Agenda Summary

July 12, 2023

Agenda Item No. B-2

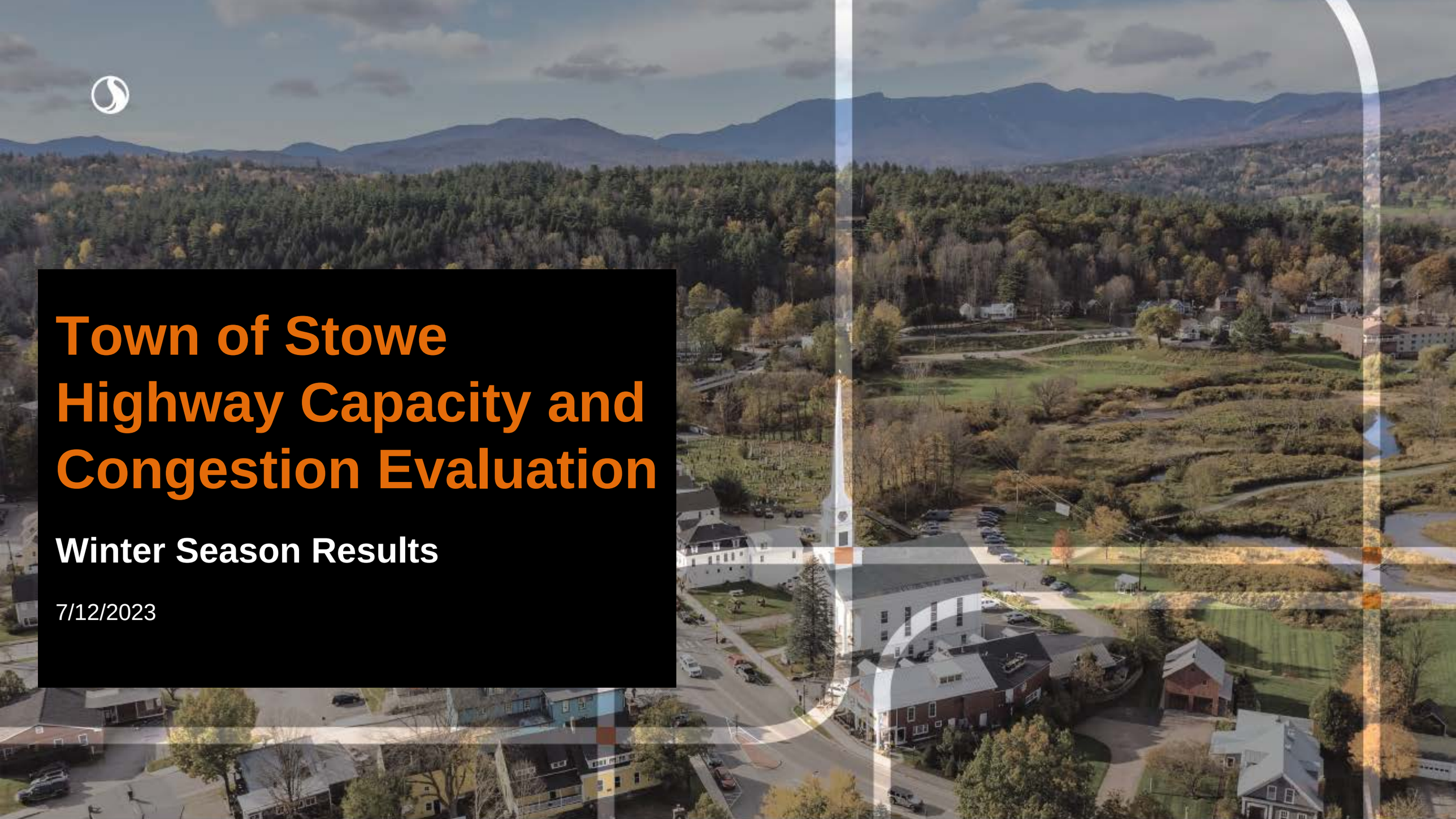
Town of Stowe Highway Capacity and Congestion Evaluation

Summary: Stantec has completed it winter season assessments for the commissioned Highway Capacity and Congestion Evaluation. Enclosed please find a Draft Report summarizing findings to date with applicable data in Appendices. It is important to note that this Draft is a work in progress and Stantec intends to both supplement and finalize this report with the summer/fall season assessments on-going. Adam Catherine, PE of Stantec will be present at the meeting to present their findings to date. His presentation slide deck is also attached. This will provide background of the project, an overview of the data collected and methodology, key capacity-related findings and mobility priorities and concepts for the Town to consider. Upon completion of the overall project, Stantec will provide the Town with a final written report which recommends an overall mobility strategy for the Town that addresses existing and future mobility needs of residents, workers, and visitors, and builds upon previous studies. The Planning Commission may use the report to inform the Transportation Chapter of the Stowe Town Plan and to develop updated Transportation goals, policies, and implementation strategies for Selectboard consideration. This time has been set aside for discussion and informational purposes.

Town Plan Impact: The Stowe Town Plan establishes the following Transportation Goal: *To provide an efficient, cost effective, multi-modal transportation network that provides for the needs of Stowe's residents and visitors*. This project conforms with the following Transportation Policy: *The Town will plan for anticipated future demand on transportation services and facilities to accommodate current and future travel demand*.

Fiscal Impact: Study funding comes from a special appropriation of $80,000 out of the Undesignated Capital Reserves Fund.

Recommendation: No Action recommended or required at this time.



Town of Stowe Highway Capacity and Congestion Evaluation

Winter Season Results

7/12/2023

Agenda

Background and Vision

Analysis

Mobility Priorities and Ideas

Next Steps

BACKGROUND AND VISION

MOBILITY STRATEGY

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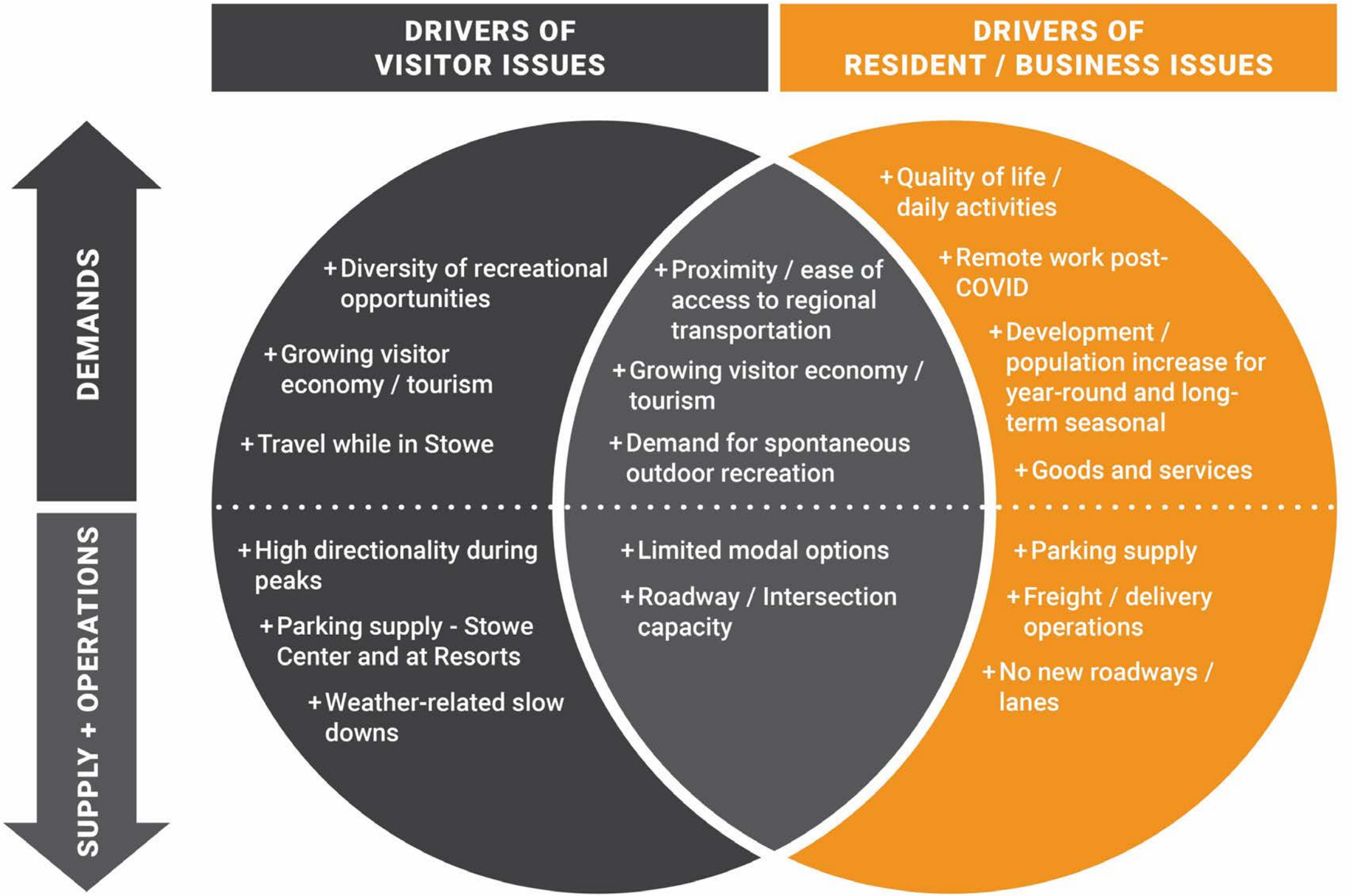

VISION

ALL RESIDENTS + BUSINESS OWNERS

A quality of life that is consistent with the character of Stowe

- Information they need, and within a reasonable timeframe, to allow them to confidently and conveniently plan their trips ahead of time and avoid peak congestion.
- Access to transportation options that provide efficient access to conduct daily business
- Transportation system and facilities that allow local businesses to operate efficiently by providing access for employees and deliveries

VISITORS

A quality, enjoyable and memorable experience to and from the resort area

- The information they need, and within a reasonable timeframe, to allow them to confidently and conveniently plan their trips ahead of time
- Easy navigation to, and have the information needed to find, vehicle parking or alternative transportation options
- Access to transportation systems that allow them to travel efficiently to, from and within the resort area with minimal congestion and delays

METHODOLOGY

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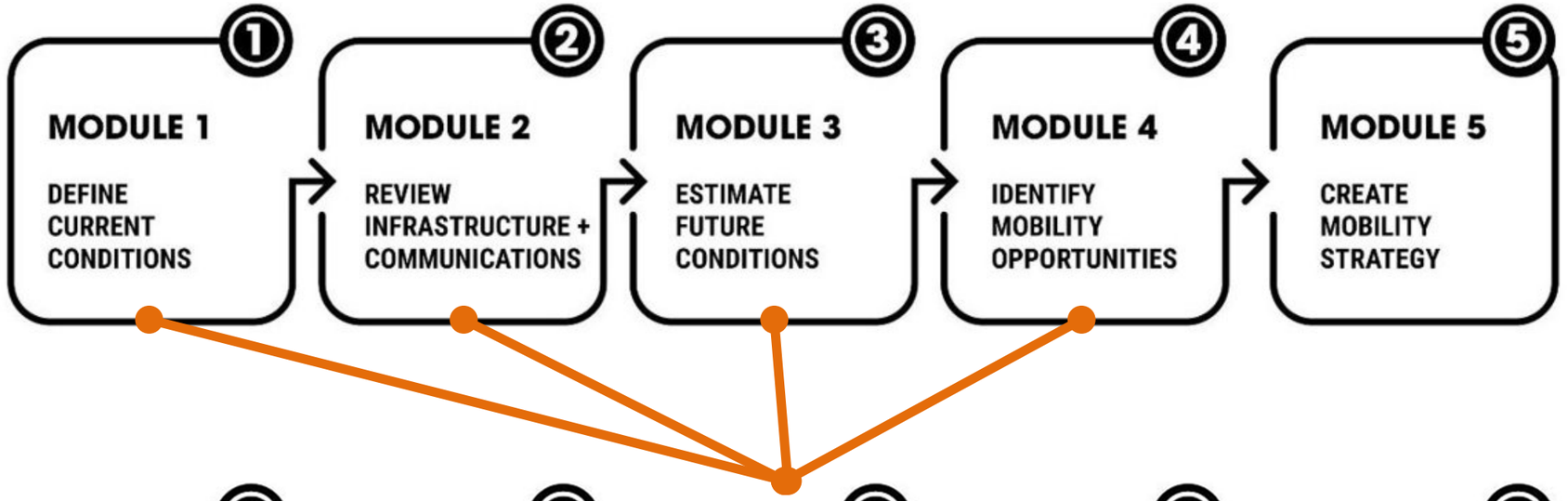
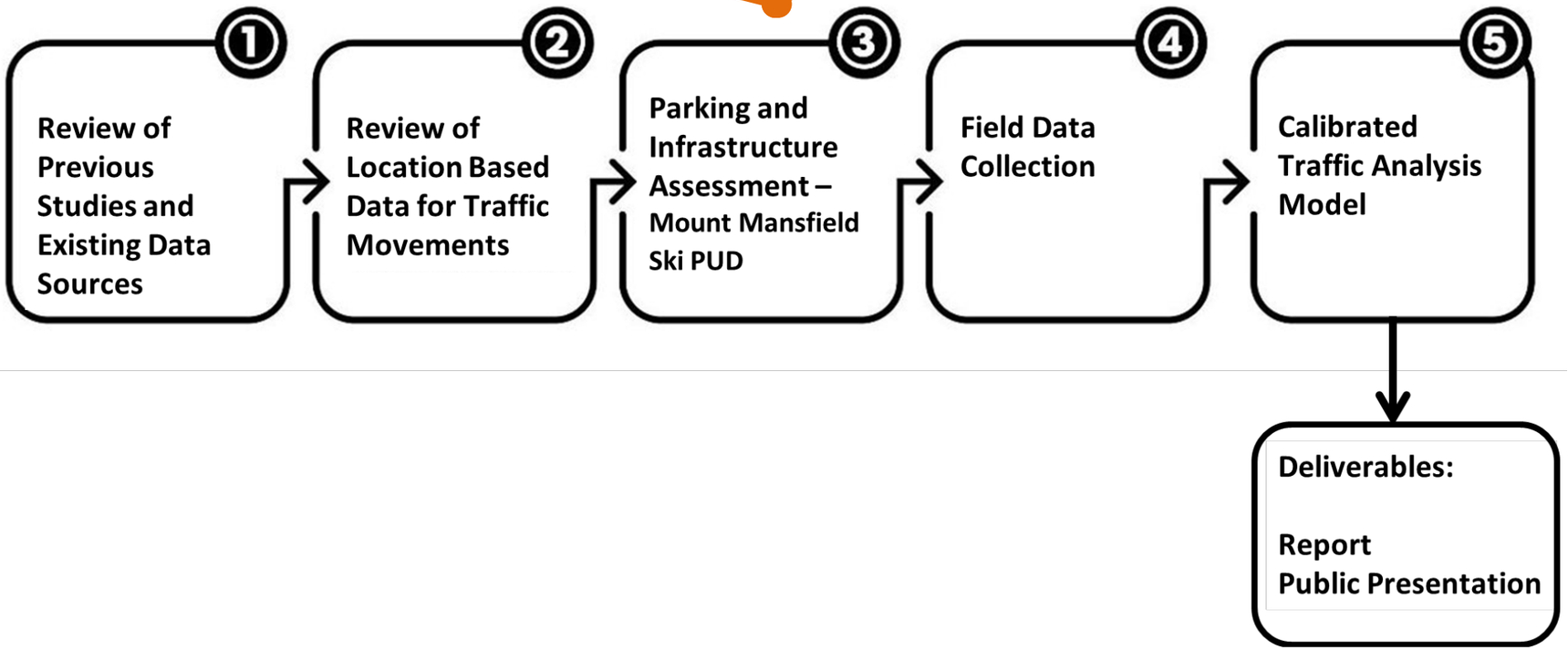
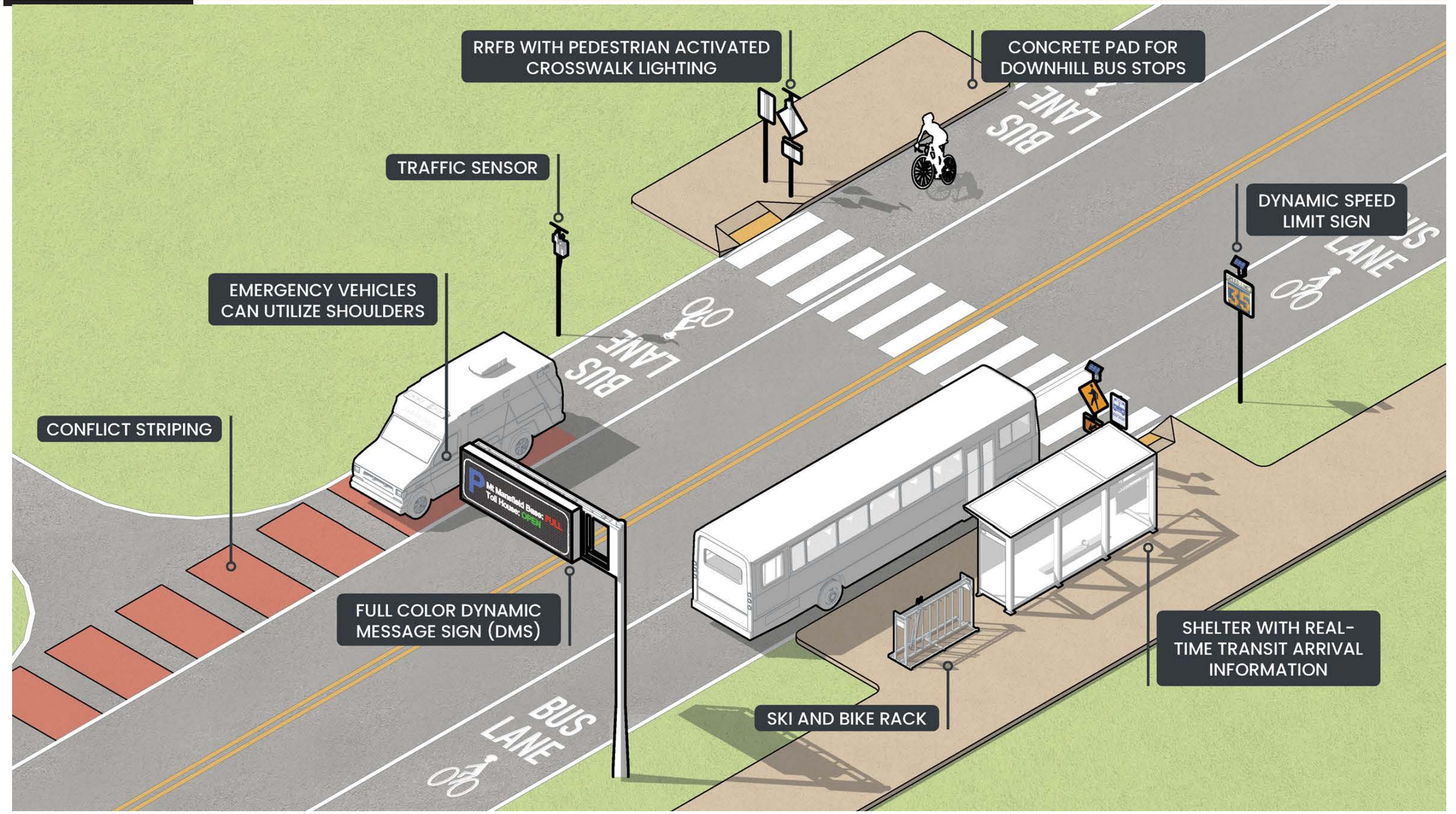
Overall Mobility Planning Process



This Study: Phase 1



RETHINKING MOBILITY: STOWE SMART CORRIDOR



ANALYSIS

TRIPS ENDING IN SMR/SPRUCE PEAK BY DAY - FEBRUARY

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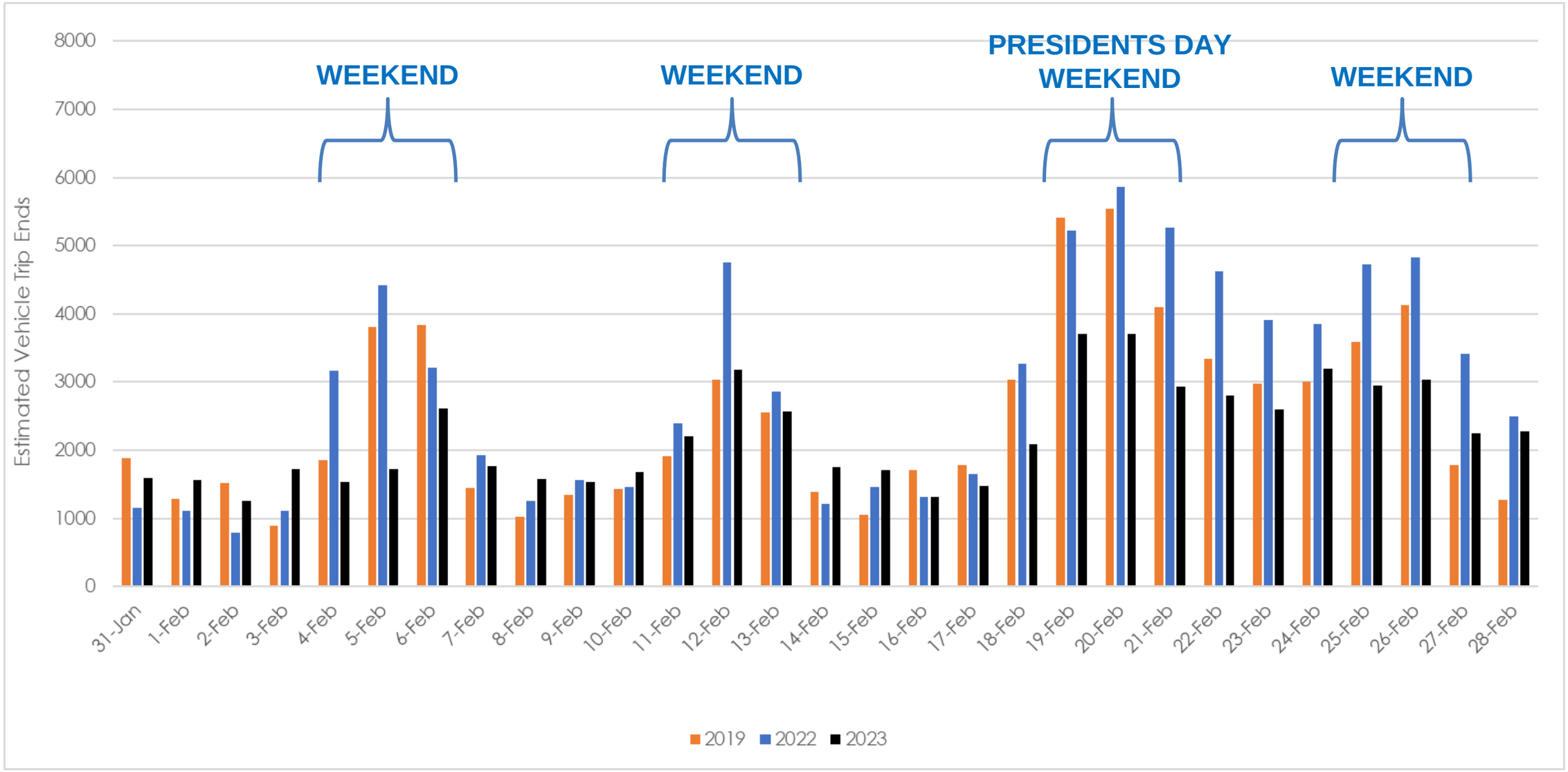

WINTER SEASON

ESTIMATED CONGESTION AND DELAY THRESHOLDS

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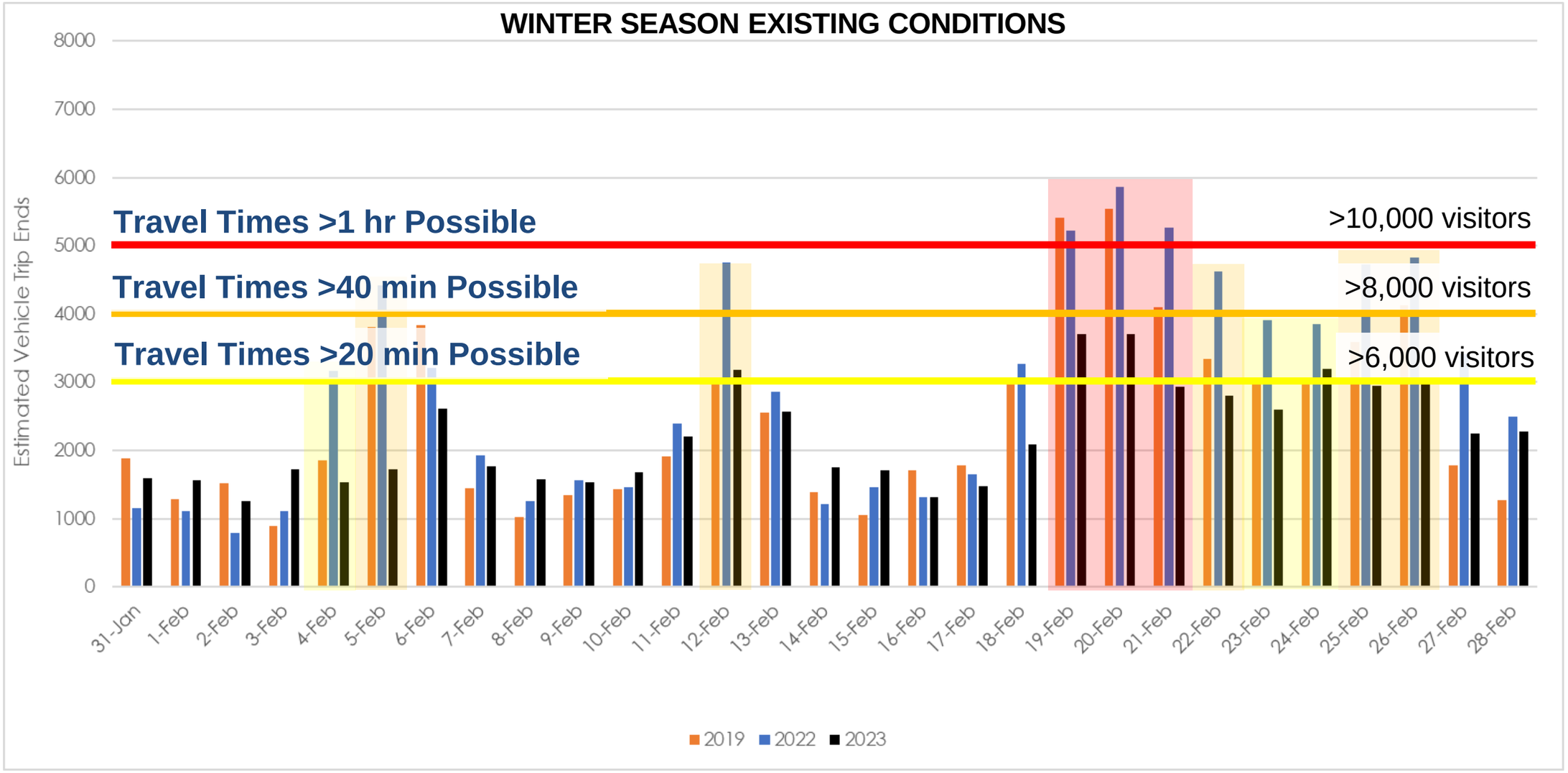

***The values presented here are intended to be used for general guidance only. Other factors such as weather, operating hours, events, parking policies, etc. may affect levels of congestion.**

ORIGIN DESTINATION - FEBRUARY

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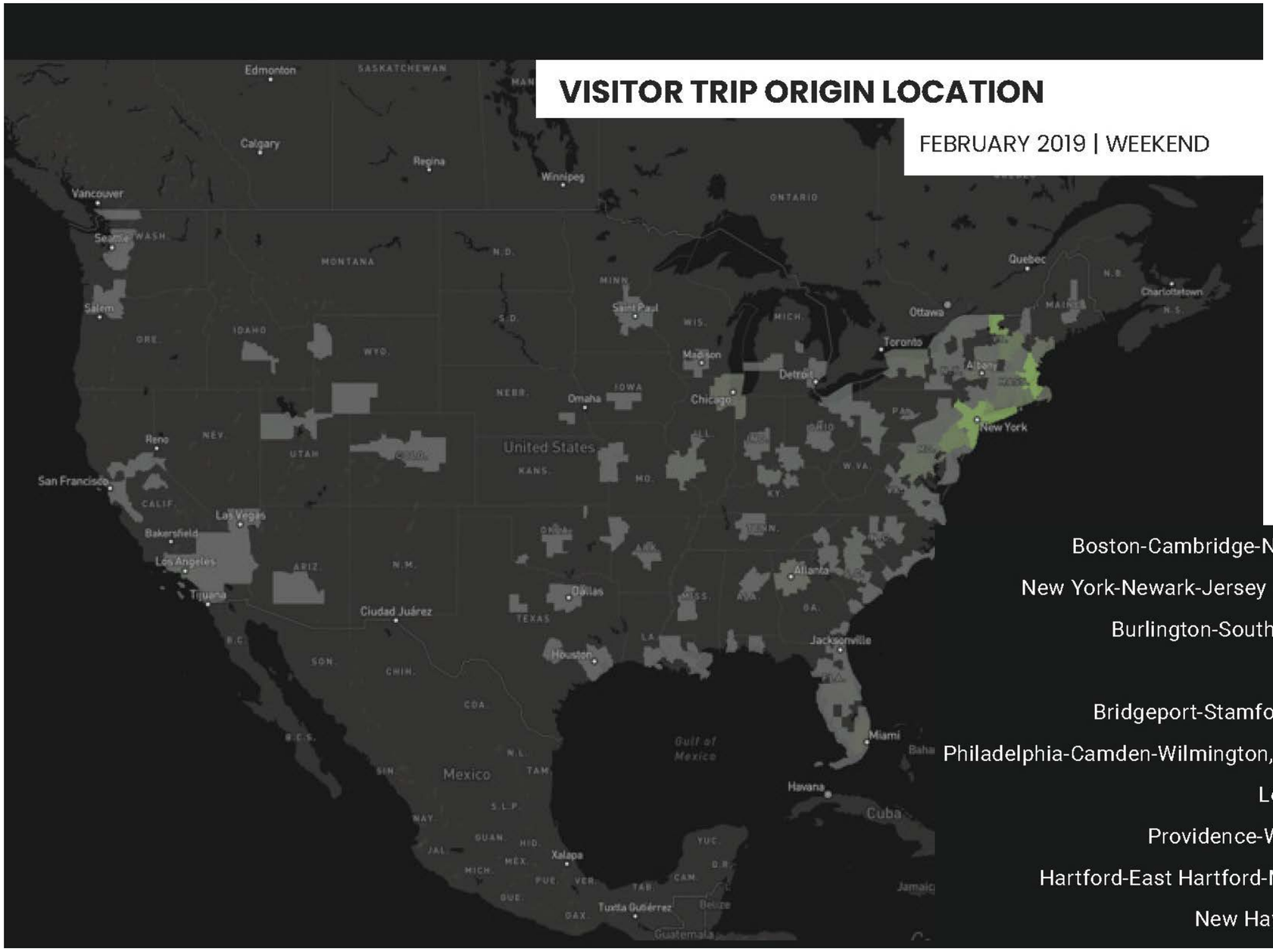

Boston-Cambridge-Newton, **MA-NH**	22%
New York-Newark-Jersey City, **NY-NJ-PA**	17%
Burlington-South Burlington, **VT**	15%
Barre, **VT**	9%
Bridgeport-Stamford-Norwalk, **CT**	3%
Philadelphia-Camden-Wilmington, **PA-NJ-DE-MD**	3%
Lebanon, **NH-VT**	3%
Providence-Warwick, **RI-MA**	2%
Hartford-East Hartford-Middletown, **CT**	2%
New Haven-Milford, **CT**	1%

Canada <3%

DESTINATION OF TRIPS ENDING IN STOWE

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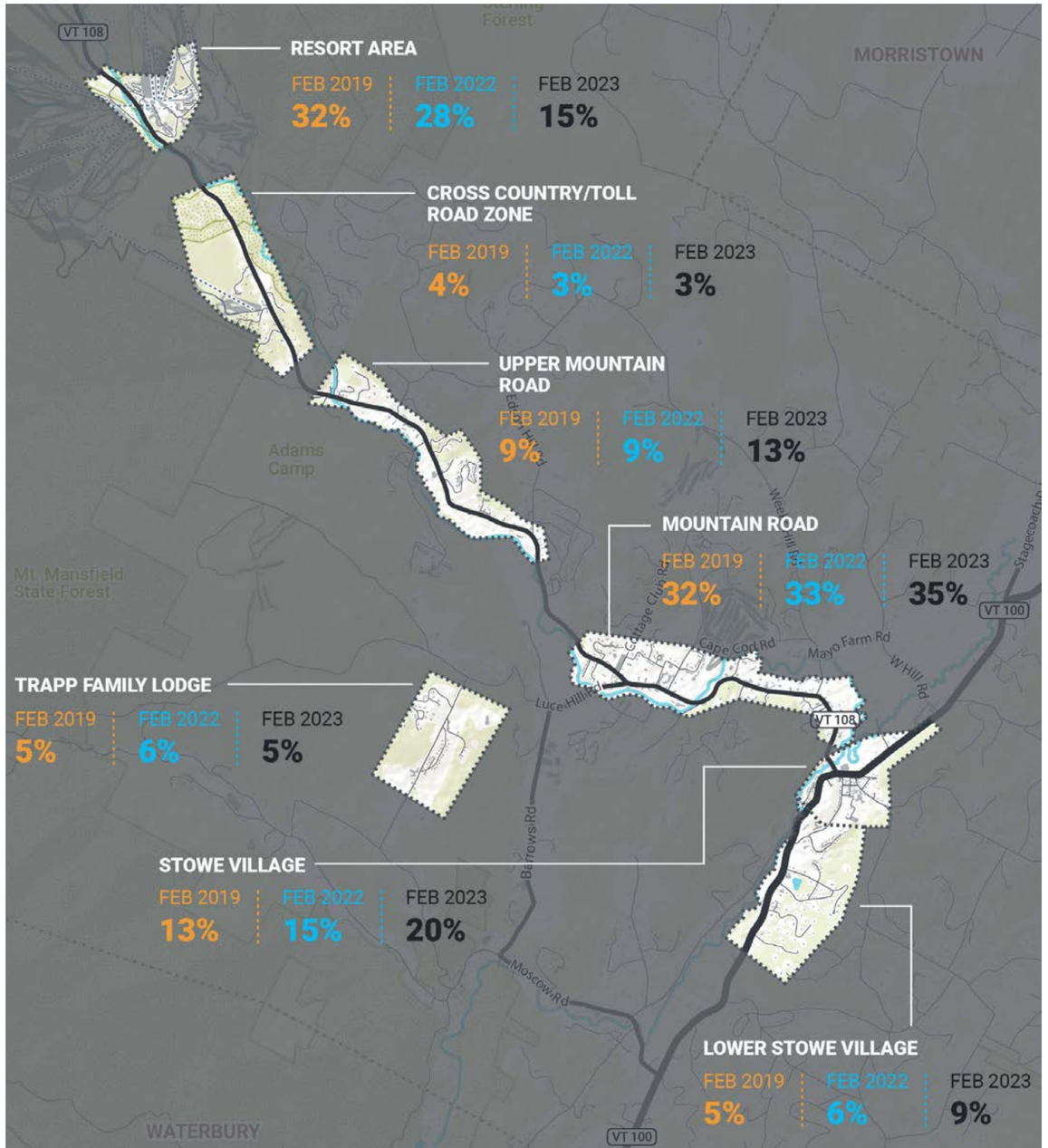

ROUTING FROM THE NORTH

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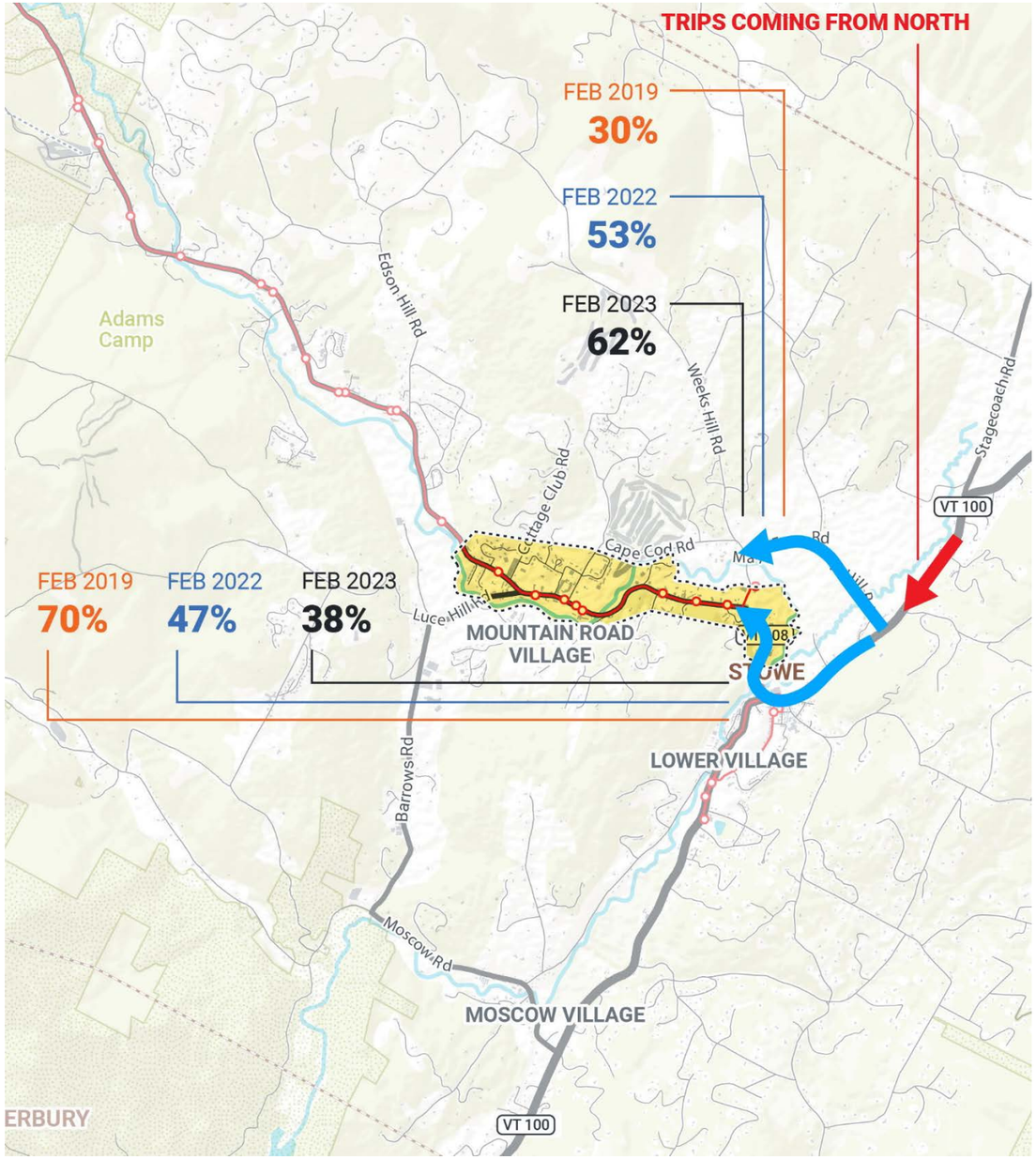

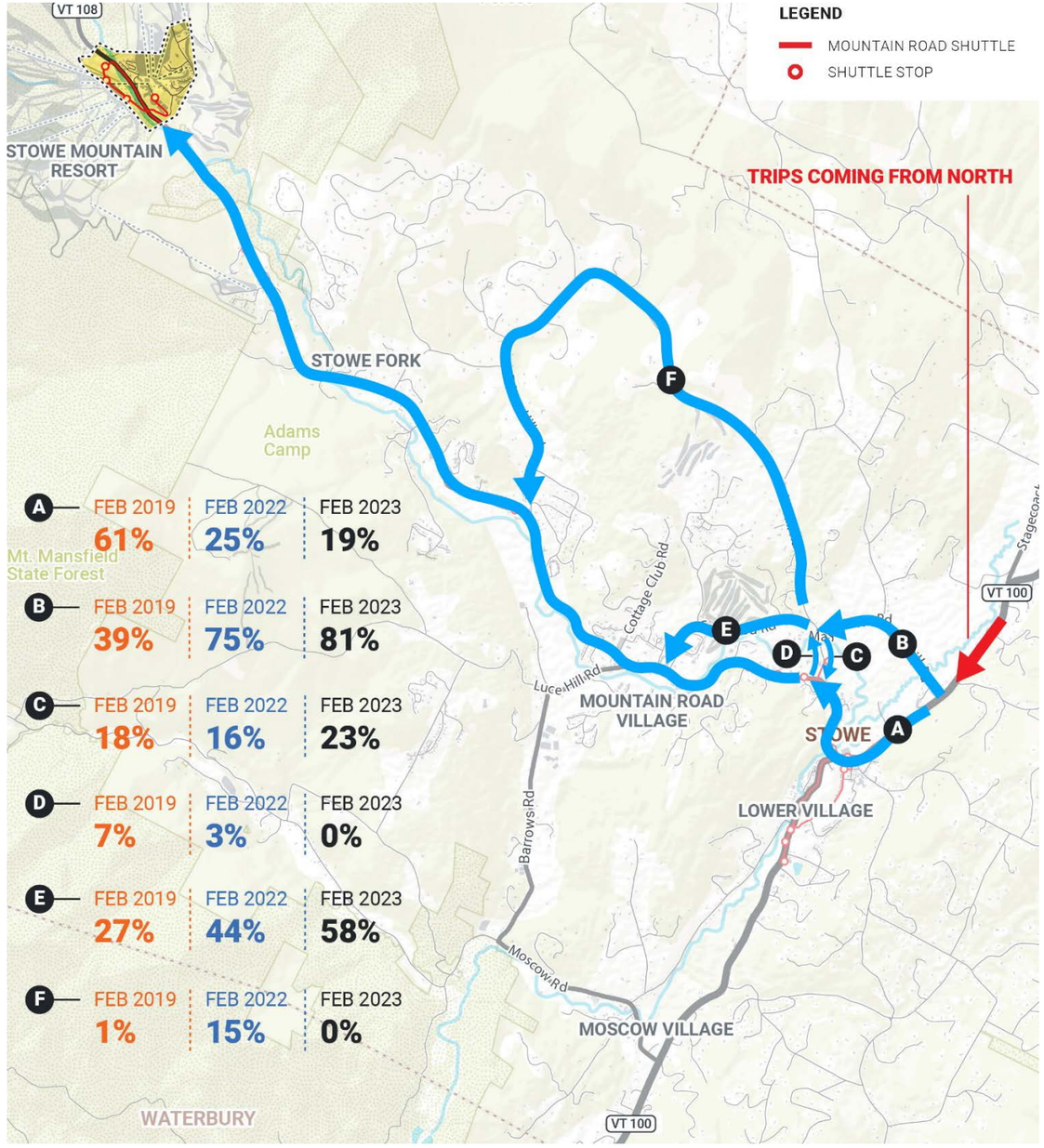

ROUTING FROM THE SOUTH

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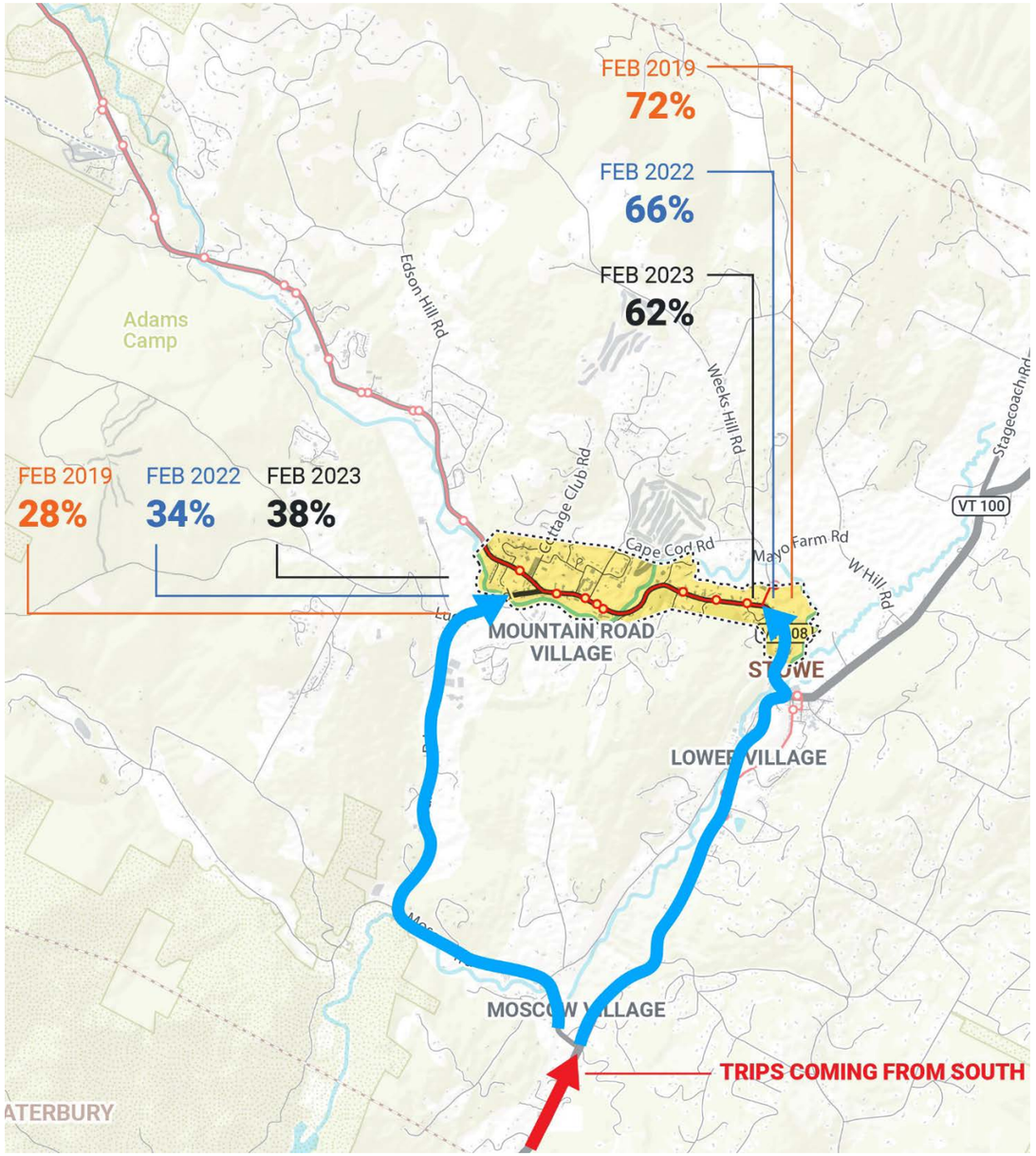
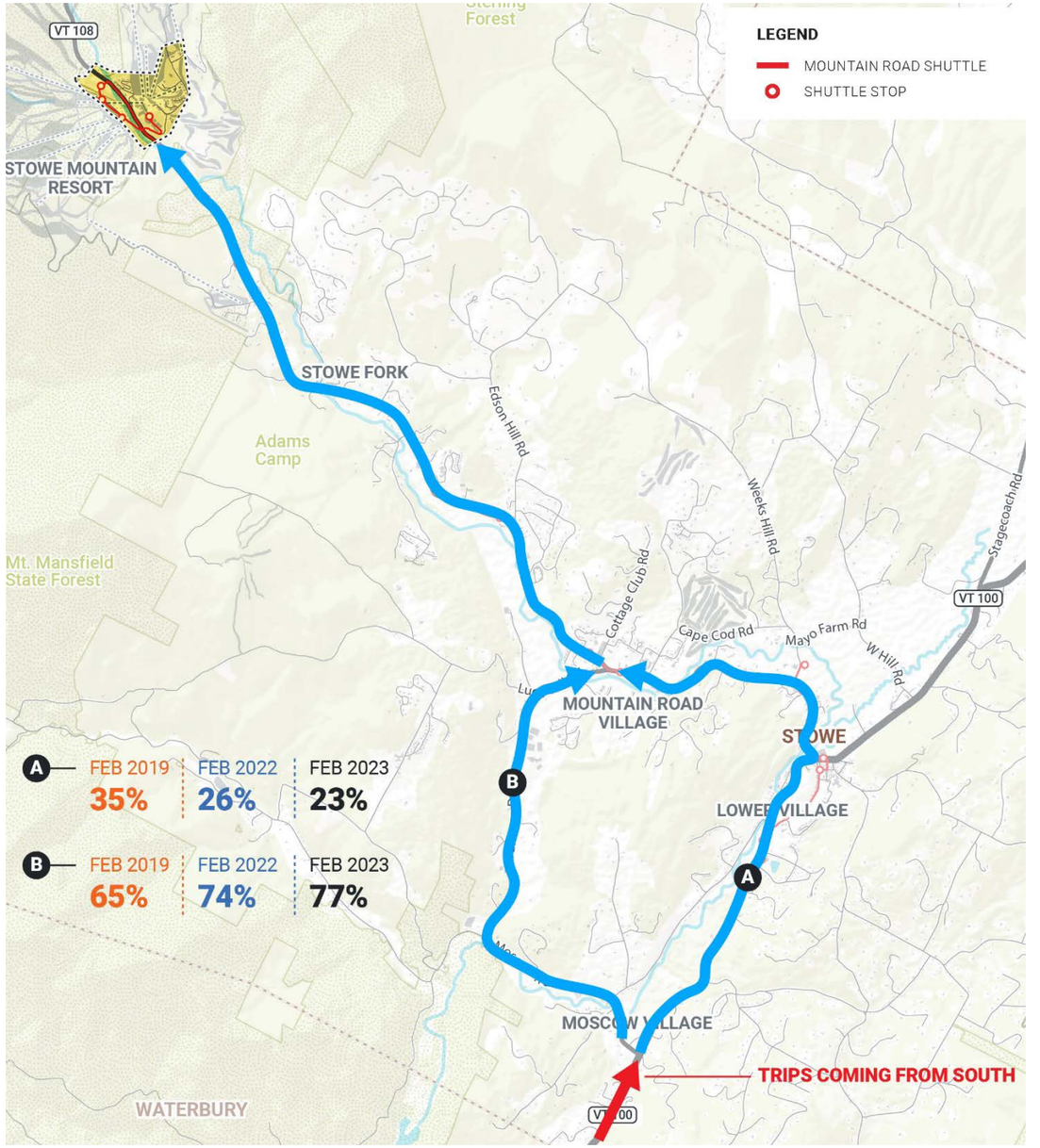




PLANNING FOR GROWTH – W HILL RD SIGNAL ONLY

Stantec

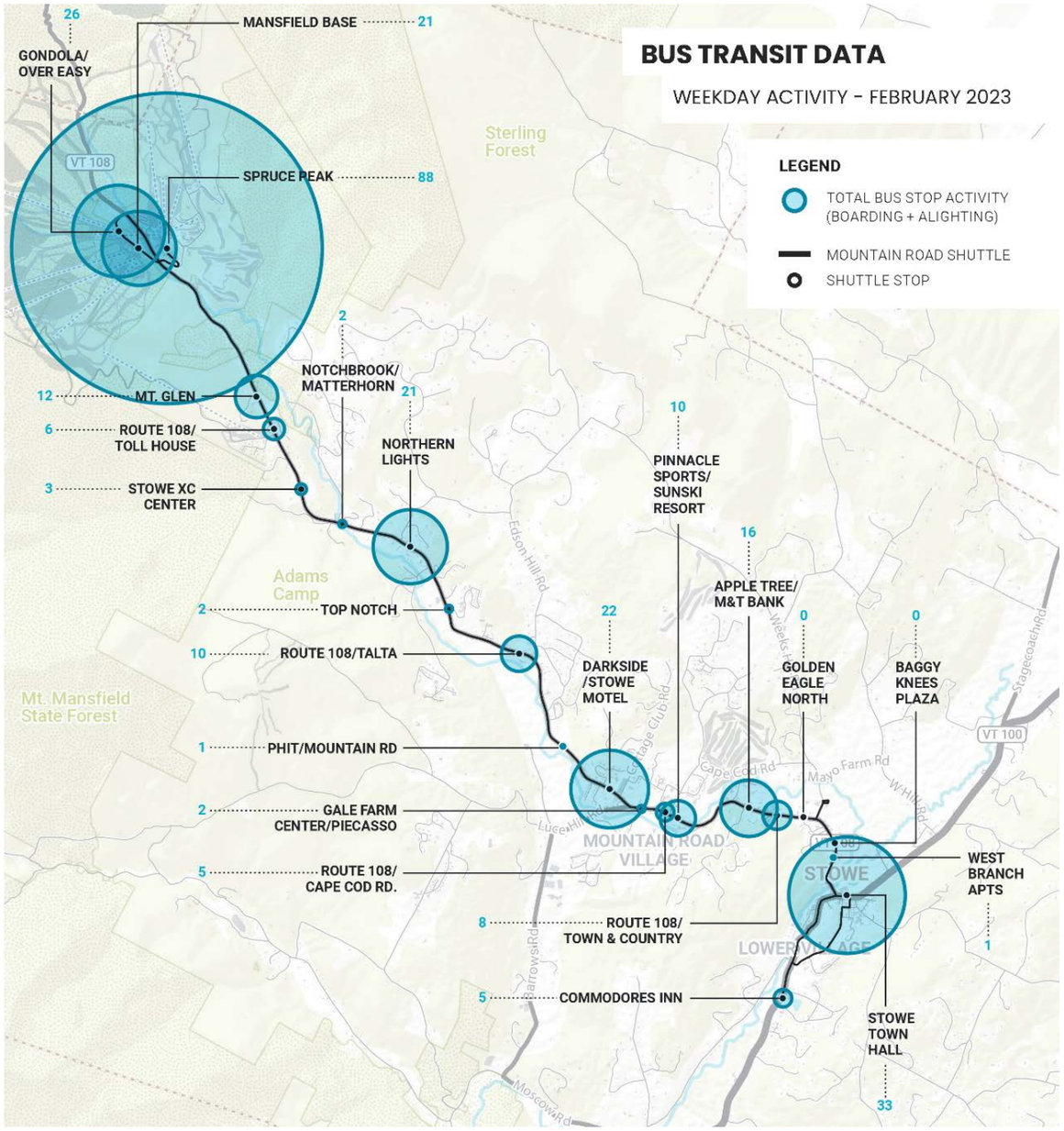
Peak Hour Percent Volume Growth	Equivalent Residential Units	Potential Issues
Existing	-	• LOS E/F movements at 3 intersections during seasonal peaks
5%-10%	50-150	• Congestion reaching critical levels at VT 108/Luce Hill Rd • **Luce Hill Road signal recommended**
15%-25%	150 - 300	• 7 intersections with LOS E or F movements • Congestion during peak seasons starts to spill into weekdays • Additional intersection **improvements needed including Moscow Road roundabout**
>25%	>300	• 8 intersections with LOS E or F movements • Congestion occurring more regularly • Localized improvements not likely to address all congestion

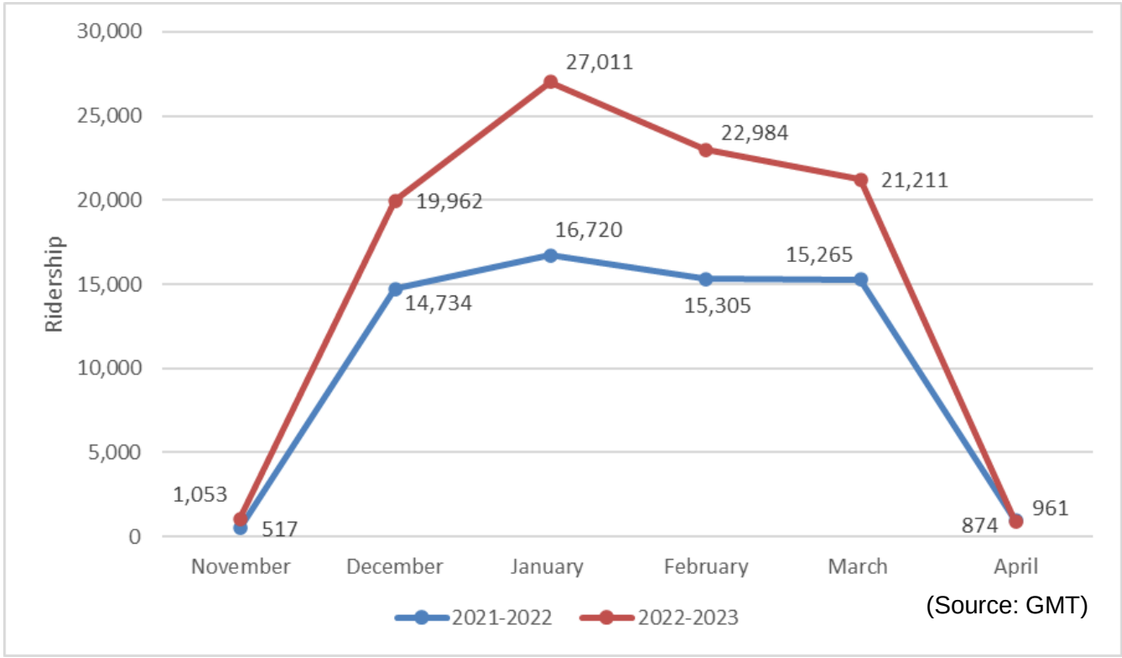
PLANNING FOR GROWTH – W HILL RD/LUCE HILL SIGNALS AND MOSCOW RD ROUNDABOUNT

Stantec

Peak Hour Percent Volume Growth	Equivalent Residential Units	Potential Issues
<10%	<125	• Generally acceptable operations – minor congestion during seasonal peaks
10%-20%	125-250	• Generally acceptable operations but some peak season congestion at unsignalized intersections
20%-30%	250-300	• VT 108/Luce Hill Rd LOS F movements during seasonal peaks - congests adjacent intersections • LOS E/F movements at 6 intersections
30%-45%	300-500	• Congestion during peak seasons starts to spill into weekdays • LOS E/F movements at 7 intersections • Additional intersection improvements needed
>45%	>500	• Congestion more regular • LOS E/F movements at 8 intersections • Localized improvements do not address all congestion • Moscow Rd roundabout failure

TRANSIT





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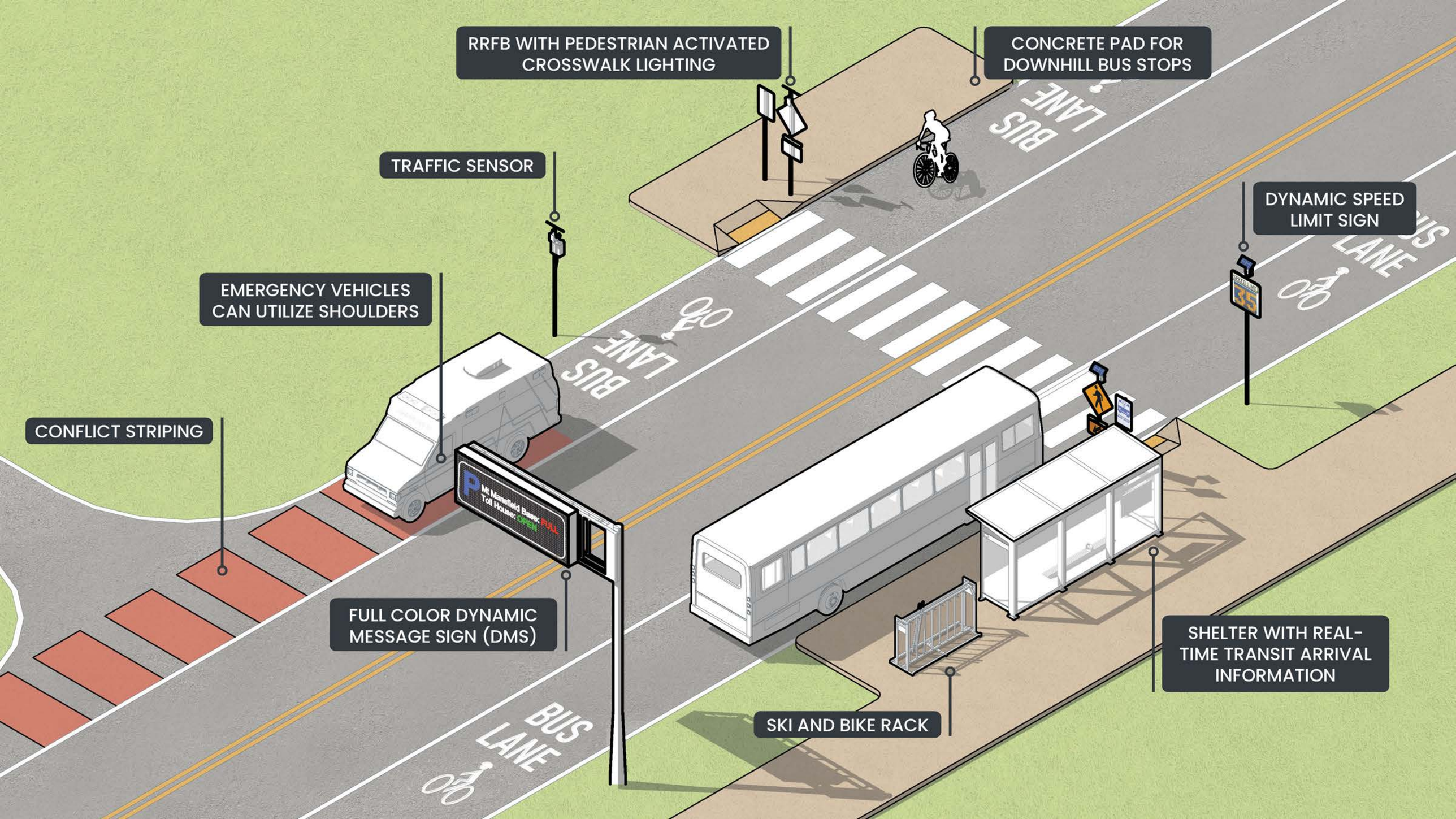

RRFB WITH PEDESTRIAN ACTIVATED CROSSWALK LIGHTING
CONCRETE PAD FOR DOWNHILL BUS STOPS
TRAFFIC SENSOR
DYNAMIC SPEED LIMIT SIGN
EMERGENCY VEHICLES CAN UTILIZE SHOULDERS
CONFLICT STRIPING
FULL COLOR DYNAMIC MESSAGE SIGN (DMS)
SHELTER WITH REAL-TIME TRANSIT ARRIVAL INFORMATION
SKI AND BIKE RACK
BUS LANE
Mt Mansfield Buses: FULL
Toll House: OPEN
35

NEEDS AND PRIORITIES

SUMMARY OF FINDINGS

What's Going Well?

Increasing transit ridership on Mountain Road shuttle

Active community and visitor base

Parking management at SMR - improving operations and increasing vehicle occupancy

Previous studies and plans for intersection and corridor improvements

What's Needs Attention?

Localized impacts due to increased use of alternate routes to VT 108

Not much room for growth on existing transportation network

Emergency access during seasonal peaks

Ped/bike connectivity and amenities

Luce Hill Road bridge

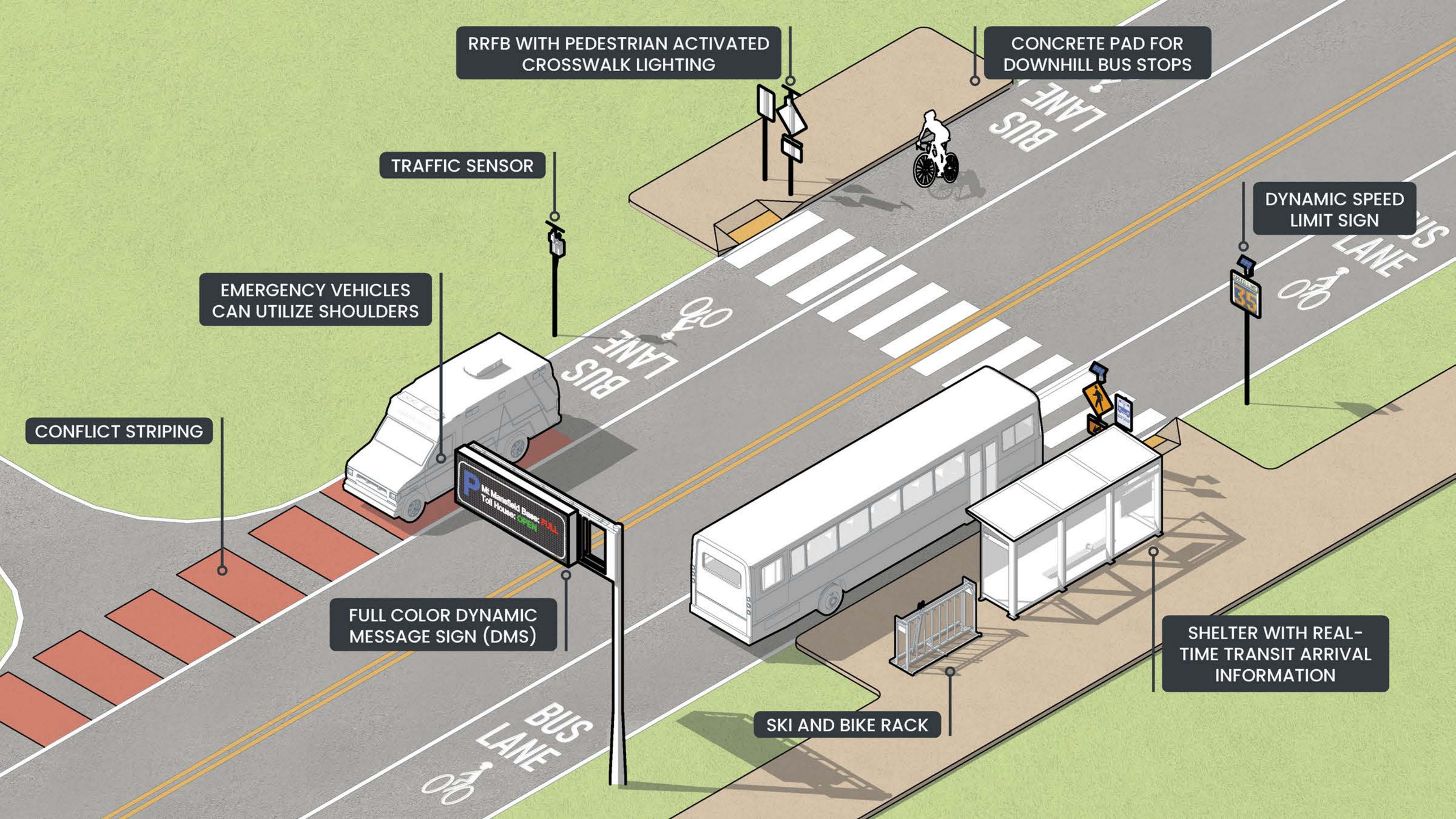
Crash clusters on VT 100 and 108

Traveler information/wayfinding

INITIAL MOBILITY PRIORITIES

HIGHER	MEDIUM	LOWER
Maintain Character of Stowe	Enhance Active Mode Infrastructure	Continue to Evaluate Parking and Management
Emergency Vehicle Access	Improve VT 100/Moscow Road	Establish Transportation Demand Management Requirements
Luce Hill Road Intersection and Bridge	Enhance Wayfinding and Traveler Information	Further Study of VT 100/VT 108 Intersection
Improve Transit Operations and Amenities	Develop Policies to Reduce Event Overlap and Improve Event Management	
Enhance Safety for All Users		

PRELIMINARY CONCEPTS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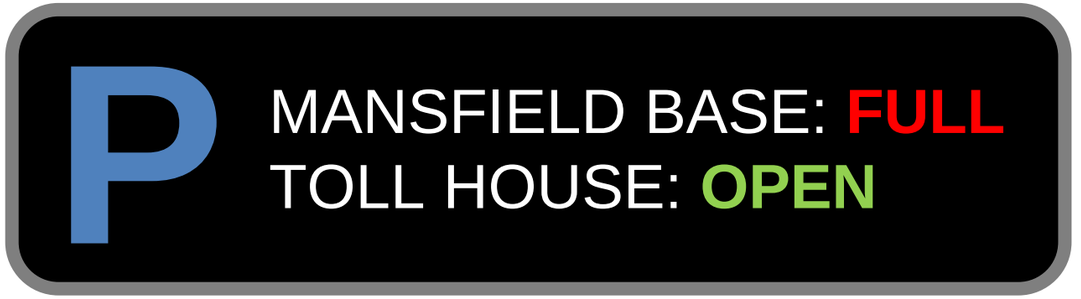
SUPPORTIVE ELEMENT: WAYFINDING/TRAVELER INFORMATION

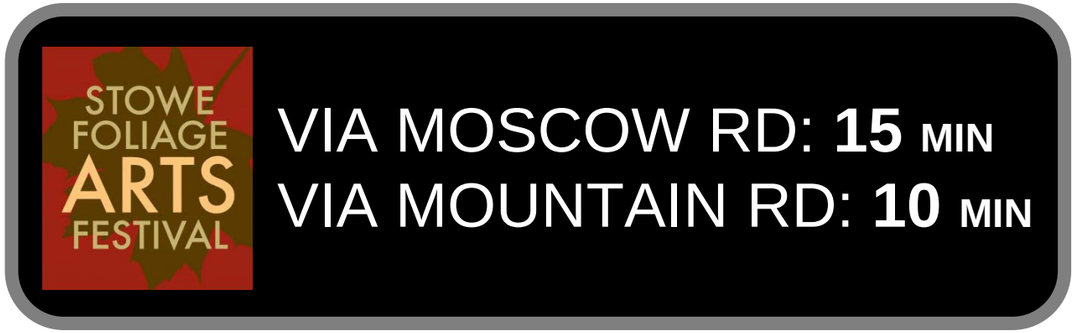
Much of the existing wayfinding is related to corridors, not destinations

Stowe has a variety of trip attractors that have seasonal peaks

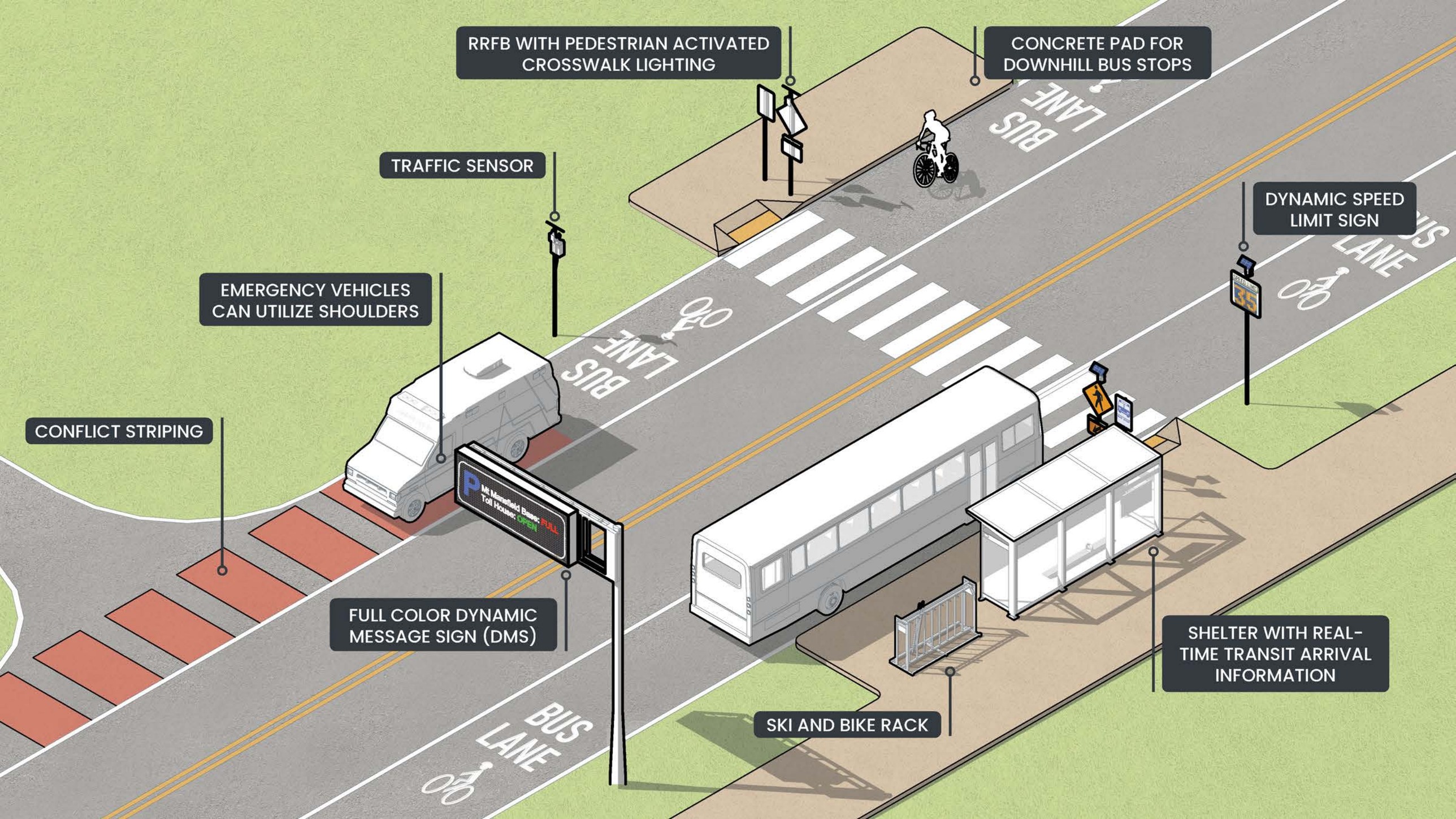
Use of GPS/apps mean most people don’t need to know how to get to a location – they need info to navigate once closer

Focus on providing information-based wayfinding for “last-mile” navigation = full-color dynamic messaging





Source: skylineproducts.com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SUPPORTIVE ELEMENT: TRANSIT

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Incorporate elements from Smart Corridor concept

Evaluate bus stop locations and consolidate in walkable areas

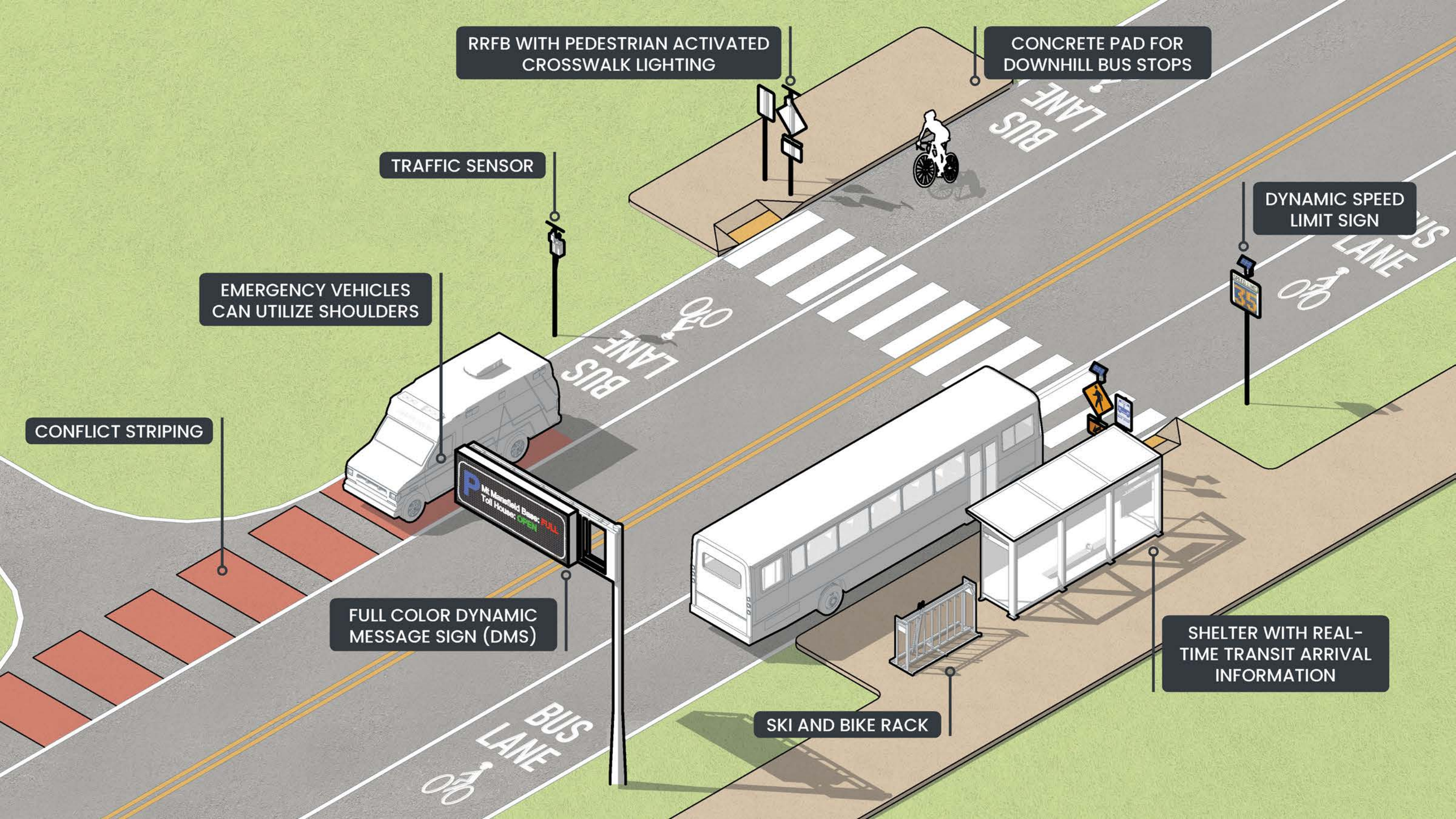
Shelters at high-use stops along with bike/ski racks

Bus stop maintenance during snow events

Real-time transit arrival information

Consider expanding service to other seasons

Source: keystoneridgedesigns.com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OTHER SUPPORTIVE ELEMENTS

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Bicycle parking/charging, consider seasonal bikeshare w/e-bikes

Enhance sidewalk network in Village areas

Conduct safety study for crash clusters

Develop event management strategy

Develop transportation demand management requirements for large developments

Solar e-Bike Charging Station in Basalt, CO (Source: Denver Post)

LUCE HILL ROAD INTERSECTION/BRIDGE

Even a signalized intersection at the existing location may not sustain future growth

Luce Hill Road is becoming an increasingly utilized corridor – bridge is a critical need

Highly encourage Town to advocate linking bridge and intersection projects

Consider realignment of Luce Hill Road to Cottage Club Road

NEXT STEPS

Evaluate Summer (July) and Fall (October) Peaks

Focus on Assessment of Mobility During Events

Update Report and Recommendations as Needed

Finalize Study in December 2023

Town of Stowe Highway Capacity and Congestion Evaluation

Phase I: Existing Conditions, Needs, and Opportunities

June 12, 2023

Prepared for:

Town of Stowe, Vermont

Prepared by:

Stantec Consulting Services, Inc
193 Tilley Drive, Suite 101
South Burlington, VT 05403

Revision	Description	Author		Quality Check		Independent Review	
1	Draft Report	Adam Catherine	6/5/2023	Kati DiRaimondo	6/9/2023	Sean Neely	6/19/2023

Prepared by _____
(signature)
Adam Catherine, PE, PTOE

Reviewed by _____
(signature)
Graeme Masterton

Approved by _____
(signature)
Gregory Goyette, PE

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

The Town of Stowe has reached a critical crossroads in mobility. Residential growth is accelerating due to Stowe's desirable character elements, it's abundance of recreational opportunities, and its proximity to I-89 and nearby cities like Burlington and Montpelier, and the shift in the ability for more people to work remotely. The abundant recreational opportunities also result in seasonal tourism, peaking in February, July, and September/October. These factors create substantial demand and congestion on primary and secondary travel routes in the Town. Periods of significant congestion can hinder the ability for employees to access their jobs, residents to run errands or get to appointments, and emergency services response times. While the Town recognizes the importance of tourism on the local and regional economy, it also recognizes the need to begin thinking comprehensively and creatively about ways to address growing concerns around traffic congestion, safety, and quality of life.

Transportation issues within the Stowe area have been the subject of previous studies conducted by other agencies. The data and recommendations contained in these studies provide a great foundation to understand the issues and identify potential solutions. However, most of these studies address specific issues at specific locations. Addressing existing mobility issues and supporting the long-term mobility equity and vitality in the Town requires a new way of approaching transportation challenges – one that requires a comprehensive town-wide plan. This plan must consider all of the contributing factors (existing and future, to the extent possible) and how they interact to create the mobility issues. It must also apply a multi-layered combination of strategies to address the problems that work in concert to respond to the needs of residents, workers, and visitors, all while considering the desire to maintain the characteristics that residents and visitors enjoy.

The purpose of the Town of Stowe Highway Capacity and Congestion Evaluation is to serve as the next phase in the development of an overall mobility strategy for the Town that addresses existing and future mobility needs of residents, workers, and visitors, building upon previous studies. This phase consists of a fact finding and data collection effort that quantifies existing mobility issues and identifies their root causes, evaluates the capacity at key intersections in the town, and develop a list of needs and opportunities to identify potential strategies that the Town could evaluate in further phases. This study will consider the work that was done previously and apply an equity and mobility-focused approach to develop a comprehensive and forward-thinking strategy for the entire town that considers evolving changes in how and when people want to travel.

Vision and Goals

There are a variety of existing and potential future transportation demand-side and supply-side issues in Stowe, some of which are common to residents, businesses/workers, and visitors, while other needs are specific to only one of those user groups. Thus, two vision statements and goals were developed: one for residents and businesses, and one for visitors.

- **Resident/Business/Worker:** A quality of life that is consistent with the character of Stowe. Residents and workers will have:
    - Information they need, within a reasonable time frame, to allow them to confidently and conveniently plan their trips ahead of time to avoid peak congestion.
    - Access to transportation options that provide equitable access to conduct daily business (work, appointments, dining/shopping, recreation, etc.).
    - A transportation system and facilities that allow local businesses to operate efficiently by providing efficient access for employees and deliveries.
- **Visitor:** A quality, enjoyable, and memorable experience that epitomizes the restorative qualities of rural Vermont. Visitors will have:
    - The information they need, within a reasonable timeframe, to allow them to confidently and conveniently plan their trip ahead of time and secure required transportation and/or parking services.
    - Easy navigation to, with the information needed to find, travel routes, vehicle parking, or alternative transportation options.
    - Access to transportation systems that allow them to travel efficiently to, from, and within the Town with minimal congestion and delays.

Methodology

This study provides a multi-step process to identify, measure, and evaluate existing and potential future mobility issues. The process includes the following steps:

1. Review previous studies and existing sources of data.
2. Evaluate travel trends utilizing location-based data provided by Streetlight, a vendor that provides anonymized location information from mobile phones, GPS devices and connected vehicles.
3. Conduct additional transportation data collection and observations during peak weekends, utilizing a combination of vehicle turning movement counts, drones from the University of Vermont Spatial Analysis Laboratory, and field observations.
4. Develop a capacity analysis model to evaluate existing vehicular operating conditions at intersections across the Town, as well as to conduct a sensitivity analysis to determine thresholds of traffic growth that would necessitate increased levels of improvements.
5. Develop and prioritize a list of needs that outlines each issue, how it impacts mobility in Stowe, and its priority relative to the other needs.

6. Outline a series of strategies that could be explored further for implementation that responds to the needs identified and prioritized in Step 5.

Mobility Needs

The results of the analysis demonstrate a need to rethink mobility in Stowe in a non-traditional way – one that is focused on increasing mobility options and overall network capacity without the need to accommodate more cars. The results show that the current network is constrained and that continued volume growth, increasing delays, and a higher proportion of drivers utilizing alternate routes within the Town to travel between VT 100 and VT 108 will continue to be issues for visitors, residents, and workers. The analysis also shows that the planned improvements to the intersections of VT 108 and Luce Hill Road, VT 100 and West Hill Road, and VT 100 and Moscow Road may not accommodate growth in Stowe of more than 20%. Operational, facility, and safety needs identified in this study are prioritized below based on the assessment of a variety of quantitative and qualitative factors.

Higher Priority Needs	Medium Priority Needs	Lower Priority Needs
Enhance emergency access.	Enhance active mode infrastructure.	Continue to evaluate parking and parking management.
Combine the Luce Hill Road bridge and intersection projects.	Improve intersection operations and safety at the VT 100/Moscow Road and VT 100/VT 108 intersections.	Develop policies to reduce event overlap and improve event management.
Improve transit operations and amenities.	Enhance wayfinding and traveler information.	Establish transportation demand requirements for large development projects or other trip attractors.
Enhance safety of all users.		
Maintain the character of Stowe.		

Preliminary Recommendations

The overall vision strategy consists of the enhancing capacity of the transportation network without widening for vehicles by re-envisioning VT 100 and VT 108 as “Smart Corridors”. A Smart Corridor combines roadway and intersection modifications, improvements to transit and active modes, and intelligent transportation corridor management to enhance operations for all modes, improve safety, and address Stowe-specific needs, including transit accessibility and performance, dynamic wayfinding and traveler information, and emergency vehicle access and response times. **Figure E-1** provides a schematic of the components of the Smart Corridor concept. Elements of the concept are described below:

- Expand full-depth pavement to a minimum width of 44 feet to support flexible use of the pavement that would generally consist of one 11-foot travel lane in each direction with one 11-foot shoulder with full depth pavement to be used as a combined bus/bike lane, as well as emergency vehicles. The cross-section could be adjusted when needed, for example, to accommodate turn lanes at key locations, or where ROW is not as available.

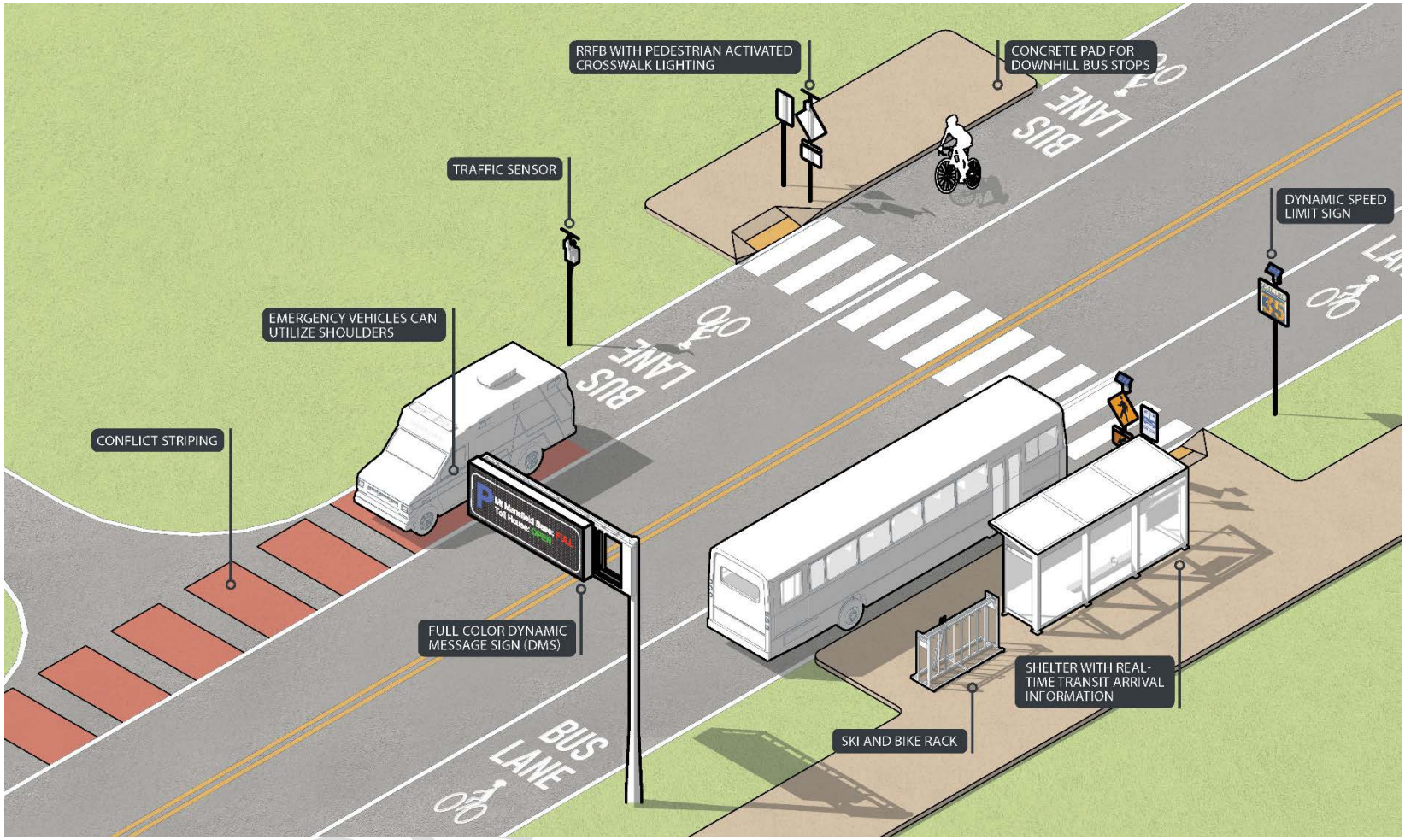

Figure E-1: Smart Corridor Concept

- Increase transportation system capacity through enhanced transit operations and amenities as well as accommodations to support active modes. Components include bus operating on shoulders, consolidated bus stops in walkable areas, bus shelters with equipment racks and real-time transit information on uphill stops, concrete pads for downhill bus stops, signed and striped crosswalks with rectangular rapid flashing beacons (RRFBs) and pedestrian-activated lighting, expansion of the sidewalk network, bicycle parking with pump and tool stations and charging ports, and a seasonal bikeshare system with e-bikes.
- Enhance operations, safety, and traveler information and wayfinding through the deployment of:
    - Roadside detection that can measure speed, volume, and travel time to provide information regarding operation of key corridors in Stowe.
    - Dynamic speed limit signs that adjust speeds based on roadway conditions.
    - Full color dynamic message signs (DMS) at key decision locations to provide dynamic wayfinding and/or traveler information. DMS are capable of displaying symbols and text and come in a variety of sizes and treatments that would be appropriate for Stowe.
    - An online clearinghouse of traveler information that could be access by the public and linked directly on websites and social media of the resorts.

Other strategies that are in addition to, but may also complement, the Smart Corridor strategy include:

Infrastructure:

- Combine the Luce Hill Road/VT 108 intersection study with an evaluation of the Luce Hill Road bridge to ensure that the two projects are complementary to maximize future safety and operations.
- Improve the intersection of VT 100 and Moscow Road as planned in previous studies.
- Evaluate potential improvements to the intersection of VT 100 and VT 108 within Stowe Village.
- Implement recommendations presented in the Mountain Road Village Roadway Master Plan but consider modifications that would allow for the implementation of the Smart Corridor cross-section.
- Conduct a comprehensive safety study to address crash clusters identified in Section 4.1.
- Address sight distance concerns at Top Notch driveway and at the intersection of Moscow Road and Barrows Road.
- Formalize shuttle stops and pedestrian crossing at the Toll House driveway with striping and pedestrian crossing signs.
- Consider installation of additional pedestrian crossings (striping and signing) to connect trip generators and attractors as well as at heavily used bus stop locations.

- Investigate enhancements to VT 108 through Smugglers Notch that may allow it to be used during the winter and/or by heavy vehicles. At a minimum, consider installation of a truck turn around at the base on Smuggler's Notch with vehicle detection to alert truck drivers that they cannot proceed.

Services and Amenities

- Work with GMT to explore the potential to provide additional service on peak weekends and holidays during the winter season. Determine if demand warrants the expansion of the Mountain Road shuttle service to other times of the year.
- Re-evaluate bus stop locations and where possible, consider locating adjacent to intersections so that pedestrian crossings can be provided there, rather than introducing mid-block crossings.
- Conduct an evaluation of existing bicycle parking to determine where additional bike parking is needed. Provide additional pump and tool stations where needed and include charging ports near bicycle parking at key destinations within Stowe.

Policies

- Conduct a parking study to establish revised requirements for parking, determine if additional parking is needed within Stowe Village, and to determine the need to restructure on-street parking to shorter durations.
- Utilize the data presented in Section 4.2.2 to establish guidance or thresholds regarding transportation improvements that would be required to accommodate growth.
- Establish a policy that requires new development over a certain threshold, or development that would, in combination with existing development on a site, exceed the threshold to develop a transportation management plan.
- Develop an Event Management guide that provides guidance for scheduling events to avoid overlap, as well as management strategies that should be employed to manage traffic based on the anticipated event size.
- Encourage SMR and Spruce Peak to offer activities at the end of a weekend ski day to help spread the exiting volumes over a longer period of time.

Next Steps

Stantec will continue to work with the Town to evaluate traffic operations during peak weekends in July and October. This report will be expanded, and recommendations may be added or modified as a result. A preliminary high-level implementation strategy will be developed at the conclusion of this phase. Future phases of study will include more in-depth analysis and recommendations regarding the implementation of general strategies identified in this report.

1.0 INTRODUCTION

The Town of Stowe has reached a critical crossroads in mobility, one that it has been approaching for decades, but has been accelerating toward more quickly in recent years. Residential growth is accelerating due to Stowe's desirable character elements, it's abundance of recreational opportunities, and its proximity to I-89 and nearby cities like Burlington and Montpelier, and the shift in the ability for more people to work remotely. The abundant recreational opportunities also result in seasonal tourism, peaking in February, July, and September/October. All of these factors create substantial demand and congestion on primary and secondary travel routes in the Town. The limited number of roadways to and from the mountain, as well as to and from major travel routes, concentrates congestion on Mountain Road (VT 108) and VT 100, resulting in long delays, queuing at critical intersections, and spillover on local roadways as vehicles try bypass congestion on the state roadways.

Furthermore, the acquisition of Stowe Mountain Resort (SMR) by Vail, continued development and growth at Spruce Peak and other resorts, and overlapping events, has resulted in increased visitor activity and in turn, periods of substantial congestion, typically occurring on and around weekends. These periods of significant congestion can hinder the ability for employees to access their jobs, residents to run errands or get to appointments, and emergency services response times, among other impacts. While the Town recognizes the importance of tourism on the local and regional economy, it also recognizes the need to begin thinking comprehensively and creatively about ways to address growing concerns around traffic congestion, safety, and quality of life.

Transportation issues within the Stowe area have been the subject of previous studies conducted by VTrans, the Lamoille County Planning Commission, and the Central Vermont Regional Planning Commission. The data and recommendations contained in these studies provide a great foundation to understand the issues and identify potential solutions. However, most of these studies address specific issues at specific locations. Addressing existing mobility issues and supporting the long-term mobility equity and vitality in the Town requires a new way of approaching transportation challenges – one that requires a comprehensive town-wide plan. This plan must consider all of the contributing factors (existing and future, to the extent possible) and how they interact to create the mobility issues. It must also apply a multi-layered combination of strategies to address the problems that work in concert to respond to the needs of residents, workers, and visitors, all while considering the desire to maintain the characteristics that residents and visitors enjoy. In general, these potential strategies fall under three main categories:

- Infrastructure: Physical changes to the transportation network that respond to specific congestion, access, and/or safety concerns. Infrastructure strategies could include intersection improvements, pedestrian/bicycle facilities, roadway widening/installation of turn lanes, reconstruction of bridges, new or realigned roadway segments, traffic calming, intelligent transportation systems (ITS), etc.

- Services and Amenities: Strategies that enhance access to and the usability of modes other than driving a car. Potential strategies that would fall within this category include new or modifications to transit routes, mobility hubs, bus shelters, secure bicycle parking, pump and tool stations, e-bike and e-scooter charging facilities, etc.
- Policy: Strategies that help to manage or reduce demand on the transportation network. Examples of policy strategies could include establishing trip thresholds for scheduling of events, modifying zoning to encourage affordable housing options close to where people work, establishing new parking requirements, complete streets requirements, or transportation demand management requirements for developers.

This report represents the first of a multi-phase approach to develop a mobility strategy for the Town that addresses existing and future needs. The goal of this phase is to define existing conditions by quantifying existing transportation issues and understanding the root causes of those issues. Capacity analysis thresholds will also be established that will outline when more substantial roadway and intersection improvements will be required. Finally, initial recommendations will be made to identify potential strategies that the Town could evaluate in further phases to ultimately develop the overall mobility strategy and implementation plan.

1.1 PURPOSE AND NEED

The primary purpose of the Town of Stowe Highway Capacity and Congestion Evaluation is to serve as the next phase in the development of an overall mobility strategy for the Town that addresses existing and future mobility needs of residents, workers, and visitors, building on the work from previous studies. There are a variety of demands placed on the existing transportation system, many of which are going to evolve over time. Therefore, the Town needs a comprehensive plan that identifies thresholds and an implementation timeline for improvements, evaluates and considers the interactivity between potential transportation improvements, and identifies new area-wide infrastructure, services, amenities, and policy strategies.

This phase consists of a fact finding and data collection effort that quantifies existing mobility issues and identifies their root causes, evaluates the capacity at key intersections in the town, and develop a list of needs and opportunities to identify potential strategies that the Town could evaluate in further phases. Several studies conducted over the past 20 years have consistently highlighted the need to address safety and congestion along the state roadway network, including recommendations for new traffic signals, intersection modifications, new park-and-ride facilities, new/enhanced pedestrian, bicycle, and transit facilities, among other improvements. This study will consider the work that was done previously and apply an equity and mobility-focused approach to develop a comprehensive and forward-thinking strategy for the entire town that considers evolving changes in how and when people want to travel.

1.2 VISION AND GOALS

There are a variety of existing and potential future transportation demand-side and supply-side issues in Stowe, some of which are common to residents, businesses/workers, and visitors, while other needs are specific to only one of those user groups (**Figure 1**). Thus, two vision statements and goals were developed: one for residents and businesses, and one for visitors.

- **Resident/Business/Worker:** A quality of life that is consistent with the character of Stowe. Residents and workers will have:
    - Information they need, within a reasonable time frame, to allow them to confidently and conveniently plan their trips ahead of time to avoid peak congestion.
    - Access to transportation options that provide equitable access to conduct daily business (work, appointments, dining/shopping, recreation, etc.).
    - A transportation system and facilities that allow local businesses to operate efficiently by providing efficient access for employees and deliveries.

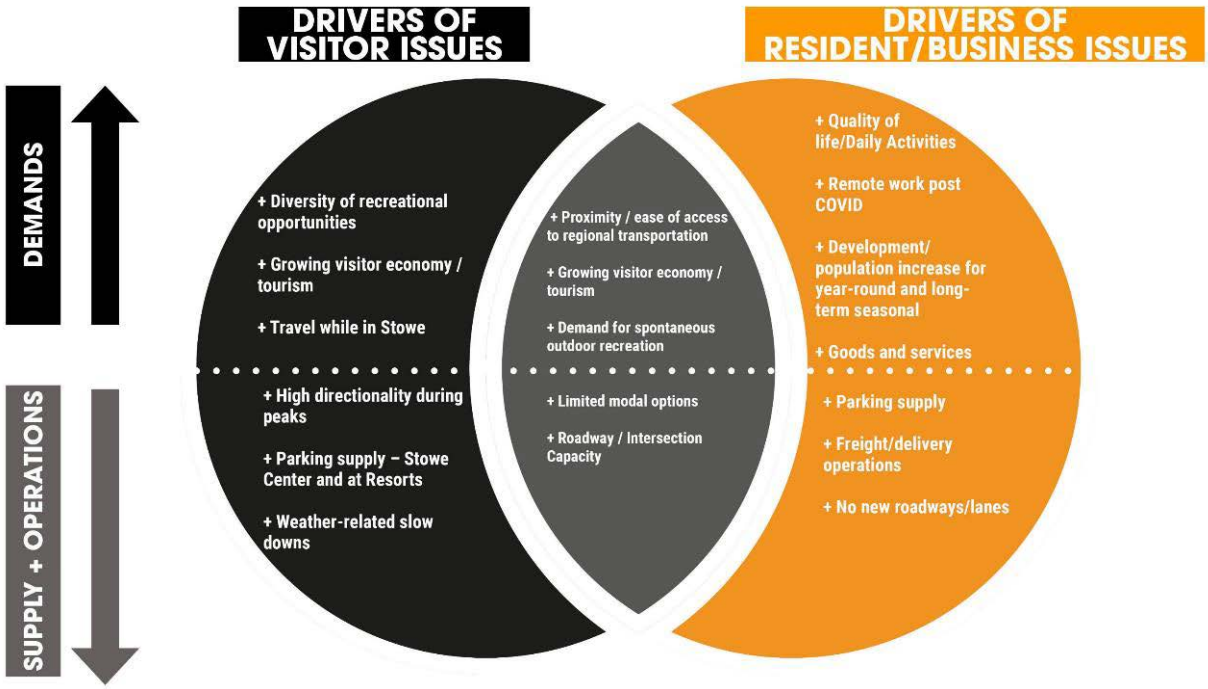

Figure 1: Stowe Mobility Demand and Supply

- **Visitor:** A quality, enjoyable, and memorable experience that epitomizes the restorative qualities of rural Vermont. Visitors will have:

- The information they need, within a reasonable timeframe, to allow them to confidently and conveniently plan their trip ahead of time and secure required transportation and/or parking services.
- Easy navigation to, with the information needed to find, travel routes, vehicle parking, or alternative transportation options.
- Access to transportation systems that allow them to travel efficiently to, from, and within the Town with minimal congestion and delays.

Other overall goals that are common to all transportation system users include:

- Accommodate anticipated transportation system demands resulting from planned and potential future development and identify thresholds for when and where improvements may be needed in the future.
- Incorporate opportunities for cultural/artistic features that create a sense of place around communities within Stowe, such as Mountain Road Village and Moscow Village.
- Avoid right-of-way impacts to private property as well as environmental impacts to the extent possible and maintain the character of the Town that residents and visitors expect and enjoy.
- Provide amenities that support non-auto modes.
- Merge decisions on land use and transportation to enhance equity across the transportation network.
- Enhance wayfinding for all modes that support safe and efficient circulation to, from, and through key areas of the Town, major destinations, and regional transportation options (**Figure 2**).

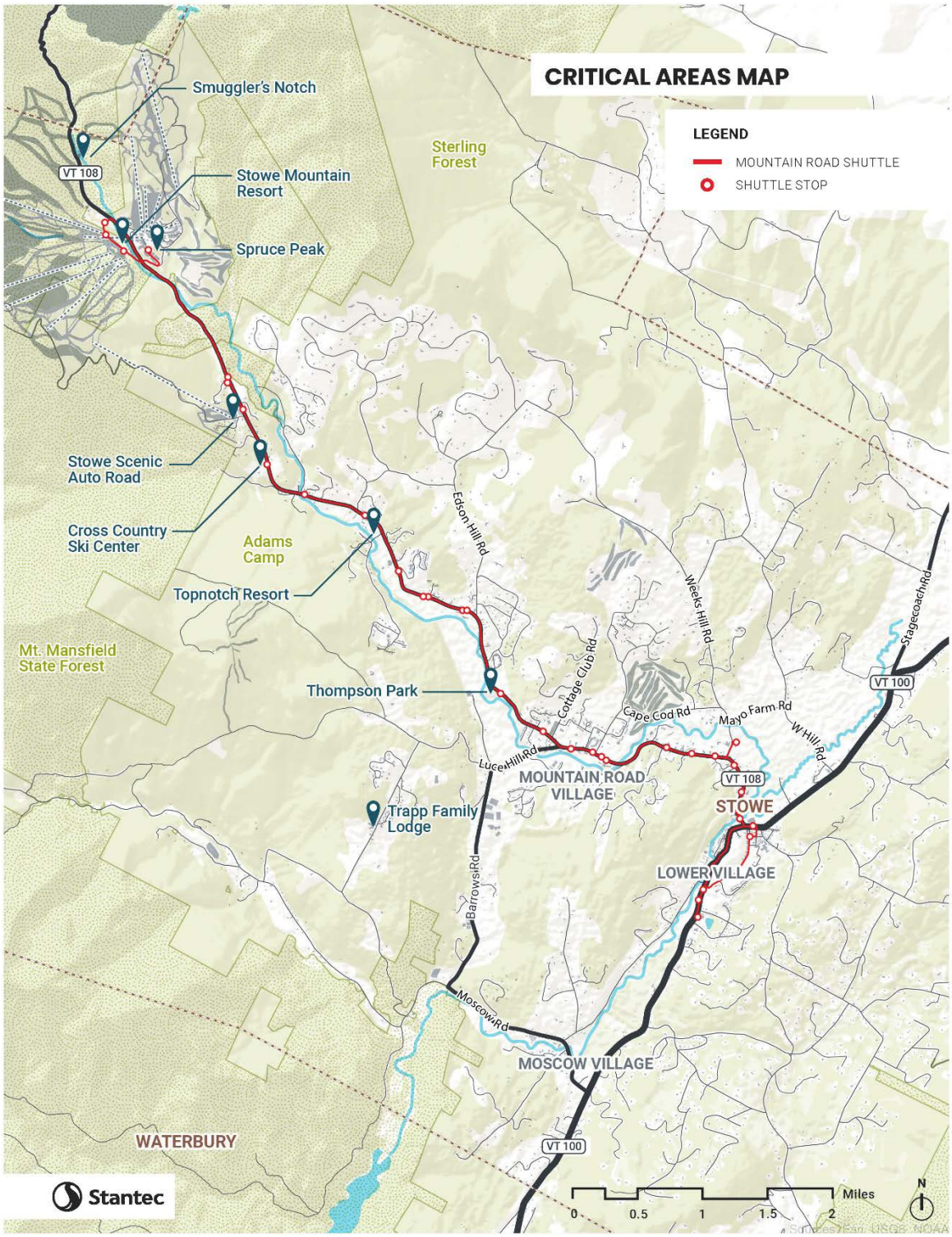

Figure 2: Stowe Study Area – Critical Areas Map

1.3 METHODOLOGY

This study provides a multi-step process to identify, measure, and evaluate existing and potential future mobility issues. The process includes the following steps:

7. **Review previous studies and existing sources of data.** As noted in Section 1.1, there have been several previous studies conducted over the past 20 years that have evaluated transportation issues, particularly on the VT 100 and VT 108 corridors. Stantec has reviewed each study and the data and recommendations contained within these studies will serve as the foundation for this analysis. In addition to previous studies, Stantec obtained volume, crash, and ridership data from the VTrans transportation demand management system (TDMS), VTrans Public Crash Data Tool, and Green Mountain Transit (GMT), respectively. The Town of Stowe also provided information regarding planned developments, associated traffic impact studies, and the SMR traffic monitoring reports.

8. **Evaluate travel trends utilizing location-based data.** Location based data provider, Streetlight, was utilized to obtain data regarding travel trends, including origin-destination data, link volume and delay, and route selection. Location-based data utilizes anonymized data from GPS and smart-phone app location data from personal and fleet devices in algorithms that generate transportation data for planners and engineers to use to evaluate general travel trends on the transportation network. Stantec staff utilized the data to evaluate several measures for 2019 (pre-pandemic), 2022, and 2023 (as data becomes available):

    a. Total estimate of visitation by month and day to key locations within Stowe.

    b. Origin of visitor trips to Stowe from other areas in the US, as well as the percentage of trips entering Stowe that are destined for several key areas in the Town.

    c. Link volume and delay to assess demand patterns on specific roadway segments within Stowe to visualize how volume and delay changes across an average weekday as well as an average weekend day.

    d. The use of local roadways as bypass routes to determine the percentage of vehicle traffic utilizing various routes between entry points to Stowe and major destinations within the Town.

9. **Conduct additional transportation data collection and observations during peak weekends.** Utilizing the location-based data, Stantec identified a peak winter season weekend and peak summer season weekend for visitation and targeted field data collection and observations for those periods. Accordingly, field data collection was conducted on Presidents Day Weekend (Saturday, February 18, and Sunday, February 19, 2023) and Saturday, July 15, 2023, during the Green Mountain Games. The following data was collected:

a. Vehicle turning movement counts at the following intersections:

   i. VT 100 and Moscow Road
   ii. VT 100 and VT 108
   iii. VT 100 and W Hill Road
   iv. VT 108 and Weeks Hill Road
   v. VT 108 and Luce Hill Road
   vi. VT 108 and Cape Cod Road

   The count data was collected between 7:00 AM and 7:00 PM; however, based on the field observations the data was processed for the AM peak period (7:00 AM – 10:00 AM), and the PM peak period (3:00 PM – 6:00 PM).

b. Drones from the University of Vermont Spatial Analysis Lab were utilized on Saturday, February 18 to record aerial videos for observations and queue measurements during the AM and PM peak periods. Two drones were utilized: one in Mountain Road Village to observe traffic patterns along VT 108 between Cottage Club Road and Town Farm Lane, and one at the Barnes Camp Visitor Center to observe operations of vehicles entering and exiting Spruce Peak as well as SMR.

c. Staff from the Lamoille County Planning Commission conducted on-board boarding and alighting counts on the Mountain Road shuttle on Sunday, February 19 and Thursday, February 23, 2023.

d. Stantec staff conducted field site observations and video-recorded drive-throughs of the major corridors between 7:00 AM and 5:00 PM to observe and document traffic conditions, pedestrian and bicycle facilities and operations, vehicle queuing, sight lines, parking operations, etc.

10. **Develop a capacity analysis model.** Utilizing the information collected in Steps 1 through 3, a Synchro 11/SimTraffic capacity analysis model was developed to evaluate existing vehicular operating conditions at intersections across the Town, as well as to conduct a sensitivity analysis to determine thresholds of traffic growth that would necessitate increased levels of improvements.

11. **Develop and prioritize a list of needs.** Utilizing the information collected in Steps 1 through 4, Stantec then developed a list of mobility needs that outlines each issue, how it impacts mobility in Stowe, and its priority relative to the other needs.

12. **Outline a series of strategies that could be explored further for implementation.** A preliminary list of strategies was developed that would respond to the needs identified and prioritized in Step 5. This list is intended to be evaluated further in future phases of the project.

2.0 REVIEW OF PREVIOUS STUDIES

As noted earlier in this report, there have been several studies that have been conducted on various areas of the transportation network by VTrans, the Lamoille County Planning Commission, and the Central Vermont Regional Planning Commission. A summary of relevant components of the previous studies is shown in **Figure 3** and the accompanying summary tables (**Table 1** and **Table 2**). The studies that were reviewed include:

- Season Mountain Road Shuttle Report for the 2021 – 2022 Season, prepared by Green Mountain Transit
- Moscow Village Streetscape Concept Plans, prepared by Hoyle Tanner and dated June 2022
- Luce Hill Road Sidewalk Scoping Study, prepared by Hoyle Tanner and dated April 2022
- Luce Hill Road Bridge Replacement Scoping Study, prepared by Hoyle Tanner and dated April 2022
- Stowe Mountain Resort Traffic Monitoring Reports (Years 1 – 5), prepared by VHB and dated January 2018 through February 2022.
- Stowe Mountain Resort Parking Affidavits and Plans (Various Dates), provided by Town of Stowe
- Stowe Area Association Occupancy Reports 2018 – 2022
- Feasibility Study for Vermont Route 100 at Moscow Road Intersection, prepared by CLD Consulting Engineers and dated November 2016
- Feasibility Study for Vermont Route 100 at West Hill Road Intersection, prepared by CLD Consulting Engineers and dated November 2016
- Speed Limit Study for Vermont Route 100 at West Hill Road Intersection, prepared by CLD Consulting Engineers and dated November 2016
- Stowe Route 100/108 Intersection Action Planning Project, prepare by RSG and dated November 1995
- VT 100 Access Management Plan, prepared by RSG and dated November 2004
- Plans for Proposed Improvement to Vermont Route 108 (STP FPAV(26)), prepared by VTrans and dated June 2018
- Plans for Proposed Improvements to Vermont Route 100 (STP PS19 (3)), prepared by DuBois and King, Inc. and dated December 2016
- Plans for Proposed Improvements to VT 100 at West Hill Road (STPG SGNL 52), prepared by VTrans and dated February 2022.
- Plans for Proposed Improvements to VT Route 100 in the Towns of Waterbury and Stowe, prepared by Stantec Consulting Services, Inc. and dated November 2017
- Documents prepared by the Stowe Transportation Management Working Group (2022)
- 2018 Stowe Town Plan

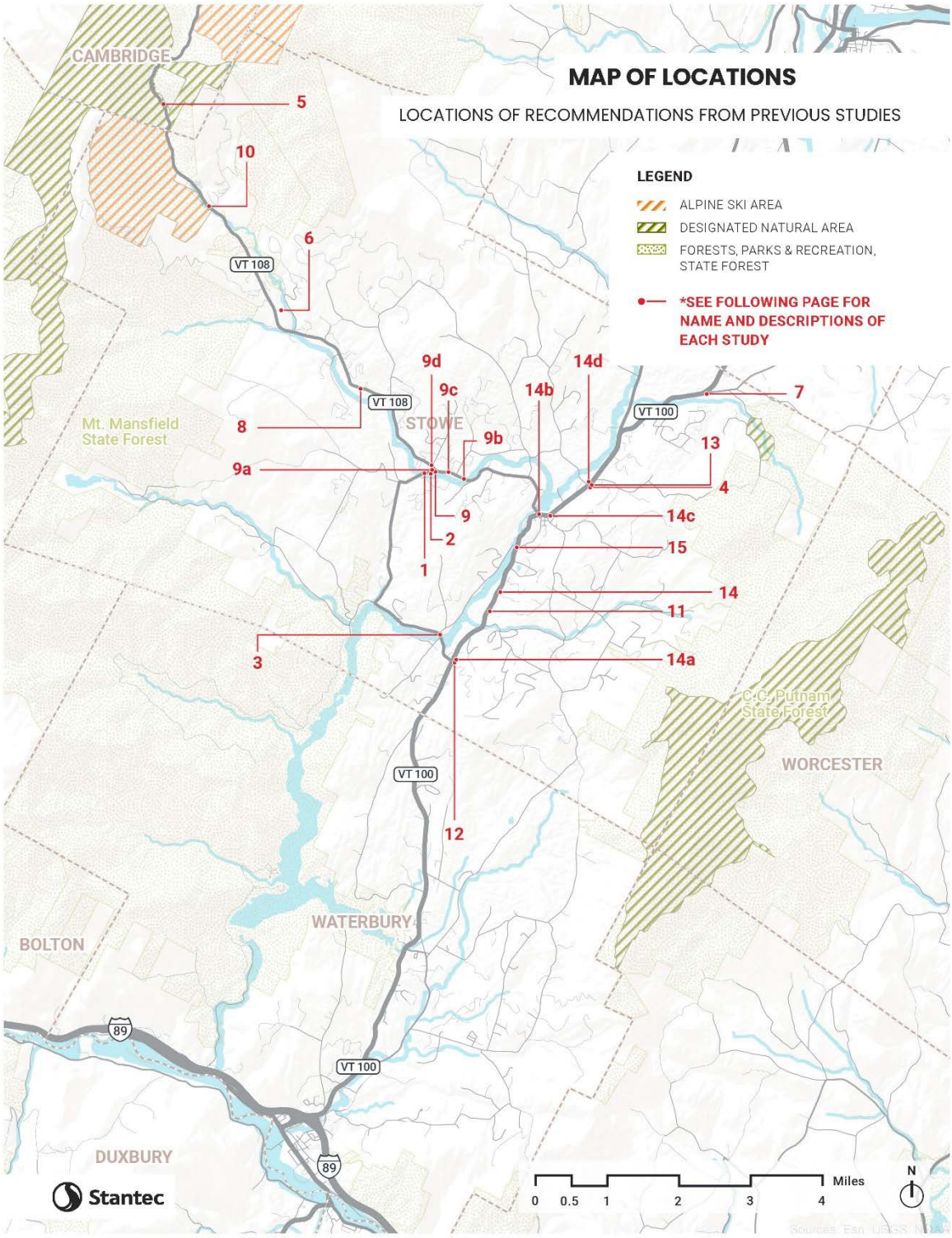

Figure 3: Map of Locations of Improvements Proposed by Previous Studies

Table 1: Summary of Recommendations from Previous Studies

TABLE 1: SUMMARY OF RECOMMENDATIONS FROM PREVIOUS STUDIES		
KEY*	**STUDY**	**DESCRIPTION**
1	**LUCE HILL ROAD BRIDGE REPLACEMENT SCOPING STUDY**	Bridge replacement with interconnected bicycle and pedestrian facilities.
2	**LUCE HILL ROAD SIDEWALK SCOPING STUDY**	Bicycle and pedestrian facilities on Luce Hill Road connecting to Mountain Road and the upcoming intersection improvement project.
3	**MOSCOW VILLAGE STREETSCAPE SCOPING STUDY**	Traffic calming, roadway rehabilitation, pedestrian facilities, streetscape amenities.
4	**STOWE STPG SGNL (52)**	Roadway widening, drainage, left turn lane addition, new traffic signal, other highway related items.
5	**STOWE STP 0235 (14) SMUGGLERS NOTCH GATEWAY**	Improvements to parking and picnic areas in the Smugglers Notch Area. Areas to be improved include the Notch Proper South Parking Area, picnic area, and the Big Spring Area.
6	**SMR EXPANDED PARKING AT 5400 MOUNTAIN ROAD**	Vail/SMR is currently negotiating with the Town to provide a satellite parking area at 5400 Mountain Road that would provide approximately 150 parking spaces and be connected to SMR by shuttle.
7	**STOWE-MORRISTOWN STP PS19(3)**	Coarse-milling, reclaiming, correcting superelevation, resurfacing with intermediate and wearing courses, pavement markings, guardrail, drainage, full depth reconstruction and realignment of Randolph Rd intersection, and other highway related items.
8	**STOWE STP FPAV(26)**	Paving existing highway, pavement markings and other highway related items.
9	**VT 108 MOUNTAIN RD VILLAGE ROADWAY MASTER PLAN (2018)**	a. Realign the Luce Hill Road Intersection and install traffic signal.
		b. Create a new recreation path segment that connects the existing path segments on both sides of Mountain Road by going under the Mountain Road bridge.
		c. Install new sidewalk and streetscaping along the south side of Mountain Road, east of Luce Hill Road.
		d. Install new sidewalk and streetscaping along the north side of Mountain Road, west of Luce Hill Road.

**See Figure 1: Map of Locations of Recommendations from Previous Studies for key number locations*

TABLE 1: SUMMARY OF RECOMMENDATIONS FROM PREVIOUS STUDIES

KEY*	STUDY	DESCRIPTION
10	VT 100/VT 108 CORRIDOR MANAGEMENT PLAN	a. Add a crosswalk on VT 108 at Toll House.
		b. Provide monitoring camera and weather condition PCMS on hill at Matterhorn/Harlow Rd.
		c. Signalize VT100 / West Hill Rd. Add preventive safety measures for vehicles passing on shoulder of NB VT100 at West Hill Rd.
		d. Rebuild Luce Hill Rd Bridge.
		e. Build Roundabout at VT100 / Moscow Rd.
		f. Rebuild/Repair Moscow Rd Bridge.
		g. Realign/Signalize Luce Hill Rd / VT108.
		h. Add passing lane or wide shoulder on VT108 by Harlow Hill.
		i. Provide control mechanism to prevent large vehicles from traveling through the Notch.
11	WATERBURY-STOWE AND STOWE STP 2945(1) AND STP STSW(1) (RE-ADVERTISED) (2017)	Cold planing, concrete pavement removal, base courses and wearing course, correcting superelevation, new pavement markings, guardrail, drainage improvements, culvert replacements, drilling and blasting, signs and other highway related items.
12	FEASIBILITY STUDY FOR VT ROUTE 100 AT MOSCOW RD INTERSECTION (2016)	Roundabout chosen as preferred alternative.
13	SPEED LIMIT STUDY FOR VT100 AT WEST HILL RD INTERSECTION (2016)	Remove trees (sight obstructions) and reduce posted speed to 30 mph (< 85 percentile).
14	VT100 ACCESS MANAGEMENT PLAN: WATERBURY, STOWE, MORRISTOWN (2004)	a. Construct roundabout at VT 100 / Moscow Rd.
		b. Install traffic signal at VT 100 / VT 108.
		c. Install traffic signal at VT 100 / School St.
		d. Install traffic signal at VT 100 / West Hill Rd.
		e. Planned for 2025.
15	VT100/VT108 ACTION PLANNING PROJECT (1995)	a. Traffic calming, parking rearrangement, changes to one-way street pattern in Village, sidewalk improvements, plantings, signage improvements.
		b. Construct a new roadway connecting VT 108 to VT 100 starting at the Inn at Little River, extending through IGA store on South Main Street.

**See Figure 1: Map of Locations of Recommendations from Previous Studies for key number locations*

Table 2: Previous Studies with General Strategies/Recommendations

TABLE 2: PREVIOUS STUDIES WITH GENERAL STRATEGIES/RECOMMENDATIONS	
STUDY	**DESCRIPTION**
STOWE TRANSPORTATION MANAGEMENT WORKING GROUP DRAFT RECOMMENDATIONS (ONGOING)	a. Enhance traffic management: Develop an operations playbook to deploy steps at congestion thresholds. Engage in coordination between Stowe and VTrans to provide physical, ITS, and communication support.
	b. Local circulation demand management: Road condition video feeds at Harlow Hill, Pumphouse Hill, and one more location to feed through web sites of resorts, town, and Stowe Area Association. More widely communicate local and nearby existing VTrans video feeds and snowplow locations.
	c. Conduct a capacity analysis of VT 108, Moscow Road, and other key intersections to benchmark the status, summarize historic trends, and define triggers for short and long-term strategies.
	d. Capacity analysis of VT 108, Moscow Rd, and related intersections. Benchmark status. Summarize historic trends. Define triggers for short- and long-term strategies.
	e. Conduct a Travel Demand Management (TDM) study that includes Waterbury, Stowe, and coordinates with the Smugglers Notch scoping study.
	f. Realign and signalize Luce Hill Road intersection.
	g. Pedestrian connections: Install sidewalks per Mountain Road Village Master Plan.
	h. Pave and widen shoulder on VT 108 where needed (e.g., Pumphouse Hill).
	i. Conduct a transit study to assess experiences with facilities & services in Stowe.
	j. Enhance or add remote parking facilities (park & ride lots) in VT 100-108 corridor or other locations served by transit to Stowe Mountain Resort (SMR) and other destinations; incentivize with parking pricing strategies.
	k. Provide/enhance bus shelters for Mountain Road Shuttle; provide bus pull-off so cars can go around; provide lighting, crossings, other improvements as appropriate.
	l. Promote TDM: Support and incentivize spreading peak travel demand by ski resorts, other destinations, restaurants, hotels, etc. Communicate multimodal options. More fully use Go Vermont free TDM services.
VT 100/VT 108 CORRIDOR MANAGEMENT PLAN	a. Provide year-round service and increase winter ride frequency for GMT Mountain Rd Shuttle to reduce wait times.
	b. Add/enhance bus shelters at designated stops for Mountain Rd Shuttle.
	c. Consider remote parking to meet needs of ski area parking.
	d. Educate users of all ages on transportation options.
	e. Conduct TDM Study from Waterbury through Smuggler's Notch Park; evaluate Park & Rides and Public Transit.

3.0 STOWE TRAVEL TRENDS

The transportation network in Stowe is, on the surface, relatively simple, with access being provided by two state routes (VT 100 and VT 108). However, the apparent simplicity of the transportation network also contributes to the complex mobility issues that impact the Town, particularly during the peak tourism season. These issues are even more evident during the winter when Smugglers Notch (VT 108) is closed to vehicular traffic, thus resulting in all access to the town being provided via VT 100. Once within the Town limits, vehicles can use only a handful of local roadways to bypass congestion on the state routes. Continued increases in growth and visitation, combined with apps, like Google Maps and Waze, have resulted in increases in traffic volumes on local roadways as drivers navigate around congested areas on the primary roadways.

To develop a comprehensive mobility strategy, it is necessary to begin quantifying overall travel trends in order to gain an understanding of how, when, and from where people living, working, and visiting Stowe travel. The first component of this process is to evaluate demand, origin-destination, and routing data, utilizing location-based data.

3.1 WHAT IS LOCATION-BASED DATA?

When you use a GPS unit, certain smart phone applications, or drive a connected car, your location is being recorded as you travel in-real time. This position and time data is obtained by location-based data services that then anonymize, aggregate, and apply algorithms to translate the location data into usable information for urban and transportation planning. This type of data has become invaluable when assessing travel trends, origins and destinations, and routing – allowing planners and engineers to evaluate the transportation network in ways that would have previously required expensive and time-consuming methods to collect. For this study, Stantec utilized Streetlight to provide the location-based data.

Streetlight provides an on-line platform to obtain the data for user-specified periods of time. A user can draw a “zone” around a specific area or roadway segment of interest, and then select various metrics over various time periods. For this study, seven zones were called out within Stowe, each representing a critical activity area that have trip-attracting locations within them, including recreation, dining, lodging, and shopping. The seven areas include:

- Resort Area: an area that includes SMR, Spruce Peak, and the parking area for Smuggler’s Notch State Park
- Cross Country/Toll Road: an area that includes the Toll Road and Cross-Country Ski Center parking areas, as well as Smugglers’ Notch Campground

- Upper Mountain Road: an area around VT 108 between Notchbrook Road and Edson Hill Road and includes trip attractors such as the Matterhorn, and Topnotch Resort along with several other inns and restaurants.
- Mountain Road Village: an area around VT 108 between Butternut Lane and the crossing of the Little River (just north of the Village).
- Stowe Village: an area around VT 100 between West Hill Road and River Road and includes all parking areas as well as the Stowe Arena.
- Lower Stowe Village: an area around VT 100 between River Road and Farr Hill Road that includes shopping, dining, and lodging options such as Commodores Inn and Dunkin.
- Trapp Family Lodge: the area encompassing Trapp Family Lodge.

Data for these zones could be selected for a specific day, or could be averaged over several days, weeks, or months. Furthermore, since Streetlight is constantly aggregating position data from its sources which allows a user to go “back in time” and evaluate data from as far back as 2018. For the purposes of this study, Stantec utilized Streetlight to obtain monthly data for 2019, 2022, and 2023.

3.2 ANNUAL AVERAGE TRAVEL TRENDS

Streetlight data was used to evaluate overall average daily trips to two areas within the Town: Stowe Village, Mountain Road Village, and the SMR/Spruce Peak area. These areas were selected for this more detailed analysis because they showcase the three highest activity areas. Data for 2019, 2022, and 2023 indicate several seasonal peaks in visitation within the Village and at the SMR/Spruce peak area. **Figures 4** through **6** show the estimated number of vehicle trip ends in each of three zones.

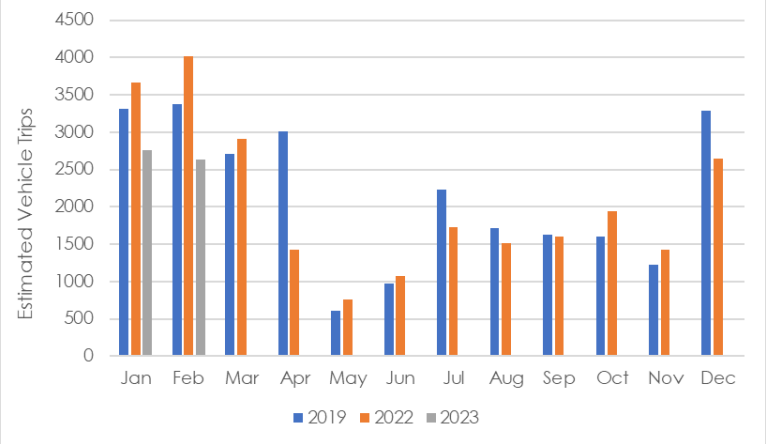

Figure 4: Average Daily Vehicle Trips by Month Ending at SMR/Spruce Peak

It should be noted that the data shows vehicle trips, not person trips. It is likely that most vehicles have more than one occupant, thus, to estimate the number of people visiting Stowe Village or SMR/Spruce Peak, the vehicle trips can be multiplied by an average vehicle occupancy. Recent data provided by SMR's Parking and Traffic Management Reporting indicates an average of 2.4 people per vehicle. For example, 4,000 daily vehicle trips would equate to approximately 9,600 visitors.

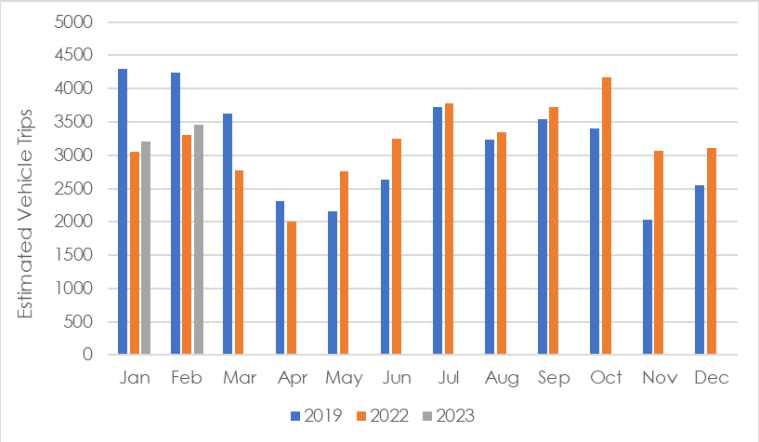

Figure 5: Average Daily Vehicle Trips by Month Ending in Stowe Village

As anticipated, the December through February period represents the overall peak of activity within Stowe, with February being the month with the highest activity. However, the zones peak slightly differently, with SMR peaking in the Winter season, Stowe Village peaking during the winter and fall seasons, and Mountain Road Village peaking in July. Therefore, three peaks will be evaluated further in this document: February, July, and October.

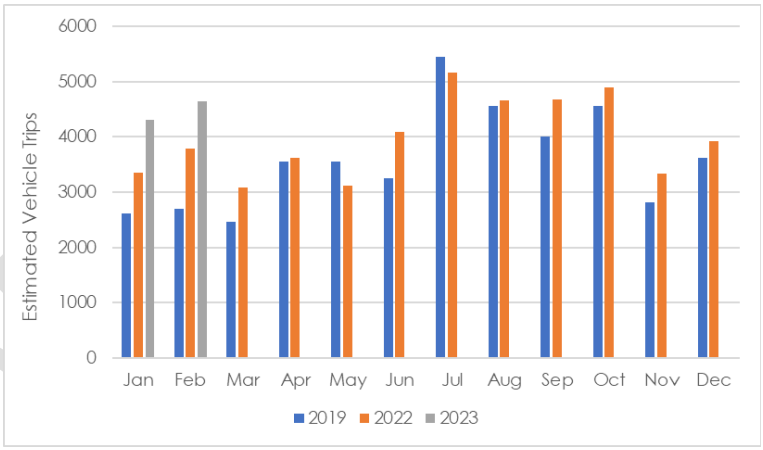

Figure 6: Average Daily Vehicle Trips by Month Ending in Mountain Road Village

3.3 WINTER SEASON PEAK - FEBRUARY

Much of Stowe's identity, particularly outside of Vermont, is oriented around winter recreational activities and the many resorts that support them. Therefore, it is not surprising that the data presented in Section 3.2 shows a clearly defined peak in activity within Stowe generally between December and March, with February showing the highest activity across most of the analyzed zones. Therefore, a thorough assessment of activity and associated traffic conditions in February was conducted that consisted of:

- Detailed analysis of Streetlight location-based data to evaluate daily trip activity, origin-destination, routing, and volume and delay profiles for select roadway segments.

- Field data collection and traffic observations on Presidents Day weekend (February 18th and 19th, 2023) that consisted of:
    - Vehicle turning movement counts at the following intersections:
        - VT 100 and Moscow Road
        - VT 100 and VT 108
        - VT 100 and W Hill Road
        - VT 108 and Weeks Hill Road
        - VT 108 and Luce Hill Road
        - VT 108 and Cape Cod Road

    The count data was collected between 7:00 AM and 7:00 PM; however, based on the field observations the data was processed for the AM peak period (7:00 AM – 10:00 AM), and the PM peak period (3:00 PM – 6:00 PM).

- Drones from the University of Vermont Spatial Analysis Lab were utilized on Saturday, February 18 to record aerial videos for observations and queue measurements during the AM and PM peak periods. Two drones were utilized: one in Mountain Road Village to observe traffic patterns along VT 108 between Cottage Club Road and Town Farm Lane, and one at the Barnes Camp Visitor Center to observe operations of vehicles entering and exiting Spruce Peak and SMR.

- Staff from the Lamoille County Planning Commission conducted on-board boarding and alighting counts on the Mountain Road shuttle on Sunday, February 19 and Thursday, February 23, 2023.

- Stantec staff conducted field site observations and video-recorded drive-throughs of the major corridors between 7:00 AM and 5:00 PM to observe and document traffic conditions, pedestrian and bicycle facilities and operations, vehicle queuing, sight lines, parking operations, etc.

3.3.1 Evaluation of Daily Trip Activity

Although February is typically the peak of activity in Stowe, the number of vehicle trips can vary substantially across the month, with weekends typically experiencing the heaviest levels of congestion. In addition to day-of-week, other factors such as weather conditions, visitor perception/weariness of travel conditions, and other events can influence the number of people traveling to and from Stowe. Streetlight data was utilized to evaluate trips per day for three locations in Stowe: Stowe Village (**Figure 7**), Mountain Road Village (**Figure 8**), and SMR (**Figure 9**). It should be noted that the data in the figures was adjusted so that common weekends line up in order to make it easier to compare the data across the three analysis years.

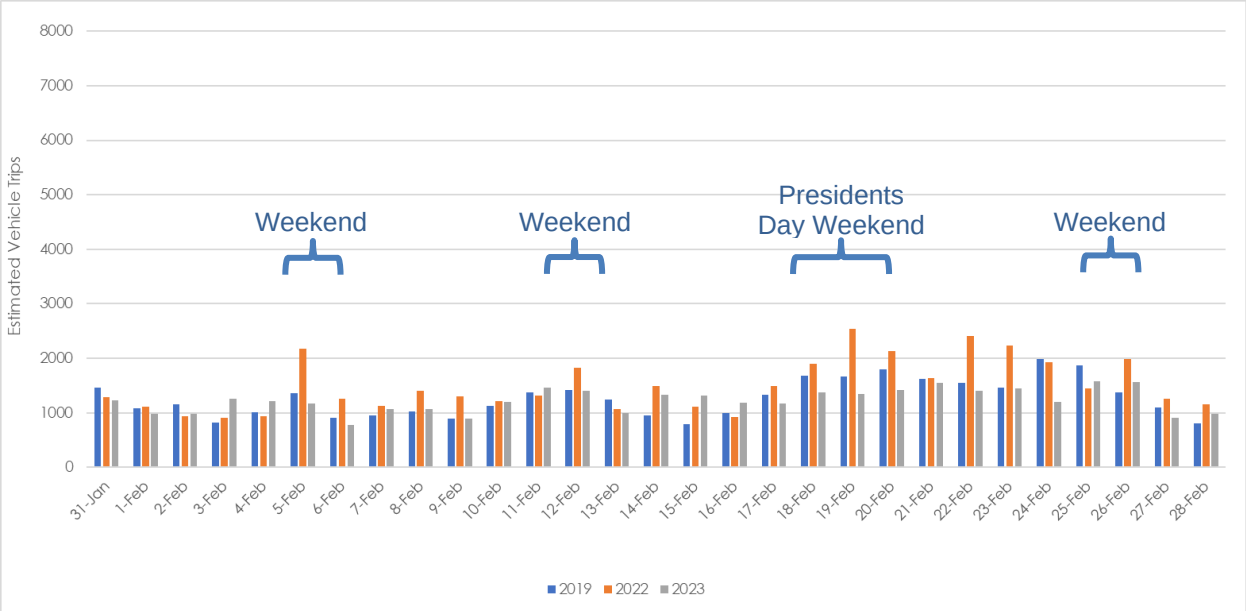

Figure 7: Estimated Daily Vehicle Trips Ending in Stowe Village in February

The estimated number of vehicle trips ending within the Village are substantially lower than Mountain Road Village or SMR, which may seem counter-intuitive given the high levels of traffic and other activity within the Village. However, the data shows trips ending in the zone, not passing through. Furthermore, field observations conducted in 2023 also show relatively limited activity within the Village, with most activity occurring along Mountain Road and within SMR, particularly around resorts, motels, and restaurants on the corridor. All three figures show clear spikes in activity, as anticipated, on weekends, with the peak in activity during Presidents Day Weekend.

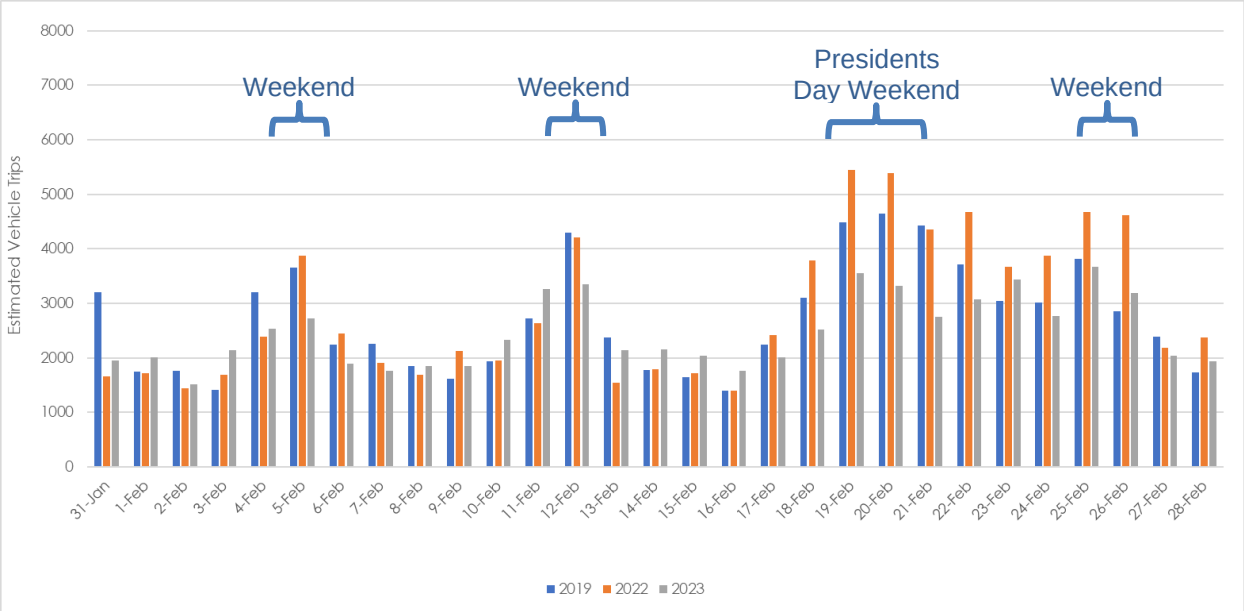

Figure 8: Estimated Daily Vehicle Trips Ending in Mountain Road Village in February

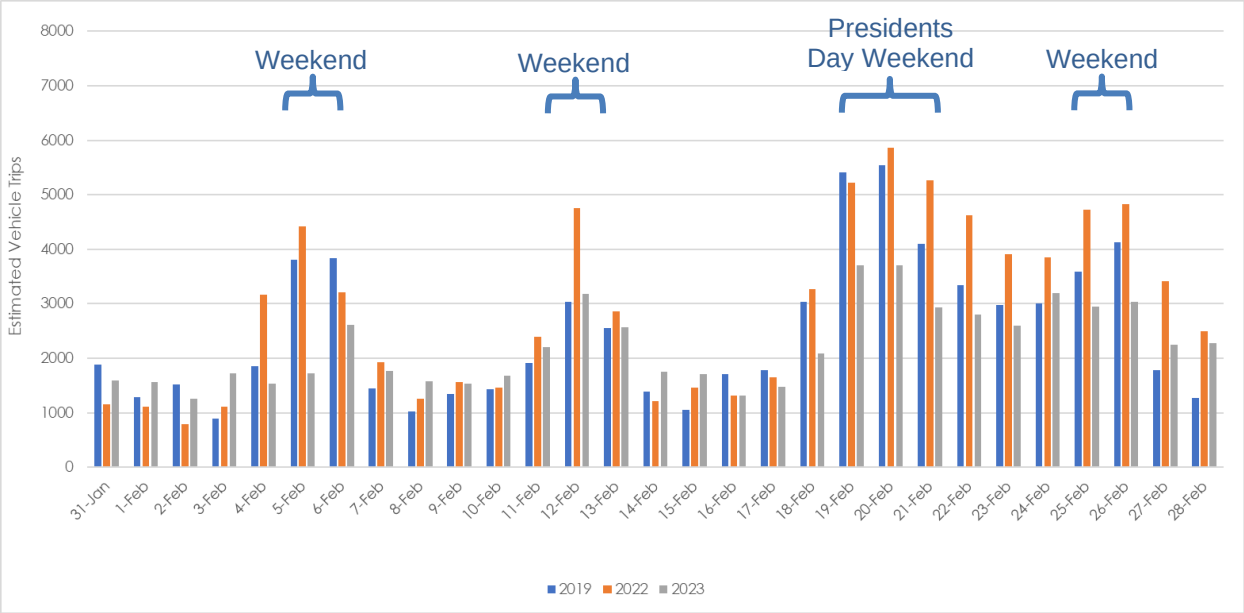

Figure 9: Estimated Daily Vehicle Trips Ending in SMR/Spruce Peak in February

When comparing trip ends across the three analysis years, it is clear that 2022 experienced the highest number of trip ends which is supported by information and observations provided by the Town which indicate substantial congestion events in 2022, sometimes leading to over one-hour travel times between the Village and SMR. This level of congestion was documented by news outlets[1] as well as data collected by SMR indicating there were 16 days during the 2021/2022 season where there were significant traffic back-ups along Mountain Road (VT 108) of over 30 minutes (**Figure 10**).

Figure 10: Screenshot of Travel Times Between Stowe Village and SMR on February 20, 2022[1]

Conversely, SMR data shows that there were only four days during the 2022/2023 season with significant traffic backups. Furthermore, data collected by Stantec, as well as field observations on Presidents Day Weekend 2023, demonstrate minimal congestion along Mountain Road (VT 108) and overall travel times between the Village and SMR were under 15 minutes. This can be directly correlated to the lower trip ends to all locations shown in **Figures 7** through **9**. The reason for the lower levels of activity during the 2022/2023 season is not known but is suspected to be due to a variety of reasons including warmer than average temperatures, more rain events, less snow, and potentially "bad press" from the 2021/2022 season which made potential visitors wary of visiting Stowe and SMR.

The total number of daily trips is not necessarily an indicator of congestion, because the level of congestion depends on how those trips are spread across an entire day. If spread evenly across the day, the number of vehicle trips shown can easily be accommodated on Mountain Road (VT 108). However, with limited skiing hours, traffic to SMR typically peaks sharply in the morning, and then again in the evening (see Section 3.3.4). Therefore, comparing the vehicle trip end data with information provided by Stowe Police regarding heavy traffic congestion, thresholds can start to be developed that relate travel time to vehicle trip ends. **Figure 11** highlights the days in February 2022 where Stowe police reported heavy delays and long travel time along Mountain Road (VT 108) between the Village and SMR. Yellow indicates moderate congestion days with peak travel times generally between 20 and 40 minutes, orange indicates days with substantial congestion with peak travel times between 40 minutes and 1 hour, and red indicates days with extreme congestion with peak travel times exceeding 1 hour.

[1] https://www.vtcng.com/stowe_reporter/news/local_news/resort-bound-traffic-jams-lead-to-epic-grumbling/article_cc0e1956-a081-11ec-8766-e331baee68d7.html

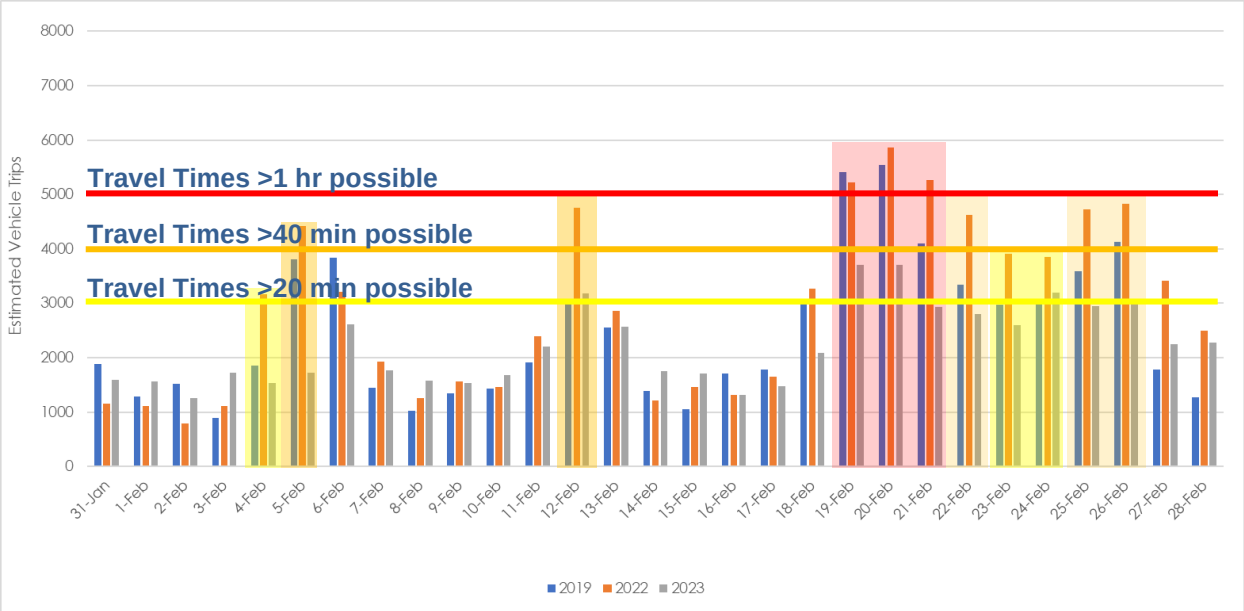

Figure 11: Estimated Daily Vehicle Trips Ending in SMR/Spruce Peak in February – Thresholds for Congestion

Congestion is likely to be minimal when vehicle trip ends are under 3,000. However, once trips begin to exceed 3,000 vehicles, moderate congestion with travel times over 20 minutes are possible. At over 4,000 vehicles, travel times exceeding 40 minutes are possible, and at over 5,000 vehicles, travel times exceeding 1 hour is possible. However, it must be noted that these thresholds are not steadfast. Weather events, crashes, or other issues may impact travel time and thus lead to heavier delays with fewer vehicle trips. Furthermore, drivers may also choose to spread trips over time for a variety of reasons, which may reduce traffic and congestion peaks.

3.3.2 Origin-Destinations of Stowe Trips

Streetlight data was utilized to determine the origin of the trips ending in Stowe during an average February weekend during the peak winter season. Trips can include visitors, residents, as well as employees that work within Stowe. This section first takes a look at the overall origins of Stowe trips from across the US, and then narrows that perspective by location within Stowe.

3.3.2.1 National and International Trip Origins and Destinations

Figure 12 shows that the highest percentage of trips comes from the Boston area (22%), followed by the New York City area (17%) and the Burlington, VT area (15%). The remaining top percentage locations are generally from points south or east of Stowe. This indicates that the majority of visitors traveling to Stowe will be likely be arriving from the south via I-89 with potentially smaller percentages of visitors arriving from the north via I-89. This type of volume split can help to identify appropriate locations for visitor traveler information.

It should be noted that Streetlight data was not available for cross-border trips. Therefore, Stantec obtained the zip codes of hotel registrations within Stowe during February 2023 to identify the locations of Canadian visitors. However, Canadian visitation was less than 3% of all registrations, with most being from various locations around Ontario and Quebec. No specific trends could be obtained from the limited number of visitors; therefore, Canadian visitor origins were not mapped in **Figure 12**.

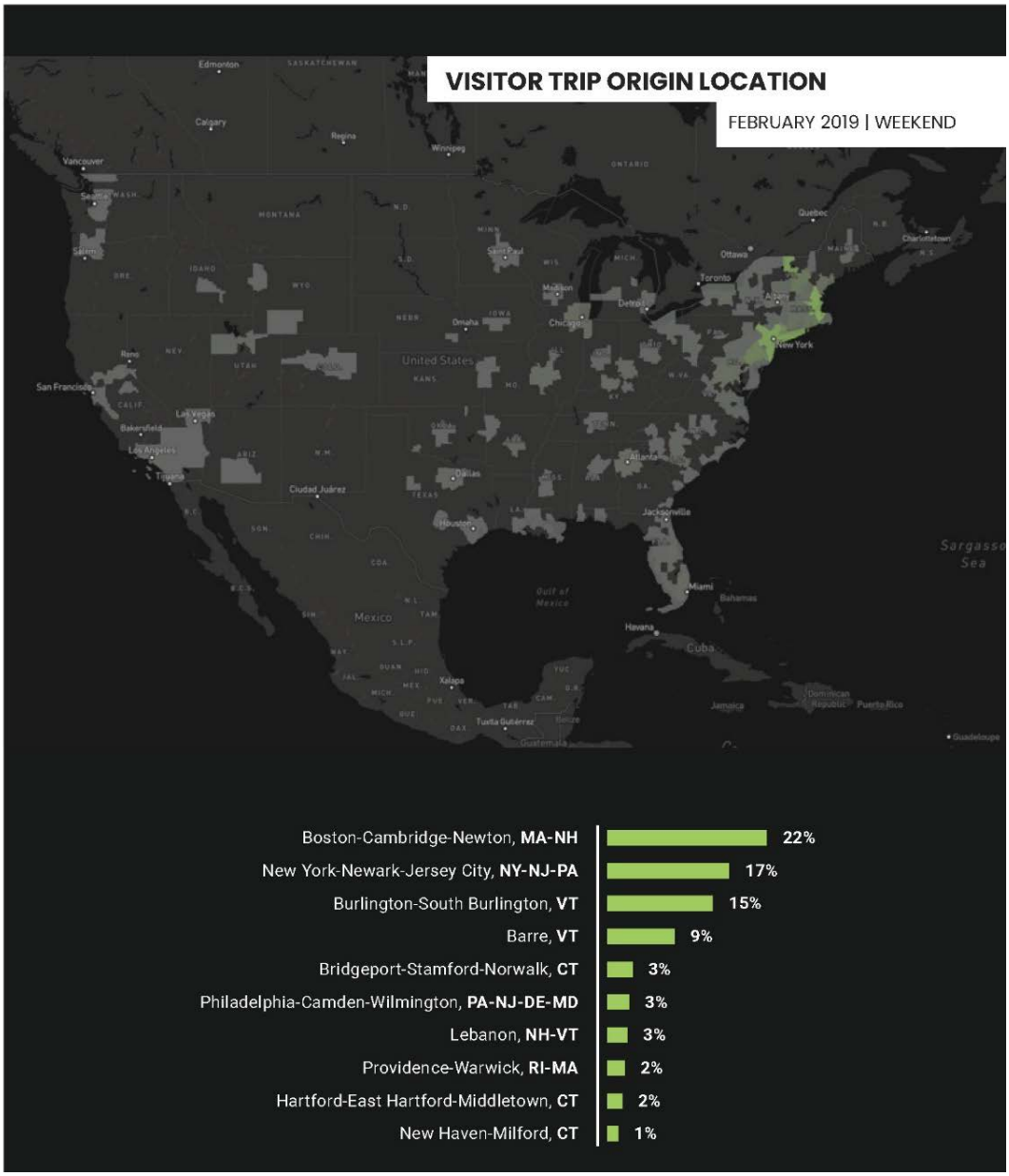

Figure 12: Visitor Origin Locations in the US

Figure 13 shows how the trips originating from outside of Stowe are distributed on an average February weekend by analysis year. As would be expected, SMR, Mountain Road Village, and Stowe Village areas experience the highest percentage of trip destinations as they experience high number of visitor, resident, and employee trips. However, it should also be noted that the trip destinations to SMR decreased significantly in 2023, lining up with the lower total number of visitors experienced in February than is typical. Therefore, there was a proportional increase in trip ends to areas like Mountain Road Village, Stowe Village and Upper Mountain Road. Future monitoring may reveal if the decrease in 2023 was an exception due to the unique conditions experienced in 2023, or if it is indicative of a shift in activity or mode. For example, an increase in the number of Mountain Road shuttle riders would likely lead to a slight decrease in trip ends within SMR.

Another interesting data point is displayed in **Figure 14**. Despite a significant portion of external trips from outside of Stowe coming from the south, there is a relatively even split between trips entering Stowe from the north and south. This could be for a variety of reasons including employees that are working within Stowe, many of which live in communities to the north, as well as visitors staying at locations to the north and then coming into Stowe for skiing and other activities. However, this highlights the importance of ensuring that trips to and from the north are not ignored, as most of the previous studies are heavily focused on the VT 100 (from south) to VT 108 travel route.

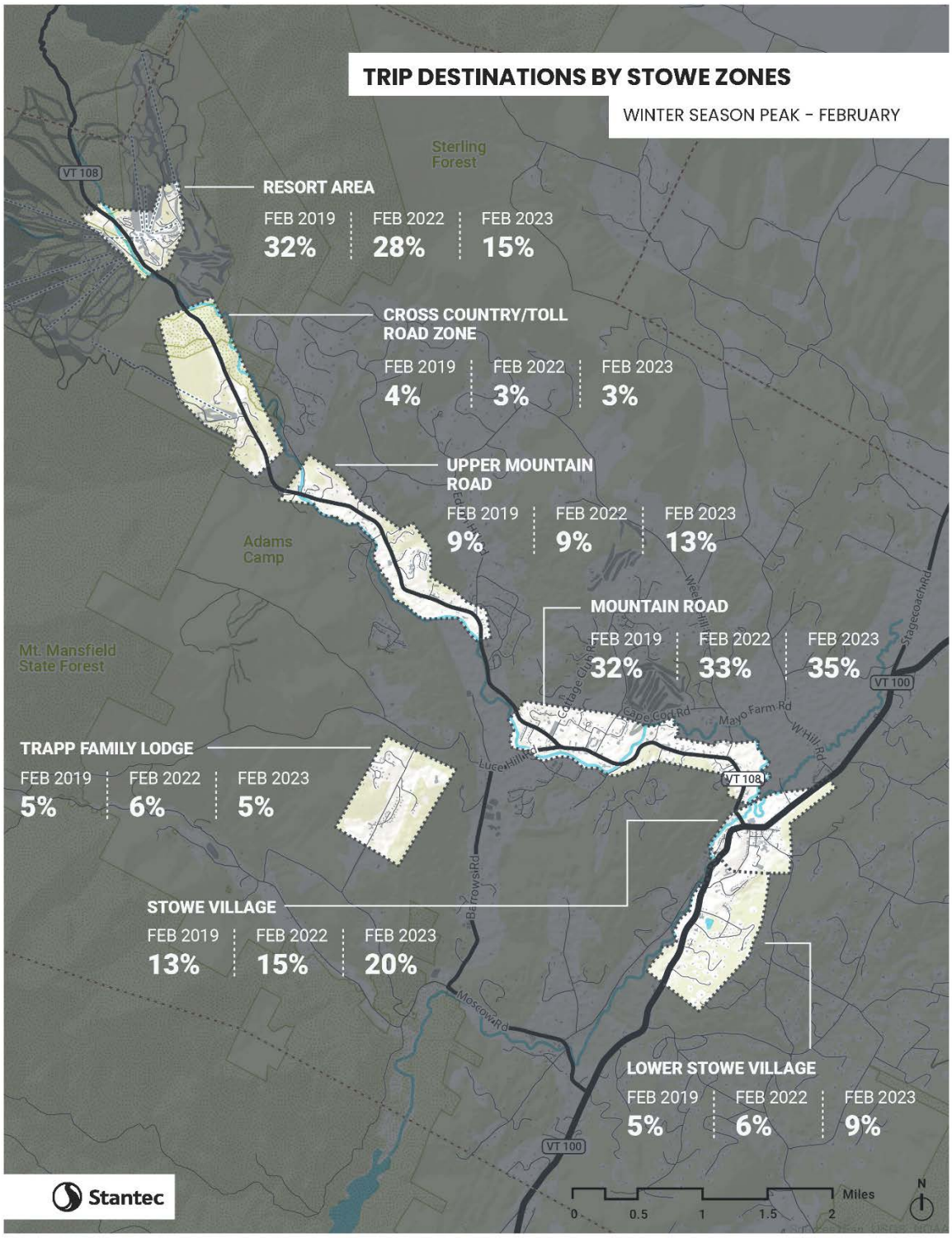

Figure 13: Distribution of Trips to Key Areas of Stowe

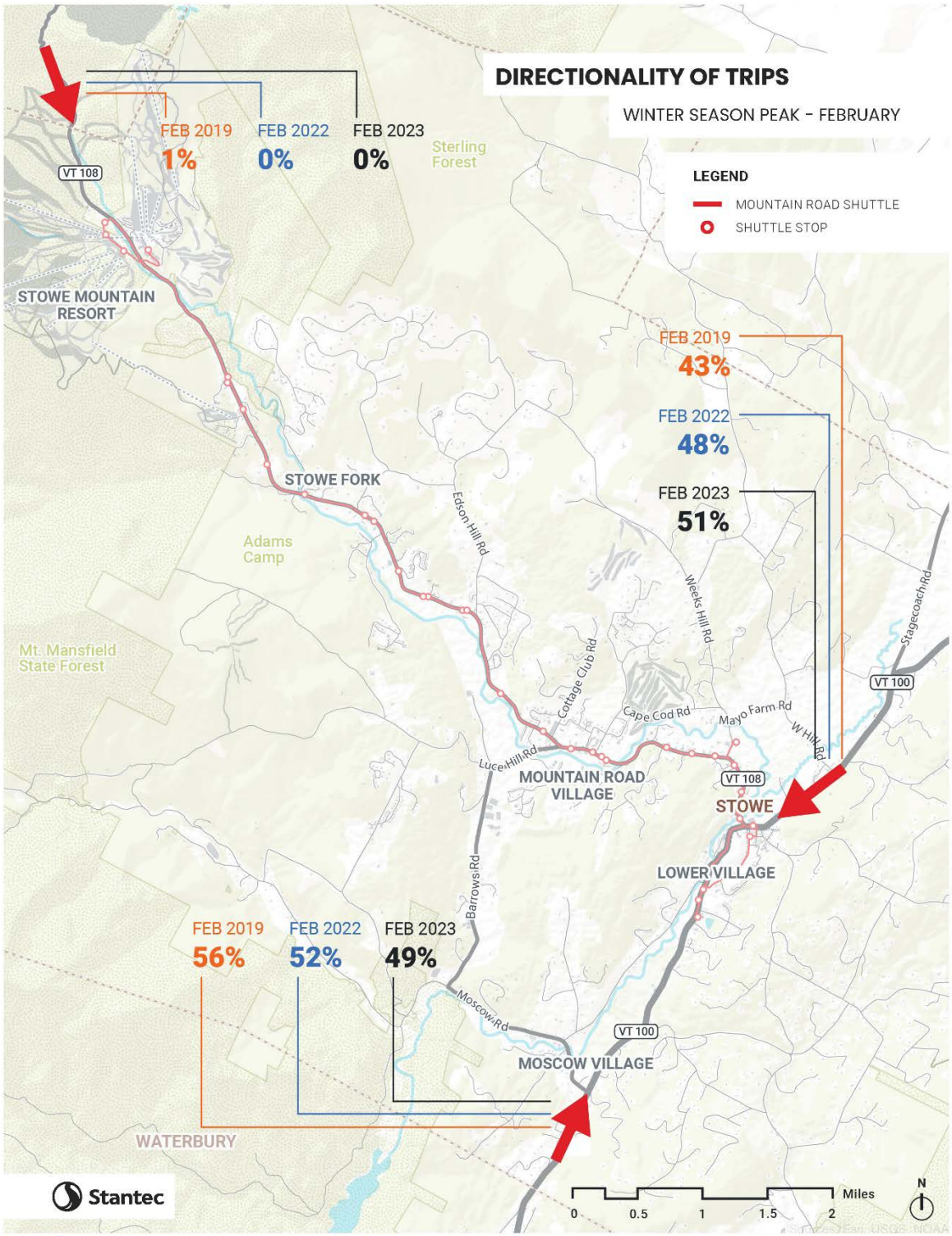

Figure 14: Directional Distribution of Trips into Stowe

3.3.2.2 Destinations within Stowe for Trips Coming from the North

Figure 15 shows the distribution of trips to major routes as well as pass through traffic for trips coming from the north. The data shows a sharp decrease in the percentage of trips heading south through the Village to access VT 108, with a corresponding increase in the use of West Hill Road. Furthermore, the data shows that approximately 30% of traffic entering the Village from the north is pass-through traffic to points south of Stowe. For trips ending in Stowe that originate from points north, the top three destinations within Stowe are in the Village, Mountain Road Village, and SMR (**Figure 16**).

3.3.2.3 Destinations within Stowe for Trips Coming from the South

Figure 17 shows the distribution of trips to major routes as well as pass through traffic for trips coming from the south. The data shows that between 30% and 40% of trips coming from the south utilize Moscow Road to access points to the north and west, such as SMR, Mountain Road Village, and Trapp Family Lodge. Furthermore, the data shows that approximately 30% of traffic entering the Village from the south is pass-through traffic to points north of Stowe. For trips ending in Stowe that originate from points south, Mountain Road Village and SMR receive the highest percentage of trips (**Figure 18**).

3.3.3 Travel Routes

When traffic is congested on the major routes within Stowe, drivers often turn to alternate routes, whether by using a GPS app or local knowledge to avoid as much of the congestion as possible. Secondary routes such as Moscow Road to Luce Hill Road and West Hill Road to Weeks Hill Road, Cape Cod Road or Edson Hill Road play an important role to help distribute traffic more evenly across the limited transportation network in Stowe, and potentially provide alternate routes for local residents and emergency services. However, significant bypass traffic on local streets can stress local infrastructure, create quality of life concerns for residents, and make it more difficult for emergency services to respond. An analysis of bypass traffic for the analysis years (2019, 2022, and 2023) between VT 100 north and south of Stowe to Mountain Road Village and SMR was conducted utilizing the Streetlight data.

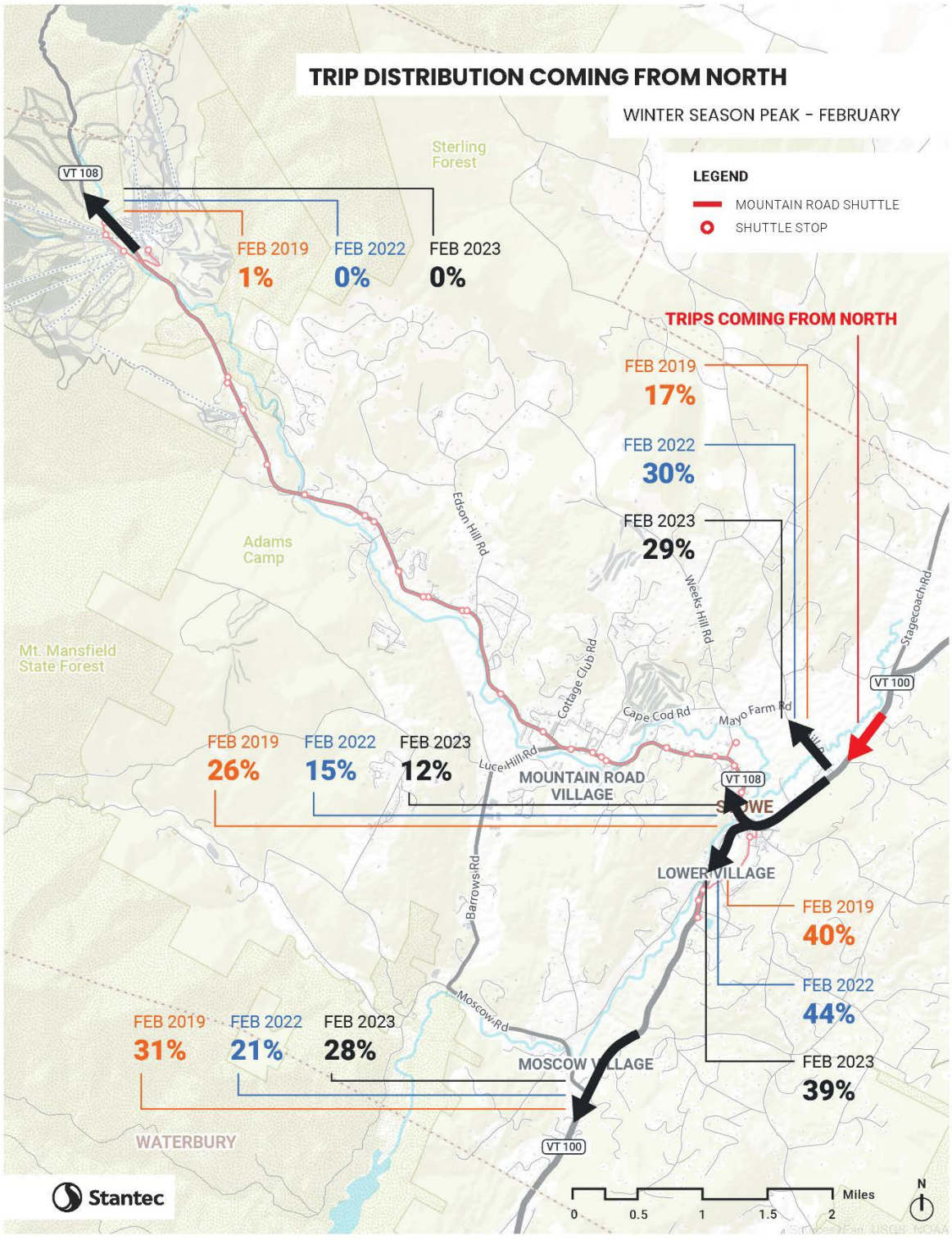

Figure 15: Distribution of Trips from the North

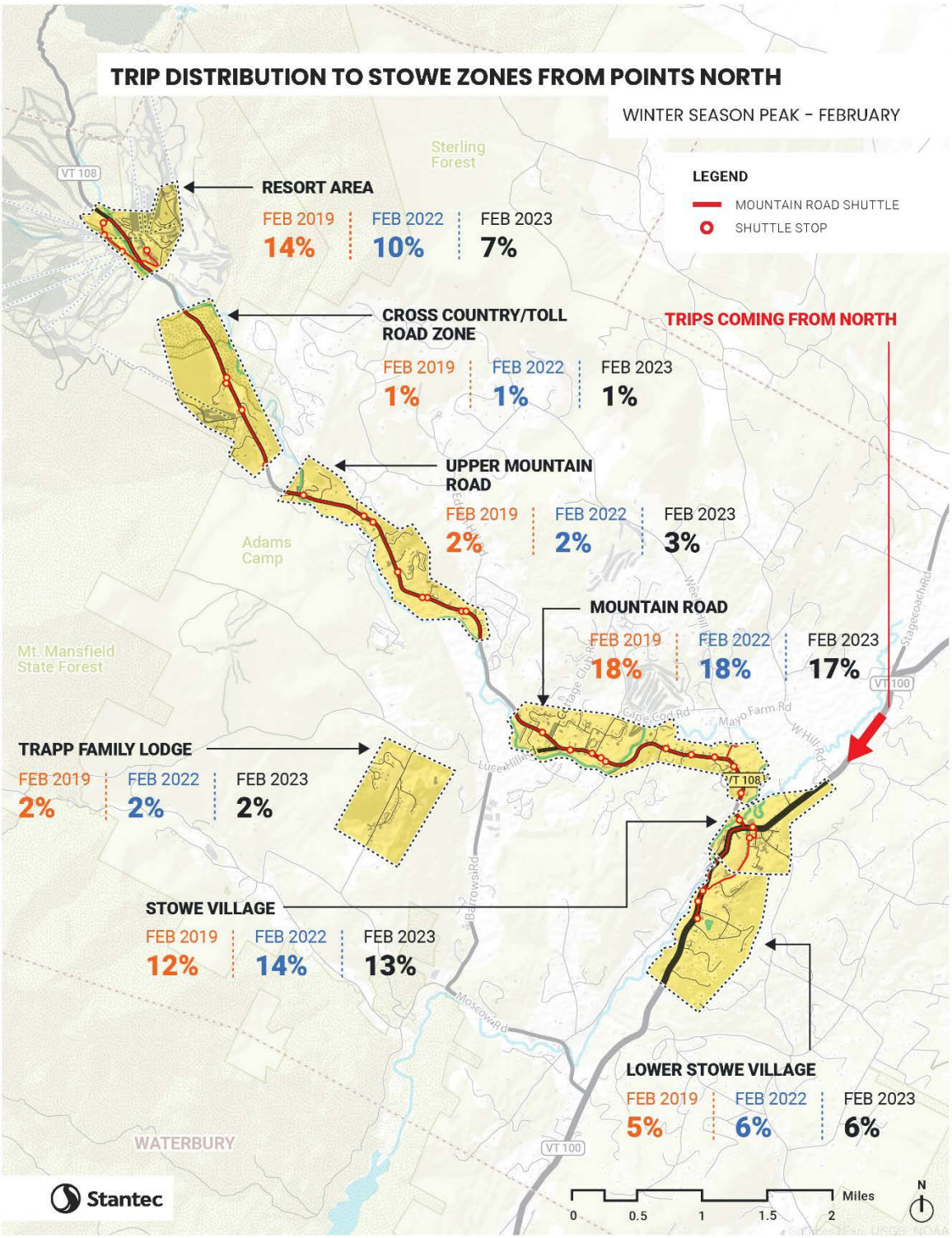

Figure 16: Trip Distribution to Areas within Stowe from Points North

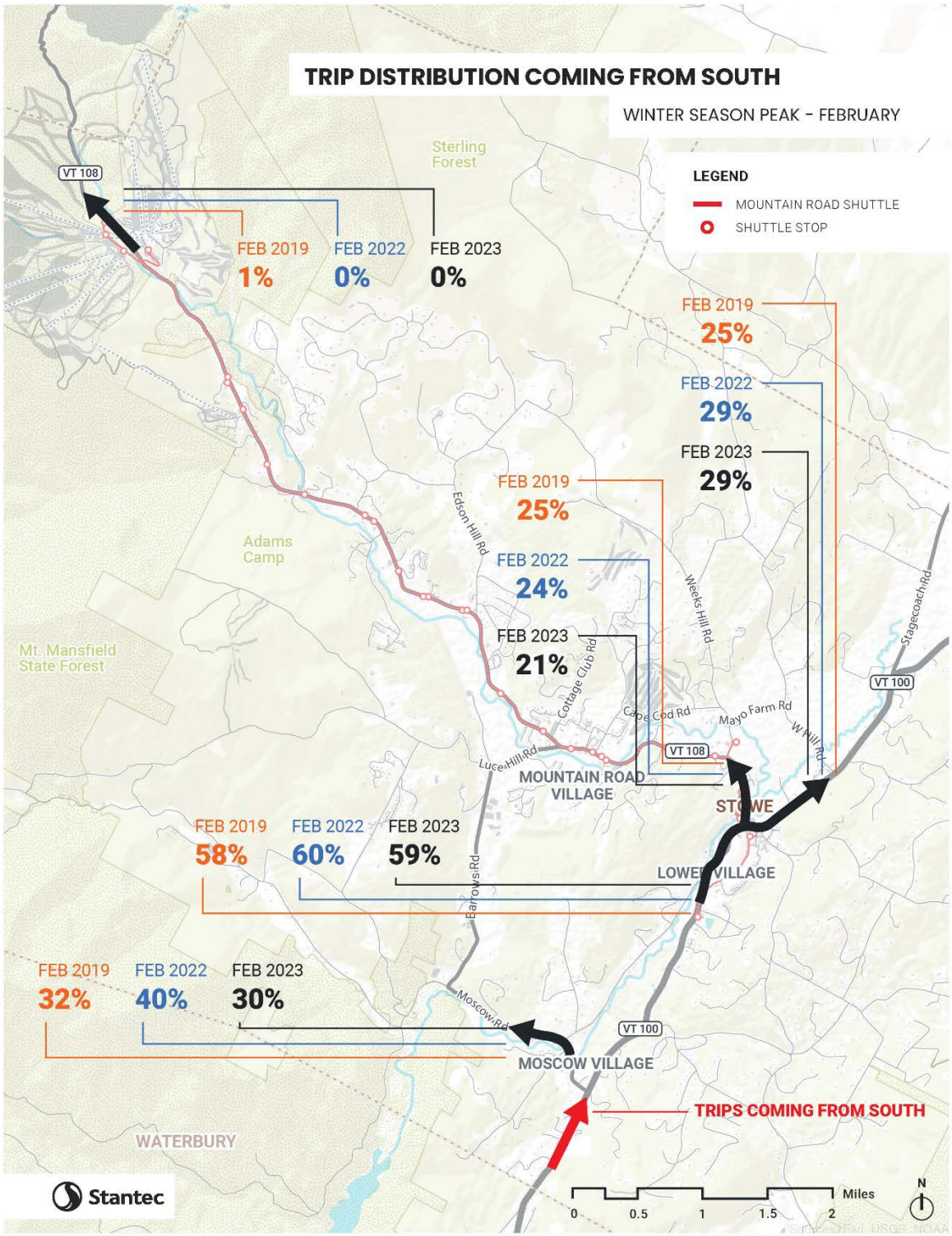

Figure 17: Distribution of Trips from the South

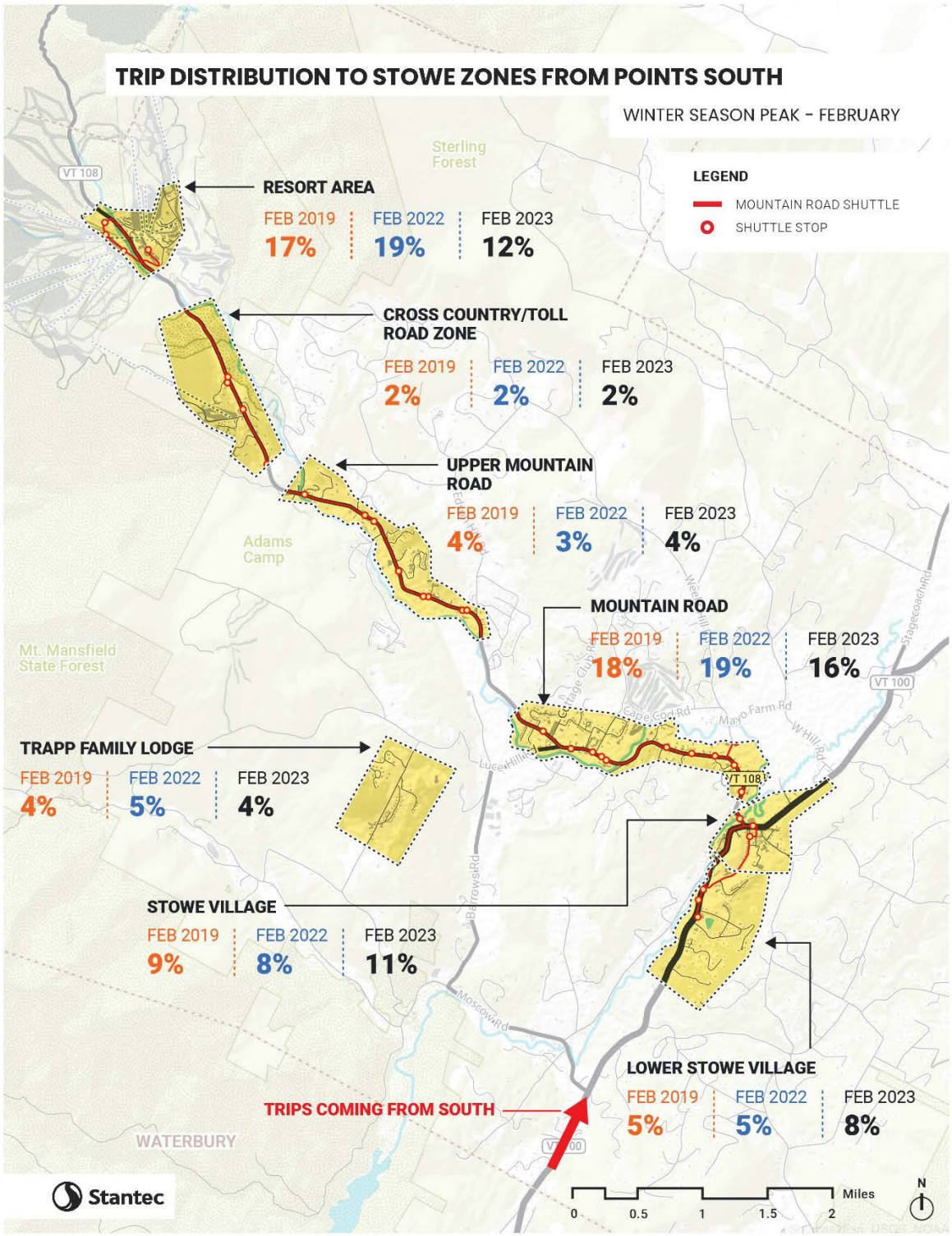

Figure 18: Trip Distribution to Areas within Stowe from Points South

Mountain Road Village

The data shows a substantial increase in the percentage of trips bypassing Stowe Village to access Mountain Road Village. For traffic coming from the north, 37% utilized West Hill Road to either Weeks Hill Road or Cape Cod Road in 2019 (**Figure 19**). That percentage increased to 61% in 2023. For traffic coming from the south, 28% of vehicle trips ending in Mountain Road Village utilized Moscow Road to Luce Hill Road to bypass Stowe Village in 2019, and that percentage increased to 38% in 2023 (**Figure 20**). Interestingly, despite the very limited congestion on Mountain Road in 2023, the percentage of vehicles utilizing the alternate routes continued to increase beyond the 2022 percentages, the year that is widely regarded as experiencing the worst traffic conditions. There could be a variety of reasons for that, including that more people became aware of the bypass routes either through knowledge of them from previous busier seasons, or potentially an even higher reliance on apps like Google Maps and Waze which typically favor these routes regardless of traffic conditions in the Village or on Mountain Road.

Stowe Mountain Resort

Evaluating routes used to access SMR reveals similar patterns to vehicles destined for the Mountain Road Village Area. **Figure 21** shows that 65% of traffic from the south utilized Moscow Road to Luce Hill Road to access SMR in 2016, while that percentage increased to 77% by 2023. Trips coming from the north are slightly more complicated given the variety of routes that can be accessed from West Hill Road. That data reveals a steady decrease in the percentage of trips passing through the Village to access VT 108 (Route A in **Figure 22**), and a corresponding increase of trips utilizing West Hill Road (Route B). The primary route for vehicles accessing SMR from West Hill Road is Cape Cod Road (Route E), which saw an increase in trip share from 27% in 2019 to 58% in 2023. A smaller percentage utilized Weeks Hill Road (Route C), which grew at a slower rate from 18% in 2019 to 23% in 2023.

The percentage of vehicles that turned from VT 108 to Weeks Hill Road to use either Cape Cod Road or Edson Hill Road dropped from 7% in 2019 to 0% in 2023, likely because most vehicles that bypass the Village to access VT 108 are doing so from West Hill Road. The use of Edson Hill Road also spiked in 2022, going from 1% in 2019, to 15% in 2022, and then decreased to 0% in 2023. This was likely due to the extraordinary levels of congestion experienced in 2022 which diverted substantial traffic to Edson Hill Road, which is narrow and unpaved and in general provides a much more circuitous route to access VT 108. The lower levels of traffic congestion in 2023 and the subsequent 0% share to Edson Hill Road clearly indicates that Edson Hill Road is only utilized in extremely heavy traffic conditions, likely when trip ends to SMR are greater than 5,000 trips (see Section 3.3.1).

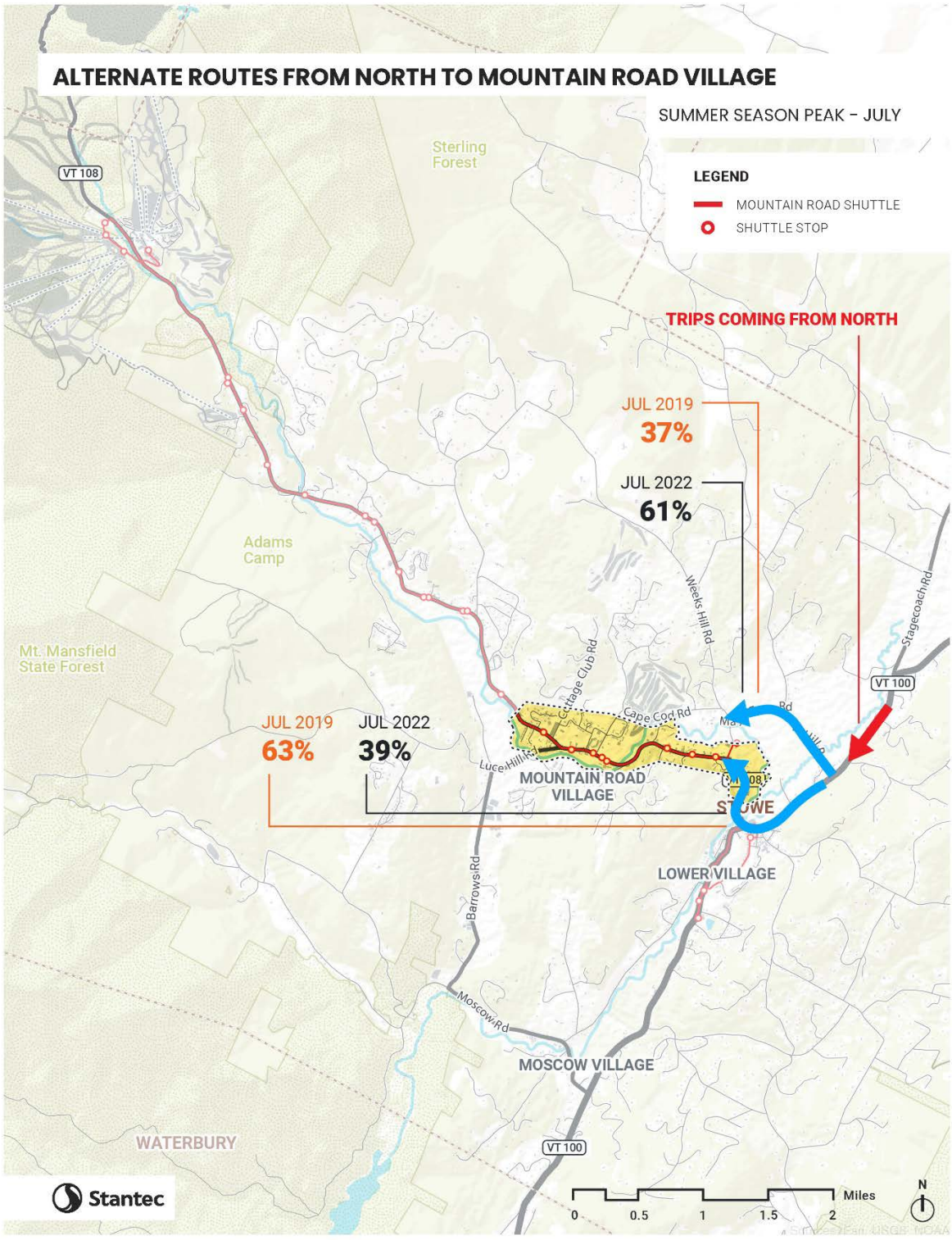

Figure 19: Trip Routes from the North to Mountain Road Village

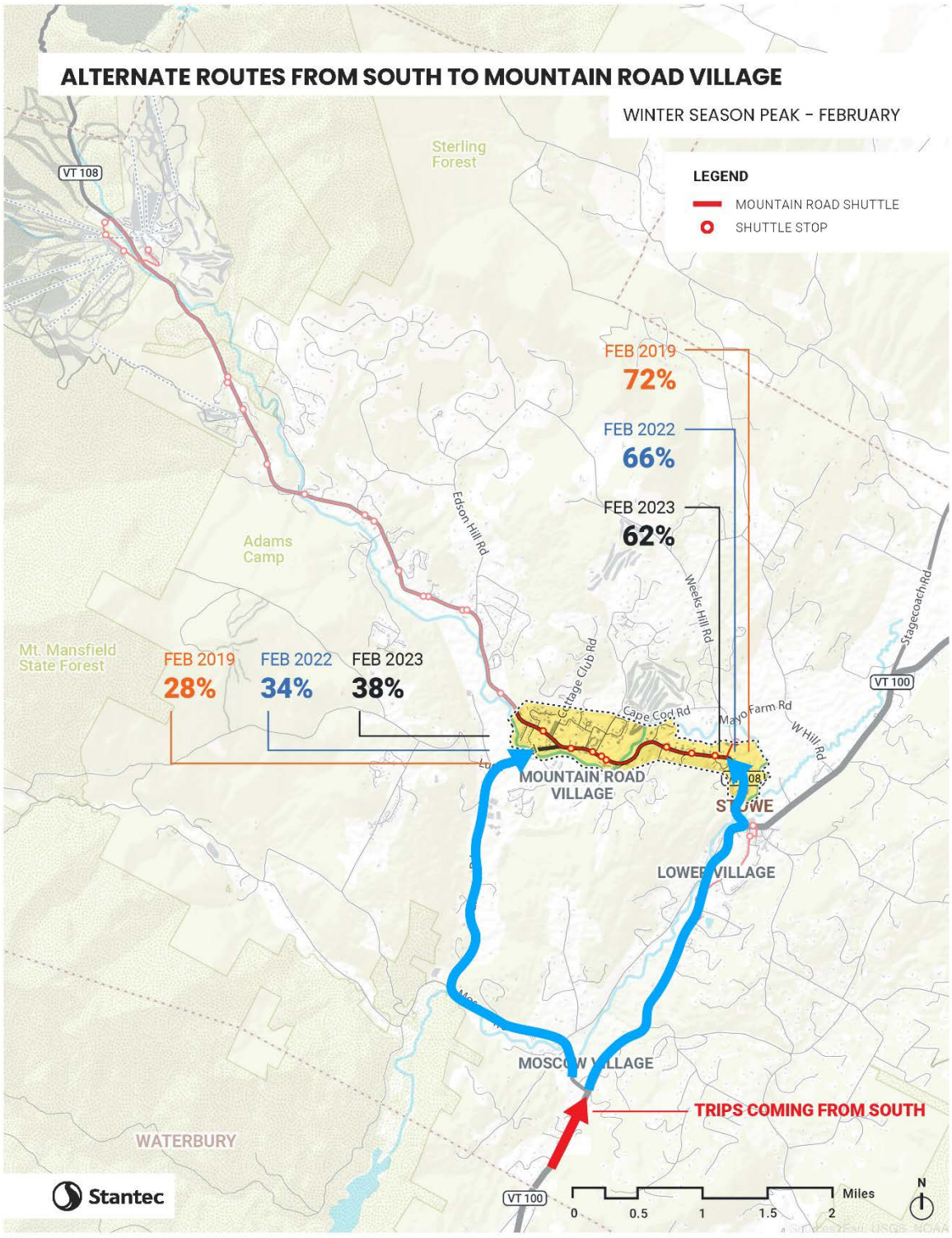

Figure 20: Trip Routes from the South to Mountain Road Village

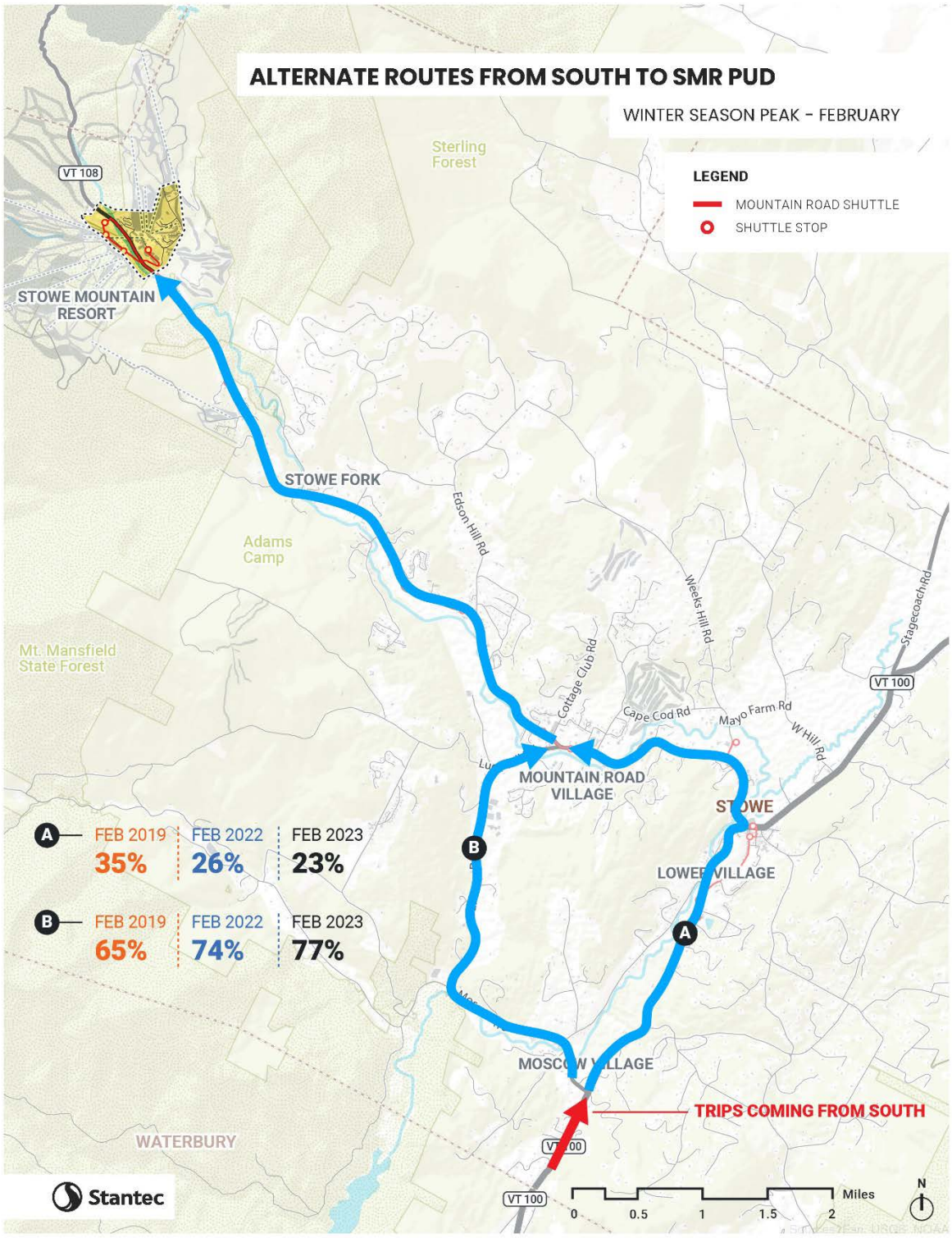

Figure 21: Trip Routes from the South to SMR

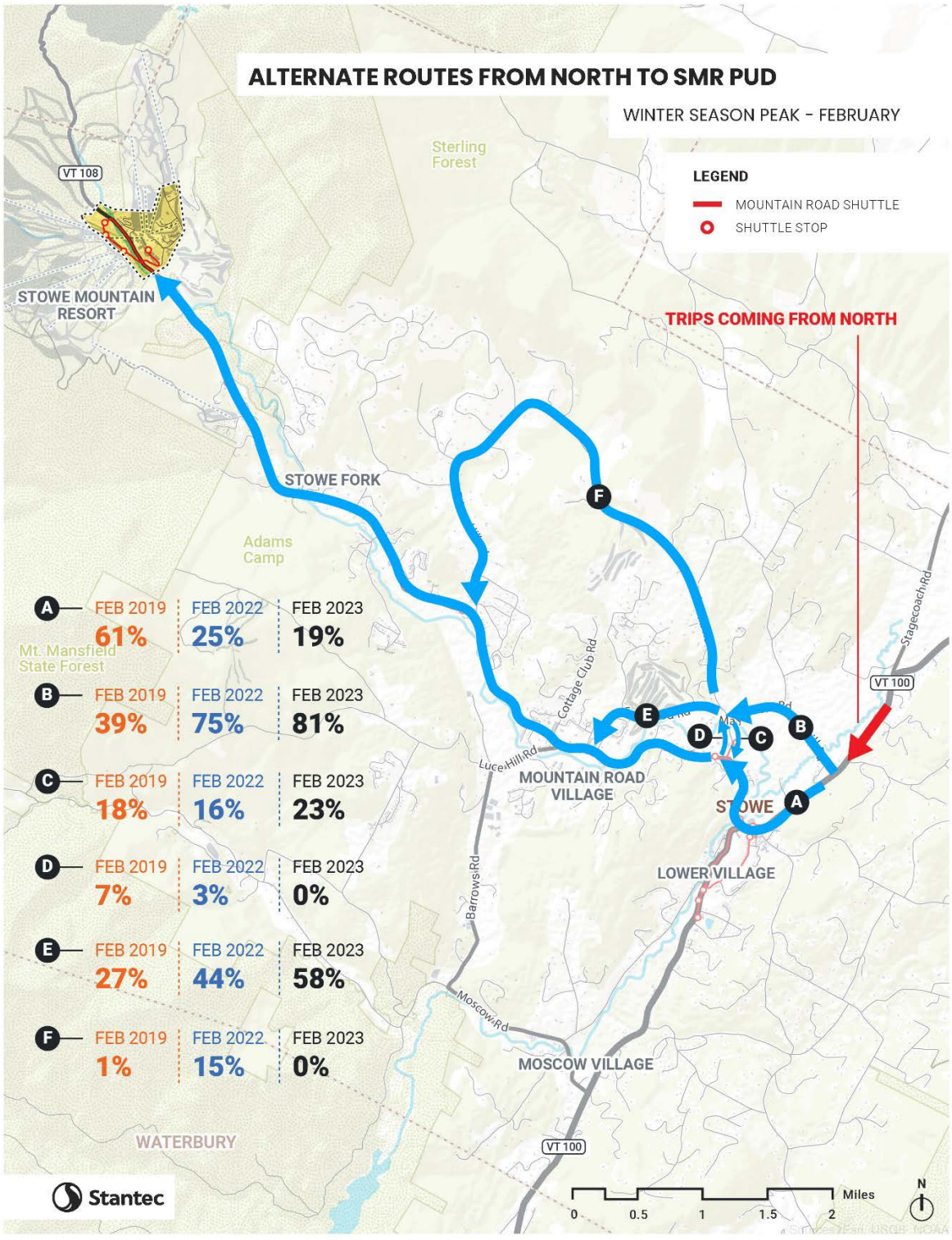

Figure 22: Trip Routes from the North to SMR

3.3.4 Volume and Delay Profiles

Finally, Streetlight was also utilized to develop daily average volume and delay profiles for selected roadway segments within the study area to evaluate the timing of peak volumes and delay and the corresponding relationship. Several locations were evaluated, including VT 108 in SMR, VT 108 in Mountain Road Village, VT 100/108 in Stowe Village, and VT 100 at West Hill Road. Two figures are provided for each location: one showing the distribution of bi-directional volume across an average weekend day, and one showing the vehicle hours of delay across an average weekend day. Vehicle hours of delay is a measurement of the aggregate time that vehicles on a roadway segment spend in congestion versus the travel time it would take in free flow conditions.

VT 108 at SMR

Figures 24 and **25** show the vehicle hours of delay and average volumes, respectively. Interestingly, the data shows that volume peaks significantly higher in the morning than in the afternoon, while delay does the opposite. However, upon further assessment of the conditions in SMR it was clear that the afternoon experiences more delay because of the exiting traffic. As SMR closes for the day, a large percentage of patrons exit at the same time and exit queues can be significant. Despite Presidents Day weekend in 2023 having lower overall traffic volumes, exit queuing was observed (**Figure 23**). Despite Stowe police directing traffic at the intersection of VT 108, SMR parking lot exit driveway and Spruce Peak, there is little that can be done with the existing exit capacity to enhance the flow of vehicles exiting. However, the data does indicate potential opportunities for SMR to consider ways to help distribute exiting traffic. These opportunities will be discussed in Section 9.0.

Figure 23: Vehicles Waiting to Exit SMR on Presidents Day Weekend 2023

Table 3 translates the data into an estimated delay experienced by each vehicle and the equivalent unsignalized intersection LOS that helps to contextualize the delay values. The data shows that LOS E and F conditions were experienced generally between 3:00 PM and 5:00 PM. However, the LOS E and F conditions do not occur at the volume peak (8:00 AM – 9:00 AM) indicating that the volumes are likely being constrained by delay generated by the exiting vehicles.

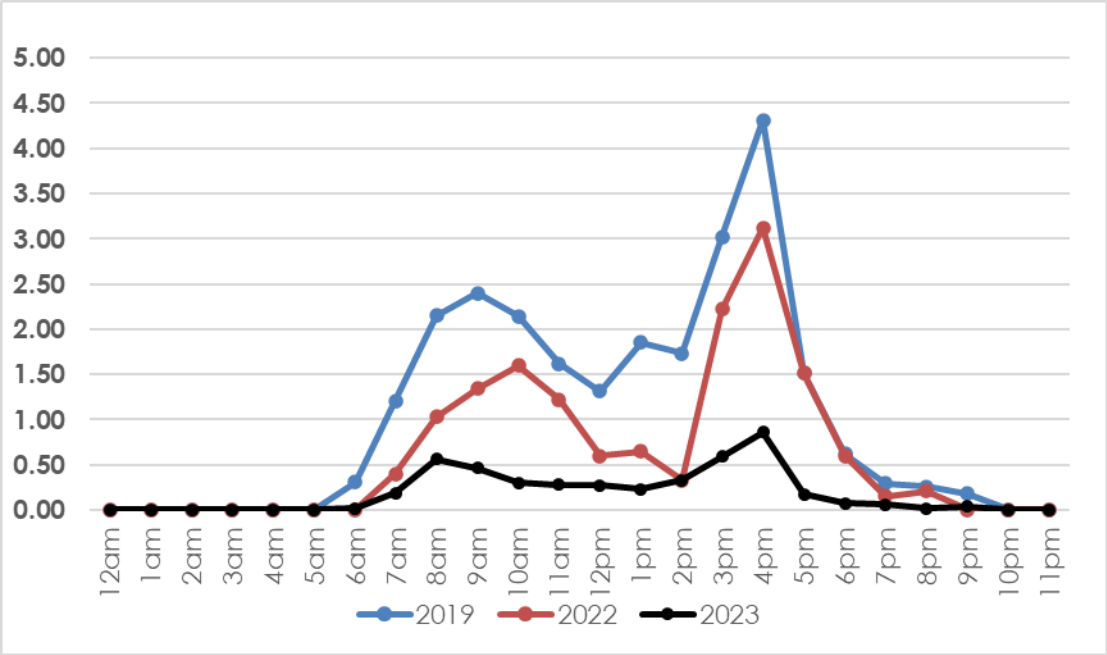

Figure 24: Vehicle Hours of Delay on an Average February Weekend at SMR

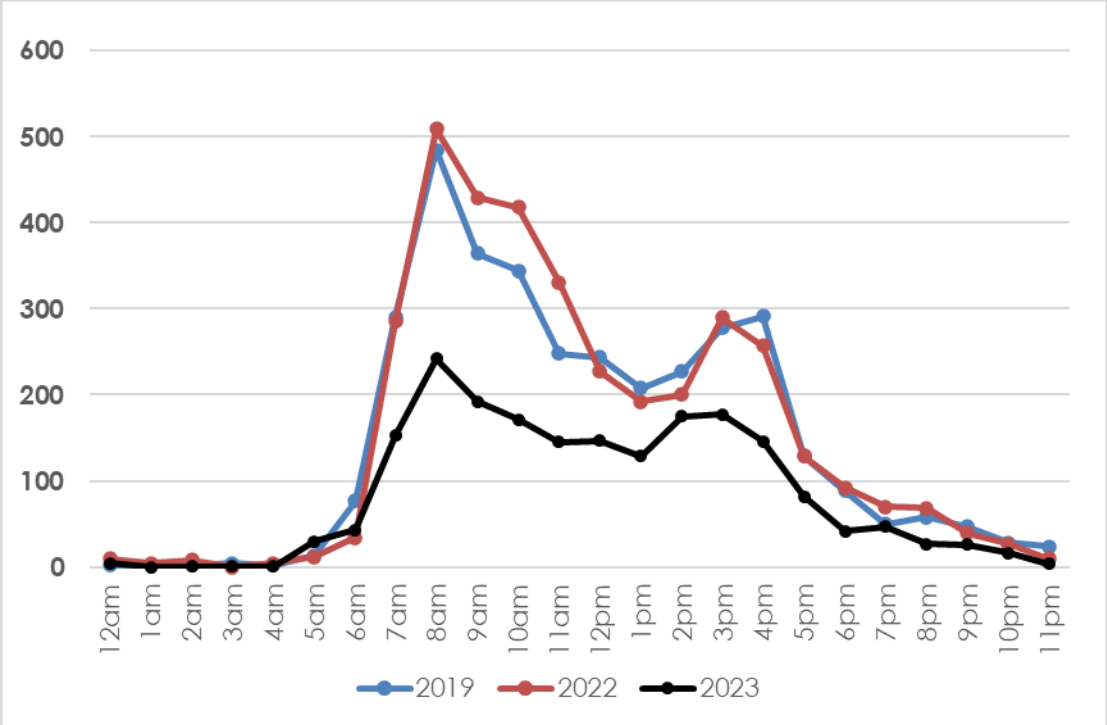

Figure 25: Bi-Directional Vehicle Volumes on VT 108 at SMR During an Average Weekend Day in February

Table 3: Estimated Vehicle Delay and Equivalent LOS for VT 108 at SMR

	Delay (sec/veh)			Equivalent Intersection LOS		
Time	**2019**	**2022**	**2023**	**2019**	**2022**	**2023**
01: 12am (12am-1am)	0.0	0.0	0.0	A	A	A
02: 1am (1am-2am)	0.0	0.0	0.0	A	A	A
03: 2am (2am-3am)	0.0	0.0	0.0	A	A	A
04: 3am (3am-4am)	0.0	0.0	0.0	A	A	A
05: 4am (4am-5am)	0.0	0.0	0.0	A	A	A
06: 5am (5am-6am)	0.0	0.0	0.0	A	A	A
07: 6am (6am-7am)	14.5	0.0	1.7	B	A	A
08: 7am (7am-8am)	15.0	5.0	4.5	B	A	A
09: 8am (8am-9am)	16.0	7.3	8.3	C	A	A
10: 9am (9am-10am)	23.7	11.2	8.6	C	B	A
11: 10am (10am-11am)	22.4	13.8	6.3	C	B	A
12: 11am (11am-12noon)	23.5	13.3	7.0	C	B	A
13: 12pm (12noon-1pm)	19.4	9.5	6.6	C	A	A
14: 1pm (1pm-2pm)	32.1	12.2	6.4	D	B	A
15: 2pm (2pm-3pm)	27.4	5.9	6.8	D	A	A
16: 3pm (3pm-4pm)	39.2	27.6	12.0	E	D	B
17: 4pm (4pm-5pm)	53.3	43.7	21.2	F	E	C
18: 5pm (5pm-6pm)	42.1	42.3	7.5	E	E	A
19: 6pm (6pm-7pm)	25.2	23.4	6.0	D	C	A
20: 7pm (7pm-8pm)	20.9	7.7	4.6	C	A	A
21: 8pm (8pm-9pm)	16.1	11.0	2.7	C	B	A
22: 9pm (9pm-10pm)	13.9	0.0	5.5	B	A	A
23: 10pm (10pm-11pm)	0.0	0.0	0.0	A	A	A
24: 11pm (11pm-12am)	0.0	0.0	0.0	A	A	A

VT 108 in Mountain Road Village

Figures 26 and **27** show the vehicle hours of delay and average volumes, respectively. Similarly to VT 108 at SMR, the data shows a more pronounced peak in vehicle hours of delay in the afternoon. However, unlike the data near SMR, the bi-directional volume on VT 108 in this segment also spikes in the afternoon. This is likely due to the combination of vehicles traveling away from SMR at the end of the ski day and vehicles generally traveling around the area to access the shopping, dining, and lodging within Stowe. It should also be noted that VT 108 in Mountain Road Village experiences the highest volume and delay peaks of any of the locations that were examined in this section.

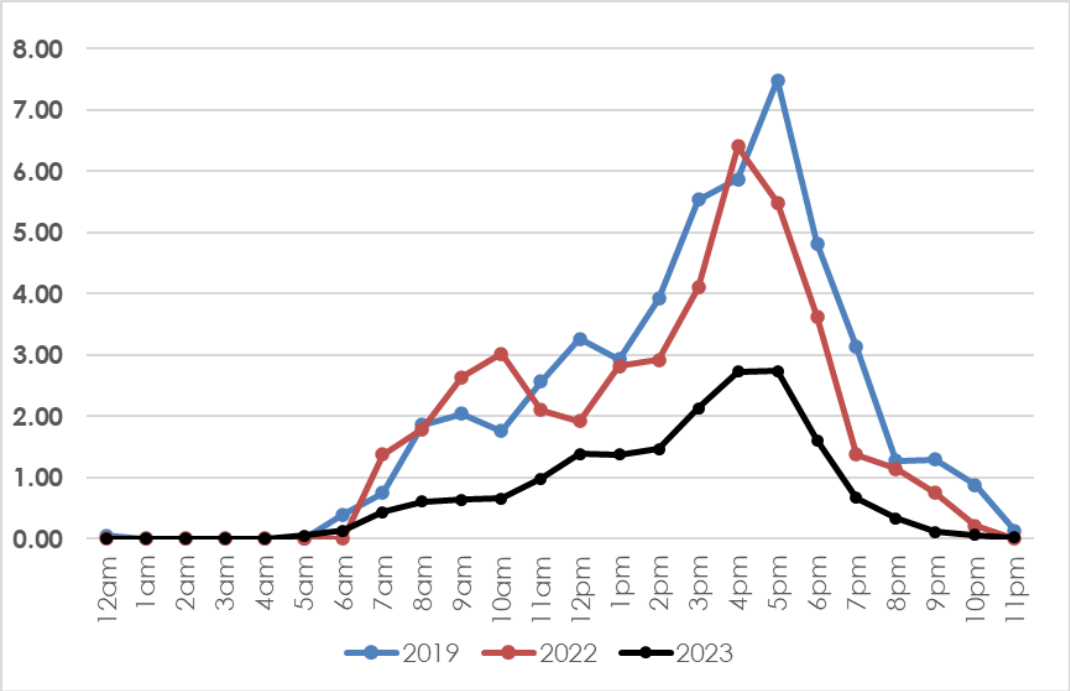

Figure 26: Vehicle Hours of Delay on an Average February Weekend on VT 108 in Mountain Road Village

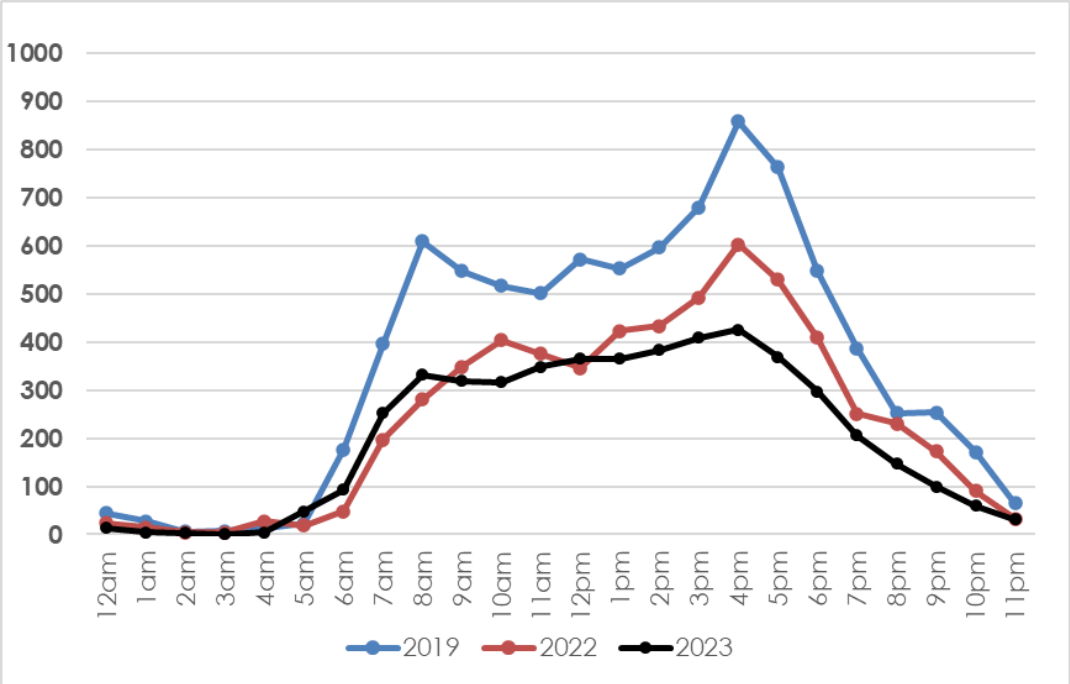

Figure 27: Bi-Directional Vehicle Volumes on VT 108 in Mountain Road Village During an Average Weekend Day in February

Table 4 translates the data into an estimated delay experienced by each vehicle and the equivalent unsignalized intersection LOS that helps to contextualize the delay values. The data shows LOS E conditions were experienced generally between 4:00 PM and 6:00 PM. Unlike the SMR location, the high delay corresponds directly to the peak in bi-directional volume of over 700 vehicles per hour.

Table 4: Estimated Vehicle Delay and Equivalent LOS for VT 108 in Mountain Road Village

	Delay (sec/veh)			Equivalent Intersection LOS		
Time	**2019**	**2022**	**2023**	**2019**	**2022**	**2023**
01: 12am (12am-1am)	4.1	0.0	0.0	A	A	A
02: 1am (1am-2am)	0.0	0.0	0.0	A	A	A
03: 2am (2am-3am)	0.0	0.0	0.0	A	A	A
04: 3am (3am-4am)	0.0	0.0	0.0	A	A	A
05: 4am (4am-5am)	0.0	0.0	0.0	A	A	A
06: 5am (5am-6am)	0.0	0.0	3.8	A	A	A
07: 6am (6am-7am)	8.0	0.0	5.1	A	A	A
08: 7am (7am-8am)	6.8	25.1	6.1	A	D	A
09: 8am (8am-9am)	11.0	22.9	6.6	B	C	A
10: 9am (9am-10am)	13.4	27.2	7.2	B	D	A
11: 10am (10am-11am)	12.3	26.9	7.5	B	D	A
12: 11am (11am-12noon)	18.4	20.1	10.1	C	C	B
13: 12pm (12noon-1pm)	20.5	20.0	13.6	C	C	B
14: 1pm (1pm-2pm)	19.1	24.0	13.5	C	C	B
15: 2pm (2pm-3pm)	23.7	24.2	13.7	C	C	B
16: 3pm (3pm-4pm)	29.4	30.0	18.7	D	D	C
17: 4pm (4pm-5pm)	24.6	38.3	23.1	C	E	C
18: 5pm (5pm-6pm)	35.3	37.4	26.7	E	E	D
19: 6pm (6pm-7pm)	31.7	31.9	19.5	D	D	C
20: 7pm (7pm-8pm)	29.2	19.6	11.7	D	C	B
21: 8pm (8pm-9pm)	18.1	17.8	8.1	C	C	A
22: 9pm (9pm-10pm)	18.4	15.7	4.0	C	C	A
23: 10pm (10pm-11pm)	18.5	8.4	3.6	C	A	A
24: 11pm (11pm-12am)	7.3	0.0	2.3	A	A	A

VT 100/108 in Stowe Village

Figures 28 and **29** show the vehicle hours of delay and average volumes, respectively. The Stowe Village data shows more sustained activity throughout the day with a smaller differential between the afternoon peak and the rest of the day than the other locations analyzed in this section. This indicates the Village is an activity center with sustained volumes throughout the day from both visitors, employees, and residents, as well as vehicles passing through to locations to the north or south. Data for 2022 and 2023 shows lower volume overall than in 2019; however, delay was higher in 2022 and 2023. This conflict between the delay data and the volume data likely indicates that volume was constricted through the analysis area more in 2022 and 2023, leading to lower recorded volumes but higher unmet demand.

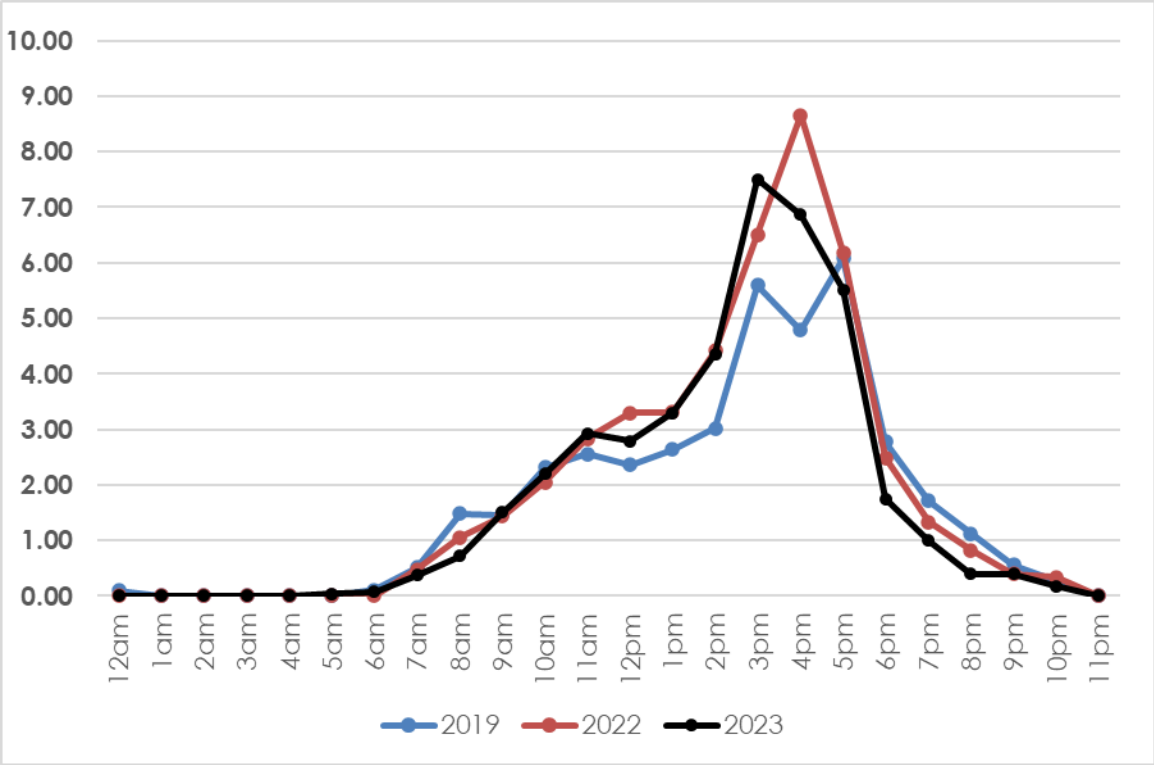

Figure 28: Vehicle Hours of Delay on an Average February Weekend in the Area of the VT 100/108 Intersection in Stowe Village

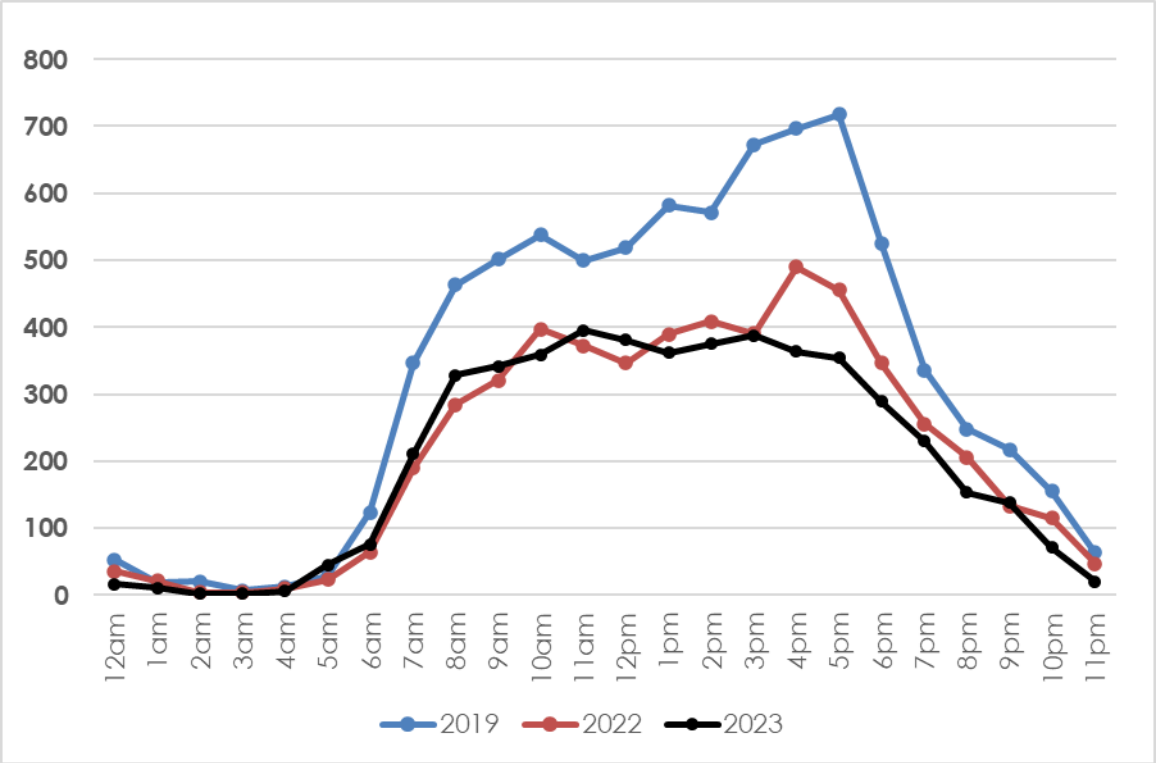

Figure 29: Bi-Directional Vehicle Volumes on an Average February Weekend in the Area of the VT 100/108 Intersection in Stowe Village

Table 5 translates the data into an estimated delay experienced by each vehicle and the equivalent unsignalized intersection LOS that helps to contextualize the delay values. The data shows LOS E conditions were experienced generally between 2:00 PM and 6:00 PM. High delays on this segment are primarily due to the intersection of VT 100 and VT 108. The data shows that when conflicting volumes begin to exceed 400 vph, the intersection becomes congested, resulting in long queues on VT 108.

Table 5: Estimated Vehicle Delay and Equivalent LOS for VT 100 in Stowe Village

	Delay (sec/veh)			Equivalent Intersection LOS		
Time	**2019**	**2022**	**2023**	**2019**	**2022**	**2023**
01: 12am (12am-1am)	6.1	0.0	0.0	A	A	A
02: 1am (1am-2am)	0.0	0.0	0.0	A	A	A
03: 2am (2am-3am)	0.0	0.0	0.0	A	A	A
04: 3am (3am-4am)	0.0	0.0	0.0	A	A	A
05: 4am (4am-5am)	0.0	0.0	0.0	A	A	A
06: 5am (5am-6am)	0.0	0.0	3.2	A	A	A
07: 6am (6am-7am)	3.2	0.0	3.3	A	A	A
08: 7am (7am-8am)	5.3	8.9	6.3	A	A	A

	Delay (sec/veh)			Equivalent Intersection LOS		
Time	**2019**	**2022**	**2023**	**2019**	**2022**	**2023**
09: 8am (8am-9am)	11.5	13.3	7.9	B	B	A
10: 9am (9am-10am)	10.5	16.2	15.8	B	C	C
11: 10am (10am-11am)	15.5	18.6	22.1	C	C	C
12: 11am (11am-12noon)	18.4	27.4	26.6	C	D	D
13: 12pm (12noon-1pm)	16.4	34.2	26.4	C	D	D
14: 1pm (1pm-2pm)	16.3	30.6	32.9	C	D	D
15: 2pm (2pm-3pm)	19.0	39.0	41.9	C	E	E
16: 3pm (3pm-4pm)	29.9	60.1	69.6	D	F	F
17: 4pm (4pm-5pm)	24.7	63.7	67.9	C	F	F
18: 5pm (5pm-6pm)	30.5	48.8	56.0	D	E	F
19: 6pm (6pm-7pm)	19.0	25.9	21.8	C	D	C
20: 7pm (7pm-8pm)	18.3	18.7	15.7	C	C	C
21: 8pm (8pm-9pm)	16.3	14.4	9.4	C	B	A
22: 9pm (9pm-10pm)	9.3	10.8	10.5	A	B	B
23: 10pm (10pm-11pm)	6.5	10.6	8.6	A	B	A
24: 11pm (11pm-12am)	0.0	0.0	0.0	A	A	A

VT 100 at West Hill Road

Figures 30 and **31** show the vehicle hours of delay and average volumes, respectively. The volume distribution along VT 100 near West Hill Road is similar to that of the Stowe Village data which show sustained volumes and less peaking. However, the delay values are more variable, particularly year to year. While the 2019 volumes were similar to the 2022 and 2023 volumes, the delay experienced in 2019 was much more significant, particularly in the afternoon peak period. At this time, it is not clear what contributed to the higher delays in 2019; however, data shown in **Table 6** shows that overall delay to vehicles on VT 100 was low on this segment.

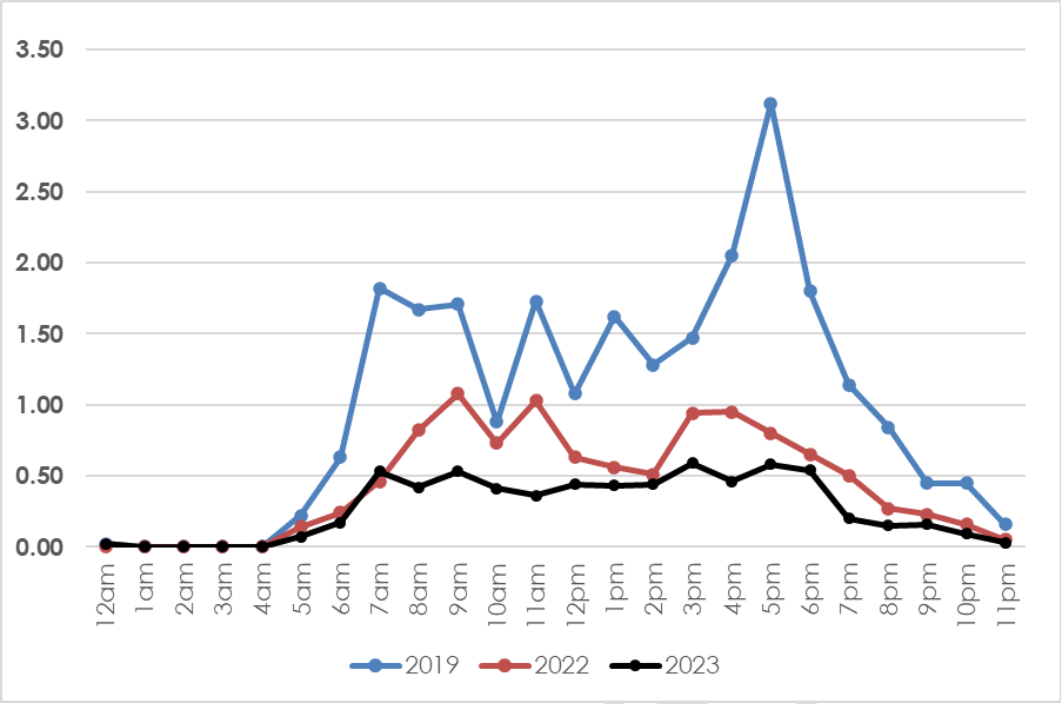

Figure 30: Vehicle Hours of Delay on an Average February Weekend on VT 100 near West Hill Road

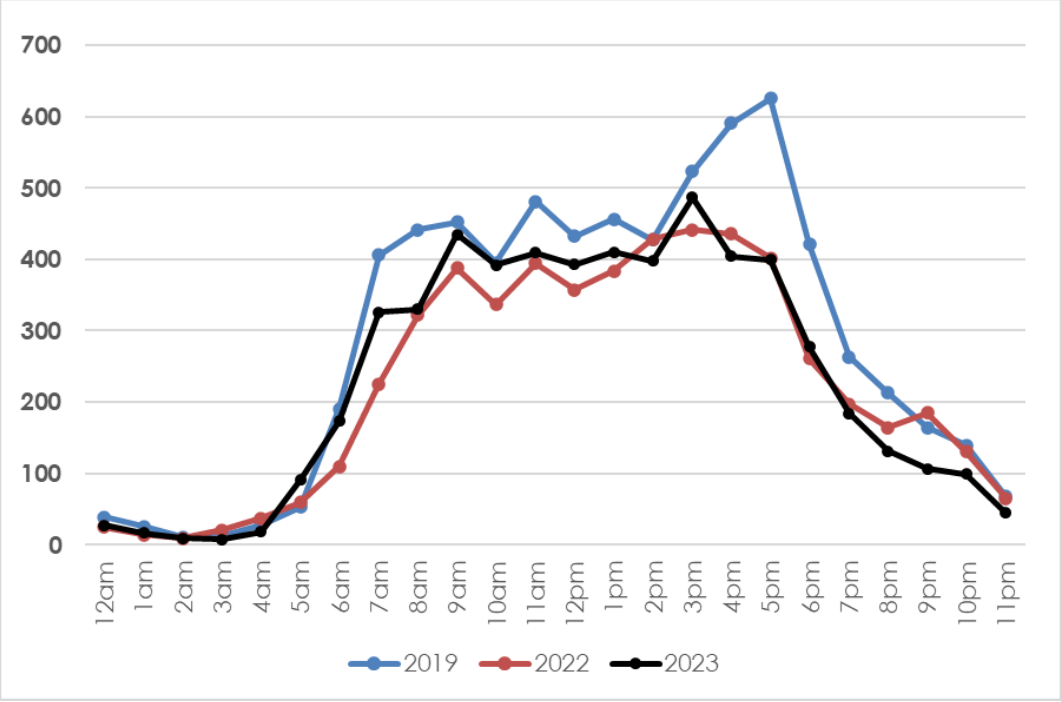

Figure 31: Bi-Directional Vehicle Volumes on VT 100 near West Hill Road During an Average Weekend Day in February

Table 6: Estimated Vehicle Delay and Equivalent LOS for VT 100 at West Hill Road

	Delay (sec/veh)			Equivalent Intersection LOS		
Time	**2019**	**2022**	**2023**	**2019**	**2022**	**2023**
01: 12am (12am-1am)	1.9	0.0	2.7	A	A	A
02: 1am (1am-2am)	0.0	0.0	0.0	A	A	A
03: 2am (2am-3am)	0.0	0.0	0.0	A	A	A
04: 3am (3am-4am)	0.0	0.0	0.0	A	A	A
05: 4am (4am-5am)	0.0	0.0	0.0	A	A	A
06: 5am (5am-6am)	15.1	8.5	2.8	C	A	A
07: 6am (6am-7am)	11.9	7.9	3.5	B	A	A
08: 7am (7am-8am)	16.2	7.4	5.9	C	A	A
09: 8am (8am-9am)	13.6	9.2	4.6	B	A	A
10: 9am (9am-10am)	13.6	10.0	4.4	B	B	A
11: 10am (10am-11am)	8.0	7.8	3.8	A	A	A
12: 11am (11am-12noon)	12.9	9.4	3.2	B	A	A
13: 12pm (12noon-1pm)	9.0	6.3	4.0	A	A	A
14: 1pm (1pm-2pm)	12.8	5.3	3.8	B	A	A
15: 2pm (2pm-3pm)	10.8	4.3	4.0	B	A	A
16: 3pm (3pm-4pm)	10.1	7.7	4.4	B	A	A
17: 4pm (4pm-5pm)	12.5	7.8	4.1	B	A	A
18: 5pm (5pm-6pm)	18.0	7.2	5.2	C	A	A
19: 6pm (6pm-7pm)	15.4	9.0	7.0	C	A	A
20: 7pm (7pm-8pm)	15.6	9.1	3.9	C	A	A
21: 8pm (8pm-9pm)	14.2	5.9	4.1	B	A	A
22: 9pm (9pm-10pm)	9.9	4.5	5.4	A	A	A
23: 10pm (10pm-11pm)	11.6	4.4	3.3	B	A	A
24: 11pm (11pm-12am)	8.5	2.8	2.4	A	A	A

3.4 SUMMER SEASON PEAK – JULY

3.4.1 Evaluation of Daily Trip Activity

3.4.2 Origin-Destination of Stowe Trips

3.4.3 Travel Routes

3.4.4 Volume and Delay Profiles

3.5 FALL SEASON PEAK – OCTOBER

3.5.1 Evaluation of Daily Trip Activity

3.5.2 Origin-Destination of Stowe Trips

3.5.3 Travel Routes

3.5.4 Volume and Delay Profiles

4.0 SAFETY AND OPERATIONS

Following the evaluation of overall travel trends utilizing the Streetlight location-based data, Stantec conducted field data collection and obtained crash data to evaluate current and potential future operations. This section will consist of a high-level assessment of crash history, transit usage, and a capacity analysis for critical intersections within Stowe.

4.1 CRASH HISTORY

Crash data for all roadways within the Stowe Town boundary was obtained from the VTrans Public Crash Data Query Tool for a five-year period between 2018 and 2022. During this period, there were a total of 503 crashes of which most (87%) were Property Damage Only, 12% resulted in an injury, and <1% (two total) crashes resulted in a fatality (**Table 7**). **Figure 32** shows the locations of crashes by crash severity within Stowe. Approximately half of all crashes occurred on VT 100 or VT 108. Both fatal crashes occurred on VT 100, within the area of Randolph Road.

The highest number of crashes (153 / 31%) was “Single Vehicle” meaning that no other vehicle was struck other than the driver’s vehicle. These types of crashes could include vehicles running off the road, striking animals, or striking other objects. Twenty-four of the 153 single vehicle crashes resulted in an injury and one resulted in a fatality. The next highest number (124 / 25%) were rear-end crashes which are typically one of the most common crash types on any roadway. It should be noted that only eight of the 124 rear-end crashes resulted in an injury.

Head-on crashes (53 / 11%), angle crashes (48 / 10%), and side-swipe crashes (43 / 9%) were the next three highest crash types. Head-on crashes occur when vehicles traveling in opposite directions collide, often because at least one vehicle crosses the roadway centerline. Sideswipe crashes occur when vehicles traveling in the same or opposite direction make contact on their sides. Angle crashes are those involving turning vehicles striking either another turning vehicle or a vehicle moving through an intersection. Angle crashes, in addition to head-on crashes, are often some of the most severe, tending to have a higher proportion of injuries or fatalities. For Stowe, injuries were experienced in 18% of the head-on and angle crashes. Although sideswipe crashes typically result in a low injury rate, there was one fatal opposite direction side swipe crash. However, it may possible that the crash type was miscoded and should have been a head-on collision. It should be noted that 66 crashes (13%) were listed as “Other”. No specific data was provided for the crash types or contributing factors.

Table 7: Crash Types and Severities within Stowe 2018-2022

Injury Level	Crash Type							Total
	Single Vehicle	Rear-End	Head-On	Angle	Sideswipe	Other	Rear-to-Rear	
Fatal	1	0	0	0	1	0	0	**2**
Injury	24	8	7	12	4	7	0	**62**
Property Damage Only	128	116	46	36	38	59	16	**439**
Total	**153**	**124**	**53**	**48**	**43**	**66**	**16**	**503**

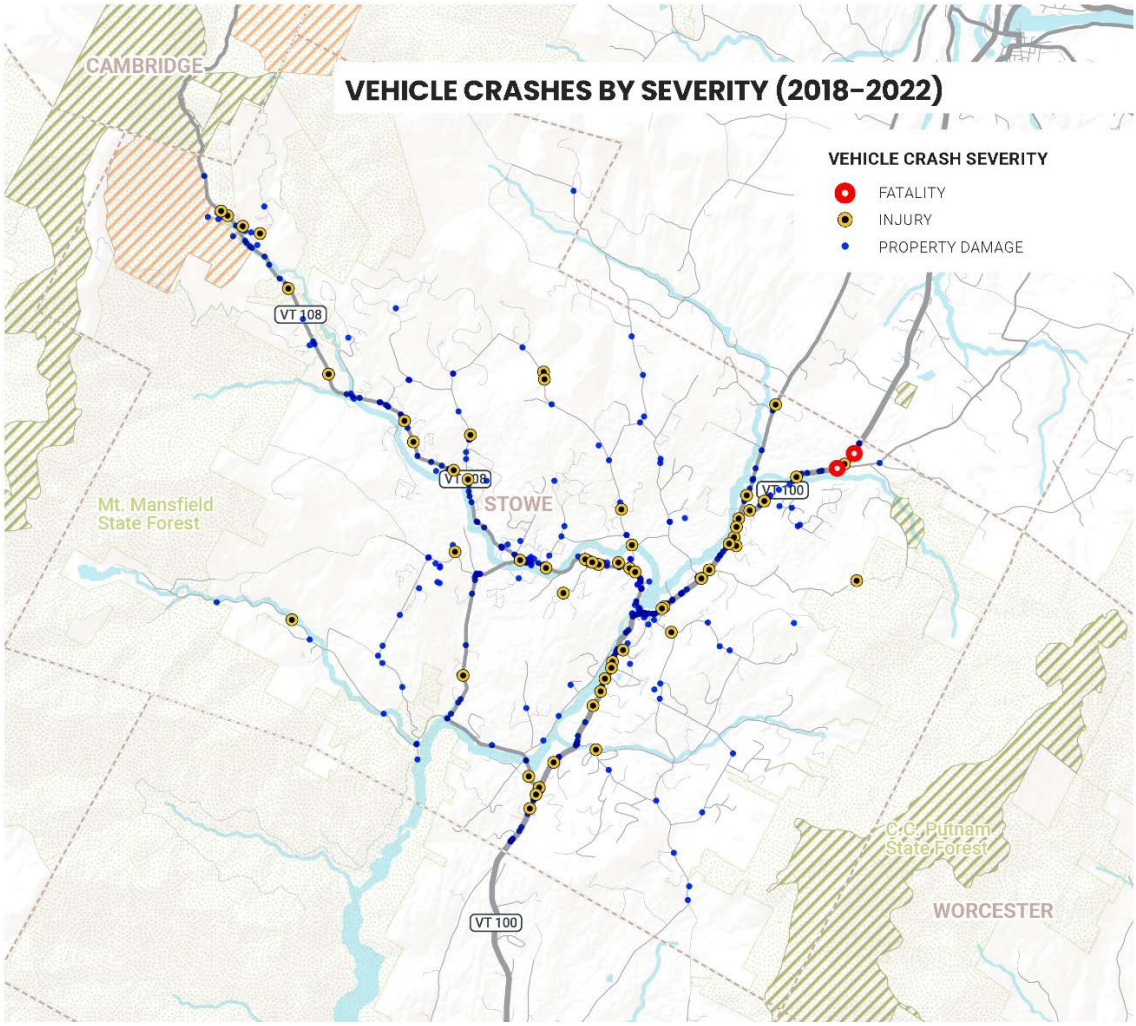

Figure 32: Crash Locations and Severities within Stowe

Weather and lighting conditions can sometimes contribute to a crash, particularly in a rural environment with icy precipitation. The 2018-2022 crash data shows that 53% of crashes, including both fatal crashes and 68% of injury crashes, occurred on dry pavement (**Table 8**). 162 (32%) of crashes occurred on snowy or icy roadways, and 62 (12%) occurred on wet pavement. When it comes to lighting, 378 (75%) of crashes occurred during daylight hours (**Table 9**). Both fatal crashes, as well as 80% of the injury crashes, occurred during the day.

Table 8: Crash Severity by Roadway Surface Conditions

Injury Level	Dry	Ice	Other/ Unknown	Sand, Mud, Dirt, Gravel	Slush	Snow	Wet	Total
Fatal	2	0	0	0	0	0	0	**2**
Injury	42	1	1	0	0	11	7	**62**
Property Damage Only	225	24	7	2	8	118	55	**439**
Total	**269**	**25**	**8**	**2**	**8**	**129**	**62**	**503**

Table 9: Crash Severity by Ambient Lighting

Injury Level	Day	Night	Unknown	Total
Fatal	2	0	0	**2**
Injury	49	13	0	**62**
Property Damage Only	327	110	2	**439**
Total	**378**	**123**	**2**	**503**

Crash Clusters

The VTrans Public Crash Data Query Tool was used to identify crash cluster areas. Four primary and three secondary clusters were identified (**Figure 33**). The location and a brief assessment of conditions are described below:

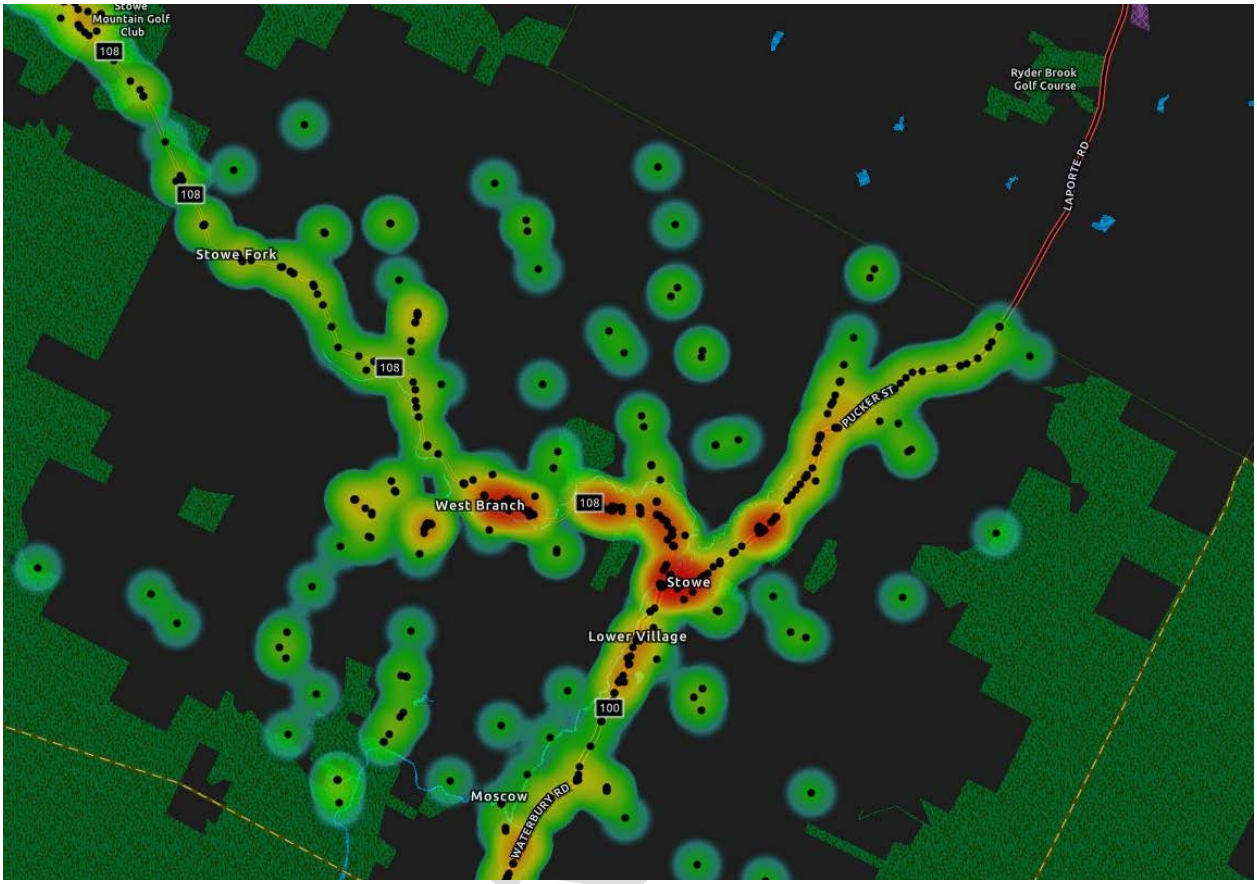

Figure 33: Crash Heat Map 2018-2022 (Source: VTrans Public Crash Data Query Tool)

- **Primary:**
  1. **VT 100 and VT 108 within Stowe Village:** Angle and rear end crashes were clustered at the VT 100/VT 108 and the VT 100/School Lane intersections. Of particular note was the School Lane intersection which has several components that may be contributing to the clustering of crashes at the location, including the topography and curvature of VT 100, the fact that there are several roadways and driveways intersecting at this location, and the presence of on-street parallel and perpendicular parking within the intersection. There was also a higher instance of angle and rear-end crashes between Highland Avenue and VT 108 potentially due to the multiple driveways along this section of roadway.
  2. **VT 100 and West Hill Road:** Angle and rear-end crashes were common, particularly from the West Hill Road approach which experiences sight distance deficiencies due to a residence being located close to the roadway. This intersection is currently being upgraded to a signalized intersection which should help to address the sight distance issues and the instance of angled crashes.
  3. **VT 108 between Stowe Village and Town Farm Lane:** Rear-end crashes were the most common type of crash on this segment of VT108. Contributing factors could include the large

number of driveways to restaurants and the limited width of the shoulders which could lead to vehicles decelerating or stopping within a travel lane in order to turn into a driveway.

4. **VT 108 between Meadow Lane and Cottage Club Road:** Similar to the other VT 108 cluster, this segment experiences rear-end and angle crashes along its length, likely also due to turning vehicles to the many driveways and side streets in this area. In addition, a cluster of angle and rear-end collisions is seen around the Luce Hill Road intersection, which is most likely due to skewed intersection geometry and complicated split approach. VTrans and the Town of Stowe are currently engaging in a study to address safety and operations at this intersection.

- **Secondary:**
  5. **VT 100 and Moscow Road:** Similar to the other intersection crash clusters, this location experiences a high instance of rear-end and angle crashes, likely due to the heavy turning movements at this location. This intersection has been the focus of several studies with the latest recommending the installation of a roundabout.
  6. **Luce Hill Road and Barrows Road:** This intersection experienced 10 crashes within the latest five-year period of which, seven were single vehicle crashes, which could be related to the steep grade and curvature of the roadway.
  7. **VT 100 in the area of Stagecoach Road:** Of particular note are the six head-on collisions that occurred in this segment which may be caused by the skewed intersection with Stagecoach Road as well as the curvature in the roadway around this intersection.

It should be noted that the summary of the crash clusters is preliminary and high-level. Additional evaluation of each cluster, including review of crash reports, should be conducted to further evaluate contributing factors and determine if additional analysis or safety audits should be conducted.

Pedestrian/Bicycle Crashes

Given the ample number of recreational opportunities within Stowe as well as the walkability of some of its areas, pedestrian and bicycle crashes were analyzed separately to determine if there were any clusters that may indicate the need for further examination. Within the crash analysis period (2018 - 2022), there were six pedestrian and six bicycle crashes within the Town, all of which resulted in an injury. As shown in **Figure 34**, these crashes were relatively spread out and no clustering or other specific issues were identified from the data. However, it should be noted that four crashes occurred within parking lots, four occurred at an intersection, and four occurred along a roadway segment not at an intersection.

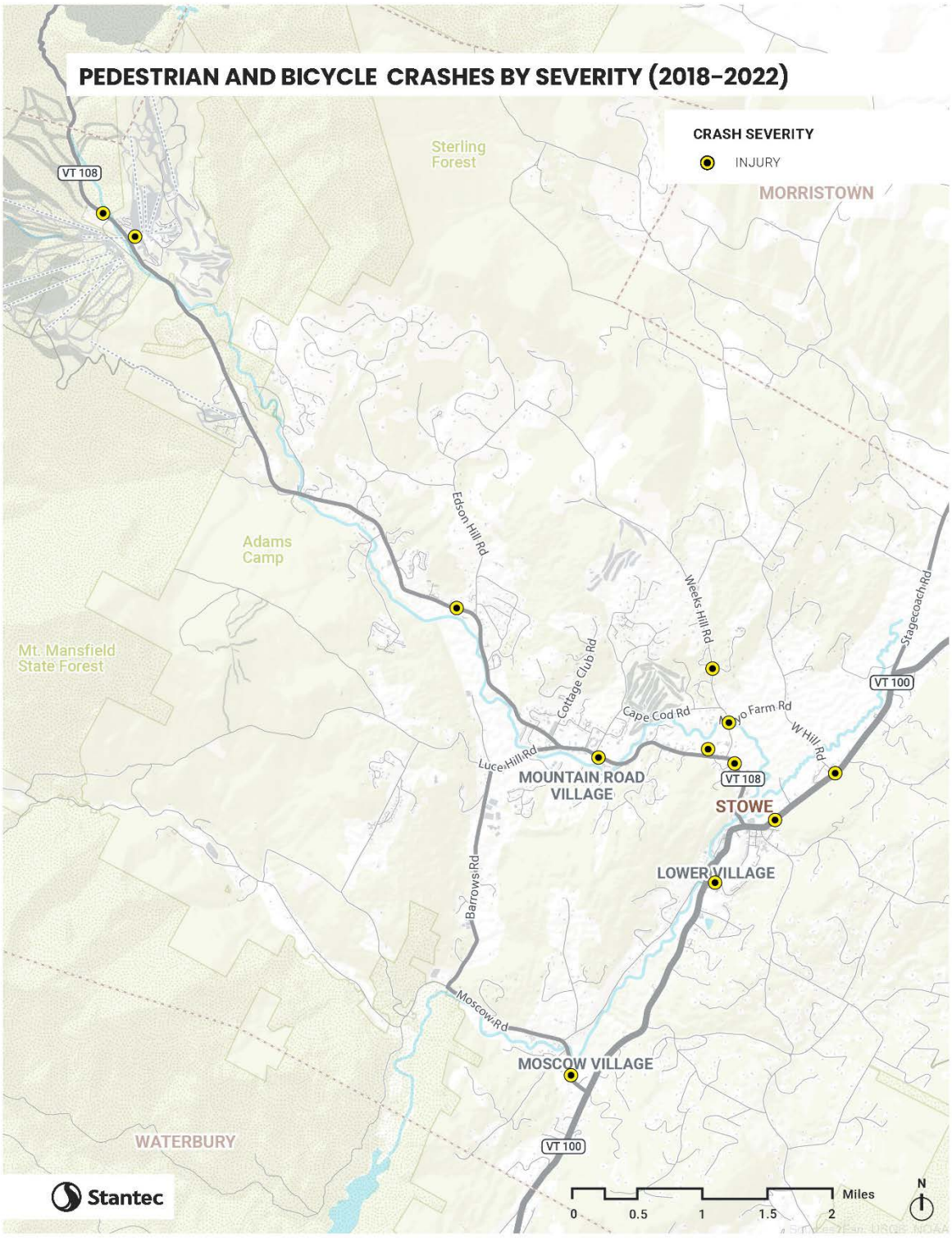

Figure 34: Pedestrian and Bicycle Crashes 2018-2022

4.2 CAPACITY ANALYSIS

The Town of Stowe continues to grow with new development planned and much more potential development to come in the future. However, there is a strong desire within the community to maintain the character of the Town and avoid large-scale roadway widening or installation of new signalized intersections. Much of the ability to accommodate growth in traffic lies at the Town's intersections, of which all are unsignalized with the exception of West Hill Road and VT 100. Therefore, it becomes important to understand the potential growth that could be accommodated on the existing transportation network in order to determine at which point intersections will begin to fail. These thresholds could be used to establish limits on the amount of development that could occur or to be utilized to prioritize transportation network improvements.

Therefore, Stantec developed AM and PM peak hour Synchro/SimTraffic 11 analysis models in order to perform a sensitivity analysis at the following six key intersections, identified in coordination with the Town:

- VT 100 and Moscow Road
- VT 100 and VT 108
- VT 100 and W Hill Road
- VT 108 and Weeks Hill Road
- VT 108 and Luce Hill Road
- VT 108 and Cape Cod Road

Turning movement counts were conducted during Presidents Day weekend (Saturday, February 18, and Sunday February 19, 2023) at the six critical intersections between 7:00 AM and 7:00 PM; however, based on the field observations the data was processed for the AM peak period (7:00 AM – 10:00 AM), and the PM peak period (3:00 PM – 6:00 PM). In addition, drones from the University of Vermont Spatial Analysis Lab were utilized on Saturday, February 18 to record aerial videos for observations and queue measurements during the AM and PM peak periods. Two drones were utilized: one in Mountain Road Village to observe traffic patterns along VT 108 between Cottage Club Road and Town Farm Lane, and one at the Barnes Camp Visitor Center to observe operations of vehicles entering and exiting Spruce Peak as well as SMR. In addition, Stantec conducted field observations to measure queuing and observe traffic issues within the study area.

As noted earlier in this report, Presidents Day Weekend 2023 had far less activity than normal, with minimal queuing and congestion on the study area roadways, when compared to conditions in previous years. However, it was concluded that the turning movement count data obtained during this period would be more appropriate for the use in a sensitivity analysis because of the more moderate volumes, and it is not typical to analyze and set policy based on "worst case" volumes. It should also be noted that Stantec incorporated several other intersections to the model because of their potential effect on the six key intersections:

- VT 100 and Depot Street
- VT 100 and Park Street
- VT 100 and School Street
- VT 108 and Cottage Club Road

Turning movement count data for these intersections was estimated utilizing existing count data from the VTrans Transportation Data Management System combined with the data collected in 2023.

4.2.1 Existing Conditions

Capacity analysis, a procedure used to estimate the traffic-carrying ability of roadway facilities over a range of defined operating conditions, was performed using Synchro 11, which is based on the methodology of the Highway Capacity Manual 6th Edition (HCM) to establish average volume to capacity (V/C) ratios, delays, and Level of Service (LOS) for each intersection. Roadway geometry and traffic data were entered into the model.

The V/C ratio relates the demand at a particular intersection (traffic volume) to the available capacity. The available capacity for each movement varies depending on number of lanes, lane width, perception/ reaction time, green time, and cycle length, among others. A V/C ratio of 1.0 means that the demand for a particular movement is equal to the capacity. A movement with a V/C ratio at or over 1.0 is considered undesirable because the movement volume exceeds the capacity, which results in queuing, indicating unmet demand along that approach.

LOS is an evaluation of the quality of operation of an intersection and is a measure of the average delay a driver experiences while traveling through the intersection. LOS is dependent on a range of defined operating conditions such as traffic demand, lane geometry, unsignalized intersection control type or traffic signal timing and phasing.

LOS can range from A to F and is based on the average control delay per vehicle in seconds. For a signalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 80 seconds per vehicle or a V/C ratio greater than 1.0. For an unsignalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 50 seconds per vehicle, or a V/C ratio greater than 1.0. The HCM delay criteria for signalized and unsignalized intersections are summarized in **Table 10**. All Synchro 11 output files are included in **Appendix B**.

Table 10: LOS Thresholds

Level of Service	Average Control Delay (seconds/vehicle)	
	Signalized	**Unsignalized**
A	Less than or equal to 10.0	Less than or equal to 10.0
B	>10.0 and ≤ 20.0	>10.0 and ≤ 15.0
C	>20.0 and ≤ 35.0	>15.0 and ≤ 25.0
D	>35.0 and ≤ 55.0	>25.0 and ≤ 35.0
E	>55.0 and ≤ 80.0	>35.0 and ≤ 50.0
F	Greater than 80.0 or V/C greater than 1.0*	Greater than 50.0 or V/C greater than 1.0*

Table 11 below shows the results of the capacity analysis for existing conditions (Presidents Day Weekend 2023). The results show that all movements at all study intersections operate at LOS D or better except:

- Moscow Road approaching VT 100 which operates at LOS E in the PM peak hour;
- West Hill Road approaching VT 100 which operates at LOS F in the PM peak hour;
- Luce Hill Road approaching VT 108 which operates at LOS F in the AM and PM peak hours; and,
- Cottage Club Road approaching VT 108 which operates at LOS E in the PM peak hour.

The capacity analysis results indicate that, despite the overall lower volumes experienced during Presidents Day weekend in 2023, the PM peak hour experiences delays that exceed the thresholds for LOS E or F at several of the study area intersections. This is consistent with the overall delay profiles for many of the roadway segments within Stowe (see Section 3.3.4) and demonstrates some of the issues that are experienced during the PM peak period with the combination of vehicles leaving SMR as well as those moving around Stowe to shopping, dining, and lodging locations. Furthermore, it demonstrates the key choke points within the network that would be more substantially impacted when volumes return to be consistent with conditions experienced in 2019 and 2022.

Table 11: 2023 Existing Conditions Capacity Analysis Results

		AM Peak Hour				PM Peak Hour			
Intersection	Movement	V/C	Delay (sec /veh)	LOS	Queue (ft)	V/C	Delay (sec /veh)	LOS	Queue (ft)
VT 100 and Moscow Road	EB-LTR	0.26	15.8	C	20	0.82	41.7	E	154
	WB-LTR	0.01	16	C	0	0.01	11.5	B	0
	NB-LTR	-	0	A	10	0.17	8.8	A	12
	SB-LTR	0.14	8.44	A	0	0.00	8.4	A	0
	Intersection	-	3.6	A	-	-	11.1	B	-
VT 100 and VT 108	EB-L	0.39	13.8	B	36	0.38	14.2	B	36
	EB-TR	0.41	13.5	B	40	0.69	22.7	C	104
	WB-LT	0.49	15.0	B	54	0.44	14.9	B	44
	WB-R	0.33	11.1	B	28	0.37	12.5	B	34
	SB-LR	0.57	16.7	C	72	0.72	23.3	C	118
	Intersection	-	14.3	B	-	-	18.9	C	-
VT 100 and Park Street	EB-T	-	0	-	0	-	0	-	0
	WB-T	-	0	-	0	-	0	-	0
	NB-LR	0.29	17.1	C	24	0.31	18.8	C	26
	Intersection	-	2.1	A	-	-	2.1	A	-
VT 100 and School Street	EB-TR	-	0	-	0	-	0	-	0
	WB-LT	0.02	8.3	A	2	0.04	8.9	A	2
	NB-LR	0.27	18.9	C	22	0.50	26.6	D	54
	Intersection	-	2.1	A	-	-	4.5	A	-
VT 100 and W Hill Road	EB-LR	0.19	16.2	C	14	0.90	64.1	F	174
	NB-LT	0.03	8.7	A	2	0.05	8.5	A	2
	SB-TR	-	0	-	0	-	0	-	0
	Intersection	-	1.7	A	-	-	15.6	C	-
VT 108 and Weeks Hill Road	WB-LR	0.20	12.5	B	14	0.46	25.4	D	46
	NB-TR	-	0	-	0	-	0	-	0
	SB-LT	0.03	8.0	A	2	0.13	8.8	A	8
	Intersection	-	2.5	A	-	-	3.9	A	-
VT 108 and Cape Cod Road	WB-LR	0.24	12.5	B	20	0.37	21.9	C	32
	NB-TR	-	0	-	0	-	0	-	0
	SB-LT	0.02	8.2	A	2	0.15	8.8	A	10
	Intersection	-	2.8	A	-	-	2.8	A	-

Intersection	Movement	AM Peak Hour V/C	AM Peak Hour Delay (sec /veh)	AM Peak Hour LOS	AM Peak Hour Queue (ft)	PM Peak Hour V/C	PM Peak Hour Delay (sec /veh)	PM Peak Hour LOS	PM Peak Hour Queue (ft)
VT 108 and Luce Hill Road	EB-LR	0.91	62.4	F	182	2.03	535.3	F	486
	NB-TR	0.04	7.7	A	2	0.25	11.9	B	20
	SB-LT	-	0	-	0	-	0	-	0
	Intersection	-	17.8	C	-	-	92.0	F	-
VT 108 and Cottage Club Road	WB-LR	0.18	17.4	C	14	0.49	48.3	E	46
	NB-TR	-	0	-	0	-	0	-	0
	SB-LT	0.02	9.5	A	0	0.07	8.5	A	4
	Intersection	-	1.1	A	-	-	2.8	A	-

4.2.2 Sensitivity Analysis – Future Development

As noted previously, one of the main purposes of developing the AM and PM peak hour base models was to understand the approximate amount of potential growth that could be accommodated on the transportation network. The existing conditions results in **Table 11** show that the VT 100/West Hill Road, VT 100/Moscow Road, and the VT 108/Luce Hill Road intersections have failing movements in at least one of the peak hours. However, these intersections have been studied previously and improvements like a roundabout or signalization have been recommended, and in the case of the VT 100/West Hill Road intersection, are currently under construction.

Two sensitivity analysis scenarios were conducted where overall study area volumes were increased in increments of 5% between 5% and 50% to determine at which point there would be widespread failure of one or more movement at an intersection. Scenario 1 includes only the signalization of the intersection of VT 100 and West Hill Road only (**Table 12**), while Scenario 2 includes the West Hill Road signalization as well as the signalization of VT 108 and Luce Hill Road and the proposed roundabout at the VT 100/Moscow Road intersection (**Table 13**).

The tables below show the percentage growth, identify intersections that would experience one or more movements that would operate at LOS E or F, as well as an approximate level of development that would correspond to the growth levels. The “Approximate Growth” value in the table was calculated by averaging the volume change between the AM peak hour and PM peak hour along VT 108 between Luce Hill Road and Cottage Club Road because much of the future planned development will occur in areas north on VT 108. Development estimates were made by utilizing trip generation data presented in the ITE Trip Generation Manual (11th Edition), Land Use Code (LUC) 221 (Multifamily Housing Mid-Rise) to represent condo residential, LUC 310 (Hotel), and LUC 822 (Retail Plaza <40,000 square feet). The values under each land use are independent of each other and not cumulative. However, a smaller combination of numbers under each category could also reach the approximate growth values. It should be noted that since the volumes used in the Synchro analysis are from a Saturday, ITE data was examined for Saturday peak hour.

Table 12: Sensitivity Analysis Summary Scenario 1: VT 100/West Hill Road Signal Only

Percent Growth	Intersections with Failing Movements (LOS E or F) AM *PM*	Approximate Volume Growth (vph)*	Corresponding Development Levels		
			Residential Condo Units	or Hotel Rooms	or Retail Square Footage
5%	VT 100/Moscow Rd (LOS *F*) VT 108/Cottage Club Rd (LOS *F*) VT 108/Luce Hill Rd (LOS F/*F*)	58	148	75	8,767
10%	VT 100/Moscow Rd (LOS *F*) VT 100/School Ln (LOS *E*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS *F*)	115	295	158	17,534
15%	VT 100/Moscow Rd (LOS *F*) VT 100/School Ln (LOS *E*) VT 100/Weeks Hill Rd (LOS *E*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS *F*)	173	443	242	26,301
20%	VT 100/Moscow Rd (LOS *F*) VT 100/VT 108 (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *E*) VT 108/Cape Cod Rd (LOS *E*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS *F*)	230	591	325	35,068
25%	VT 100/Moscow Rd (LOS *F*) VT 100/VT 108 (LOS *F*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *E*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS *F*)	288	738	409	43,836
30%	VT 100/Moscow Rd (LOS *F*) VT 100/VT 108 (LOS *F*) VT 100/Park St (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS *F*)	346	886	492	52,603

Percent Growth	Intersections with Failing Movements (LOS E or F) AM *PM*	Approximate Volume Growth (vph)*	Corresponding Development Levels		
			Residential Condo Units	or Hotel Rooms	or Retail Square Footage
35%	VT 100/Moscow Rd (LOS *F*) VT 100/VT 108 (LOS E/*F*) VT 100/Park St (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS E/*F*)	403	1034	576	61,370
40%	VT 100/Moscow Rd (LOS *F*) VT 100/VT 108 (LOS E/*F*) VT 100/Park St (LOS E/*E*) VT 100/School Ln (LOS E/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS E/*F*)	461	1,182	659	70,137
45%	VT 100/Moscow Rd (LOS E/*F*) VT 100/VT 108 (LOS F/*F*) VT 100/Park St (LOS E/*F*) VT 100/School Ln (LOS E/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS E/*F*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS F/*F*)	518	1,329	743	78,904
50%	VT 100/Moscow Rd (LOS E/*F*) VT 100/VT 108 (LOS F/*F*) VT 100/Park St (LOS F/*F*) VT 100/School Ln (LOS F/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS E/*F*) VT 108/Luce Hill Rd (LOS F/*F*) VT 108/Cottage Club Rd (LOS F/*F*)	576	1,477	826	87,671

Table 13: Sensitivity Analysis Summary Scenario 2: Improvements at VT 100/Moscow Road, VT 100/West Hill Road, and VT 108/Luce Hill Road

Percent Growth	Intersections with Failing Movements (LOS E or F) AM *PM*	Approximate Volume Growth (vph)*	Corresponding Development Levels		
			Residential Condo Units	or Hotel Rooms	or Retail Square Footage
5%	VT 108/Cottage Club Rd (LOS *F*)	58	148	75	8,767
10%	VT 100/School Ln (LOS *E*) VT 108/Luce Hill Rd (LOS *E*) VT 108/Cottage Club Rd (LOS *F*)	115	295	158	17,534
15%	VT 100/School Ln (LOS *E*) VT 100/Weeks Hill Rd (LOS *E*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS *F*)	173	443	242	26,301
20%	VT 100/VT 108 (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *E*) VT 108/Cape Cod Rd (LOS *E*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS *F*)	230	591	325	35,068
25%	VT 100/VT 108 (LOS *F*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *E*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS *F*)	288	738	409	43,836
30%	VT 100/VT 108 (LOS *F*) VT 100/Park St (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS *F*)	346	886	492	52,603

Percent Growth	Intersections with Failing Movements (LOS E or F) AM *PM*	Approximate Volume Growth (vph)*	Corresponding Development Levels		
			Residential Condo Units	or Hotel Rooms	or Retail Square Footage
35%	VT 100/VT 108 (LOS E/*F*) VT 100/Park St (LOS *E*) VT 100/School Ln (LOS *F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS E/*F*)	403	1034	576	61,370
40%	VT 100/Moscow Rd (LOS *E*) VT 100/VT 108 (LOS E/*F*) VT 100/Park St (LOS E/*E*) VT 100/School Ln (LOS E/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS E/*F*)	461	1,182	659	70,137
45%	VT 100/Moscow Rd (LOS *E*) VT 100/VT 108 (LOS F/*F*) VT 100/Park St (LOS E/*F*) VT 100/School Ln (LOS E/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS F/*F*)	518	1,329	743	78,904
50%	VT 100/Moscow Rd (LOS E/*F*) VT 100/VT 108 (LOS F/*F*) VT 100/Park St (LOS F/*F*) VT 100/School Ln (LOS F/*F*) VT 100/Weeks Hill Rd (LOS *F*) VT 108/Cape Cod Rd (LOS *F*) VT 108/Luce Hill Rd (LOS *F*) VT 108/Cottage Club Rd (LOS F/*F*)	576	1,477	826	87,671

*Average of AM and PM peak hour growth at VT 108 between Luce Hill Road and Cottage Club Road.

The results of the sensitivity analyses indicate that failing movements are experienced as soon as 5% growth in traffic volume in both scenarios. However, that should not be considered as a barrier to future development. Rather, it simply indicates that future development that would impact the listed intersections should consider ways to mitigate operational deficiencies even if the proposed development is not

immediately adjacent to the affected intersection. A review of the Synchro model for Scenario 1 reveals that, at between 5% and 10% growth substantial delay and volume-to-capacity ratios of over 1.0 are anticipated at several intersections. It is likely that improvements to the VT 100/Moscow Road and VT 108/Luce Hill Road intersection will be necessary in order to accommodate this relatively low level of growth, particularly if the growth is oriented in areas to the north along VT 108.

The results of Scenario 2 indicate that at between 15% and 20% growth in peak hour traffic, volume to capacity ratios at the intersection of VT 108 and Luce Hill Road exceed 1.0, indicating the likely need for more substantial improvements beyond the signalization that was already incorporated into the analysis. The congestion from the Luce Hill Road intersection also results in substantial delay for vehicles turning from Cottage Club Rd to VT 108.

Therefore, cumulative development that exceeds the 173 additional peak hour trips, particularly on VT 108, should be carefully evaluated. As an example, this growth would correspond to approximately 443 new condo units, 242 new hotel rooms, or 26,301 square feet of retail space. However, these thresholds should be evaluated periodically as volumes may change over time. Furthermore, the location of proposed development may also change where and when more substantial improvements may need ot be considered.

4.2.3 Field Observations

Stantec personnel as well as drones from the University of Vermont Spatial Analysis Lab were in Stowe during Presidents Day weekend 2023 to observe traffic conditions. Although traffic volumes and congestion were substantially less than in previous years, the observations made during this time were still valuable because they still indicated issues that would likely be exacerbated by the higher volumes which are more typical of other winter seasons. Key focus areas of the drones and on-the-ground observations included VT 108 in the area of SMR and Spruce Peak, Toll House and Cross Country Ski Center parking areas, VT 108 and Luce Hill Road, VT 108 through Mountain Road Village, and VT 100/108 within Stowe Village. In addition, drive-throughs of corridors including VT 100, VT 108, Moscow Road-Barrows Road-Luce Hill Road, and West Hill Road to Weeks Hill Road, Cape Cod Road, and Edson Hill Road, were also conducted to observe conditions on those roadways that were not specific to one of the focus areas. This section will discuss observations by corridor.

4.2.3.1 VT 100 South of Moscow Road to West Hill Road

During the field observation, VT 100 was relatively free flow with the exception of the segment of the corridor through Stowe Village where minor queuing of approximately eight to ten vehicles was observed at the all-way stop control intersection between VT 100 and VT 108, as well as general lower speeds through the Village due to pedestrian crossings and parallel parking vehicles, which are typical for business centers like Stowe Village. Two issues were identified during the field observations:

1. At the all-way stop controlled intersection of VT 100 and VT 108, additional lost time was observed when there were vehicles turning from VT 108 to VT 100 and the turn and thru lanes on

VT 100 were occupied by vehicles. Drivers appeared to be unsure that all vehicles were stopped before turning, which led to additional delay time, particularly for VT 108. Multiple approach lanes, like those on VT 100, can be challenging for all-way stop controlled intersections because it is not always clear when vehicles have arrived within different lanes on the same approach, and thus some drivers may not move with the expected vehicle pattern. Furthermore, larger vehicles in the turn lanes can occlude the view of vehicles that may be in adjacent lanes. Finally, pedestrians were observed to try to cross VT 100 at this location despite the lack of crosswalks.

2. The intersection of School Street, VT 100, and Sunset Street is complex, particularly with the curvature of VT 100, the presence of the driveway to the Stowe Recreation Path, the skew of the Sunset Street approach and the presence of on-street parallel and perpendicular parking within the intersection area (**Figure 35**). Drivers and pedestrians must navigate through this area of heavy activity. Furthermore, vehicles traveling southbound on VT 100 are often entering the Village at high speeds, and with the curvature of the roadway it can be challenge for vehicles to turn left from VT 100 into the driveway that accesses parking for the Village and the Stowe Recreation Path.

Figure 35: VT 100/School Street/Sunset Street Intersection (Image: Google Streetview)

4.2.3.2 VT 108 from VT 100 to SMR

VT 108 is a dynamic corridor providing the only access to SMR from Stowe and the main point of access to many of Stowe's most popular outdoor/recreational attractions. Sections of the corridor are rural in nature, while others pass through village areas with substantial development including restaurants, shopping, residential areas, and lodging. The corridor can be divided into five main operational segments, each with their own operational needs:

Lower Mountain Road/Stowe Village Segment:

This segment lies between the intersection of VT 100 in Stowe Village and Town Farm Lane (Stowe Cider). This segment is characterized by its winding geometry as it descends from the north down into Stowe Village. The roadway generally consists of one approximately 11-foot-wide travel lane in each direction with variable-width shoulders of between three and five feet. There are many trip generators and attractors along this segment, including restaurants, hotels, and retails centers, resulting in a multitude of closely spaced driveways, some of which are narrow and steep due to the topographic changes along the southern portion of the segment. A sidewalk/pathway lies along the northbound side of the roadway, but there are no sidewalks on the southbound side, likely due to the significant topographical challenges on that side of the roadway.

This segment of the corridor experiences substantial activity throughout the day due to the adjacent land uses, and vehicle speeds during the corridor drive-through were at or slightly below the posted speed limit. There are several Mountain Road shuttle stops along this segment; however, the stops on the southbound side of the corridor drop people onto grassy areas, sometimes close to drainage ditches (**Figure 36**). Buses stopping to discharge passengers as well as vehicles turning into driveways introduce stop-and-go flow along this segment.

Figure 36: Example of a Mountain Road Shuttle Stop (Image Source: Google Streetview)

However, the primary source of congestion along this segment during many weekends, not just during the winter season, is the all-way stop controlled intersection with VT 100. Significant queueing, extending up to one-half mile, has been recorded. Queuing of over 1,000 feet was experienced during the PM peak period (**Figure 37**).

Figure 37: PM Peak Period Queuing Along SB VT 108

<u>Mountain Road Village Segment:</u>

This segment lies between the crossing of the West Branch of the Little River and Butternut Lane/Edelweiss. The cross-section of this segment is similar to that of the Lower Mountain Road/Stowe Village area described above (11-foot travel lanes with variable shoulders of three to five feet). A sidewalk/path lies along the northbound side of the roadway from the intersection of Cape Cod Road to the area of Gale Farm Center, and similar issues exist with pedestrian access to southbound Mountain Road shuttle stops. There are several restaurants, breweries, retail stores and lodging options along this

segment of the corridor. The Stowe Recreation Path crosses the corridor at the intersection with Cape Cod Road, and it should be noted that there was one pedestrian crash recorded at this location between 2018 and 2022.

Similar to the Lower Mountain Road/Stowe Village segment of the corridor, the number of driveways and side streets result in turning vehicles that can slow and stop traffic. Queuing is often experienced in the PM peak period at the Cape Cod Road intersection as SB vehicles wait for gaps in northbound traffic to turn from VT 108 to Cape Cod Road.

Figure 38: Queuing Behind Turning Vehicle at Cape Cod Road in the PM Peak Period

However, the most significant need on this segment of the corridor is to address the Luce Hill Road intersection. This intersection experiences heavy congestion during peak periods due to traffic utilizing the Moscow Road – Barrows Road – Luce Hill Road alternate access to VT 108. Streetlight data shows that 77% of vehicles traveling from points south of Stowe utilize this route to access SMR, and 38% utilize this route to access the Mountain Road Village area. Furthermore, congestion and queuing from this intersection can negatively impact nearby intersections and driveways on VT 108 and Luce Hill Road. The relatively high volume at the intersection is only one component of the issue. The intersection is skewed with a unique two-way “Y”-shaped approach on Luce Hill Road which was observed to be confusing for some drivers. Some of the issues observed include the use of the leg for traffic to/from as a double left-turn lane (**Figure 39**), vehicles utilizing the middle of the north leg making it impossible for southbound traffic to turn right, and vehicles traveling southbound on VT 108 sometimes missing the initial turn and have to try to make a very difficult angled turn to the southern leg of the “Y” (**Figure 40**).

Figure 39: Vehicles Double-Stacking to Turn Left to Northbound VT 108

Figure 40: Southbound Vehicle Misses Initial Right Turn to Luce Hill Road

In addition, vehicles that turn right from VT 108 to Luce Hill Road sometimes need to stop suddenly for vehicles turning from northbound VT 108 to Luce Hill Road using the southern leg of the "Y". Not only does this substantially reduce capacity on VT 108, but can lead to rear-end collisions, as demonstrated in the crash data. Some travelers with local knowledge were also seen cutting through the Stowe Motel driveway that runs between VT 108 and Luce Hill Road to avoid the intersection (**Figure 41**).

Figure 41: Queuing Along Southbound VT 108 in Approach to Luce Hill Road Intersection

Upper Mountain Road Segment:

After proceeding northward from the Mountain Road Village area, VT 108 becomes more pastoral with lower density and more open space. The cross-section of this segment of the corridor remains similar to that of the previous two sections but lacks any pedestrian accommodations. Several observations were made:

1. The lack of pedestrian facilities requires pedestrians to be picked up and dropped off on the roadside, which in the winter can be covered with snow berms from plowing. In addition, there are no crosswalks or accommodations to support pedestrians crossing VT 108 from the southbound bus stops to the lodging options on the northbound side of the corridor.

2. Sight distance issues are present for vehicles exiting Top Notch Resort. There is a small hill to the north of the driveway, along with guiderail and a wall in front of the Toscana Country Inn that can obscure the view of vehicles traveling southbound on VT 108 (**Figure 42**).

3. There are also periods of substantial pedestrian activity at the Top Notch Driveway due to the Mountain Road shuttle stop for the resort as well as the carriage and sleigh ride facility across the street. A crosswalk was striped across VT 108 at this location previously but has since been worn away and there are no pedestrian crossing signs present. High vehicle speeds as well as the small hill may warrant advanced pedestrian crossing warning signs as well.

4. Harlow Hill presents challenges to vehicle flow, particularly during winter weather conditions due to the steep grade.

Figure 42: Sight Distance Challenges Exiting Top Notch Resort

<u>Toll House/Cross Country Ski Center Segment:</u>

North of Harlow Hill, there is substantially less density and more open/recreational space. The corridor also has a variable width in this segment, ranging from as narrow as 26 feet to as wide as almost 50 feet. Several observations were made within this segment, including:

1. SMR has enhanced signing along VT 100 with temporary signs and VMS indicating the locations of the free parking. The location and availability of the free parking is easy to identify for drivers. Some drivers were also observed using the free lots as park-and-ride facilities in order to be able to park for free at SMR. However, although this activity was not significant, it may increase in the future as more visitors become aware of the option to park for free at SMR if carpooling.

2. Northbound queuing can occur at Cross Country and Toll House parking areas due to vehicles waiting to turn left into the parking areas.

3. There is substantial pedestrian activity crossing VT 108 in the area of the two Toll House parking lots, which are on opposite sides of VT 108 from each other. Even though the SMR shuttle enters the Toll House lot, some pedestrians that park in the Toll House lot cross the street to access the northbound shuttle on VT 108. In addition, when the shuttles return in the afternoon, pedestrians

need to cross from the southbound side to access to the free parking lot on the northbound side. SMR staff place traffic cones down the center line and there are pedestrian crossing signs at the driveway. However, the signs do not point to a specific crossing location. The northbound sign is located on the south side of the driveway while the southbound sign is located on the north side. As a result, pedestrians cross at multiple points within the intersection. Therefore, this intersection may benefit from improved pedestrian guidance and a single crosswalk that is located adjacent to the shuttle stop.

4. The Bingham Falls trailhead parking area reaches capacity on popular summer and fall weekends, and vehicles sometimes park along VT 108 which is not permitted due to the limited shoulder along this segment.

5. There is a plow turn-around area located just south of the SMR/Spruce Peak driveways. This area is often utilized as free parking. However, that results in pedestrians walking along the roadway (**Figure 43**). Pedestrian visibility can be a challenge during low light conditions.

Figure 43: Pedestrians Walking Along SB VT 108 to Access Parked Vehicles in Plow Turn-Around Area

SMR/Spruce Peak Segment:

The SMR/Spruce Peak segment of VT 108 was observed by drone. No issues were observed during the AM peak period. Vehicles entered SMR parking efficiently, and the lower overall volumes during the observations were easily accommodated by the SMR parking staff. The only conditions to note were during the PM peak period when the mountain closed and a there were a large outflow of visitors from the SMR parking areas back down VT 108. Even with the lower volumes during the observations, there was substantial queuing for 30-45 minutes along the SMR exit driveway as well as along the Spruce Peak main roadway. Stowe police were present at the intersection throughout the duration of the PM peak period and directed traffic for a portion of that time when queues began to lengthen (**Figure 44**).

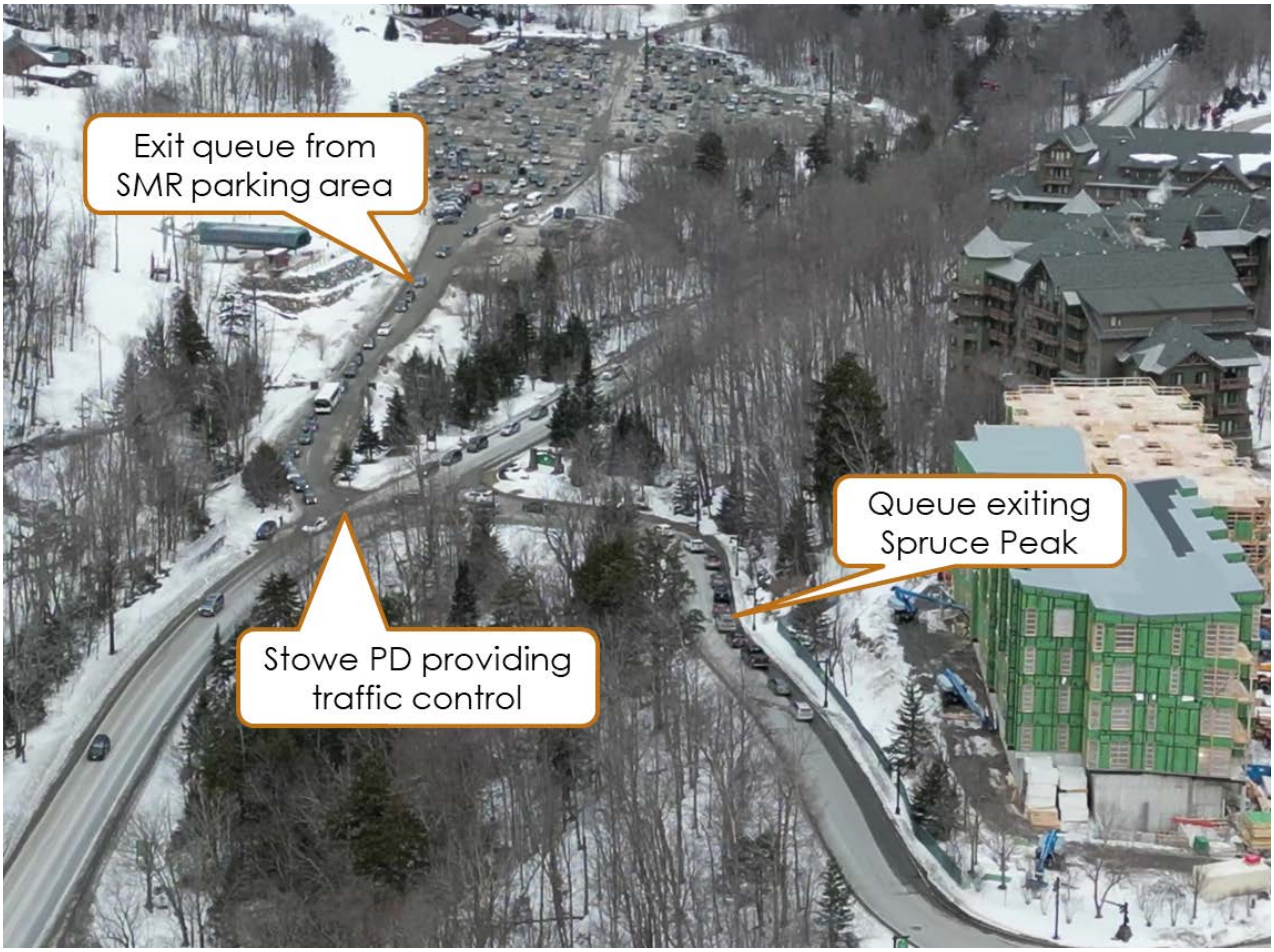

Figure 44: Congestion Exiting SMR and Spruce Peak Following End of Ski Day

4.2.3.3 Moscow Road – Barrows Road – Luce Hill Road

As discussed in Section 3.3.3, the Moscow Road – Barrows Road – Luce Hill Road route is utilized by 77% of all traffic coming from the south on VT 100 that wishes to access VT 108 to get to points north like SMR and Spruce Peak. Not only is this route signed on both VT 100 and VT 108, it is also commonly suggested as the quickest route when utilizing GPS apps like Google and Waze. This is an important route to help distribute vehicles more evenly across the limited roadway network in Stowe. However, there were several observations made regarding traffic operations and needs on this route, including:

1. Vehicles were observed to travel well over the posted speed limit along Moscow Road and Barrows Road. The high vehicle speeds are particularly an issue within the Moscow Road Village area where there are more pedestrians as well as buildings located closer to the roadway. Stowe is currently planning a traffic calming project which should help to address the issue.

2. As Moscow Road approaches Barrows Road, there is a curve as well as trees present close to the roadway. During the field observations, there was a concern regarding sight distance for vehicles waiting to turn from Barrows Road to Moscow Road. However, it should be evaluated in the field when foliage is present.

3. The Luce Hill Road bridge is narrow, and structurally entering the end of its life. This is a critical corridor for Stowe, and the bridge condition should be addressed before a closure is required. The bridge should be addressed in conjunction with the potential options for the intersection of VT 108 and Luce Hill Road in case realignment of the roadway is needed. See Section 4.2.3.2 for further discussion regarding this intersection.

4.2.3.4 West Hill Road – Weeks Hill Road – Cape Cod Road – Edson Hill Road

Approximately 62% of all vehicles coming from the north that wish to access Mountain Road Village utilize West Hill Road to Weeks Hill Road and Cape Cod Road. Similarly, 81% of vehicles coming from the north utilize West Hill Road to Weeks Hill Road, Cape Cod Road, and Edson Hill Road to access SMR. There were no specific issues identified during the field observations on any of these roadways, except for the sight distance issue at the West Hill Road/VT 100 intersection. However, this will be corrected upon completion of the current signalization project.

It should also be noted that Edson Hill Road is a narrow, unpaved roadway that is not intended to take high volumes of pass-through traffic. However, use of Edson Hill Road is highly dependent on the delay being experienced on VT 108. The data shown in Section 3.3.3 shows that Edson Hill Road was only utilized as a bypass in 2022 due to the volume and delay conditions experienced in the 2022 winter season.

4.3 WAYFINDING

A detailed assessment of wayfinding was not included in the scope for this phase, and it will be conducted during future studies. However, the team made some preliminary observations regarding wayfinding during the data collection on Presidents Day Weekend in 2023:

- While there was clear signage guiding drivers to/from VT 100 and VT 108 to the alternate routes to the north and south, the signage focused primarily on noting what routes were being connected and not what destinations could be reached. Drivers who are unfamiliar with the area may not know route numbers or where the bypass routes start and end relative to where they want to go without additional wayfinding.
- Although wayfinding signs are important for some drivers, the use of GPS apps like Google Maps and Waze lessen the need for drivers to rely on roadside signs to help guide them to their destination. Instead, traveler information, such as travel times for different routes to SMR, may be more valuable information that could impact a driver's route choice despite the use of apps. This could be accomplished using dynamic message signs (DMS) which can display graphics and images. DMS could be more effective than static wayfinding because the message can be changed to provide information regarding destinations that are important for that time. For example, signs may display guidance to reach SMR in winter while in summer, they may be used to direct travelers to an event.

4.5 TRANSIT – MOUNTAIN ROAD SHUTTLE

The Mountain Road Shuttle, operated by Green Mountain Transit, provides an important alternative mode for reaching SMR/Spruce Peak from the Village and the many destinations in between. The shuttle operates every day from the end of November through the beginning of April between 6:30 AM and 9:30 PM on weekdays and between 6:20 AM and 9:00 PM on weekends and holidays. The service runs every 30 minutes on weekdays and every 20 minutes on weekends and holidays, with the exception of late evening when the service runs every hour between 6:00 PM and 9:00 PM. The southern end of the route is Commodores Inn while the northern end is SMR. The route generally travels on VT 100 and VT 108 except for the return loop in Stowe Village, and extensions to the Stowe Events Field Parking area and Spruce Peak.

4.5.1 Ridership

Data provided by Green Mountain Transit shows a steady growth in ridership from the 2017-2018 season to the 2019-2020 season (**Figure 45**). The 2020-2021 season had significantly lower ridership due to COVID, but the data shows that ridership has made a strong recovery.

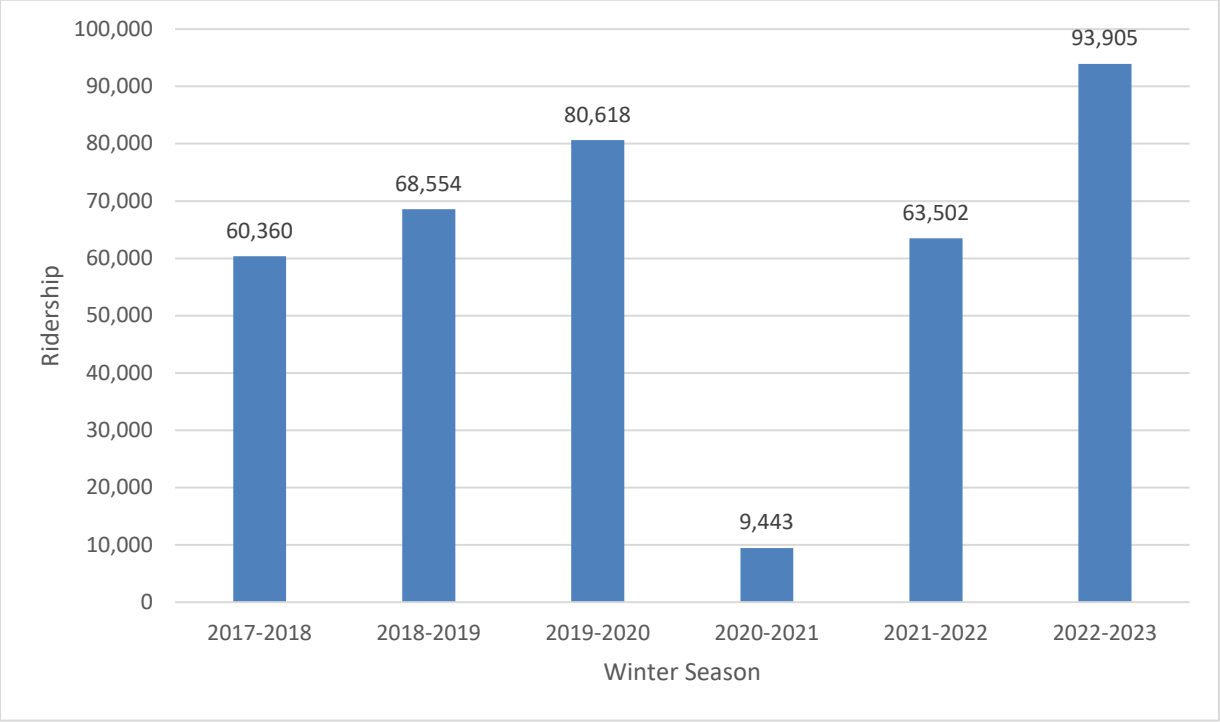

Figure 45: Ridership by Season 2018 - 2023 (Source: Green Mountain Transit)

Ridership by month for the 2021-2022 season and the 2022-2023 season shows over 10,000 more rider trips in January 2023 as well as over 7,000 more trips in February 2023 when compared to 2022 (**Figure 46**). Interestingly, although the Streetlight data and on-the-ground observations indicate less vehicular

activity than in the 2022 season, the higher ridership could indicate a contributing factor to congestion. However, a more thorough examination of daily boardings may be needed in order to compare ridership on various weekends in 2023.

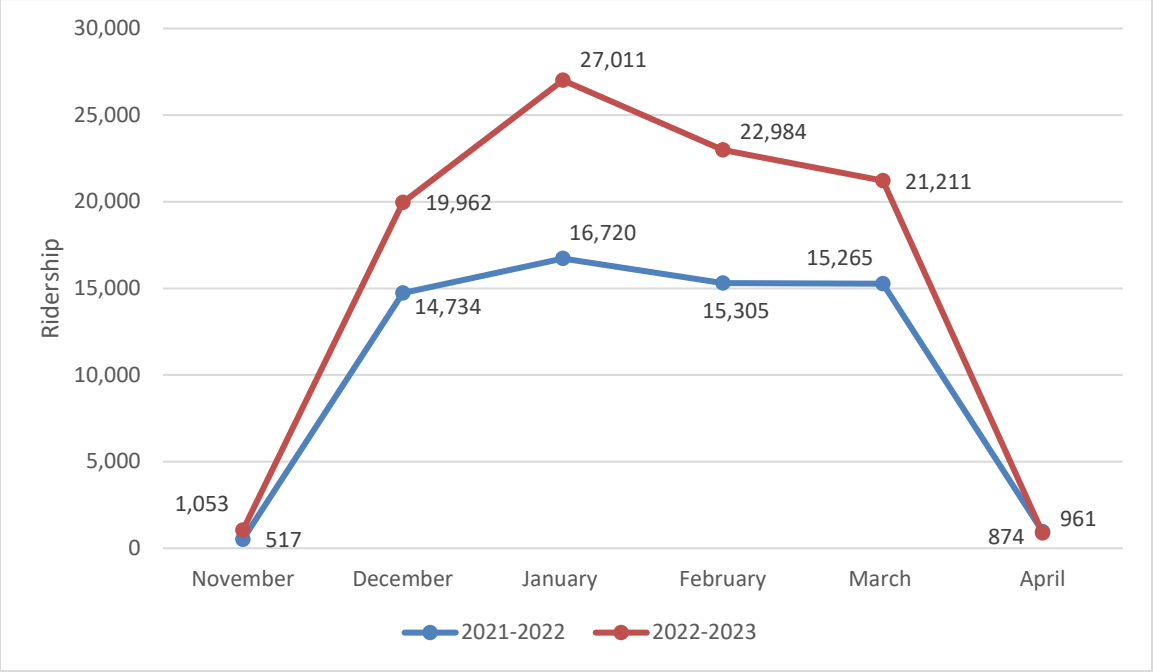

Figure 46: Ridership by Month for the 2021-2022 and 2022-2023 Seasons (Source: Green Mountain Transit)

In addition to data provided by Green Mountain Transit, the Lamoille County Planning Commission also utilized its own staff to collect boarding and alighting data, as well as dwell times for two northbound and two southbound runs on Sunday, February 19, 2023 as well as two northbound and southbound runs on Thursday, February 23, 2023. This data is summarized in **Figure 47** for February 19, and **Figure 48** for February 23. Overall boarding and alighting activity was observed to be relatively low, likely due to weather conditions and the overall lower levels of activity that were experienced on Presidents Day Weekend. In fact, there was higher ridership on Thursday February 23rd likely due to snowy weather that was present during that time.

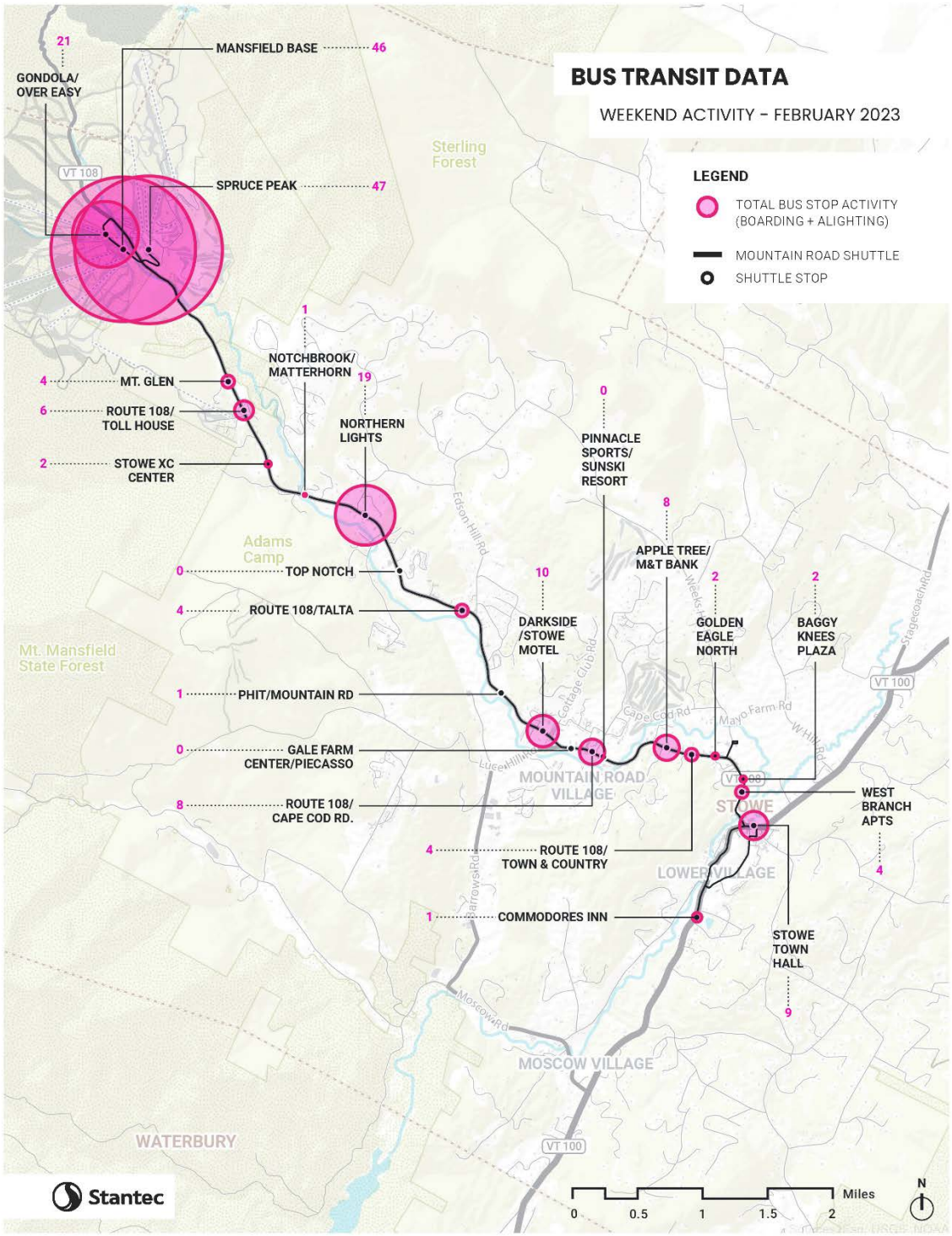

Figure 47: Weekend Boarding and Alighting Activity (Average of Data Collection of February 19, 2023)

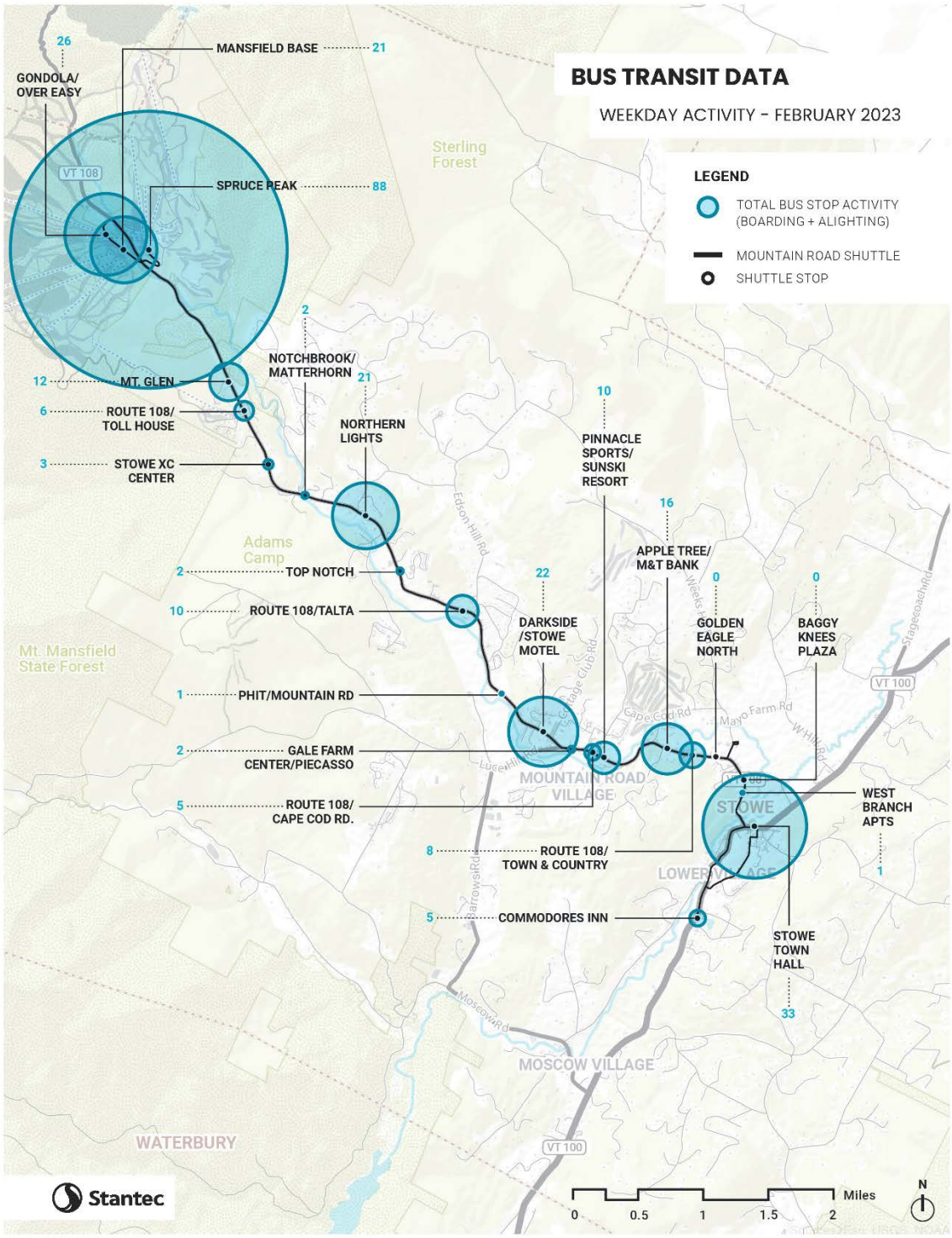

Figure 48: Weekday Boarding and Alighting Activity (Average of Data Collection of February 23, 2023)

Other than SMR and Spruce Peak stops, several stops were observed to have high levels of boarding and alighting, including Stowe Town Hall, Darkside/Stowe Motel, and Northern Lights. Ridership was low during both periods at locations including Baggy Knees Plaza, Golden Eagle North, Gale Farm Center/Piecaso, PHIT Performance/Mountain Road, and Top Notch. In addition to boarding and alighting volumes, dwell time (the time the bus is stopped to pick-up and discharge passengers) was measured. Consideration could be given to combining stops where feasible to reduce the number of stops and improve route efficiency (see Section 9.2.2).

Dwell time values ranged from over two minutes at stops like Spruce Peak and SMR to as little as six seconds. However, dwell time does not have a direct correlation between the boarding/alighting activity at each stop. Some stops saw 11 people board in 37 seconds, while others were stopped for the same amount of time, but only two people boarded. Observations show that dwell time was dependent on the familiarity of the users with the bus route and the amount of equipment they were bringing on to the bus. The average uphill dwell times were 38 seconds during the Sunday count and 31 seconds during the Thursday count. The average downhill dwell times were slightly lower at 22 seconds during the Sunday counts and 21 seconds during the Thursday counts.

4.6 FACILITIES AND OPERATIONS

In general, buses stop within the travel lane to pick-up and discharge passengers. Many previous studies have recommended considering bus pull-offs to reduce impact to traffic on VT 108. However, in this application bus pull-offs may negatively impact bus operations. When buses exit the travel lane, they must then merge back into the travel flow, which may be difficult if there are limited gaps in the traffic stream. Furthermore, during congested conditions, if a bus stops in the travel lane it allows the roadway in front of the bus to clear, which may provide a small travel time benefit for the bus. Therefore, if there is a desire to prioritize bus operations over vehicular operations, it may be prudent to continue to have the buses stop within the travel lane.

Figure 49: Bus Stop Sign on Mountain Road

Stops consist of a sign indicating the location of the bus stop. Bus stop locations have generally been selected to be close to retail, restaurants, and lodging locations along the corridor. Sidewalks are generally provided along the northbound (uphill) side of route from Stowe Village through Mountain Road Village (**Figure 49**). However, once past Mountain Road Village there are limited pedestrian facilities along VT 108 to connect to the bus stops. Furthermore, stops in the southbound (downhill direction) are often left within grassy areas and ditches which

may be hard to navigate during winter conditions. Consideration should be given to providing a standard treatment for bus stops and working with adjacent property owners to help maintain the stop locations during snow events because plowed berms of snow make it difficult to load and increase bus dwell times (**Figure 50**).

Figure 50: Passengers Navigate Slippery Conditions to Board Bus During Snow Event

5.0 PARKING

Parking supply and management can have a significant impact on residents, visitors, and businesses. An oversupply of parking, particularly free parking, can have unintended consequences of encouraging more vehicular trip generation with lower vehicle occupancies, while undersupply can create frustrations for users and result in vehicles circulating the roadway network looking for available parking or can discourage people from visiting. Parking within Stowe Village as well as at SMR and Spruce Peak are of particular concern to the Town. Therefore, Stantec reviewed materials provided by the Town as well as field observations to assess parking supply and operations within the Village as well as at SMR and Spruce Peak.

5.1 STOWE VILLAGE

During the Presidents Day 2023 field data collection, Stantec conducted observations of parking supply throughout both weekend days. Starting around 7:00 AM, ample on-street parking and off-street parking was observed. As the morning progressed, on-street parking began to fill first in the areas with breakfast/coffee offerings, including Café on Main, Butler's Pantry, and Black Cap Coffee and Bakery. As on-street parking began to fill on VT 100, it then spilled onto side streets, including Park Street and Depot Street. On-street parking was in steady use throughout the day, thus resulting in a slow accumulation of vehicles in off-street parking lots through the early evening hours. However, there was not a time where off-street parking options were observed to be completely filled, with the exception of the Stowe Recreation Path parking area which was filled for much of the midday period.

The only potential need observed during Presidents Day weekend was regarding parking turn over. The on-street parking is generally signed for 3-hours, which can sometimes lead to long turnover. Typically, on-street parking should be prioritized for shorter visits, such as picking up take-out at a restaurant, or doing quick shopping. Longer durations should be pushed to the off-street parking lots. However, a more detailed parking study would be needed to verify the demand for shorter-term parking.

Additional observations of parking within the Village will be conducted during future observations of peak summer and peak fall activity.

5.2 STOWE MOUNTAIN RESORT

SMR has a combination of parking areas around the base of Mount Mansfield (over 1,600 spaces), as well as several satellite parking lots at the Toll House and Cross Country Ski Center. 2023 was the first season for Vail charging for parking in the lots surrounding Mount Mansfield base. A parking fee of $30 was introduced on weekends and holidays, with the ability for people to park for free if there were four or more passengers in their vehicle. Parking is paid utilizing a kiosk, and drivers with four or more passengers can obtain a code from a parking attendant to print a parking pass for free. The parking areas were well-defined and easy to navigate which allowed for vehicles to enter SMR efficiently without

substantial queuing back onto VT 108. In addition, the parking areas did not fill to capacity on either February 18th or February 19th.

SMR also offers three free parking lots with shuttle connections as an additional option for skiers who do not want to pay, and as a way to reduce demand at the main parking area. A VMS is located on VT 108 at Harlow Hill to inform drivers where free parking is being provided (**Figure 51**), and A-frame signs are used to further designate where parking is available as drivers approach the free parking areas.

Figure 51: VMS on Harlow Hill in Advance of Free Parking Areas

Free parking is first opened at Toll House area lots. The west lot, which is paved and has 58 striped parking spaces, is filled first, and then drivers are directed to the east lot which is gravel with no striped spaces and an approximate capacity listed by SMR as 140 vehicles. Observations of entering and exiting vehicles revealed a substantial number of vehicles exiting the lots in the AM peak period, and then turning left to head up to SMR. It is assumed that some people are using the free lots for carpooling and then combining into one vehicle to take advantage of the free parking for vehicles with four or more people at SMR.

During both days of parking observations, both lots were filled before 9:00 AM. After filling the Toll House lots, signs are modified to direct drivers to the Cross Country Ski Center parking area which is a large gravel lot with no striping. This lot did not reach the listed capacity of 427 vehicles and was observed to have a maximum occupancy of approximately 80 vehicles. It should be noted that both free parking areas are served by SMR shuttles provided by Vail as well as the Mountain Road shuttle.

Overall, minimal issues were observed with the free parking. Minor delay was observed on VT 108 due to turning vehicles, as well as occasional vehicles that would pull into the east parking lot to ask the attendant a question. When this occurred, other vehicles were blocked from entering the parking area, resulting in queuing onto VT 108. In addition, pedestrians were observed crossing VT 108 at the Toll House lots to access shuttles on either side of the roadway. Section 4.2.3.2 also discusses needs to enhance control over pedestrians crossing at this location.

5.3 SPRUCE PEAK

Spruce Peak is a growing resort community with a lodge, residences, penthouses, townhomes, and cabins, along with amenities that include restaurants, a spa, golf course, and an arts center. There is limited paid public parking within Spruce Peak, and visitors are instructed to utilize the parking at the Mount Mansfield base outside of the winter season to park for free and utilize the gondola access to

Spruce Peak. Most of the parking within Spruce Peak is structured parking for residents and guests. According to data provided by the Town, there are approximately 1,050 parking spaces within Spruce Peak that are supplemented during non-winter periods with parking in the Main Lot of Mount Mansfield.

Several new buildings have been proposed at Spruce Peak that will contain condominiums with parking below, resulting in a total parking amount of 1,170 spaces. The current proposed parking ratio is one space per unit. However, there are a total of 231 bedrooms proposed in 104 units between buildings C and D. Therefore, the average number of bedrooms is 2.2 bedrooms per unit. Given the recreational nature of Spruce Peak, it is likely that many of these condo units will be occupied by groups of people that may be arriving in more than one car. It may be appropriate to increase the parking ratio to 1.5 spaces per unit to account for this and/or to provide a clear designation of where extra resident/lodging parking should be accommodated. Shared parking opportunities may exist within some of the parking areas around Spruce Peak that support the amenities onsite.

5.4 BARNES CAMP VISITOR CENTER PARKING

The Barns Camp Visitor center along northbound VT 108 between the entrance to the Mansfield Base parking area and the gate to Smugglers Notch. This area is utilized year-round because it provides access to a variety of activities including hiking, rock climbing, bouldering, ice climbing, etc. There are approximately 15 parking spaces in the lot on the northbound side of VT 108, as well as a gravel area on the southbound side of the roadway that is also used for parking.

Following the implementation of parking fees at SMR, there was substantial concern from the recreational community regarding the use of the Barnes Camp Visitor Center parking area by skiers looking to avoid the parking fees. As a result, SMR posts 90-minute parking signs within the Barnes Camp parking area when parking fees are in effect. However, this has introduced new concerns that the 90-minute limit is not enough time to recreate within the notch. While on-site doing observations of the operation of Mountain Road at the Mansfield Base driveway, Stantec staff received several questions about the time limit and its enforcement from visitors looking to hike the Smugglers Notch and other trails about the time limit. Several people also asked Stantec staff if it was possible to mark their vehicles so that they were not towed.

Some people recreating in the area of Barnes Camp need more time than the posted 90 minutes for their activities. However, the challenge lies in the ability to allow longer parking durations while also keeping out skiers that are trying to avoid the parking fees at SMR. The Town should continue to work with SMR on strategies to provide access to recreation in Smuggler's Notch. One option could be to have SMR staff the parking area during the morning hours, when most people are arriving to the mountain, to prevent skiers from using the parking area to access SMR.

Parking

6.0 EVENT MANAGEMENT

The bucolic setting of Stowe and its ample open space and recreational opportunities also attract a variety of events including races, walks, festivals, arts and craft fairs, concerts, and sporting events, among other types of events. Most of these events occur during warmer weather months from June through October, with fewer events leading into the holiday season. These events range in size from around 150 in attendance to as many as over 5,000 (**Table 14**). The largest event was Stowe Mountain Lodge Tennis Tournament which had an estimated 7,600 people in attendance. There were several other events with attendance over 4,000 including the Stowe Brewers Festival, the Vermont Renaissance Faire, and the Foliage Arts Festival.

In addition to the significant attendance of some of the events, there also seems to be a clustering of events within certain months, with the potential for some overlap, particularly in June when there were three events with 3,000 to 5,000 attendees, as well as at the end of September and beginning of October with Oktoberfest (3,000 attendees), and the Foliage Arts Festival (5,000 attendees).

Depending on the event type and hours of operation, event traffic overlapped with other recreational traffic can cause spikes in volume and lead to congestion on VT 100 and VT 108. If an event draws 5,000 attendees, that can equate to approximately 2,000 – 2,500 cars, and that added with the other traffic volume on the roadway network can start to exceed the estimated threshold of 3,000 vehicle trips to start experiencing congestion and queuing. Stantec will conduct observations in July and October and will schedule the observations to overlap with events so that event traffic impacts and management can be evaluated. Ultimately, this evaluation may lead to recommendations for scheduling of events to minimize overlap whenever possible, as well as to develop an event management plan.

Table 14: Previous Stowe Event Dates and Estimated Attendance

Event Name	Event Location	Estimated Attendance	Most Recent Event Period
Winter Carnival Volleyball	Stowe Cider (17 Towne Farm Lane)	200	1/23/2022
Stowe Derby	Mt. Mansfield to Town	400	2/13/2022
Parkinson's Optimism Walk	Recreation Path	150	5/19/2018
Craft Brew Races Stowe	Stoweflake Resort & Spa	1,500	5/21/2022
Stowe Triathlon	Swimming Hole/Rec Path	150	6/9/2019
B3 Festival Block Party	Park Street/Main Street/ Village Green	500	6/14/2019
Nordic Cup	Mayo & Polo Fields	1,000	6/16/2018 - 6/17/2018
Bitter Lax Festival 1	Mayo Fields, Polo Fields, High School Fields, Topnotch Fields	3,000	6/17/2022, 7/16/2022
Chowderpalooza/AOP	Park Street/Main Street/ Village Green	800	6/22/2019
Catamount Ultra 25 & 50K race	Trapp Family Lodge	600	6/25/2022
Vermont Renaissance Faire	Mayo Event Fields A & B	5,000	6/25/2022 - 6/26/2022
Kids Adventure Games	Trapp Family Lodge	500	6/26/2019 - 6/27/2019
Stowe Brewers Festival	Mayo Event Fields	4,000	6/28/2019 - 6/30/2019
Fourth of July	Main Street, Mayo Events Fields	2,000	7/4/2022
Hot Air Balloon Festival	Stoweflake Resort & Spa	2,500	7/5/2019 - 7/6/2019
Stowe 8-Miler	Mayo Events Field (Parking/Staging)	750	7/7/2019
Music in the Meadow	Trapp Family Lodge	1,500	7/10/2022, 8/14/2022, 8/21/2022
Art on Park	Park Street/Main Street/ Village Green	500	Weekly 7/11/2019 - 8/22/2019
Bitter Lax Festival 2	Mayo Fields, Polo Fields	3,500	7/20/2019 - 7/21/2019
Jam for the Land	Stowe Cider (17 Towne Farm Lane)	500	7/20/2019
Saturday Cinema on the Lawn	Library lawn	250	7/28/2018, 8/11/2018
B3 Festival Critical Mass Ride	Mountain Road	300	7/29/2022
Stowe Jazz Festival	Alchemist Brewery Property	2,000	8/5/2022 - 8/7/2022
Spruce Peak Folk Festival	Spruce Peak	1,000	8/10/2019 - 8/11/2019
100 on 100 Relay	Trapp Family Lodge/Route 100	800	8/13/2022
Stowe Mtn Lodge Tennis	Stowe Mountain Lodge	7,600	8/18/2018 - 8/22/2018
Tango Music Festival	Town Green/Main Street	150	8/18/2018

Event Management

Event Name	Event Location	Estimated Attendance	Most Recent Event Period
Race to the Top of VT	Toll Road at Stowe Mountain Resort	700	8/28/2022
British Invasion	Mayo Events Fields	1,800	9/9/2022 - 9/11/2022
British Invasion Block Party	Main Street	1,500	9/9/2022
Bailey Memorial Jamboree	Mayo Events Fields	1,000	9/17/2022 - 9/18/2022
Foliage Art on Park	Park Street/Main Street/ Village Green	500	9/22/2018
Pumpkin Chuckin Festival	Stoweflake Resort & Spa	1,000	9/25/2022
Oktoberfest	Mayo Events Fields	3,000	9/28/2018 - 9/30/2018
Foliage Art Festival	Topnotch Fields	5,000	10/7/2022 - 10/9/2022
Indigenous People's Day Rocks	Mayo Events Field	300	10/8/2022
Talta Fall Opening Celebration	Talta Lodge, 3343 Mtn Road	400	10/9/2021
Heady Trotter	Alchemist Brewery Property	2,000	10/16/2022
Trapp Mountain Marathon	Trapp Family Lodge	500	10/16/2022
Open House: Art Now	The Current	200	10/23/2021
Vermont 10 Miler	Mayo Event Fields (parking/staging)	1,200	11/6/2022
Roller Ski Race	Nebraska Valley, Barrows, Trapps	150	11/13/2021
Traditional Christmas	Main Street, Village	1,000	12/3/2021 - 12/5/2021

7.0 SUMMARY OF FINDINGS AND MOBILITY NEEDS

The analysis of the transportation network in Stowe presented in the previous sections has resulted in the identification of several mobility needs. The needs have been prioritized based on the assessment of a variety of quantitative and qualitative factors. However, it should be noted that these needs reflect the analysis that was conducted for the winter peak season. Needs may be added or modified as the result of future analyses of July and October peaks. The needs are as follows:

7.1 HIGHER PRIORITY NEEDS

Enhance Emergency Access

As SMR, Spruce Peak, and other resorts continue to grow and additional development takes place along the VT 108 corridor, the potential need for emergency services becomes even more critical than it is today. With growth comes congestion, and with only one primary route up the mountain and former alternate routes that were local knowledge becoming more widely utilized, it will become increasingly difficult to provide quick response times for emergency services. In addition, the combination of increased activity and more congestion could also make evacuations more difficult.

Combine the Luce Hill Road Bridge and Intersection Projects

Based on the findings of this analysis, the intersection of Luce Hill Road and VT 108 requires the most immediate attention. Traffic volumes have significantly increased on the Luce Hill Road approach with more drivers utilizing the Moscow Road – Barrows Road – Luce Hill Road route to bypass congestion in Stowe Village and on VT 108. Furthermore, the intersection was identified as a crash cluster location within the Mountain Road Village area.

VTrans and the Town of Stowe are currently re-engaging a concept development study to develop a final recommendation for the intersection. However, VTrans and the Town need to include considerations for the Luce Hill Road Bridge when developing intersection recommendations. The nearby Luce Hill Road bridge is reaching the end of its functional life. Replacement of the bridge will be required within the near future, which provides the opportunity to adjust the roadway alignment as well as provide other features such as sidewalk for pedestrians to access the Recreation Path.

The sensitivity analysis conducted as part of this study revealed that, even with the installation of a traffic signal at the existing intersection location, the geometry and other constraints would limit the operational effectiveness of the intersection, resulting in LOS E and F operations with as low as 10% growth. Therefore, consideration should be given to more substantial enhancements that may include realignment of Luce Hill Road.

Improve Transit Operations and Amenities

Data provided by Green Mountain Transit show that demand for the Mountain Road shuttle service has increased steadily over the past six seasons (excluding COVID impacts to the 2020-2021 season). Green Mountain Transit, the Town, SMR, Spruce Peak, and other businesses should have a vested and common interest in the continued growth and success of the bus service. Enhancing operational efficiencies, reducing travel times, increasing frequency, and enhancing access must be a top priority. This includes consolidating stops where appropriate, providing improved bus stop amenities (i.e., pads, shelters, benches, equipment areas), clearing snow berms from bus stop areas, and providing bus lanes or queue jumps (a short area on the shoulder of a roadway that allows buses to bypass queues at intersection) where feasible.

Enhance Safety for All Users

A comprehensive safety study should be conducted to evaluate crash cluster areas identified in Section 4.1, and methods to calm traffic in key activity areas should be explored. The Town is currently planning traffic calming measures in Moscow Road Village. However, measures such as gateway treatments, enhanced streetscaping and pedestrian and bicycle facilities, as well as other traffic calming devices, should be considered in Mountain Road Village, as well as in approach to Stowe Village on VT 100.

In addition, the crash data indicates there are several crash cluster areas where there are higher instances of rear-end and side-swipe collisions around driveways and side streets. This is likely due to turning vehicles which are decelerating or stopping within the main travel lanes. Therefore, a detailed crash study should also consider the need for additional turn lanes at higher volume driveways or side streets, particularly along VT 108 through the Mountain Road Village area.

Maintain the Character of Stowe

Residents and visitors to Stowe alike appreciate the character of the Town and surrounding areas, yet also appreciate the amenities and opportunities that come with a resort area. Roadway widening to provide multiple lanes and widespread signalization should be avoided. Balancing the desire to maintain the bucolic setting of the Town while also address existing and future operational deficiencies is a challenge that requires a new approach to traffic management that challenges existing demand management methods and may require tough decisions regarding potential thresholds for growth.

7.2 MEDIUM PRIORITY NEEDS

Enhance Active Mode Infrastructure

Walking, hiking, and biking are important recreational opportunities within Stowe, but more could be done to enhance those recreational opportunities as well as provide improved facilities to encourage more people to consider these modes as a way to travel around Stowe.

Many of the local roadways are low volume and would be considered bike-friendly. However, the VT 100 and VT 108 corridors, which provide some connections that local roads cannot make are intimidating for some riders. The Stowe Recreation Path is an excellent resource and can be used by bicyclists as a parallel option to VT 108 to connect between Stowe Village and Mountain Road Village. However, the path ends at Brook Road, and there are no facilities to connect to destinations like SMR or Spruce Peak further north on VT 108. Opportunities should be explored to extend the trail or potentially improve the cross-section of VT 108. Similar opportunities should be explored on VT 100.

If enhanced infrastructure is provided, Stowe should consider exploring opportunities for a bikeshare system which would allow visitors, residents, and workers to be able to take advantage of the facilities without owning (or bringing) their own bikes. The deployment of e-bikes as part of a bikeshare system could also be considered in order to expand the range of users that could utilize bikes to move around given the topography of the area. Regular bike parking should also be expanded within key activity centers within the Town.

There are several opportunities to enhance pedestrian infrastructure in activity areas within Stowe, such as Moscow Road Village, Stowe Village, Mountain Road Village, and north Mountain Road. The Town should evaluate opportunities to implement the concepts presented in the Mountain Road Village Corridor Master Plan to other activity centers to provide pedestrian facilities on both sides of the roadway, where possible, enhance pedestrian crossings, and provide pedestrian connections between adjacent land uses as well as to and from transit stops.

Improve Intersection Operations and Safety at VT 100/Moscow Road and VT 100/VT 108 Intersections

The Town should encourage VTrans to continue advancing projects like the Moscow Road roundabout in order to address congestion and safety at that location as well. Furthermore, the Town may also need to consider improvements to the intersection of VT 100 and VT 108 in the Village to address operational deficiencies and challenges with the current all-way stop intersection.

Enhance Wayfinding and Traveler Information

As the use of GPS apps like Google Maps and Waze continue to become the primary way that many people navigate, the need for extensive static wayfinding becomes less important. Instead, dynamic traveler-based wayfinding could provide a more impactful solution by responding to where people may be headed on a particular day and giving real-time traffic conditions. For example, a dynamic message sign on VT 100 may display wayfinding or travel time information to SMR on a busy winter season weekend but could display wayfinding information to an event location for a festival in the fall. This type of on-the-ground infrastructure should also be coupled with on-line information that can be used by the Town, SMR, Spruce Peak, and other resorts and businesses on their websites and social media to communicate to visitors about real-time traffic conditions as well as options for alternate modes of travel.

7.3 LOWER PRIORITY NEEDS

Continue to Evaluate Parking and Parking Management

Demand for parking is likely to continue to evolve as development takes place, travel trends change, and infrastructure for other modes is provided. Stowe should continue to assess parking needs and revise zoning policies as appropriate. In addition, a parking study for Stowe Village should be conducted to evaluate parking utilization in more detail, and determine if changes, such as paid parking, or reduced on-street parking durations would be beneficial.

Develop Policies to Reduce Event Overlap and Improve Event Management

The Town should consider establishing an event management plan that provides clear guidance for the scheduling and management of events to reduce the likelihood of overlap between large events, as well as guidance for what strategies the Town and event organizers need to put in place to managed event-related traffic based on attendance thresholds.

Establish Transportation Demand Management Requirements for Large Development Projects/Trip Attractors

Managing traffic and encouraging the use of other modes requires agencies to provide the infrastructure and services, but also requires active participation from the resorts and other large developments. The Town should consider requiring a transportation impact fee and/or transportation management plans for developments that would result in cumulative trips over a pre-established threshold. A transportation impact fee could be used to provide enhanced multi-modal infrastructure and services, while a transportation management plan would outline the strategies and policies a developer or business would employ to reduce vehicle trips and encourage the use of other modes.

8.0 PRELIMINARY RECOMMENDATIONS

This study is the next step to thinking about mobility in Stowe comprehensively, building from the many studies that have been conducted for specific areas of the Town, as well as work conducted by the Stowe Transportation Management Working Group, into a prioritized implementation plan for infrastructure, services/amenities, and policy strategies. The preliminary recommendations below are based on the data reviewed for the winter season and may be adjusted to reflect findings of other analysis periods. Furthermore, a preliminary high-level implementation strategy will be developed following the conclusion of the summer and fall season analyses. In general, strategies typically can be divided into three categories:

- Infrastructure: Physical changes to the transportation network that respond to specific congestion, access, and/or safety concerns. Infrastructure strategies could include intersection improvements, pedestrian/bicycle facilities, roadway widening/installation of turn lanes, reconstruction of bridges, new or realigned roadway segments, traffic calming, intelligent transportation systems (ITS), etc.

- Services and Amenities: Strategies that enhance access to and the usability of modes other than driving a car. Potential strategies that would fall within this category include new or modifications to transit routes, mobility hubs, bus shelters, secure bicycle parking, pump and tool stations, e-bike and e-scooter charging facilities, etc.

- Policy: Strategies that help to manage or reduce demand on the transportation network. Examples of policy strategies could include establishing trip thresholds for scheduling of events, modifying zoning to encourage affordable housing options close to where people work, establishing new parking requirements, complete streets requirements, or transportation demand management requirements for developers.

However, in order to consider mobility needs in Stowe comprehensively and with a new approach, there needs to be one overarching vision strategy that contains components of infrastructure, service and amenity, and policy strategies and is focused on increasing mobility options and overall network capacity without the need to accommodate more cars.

8.1 VISION STRATEGY: SMART STOWE CORRIDORS

The overall vision strategy consists of the enhancing capacity of the transportation network without widening for vehicles by implementing “Smart Corridors”. A Smart Corridor combines roadway and intersection modifications, improvements to transit and active modes, and intelligent transportation corridor management to enhance operations for all modes, improve safety, and address Stowe-specific needs, including transit accessibility and performance, dynamic wayfinding and traveler information, and emergency vehicle access and response times. **Figure 52** provides a schematic of the components of the Smart Corridor concept. Elements of the concept are described below:

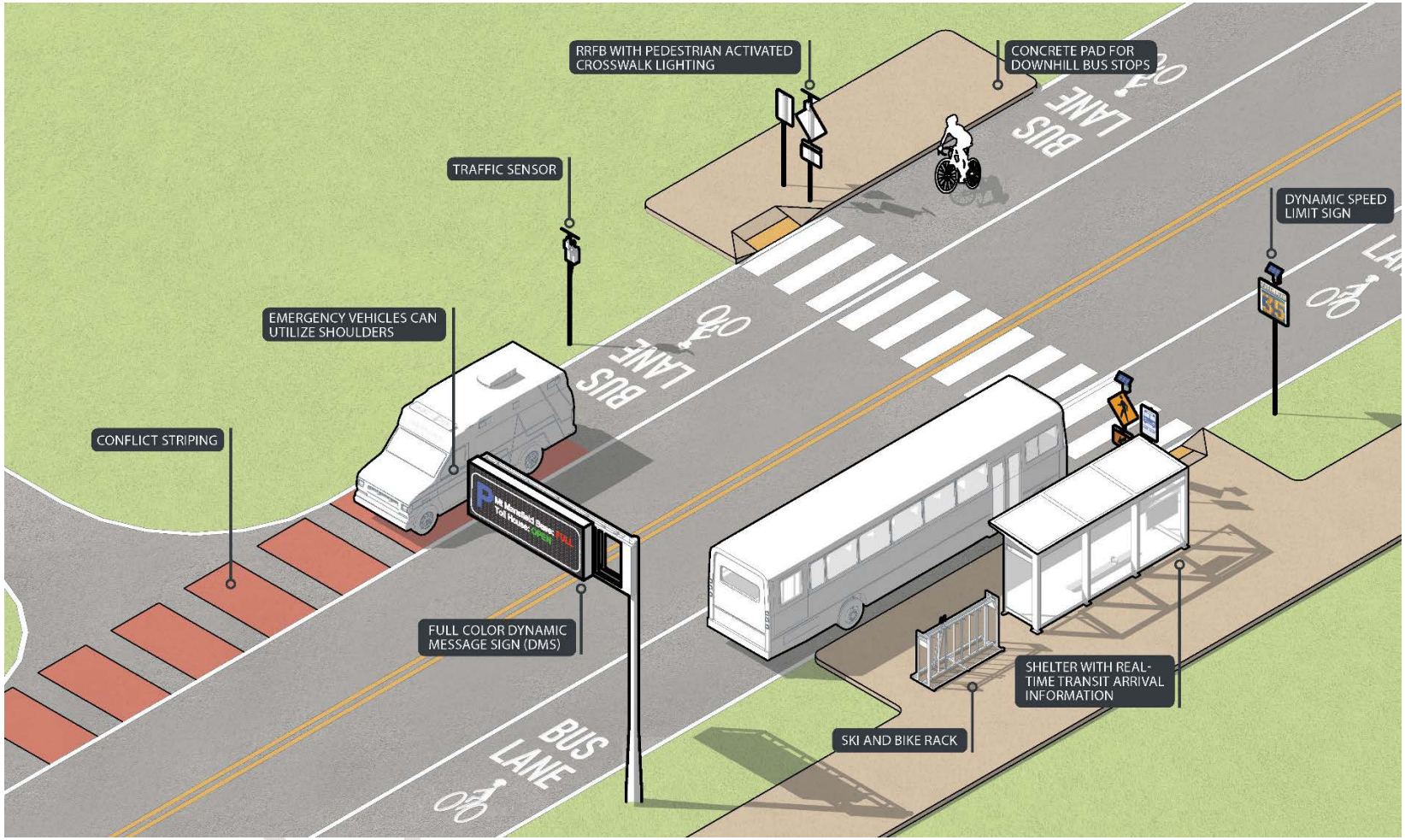

Figure 52: Smart Corridor Concept

- **Roadway Cross-Section:** Expand full-depth pavement to a minimum width of 44 feet to support flexible use of the pavement depending on the needs of the area in which the corridor is passing through. In general, the cross-section would consist of one 11-foot travel lane in each direction with one 11-foot shoulder with full depth pavement to be used as a combined bus/bike lane, as well as emergency vehicles. In the event of an emergency evacuation, this cross-section would provide enough room to maintain multiple evacuation lanes while still providing a counter flow lane for emergency vehicles.

  A combination of signs and pavement symbols would be used to designate the shoulder as a combined bus/bike lane. Colored pavement could be considered in conflict areas, such as driveways and side streets to reinforce that drivers should consider if buses or bikes are present in the shoulder before turning across it.

  The cross-section could be adjusted when needed, for example, to accommodate turn lanes at key locations, or where ROW is not as available, lane widths could be reduced. However, every effort should be made to maintaining the full cross-section to maximize the benefits to bus operations, emergency management, and improve active modes.

- **Transit Operations and Amenities:** The investment in enhancing the cross-section to provide a bus lane should be supported by amenities for the riders that make the service more attractive and support efficient boarding and alighting which helps to reduce overall bus travel time. These amenities include:

    - Consolidated bus stops in walkable areas.
    - Bus shelters on uphill stops to provide wind protection, real-time bus arrival information, and rails and other storage devices for riders to place equipment while waiting for the bus.
    - Concrete pads for downhill bus stops. Where sidewalk is not provided, curb ramps and crosswalks should be provided near the downhill stop to connect it to the sidewalk network.
    - Coordination with adjacent businesses to procure and maintain shelters, particularly to clear snow to maintain access between the shelter and the bus.

- **Accommodations for Active Modes:** Accommodations for pedestrians and bicyclists should also be key components of the Smart Corridors. Outside of the winter season when the Mountain Road Shuttle is not operating and biking becomes a more viable mode of transportation, the shoulder lanes will help to enhance connections around Stowe, particularly along VT 108 north of the terminus of the Recreation Path. Pedestrians and bicycles should be supported by amenities such as:

    - Signed and striped crosswalks at key intersections/bus stops. This could include rectangular rapid flashing beacons (RRFBs) and pedestrian activated lighting.

  - Expansion of the sidewalk network in areas like Mountain Road Village as identified in the master plan.
  - Bicycle parking near major trip attractors, including pump and tool stations and charging ports.
  - Seasonal bikeshare system with potential for e-bikes to make biking a more accessible way of getting around the challenging topography.

- **Intelligent Corridor Management and Dynamic Wayfinding:** Enhancing operations, safety, and traveler information and wayfinding through the deployment of:
  - Roadside detection that can measure speed, volume, and travel time to provide information regarding operation of key corridors in Stowe.
  - Dynamic speed limit signs that adjust speeds based on roadway conditions. For example, speeds may be reduced in advance of the back of a traffic queue, within an event area where there may be more vehicles and pedestrians crossing the roadway, or due to inclement weather.
  - Full color DMS at key decision locations to provide dynamic wayfinding and/or traveler information. DMS are capable of displaying symbols and text and come in a variety of sizes and treatments that would be appropriate for Stowe. These signs could be used to display directions to an event, provide parking information, alert drivers to an incident on the roadway, or to display travel times utilizing different routes to a destination.
  - An online clearinghouse of traveler information that could be access by the public and also linked directly on websites and social media of the resorts.

8.2 ADDITIONAL SPECIFIC STRATEGIES

Strategies that are in addition to, but may also complement, the vision strategy presented in Section 9.1, are summarized below:

8.2.1 Infrastructure

- Combine the Luce Hill Road/VT 108 intersection study with an evaluation of the Luce Hill Road bridge to ensure that the two projects are complementary. Strong consideration should be given to implementing a long-term solution which may include the realignment of Luce Hill Road to connect to VT 108 in the area of Cottage Club Road.
- Improve the intersection of VT 100 and Moscow Road as planned in previous studies.
- Evaluate potential improvements to the intersection of VT 100 and VT 108 within Stowe Village.

- Implement recommendations presented in the Mountain Road Village Roadway Master Plan but consider modifications that would allow for the implementation of the Smart Corridor cross-section described in Section 9.1.
- Conduct a comprehensive safety study to address crash clusters identified in Section 4.1.
- Address sight distance concerns at Top Notch driveway and at the intersection of Moscow Road and Barrows Road.
- Formalize shuttle stops and pedestrian crossing at the Toll House driveway with striping and pedestrian crossing signs.
- Consider installation of additional pedestrian crossings (striping and signing) to connect trip generators and attractors as well as at heavily used bus stop locations.
- Investigate enhancements to VT 108 through Smugglers Notch that may allow it to be used during the winter and/or by heavy vehicles. At a minimum, consider installation of a truck turn around at the base on Smuggler's Notch with vehicle detection to alert truck drivers that they cannot proceed.

8.2.2 Services and Amenities

- Work with GMT to explore the potential to provide additional service on peak weekends and holidays during the winter season. Determine if demand warrants the expansion of the Mountain Road shuttle service to other times of the year.
- Conduct a detailed analysis of Mountain Road shuttle stops to determine where they can be consolidated. Initial data obtained for this study indicates the potential to consolidate stops including:
    - West Branch Apartments and Baggy Knees Plaza
    - Golden Eagle North and Town & Country
    - Pinnacle Sports/Sun & Ski Resort, Cape Cod Road, and Gale Farm/Piecaso
- Re-evaluate bus stop locations and where possible, consider locating adjacent to intersections so that pedestrian crossings can be provided there, rather than introducing mid-block crossings.
- Conduct an evaluation of existing bicycle parking to determine where additional bike parking is needed. Provide additional pump and tool stations where needed and include charging ports near bicycle parking at key destinations within Stowe. Investigate the demand for a seasonal bikeshare with e-bikes if bicycle facilities are expanded as discussed in Section 9.1.
- Work with adjacent property owners/businesses to procure and maintain bus shelters.

8.2.3 Policies

- Conduct a parking study to establish revised requirements for parking, determine if additional parking is needed within Stowe Village, and to determine the need to restructure on-street parking to shorter durations.
- Utilize the data presented in Section 4.2.2 to establish guidance or thresholds regarding transportation improvements that would be required to accommodate growth.
- Establish a policy that requires new development over a certain threshold, or development that would, in combination with existing development on a site, exceed the threshold to develop a transportation management plan. A transportation management plan would outline transportation demand management strategies that a developer or property owner would implement in order to reduce vehicle trip generation and encourage use of other modes.
- Develop an Event Management guide that provides guidance for scheduling events to avoid overlap, as well as management strategies that should be employed to manage traffic based on the anticipated event size.
- Encourage SMR and Spruce Peak to offer activities at the end of a weekend ski day to help spread the exiting volumes over a longer period of time.

8.3 NEXT STEPS

Stantec will continue to work with the Town to evaluate traffic operations during peak weekends in July and October. This report will be expanded, and recommendations may be added or modified as a result. A preliminary high-level implementation strategy will be developed at the conclusion of this phase. Future phases of study will include more in-depth analysis and recommendations regarding the implementation of general strategies identified in this report.

APPENDIX/DIVIDER TITLE

Appendix Subtitle

Appendix A

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A. HEADING 8

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i. Heading 9

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