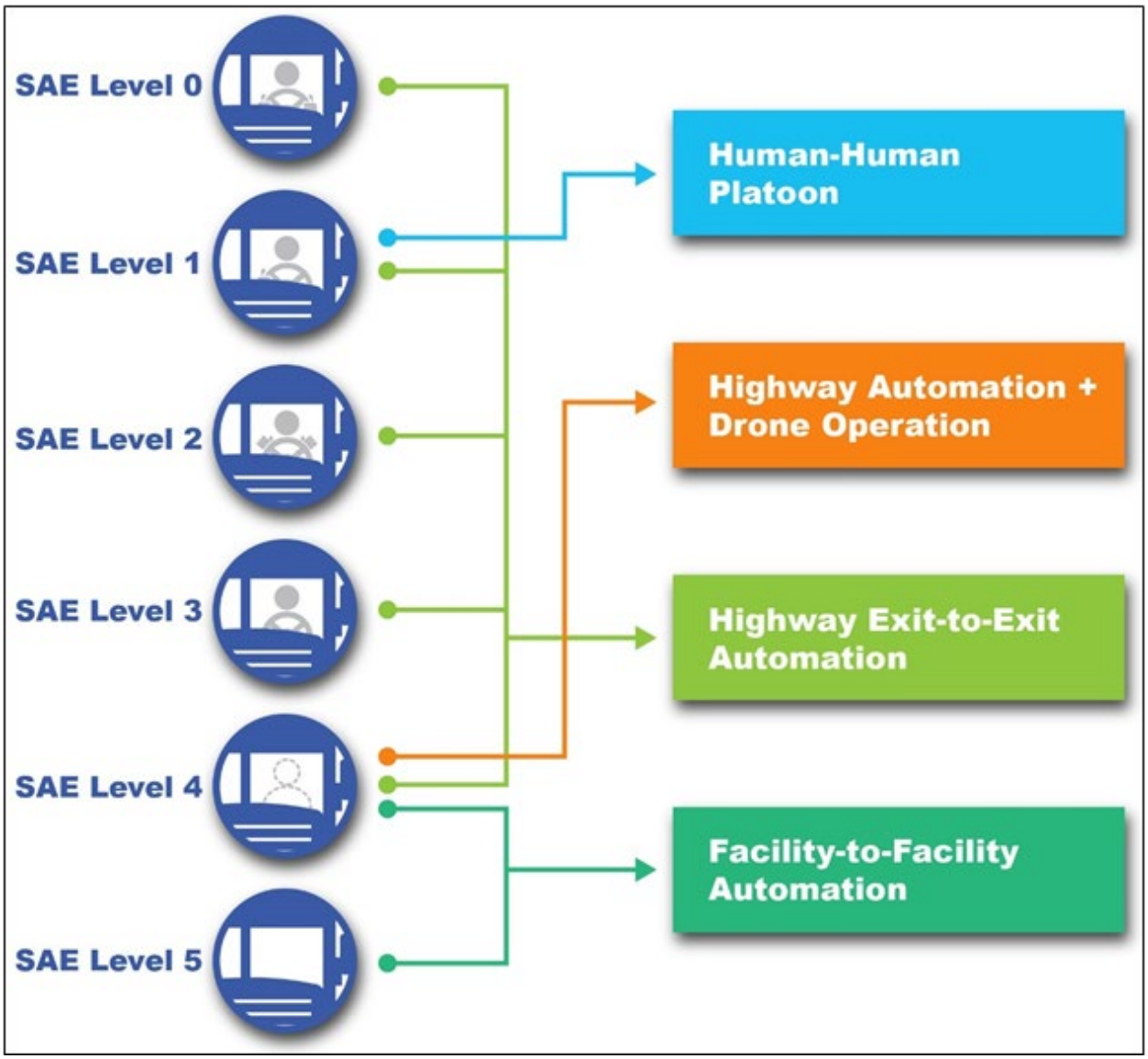
FIGURE 4.16 SOCIETY OF AUTOMOTIVE ENGINEERS LEVELS OF DRIVING AUTONOMY—UPDATED INFOGRAPHIC



Source: https://www.sae.org/news/2019/01/sae-updates-j3016-automated-driving-graphic

Within these broadly defined SAE categories, there are different use-scenarios, including platooning, highway exit-to-exit automation, highway automation with remote (drone) access, and facility-to-facility automation (when facilities are located close to a highway interchange). The interaction between SAE levels and potential use-scenarios is shown in Figure 4.17 below.

FIGURE 4.17 INTERACTION OF SAE LEVEL AND CURRENT/ANTICIPATED USE-SCENARIOS



Source: "Commercial Vehicle Safety Alliance – Automated Commercial Motor Vehicle Working Group Final Report"

Companies are developing SAE Level 1, Level 2, and Level 4 vehicles at this time, with Level 1 and Level 2 vehicles already operating in the United States.

Numerous firms are currently testing Level 4 trucks (with a human safety driver in the vehicle who can take over control if necessary) in multiple states, principally in the southern and western U.S. In early July 2020, TuSimple announced plans to ramp up delivery runs using a Level 4 truck (with a human safety driver in the

vehicle) to 100 deliveries a week in the next four years, offering service between Los Angeles and Jacksonville by 2022, and expanding nationwide by 2023.[145]

However, widescale adoption of this technology is still far from certain. In a sign of the potential issues with AV/CV technologies in trucks, Starsky Robotics, a Silicon Valley firm that had received venture capital investments to develop Level 4 trucks, announced in March 2020 that it was ceasing operations.[146] They blamed their closure in part on the decreasing marginal value of supervised machine learning technology. This means, in short, that the intelligence gained from machine learning technology can rapidly improve before flattening out. This led Starsky to doubt that automated vehicles will ever be sophisticated enough to be considered safe for the road.

One of the factors that makes the adoption of autonomous vehicles more complicated is that there is limited federal legislative or policy frame work in place to guide consistent practices and govern the standards of this technology. As of March 2020, according to the National Conference of State Legislatures, 30 states have enacted legislation regarding AVs, 6 states have executive orders in effect, and 5 states have both (see Figure 4.18). In June 2019, Vermont passed legislation (24 VSA Chapter 41) to create a permitting process to allow test of autonomous vehicles on state highways and town Class I highways (continuation of U.S. and State numbered routes through municipalities). Approval by the Vermont Traffic Committee is required for all vehicle test permits.[147] Vermont has not passed any legislation to allow for truck platooning (SAE Level 1) technology.[148] Federally, trucks cannot currently operate without a human driver except in limited testing environments, limiting potential deployment of human-driverless vehicles pending changes in legislation.

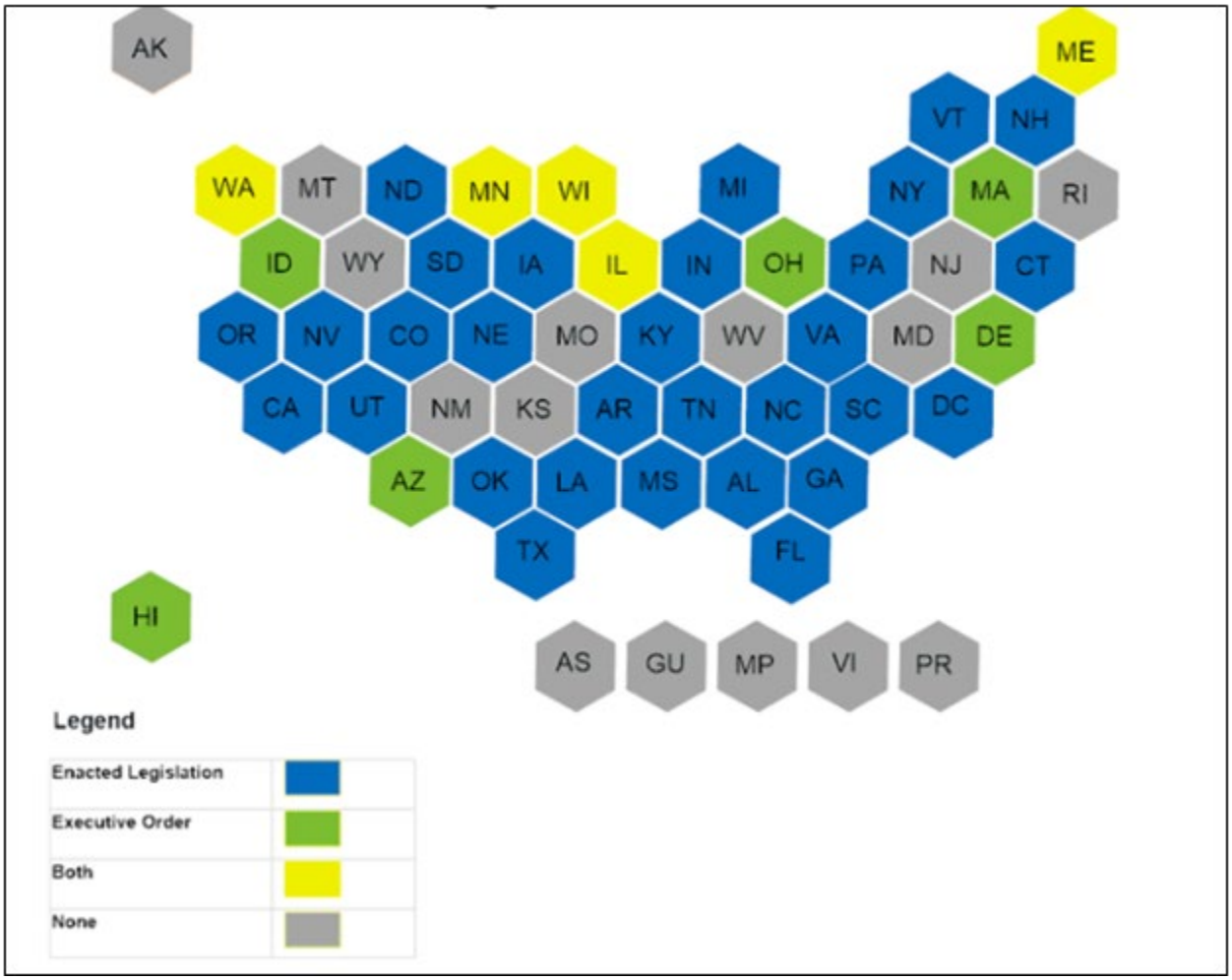
[145] https://www.theverge.com/2020/7/1/21310209/tusimple-self-driving-truck-network-ups-xpress-penske

[146] https://medium.com/starsky-robotics-blog/the-end-of-starsky-robotics-acb8a6a8a5f5

[147] https://vermontbiz.com/news/2020/may/27/vtrans-seeks-public-comment-automated-vehicle-testing-permit-guidance

[148] https://peloton-tech.com/platooning-regulatory-status/

FIGURE 4.18 STATES WITH AUTONOMOUS VEHICLE ENACTED LEGISLATION AND EXECUTIVE ORDERS (MARCH 2020)



Source: https://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx

5.0 AIR MODAL PROFILE

5.1 Overview

Typically, cargo with high value, high-time sensitivity and/or high security requirements move by air as it is the fastest and often best tracked method to move goods. High-value electronics, pharmaceuticals, some agricultural product, and essential replacement parts for manufacturing lines are examples of goods commonly moved by air. Although air cargo comprises a small fraction of the overall total of goods moved to, from, and within Vermont it provides crucial options to the State's businesses and residents.

Additionally, airports that do not (or only rarely) support cargo flights still help freight-related businesses in the State by providing transportation access for clients, company employees, and business partners.

There are 16 public-use airports in Vermont including one municipal airport (Burlington International), 10 state-run airports, and 5 private airports. Of these, Burlington and Rutland-Southern Vermont are commercial service airports (see Figure 5.1).[149]

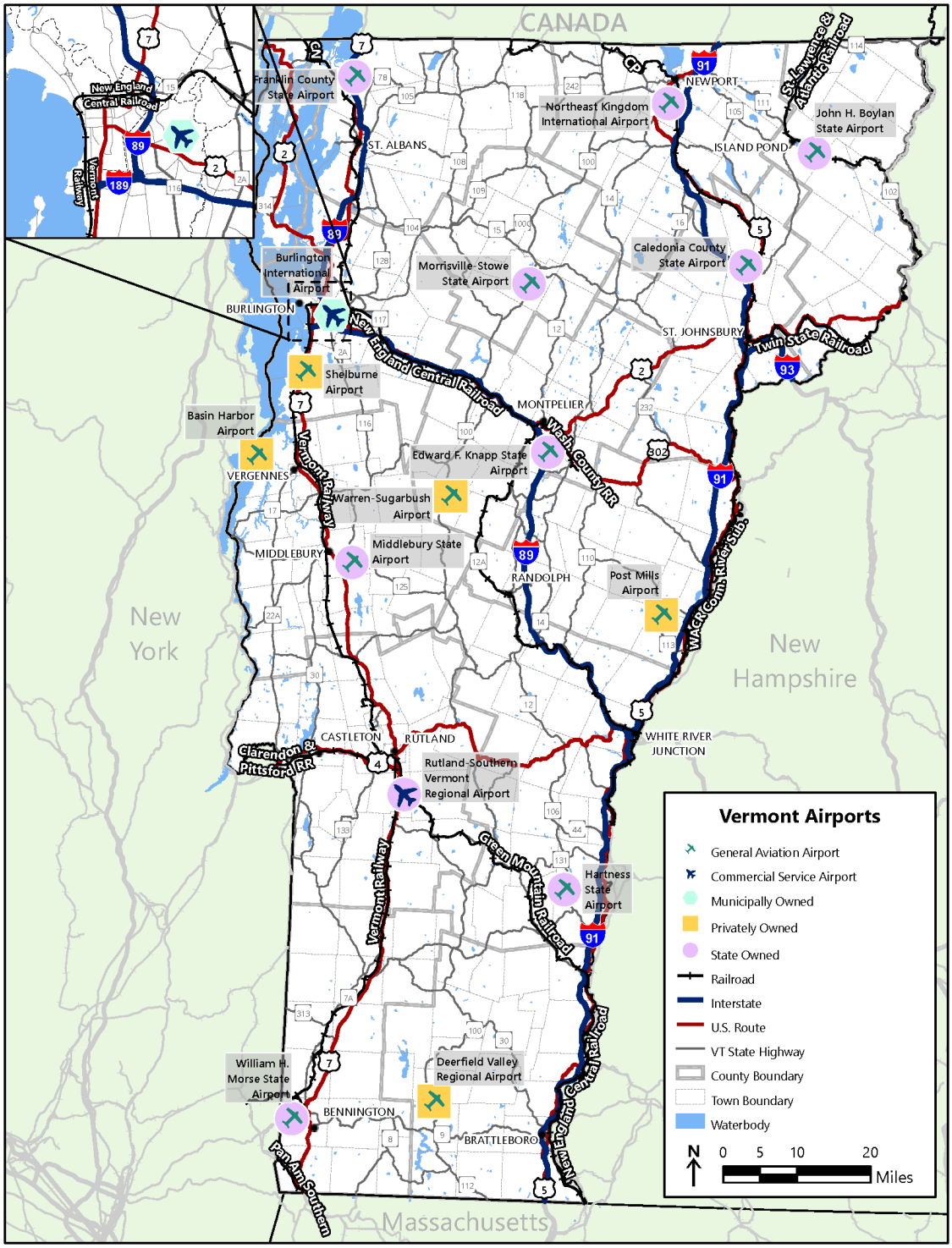
The Vermont Airport System Policy Plan (2007) classifies Vermont's public use airports into four categories based on these attributes and their role in the state's air transportation system. These categories are maintained for the 2018 Plan and include:

- **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.

Details for each airport are included in Table 5.1.

[149] For a full inventory of airports in Vermont, see: https://vtrans.vermont.gov/sites/aot/files/aviation/documents/statepolicyplan/3-Inventory%20-%20Draft.pdf

FIGURE 5.1 VERMONT AIRPORTS



Source: Draft Vermont Air Systems Plan (2018).

TABLE 5.1 VERMONT AIRPORT OVERVIEW

Airport	Associated City	VTrans Airport Category	Ownership	Primary Runway Length/Width (feet)	AvGas/ Jet A Fuel
Basin Harbor	Vergennes	Specialty Service	Private	3,000/90	N/N
Burlington International	Burlington	National Service	Public	8,319/150	Y/Y
Caledonia County State	Lyndonville	Local Service	Public	3,300/60	Y/N
Deerfield Valley Regional	West Dover	Specialty Service	Private	2,650/75	N/N
Edward F. Knapp State	Barre/ Montpelier	National Service	Public	5,002/100	Y/Y
Franklin County State	Highgate	Local Service	Public	3,000/60	Y/Y
Hartness State	Springfield	Regional Service	Public	5,501/100	Y/Y
John H. Boylan State	Island Pond	Specialty Service	Public	2,650/120	N/N
Middlebury State	Middlebury	Local Service	Public	2,500/50	Y/N
Morrisville-Stowe State	Morrisville	Regional Service	Public	3,700/75	Y/Y
Northeast Kingdom International	Newport	Local Service	Public	5,000/100	Y/Y
Post Mills	Post Mills	Specialty Service	Private	2,900/80	N/N
Rutland-Southern Vermont Regional	Rutland	National Service	Public	5,003/100	Y/Y
Shelburne	Shelburne	Specialty Service	Private	3,077/60	N/N
Warren-Sugarbush	Warren	Specialty Service	Private	2,575/30	Y/N
William H. Morse State	Bennington	Regional Service	Public	3,704/75	Y/Y

Source: Draft Vermont Air Systems Plan (2018).

5.2 Burlington International Airport and Rutland-Southern Vermont Regional Airport

Due to the size of Vermont's airports, the best source of data on cargo movements is the Bureau of Transportation Statistics (BTS) T-100 data. As discussed in the Vermont Airport Systems Plan, this data set has deep flaws because the U.S. Department of Transportation routinely waives reporting requirements for commercial operations resulting in revenues below certain plateaus. For major cargo airports, such exclusions would amount to little more than a mathematical rounding error but for smaller Vermont airports

(including Burlington) the exclusions include nearly all outbound cargo at Rutland-Southern Vermont Regional Airport (RUT) and all cargo (inbound and outbound) at E.F. Knapp Airport (MPV) in Montpelier. Consequently, T-100 data for BTV is at least partially representative but deeply compromised for RUT and non-existent for MPV. The 2017 Fact Book published by AOT notes that there were 1.5 million pounds of freight moved through Rutland and 545,000 pounds moved through E.F. Knapp in 2016.[150]

Based on T-100 data, Burlington International Airport received approximately 4.9 million pounds of freight and originated approximately 3.7 million pounds of freight in 2019. Approximately 83 percent of the inbound freight originated in Syracuse, NY and was carried by Federal Express (FedEx), followed by inbound shipments from Memphis and Portland, ME also carried by FedEx. These three airports also dominated outbound shipments from Burlington. Smaller amounts of cargo also traveled between Burlington and Atlanta (Delta Airlines), Charlotte (PSA Airlines), Chicago (United Airlines), Newark (United Airlines), and Philadelphia (Piedmont Airlines). Freight on these routes moves in the belly of a passenger flight. Burlington International Airport has a U.S. Customs Port of Entry open from 8 A.M. to 8 P.M. daily which can process goods arriving directly from outside the United States.[151]

Noting the above flaws with the BTS data, Rutland received approximately 235,000 pounds and originated approximately 600 pounds. Of this, more than 99 percent arrived via FedEx from Albany, NY with the remainder arriving from Newark on FedEx. Outbound cargo from Rutland went to Cincinnati, OH on USA Jet Airlines, Inc. Inbound and outbound cargo volumes for these two airports are shown in Table 5.2.

It is also important to note that airports in Montreal and Boston with more frequent and expansive service (including to overseas markets) likely play a role in moving air cargo to and from Vermont, with trucks serving as the link between Vermont origins/destinations and those major airports.

TABLE 5.2 VERMONT AIRPORT CARGO VOLUMES BY DIRECTION (2019)

City Pair	Burlington		Rutland		Total
	Inbound (Pounds)	Outbound (Pounds)	Inbound (Pounds)	Outbound (Pounds)*	Total (Pounds)
Albany	-	-	233,876	-	**233,876**
Atlanta	3,548	1,161	-	-	**4,709**
Charlotte	277	457	-	-	**734**
Chicago	4,686	2,891	-	-	**7,577**
Cincinnati	-	-	-	600*	**600***
Denver	2	-	-	-	**2**
Memphis	438,171	334,105	-	-	**772,276**
Newark	1,639	417	1,570	-	**3,626**

[150] 2017 AOT Fact Book and Annual Report

[151] https://www.cbp.gov/contact/ports/burlington-international-airport-vermont-0207

City Pair	Burlington		Rutland		Total
	Inbound (Pounds)	Outbound (Pounds)	Inbound (Pounds)	Outbound (Pounds)*	Total (Pounds)
Newburgh	-	51	-	-	**51**
Philadelphia	895	1,380	-	-	**2,275**
Portland	383,930	488,909	-	-	**872,839**
Stockholm (Sweden)	40	-	-	-	**40**
Syracuse	4,035,154	2,846,452	-	-	**6,881,606**
Total	**4,868,342**	**3,675,823**	**235,446**	**600***	**8,780,211**

Source: U.S. Bureau of Transportation Statistics, T-100 Data (2019).
**Note that T-100 data for Rutland is likely under-reported due to BTS reporting threshold for revenue.*

5.3 Unmanned Aircraft Systems

Unmanned aircraft systems (UAS) or colloquially as "drones" are a growing area of research for freight movement. In early 2018, Boeing began testing an "unmanned electric vertical-takeoff-and-landing (eVTOL) cargo air vehicle (CAV)" at its research lab in St. Louis, Missouri. The CAV is capable of lifting a 500 pound payload and is another step towards automated delivery of goods and packages via drone.[152] Drones offer an interesting approach to solving last-mile delivery needs, especially for smaller packages. Currently Alphabet, Inc. offers commercial service in limited parts of the U.S. (rural Virginia) and around the world through its company Wing,[153] and other companies, including UPS and Amazon (Prime Air), are conducting tests.[154]

While commercial deployment for freight movement remains limited, VTrans has utilized drones in multiple scenarios in recent years. The State employs six certified remote pilots who can provide highly detailed maps for various efforts, take photos of structures and areas after extreme events, and may eventually be used in other areas such as bridge inspections that could be beneficial to all modes of transportation

[152] https://www.theverge.com/2018/1/10/16875382/boeing-drone-evtol-cav-500-pounds

[153] https://www.bloomberg.com/news/articles/2020-04-08/alphabet-s-delivery-by-drone-surge-to-stay-at-home-customers?sref=ExbtjcSG

[154] https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011

including freight movement.[155] The Spatial Analysis Lab at the University of Vermont-Burlington is another resource and was instrumental in helping to document the 2015 Amtrak *Vermonter* crash near Northfield.[156]

[155] 2020 VTrans Fact Book. Online at: http://factbook.vtrans.vermont.gov/sites/aot/files/AOT%20Fact%20Book%202020%20-%20web.pdf

[156] http://www.slate.com/blogs/future_tense/2015/10/09/how_vermont_used_drones_after_an_amtrak_derailment.html

6.0 WATER MODAL PROFILE

In addition to two major bridges crossing Lake Champlain, one between Alburgh, VT and Rouses Point, NY, and the other between Shoreham, VT and Crown Point, NY, Vermont's highway system is connected to New York's by privately operated water transportation services crossing Lake Champlain in four locations.

Lake Champlain Ferries operated by Lake Champlain Transportation Company (LCT) provides regular ferry service between Grand Isle, VT and Plattsburg, NY; Burlington, VT to Port Kent, NY; and Charlotte, VT to Essex, NY. The Grand Isle – Plattsburg crossing operates 24-hours per day year-round. Burlington – Port Kent operates from May to October. Charlotte – Essex runs year-round during the daytime.

Farther to the south and under different ownership, the Fort Ticonderoga Ferry provides service between Ticonderoga, NY and Shoreham, VT in Addison County. The "Fort Ti Ferry" provides service from earlyMay to late-October. Each of these services provides an important connection for passenger and truck freight traffic across Lake Champlain.

The lake itself also serves as a link in a continuous navigable water route connecting the Hudson River at Albany with the St. Lawrence River in Sorel Quebec. 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 largely used for recreational purposes, with freight being virtually non-existent. 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.[157]

North of Lake Champlain, the Chambly Canal has a depth of between six and seven feet which limits commercial access.[158]

South of Lake Champlain, work over the last decade by General Electric to dredge portions of the Champlain Canal to remove polychlorinated biphenyls (PCBs) removed approximately 450,000 cubic yards of sediment from the navigation channel. Limited maintenance dredging (conducted by the New York State Canal Corporation) had occurred since the 1970s. This means that multiple sections of the channel have a depth of less than 12 feet.[159]

[157] Vermont State Freight Plan, 2015.

[158] https://www.ijc.org/sites/default/files/2020-07/LCRR_Facts_Series-Chambly_Canal%20_EN.pdf

[159] http://www.canals.ny.gov/wwwapps/navinfo/navinfo.aspx?waterway=champlain

With the work by General Electric substantially complete as of 2019, the Environmental Protection Agency notes that the Canal Corporation should be free to pursue permits and funding for maintenance dredging work.[160]

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[160] https://www.epa.gov/newsreleases/after-extensive-consultation-and-analysis-epa-announces-two-actions-upper-hudson-river