

# Northeast Kingdom Transportation Infrastructure Plan

June 2014

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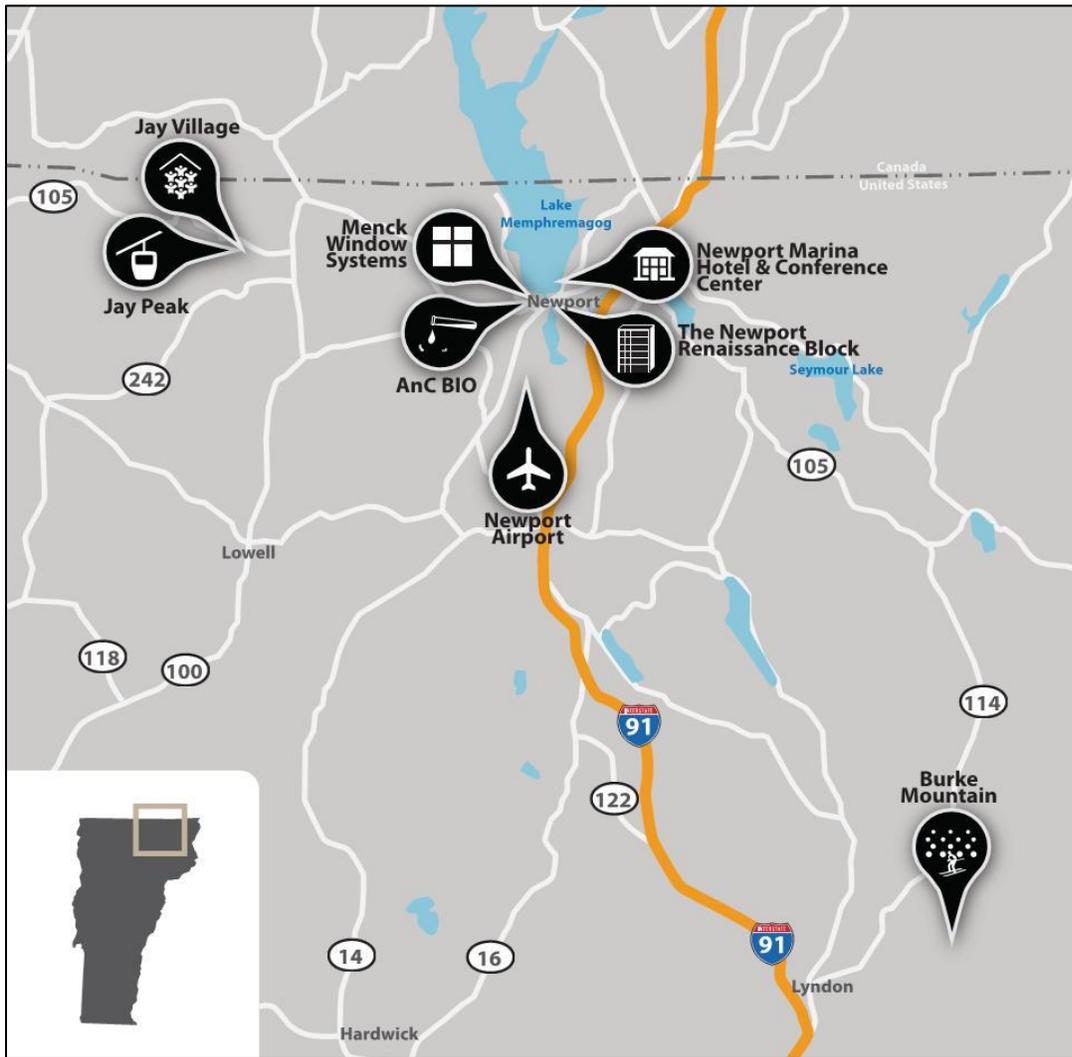
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# 1 INTRODUCTION

The Northeast Kingdom has received significant attention recently with discussions of increased efforts to strengthen the overall vibrancy and vitality of the region. This is an opportune time to evaluate the implications of projected EB-5 growth in the Jay, Newport/Derby, and Burke/Lyndon areas to ensure that the transportation system can continue to support this and future growth sustainably and in a manner consistent with the region’s vision for the future. This effort is focused on accommodating the initial wave of 1,500 – 2,000 jobs expected to be generated directly by the nine EB-5 Immigrant Investor -related economic development projects identified in Figure 1 below.

Figure 1: Northeast Kingdom Study Area Context



The eight EB-5 economic development projects that form the basis of this study include:

- **Jay Peak (2 projects)** – a total of \$170 million in investment in new facilities, anticipated to be built in 2013 and 2014
- **Jay Village** – \$120 million investment in a new 150-suite hotel offering recreation and entertainment facilities, anticipated to be operational in 2015
- **Newport Manufacturing (2 projects)** – approximately 165,000 square feet of new manufacturing and distribution facilities generating 2,000 direct and indirect jobs, anticipated to be operational in 2013 and 2014
- **Newport Marina Hotel and Conference Center** – a new 150-unit hotel anticipated to be constructed in 2014
- **The Newport Renaissance Block** – a new 6-level mixed-use building in downtown Newport anticipated to be constructed in 2014
- **Burke Mountain** - \$108 million in investment in new hotel facilities generating over 2,000 direct, indirect and induced jobs, anticipated to be constructed between 2013 and 2015.

The growth projected to be associated with the EB-5 projects is sure to have a positive impact on the region's economy. However, this growth (both primary and induced) will place a strain on the current transportation infrastructure. This is the perfect opportunity to step back and evaluate the future scenario from a truly regional perspective to ensure that transportation improvements occur in an orderly and planned fashion and are consistent with a vision for the region articulated by residents and business owners from across the Northeast Kingdom. While a key component of this study is the review and update of recent transportation planning initiatives to ensure compatibility with EB-5 growth projections, this plan is also an opportunity to bring the region together to develop a shared vision for the future of the Northeast Kingdom and identify specific recommendations, triggers, and an implementation plan to ensure that the plan's conclusions become reality.



## 2 PROJECT BACKGROUND

### 2.1 EXISTING PLAN AND STUDY REVIEW

Seven relevant studies of note (shown below in Figure 2) have been reviewed to establish a comprehensive background for this transportation study. A brief summary of the key findings and recommendations of each of these studies is provided below.

Figure 2 Existing Plan and Study Review

	Date	Report Title	Author	Sponsor
1	2010	Newport City Thoroughfare Plan	Smart Mobility	NVDA
2	2008	Lyndon Area Corridor Management Plan	Smart Mobility	NVDA
3	2008	Intersection Study at Main Street, Causeway & Railroad Square	Lamoureux & Dickinson	NVDA, Newport City
4	2007	Intersection Study for the US 5/VT 5A/VT 105 Intersection in the Town of Derby, Vermont	Summit Engineering	NVDA, Town of Derby
5	2007	Burke Mountain Area Transportation Infrastructure Study	RSG, LandWorks	NVDA, Towns of Burke and Lyndon
6	2006	Jay Peak Transportation Infrastructure Study	RSG, LandWorks	NVDA, Jay Peak Resort, Towns of Jay, Troy, and Westfield
7	2006	US 5 Corridor Study	RSG	NVDA, Newport City, Town of Derby, Village of Derby Center

#### NEWPORT CITY THOROUGHFARE PLAN (*SMART MOBILITY, 2010*)

- E Main Street (US 5): extend sidewalk to Causeway/Union Intersection; narrow cross section, improve crosswalks with bulb-outs, reduce access points, replace outdated traffic signal. *Some progress*
- Bicycle Network: plan, sign and mark bicycle routes to nearby destinations. *Not implemented*
- Main Street (US 5): replace signal at Coventry to coordinate with new signal, reconfigure Coventry intersection for wider sidewalks and narrower lanes. *Not implemented*
- Coventry Street: resurface, provide pedestrian improvements, reconfigure with on-street parking. *Paving completed in 2011*
- Causeway: establish Parkway Streetscape with greenbelt along sidewalk, landscaped median, and tree arcade. *Not implemented*

#### LYNDON AREA CORRIDOR MANAGEMENT PLAN (*SMART MOBILITY, 2008*)

- Broad Street Project: scale-back continuous third lane, add greenbelt between roadway and sidewalk, extend project limit north to include safety and capacity concerns at Hill Street/South Street Intersection, implement innovative storm water treatment. *Some progress*
- Charles Street: restore two-way operations. *Not implemented*
- VT 114: consider bicycle transportation in corridor; access management. *Not implemented*
- VT 122: consider truck route designation and associated improvements. *Not implemented*
- Lyndonville: expand downtown parking; Depot Street streetscape improvements. *Not implemented*



### **INTERSECTION STUDY AT MAIN STREET, CAUSEWAY & RAILROAD SQUARE (LAMOUREUX & DICKINSON, 2008)**

- Three alternatives: signalization, roundabout, or one-way traffic circulation; one-way circulation preferred. *Not implemented*

### **INTERSECTION STUDY FOR THE US 5/VT 5A/VT 105 INTERSECTION IN THE TOWN OF DERBY, VERMONT (SUMMIT ENGINEERING, 2007)**

- Intersection signalization with pedestrian accommodations (alternative 3). *Not implemented*

### **BURKE MOUNTAIN AREA TRANSPORTATION INFRASTRUCTURE STUDY (RSG AND LANDWORKS, 2007)**

- US 5 (Broad Street): widen to a 3-lane section with center two-way left-turn lane, landscaping, and consolidated curb cuts. *Not implemented*
- US 5/VT 114 Intersection: remove northbound slip lane and re-time traffic signal; evaluate roundabout. *Not implemented*
- US 5/Back Center Road: re-time traffic signal. *Not implemented*
- East Burke: streetscape, bike/ped/gateway, intersection and access management enhancements. *Bike and Ped grant awarded for final engineering and construction*
- Lyndonville: convert two-way roads into a one-way circulation scheme. *Not implemented*
- Regional: new shuttle bus between Burke Mountain Resort, East Burke and Lyndon. *Not implemented*
- VT 122: pavement reconstruction from Matthewson Hill Road to Pudding Hill Road. *Paving overlay to exit 24 completed*
- VT 114: pavement reconstruction from US 5 to Quarry Road (Newark). *Not implemented*
- Burke: bridge replacement BR 15 and BR 17 over Dish Mill Brook. *Completed*

### **JAY PEAK TRANSPORTATION INFRASTRUCTURE STUDY (RSG AND LANDWORKS, 2006)**

- VT 242: shoulder expansion from Jay village to Jay Peak Resort; pavement reconstruction. *Paving project schedule for Summer 2014*
- VT 105: pavement reconstruction from VT 101 to North Troy. *Completed*
- VT 242/VT 101 Intersection: add northbound left and eastbound right turn lanes. *Not implemented*
- Regional: village enhancements (i.e., sidewalks, drainage, streetscaping, traffic calming) in Jay, North Troy, Troy and Westfield; implement land use recommendations. *Westfield feasibility study completed in 2012*
- VT 242: install new safety signage – *Not implemented*
- Jay Peak: install four new directional signs and relocate two Official Business Directional Signs – *Not implemented*

### **US 5 CORRIDOR STUDY (RSG, 2006)**

- New Sidewalks on US 5 between Quarry Road & Shaws Plaza and between West Street and VT 105. *Not implemented*



- Spot-Speed Study in Derby Center Village. *Not implemented*
- Transit shelters/signage on US 5. *Completed*
- Intersection improvements on US 5 at Western Avenue, Community Drive, Shattuck Hill Road, Quarry Road, Shaws Plaza, I-91 ramps, and VT 105. *Completed*
- US 5 widening: Western Avenue to Industrial Drive, Industrial Drive to I-91, I-91 to VT 105. *Not implemented*
- Construct new local roads between Shattuck Hill Road and US 5. *Not implemented*
- Construct new connectors between Shaws Plaza and Quarry Road, and between US 5 and West Street. *Commons Road constructed between Shaws Plaza and Quarry Road*

## 2.2 PROJECT KICK-OFF MEETING

In addition to the information gleaned from the previous studies described in Section 2.1 of this report, local and regional stakeholders provided valuable input during the project kick-off meeting, held on June 12, 2013. Local insights relevant to this study are shown graphically in Figure 3, Figure 4, and Figure 5 for the three study areas.



Figure 3: Kick-off Meeting Comments – Newport/Derby Study Area

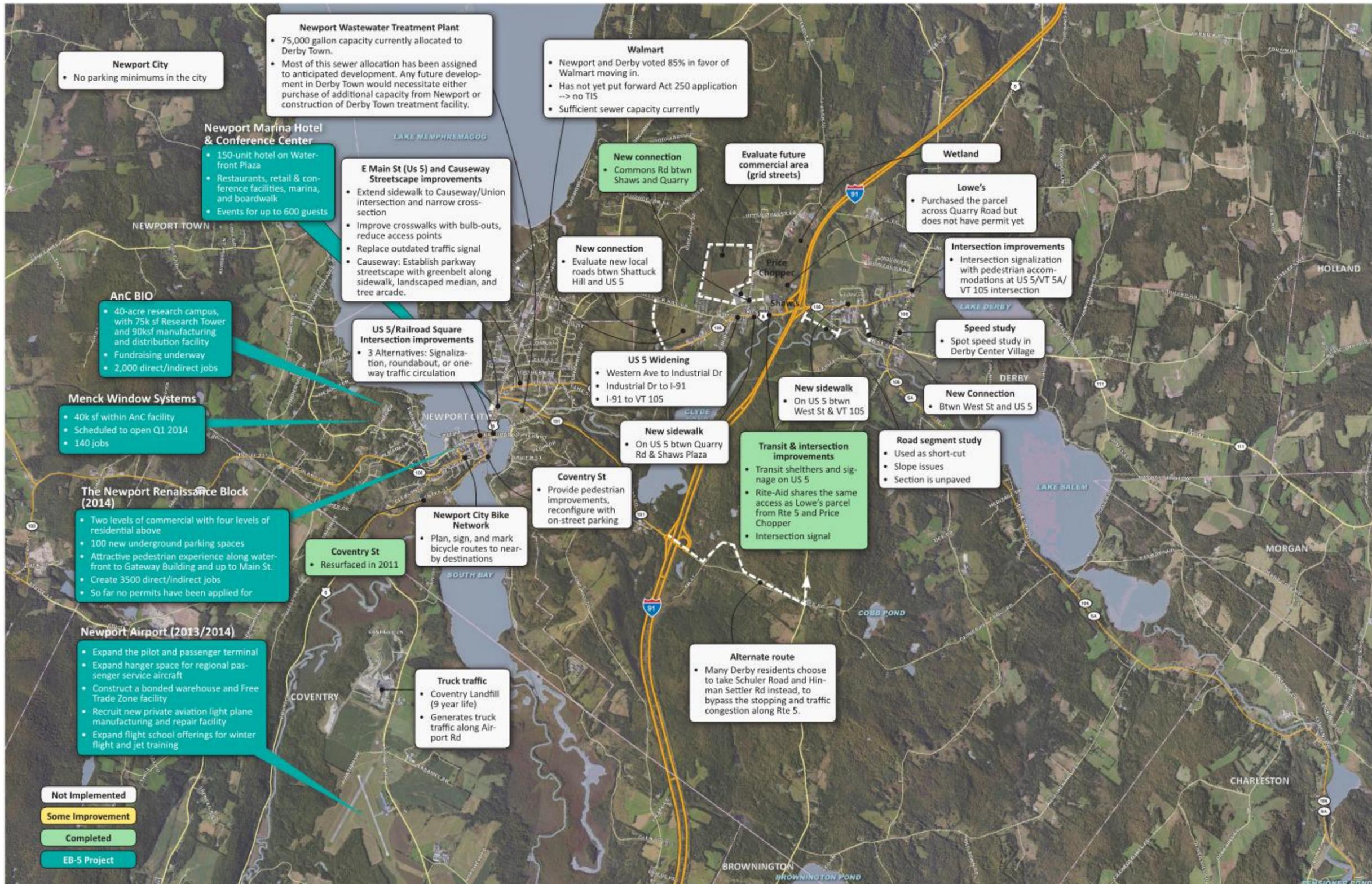


Figure 4: Kick-off Meeting Comments – Burke/Lyndon Study Area

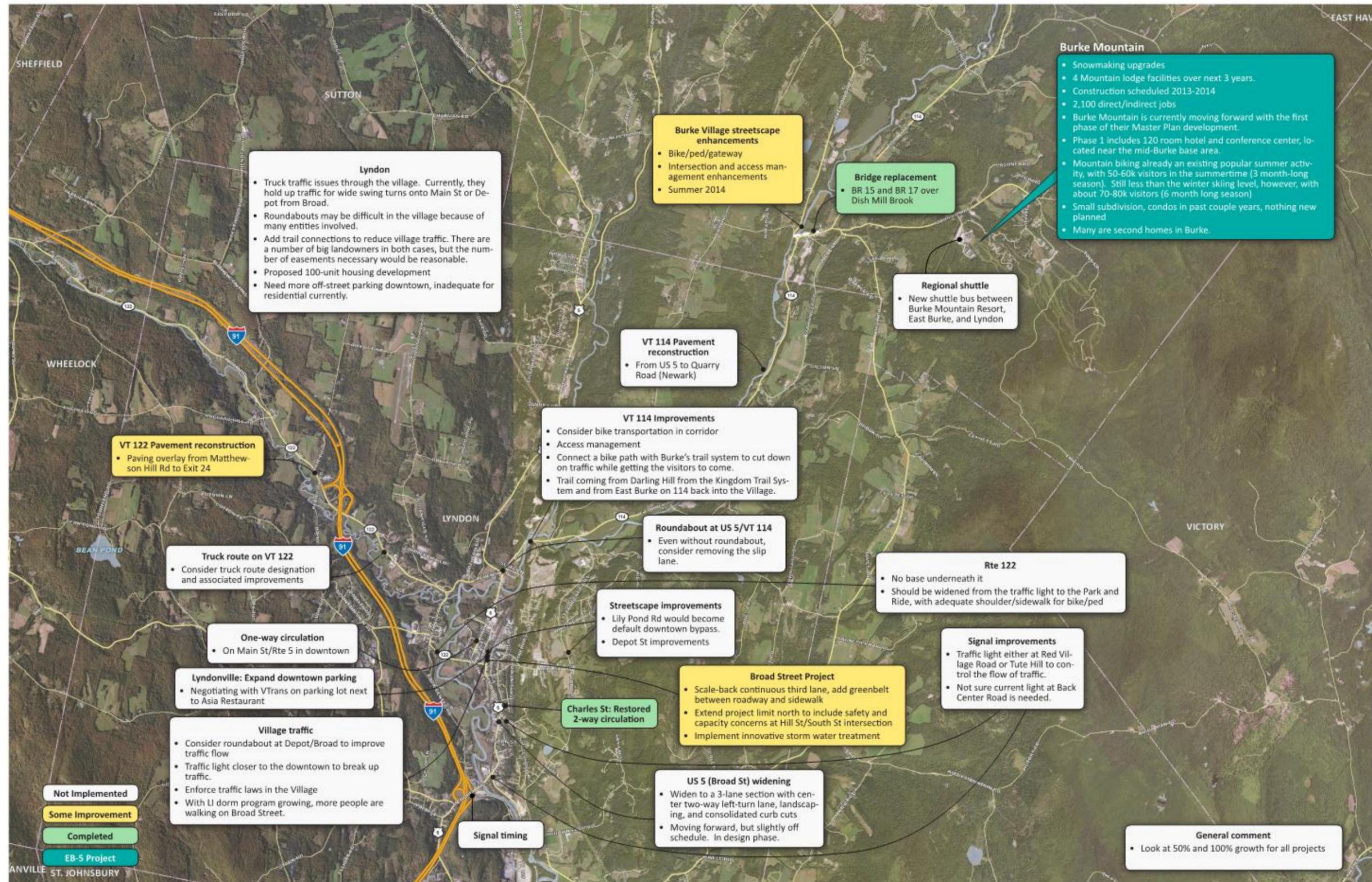
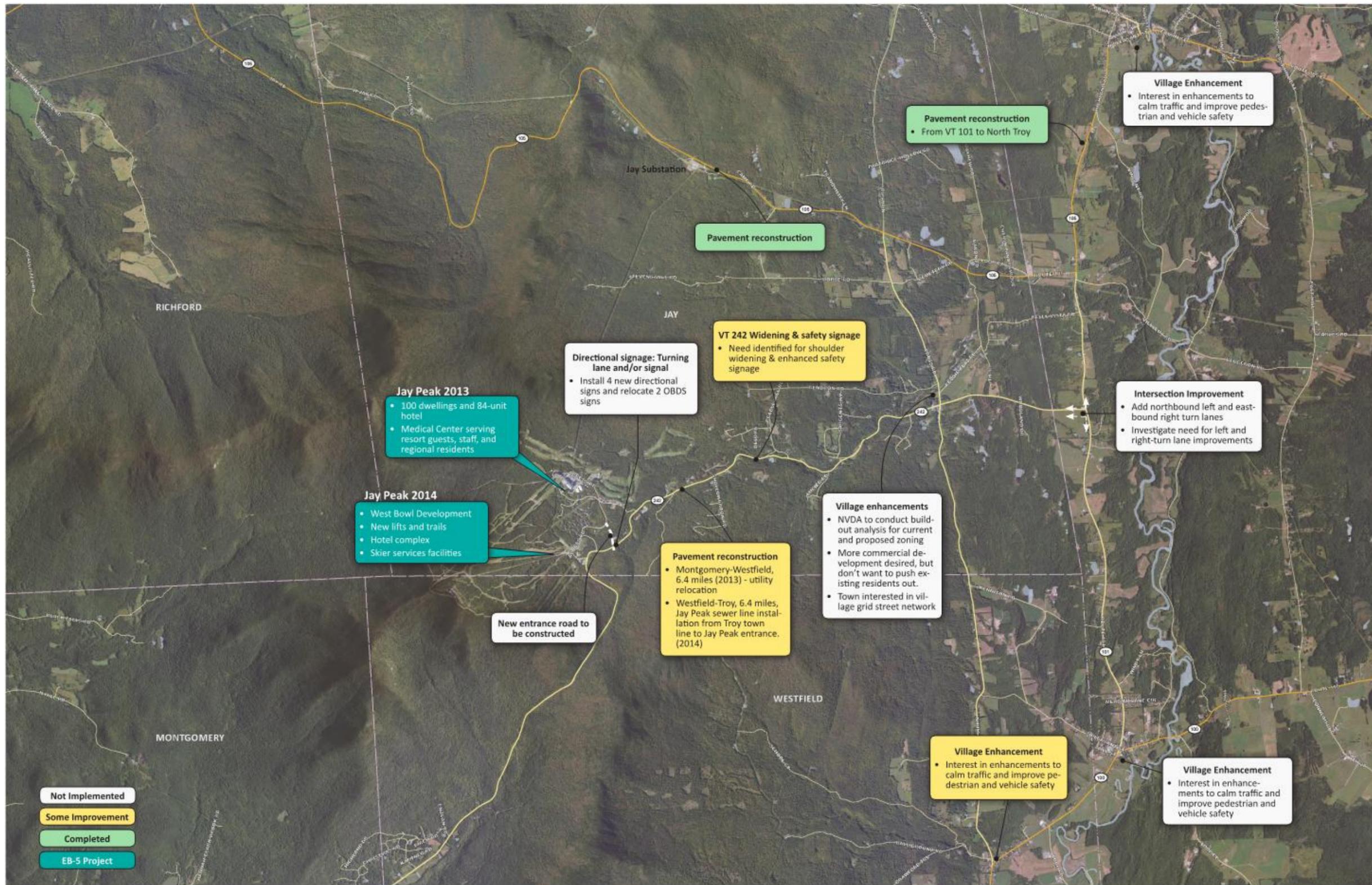


Figure 5: Kick-off Meeting Comments – Jay Study Area



## 3 EXISTING CONDITIONS

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### 3.1 PROJECT STUDY AREA

The Northeast Kingdom Transportation Infrastructure Plan is split into three study areas, due to the large geographic area covered by the study. The three study areas are the Newport/Derby Study Area, the Burke/Lyndon Study Area, and the Jay Study Area.

#### NEWPORT/DERBY STUDY AREA

The Newport/Derby Study Area is shown below in Figure 6 and Figure 7. It is located in the area bounded by the Town of Newport to the west, Lake Memphremagog to the north, the towns of Morgan and Holland to the east, and the towns of Coventry and Brownington to the south. There are a total of 16 intersections within the Newport/Derby Study Area identified for evaluation in this study:

##### *Newport Intersections*

1. Main Street/Lake Road
2. Main Street (US 5/VT 105)/School Street/Third Street
3. Main Street (US 5/VT 105)/Coventry Street/Seymour Lane
4. Main Street (US 5/VT 105)/Causeway/Railroad Square
5. E Main Street (US 5/VT 105)/VT 191
6. E Main Street (US 5/VT 105)/Union Street
7. Coventry Street (US 5)/Airport Road
8. Highland Avenue (VT 105)/Logan Drive
9. Highland Avenue (VT 105)/Alderbrook Road
10. Highland Avenue (VT 105)/Pleasant Street (US 5)

##### *Derby Intersections*

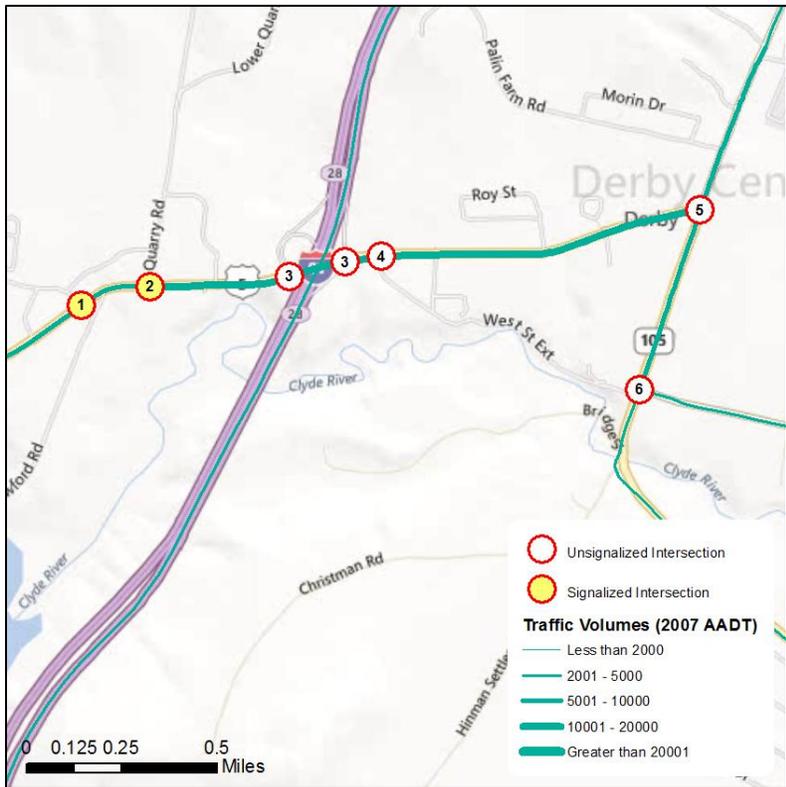
1. US 5/Shattuck Hill Road/Crawford Road
2. US 5/Quarry Road
3. US 5/I-91 Northbound & Southbound Ramps
4. US 5/West Street
5. Main Street (US 5/VT 5A/VT 105)/Derby Line Road
6. Main Street (VT 5A/VT 105)/VT 111



Figure 6: Newport Study Intersections and Traffic Control



Figure 7: Derby Study Intersections and Traffic Control



## BURKE/LYNDON STUDY AREA

The Burke/Lyndon Study Area is shown below in Figure 8 and Figure 9. It is located in the area bounded by I-91 to the west, the towns of Newark and East Haven to the north, Burke Mountain to the east, and the Town of St. Johnsbury to the south. There are a total of seven intersections within the Burke/Lyndon Study Area identified for evaluation in this study:

### Burke Intersections

1. VT 114/Mountain Road
2. VT 114/East Darling Hill Road

### Lyndon Intersections

1. US 5/VT 114/VT 122
2. Main Street (US 5)/Depot Street
3. Depot Street (US 5)/Broad Street
4. US 5/Red Village Road
5. US 5/Back Center Road/Calkins Drive

Figure 8: Burke Study Intersections and Traffic Control

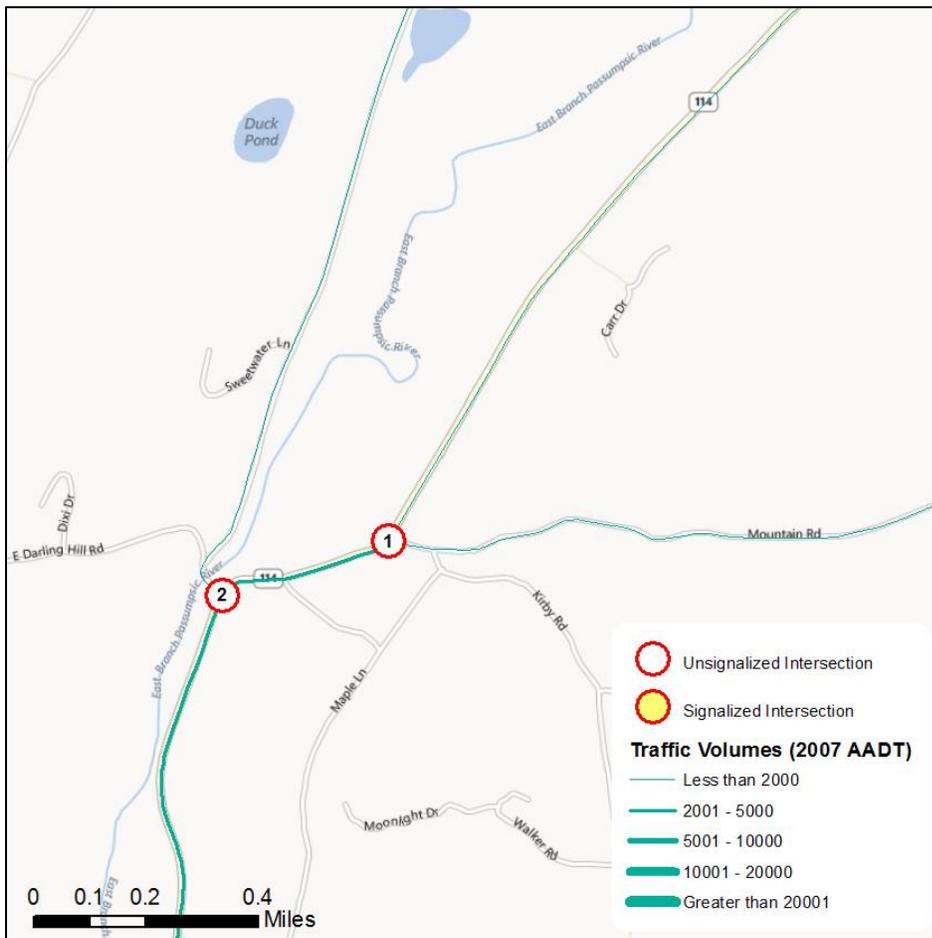
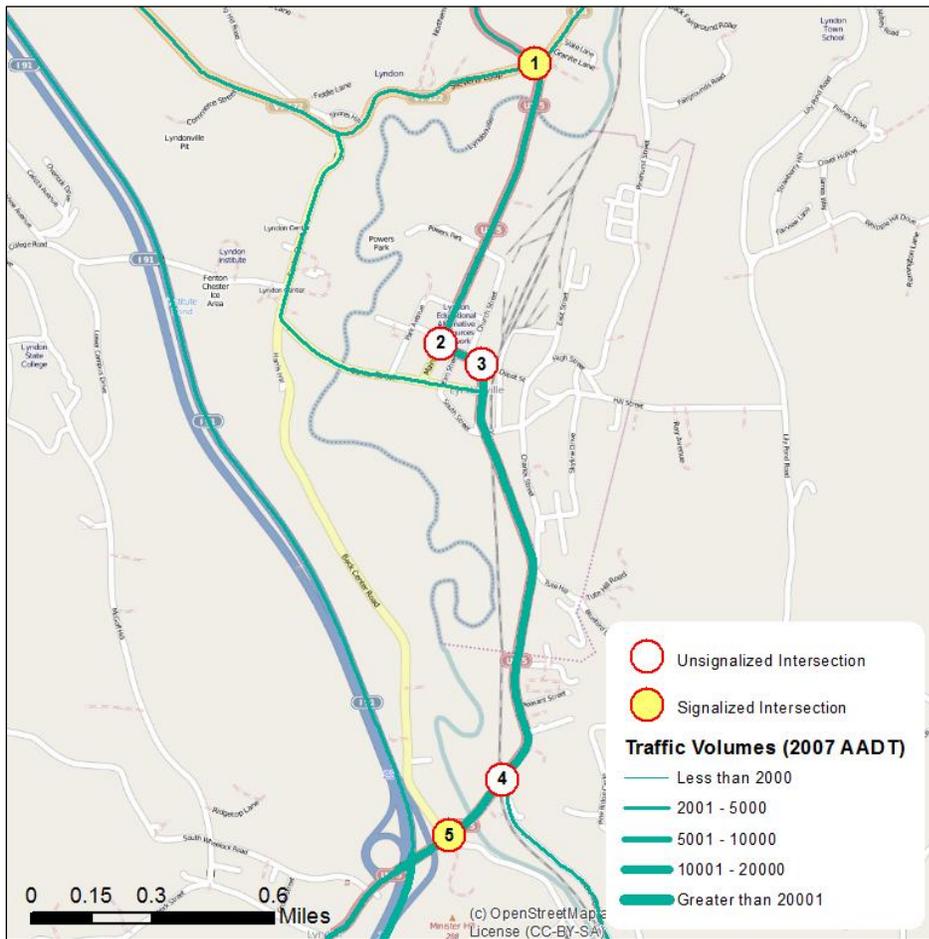


Figure 9: Lyndon Study Intersections and Traffic Control

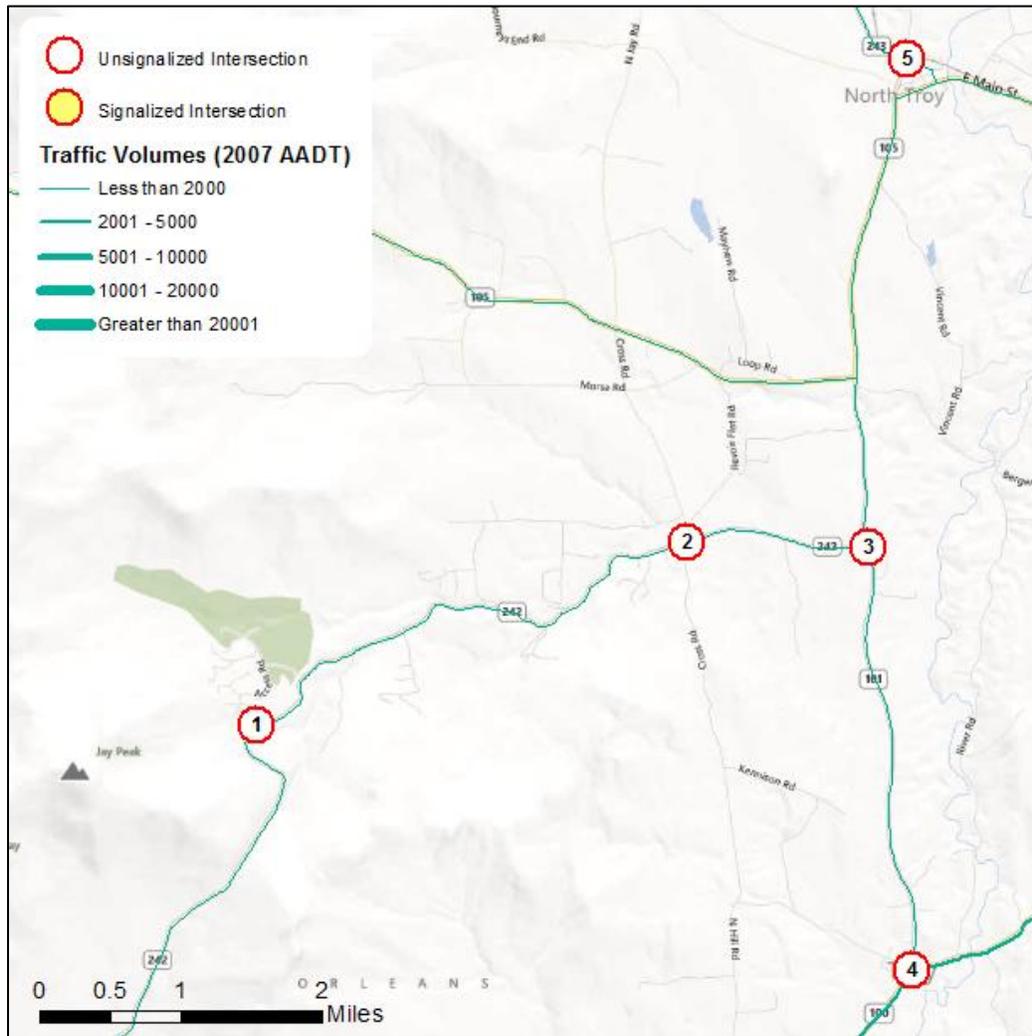


### JAY STUDY AREA

The Jay Study Area is shown below in Figure 10. It is located in the area bounded by Jay Peak to the west, the Canadian border to the north, the Town of Newport to the east, and the Town of Westfield to the south. There are a total of five intersections within the Jay Study Area identified for evaluation in this study:

1. VT 242/Jay Peak Access Road
2. VT 242/Cross Road
3. VT 242/VT 101
4. VT 101/VT 100
5. VT 243/Elm Street/Railroad Street

Figure 10: Jay Study Intersections and Traffic Control



### 3.2 ROADWAY CHARACTERISTICS

The roadway characteristics for the major roadway corridors in the three project study areas are summarized in Figure 11. Characteristics include the roadway’s functional classification, jurisdiction, number of travel lanes, posted speed limits (mph), and approximate shoulder widths. The functional classification and jurisdiction hierarchies are described below.

#### FUNCTIONAL CLASSIFICATION

The Federal Highway Administration’s roadway functional classification system is organized as a hierarchy of facilities, based on the degree to which the roadway serves mobility and access to adjacent land uses. Freeways and interstate highways, at the top of the hierarchy, are devoted exclusively to vehicle mobility, with no direct access to adjacent land. Arterials and Collectors provide both mobility and access to adjacent land uses. The local road system is devoted exclusively to providing local access, with limited capacity and relatively slow speeds.



As shown in Figure 11, most of the study area roadways are classified as major collectors and serve the primary role of providing a connection between the local road network and the arterial network. Other roadways in the study area are classified as minor arterials or interstate (I-91).

## ROADWAY JURISDICTION

Roadway jurisdictions refer to the local, state, or federal entity responsible for the operation and maintenance of a roadway facility. The different designations are provided below.

- State Route: Forms the primary transportation network through the State and is the responsibility of VTrans. State routes include all state numbered highway routes not designated as Class 1 town highways and US highways.
- Class 1 Town Highway: Forms the extension of state numbered highway routes through a town, and which carry a state highway route number. Class 1 town highways are subject to concurrent jurisdiction between the Municipality and VTrans on several matters.
- Class 2 Town Highway: Those town highways selected as the most important highways in each town. As far as practicable they shall be selected with the purposes of securing trunk lines of improved highways connecting two towns and to places which by their nature have more than a normal amount of traffic. Class 2 highways are primarily the responsibility of municipalities.
- Class 3 Town Highway: All other town highways that are "negotiable under normal conditions all seasons of the year by a standard pleasure car." Class 3 town highways, including sidewalks, crosswalks, and parking, are the responsibility of municipalities.
- Class 4 Town Highway: All other town highways are considered Class 4 town highways. The majority of these receive limited or no maintenance.

As shown in Figure 11, most of the major study area roadways fall under the jurisdiction of the State. Those facilities located within the city/town limits of Newport and Lyndonville fall under the jurisdiction of the Town. I-91 is part of the Interstate Highway System, and therefore is under joint State and Federal jurisdiction.



Figure 11: Characteristics of Major Study Area Roadways

Roadway	Functional Classification	Jurisdiction	Speed Limit (mph)	# of Travel Lanes (in each direction)	Shoulder Width
<b>Newport/Derby Study Area</b>					
I-91	Interstate	Federal	65	2	Approx. 6'
US 5	Minor Arterial; Major Collector s/o Newport City and n/o Town of Derby	State outside of Newport City; Town in Newport City	25 - 35	1-2	Approx. 0' – 3'
VT 191	Minor Arterial	State	35-50	1	Approx. 1' – 3'
VT 111	Major Collector	State	35	1	None
VT 105	Minor Arterial	State outside of Newport City; Town in Newport City	35	1	Approx. 1' – 3'
VT 5A	Minor Arterial	State	35	1	Approx. 1' – 3'
<b>Burke/Lyndon Study Area</b>					
US 5	Major Collector	State outside of Lyndonville; Town in Lyndonville	35	1	Approx. 1' – 5'
VT 122	Major Collector	State	35	1	Approx. 1' – 3'
VT 114	Major Collector	State	30 - 40	1	Approx. 1' – 3'
<b>Jay Study Area</b>					
VT 243	Major Collector	State	25-40	1	Approx. 0' – 3'
VT 242	Major Collector	State	35	1	Approx. 0' – 1'
VT 101	Major Collector	State	50	1	Approx. 1' – 3'
VT 100	Minor Arterial	State	35	1	Approx. 1' – 3'

### 3.3 TRAFFIC VOLUMES

#### EXISTING TRAFFIC VOLUMES

The most recent Average Annual Daily Traffic (AADT) data is presented below in Figure 12 and shows that US 5 experiences the highest traffic volumes across the three study areas. The three areas along US 5 that carry the highest traffic volumes in the study area are: west of downtown Newport, west of I-91 in Derby, and east of I-91 in Lyndon.



Figure 12: Average Annual Daily Traffic (AADT) Volumes

Location	AADT	Count Year	Source
US 5, east of Coventry Rd (Newport)	15,800	2010	VTrans ATR
US 5, west of Quarry Rd (Derby)	12,400	2010	VTrans ATR
US 5, south of Back Center Rd (Lyndon)	12,300	2010	VTrans ATR
US 5, south of VT 191 (Newport)	9,900	2011	VTrans ATR
US 5, east of West St (Derby)	9,900	2012	VTrans ATR
US 5, west of Depot St (Lyndon)	9,500	2009	VTrans ATR
VT 105, north of VT 111 (Derby)	6,600	2012	VTrans ATR
US 105, west of US 5 (Newport)	4,900	2010	VTrans ATR
VT 114, north of Burke Hollow Rd (Burke)	3,500	2012	VTrans CTC
VT 101, south of VT 242 (Troy)	1,900	2010	VTrans ATR
VT 242, west of Cross Rd (Jay)	1,700	2012	VTrans ATR
Jay Peak Access Rd (Jay)	1,200	2010	VTrans CTC
Mountain Rd (Burke)	1,100	2012	VTrans CTC

## TURNING MOVEMENT COUNTS

The most recent weekday afternoon and winter weekend afternoon turning movement count data was compiled for the study intersections and is summarized in Figure 13 below. Winter weekend afternoon data was used in place of midweek afternoon data near Burke Mountain Resort and Jay Peak Resort because it is during this time period when traffic volumes were highest due to ski resort traffic.



Figure 13 Turning Movement Count Volumes (Count Year and Source)

Location	Period	Count Year	Source
<b>Newport Intersections</b>			
1. W Main St and Main St / Lake Rd	Midweek	2013	NVDA
2. US 5 / Main and School St	Midweek	2011	VTrans
3. US 5 / Coventry St	Midweek	2012	VTrans
4. US 5 / Causeway / Railroad Sq	Midweek	2013	NVDA
5. US 5 / VT 191	Midweek	2012	VTrans
6. US 5 / Union St	Midweek	2012	VTrans
7. US 5 / Airport Rd	Midweek	2011	VTrans
8. VT 105 / Logan Dr	Midweek	2013	NVDA
9. VT 105 / Alderbrook Rd	Midweek	2011	VTrans
10. VT 105 / US 5	Midweek	2013	VTrans
<b>Derby Intersections</b>			
1. US 5 / Shattuck Hill Rd and Crawford Rd	Midweek	2013	VTrans
2. US 5 / Quarry Rd	Midweek	2013	VTrans
3A & 3B. US 5 / I-91 NB & SB Ramps	Midweek	2012	VTrans
4. US 5 / West St	Midweek	2005	RSG
5. US 5 / VT 105	Midweek	2012	VTrans
6. VT 105 / VT 111	Midweek	2012	VTrans
<b>Burke Intersections</b>			
1. VT 114 / Mountain Rd	Weekend	2011	NVDA
2. VT 114 / Burke Hollow	Weekend	2011	NVDA
<b>Lyndon Intersections</b>			
1. US 5 / VT 114 and VT 122	Midweek	2012	VTrans
2. Depot St / Main St	Midweek	2013	NVDA
3. US 5 / Depot St / Broad St	Midweek	2013	NVDA
4. US 5 / Red Village Rd	Midweek	2011	VTrans
5. US 5 / Back Center Rd and Calkins Dr	Midweek	2011	VTrans
<b>Jay Intersections</b>			
1. VT 242 / Jay Access Road	Weekend	2011	NVDA
2. VT 242 / Cross Rd	Weekend	2011	NVDA
3. VT 101 / VT 242	Weekend	2011	NVDA
4. VT 101 / VT 100	Midweek	2010	VTrans
5. VT 243 / Elm St and Dominion Ave	Midweek	2008	VTrans



## TRAFFIC ADJUSTMENTS

Following VTrans traffic study guidelines, raw peak hour traffic volumes were adjusted to represent the design hour volume (DHV)<sup>1</sup> in 2014 using two adjustment factors:

1. Design hour adjustment factors are based on multiple VTrans permanent count stations. The 2012 DHV at these stations were compared to the peak hour volumes on the date of the turning movement count to formulate DHV adjustments.<sup>2</sup>
2. An annual adjustment factor, which represents general background traffic growth, is based on historic count data at multiple VTrans permanent count stations, as presented in the 2012 VTrans *Red Book*.

### 3.4 2014 CONGESTION ANALYSIS

Level-of-service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. LOS is estimated using the procedures outlined in the 2010 Highway Capacity Manual (HCM). In addition to traffic volumes, key inputs include the number of lanes at each intersection and the traffic signal timing plans. The LOS results are based on the existing lane configurations and control types (signalized or unsignalized) at each study intersection.

The 2010 HCM defines six qualitative grades to describe the LOS at an intersection. LOS is based on the average control delay per vehicle. Figure 14 shows the various LOS grades and descriptions for unsignalized and signalized intersections.

**Figure 14: Level-of-Service Criteria for Signalized and Unsignalized Intersections**

LOS	Characteristics	Unsignalized	Signalized
		Total Delay (sec)	Total Delay (sec)
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short delays	10.1-15.0	10.1-20.0
C	Average delays	15.1-25.0	20.1-35.0
D	Long delays	25.1-35.0	35.1-55.0
E	Very long delays	35.1-50.0	55.1-80.0
F	Extreme delays	> 50.0	> 80.0

The delay thresholds for LOS at signalized and unsignalized intersections differ because of the driver’s expectations of the operating efficiency for the respective traffic control conditions. According to HCM procedures, an overall LOS cannot be calculated for two-way stop-controlled intersections because not all movements experience delay. In signalized and all-way stop-controlled intersections, all movements experience delay and an overall LOS can be calculated.

The VTrans policy on level of service is:

<sup>1</sup> The DHV is the 30th highest hour of traffic for the year and is used as the design standard in Vermont.

<sup>2</sup> Due to poor data in their vicinity, all intersections in Lyndon used a different, but still VTrans approved, adjustment factor. The design hour adjustments were based on VTrans count stations, which had recorded an Annual Average Daily Traffic (AADT). These design hour adjustment factors are based on the VTrans “k” factor and DHV equations for Urban Roads presented in the 2012 VTrans Red Book.



- Overall LOS C should be maintained for state-maintained highways and other streets accessing the state's facilities
- Reduced LOS may be acceptable on a case-by-case basis when considering, at minimum, current and future traffic volumes, delays, volume to capacity ratios, crash rates, and negative impacts as a result of improvement necessary to achieve LOS C.
- LOS D should be maintained for side roads with volumes exceeding 100 vehicles/hour for a single lane approach (150 vehicles/hour for a two-lane approach) at two-way stop-controlled intersections.

The HCM congestion reports from Synchro (v8), a traffic analysis software package from Trafficware, were used to assess congestion at the study intersections. In general, existing intersection geometries, traffic control, and signal timings were used for the congestion analysis.

The congestion analysis results indicate that almost all intersection approaches currently operate at LOS D or better during the peak hour. The only exceptions to this are listed below:

- The westbound and northbound approaches at the US 5/Mt Vernon Street intersection in Newport, which operate at LOS F and E respectively.
- The northbound left at the US 5/Depot Street/Broad Street intersection in Lyndon, which operates at LOS F.

Additionally, despite falling within VTrans acceptable guidelines, it is worth noting that the following approaches currently operate at LOS D:

- The southbound left approach at the US 5/I-91 Southbound Ramps intersection in Derby
- The northbound left approach at the US 5/I-91 Northbound Ramps intersection in Derby
- The eastbound left approach at the US 5/VT 105 intersection in Derby
- The westbound approach at the US 5/Red Village Road intersection in Lyndon

The congestion analysis results, including intersection LOS, average vehicle delay (in seconds) and the volume to capacity ratio (v/c), are presented below.



Figure 15: Existing Level-of-Service Results (Newport Intersections)

Newport Intersections	Peak Hour 2014 No Build			
	LOS	Delay	v/c	
 <b>1. Main St / Lake Rd</b>	EB, Exiting W Main St	A	8	0.10
	WB, Exiting Main St	B	10	0.43
	SB, Exiting Lake Rd	A	9	0.16
 <b>2. US 5 / Main and School St*</b>	EB, along Main St	A	10	-
	WB, along US 5	A	4	-
	NB, along US 5	A	7	-
	SB, exiting School St	A	8	-
 <b>3. US 5 / Coventry St</b>	Overall	C	30	0.56
	EB, along US 5	C	33	-
	WB, along US 5	C	26	-
	NB, exiting Coventry St	C	32	-
	SB, exiting Lane St	D	35	-
 <b>4. Main St (US 5/VT 105)/Causeway/Railroad Sq</b>	EB Left, along US 5	A	3	-
	EB Through/Right, exiting US 5	A	2	-
	WB, exiting Railroad Sq	F	>100	-
	NB, exiting Poulin Grain Dr	E	42	-
	SB, along US 5	A	8	-
 <b>5. US 5 / VT 191</b>	Overall	B	15	0.68
	WB, exiting VT 191	C	24	-
	NB, along US 5	B	16	-
	SB, along US 5	A	8	-
 <b>6. US 5 / Union St</b>	Overall	B	11	0.46
	WB, along US 5	C	23	-
	NB, along US 5	A	3	-
	SB, exiting Union St	A	10	-
 <b>7. US 5 / Airport Rd</b>	WB, Exiting Airport Rd	A	9	0.03
	SB, along US 5	A	8	0.02
 <b>8. VT 105 / Logan Dr</b>	EB, along VT 105	A	8	0.00
	SB, exiting Logan Dr	B	11	0.02
 <b>9. VT 105 / Alderbrook Rd</b>	WB, along VT 105	A	8	0.07
	NB, exiting Alderbrook Rd	B	10	0.10
 <b>10. VT 105 / US 5</b>	WB, along US 5	A	8	0.03
	NB, along US 5	B	10	0.06

\*Denotes an intersection where SimTraffic was used to calculate delay



Figure 16: Existing Level-of-Service Results (Derby Intersections)

Derby Intersections	Peak Hour 2014 No Build		
	LOS	Delay	v/c
 <b>1. US 5 / Shattuck Hill Rd and Crawford Rd</b> Overall EB, exiting Shattuck Hill Rd WB, exiting Crawford Rd NB, along US 5 SB, along US 5	B	17	0.59
	C	30	-
	B	18	-
	B	14	-
	B	14	-
 <b>2. US 5 / Quarry Rd</b> Overall EB, exiting Quarry Rd WB, exiting Parking Lot NB, along US 5 SB, along US 5	B	13	0.53
	B	12	-
	B	11	-
	B	14	-
	B	12	-
 <b>3A. US 5 / I91 SB Ramps</b> EB Left, exiting US 5 SB Left, exiting I91 SB SB Right, exiting I91 SB	A	9	0.09
	D	31	0.06
	B	12	0.07
 <b>3B. US 5 / I91 NB Ramps</b> EB Left, exiting US 5 NB Left, exiting I91 NB NB Right, exiting I91 NB	A	9	0.04
	D	29	0.20
	B	14	0.17
 <b>4. US 5 and West St</b> WB, US 5 NB, exiting West St	A	9	0.00
	C	21	0.10
 <b>5. US 5 / VT 105</b> EB Left, along US 5 EB Right, exiting US 5 NB, along VT 105 SB, along US 5	D	25	0.54
	B	12	0.38
	A	8	0.15
	-	-	-
 <b>6. VT 105 / VT 111</b> WB, exiting VT 111 SB, along VT 105	B	12	0.24
	A	8	0.12

Figure 17: Existing Level-of-Service Results (Burke Intersections)

Burke Intersections	Peak Hour 2014 No Build		
	LOS	Delay	v/c
 <b>1. VT 114 / Mountain Rd</b> WB, exiting Mountain Rd SB, along VT 114	B	15	0.50
	A	8	0.00
 <b>2. VT 114 / Darling Hill Rd</b> EB, exiting Burke Hollow Rd NB, along VT 114	B	13	0.10
	A	8	0.02



Figure 18: Existing Level-of-Service Results (Lyndon Intersections)

Lyndon Intersections	Peak Hour 2014 No Build		
	LOS	Delay	v/c
 <b>1. US 5 / VT 114 and VT 122</b> Overall EB, exiting VT 122 WB, exiting VT 114 NB, along US 5 SB, along US 5	B	11	0.66
	A	8	-
	B	12	-
	B	12	-
	B	11	-
 <b>2. Depot St./Main St*</b> WB, along US 5 NB, exiting Main St SB, along US 5	A	2	-
	B	13	-
	A	1	-
 <b>3. US 5/Depot St/Broad St</b> EB Through exiting US 5 EB Right, along US 5 WB Left, exiting Depot St WB Through, exiting Depot St NB Left, along US 5 NB Right, exiting US 5 SB, exiting Angies Alley	B	11	0.14
	C	19	0.63
	B	13	0.21
	B	11	0.14
	F	69	0.92
	A	9	0.12
	B	10	0.04
 <b>4. US 5 / Red Village Rd</b> WB, exiting Red Village Rd SB Left, exiting US 5	D	30	0.50
	A	10	0.09
 <b>5. US 5 / Back Center Rd and Calkins Dr</b> Overall EB, Exiting Back Center Rd WB, exiting Calkins Dr NB, along US 5 SB, along US 5	A	6	0.56
	C	21	-
	B	20	-
	A	6	-
	A	4	-

\*Denotes an intersection where SimTraffic was used to calculate delay

Figure 19: Existing Level-of-Service Results (Jay Intersections)

Jay Peak Area Intersections	Peak Hour 2014 No Build		
	LOS	Delay	v/c
 <b>1. VT 242 / Jay Access Road</b> EB, along VT 242 SB, exiting Jay Peak Resort	A	7	0.02
	C	17	0.64
 <b>2. VT 242 / Cross Rd</b> EB, along VT 242 WB, along VT 242 NB, along Cross Rd SB, along Cross Rd	A	7	0.01
	A	8	0.00
	B	12	0.06
	A	10	0.03
 <b>3. VT 101 / VT 242</b> EB, Exiting VT 242 NB, along VT 101	B	12	0.41
	A	7	0.03
 <b>4A. VT 101 / VT 101 (North)</b> EB, along S Pleasant St WB, along S Pleasant St NB, along VT 101 SB, along VT 101	B	13	0.08
	A	10	0.15
	A	7	0.03
	A	8	0.09
 <b>4B. VT 101 / VT 101 (South)</b> EB, along VT 100 SB, exiting VT 101	A	8	0.05
	A	9	0.05
 <b>4C. VT 101 / VT 101 (East)</b> SB, Exiting S Pleasant St	B	12	0.23
 <b>5. VT 243 / Elm St and Dominion Ave</b> EB, exiting Elm St WB, exiting Dominion Ave NB, along VT 243	A	9	0.05
	A	9	0.02
	A	7	0.01



### 3.5 LAND COVER

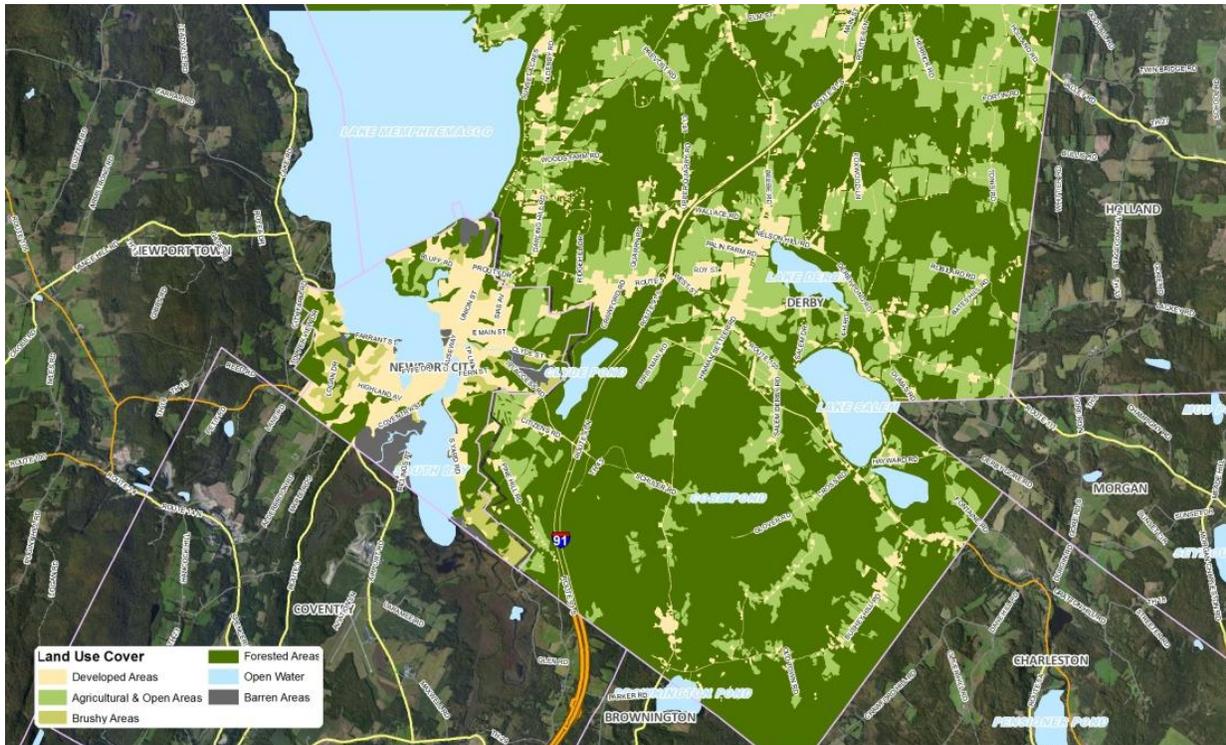
The three study areas comprise five towns (Newport City, Derby, Lyndon, Burke, and Jay) and a total land area of 110,372 acres. The majority of the study areas' land cover falls within the classification of Forested Areas (73 percent), with Agricultural & Open Space as the next largest category (17 percent). Only 7 percent is classified as Developed Area, where 30 percent or more of the area is characterized by constructed materials.<sup>3</sup>

#### NEWPORT/DERBY STUDY AREA

Newport City is the smallest study area municipality in total land area (4,971 acres), but has the highest percentage of developed areas (28 percent) and open water (23 percent). The city has a concentrated density of commercial and office uses in its downtown, surrounded by higher density residential. (Figure 20) The area along the Causeway is slated for major redevelopment as part of the EB-5 projects, as well as the Renaissance Block along Main Street in the historic downtown.

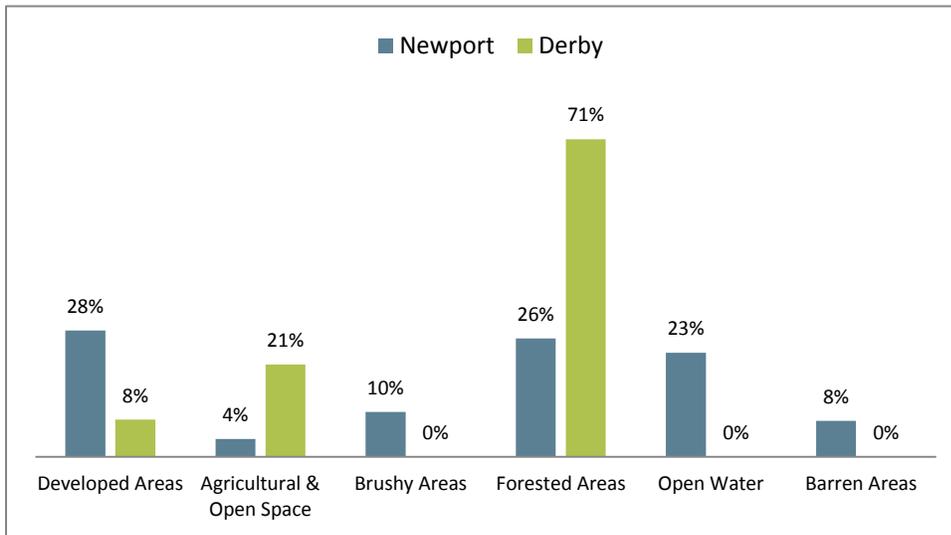
Derby is the largest study area town in terms of total land area (36,566 acres), with over two-thirds of its land cover classified as Forested Areas and only 8 percent classified as Developed Areas. Much of the commercial development is concentrated along two major arterials: east-west along E Main Street/Derby Road/US 5 and north-south along Derby Line Road/US 5. Within the town is Derby Center, a residential village that is positioned around the intersection of Main Street and VT 111, and contains a library, junior high school, and community-serving retail.

Figure 20: Existing Land Cover in Newport/Derby Study Area



<sup>3</sup> NLCD 2001 Land Cover Class Definitions. U.S. EPA.

Figure 21: Existing Land Cover in Newport/Derby Study Area by Percentage



### BURKE/LYNDON STUDY AREA

Shown in Figure 22 and Figure 23, the Lyndon/Burke study area is also predominantly classified as Forested Areas. However, Lyndon is more developed than Burke, particularly in the Lyndonville area. The majority of central Lyndon is zoned residential, with pockets of industrial and industrial-commercial north of VT 114. A village commercial corridor runs along Main Street, Church Street, and Center Street at the core.

Burke is largely Forested Areas (81 percent) and Agricultural & Open Space (11 percent), consistent with its desire to be a tourist destination that is predominantly a rural community with a working landscape, punctuated by pockets of village centers.<sup>4</sup> The majority of the Developed Areas (5 percent) are homes and businesses that are concentrated in the village centers of West Burke and East Burke, and adjacent to the Burke Mountain recreation area.

<sup>4</sup> Burke Town Plan. Burke Planning Commission and Selectboard. July 11, 2011.



Figure 22: Existing Land Cover in Lyndon/Burke Study Area

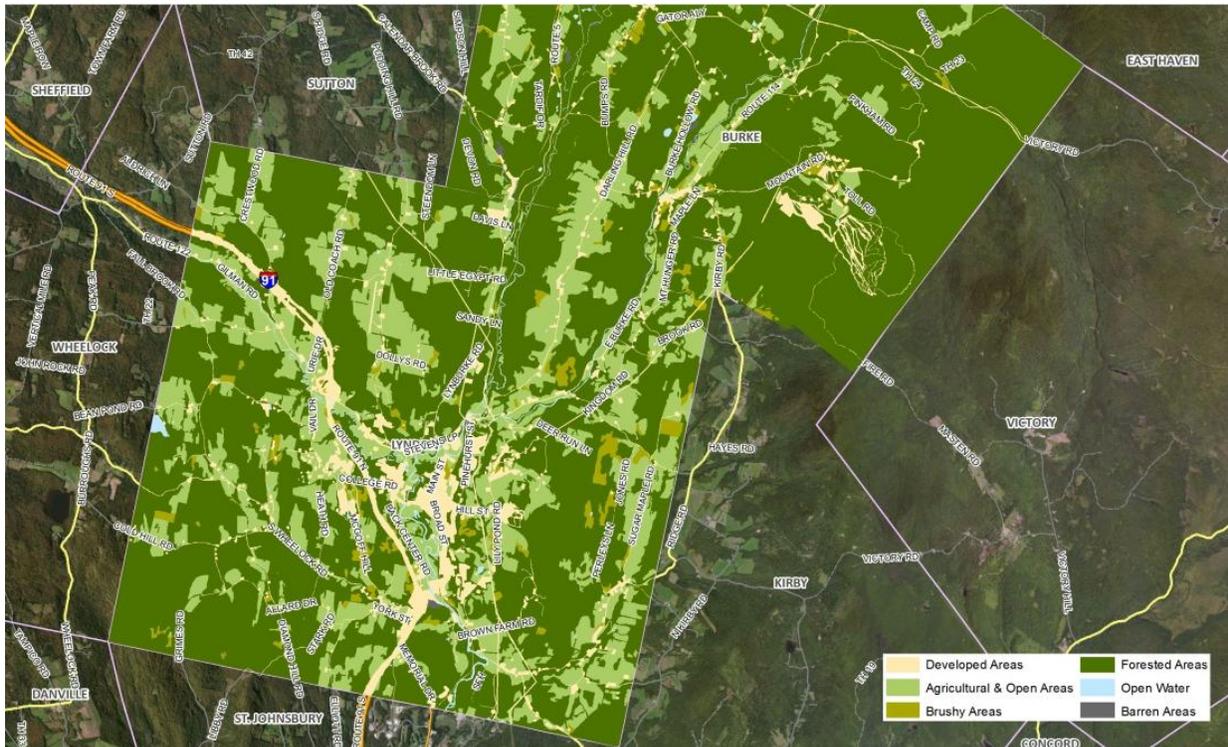
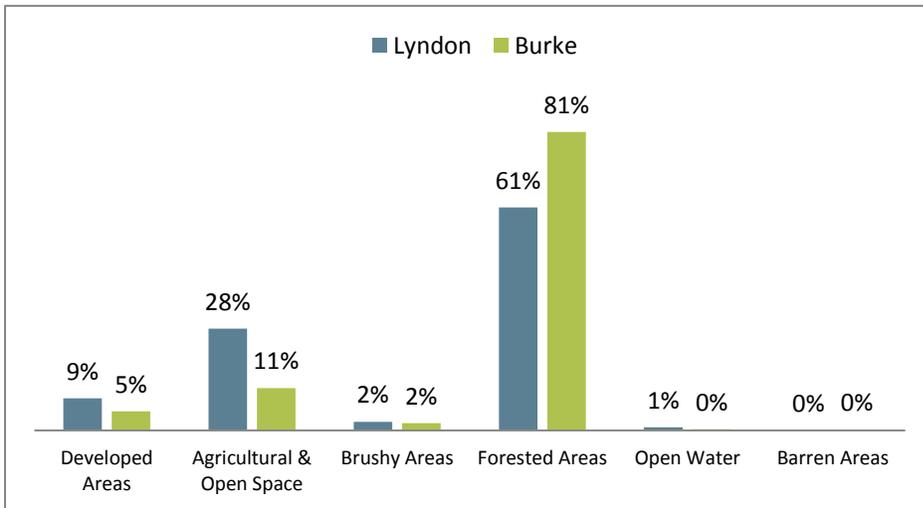


Figure 23: Existing Land Cover in Jay Study Area by Percentage



### JAY STUDY AREA

Jay is roughly the same land area as Burke (21,764 acres), but with half the amount of developed area (519 acres compared to 1,109 acres in Burke). The Town of Jay is the most rural in character of the towns within the study area, with 91 percent of the town classified as Forest Areas and an additional 6 percent as Agricultural & Open Space. (Figure 24 and Figure 25) The community anticipates growth, but wants to maintain a “rural recreational destination” character and ensure that new development does not worsen



traffic conditions.<sup>5</sup> Jay is connected to the rest of the region via two state highways: VT 105 and VT 242. The majority of the developed areas are located along VT 242, particularly at the Jay Peak resort and in the Jay Village area.

Figure 24: Existing Land Cover in Jay Study Area

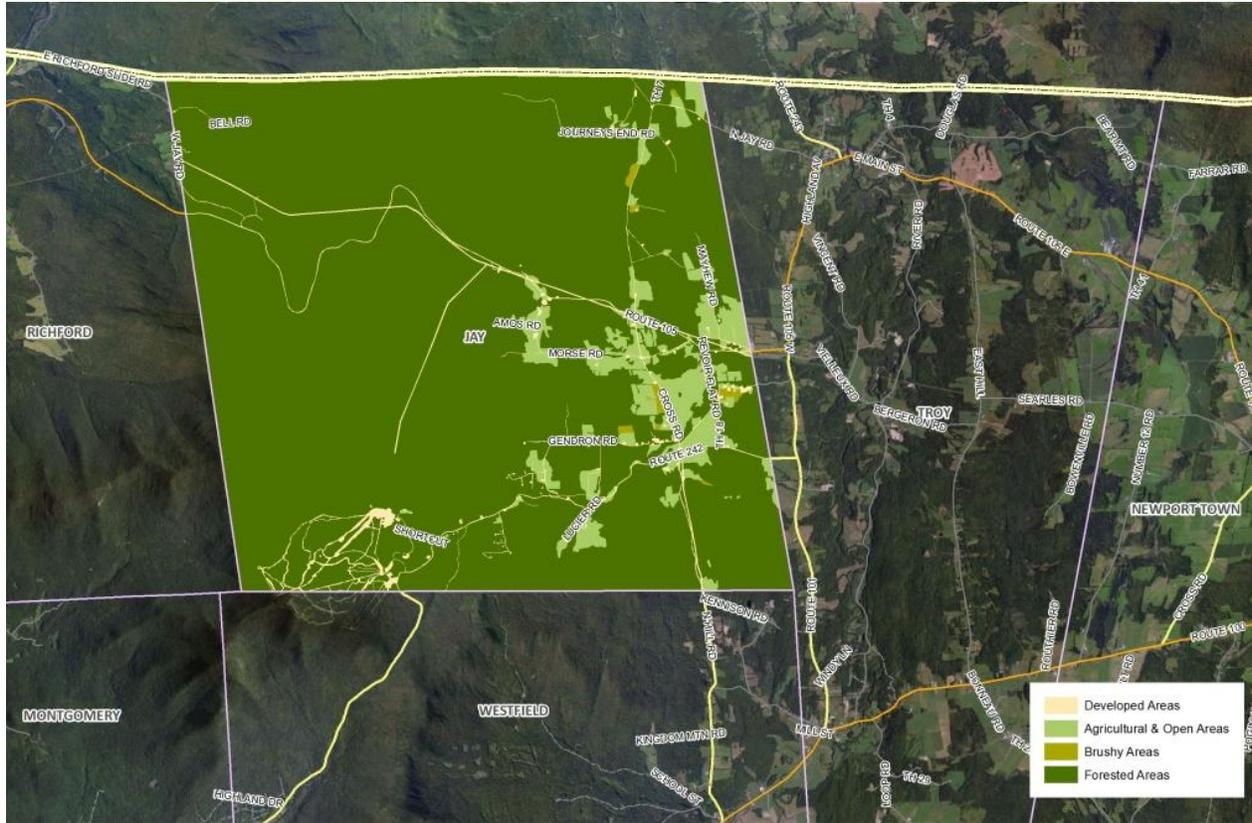
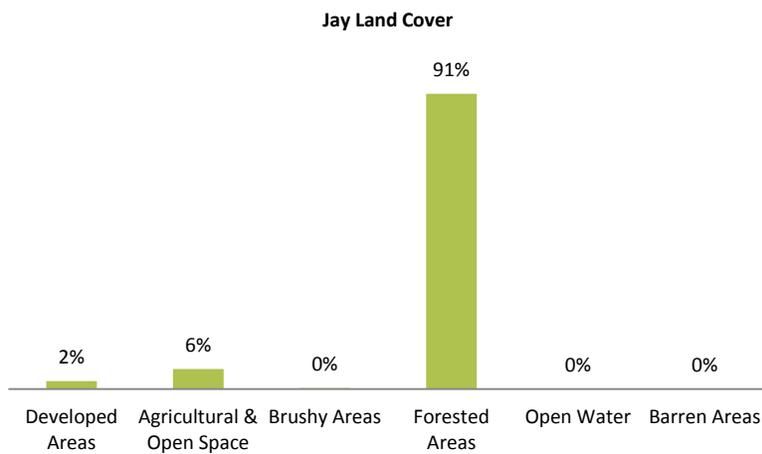


Figure 25: Existing Land Cover in Jay Study Area by Percentage



<sup>5</sup> Jay Community Development Plan. Town of Jay Selectmen. August 2010.



## 3.6 ALTERNATIVE TRANSPORTATION

### PUBLIC TRANSIT SERVICE

The Northeast Kingdom's population is dispersed throughout a broad geographic area and private cars are the primary means of transportation. However, the demographics of the Northeast Kingdom indicate a high number of low income people who do not have access to cars, and a significant population of older adults and persons with disabilities. These three population groups tend to have a high need for public transportation services. This is reflected in the fact that despite being a very rural region, the Northeast Kingdom has a variety of transit services that are available to the general public as well as clients of human service agencies.

#### *Rural Community Transportation, Inc.*

Rural Community Transportation, Inc. (RCT) is a private non-profit organization that provides various modes of transportation in the Northeast Kingdom, including shuttle services for all purposes, commuter buses, shopping shuttles, and other demand response services oriented toward seniors, people with disabilities, and others who have limited access to transportation. RCT transit routes are described below and are shown graphically in Figure 26, Figure 27, and Figure 28.

#### *Deviated Fixed-Route Service*

RCT operates two year-round local shuttle routes with full day service. In St. Johnsbury and Lyndonville, the Jay-Lyn Shuttle operates Monday through Friday from 6:30 AM to 5:30 PM. There are five trips in each direction per day.

In Derby and Newport City, the Highlander Shuttle runs six days per week, 7:30 AM to 5:30 PM Monday through Friday, and 9AM to 1:30PM on Saturdays. The four round trips on weekdays are two to three hours apart and two round trips on Saturdays are two-and-a-half hours apart. Both the Jay-Lyn and the Highlander routes are deviated fixed routes, meaning that the vehicles are allowed to deviate off of the fixed-route up to a distance of a quarter mile along the route upon request. (Passengers may request a deviation upon boarding or call in advance to schedule a pick-up.)

#### *Commuter Bus*

RCT also operates two commuter bus services, one that runs between St. Johnsbury and Lyndonville via Route 5 (Jay-Lyn Express) and one that operates between St. Johnsbury and Montpelier (US2 Commuter). Both routes are accessible via the local shuttle services.

The Jay-Lyn Express travels between St. Johnsbury and Lyndonville and is designed to get people to and from employment along the Route 5 corridor. The bus stops at major facilities along the corridor with arrival and departure times coordinated with work start and end times. There is one trip in each direction in the morning and afternoon peak hours.

Additionally, RCT operates a commuter route in cooperation with Green Mountain Transit Agency (GMTA). The US 2 Commuter connects St. Johnsbury and Montpelier, East Montpelier, Plainfield, Marshfield, and Danville. There are four full-route round-trips, two of which are operated by GMTA (as Route 84) and two of which are operated by RCT. There is also one additional truncated round trip operated by GMTA. The service is available during the morning and afternoon peak hours Monday through Friday.



### *Shopping Shuttles*

RCT operates five shopping shuttles in the Northeast Kingdom. These routes provide one round trip per service day, departing from residential areas in the mid-morning, and returning to the residential area by the early afternoon. Service alternates between the different communities; the Island Pond (Newport/ Island Pond) and Johnson Shopper (Hydes Park/ Johnson) operate once per week, and Ridge Runner (Craftsbury/ Hardwick/ Wolcott/ Morrisville), Kingdom Shopper (Littleton, NH/ Island Pond) and the Greenleaf (Danville/Woodville, NH) operate every other week.

### *Fares*

All of RCT's bus services are free to riders. Because the US 2 Commuter route is jointly operated by RCT and GMTA, the routes that GMTA operates charge a fare. The one-way fare for the US 2 Commuter is \$2 and there is an option to purchase monthly pass for discount. The RCT website reflects this difference.

### *Fleet*

Rural Community Transportation has 18 active vehicles, comprising 12 vans and 6 buses. Ten vehicles (4 buses and 6 vans) are operated out of its facility in St. Johnsbury, six vehicles (2 buses and 4 vans) are operated out of Newport, and two vans are operated out of Morrisville. All vehicles are gasoline powered, except for one diesel bus garaged in St. Johnsbury. All RCT vans and buses are equipped with wheelchair lifts and mobile phones.

### *Passenger Information*

A passenger survey issued in 2012 showed that about 70 percent of respondents were frequent riders, using the bus three to five days per week. About half of the riders are between 51 and 65, and the rest are evenly distributed among the age groups of 19-30, 31-50, and over 65.

More than half of the RCT riders have household incomes of under \$20,000 annually. On the shuttle routes, these low income riders make up 96 percent of the respondents, whereas riders on the commuter routes represent a broader range of the income spectrum. The shuttle routes serve transit-dependent riders almost exclusively, while the commuter routes serve choice riders – those who choose to ride the bus rather than having no other option.

### *Ridership*

During fiscal year 2011, RCT provided 178,688 trips on all services, including volunteer driver trips, demand response van, and fixed route service. Close to two-thirds of the total trips were provided by volunteer drivers; 27 percent were taken on the fixed route shuttle service; and 11 percent on the demand service vans. Of the fixed routes, the Jay-Lyn Shuttle is the most productive service, with 8.4 boardings per revenue hour. The Highlander had an average of 5 boardings per revenue hour, and the US 2 Commuter within the RCT jurisdiction had 3.2 boardings per revenue hour.

### *Agency Budget*

In fiscal year 2011, RCT's total operating budget was approximately \$3.8 million. More than half of the budget comes from the Medicaid program, and about a third of the funds come from a combination of Federal Transit Administration and the State of Vermont. The rest of the budget is funded by Community Organizations and Department Services, local towns, and other human service agency partners.



Figure 26: Existing Transit Routes Overview

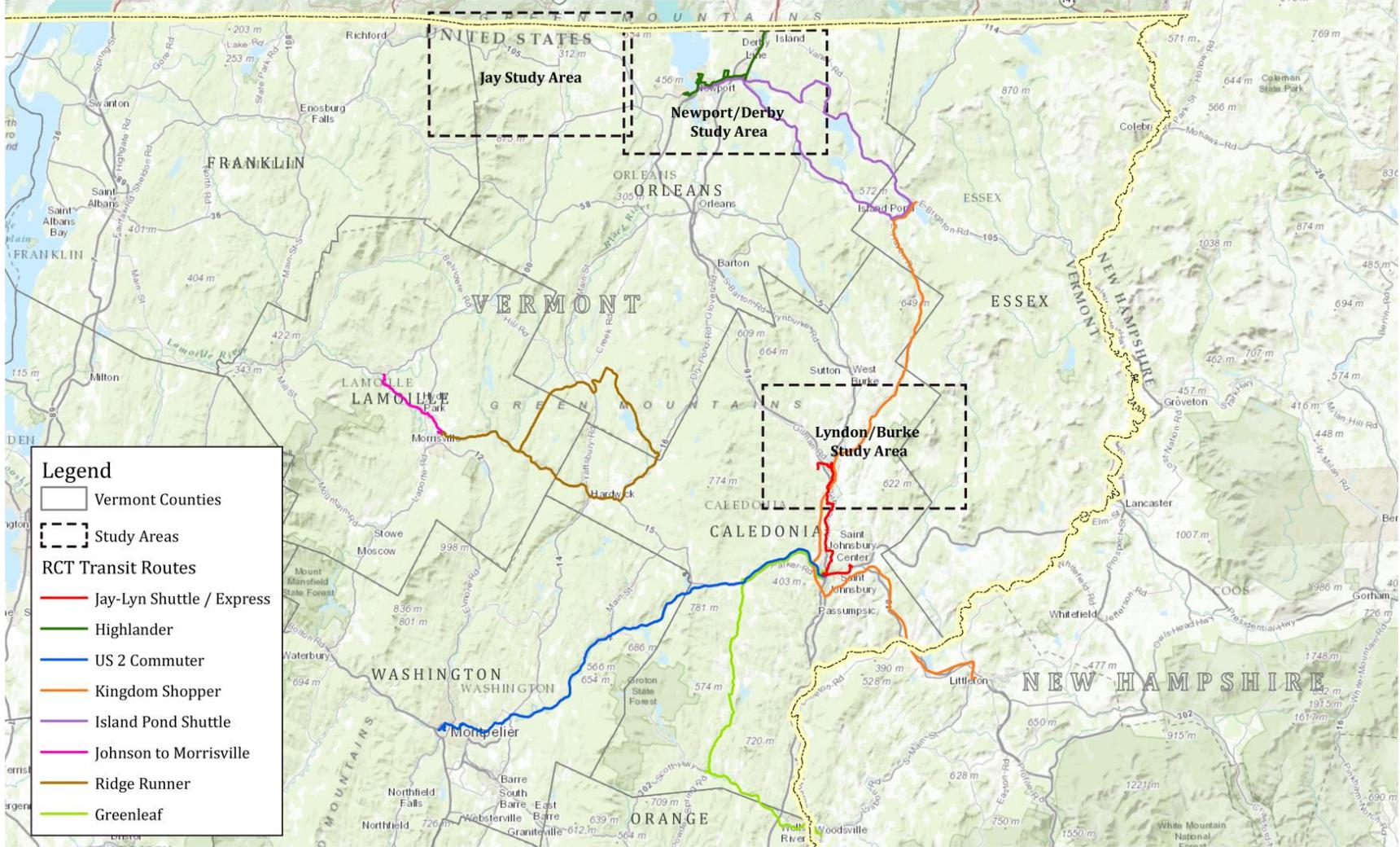


Figure 27: Existing Transit Routes in Lyndon/Burke Study Area

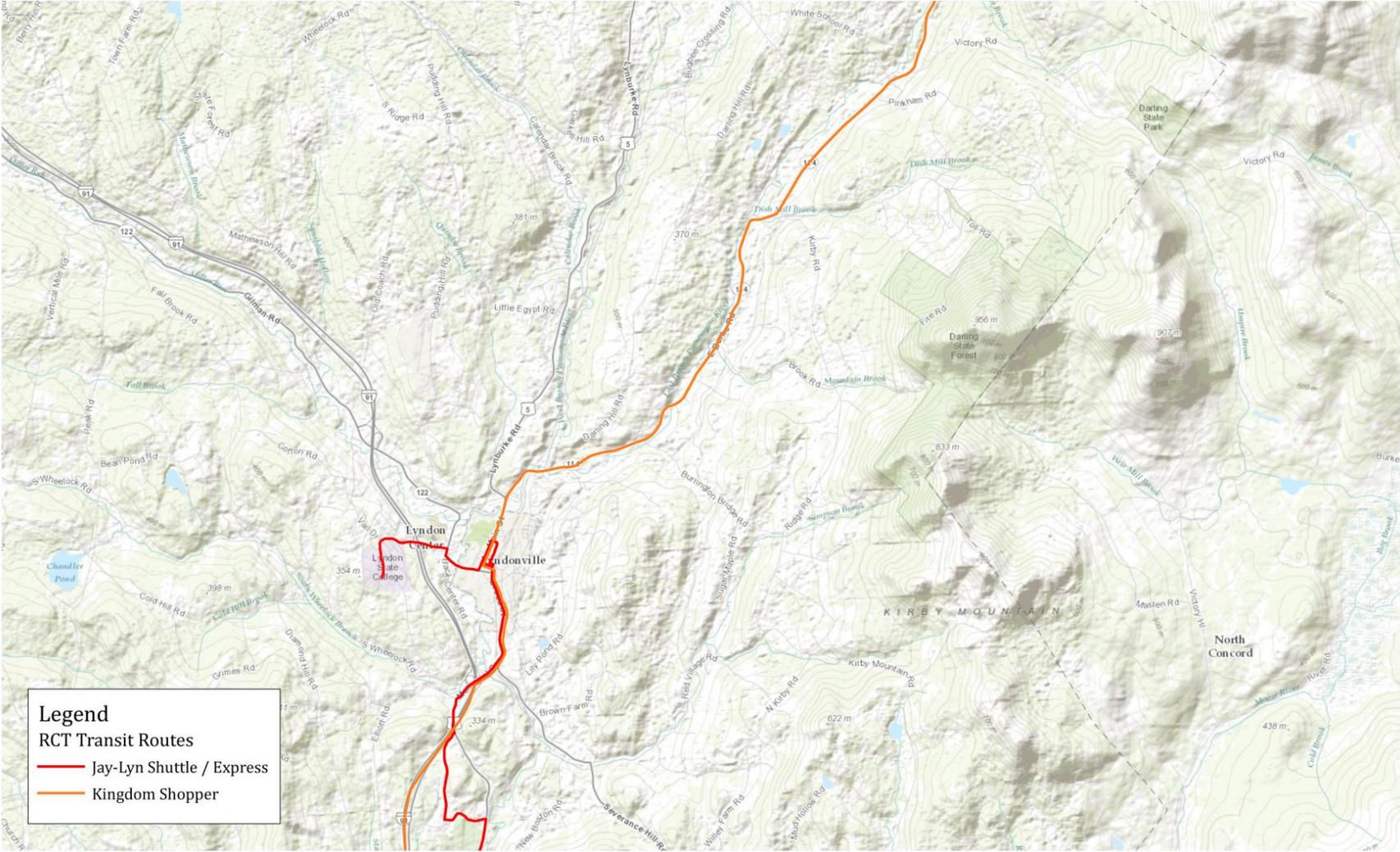
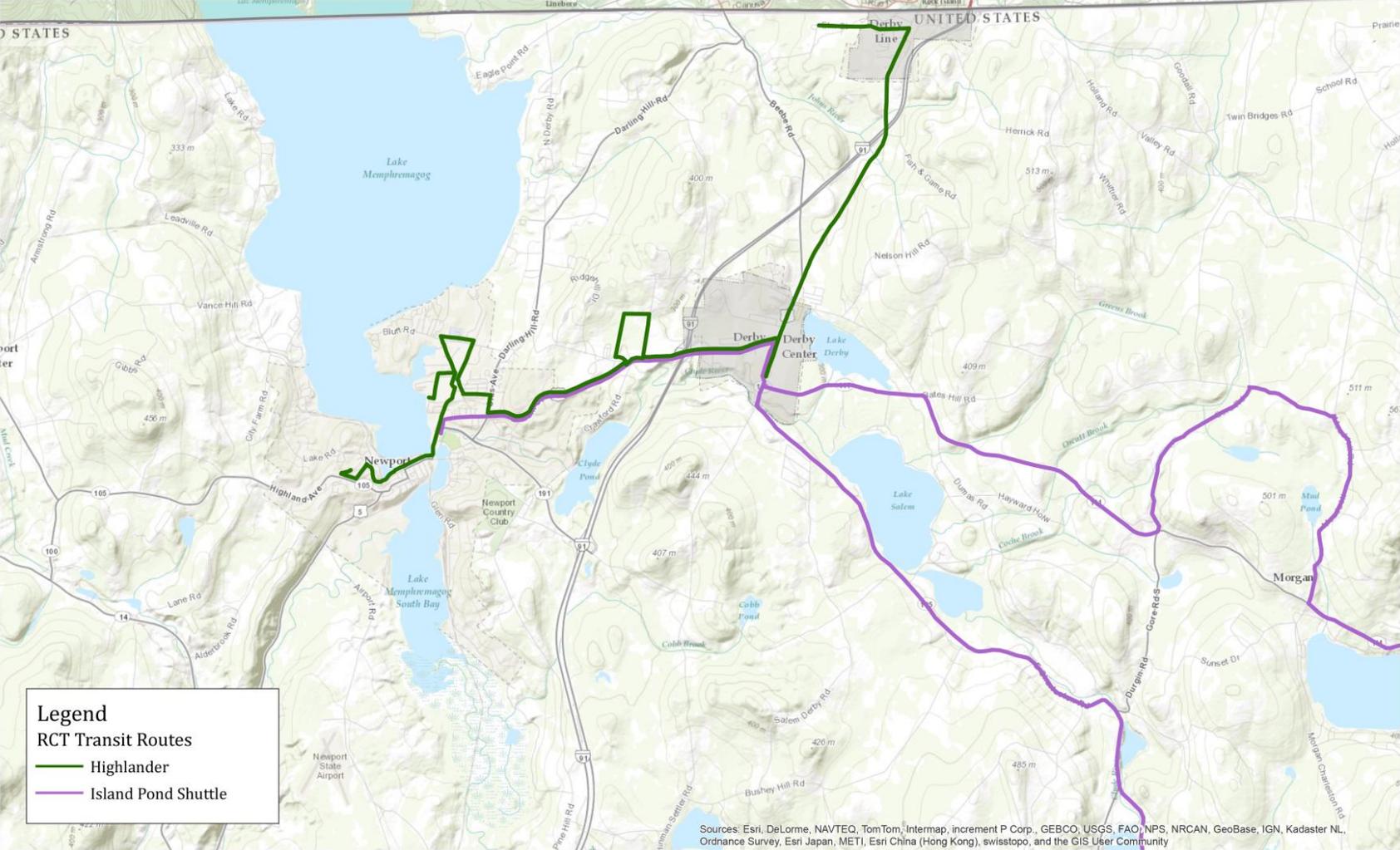


Figure 28: Existing Transit Routes in Newport/Derby Study Area



## RESORT SERVICES

Jay Peak Resort, located at the northernmost edge of the Northeast Kingdom, operates a free shuttle that travels within the resort, connecting residential locations to important mountain facilities. This includes base lodges as well as hotels and the golf clubhouse. However, the shuttle does not leave the resort and service is available only to the guests staying at the resort. During the peak season, starting from mid-December to April, shuttle runs from 5 AM to 11 PM daily, running until 2AM on the weekends depending on the demand. In addition, during the winter season, the resort offers short shuttle service to the employees who park their cars in the remote parking garage. There is no set schedule, but there are four to six active buses running constantly within the resort area. During the rest of the year (April to mid-December), the shuttle is available through on-call dispatch system and the frequency changes by the occupancy level.

Jay Peak owns two 14-passenger buses and two 18-passenger buses. To meet higher demands in the winter, the resort rents out 15-passenger buses as well. Jay Peak Resort also provides pick-up and drop-off services at Burlington International Airport and Amtrak Station for the resort guests. The price of this service varies by the location.

Burke Mountain Resort, under the same ownership of Jay Peak Resort, also operates a free shuttle service on the weekends. Burke Mountain is largely a ski resort but also attracts a lot of visitors who mountain bike at the nearby Kingdom Trails and Burke Mountain Bike Park. A shuttle runs from the center of East Burke through the entrance of Kingdom Trail at Darling Hill Road to Burke Mountain Bike Park. This shuttle service is available to the general public, although most of the passengers are mountain bikers. The resort operates a medium-sized bus that is capable of carrying approximately 20 passengers per trip with an attached trailer bed to carry the bicycles. Shuttles operate from 11 AM to 6 PM on Saturdays, and 10 AM to 4 PM on Sundays.

Because Jay Peak and Burke Mountain Resorts are owned by the same group, use of the vehicles is coordinated to meet the transportation demands.

## SPECIALIZED TRANSPORTATION SERVICE (HUMAN SERVICE AND MEDICAL TRANSPORTATION)

There are nine regional and three statewide human service agencies in the Northeast Kingdom. While most of the human service agencies are independent organizations, they are largely funded and overseen by the Vermont Agency of Human Services or the Area Agency on Aging. Of the nine agencies, two (NEK Mental Health and Green Mountain Adult Day Health) directly operate transportation services. The other agencies purchase transportation services from RCT or other providers. Human service transportation, however, is not available to members of the public and riders must qualify to use the services. Figure 29 summarizes services available in the Northeast Kingdom.

### *Volunteer Drivers*

Rural Community Transportation manages a volunteer driver program. Most of the trips provided in this program are to support medical trips, especially Medicaid services, although RCT will use volunteer drivers to support other transportation needs. Volunteer drivers are reimbursed for mileage expenses. RCT is responsible for collecting trip requests, organizing and training volunteer drivers and making sure the riders get to/from their destination safely and on time. There are approximately 200 volunteer drivers in RCT's database, and about 40 percent of them are "full-time" volunteer drivers. In fiscal year 2012, these drivers provided 106,825 trips.



**Figure 29: Human Service Agency Service Description**

Agency	Service Area	Service Description
Green Mountain Adult Day Service	Orleans and northern Essex counties	<ul style="list-style-type: none"> <li>Purchases service from RCT</li> </ul>
Disabled American Veterans	Statewide – local NEK office serves Caledonia, Essex and Orleans counties	<ul style="list-style-type: none"> <li>Owns vehicles operated by volunteers</li> <li>Purchases service from RCT</li> </ul>
Northeast Kingdom Community Action	Caledonia, Essex and Orleans counties	<ul style="list-style-type: none"> <li>Purchases services from RCT</li> <li>Reimbursements to volunteers</li> </ul>
Agency of Human Services – Vermont Department of Children and Families, Economic Services Division	Statewide; local office serves Caledonia and southern Essex counties	<ul style="list-style-type: none"> <li>Purchases transportation services from RCT and The Good News Garage</li> </ul>
Agency of Human Services – Department of Disabilities, Aging and Independent Living, Division of Vocational Rehabilitation	Statewide; local office serves Caledonia and southern Essex counties	<ul style="list-style-type: none"> <li>Purchases transportation services from RCT</li> </ul>
Area Agency on Aging for Northeastern Vermont	Caledonia, Essex and Orleans counties	<ul style="list-style-type: none"> <li>Purchases service from RCT</li> </ul>
Northeast Kingdom Human Services	Caledonia, Essex and Orleans counties	<ul style="list-style-type: none"> <li>Direct operation of vans</li> <li>Purchases service from RCT</li> </ul>
The Meeting Place	Orleans County	<ul style="list-style-type: none"> <li>Purchases service from RCT</li> </ul>
Retired and Senior Volunteer Program for Central Vermont and the Northeast Kingdom	Washington, Lamoille, Caledonia, Orleans, Essex and parts of Orange counties	<ul style="list-style-type: none"> <li>Volunteers use their personal vehicles</li> </ul>
Riverside Life Enrichment Center	Caledonia and southern Essex counties	<ul style="list-style-type: none"> <li>Purchases service from RCT</li> </ul>
Vermont Association for the Blind and Visually Impaired	Statewide	<ul style="list-style-type: none"> <li>Utilizes volunteer and paid drivers</li> <li>Taxi services</li> <li>Paratransit services</li> <li>Purchases services from RCT</li> </ul>

Source: Adapted from Vermont Public Transit Human Service Transportation Coordination Plan, Ch. 4  
[http://publictransit.vermont.gov/policies\\_reports/hscp](http://publictransit.vermont.gov/policies_reports/hscp)

**Medicaid**

RCT functions as a broker for Non-Emergency Medical Transportation (NEMT) service in the Northeast Kingdom. This state and federally funded program provides transportation for Medicaid eligible individuals traveling to Medicaid eligible health care activities such as doctor appointments and prescription pick-ups. NEMT is available 24 hours a day and seven days a week; trips must be scheduled at least 24 hours in advance. There is no fare or fee to the riders. RCT functions as the broker for these trips and is responsible for taking trip requests, assigning trips, and ensuring passengers and trips meet eligibility requirements. Trips may be coordinated with other services, so that people traveling on Medicaid can ride on the same vehicle with other people traveling as part of other programs. Management of the Medicaid program for the Northeast Kingdom accounts for over half of RCT’s total operating budget.



## ***Reach Up***

Reach Up is Vermont's Transitional Assistance to Needy Families (TANF) program providing assistance, including transportation service, to low-income families with children to support self-sufficiency. Both RCT and Good News Garage offer rides for eligible trips to Reach Up clients in the Northeast Kingdom.

Good News Garage is a non-profit car donation program run by Lutheran Social Services. In Vermont, Good News Garage provides rides to jobs and job-related destinations for Reach Up clients through the Ready to Go program. Good News Garage also contracts with the Economic Services Division of the Department of Children and Families to provide vehicles to participants of the Reach Up program.

## **RIDESHARING, CARPOOLS AND VANPOOLS**

Go! Vermont is a free carpool and vanpool program that offers a computerized matching service for commuters or people seeking regular rides to share.

## **RAILROADS**

The closest passenger rail to the Northeast Kingdom is Amtrak's Vermonter service, accessible at White River Junction or Montpelier. Trains run once per day in each direction, with through service to Washington, DC.

## **TAXI AND ON-DEMAND TRANSPORTATION**

Kingdom Express is the primary operator of on-demand transportation in the Northeast Kingdom. The company is family owned and operated and based in Burke, Vermont. Its services are as follows:

- **Kingdom Express Taxi Service** remains mainly within northern Vermont and New Hampshire, but will travel throughout New England, New York and Quebec upon request. Service is available to the general public in the Newport area, and by reservation between 8:00 am and 5:00 pm.
- **Kingdom Express Charter Service** encompasses a variety of services, from charters for up to 18 people to trips to the airport. The company's fleet includes vehicles with wheelchair lifts, which can be hired to transport one or more people at a flat rate.

## **BICYCLE FACILITIES**

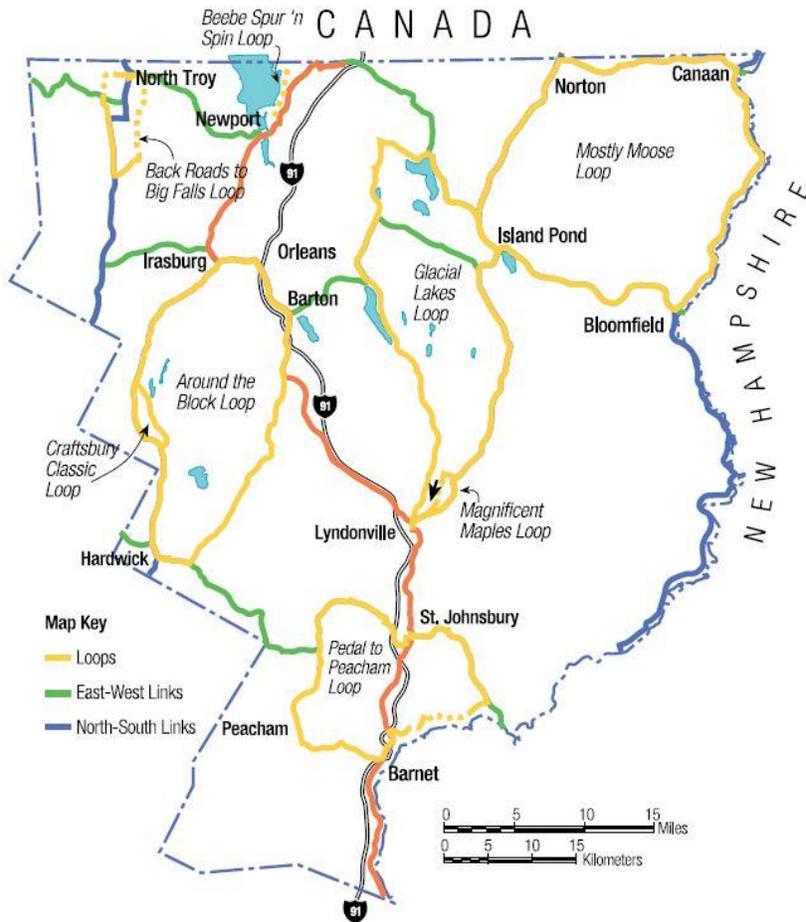
According to NVDA, the Northeast Kingdom has nearly 2,300 miles of ideal biking roads, of which a little over half (1,500 miles) are unpaved. The on-road routes, shown in Figure 30, are comprised of eight loops, five north-south links, and three east-west links. Half of the 16 bike routes connect to destinations within the study areas:

- "[Back Roads to Big Falls](#)" covers 22.4 miles around Jay, North Troy, Troy, and Westfield, intersecting with VT 242 and running north-south along Jay Road on the western leg, then connecting to VT 105 in North Troy.
- "[Beebe Spur 'n Spin](#)" covers 11.2 miles, linking from the edge of Lake Memphremagog in downtown Newport to Beebe Plain along the Beebe Spur Rail Trail parallel to the eastern edge of the lake.
- "[Glacial Lakes](#)" is a multi-day, 68.9 mile ride that starts in the south in Lyndonville and runs northeastward along VT 114 to connect to East Burke. The route continues along VT 114 until it connects at VT 111, where riders begin to head northeast towards Morgan. Eventually the ride loops around to West Charleston and the final leg runs along US 5 in West Burke back down to Lyndonville.



- “Magnificent Maples” follows the first segment of the Glacial Lakes route, starting from Lyndonville and heading up VT 114 towards East Burke. The 11.4 mile ride loops west at East Darling Hill Road and travels back south to Lyndonville.
- “North-South Link 3” is a 39.8 mile ride along paved roads and railroad trails, connecting between Lyndonville and Norton, through East Burke, along VT 114.
- “North-South Link 7” connects between Lowell in the south to North Troy near the Canada border through the Town of Jay. This route is paved and runs along VT 100, VT 242, VT 101, and VT 105.
- “North-South Link 91” runs along paved roads for 79.8 miles between the Derby Line, through Newport, and all the way south to Ryegate, through Lyndonville. The bike route travels along US 5 through Newport, with a long stretch on VT 122 down to Lyndonville, where it switches back to US 5 for the remainder of the journey south.
- “East-West Link 2” is a challenging 78.5 mile paved bike route that connects from Jay in the west to Canaan on the east. This route follows along VT 105 from Jay to Newport, where it continues on US 5 to Derby.

Figure 30: Northeast Kingdom On-Road Bicycle Network



### 3.7 SAFETY ASSESSMENT

Crash histories were collected from VTrans for the most recent 5 years of available data (January 2008-December 2012). VTrans maintains a statewide database of all reported crashes along all state highways and federal aid road segments.<sup>6</sup>

Additionally, the Vermont Agency of Transportation maintains a list of high crash locations (HCL), which are intersections and roadway segments that have high crash rates over five years compared to other intersections or segments with similar functional classification and traffic levels. For the most recent period of VTrans designation (2006-2010) there were 19 designated HCL road segments and no HCL intersections in the three study areas.

Crash histories and HCLs were examined by study area in the sections below.

#### NEWPORT/DERBY STUDY AREA

Within this 5 year period of available data, 261 crashes were reported within the Newport/Derby Study Area. These crashes resulted in 61 injuries and 3 fatalities. Maps indicating the locations of these crashes are shown in Figure 31 and Figure 32. No recurring theme was found in the contributing circumstances reported for the crashes in this study area. The majority of crashes were the result of a rear-end incidents, with left-turn broadsides occurring as the second highest cause of accidents.

For the most recent period of VTrans designation (2006-2010), there were four study intersections located in designated HCL road segments in Newport and four in Derby. No recurring theme was found regarding land use or traffic volume at these eight HCL road segments.

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<sup>6</sup> This data is exempt from Discovery or Admission under 23 U.S.C. 409.



Figure 31: Newport Crash Locations (2008-2012)

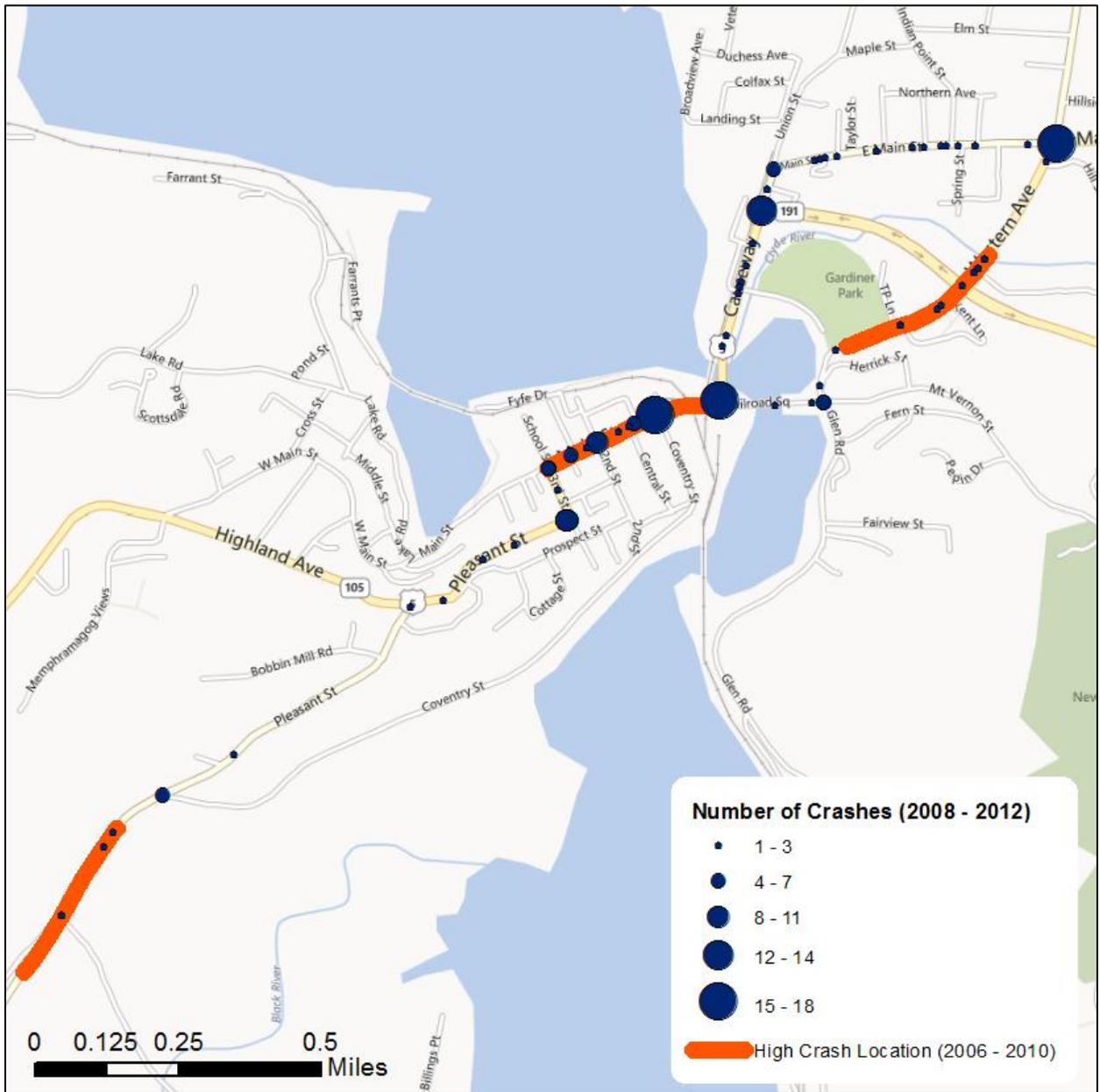
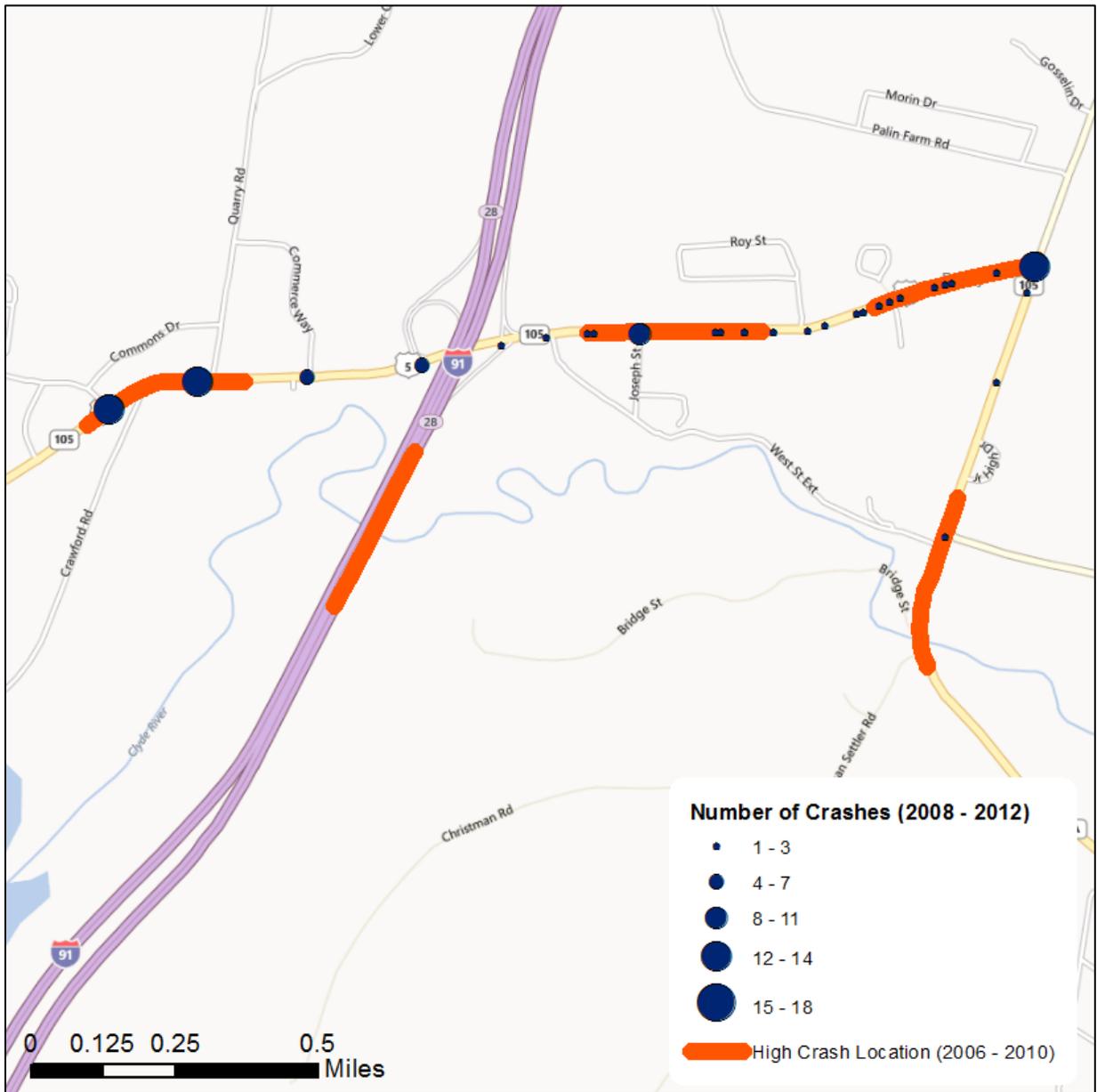


Figure 32: Derby Crash Locations (2008-2012)



### BURKE/LYNDON STUDY AREA

Within the 5 year period of available crash data, 115 crashes were reported within the Burke/Lyndon Study Area. These resulted in 20 injuries and no fatalities. A map of these crashes is presented below (Figure 33 and Figure 34). No recurring theme was found in the contributing circumstances reported for these crashes in this study area. The majority of crashes are the result of a rear-end incidents, with left-turn broadsides occurring as the second highest cause of accidents.



For the most recent period of VTrans designation (2006-2010) there were four study intersections located in designated HCL road segments in Lyndon and none in Burke. These crash locations are generally located in commercial areas where there are a large number of driveways and side streets with no traffic control.

Figure 33: Burke Crash Locations

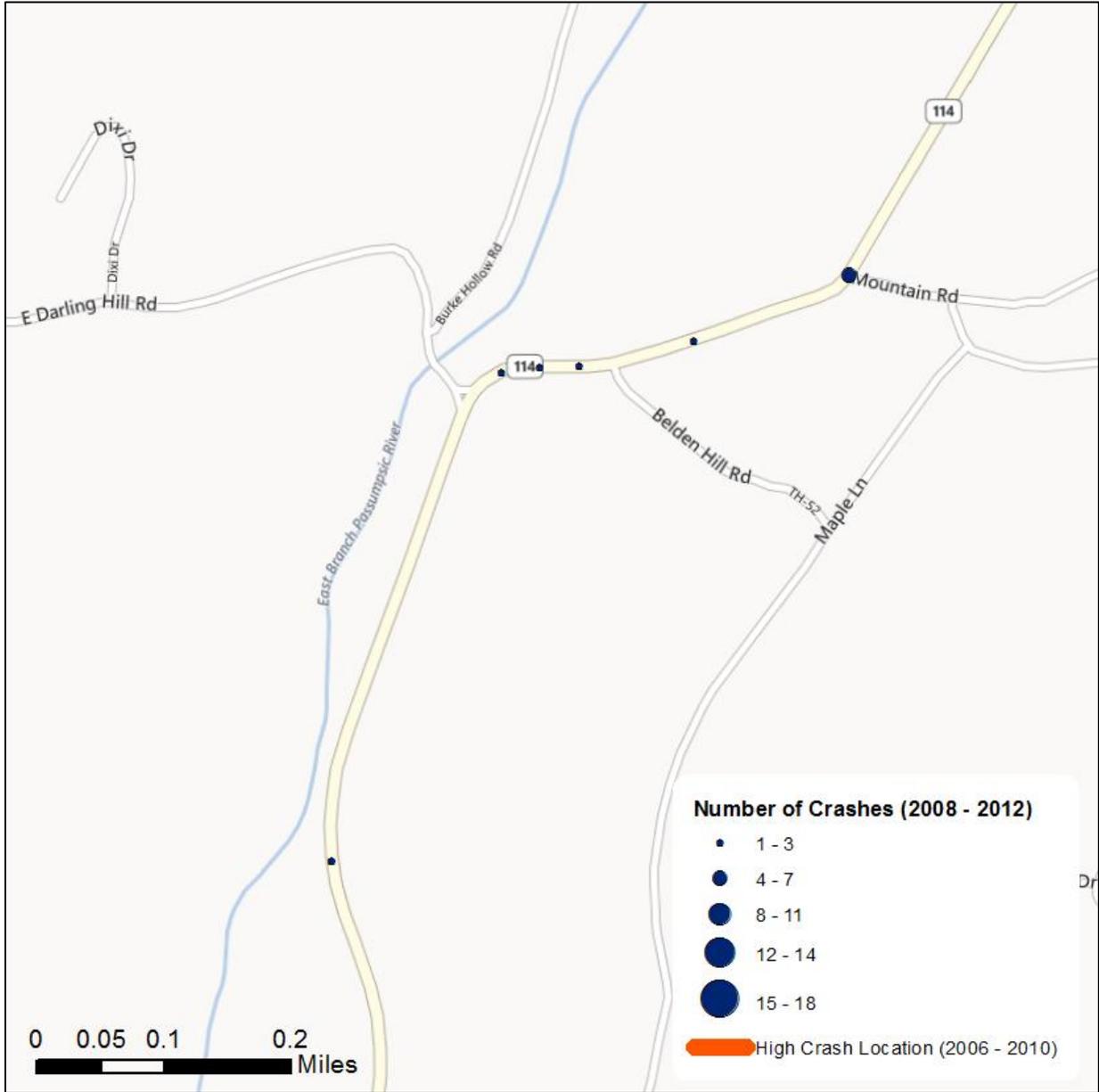
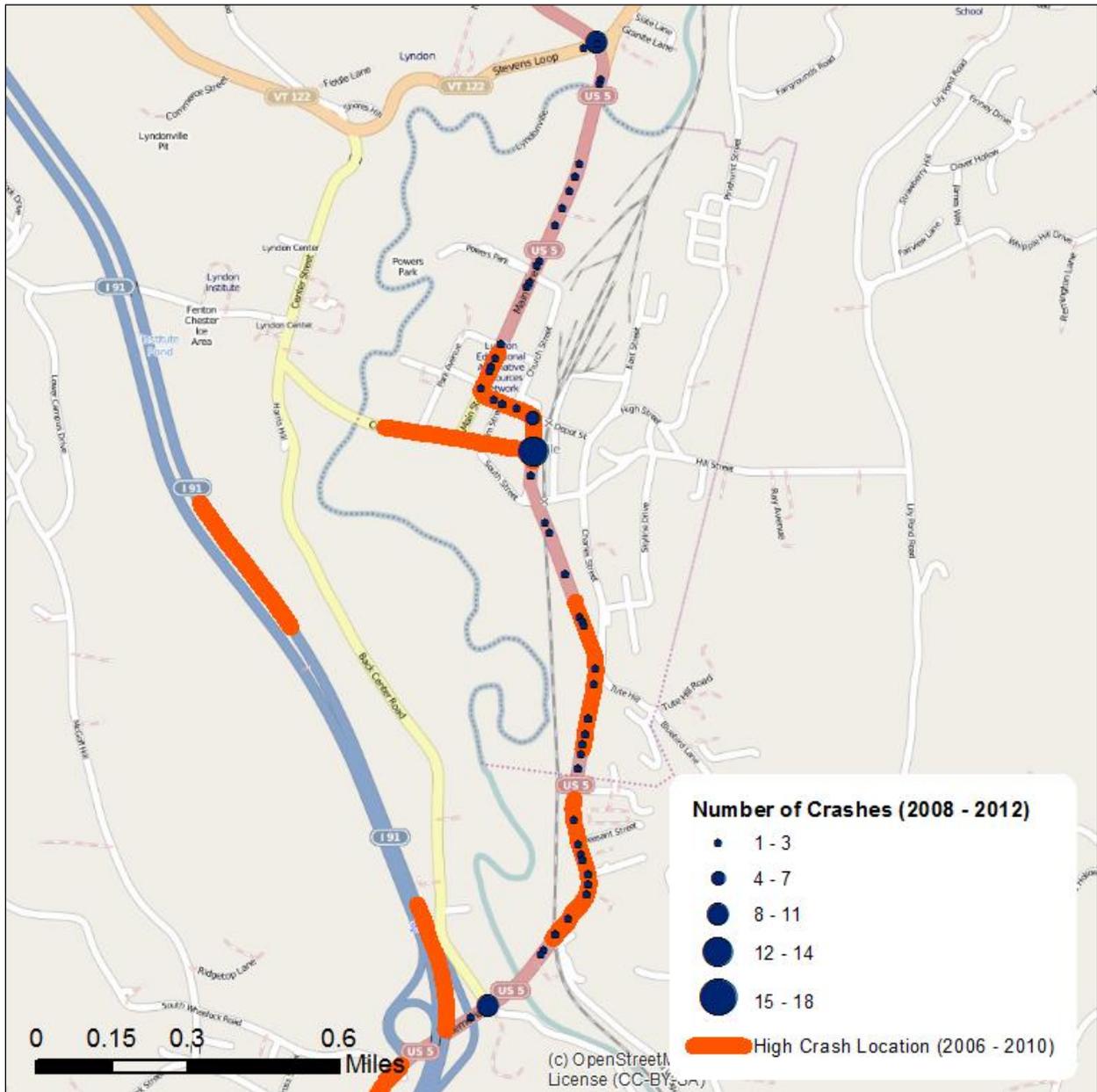


Figure 34: Lyndon Crash Locations



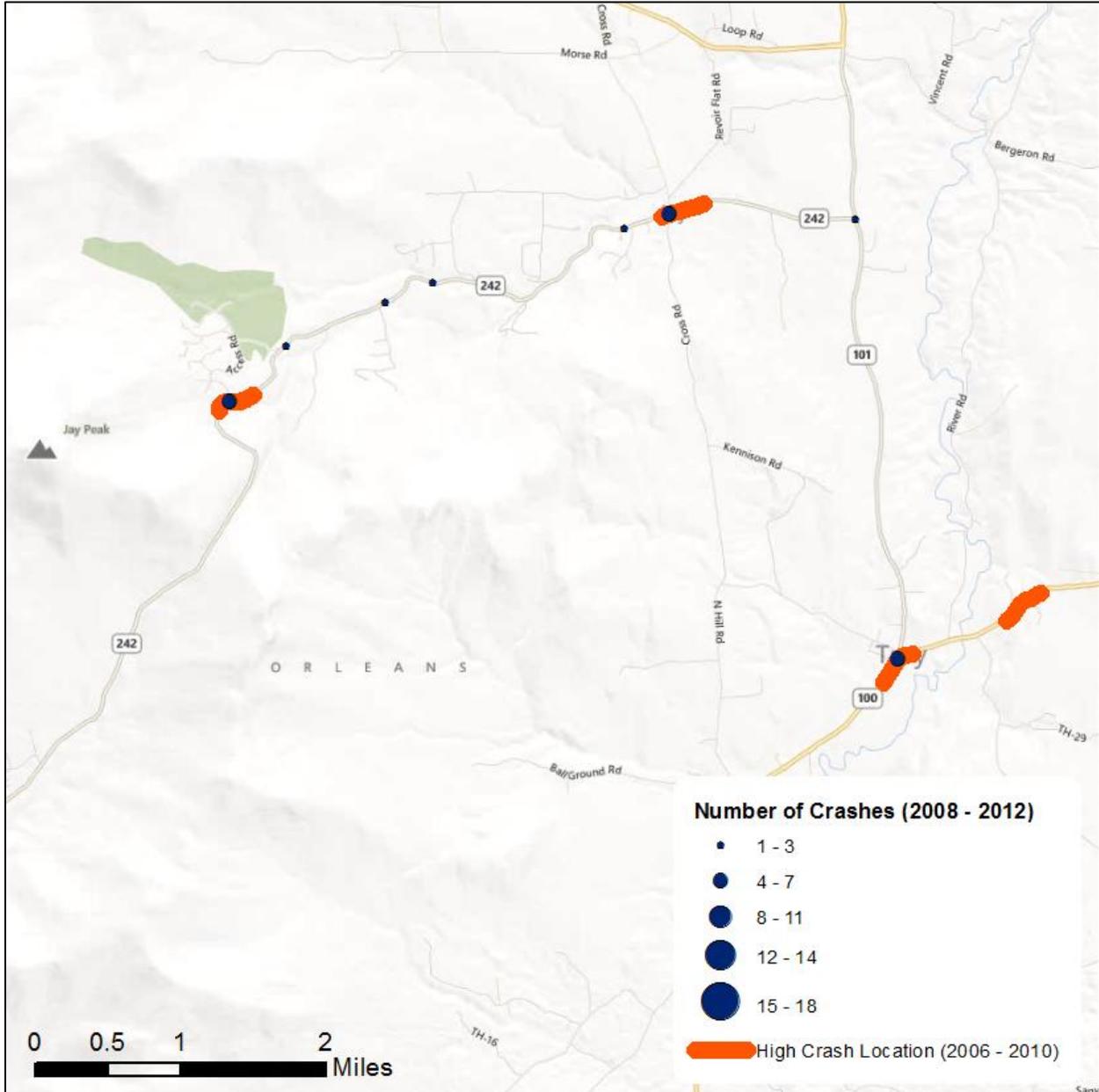
### JAY STUDY AREA

Within the 5 year period of available crash data, 22 crashes were reported within the Jay Study Area. These resulted in 10 injuries and 0 fatalities. A map of these crashes is presented below (Figure 35). Forty-one percent of the crashes along VT 242 were due to ‘driving too fast for conditions’. The majority of crashes resulted in rear-end and single vehicle incidents.



For the most recent period of VTrans designation (2006-2010) there were four study intersections located in designated HCL road segments in the Jay Study Area. No recurring theme was found regarding land use or traffic volume at these HCL road segments.

Figure 35: Jay Peak Area Crash Locations



## 4 LOCAL CONCERNS MEETINGS

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Two Local Concerns Meetings were held in August 2013, one in Newport and one in Lyndonville. During these meetings, RSG and NVDA gave a brief presentation outlining the objectives of the study and highlighting several of the findings that came out of the Existing Conditions assessment. An informal question and answer with the project team and community members followed the presentation. At the end of the evening, community members were invited to speak one-on-one to representatives of the project team. A summary of the comments received during these two sessions are provided below; all relevant meeting materials can be found in Appendix A.

### 4.1 NEWPORT/JAY

This meeting was held on August 22, 2013 at the Gateway Center in Newport from 6:00pm to 8:00pm; it was held in conjunction with the Newport Community Commons Meeting.

#### GENERAL COMMENTS

- How does the effort tie into the bus tour with legislators several months ago?
  - This study will integrate with previous studies and involve State Representatives
- Important to emphasize solutions for all users and not only focus on EB-5
- Important to identify improvements that can be implemented in the short-term
- R/UDAT Plan may be relevant to the study

#### OPERATIONAL COMMENTS

- Roundabout at Coventry and Main has been discussed by the Mayor. Could a roundabout fit here and at Railroad Square?
- The traffic peaks for hospital and schools is 7:00am and 3:00pm
- Slow trucks on VT 14 on the way to landfill in Coventry
- Check signal timings on Causeway
- Traffic delays on southbound US 5 are sometimes a problem in Derby Line due to queues at border crossing
- Congestion for east-west traffic through town
- US 5/VT 105 intersection delays; need a signal or an all-way stop
- Safety issues at Railroad Square intersection
- Safety issues at Darling Hill and Shattuck Hill intersection ought to be addressed
  - Included as a High Risk Rural Roads candidate a couple years back; will check status

#### TRANSIT, BICYCLE, AND PEDESTRIAN COMMENTS

- Build more bicycle lanes and augment transit service to fix the problem; do not expand roads endlessly



- Would support additional transit service, including Newport-Jay Peak connection
- Will additional transit be factored into our assessment?
  - Yes
- What locations are appropriate for park & ride facilities?
- Will rail be considered for this study?
  - No, not in this study
- Consider Complete Streets for downtown Newport
- Newport Renaissance is looking at a better-connected bicycle system
- Complete Streets and bicycle facilities will help to encourage new employers and employees to locate in Newport
- Generally unsafe conditions for bicyclists; need to add “Share the Road” signs indicating the presence of bicyclists, particularly on hills
- Need to identify adjustments to downtown Newport to improve multimodal trips

## 4.2 LYNDON/BURKE

This meeting was held on August 28, 2013 at the Public Safety Building in Lyndonville from 6:00pm to 8:00pm; it was held in conjunction with the Lyndon Planning Commission meeting.

### GENERAL COMMENTS

- Doesn't seem like there is going to be any mitigation for moving Cumberland Farms
- Broad Street is the number 1 issue in the study area
  - Limit access points
  - Add center lane to protect left turns
  - Very little room to widen road
  - The scope of these improvements are not realistic from a budgetary standpoint

### OPERATIONAL COMMENTS

- Red Village Road/Lily Pond Road is used as a shortcut to Burke and could be used even more frequently if downtown Lyndonville becomes more congested with future growth.
  - Supposedly the connection is okay, and not very unsafe, but is a narrow dirt road and thus shouldn't be seeing too much re-routing traffic
  - The bridge on Lily Pond Road just south of VT 114 is very narrow
  - Back Center > Center > 122 is also used as a shortcut. Covered bridge right before joining 122 is only one lane and cannot fit an 18 wheeler. Has been an issue in the past



- Current Trustees believe that the 3-way stop at Broad/Depot in downtown Lyndonville is the correct solution; however the majority of others support different solution
  - Queues can back up almost all the way to Rite Aid, more than 1/2 mile from the intersection
- Max congestion in downtown Lyndonville is when the industrial park lets out at 3pm
- Realistically the town would be happy with fixing the Depot St/Red Village Road intersections

## TRANSIT, BICYCLE, AND PEDESTRIAN COMMENTS

- Better scheduling needed for bus connections in Montpelier for trips from Lyndon > Burlington
  - This connection may have already been improved
- Steven's Loop is not safe for running
- VT 122 needs shoulder widening for peds/bikes
- Major pedestrian movement is from the students up on the hill down to the services on Broad Street; sidewalks needed on Center St to accommodate students
- Kingdom Trails parking issues/way too many bikers in downtown
- The Back Center/US 5 signal was temporary but then just stayed in. Need to check signal timing as it was indicated that the movement from Back Center has virtually no green time.
- Lots of bikes on US 5



## 5 FUTURE TRAFFIC CONDITIONS

This section presents future year traffic projections for the study intersections in the three project study areas. These projections are based on an estimated trip generation resulting from the identified EB-5 projects as well as other identified initiatives around the region. Additionally, background traffic has been estimated to represent the anticipated traffic growth that is expected over the planning horizon over and above the specific developments identified in this section.

The estimated future traffic resulting from these two components was distributed onto the surrounding transportation network using standard procedures. For residential, retail, and employment-based trips, a combination of Census Journey-to-Work data and background trip distributions was used. For resort related trips, the Jay Peak and Burke Mountain traffic permitting documents were used.

With the trip generation and distribution completed, the base year traffic congestion was analyzed for the afternoon peak hour to determine whether any new intersection “hotspots” are expected to emerge in the future, and the extent to which existing operational deficiencies will worsen. This scenario, referred to as the No Build Scenario, maintains today’s infrastructure and does not consider any of the proposed infrastructure improvements described in Section 2.1 or Section 2.2. To account for the potential benefit of proposed infrastructure improvements at locations where significant operational deficiencies have been identified, a second scenario, referred to as the Preliminary Build Scenario, was developed.

### 5.1 DEVELOPMENT ASSUMPTIONS

Due to the uncertainty of timelines associated with projects that are currently at various stages in the project development process, two future year scenarios have been evaluated to reflect projected traffic conditions in 2019 and 2024. The specific developments included in each scenario are described below.

#### EB-5 PROJECTS

Based upon local knowledge and input received from the Project Steering Committee, 50 percent of the full-build out of EB-5 projects was included in the 2019 Scenario, while 100 percent of the full-build out was included in the 2024 Scenario. Details regarding each EB-5 development are presented in the figure below.

Figure 36: EB-5 Development Assumptions

	<i>Location</i>	<i>Development Details</i>	<i>Trip Generators</i>
Jay Peak Resort - Stateside Expansion	Jay Peak Resort	Condos, hotel, and lift	Data Obtained from Jay Peak Resort Expansion Traffic Impact and Access Study
Jay Peak Resort - West Bowl Development	Jay Peak Resort	Condos, hotel, and 3 lifts	Data Obtained from Jay Peak Resort Expansion Traffic Impact and Access Study
Jay Village Project	VT 242 near intersection with Cross Road, Jay	Hotel and multi-use recreation facility	150 All-Suites Hotel Rooms (LU 311) 50,000 Square Foot Multipurpose Rec. Facility (LU 435)
AncBIO Vermont	Bogner Drive, Newport	Research and development facility	165,000 Square Foot Research and Development Center (LU 760)
Manufacturing/Light Industrial	Bogner Drive, Newport	Manufacturing facility	40,000 Square Foot General Light Industrial (LU 110)
Newport Marina Hotel & Conference Center	Waterfront Plaza, Newport	Hotel and conference center	150 Hotel Rooms (LU 310)
Newport Renaissance Block	Main Street near intersection with Coventry Street, Newport	Hotel, office, and retail	68,000 Square Foot Shopping Center (LU 820) 80 Apartment Units (LU 220)
Burke Mountain Lodge Expansion	Q Burke Mountain Resort	Hotels	Four 56-Unit Hotels (LU 310) Racquet/Tennis Club (8 indoor courts) (LU 491)



## OTHER FUTURE DEVELOPMENTS

Based upon local knowledge and input received from the Project Steering Committee, all developments noted below were included in the 2019 Scenario, with the exception of Lowe’s, which was included in the 2024 Scenario. While some of these projects may have been completed and opened at the time this report was finalized, they were not generating traffic during the time period captured in the traffic volumes used as a basis for this assessment. Details regarding each development are presented in the figure below.

**Figure 37: Other Future Development Assumptions**

	<i>Location</i>	<i>Development Details</i>	<i>Trip Generators</i>
Newport Airport	Airport Road, Newport	Passenger Terminal and 8 hangers	5,000 Square Foot Passenger Terminal
Walmart	Between US 5 and Shattuck Hill Road, Derby	Supercenter	150,000 Square Foot Free-Standing Discount Superstore (LU 813)
Lowe’s	Quarry Road, Derby	Home improvement Store	112,000 Square Foot Home Improvement Superstore (LU 862)
Louis Garneau	US 5 east of I-91 interchange, Derby	Relocated/expanded outerwear factory and retail outlet	55,000 Square Foot General Light Industrial (LU 110) 5,000 Square Foot Apparel Store (LU 876)
Sticks and Stuff Hardware/Lumber Store	IROC Site, Quarry Road, Derby	Home center	60,000 Square Foot Home Improvement Superstore (LU 862)
CVS	Intersection of US 5 and Shattuck Hill Road, Derby	Pharmacy	13,000 Square Foot Pharmacy/Drugstore with Drive-Through Window (LU 881)
338 Highland Avenue (old hospital)	338 Highland Avenue, Newport	Residential Units	82 Apartment Units (LU 220)
Maplefields	Intersection of Third Street and Main Street, Newport	Expanded gas station and convenience store	4,500 Square Foot Convenience Market with Gasoline Pumps (LU 853)
Cumberland Farms	US 5 south of Center Street, Lyndon	Relocated and expanded gas station/convenience store	Data Obtained from Cumberland Farms Traffic Impact Study

## 5.2 FUTURE TRIP GENERATION & TRAFFIC VOLUMES

Due to the relatively large number of proposed developments in the study area, traffic volumes are expected to significantly increase over the next 10 years. The projected increase in evening peak hour traffic volumes increases at each of the study intersections is shown in the figure below. These growth rates shown below include an estimated background growth based on historic VTrans traffic counts. Including this background growth in addition to the EB-5 and other developments may produce overly conservative results as background traffic volume growth is largely a product of local development. As noted in the figure, future traffic volumes are projected to increase by up to 80% at some intersections as a result of the anticipated traffic growth.



Figure 38: PM Peak Hour Traffic Growth Projections by Study Intersection (2014 to 2024)

Newport Intersections	2014	2024 Trip Generation		2014 - 2024	2024 Full Build Out	Increase
		EB-5 Developments	Other Developments	Background Growth		
1. Main St / Lake Rd	571	203	72	17	864	51%
2. US 5 / Main and School St	969	297	134	29	1,429	48%
3. US 5 / Coventry St	1,652	315	192	50	2,209	34%
4. Main St (US 5/VT 105)/Railroad Sq	1,786	289	189	54	2,317	30%
5. US 5 / VT 191	1,752	249	176	53	2,229	27%
6. US 5 / Union St	1,267	190	173	38	1,668	32%
7. US 5 / Airport Rd	276	45	15	8	345	25%
8. VT 105 / Logan Dr	454	80	54	14	602	33%
9. VT 105 / Alderbrook Rd	620	62	76	19	776	25%
10. VT 105 / US 5	442	107	80	13	643	45%

Derby Intersections	2014	2024 Trip Generation		2014 - 2024	2024 Full Build Out	Increase
		EB-5 Developments	Other Developments	Background Growth		
1. US 5 / Shattuck Hill Rd and Crawford Rd	1,197	88	493	36	1,814	52%
2. US 5 / Quarry Rd	1,172	84	703	35	1,993	70%
3A. US 5 / I91 SB Ramps	1,362	83	518	41	2,004	47%
3B. US 5 / I91 NB Ramps	1,314	80	440	39	1,873	43%
4. US 5 and West St	1,245	66	418	37	1,767	42%
5. US 5 / VT 105	1,038	65	343	31	1,477	42%
6. VT 105 / VT 111	699	48	200	21	968	39%

Burke Intersections	2014	2024 Trip Generation		2014 - 2024	2024 Full Build Out	Increase
		EB-5 Developments	Other Developments	Background Growth		
1. VT 114 / Mountain Rd	665	167	0	27	859	29%
2. VT 114 / Darling Hill Rd	662	156	0	26	844	27%

Lyndon Intersections	2014	2024 Trip Generation		2014 - 2024	2024 Full Build Out	Increase
		EB-5 Developments	Other Developments	Background Growth		
1. US 5 / VT 114 and VT 122	1,123	156	17	45	1,341	19%
2. Depot St./Main St	1,040	141	17	42	1,240	19%
3. US 5/Depot St/Broad St	1,183	141	21	47	1,392	18%
4. US 5 / Red Village Rd	1,341	141	16	54	1,551	16%
5. US 5 / Back Center Rd and Calkins Dr	1,470	141	15	59	1,684	15%

Jay Peak Area Intersections	2014	2024 Trip Generation		2014 - 2024	2024 Full Build Out	Increase
		EB-5 Developments	Other Developments	Background Growth		
1. VT 242 / Jay Access Road	725	575	0	21	1,321	82%
2. VT 242 / Cross Rd	528	385	0	15	928	76%
3. VT 101 / VT 242	499	300	0	14	814	63%
4A. VT 101 / VT 101 (North)	417	205	0	12	634	52%
4B. VT 101 / VT 101 (South)	307	75	0	9	391	27%
4C. VT 101 / VT 101 (East)	485	205	0	14	704	45%
5. VT 243 / Elm St and Dominion Ave	138	95	0	4	238	72%



### 5.3 CONGESTION ANALYSIS

The congestion analysis compares existing conditions (2014 No Build) with four future year scenarios:

- 2019 No Build – Conditions representing a 5-year horizon without any improvements to study intersections
- 2019 Build – Conditions representing a 5-year horizon including previously recommended/studied improvements to study intersections
- 2024 No Build – Conditions representing 10-year horizon without any improvements to study intersections
- 2024 Build – Conditions representing a 10-year horizon including previously recommended/studied improvements to study intersections

It should be noted that all signal timings were optimized in the two build scenarios, even at study intersections where there were no previously recommended/studied improvements.

### NEWPORT STUDY INTERSECTIONS

Figure 39 summarizes intersection operating conditions for the ten study intersections located in Newport for existing conditions and four future year scenarios.



Figure 39: Level-of-Service Results (Newport Intersections)

Newport Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build			
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	
1. Main St / Lake Rd	EB, Exiting W Main St	A	8	0.10	A	9	0.18	A	9	0.18	A	10	0.24	A	10	0.24
	WB, Exiting Main St	B	10	0.43	B	12	0.54	B	12	0.54	B	15	0.61	B	15	0.61
	SB, Exiting Lake Rd	A	9	0.16	B	10	0.25	B	10	0.25	B	11	0.32	B	11	0.32
2. US 5 / Main and School St*	EB, along Main St	A	10	-	C	18	-	C	18	-	D	29	-	D	29	-
	WB, along US 5	A	4	-	A	4	-	A	5	-	A	5	-	A	5	-
	NB, along US 5	A	7	-	B	10	-	B	12	-	B	14	-	B	14	-
	SB, exiting School St	A	8	-	B	10	-	C	16	-	B	13	-	B	13	-
3. US 5 / Coventry St	Overall	C	30	0.56	F	97	0.73	C	34	0.64	F	>100	0.83	D	40	0.71
	EB, along US 5	C	33	-	F	>100	-	D	37	-	F	>100	-	D	38	-
	WB, along US 5	C	26	-	C	31	-	C	28	-	D	37	-	D	40	-
	NB, exiting Coventry St	C	32	-	C	32	-	D	40	-	C	33	-	D	42	-
	SB, exiting Lane St	D	35	-	D	36	-	D	44	-	D	37	-	E	56	-
4. Main St (US 5/VT 105)/Causeway/Railroad Sq	EB Left, along US 5	A	3	-	A	4	-	N/A	A	4	-	N/A	A	2	-	
	EB Through/Right, exiting US 5	A	2	-	A	2	-		A	2	-					
	WB, exiting Railroad Sq	F	>100	-	F	>100	-		F	>100	-					
	NB, exiting Poulin Grain Dr	E	42	-	F	>100	-		F	>100	-					
	SB, along US 5	A	8	-	A	10	-		B	13	-					
4. Main St (US 5/VT 105)/Causeway/Railroad Sq	Overall	N/A	N/A	N/A	C	23	0.73	N/A	C	25	0.80					
	EB, exiting US 5				C	23	-		C	25	-					
	WB, exiting Railroad Sq				D	47	-		D	47	-					
	NB, exiting Poulin Grain Dr				D	47	-		D	51	-					
	SB, along US 5				B	17	-		B	17	-					
5. US 5 / VT 191	Overall	B	15	0.68	B	19	0.83	B	19	0.83	D	39	0.92	D	39	0.92
	WB, exiting VT 191	C	24	-	C	25	-	C	25	-	C	26	-	C	26	-
	NB, along US 5	B	16	-	C	25	-	C	25	-	E	61	-	E	61	-
	SB, along US 5	A	8	-	A	9	-	A	9	-	B	10	-	B	10	-
6. US 5 / Union St	Overall	B	11	0.46	B	15	0.54	B	15	0.54	B	17	0.58	B	17	0.58
	WB, along US 5	C	23	-	C	24	-	C	24	-	C	25	-	C	25	-
	NB, along US 5	A	3	-	A	10	-	A	10	-	B	14	-	B	14	-
	SB, exiting Union St	A	10	-	B	11	-	B	11	-	B	12	-	B	12	-
7. US 5 / Airport Rd	WB, Exiting Airport Rd	A	9	0.03	A	9	0.03	A	9	0.03	A	9	0.04	A	9	0.04
	SB, along US 5	A	8	0.02	A	8	0.02	A	8	0.02	A	8	0.02	A	8	0.02
8. VT 105 / Logan Dr	EB, along VT 105	A	8	0.00	A	8	0.01	A	8	0.01	A	8	0.01	A	8	0.01
	SB, exiting Logan Dr	B	11	0.02	B	12	0.04	B	12	0.04	B	13	0.07	B	13	0.07
9. VT 105 / Alderbrook Rd	WB, along VT 105	A	8	0.07	A	8	0.08	A	8	0.08	A	8	0.09	A	8	0.09
	NB, exiting Alderbrook Rd	B	10	0.10	B	11	0.13	B	11	0.13	B	11	0.14	B	11	0.14
10. VT 105 / US 5	WB, along US 5	A	8	0.03	A	8	0.03	A	8	0.03	A	8	0.04	A	8	0.04
	NB, along US 5	B	10	0.06	B	11	0.09	B	11	0.09	B	12	0.11	B	12	0.11

Notes: \* denotes an intersection where SimTraffic was used to calculate delay.  
N/A is shown for scenarios where the control type was modified from stop- to signal-controlled.

The congestion analysis results indicate that intersection approaches at the following two study intersections are expected to deteriorate to unacceptable levels during the peak hour for one or more of the future year study scenarios:

**US 5/Coventry Street**

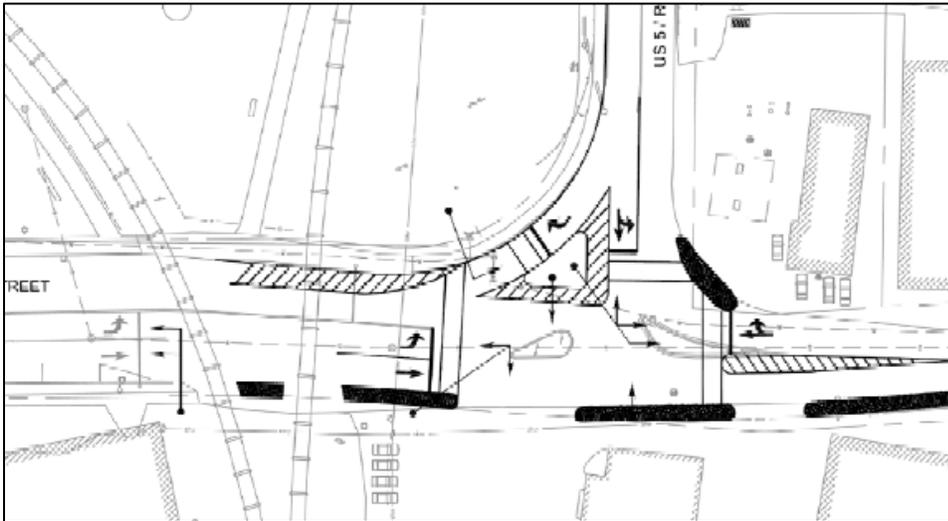
The eastbound approach is projected to cause the intersection to operate at LOS F in the 2019 and 2024 No Build Scenario. Signal optimization at this intersection improves operating conditions to acceptable levels (LOS C in 2019 and LOS D in 2024) for this scenario.



**Main Street (US 5/VT 105)/ Causeway/Railroad Square**

The westbound and northbound approaches are projected to operate at LOS F in both future year No Build scenarios. This intersection has been the subject of several previous studies, including the *Newport City Thoroughfare Plan* (NVDA, 2010), which included three alternative improvements to address operational deficiencies. The alternative that included intersection signalization was selected for refinement in this Plan, and is shown below in Figure 40.

**Figure 40: Railroad Square Intersection Signalization Diagram**



Source: *Newport City Thoroughfare Plan* (NVDA, 2010)

This alternative was selected because it provided the highest level of congestion relief with the lowest expected impact to adjacent intersections and regional access. Signalization at this intersection improves operating conditions to acceptable levels (LOS C) for both future year build scenarios.

**DERBY STUDY INTERSECTIONS**

Figure 41 summarizes intersection operating conditions for the six study intersections located in Derby for existing and future conditions.



Figure 41: Level-of-Service Results (Derby Intersections)

Derby Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build			
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	
 1. US 5 / Shattuck Hill Rd and Crawford Rd	Overall	B	17	0.59	C	22	0.77	C	22	0.77	C	24	0.82	C	24	0.82
	EB, exiting Shattuck Hill Rd	C	30	-	C	33	-	C	33	-	D	36	-	D	36	-
	WB, exiting Crawford Rd	B	18	-	C	21	-	C	21	-	C	21	-	C	21	-
	NB, along US 5	B	14	-	C	21	-	C	21	-	C	24	-	C	24	-
	SB, along US 5	B	14	-	C	20	-	C	20	-	C	21	-	C	21	-
 2. US 5 / Quarry Rd	Overall	B	13	0.53	D	47	0.75	B	13	0.70	B	17	0.76	B	17	0.76
	EB, exiting Quarry Rd	B	12	-	B	13	-	C	21	-	C	24	-	C	24	-
	WB, exiting Parking Lot	B	11	-	B	11	-	B	16	-	B	17	-	B	17	-
	NB, along US 5	B	14	-	E	75	-	B	13	-	B	17	-	B	17	-
	SB, along US 5	B	12	-	C	27	-	B	11	-	B	14	-	B	14	-
 3A. US 5 / I91 SB Ramps	EB Left, exiting US 5	A	9	0.09	A	9	0.13	A	9	0.13	A	10	0.15	A	10	0.15
	SB Left, exiting I91 SB	D	31	0.06	F	63	0.13	F	63	0.13	F	82	0.16	F	82	0.16
	SB Right, exiting I91 SB	B	12	0.07	B	14	0.18	B	14	0.18	C	15	0.21	C	15	0.21
 3B. US 5 / I91 NB Ramps	EB Left, exiting US 5	A	9	0.04	A	9	0.10	A	9	0.10	A	10	0.12	A	10	0.12
	NB Left, exiting I91 NB	D	29	0.20	F	87	0.52	F	87	0.52	F	>100	0.69	F	>100	0.69
	NB Right, exiting I91 NB	B	14	0.17	C	18	0.22	C	18	0.22	C	20	0.26	C	20	0.26
 4. US 5 and West St	WB, US 5	A	9	0.00	A	10	0.00	A	10	0.00	B	10	0.00	B	10	0.00
	NB, exiting West St	C	21	0.10	D	31	0.17	D	31	0.17	E	38	0.22	E	38	0.22
 5. US 5 / VT 105*	EB Left, along US 5	D	25	0.54	F	>100	0.99	C	18	0.53	F	>100	1.20	C	20	0.59
	EB Right, exiting US 5	B	12	0.38	B	14	0.54	C	23	0.72	C	16	0.60	D	33	0.81
	NB, along VT 105	A	8	0.15	A	9	0.22	C	18	0.57	A	9	0.24	C	21	0.64
	SB, along US 5	-	-	-	-	-	-	B	15	0.50	-	-	-	C	17	0.55
 6. VT 105 / VT 111	WB, exiting VT 111	B	12	0.24	B	14	0.33	B	14	0.33	B	15	0.37	B	15	0.37
	SB, along VT 105	A	8	0.12	A	8	0.16	A	8	0.16	A	8	0.17	A	8	0.17

Notes: \*Intersection was converted to an all way stop in Build Scenarios  
 N/A is shown for scenarios where the control type was modified from stop- to signal-controlled.

The congestion analysis results indicate that intersection approaches at the following four study intersections are expected to deteriorate to unacceptable levels during the peak hour for one or more of the future year study scenarios:

**US 5/I-91 Ramps**

Left turns onto US 5 from the southbound and northbound I-91 off-ramps are projected to operate at LOS F in all future year scenarios. The northbound I-91 off-ramp was studied as part of the Louis Garneau site development traffic study (lot located in the northeast quadrant of the I-91 Interchange). It was identified as failing (LOS F) during the peak; however no improvements were recommended and that study indicated that intersection signalization was unwarranted. Both off-ramp intersections will be evaluated for potential improvements in Section 6 of this Plan.

**US 5/West Street**

The northbound approach (exiting West Street) is projected to operate at LOS E in 2024. Improvements to this intersection have not previously been studied or recommended; therefore, this intersection will be evaluated for potential improvements in Section 6 of this Plan.



### US 5/VT 105

The eastbound approach (left turns from US 5 onto VT 105) is projected to operate at LOS F in both future year no build scenarios. This intersection has been the subject of previous studies, including the *Intersection Study for the US 5/VT 5A/VT 105 Intersection in the Town of Derby, Vermont* (NVDA, 2007), which presented three separate alternatives, which are as follows:

- All way stop
- Two way stop (eastbound and southbound approaches stop-controlled)
- Signalize

Through discussions with the project Steering Committee, it was agreed upon that an all-way stop would be the preferred alternative at this location. Implementing the all-way stop improves future year Level of Service from F to D for the critical movement at this intersection.

### BURKE STUDY INTERSECTIONS

Figure 42 summarizes intersection operating conditions for the two study intersections located in Burke for existing conditions and four future year scenarios. The congestion analysis results indicate that both intersections are projected to operate at LOS C or better conditions for all future year scenarios.

**Figure 42: Level-of-Service Results (Burke Intersections)**

Burke Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
<b>STOP</b> 1. VT 114 / Mountain Rd WB, exiting Mountain Rd SB, along VT 114	B	15	0.50	C	17	0.59	C	17	0.59	C	21	0.69	C	21	0.69
	A	8	0.00	A	8	0.01	A	8	0.01	A	8	0.01	A	8	0.01
<b>STOP</b> 2. VT 114 / Darling Hill Rd EB, exiting Burke Hollow Rd NB, along VT 114	B	13	0.10	B	14	0.11	B	14	0.11	B	15	0.13	B	15	0.13
	A	8	0.02	A	9	0.02	A	9	0.02	A	9	0.02	A	9	0.02

### LYNDON STUDY INTERSECTIONS

Figure 43 summarizes intersection operating conditions for the five study intersections located in Lyndon for existing conditions and four future year scenarios.



Figure 43: Level-of-Service Results (Lyndon Intersections)

Lyndon Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build			
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	
 1. US 5 / VT 114 and VT 122	Overall	B	11	0.66	B	12	0.72	B	12	0.72	B	13	0.75	B	13	0.75
	EB, exiting VT 122	A	8	-	A	8	-	A	8	-	A	8	-	A	8	-
	WB, exiting VT 114	B	12	-	B	12	-	B	12	-	B	13	-	B	13	-
	NB, along US 5	B	12	-	B	13	-	B	13	-	B	14	-	B	14	-
	SB, along US 5	B	11	-	B	12	-	B	12	-	B	13	-	B	13	-
 2. Depot St./Main St*	WB, along US 5	A	2	-	A	3	-	A	2	-	A	3	-	A	3	-
	NB, exiting Main St	B	13	-	C	17	-	C	18	-	D	31	-	D	29	-
	SB, along US 5	A	1	-	A	1	-	A	1	-	A	2	-	A	2	-
 3. US 5/Depot St/Broad St	EB Through exiting US 5	B	11	0.14	B	11	0.14	A	10	-	B	11	0.14	B	12	-
	EB Right, along US 5	C	19	0.63	C	25	0.71	A	<1	-	D	31	0.79	A	<1	-
	WB Left, exiting Depot St	B	13	0.21	B	13	0.22	F	51	-	B	13	0.23	F	68	-
	WB Through, exiting Depot St	B	11	0.14	B	12	0.15	F	68	-	B	12	0.15	F	>100	-
	NB Left, along US 5	F	69	0.92	F	>100	1.07	A	3	-	F	>100	1.16	A	3	-
	NB Right, exiting US 5	A	9	0.12	A	10	0.13	A	<1	-	A	10	0.13	A	<1	-
	SB, exiting Angies Alley	B	10	0.04	B	11	0.04	C	17	-	B	11	0.04	C	16	-
	Overall															
 4. US 5 / Red Village Rd	WB, exiting Red Village Rd	D	30	0.50	E	39	0.59				F	52	0.67			
	SB Left, exiting US 5	A	10	0.09	A	10	0.09	N/A			A	10	0.10	N/A		
 4. US 5 / Red Village Rd	Overall							B	13	0.70				B	15	0.73
	WB, exiting Red Village Rd							C	29	-				C	29	-
	NB, along US 5							B	16	-				B	20	-
	SB, along US 5							A	4	-				A	5	-
 5. US 5 / Back Center Rd and Calkins Dr	Overall	A	6	0.56	A	7	0.59	A	7	0.60	A	7	0.62	A	7	0.63
	EB, Exiting Back Center Rd	C	21	-	C	22	-	C	21	-	C	24	-	C	22	-
	WB, exiting Calkins Dr	B	20	-	C	21	-	C	20	-	C	22	-	C	21	-
	NB, along US 5	A	6	-	A	6	-	A	6	-	A	6	-	A	7	-
	SB, along US 5	A	4	-	A	4	-	A	4	-	A	4	-	A	4	-

Notes: \* denotes an intersection where SimTraffic was used to calculate delay.

N/A is shown for scenarios where the control type was modified from stop- to signal-controlled.

The congestion analysis results indicate that intersection approaches at the following three study intersections are expected to deteriorate to unacceptable levels during the peak hour for one or more of the future year study scenarios:

### Depot Street (US 5)/Broad Street

The northbound approach (left turns from Broad Street onto Main Street) currently operates at LOS F and is projected to continue to fail in both future year No Build scenarios. This intersection has been the subject of previous studies, including the *Burke Mountain Area Transportation Infrastructure Study* (NVDA, 2007), which included three alternative improvements to address operational deficiencies: all-way stop, intersection signalization, and a roundabout. The study also evaluated several one-way traffic circulation schemes for travel throughout downtown Lyndonville.

Shortly after the study was completed, a decision was made by Village officials to implement the all-way stop alternative. Our analysis of this all-way stop configuration shows significant delay and congestion projections with future traffic volumes in place. Due to these projected delays with the all-way stop configuration, we do not recommend this as a preferable long term solution. Recommendations for long-term improvements at this intersection will be examined in detail in Section 6 of this Plan.



### US 5/Red Village Road

The westbound approach (turning onto US 5 from Red Village Road) at this intersection is projected to operate at LOS E in the 2019 Build Scenario and LOS F in the 2024 Build Scenario. Improvements at this intersection have been discussed in previous studies, including the *Lyndon Area Corridor Management Plan* (NVDA, 2008). This study indicated that VTrans is currently developing plans for signaling and improving this intersection to address the difficulty of making left turns onto US 5 from Red Village Road. Consistent with this discussion, intersection signalization was included in this Plan and was found to improve operating conditions to acceptable levels (LOS B) for both future year build scenarios. It is important to note that there is an active rail crossing on the west side of the intersection, which needs to be factored into the signal/stripping design.

### JAY STUDY INTERSECTIONS

Figure 44 summarizes intersection operating conditions for the five study intersections located in Jay for existing conditions and four future year scenarios.

Figure 44: Level-of-Service Results (Jay Peak Area Intersections)

Jay Peak Area Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
<b>STOP 1. VT 242 / Jay Access Road</b> EB, along VT 242 SB, exiting Jay Peak Resort	A	7	0.02	A	7	0.01	A	7	0.01	A	8	0.02	A	8	0.02
	C	17	0.64	C	17	0.43	C	17	0.43	E	41	0.83	E	41	0.83
<b>STOP 2. VT 242 / Cross Rd</b> EB, along VT 242 WB, along VT 242 NB, along Cross Rd SB, along Cross Rd	A	7	0.01	A	7	0.02	A	7	0.02	A	8	0.02	A	8	0.02
	A	8	0.00	A	8	0.01	A	8	0.01	A	9	0.01	A	9	0.01
	B	12	0.06	B	14	0.10	B	14	0.10	C	17	0.14	C	17	0.14
	A	10	0.03	B	10	0.04	B	10	0.04	B	11	0.05	B	11	0.05
<b>STOP 3. VT 101 / VT 242</b> EB, Exiting VT 242 NB, along VT 101	B	12	0.41	B	14	0.56	B	14	0.56	C	19	0.71	C	19	0.71
	A	7	0.03	A	7	0.04	A	7	0.04	A	7	0.04	A	7	0.04
<b>STOP 4A. VT 101 / VT 101 (North)</b> EB, along S Pleasant St WB, along S Pleasant St NB, along VT 101 SB, along VT 101	B	13	0.08	C	15	0.10	C	15	0.10	C	18	0.13	C	18	0.13
	A	10	0.15	B	10	0.18	B	10	0.18	B	11	0.20	B	11	0.20
	A	7	0.03	A	8	0.03	A	8	0.03	A	8	0.03	A	8	0.03
	A	8	0.09	A	8	0.13	A	8	0.13	A	8	0.16	A	8	0.16
<b>STOP 4B. VT 101 / VT 101 (South)</b> EB, along VT 100 SB, exiting VT 101	A	8	0.05	A	8	0.05	A	8	0.05	A	8	0.05	A	8	0.05
	A	9	0.05	B	10	0.11	B	10	0.11	B	11	0.17	B	11	0.17
<b>STOP 4C. VT 101 / VT 101 (East)</b> SB, Exiting S Pleasant St	B	12	0.23	B	13	0.32	B	13	0.32	B	15	0.41	B	15	0.41
<b>STOP 5. VT 243 / Elm St and Dominion Ave</b> EB, exiting Elm St WB, exiting Dominion Ave NB, along VT 243	A	9	0.05	A	10	0.10	A	10	0.10	A	10	0.14	A	10	0.14
	A	9	0.02	A	9	0.02	A	9	0.02	A	9	0.02	A	9	0.02
	A	7	0.01	A	7	0.01	A	7	0.01	A	7	0.01	A	7	0.01

The congestion analysis results indicate that the following study intersection is expected to deteriorate to unacceptable levels during the peak hour for the 2024 No Build and Build scenarios:

### VT 242/New Jay Access Road

Traffic exiting Jay Peak Resort is projected to encounter LOS E conditions attempting to turn onto VT 242 in the year 2024. The *Jay Peak Resort Expansion* study (Jay Peak Resort, 2012) recognized that LOS E conditions would occur during peak ski conditions for southbound-left movements, but that this condition would not



occur on a daily basis and that the intersection would otherwise operate at an acceptable LOS.<sup>7</sup> It also stated that traffic monitoring and data collection would be conducted to manage any traffic operations issues that may arise, and that appropriate measures would be pursued by Jay Peak Resort as mitigation. Because the Resort has assumed responsibility for maintaining acceptable operations at this future intersection, this Plan will not evaluate any potential improvements.

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<sup>7</sup> A signal was warranted at this location, but only during relatively rare occasions (i.e., peak Saturday afternoons during big ski weekends in the winter). Rather than installing a signal that would be unnecessary during most days of the year, Jay Peak offered to assist intersection operations manually with on-the-ground traffic assistance during these rare peak conditions.



## 6 RECOMMENDED IMPROVEMENTS

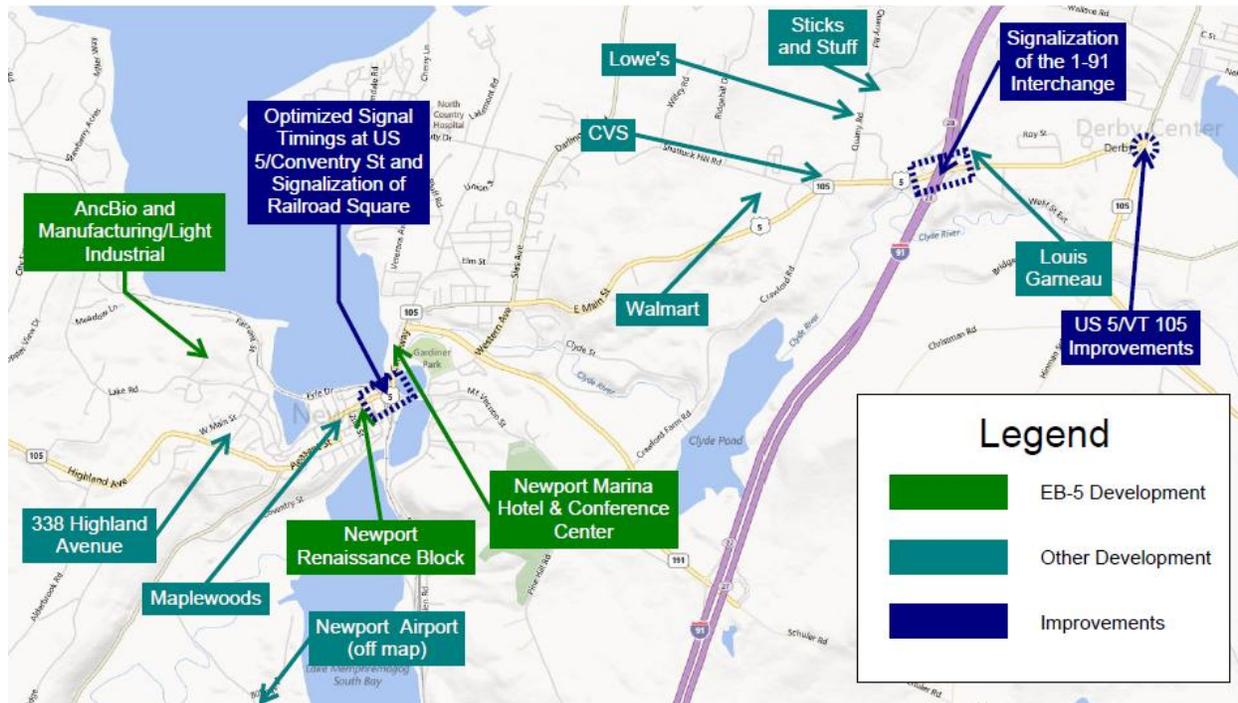
This Section presents a comprehensive summary of the recommended study area improvements, based on the results of the assessment of future traffic conditions and previously-developed improvement recommendations presented in the previous section. The recommendations presented in this section include refinements to previously-developed improvements where feasible, as well as new improvement recommendations as needed to address the projected future traffic levels considering the EB-5 and pother anticipated regional growth through 2025.

The recommended improvements in this section are presented by geographic area, followed by a summary table of all improvements, prioritization, and cost estimates.

### 6.1 NEWPORT/DERBY STUDY AREA

A map of the assumed developments and recommended improvements in the Newport/Derby study area is shown below. Additional detail on each of the recommendations follows the map.

Figure 45: Newport/Derby Study Area Developments and Recommended Improvements



#### US 5/COVENTRY STREET

As discussed in the Future Traffic Conditions section of this report, the eastbound approach is projected to cause the intersection to operate at LOS F in the 2019 and 2024 No Build Scenario. Signal optimization at this intersection improves operating conditions to acceptable levels (LOS C in 2019 and LOS D in 2024) for this scenario. Signal optimization includes a slightly longer cycle length and greater allocation of green time to the east and west movements due to large increases in traffic volume as a result of developments. Signal timings should be updated as the need arises and based on the most recent available turning movement counts.



Figure 46: Level-of-Service Results (US 5/Coventry Street)

Newport Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build			
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	
 <b>3. US 5 / Coventry St</b>	Overall	C	30	0.56	F	97	0.73	C	34	0.64	F	>100	0.83	D	40	0.71
	EB, along US 5	C	33	-	F	>100	-	D	37	-	F	>100	-	D	38	-
	WB, along US 5	C	26	-	C	31	-	C	28	-	D	37	-	D	40	-
	NB, exiting Coventry St	C	32	-	C	32	-	D	40	-	C	33	-	D	42	-
	SB, exiting Lane St	D	35	-	D	36	-	D	44	-	D	37	-	E	56	-

An alternative recommendation for this intersection was developed, but not selected due to concerns from the Steering Committee about high costs and a slight increase in intersection delay. This recommendation is presented in Appendix E.

Additionally a single lane roundabout was examined, but not selected, due to unacceptable levels of operation in the future scenarios and large right-of-way impacts.

### MAIN STREET (US 5/VT 105)/ CAUSEWAY/RAILROAD SQUARE

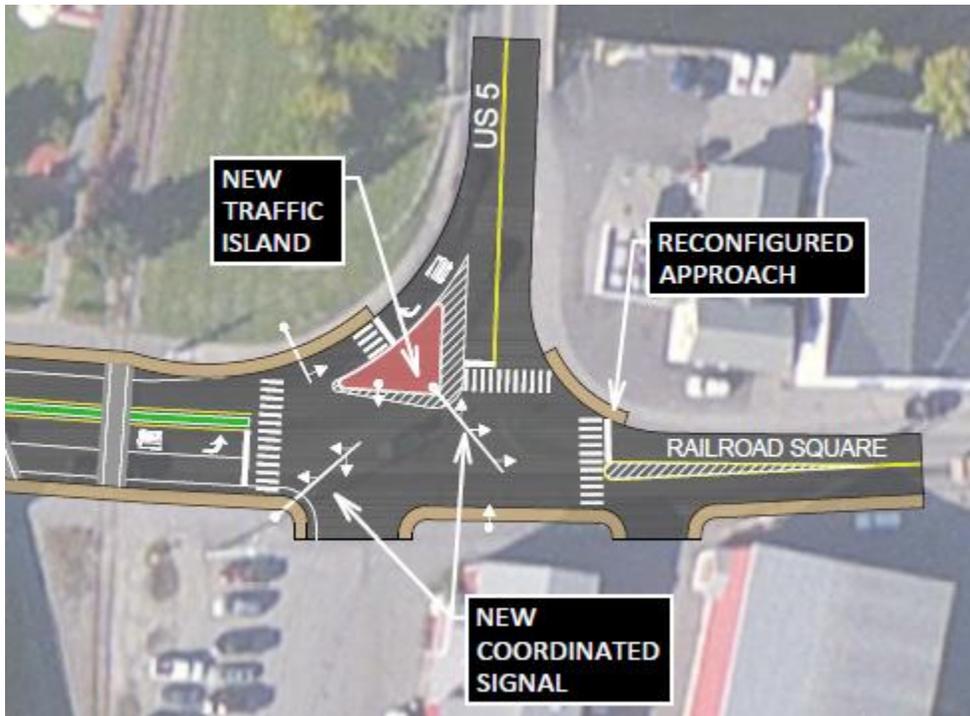
Currently the through movement, US 5, makes a sweeping 90 degree bend at this intersection with no stop control. This creates safety and congestion issues for all vehicles using the Railroad Square Bridge or entering/exiting from Poulin Grain. In addition to signalization, we recommend that the intersection be realigned so that US 5 and Railroad Square are the through movement. This creates a more traditional intersection design and thus improves safety over the current configuration. As discussed in Section 5, this realignment, along with signalization, significantly reduces delays with overall LOS improving from F to C. Additionally, an exclusive pedestrian phase would be installed, thus improving circulation and safety for pedestrians.

In order to minimize queuing over the railroad tracks coordination between the signal and the railroad crossing would be implemented. Additionally, a signal would be installed to the west of the railroad crossing for the eastbound approach to further minimize queuing over the railroad tracks.

Ideally these improvements would be combined with the “road diet” along Main Street, but could be implemented with or without these improvements. The figure below presents a design plan for the Main Street (US 5/VT 105)/ Causeway/Railroad Square with the “road diet” implemented.



Figure 47: Railroad Square Intersection Signalization Design Plan



### US 5/QUARRY ROAD

The US 5/Quarry Road is projected to operate adequately in both 2019 and 2024. In 2024, due to the Lowe’s and Sticks and Stuff developments on Quarry Road, and the increased traffic along US 5, it recommended that a protected left-turn phase be examined for the movement from US 5 onto Quarry Road. According to the Federal Highway Administration (FHWA) publication *Signalized Intersections: Informational Guide*<sup>8</sup> it recommended that a protected left-turn phase be considered if the product of opposing and left-turn hourly volumes exceed 50,000<sup>9</sup>. The product of the left-turn movement off of US 5 onto Quarry Road and the opposing movement is projected to be 69,000 in 2024. Due to this, we recommend considering protected left-turn phasing when future development on Quarry Road occurs.

### US 5/SHAW’S PLAZA

Although the US 5/Shaw’s Plaza and US 5/Commerce Drive intersections were not in our study area, we recommend that they be analyzed for potential signalization in the future. According to the *US 5 Corridor Study*<sup>10</sup> the US 5/Shaw’s Plaza intersection experienced LOS F conditions during the PM peak hour on the southbound left-turn approach exiting Shaw’s Plaza. Similar conditions likely exist at the US 5/Commerce Drive intersection and will worsen with more development along Commerce Drive.

<sup>8</sup> Federal Highway Administration, Research Publications, *Signalized Intersections: Informational Guide* (Washington, DC: United States Department of Transportation, August 2004).

<sup>9</sup> Platoon arrivals (other traffic signals with 0.5 mile), one opposing lane of travel.

<sup>10</sup> Resource Systems Group, *US 5 Corridor Study: Final Report* (19 May 2006)



Consolidating the main entrance from Shaw's Plaza with Commerce Way and signaling one of the accesses and converting the other access to right in/right out should be considered to improve access management along the corridor. This same approach could be considered for the Vermont Pie & Pasta Company as well.

## US 5/I-91 RAMPS

In 2019 and 2024, the left-turning movements from the northbound and southbound ramps are projected to operate at LOS F conditions. Based on projected future traffic volumes, a signal is recommended at both sides of the interchange due to improved overall operations and safety.

Traffic volumes at both stop-controlled interchange intersections were evaluated to see if they meet the 8-hour, 4-hour, and/or peak-hour traffic signal warrants as defined in the *Manual on Uniform Traffic Control Devices (MUTCD)*. The results of the signal warrant assessment found that all three volume-based warrants are met starting in 2019 for both intersections.

The installation of a signal at both sides of the interchange improves the overall operations to LOS B. The table below (Figure 50) shows congestion results with and without the installation of a signal. Additionally, we recommend that the right-turn slip lane on the northbound on-ramp approach to US 5 be reconstructed to reduce the overall approach radius (Figure 48). This realignment will help to improve safety by reducing right-turn movement speeds and by lengthening the distance from this movement to the US 5/West Street intersection to the east.



Figure 48: US 5/I-91 Ramps Intersection Signalization Design Plan (I-91 SB ramps)



Figure 49: US 5/I-91 Ramps Intersection Signalization Design Plan (I-91 NB ramps)

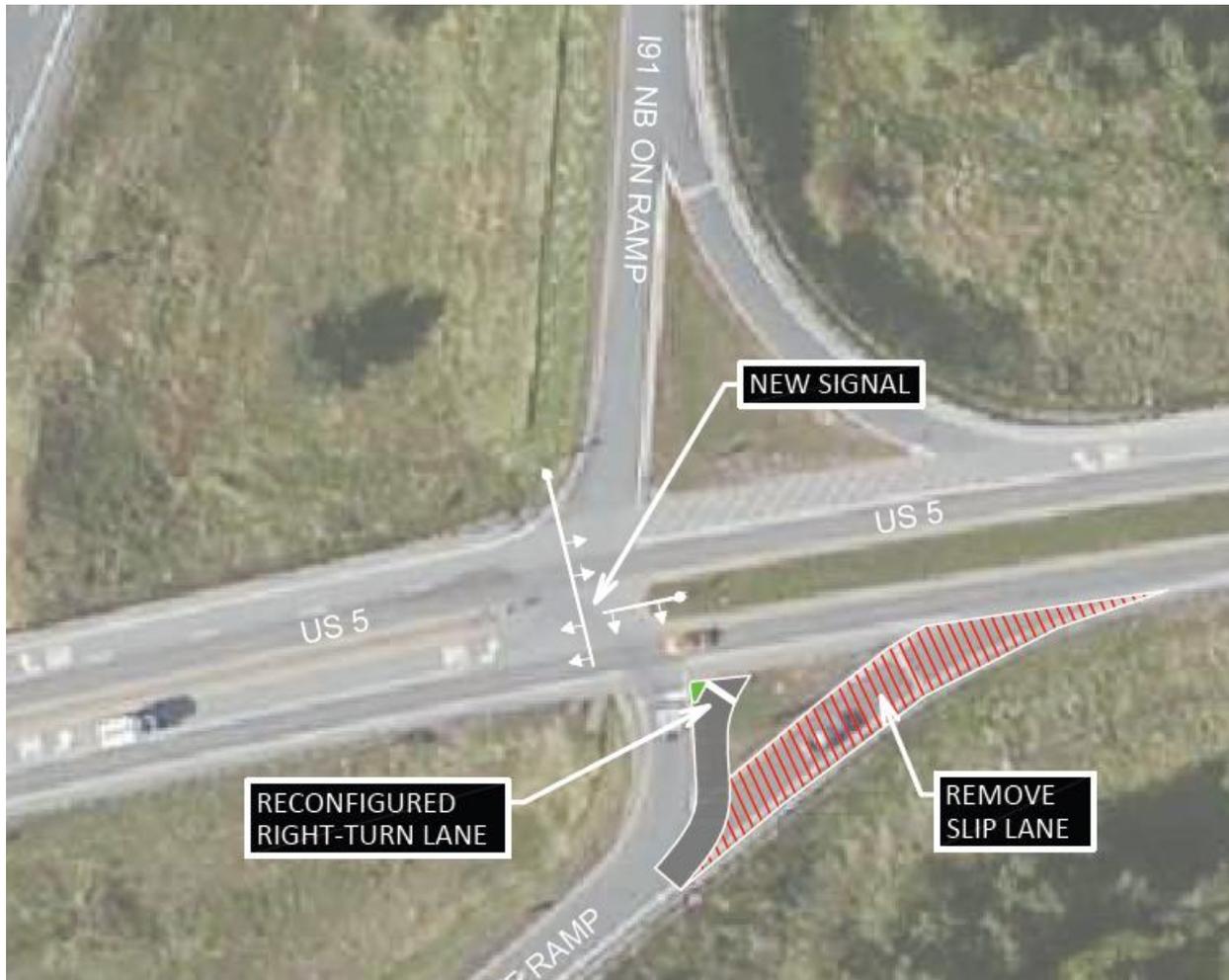


Figure 50: Level-of-Service Results (US 5/I91 Ramps)

Derby Intersections	2014 No Build			2019 Build			Peak Hour			2024 Build			2024 Build + RSG		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
<b>STOP</b> 3A. US 5 / I91 SB Ramps															
EB Left, exiting US 5	A	9	0.09	A	9	0.13				A	10	0.15			
SB Left, exiting I91 SB	D	31	0.06	F	63	0.13				F	82	0.16			
SB Right, exiting I91 SB	B	12	0.07	B	14	0.18				C	15	0.21			
<b>3A. US 5 / I91 SB Ramps</b>															
Overall							B	12	0.75				B	12	0.75
EB, along US 5							A	9	-				A	9	-
WB, along US 5	N/A			N/A			B	16	-				B	16	-
SB, exiting I91 SB							C	21	-				C	21	-
<b>STOP</b> 3B. US 5 / I91 NB Ramps															
EB Left, exiting US 5	A	9	0.04	A	9	0.10				A	10	0.12			
NB Left, exiting I91 NB	D	29	0.20	F	87	0.52				F	>100	0.69			
NB Right, exiting I91 NB	B	14	0.17	C	18	0.22				C	20	0.26			
<b>3B. US 5 / I91 NB Ramps</b>															
Overall							B	13	0.73				B	13	0.73
EB, along US 5							A	8	-				A	8	-
WB, along US 5	N/A			N/A			B	19	-				B	19	-
NB, exiting I91 NB							C	22	-				C	22	-



## US 5/WEST STREET

Despite relatively high delays for the northbound approach from West Street, we recommend that this intersection be left in its current state. This decision is based on the relatively small number of northbound vehicles that are affected by this insufficient LOS and the fact that this roadway serves mostly cut-through traffic between Derby Center and US 5.

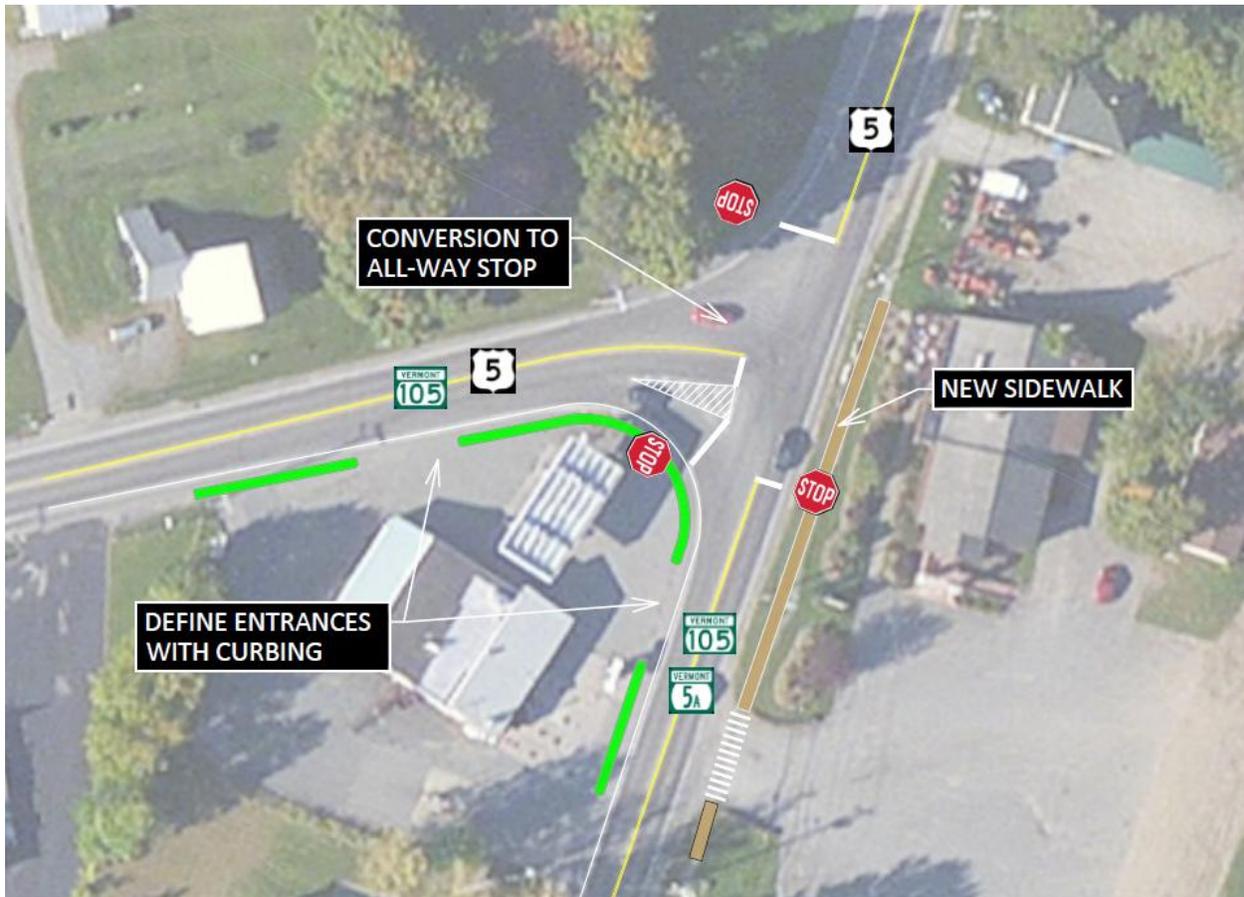
Conditions at this intersection should continue to be monitored with increased traffic along US 5. If significant delays prove to be an issue in the future (e.g. crash rates escalate as drivers get frustrated and try to enter US 5 with insufficient gaps), then an alternative that re-routes West Street east of the Shell gas station to intersect US 5 across from the Louis Garneau site entrance should be considered. Given the West Street and Louis Garneau projected volumes, a traffic signal should be considered at this reconfigured intersection in the future. It should be noted that improving the operations of the West Street approach could result in increased usage of West Street as a short-cut.

## US 5/VT 105

Currently the eastbound approach at the US 5/VT 105 intersection is stop controlled while the northbound and southbound approaches are free. In future years this results in the eastbound approach experiencing failing conditions, while the northbound and southbound approaches experience essentially no delay. By changing this intersection to an all way stop delay is balanced between approaches in a more equal manner, thus improving overall LOS. As discussed in Section 5 changing the US 5/VT 105 intersection to an all way stop improves the overall LOS from F to D.



Figure 51: US 5/VT 105 Intersection All Way Stop Design Plan



Additionally, a sidewalk should be installed on the eastern edge of the intersection to provide pedestrian connectivity through this intersection. Shown in Figure 52 below is a treaded path in front of the Derby Cow Palace where a sidewalk should be installed. The missing sidewalk segment is approximately 225 feet in length.

The Derby Corner Mini-Mart and gas station access points should be consolidated to one curb cut along each roadway. These curb cuts should be as far removed for the intersection of US 5 and VT 5A as possible without resulting in major renovations at the Mini-Mart.



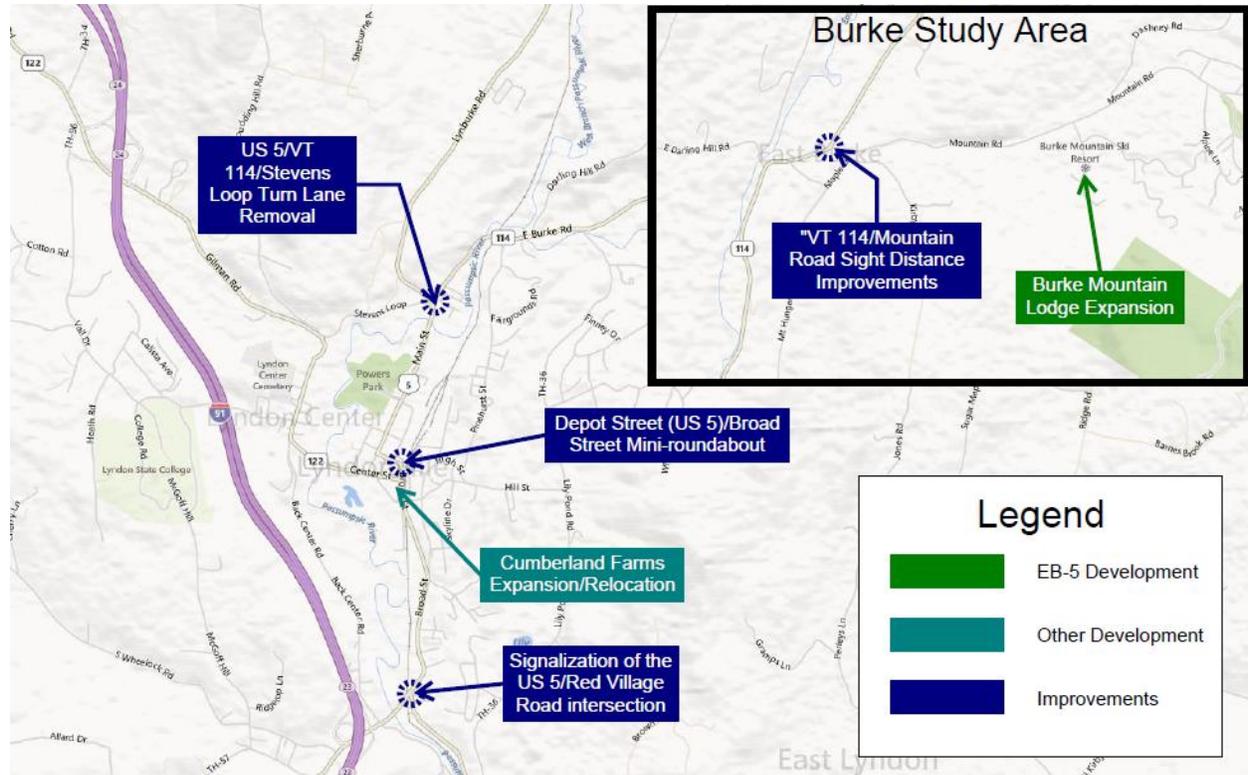
Figure 52: Missing Sidewalk Segment at US 5/VT 105 intersection



## 6.2 BURKE/LYNDON STUDY AREA

A map of the assumed developments and recommended improvements in the Burke/Lyndon study area is shown below. Additional detail on each of the recommendations follows the map.

Figure 53: Burke/Lyndon Study Area Developments and Recommended Improvements



## VT 114/MOUNTAIN ROAD

Although the VT 114/Mountain Road intersection does not present congestion concerns in future years, limited sight distances on the Mountain Road approach could result in safety concerns due to increased traffic in the future. This intersection is part of a designated High Crash Location section (2008-2012).<sup>11</sup>

The VT 114/Mountain Road intersection serves as the primary access to Burke Mountain Resort. This intersection, located on a horizontal and vertical curve, had two crashes, one of which resulted in an injury. Both collisions were broadside crashes between left turning vehicles attempting to pull out of Mountain Road and northbound through vehicles on VT 114. Of note is that despite the limited corner sight distance for cars pulling out of Mountain Road available to see southbound VT 114 vehicles, these types of collisions were not reported.

**Figure 54: Sight Distance Views at VT 114/Mountain Road Intersection**

View from Mountain Road Toward East Burke Village



View from VT 114 in East Burke Village Toward Mountain Rd



The American Association of State Highway Transportation Officials (AASHTO) defines two types of sight distances: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance is the distance required for a vehicle, traveling at the design speed, to stop before reaching a stationary object in its path, such as a stopped vehicle. The provision of adequate stopping sight distance is critical for safe operations. The *2004 Policy on Geometric Design of Highways and Streets* states that, “[i]f the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions.” The *2004 Policy on Geometric Design of Highways and Streets* goes on to state that, “intersection sight distances that exceed stopping sight distances are desirable along the major road.” The minimum stopping sight distances are calculated based on factors such as design speed, response times, and grades as reported in the *2004 Policy on Geometric Design of Highways and Streets*.<sup>12</sup>

At the VT 114/Mountain Road intersection, adequate southbound stopping sight distance (SSD) means southbound vehicles on VT 114 can see far enough ahead to stop to avoid a vehicle exiting Mountain Road. Given the 30 mph posted speed limit, AASHTO recommends the stopping sight distance be at least 200 feet on this approach. As measured in the field, there is 285 feet of stopping sight distance. Thus, the stopping sight

<sup>11</sup> At the time Section 3 of this report was submitted 2008-2012 data was not yet available. This is why this section is not labeled as a High Crash Location in the crash maps in Section 3.

<sup>12</sup> American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets*, Fifth Edition (Washington D.C.: American Association of State Highway and Transportation Officials, 2004), pg. 651-659.



distance is adequate for safe operations. As an additional measure, there is also a sign posted on VT 114 alerting southbound vehicles that they are approaching an intersecting road (Figure 55).

**Figure 55: Sign along VT 114 Indicating Mountain Road and Curve in Road**



Adequate intersection sight distance (ISD) to the north means vehicles exiting Mountain Road can see far enough along VT 114 to decide whether it is safe to enter VT 114 without colliding with another vehicle. The ISD measured in the field is 150 feet, but it should be at least 200 feet. It would be desirable to have 335 feet of intersection sight distance.

Figure 56 illustrates the *stopping sight distance* and *intersection sight distance* at the VT 114/Mountain Road intersection.

**Figure 56: Sight Distance Photographs**

SSD for Southbound Vehicles on VT 114



ISD for Vehicles Exiting Mountain Rd



As this intersection serves as the primary access/egress point for the Burke Mountain Ski Resort, it is important to ensure safe conditions are maintained at this intersection. Although the minimum stopping sight distance requirements are currently met, the vertical curvature of VT 114 north of Mountain Road and the presence of a steep bank on the east side of VT 114 do limit sight distances to and from the north.

To fully address sight distance limitations, we recommend a more comprehensive engineering assessment be conducted to identify the feasibility and potential benefits associated with reducing the vertical curve and cutting back the side slope on VT 114 north of Mountain Road as shown below in Figure 57.

**Figure 57: Potential Improvements to the VT 114/Mountain Road Intersection**

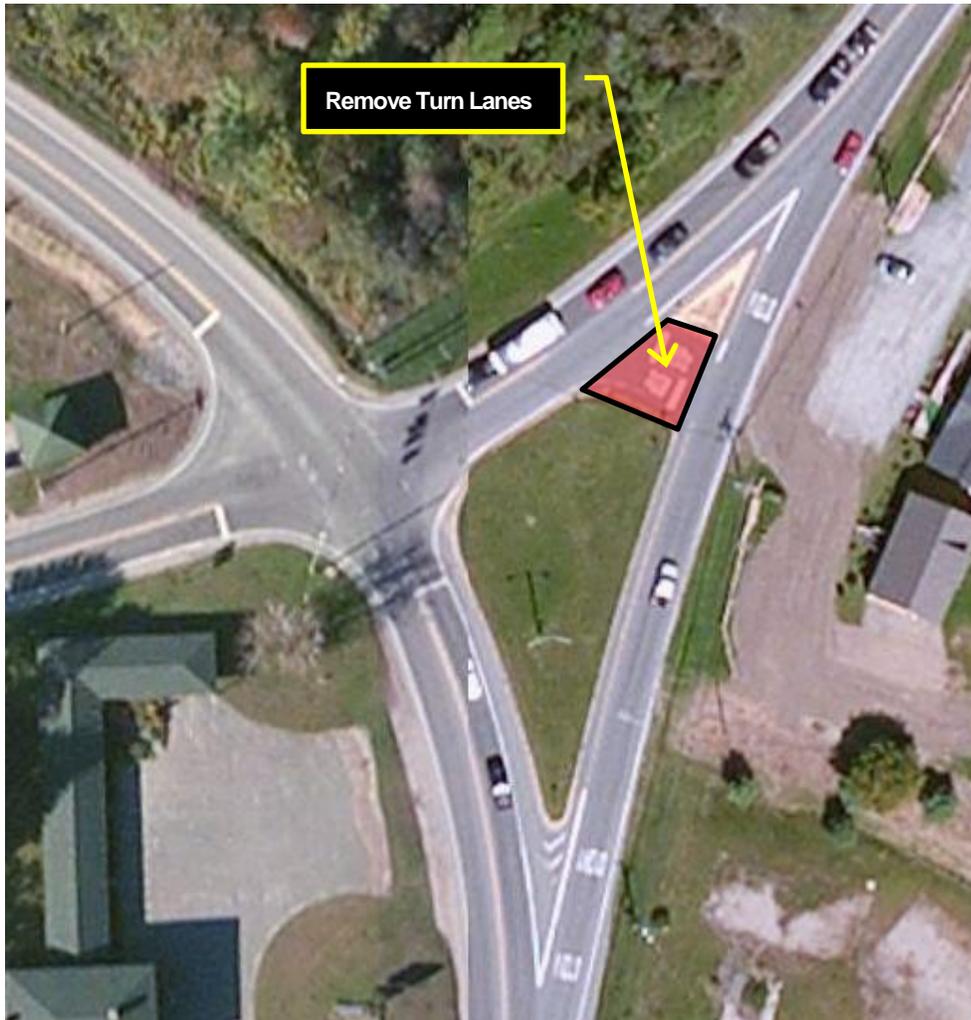


### US 5/VT 114/STEVENS LOOP

The US 5/VT 114/Stevens Loop intersection currently operates at overall LOS B and is projected to continue to operate at LOS B in the future. Although the average delay per vehicle is acceptable according to VTrans standards, there are still operational concerns due to its confusing and unnecessarily complex slip lane configuration. Currently there are turn lanes connected to the slip-lane that were installed to allow all movements from a site access along the slip lane that no longer exists. With this access along the slip lane closed, there is no need for these turn lanes. Due to this, it is our recommendation that these turn lanes be removed. This recommendation is shown below in Figure 58.



Figure 58: Recommended Turn Lane Removal



**DEPOT STREET (US 5)/BROAD STREET**

As discussed in Section 5, the northbound approach (left turns from Broad Street onto Main Street) currently operates at LOS F and is projected to continue to fail in both future year No Build scenarios. A roundabout was examined in the previous *Burke Mountain Area Transportation Infrastructure Study* (NVDA, 2007), and was found to significantly improve traffic operations of the intersection. However, Lyndonville Village Trustees have been reluctant to pursue the roundabout alternative due to its potential costs and impacts to on-street parking.

Recently the Federal Highway Administration (FHWA) has been performing research regarding the implementation of “mini-roundabouts” in the United States, since they have proven to be quite successful in Europe. Mini-roundabouts are implemented where there are physical constraints that do not allow for the installation of a traditional roundabout. Mini-roundabouts are characterized by a much smaller inscribed center diameter (50 to 80 feet) than a traditional roundabout and a center island/medians that are traversable by large vehicles. This allows for a smaller footprint that can still accommodate large vehicles.



Additionally, the mini-roundabout benefits pedestrians by shortening the crossing distance at all three approaches and providing refuge in the middle of the crossing with a median.

The installation of a mini-roundabout at the Depot Street (US 5)/Broad Street intersection improves the overall operations to LOS B in 2019 and LOS C in 2024. Figure 59 below compares congestion results for existing intersection control and a mini-roundabout.

Figure 59: Level-of-Service Results (US 5/Depot St/Broad St)

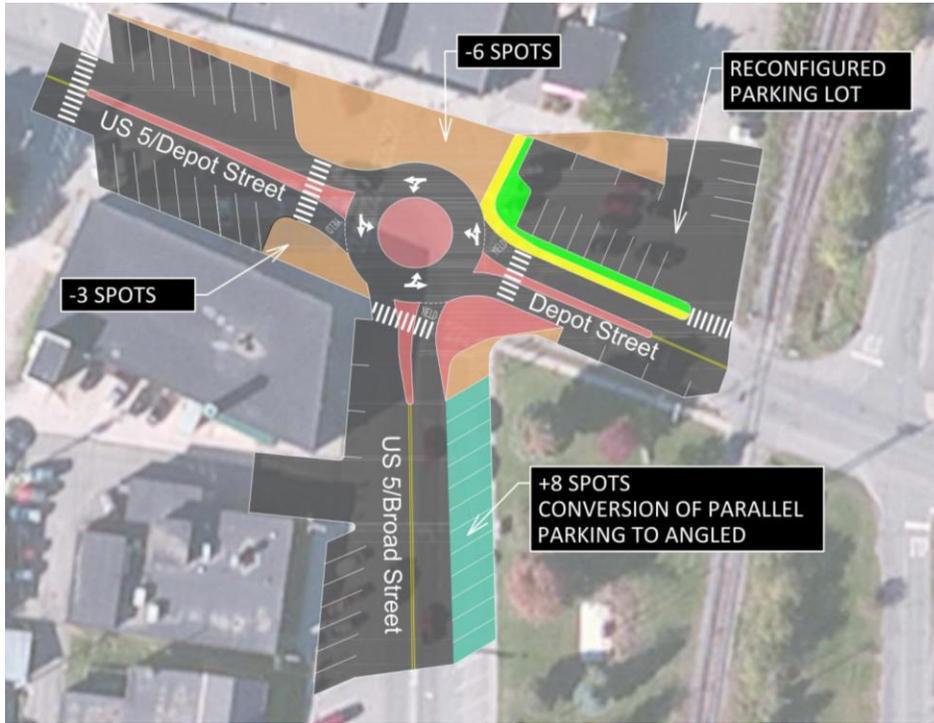
Lyndon Intersections	2014 No Build			2019 No Build			Peak Hour 2019 Build			2024 No Build			2024 Build		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
 <b>3. US 5/Depot St/Broad St</b>															
EB Through exiting US 5	B	11	0.14	B	11	0.14	N/A			B	11	0.14	N/A		
EB Right, along US 5	C	19	0.63	C	25	0.71				D	31	0.79			
WB Left, exiting Depot St	B	13	0.21	B	13	0.22				B	13	0.23			
WB Through, exiting Depot St	B	11	0.14	B	12	0.15				B	12	0.15			
NB Left, along US 5	F	69	0.92	F	>100	1.07				F	>100	1.16			
NB Right, exiting US 5	A	9	0.12	A	10	0.13				A	10	0.13			
SB, exiting Angies Alley	B	10	0.04	B	11	0.04				B	11	0.04			
 <b>3. US 5/Depot St/Broad St</b>															
EB, from US 5							B	10	0.54				B	12	0.59
WB, from Depot St							B	10	0.31				B	11	0.33
NB, from US 5							B	14	0.66				C	15	0.72
SB, exiting Angies Alley							A	8	0.04				A	8	0.05

Figure 60 below shows a conceptual plan of a proposed mini-roundabout at the Depot Street/Broad Street intersection.

In the design plan below it is shown that the Angies Alley access is closed to the mini-roundabout. We recommend this because it allows for a large open outdoor to the north of the mini-roundabout that can be used for outdoor seating, green areas, etc. If desired, Angies Alley could have access to the mini-roundabout with negligible effect on the traffic operations of the mini-roundabout.



Figure 60: Depot Street (US 5)/Broad Street Mini-roundabout Conceptual Design Plan



When examining improvements at the Depot Street (US 5)/Main Street intersection traffic operations were not the only concern. Due to the downtown location of this intersection there are many other important aspects beyond traffic operations that need to be addressed. We feel that, in addition to improving traffic operations, a mini-roundabout significantly improves pedestrian access, safety, and the overall look and feel of downtown Lyndon.

The mini-roundabout recommended for this intersection would have an inscribed center diameter of approximately 65 feet, which would fit within the footprint of the current intersection configuration. This would eliminate any costly acquisition of land from adjacent property owners.

Additionally, the mini-roundabout would result in a net loss of one parking spot. The table below shows where parking spots would be gained and lost with the installation of a mini-roundabout.

Figure 61: Parking Reconfiguration

Location	Change in parking spots
East of intersection	No change
West of intersection	-6
North of intersection	-3
South of intersection	+8
<b>Net Change</b>	<b>-1</b>



As seen in the figure above the area north and west of the intersection would lose a fair number of parking spots as result of the mini-roundabout and adjacent pedestrian crossing. This loss of parking is mostly offset by the conversion of parallel parking to angled parking to the south of the intersection. The conversion of parallel parking to angled parking is made possible by the mini-roundabout only requiring one approach lane instead of the two that currently exist.

With the reconfiguration of parking due to a mini-roundabout a significant amount of new open space will be reclaimed to north of the intersection that was previously used by the intersection and parking. This new space could be used for landscaping, open space, outdoor seating, etc.

In addition to the installation of the mini-roundabout we recommend reconfiguring the parking lot on the northeastern edge of the intersection. Currently access to this parking lot is gained through a 100 foot wide curb cut adjacent to the intersection. We recommend significantly tightening up this entrance and moving it as far east as possible to allow for maximum spacing between curb cuts and the mini-roundabout.

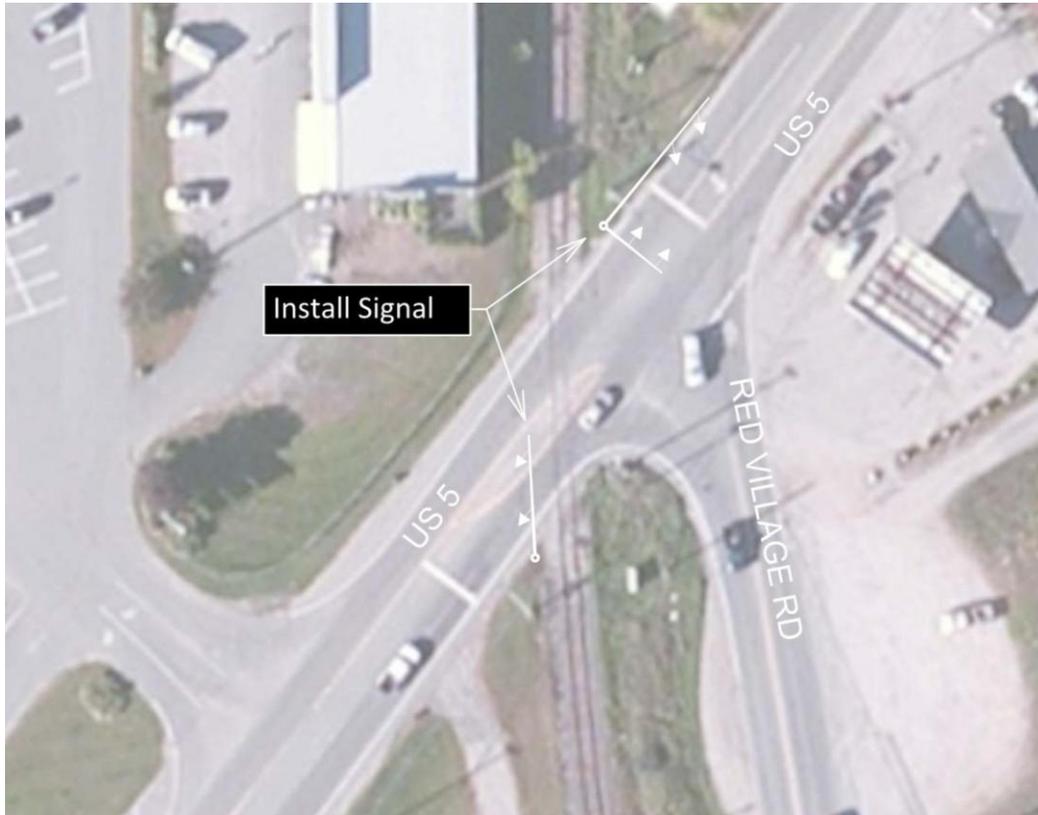
Pedestrian safety and mobility would be improved through a significant reduction in crossing distance (maximum crossing distance is reduced from 60 to 30 feet) and by installation of a crosswalk on the westbound approach. Pedestrian safety would also be improved through tightening up the parking lot entrance as discussed in the previous paragraph. US 5/Red Village Road

As discussed in Section 5, the westbound approach (turning onto US 5 from Red Village Road) at this intersection is projected to operate at LOS E in the 2019 Build Scenario and LOS F in the 2024 Build Scenario. Traffic volumes at this stop-controlled intersection were evaluated to see if they met the 8-hour, 4-hour, and/or peak-hour traffic signal warrants as defined in the *Manual on Uniform Traffic Control Devices (MUTCD)*. The results of the signal warrant assessment are that all three volume-based warrants are currently met. Additional future growth will result in even greater delays and need for signalization of the US 5/Red Village Road intersection.

Figure 62 below shows a schematic plan of the proposed signalization of the US 5/Red Village Road intersection. Given the proximity of the Washington County Railroad crossing, any signalization of the Red Village Road intersection will need to include adequate rail pre-emption and upstream signalization to avoid signal conflicts when a train crosses US 5.



Figure 62: US 5/Red Village Road Intersection Signalization Diagram



## 7 IMPLEMENTATION PLAN

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Figure 63 below shows each of the recommended roadway, bicycle, and pedestrian projects identified for the Newport/Derby and Burke/Lyndon study areas. The improvement matrix includes a cost estimate; a listing of potential funding sources, and an identification of implementing partners for each recommendation.



Figure 63: Draft Roadway Improvement Matrix

	Improvement	Cost Estimate	Cost per PM peak hour trip	Potential Funding Source(s)*	Implementing Partners
Newport/Derby	Main Street Newport and Railroad Square Improvements Signalization and reconfiguration of Railroad Square intersection and "road diet" along US 5	\$1,500,000	\$3,000	STP, MUNI, HSIP, PRIVATE, B/P, TA	VTrans, Town of Newport
	US 5/I-91 Interchange Improvements Signalization and slip lane improvements	\$900,000	\$1,800	STP, MUNI, PRIVATE	VTrans, Town of Derby
	US 5/VT 105 Intersection Improvements Convert to an all-way stop, install sidewalk, curbing	\$80,000	\$200	STP, MUNI, PRIVATE, HSIP, B/P, TA	VTrans, Town of Derby
Burke/Lyndon	VT 114/Mountain Road Sight Distance Improvements Minimize vertical curve on VT 114	\$600,000	\$3,700	STP, MUNI, HSIP, PRIVATE	VTrans, Town of Burke
	Depot Street (US 5)/Broad Street Improvements Install mini roundabout, parking lot improvements, and general downtown improvements	\$400,000	\$2,600	STP, MUNI, HSIP, PRIVATE, B/P, TA	VTrans, Town of Lyndon
	US 5/Red Village Road signalization	\$600,000	\$3,900	STP, MUNI, HSIP, PRIVATE	VTrans, Town of Lyndon

\* The f (B/P) - Bike/Ped  
 (TA) - Transportation Alternatives  
 (STP) - Surface Transportation Program  
 (MUNI) - Municipal/Local  
 (PRIVATE) - Private landowners, developers  
 (HSIP) - Highway Safety Improvement Program

VT 114/Mountain Road improvements are from 2006 Burke Infrastructure study. 5% added for inflation.



## APPENDIX A: LOCAL CONCERNS MEETING MATERIALS





## Northeast Kingdom Transportation Infrastructure Plan

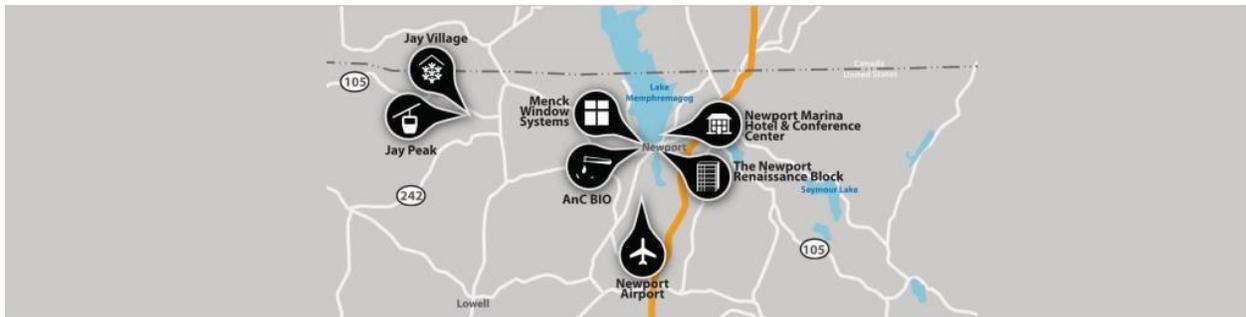
# 6:00 PM

Thursday  
August 22, 2013

at Gateway Center in Newport  
84 Fyfe Drive, Newport, Vermont

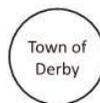
Come join us for an **open house and brief presentation** to learn about the Northeast Kingdom Transportation Infrastructure Plan and the EB-5 Program's anticipated impact on transportation conditions in the region.

We look forward to your input regarding transportation challenges in Newport, Derby, and Jay.



For more information, contact:

**Doug Morton**, Senior Transportation Planner, NVDA • (802) 748-1221 • [morton@nvda.net](mailto:morton@nvda.net)





## Northeast Kingdom Transportation Infrastructure Study Newport/Derby and Jay Study Areas

**Project Goal:** ensure that the transportation system can support EB-5 and future growth sustainably and in a manner consistent with the region's vision for the future.

**Project Status:** fact-finding and Steering Committee input brought to light relevant issues/concerns.

**Tonight's Objective:** solicit input from you regarding existing transportation challenges and your concerns about future development.

**Next Step:** evaluate impact of future planned growth on transportation network and recommend solutions to address impacts



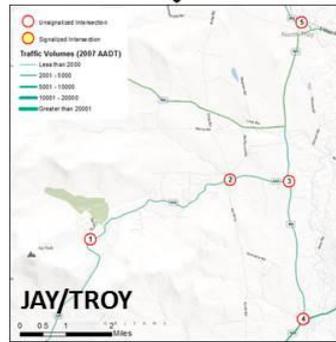
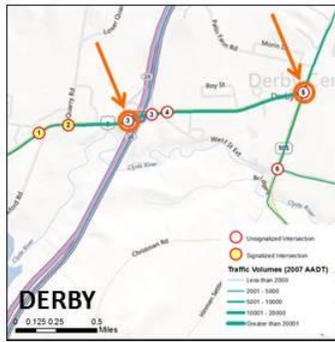


# Northeast Kingdom Transportation Infrastructure Study

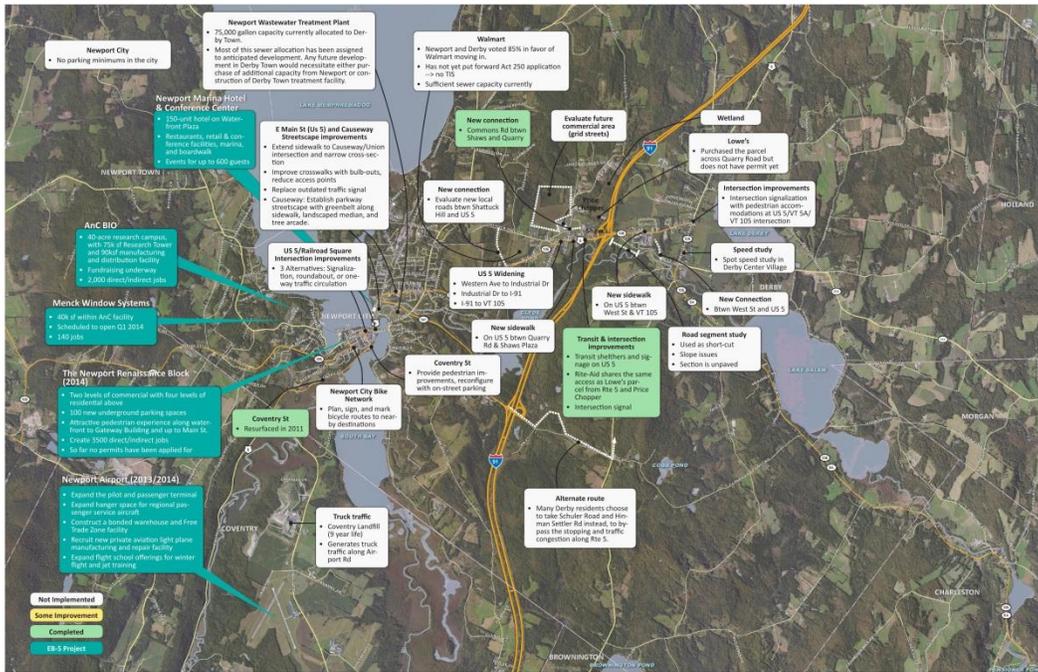
## Newport/Derby and Jay Study Areas

### Existing Conditions Study Highlights:

- Accidents consist mainly of rear-ends and left-turn broadsides; on VT 242 the main contributing factor to accidents is “driving too fast for conditions”
- There is a robust regional bicycle network
- Varied RCT services and privately-operated ski resort shuttles
- Congestion analysis indicated that the worst delays are found at the intersection of Main Street/Causeway/Railroad Square in Newport



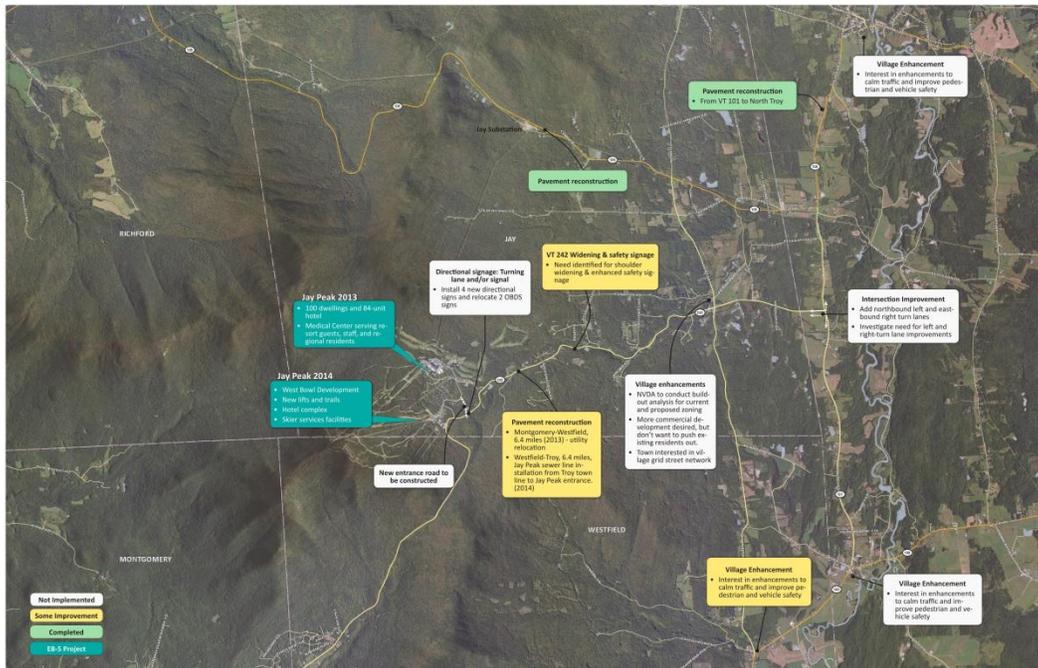
# Northeast Kingdom Transportation Infrastructure Plan



0 0.5 1 2 Miles



**Newport/Derby Study Area**  
New Development and Transportation/Planning Recommendations.



0 0.5 1 2 Miles



**Jay Study Area**  
New Development and Transportation/Planning Recommendations.



MEETING SIGN-IN SHEET			
<b>Project:</b>	NEK Trans Infrastructure Study Existing Conditions		<b>Meeting Date:</b> 08/22/13
<b>Facilitator:</b>	Doug Morton		<b>Place/Room:</b> Gateway Center Newport City

Name	Town/Organization	Phone	E-Mail
Beth Barnes	Newport Resident	562 413 3583	gotwaves@beyond.com
Pam Ladd	~ ~	802.334.7498	laddspan@gmail.com
Woodman Page	Newport Resident	802 334-6988	
Arzu Page	Newport "	802-334-6988	
Dave Snedeker	NVDA	748-8303	dsnedeker@nvda.net
Michael Marcotte	State Rep	334-6302	mmarcotte@leg.state.vt.us
Sandy Thorpe	RET	748-8170 x401	sandy.thorpe@gmail.com
Matthew Kennehan	VT Trans	802 828 5578	matthew.kennehan@state.vt.us
Robin Smith	Orleans County Recard	you have it	
Steven Mason	NEKTI Consulting	744-6600	steve@kingdomcommons.com
Patricia Secars	Newport City Renaissance	323 1056	patricia.secars@discovernewport.com
Paul Sicard	JPSicard Inc	525-9506	Paul@JPSicard.com
Tom Livormore	Newport		TOM LIVORMORE 54@yahoo.com





## Northeast Kingdom Transportation Infrastructure Plan

**6:00 PM**  
Thursday  
August 28, 2013

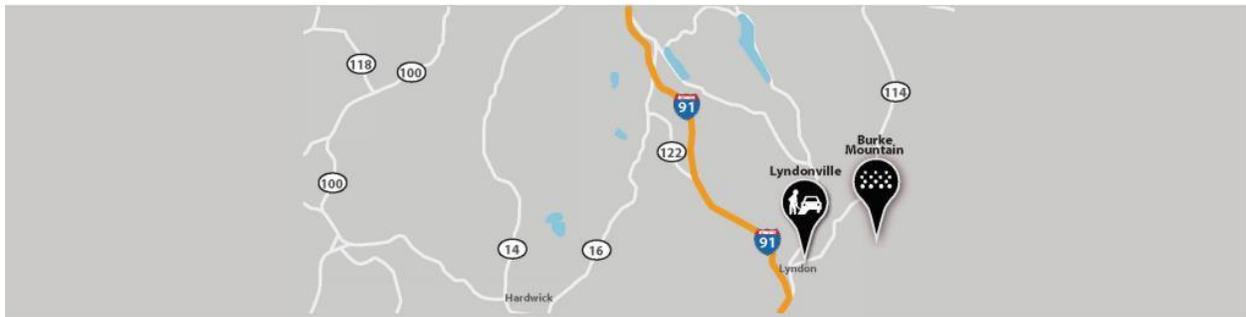
at Lyndonville Public Safety Building  
316 Main Street, Lyndonville, Vermont

Come join us for an **open house and brief presentation** to learn about the Northeast Kingdom Transportation Infrastructure Plan and the EB-5 Program's anticipated impact on transportation conditions in the region.

We look forward to your input regarding transportation challenges in Lyndon and Burke.



**\*Light refreshments will be provided!**



For more information, contact:

**Doug Morton**, Senior Transportation Planner, NVDA • (802) 748-1221 • [morton@nvda.net](mailto:morton@nvda.net)





## Northeast Kingdom Transportation Infrastructure Study Lyndon/Burke Study Area

**Project Goal:** ensure that the transportation system can support EB-5 and future growth sustainably and in a manner consistent with the region's vision for the future.

**Project Status:** fact-finding and Steering Committee input brought to light relevant issues/concerns.

**Tonight's Objective:** solicit input from you regarding existing transportation challenges and your concerns about future development.

**Next Step:** evaluate impact of future planned growth on transportation network and recommend solutions to address impacts



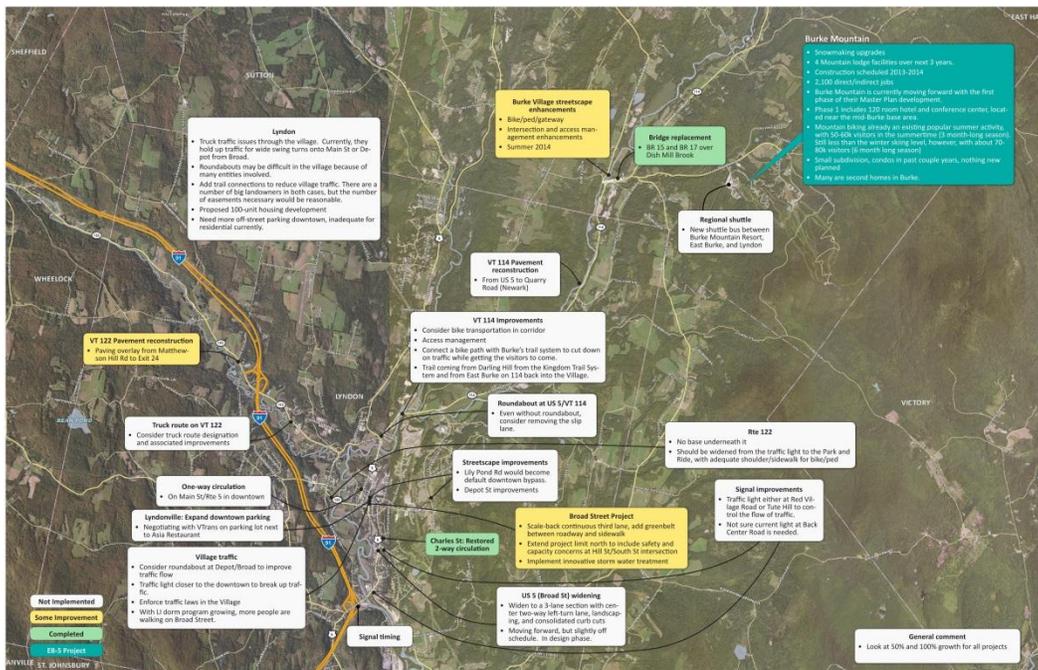
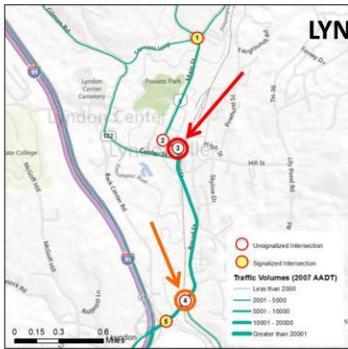
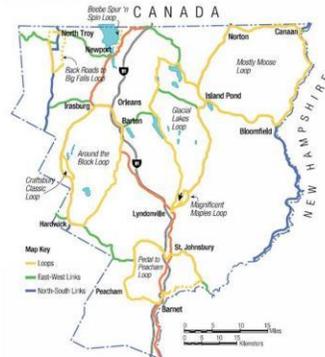


# Northeast Kingdom Transportation Infrastructure Study

## Lyndon/Burke Study Area

### Existing Conditions Study Highlights:

- Accidents consist mainly of rear-ends and left-turn broadsides and generally occur in commercial areas where there are a large number of driveways and side streets with no traffic control
- There is a robust regional bicycle network
- Varied RCT services and privately-operated ski resort shuttles
- Congestion analysis indicated that the worst delays are found at the intersection of Depot Street/Broad Street in Lyndonville



Lyndon/Burke Study Area  
New Development and Transportation/Planning Recommendations.

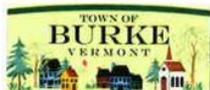




Northeast Kingdom Transportation Infrastructure Plan

**SIGN IN SHEET**

NAME	ORGANIZATION	E-MAIL (for project updates)
Justin Smith	Town of Lyndon/Village of Lyndensville	lynzoninj@kingcon.com
Marty Feltus	Lyndon - State	martyfeltus@gmail.com
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Tami Pitman	Planning Commission	t1hpitman1776@gmail.com
Ryan Noyes	LYNDON PLANNING COMM	RYANNoyes@hotmail.com
Susan Mills	Lyndon Planning Comm	millsgrp@myfairpoint.net



# **APPENDIX B: NORTHEAST KINGDOM - TRANSIT SERVICE DEVELOPMENT OPPORTUNITIES**



# Northeast Kingdom - Transit Service Development Opportunities

## BACKGROUND/OVERVIEW

The towns of Newport and Derby, plus resorts at Jay Peak and Burke Mountain stand to see a significant amount of growth in the very near future. A robust transportation infrastructure network will be required to support a more intense level of development – both to alleviate congestion and increase individual transportation options. Some of the jobs created by this development will be on the lower end of the wage scale, making transportation to and from employment potentially difficult, especially given some workers may travel long distances. Developing alternative transportation modes such as transit service, therefore, can ensure employers have a reliable workforce and workers have safe, affordable options for getting to work. Transit services can also benefit other groups, including both residents and tourists, who want to travel between services and shopping being developed in Newport, Jay and Derby.

Investments driven by the EB-5 Immigrant Investor program could create up to 5,000 jobs in the Northeast Kingdom. Based on the investment program articulated to date, Jay Peak Partners plans to expand its ski facility by adding a hotel on Lake Memphremagog, retail and conference facilities in downtown Newport, a biotech research facility in Newport, plus improvements at both Burke Mountain and Jay Peak. In addition, a new Wal-Mart Superstore is planned for Derby Center. Travel demand estimates related to these projects are as high as 3,000 new trips for the peak afternoon hour. Not only will these investments and development initiatives attract employees, they will attract additional customers. The full build out plan of Jay Peak has a current estimate of 4,000 beds, Burke 400. In addition, the enhanced facilities will draw higher numbers of daytime visitors.

There are several initiatives underway to accommodate this increased growth. For example, Rural Community Transportation (RCT), the regional transit provider, is laying the groundwork for new bus routes to serve St. Johnsbury, Lyndon and Newport to further tie these towns in to the growth in Newport and Derby. The purpose of the Northeast Kingdom Investment Plan is another example of the work being done to support additional growth. One element of the plan is identifying a set of transit service alternatives that will help to meet travel needs in this growing area and considering potential ways such services could be funded.

## TRANSIT PLANNING PRINCIPLES

In general, research shows that transit services work best when they offer one or more of the following:

- Comparable travel convenience with the automobile.
- Time or cost savings over driving.
- Serve high concentrations of individuals with limited or no transportation options.

Rural areas, like the study area, typically do not have significant traffic congestion or parking problems, which makes it difficult for transit to be more convenient than travel by car. An exception may be during the winter months when some drivers may be willing to take a slightly less convenient service in order to avoid hazardous driving conditions. Transit may realize an advantage, however, by offering a less expensive trip (fare v. driving costs) and potentially freeing up the need for an additional household vehicle. As a result, we will consider how services might

best serve transit dependent populations and/or offer cost savings and reasonably convenient service for key trips in the study area.

## **Service Design Guidelines**

As the Northeast Kingdom works towards increasing public transportation services, it is also important to identify a series of transit guidelines that will be kept in mind as new services are created. Public transportation typically seeks to balance the needs of a wide variety of travelers, trip types, and transportation demands.

The needs of individual markets, however, frequently conflict with each other. For example, most riders want fast service, but others want stops located close together to minimize the distances that they have to walk. Providing frequent stops results in slower service. Thus, service elements that will attract one type of rider to transit can drive other riders away. As the study area considers new service, the team NVDA staff must remember to balance competing demands and avoid eroding the objectives associated with an individual service design.

The following includes several important transit service design guidelines:

### **Service Should be Simple**

First and foremost, for people to use transit, they must be able to understand it. Accordingly, service should be designed so that it is easy to remember, understand, and use. This makes it easier for potential riders to learn about the options that are available, and helps ensure that riders get where they want to go, when they want to, without experiencing frustration and problems. Most of the transit planning guidelines listed here are aimed at making service intuitive, logical, and easy to understand.

### **Routes Should Operate Along a Direct Path**

The fewer directional changes a route makes, the easier it is to understand. Further, circuitous alignments are disorienting and difficult to remember. Routes should not deviate from the most direct alignment unless there is a compelling reason.

### **Routes Should be Symmetrical**

Routes should operate along the same alignment in both directions. This will make it easier for riders to know how to get back to where they came from. All routes should operate along the same alignment in both directions except in cases where such operation is not possible due to one-way streets or turn restrictions. In those cases, routes should be designed so that the opposite directions parallel each other as closely as possible. This design principle is often difficult to follow in rural and small town locations because as compared with looping services, symmetrical routes will reduce the service area (or geographic coverage). Routes that operate with a looping alignment, however, will nearly always create longer travel times in at least one direction of travel and consequently, will be less attractive to riders.

### **Route Deviations Should be Minimized**

Service should be relatively direct, and to make service direct, the use of route deviations—traveling off of the most direct route such as into a housing complex—should be minimized. However, there are many instances when the deviation of service off of the most direct route is

appropriate; for example, to provide service to major shopping centers, employment sites, schools, etc. In these cases, the benefits of operating the route off of the main route must be weighed against the inconvenience caused to passengers already on board.

### **Transit Routes Should Operate Along Arterials**

Potential transit users have at least a basic knowledge of an area's arterial road system and use that knowledge as points of reference. In the Northeast Kingdom, major arterials are also likely to pass through the center of most towns and villages; and in most cases travel is fairly high speed. The operation of bus service along arterials therefore makes transit service more visible as well as easier to figure out and to use. It also makes service faster.

### **Service Should be Consistent and Operate at Regular Intervals**

People can easily remember repeating patterns but have difficulty remembering irregular sequences. For this reason, routes should operate along consistent alignments and at regular intervals (headways). This is true even if the route operates limited departures during certain times of the day, such as commuting hours. Thus, even if there are only two trips per day, the departures ideally will be scheduled at 6:15 AM and then again at 7:15 AM, or potentially 8:15 AM, depending on service schedules.

### **Services Should be Well Coordinated**

Even in places such as the Northeast Kingdom with only a handful of specialized services, several services – including those proposed in this report - operate to the same destinations (i.e. downtown Newport). A key objective, therefore, is to design services so they are coordinated.

This may mean ensuring services meet at some locations (i.e. service origin points) to support transfers; and staggering arrival times in others (i.e. Wal-Mart) to increase service to/from the destination. Coordinating service, including services operated by different entities such as RCT and GMTA, will help expand the network of services, improve service efficiency and increase consumer confidence.

### **Stops Should be Spaced Appropriately**

Transit stops are the access and egress points for transit services and should be conveniently located. Many rural operators address this need by permitting riders to hail or flag the bus anywhere along the route. However, transit stops are also the major reason that transit service is slower than automobile trips. Most riders want service that balances convenience and speed; the number and location of stops is a key component of determining that balance.

The study area can encourage use of designated stops by installing transit shelters with service information posted at high visibility locations, located where possible along streets and corridors with transit supportive pedestrian infrastructure (sidewalks and crosswalks). The shelters will encourage passengers to congregate at this location and improve transit operations.

## **TRANSIT OPPORTUNITIES IN THE NORTHEAST KINGDOM**

Population and employment densities are the strongest indicators of transit. This reflects the fact that places where more people live and/or work in close proximity to one another means there are more people to use the service and more people can walk to transit service. Another important

factor to consider is the location of major activity centers, which indicates where people want to go. In the Northeast Kingdom this is not only tourist destinations such as Jay Peak and Burke Mountain, but also day-to-day destinations such as downtown Newport, with significant employment and population densities, as shown in Table 1. Stakeholders also identified Littleton, New Hampshire as an important destination and emphasized the travel demand in both directions for people traveling for work, services, and personal reasons. In recognition of its regional importance, Littleton is included in Table 1; however, it was not included in the transit service design analysis.

**Table 1 Regional Town Populations**

Name	Census Designation	Population 2010*	Employment 2011**	Top Two Employment Sectors (% of all Jobs)**
<b>Newport</b>	Newport City	4,589	3,379	<ul style="list-style-type: none"> <li>▪ Health Care and Social Assistance (35%)</li> <li>▪ Manufacturing (15%)</li> </ul>
<b>Derby</b>	Derby Town, Orleans County	4,621	1,887	<ul style="list-style-type: none"> <li>▪ Retail Trade (25%)</li> <li>▪ Manufacturing (11%)</li> </ul>
<b>Burke</b>	Burke Town	1,753	320	<ul style="list-style-type: none"> <li>▪ Arts, Entertainment and Recreation (29%)</li> <li>▪ Educational Services (23%)</li> </ul>
<b>Jay Peak</b>	Jay Town	521	553	<ul style="list-style-type: none"> <li>▪ Accommodation and Food Services (69%)</li> <li>▪ Construction (11%)</li> </ul>
<b>Littleton, NH**</b>	Littleton CDP	4,413	2,033	<ul style="list-style-type: none"> <li>▪ Manufacturing (19%)</li> <li>▪ Retail Trade (14%)</li> <li>▪ Health Care and Social Assistance (14%)</li> </ul>
<b>Lyndonville</b>	Lyndonville Village	1,207	1,013	<ul style="list-style-type: none"> <li>▪ Manufacturing (36%)</li> <li>▪ Retail Trade (14%)</li> </ul>
<b>St Johnsbury</b>	St. Johnsbury CDP	6,193	4,199	<ul style="list-style-type: none"> <li>▪ Health Care and Social Assistance (23%)</li> <li>▪ Retail Trade (17%)</li> </ul>
<b>Morrisville</b>	Morrisville Village	1,958	1,732	<ul style="list-style-type: none"> <li>▪ Health Care and Social Assistance (53%)</li> <li>▪ Educational Services (11%)</li> </ul>
<b>Montpelier**</b>	Montpelier City	7,855	9,949	<ul style="list-style-type: none"> <li>▪ Public Administration (23%)</li> <li>▪ Financial and Insurance (16%)</li> </ul>

\*US Census 2010 \*\*LEHD Census Data 2011 \*\* Outside of the study area

## Local Transit Markets

There are multiple types of **transit markets** in the study area towns, but in general demand for transit is expected to be driven from one of three markets:

- **Tourism** – the tourism market includes both local services (people traveling around the Northeast Kingdom) and people staying at major destinations (e.g. Jay Peak) seeking to travel into Newport for dinner or shopping. In addition there is expected to be some demand from people staying at the marina in Lake Memphremagog to basic shopping needs, such as the Wal-Mart in Derby.
- **Employment** –the largest employers in the Northeast Kingdom tend to be school districts and medical and health care services, including the Northeastern Vermont

Regional Hospital (NVRH) and North Country Hospital. As planned development comes on line, however, the highest concentrations of jobs may shift to Jay Peak and Newport, with smaller job concentrations in Derby and Burke. Getting workers to and from these jobs is likely the highest and most reliable concentration of transit need.

- **Services** – as the largest communities in the Northeast Kingdom, Newport and Derby have the highest concentration of professional services, such as hospitals and medical offices, but also shopping and other services people use on a regular basis. Creating opportunities for people to reach these service centers is also an important market for transit.

The municipalities of Morrisville, Montpelier, St. Johnsbury and Lyndonville are well established communities in Northeastern Vermont and are currently served by transit already, through a combination of service operated by Rural Community Transit (RCT) or Green Mountain Transit Authority (GMTA) (see Figure 1). Thus, connecting service from towns in the study area to these cities and towns would increase the transit network coverage significantly.

## **SERVICE OPPORTUNITIES**

The anticipated growth in both population and employment in the Northeast Kingdom suggests the potential to both expand existing transit services and develop new services. The proposed service network should build on existing services (see Figure 1) and also focus on making connections between key regional hubs (i.e. Newport, St. Johnsbury, Lyndonville or Morrisville) and providing direct service from these hubs to major employment and service centers, such as Derby Center, Jay Peak, and Burke Mountain. The idea is that if people can get to one of the primary hubs (i.e. Newport, St. Johnsbury, Lyndonville or Morrisville), they can get to the major employment markets or any one of the other hubs. In some cases, people may need to drive or get dropped off at one of the hubs, but once they are there, they will have access to the entire system. Ensuring the network is effective also means the service will need to be scheduled and timed effectively so wait times between routes is minimized. Supporting transfers with passenger shelters and waiting areas is also an important part of service development.

The recommendations developed below include enhancing RCT's existing Jay-Lyn and Highlander Shuttles and developing four new routes (see also Table 2 and Figure 2). Together, this expanded transit service would help improve access to regional employment and services and support the regional tourism industry. The five proposed transit service improvements include (see Appendix A for route descriptions and maps):

1. Enhance Highlander Shuttle between Newport and Derby<sup>1</sup>
2. Enhance Jay-Lyn Shuttle between Lyndonville and St. Johnsbury
3. Newport to Jay Peak
4. Newport to Lyndonville
5. Jay Peak to Morrisville
6. Lyndon State University to Lyndonville to East Burke/Burke Mountain Resort

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<sup>1</sup> The Highlander Shuttle between Newport and Derby used to operate on Saturdays but this service was discontinued. The service expansion proposed in this analysis reflects increased attractions and demand for travel between the two communities, which is expected to increase ridership.

Operating these six new/expanded routes would require seven additional vehicles (six in operation plus one spare) and approximately \$1.1 million at full build out; a phased implementation approach estimates initial costs to be roughly \$875,000, inclusive of \$475,000 in operating costs and \$400,000 for capital investments (see Table 2) (see also Appendix B). This level of investment in transit for the Northeast Kingdom is significant. RCT's currently annual operating budget is less than \$1 million, thus full build of the transit routes listed here would approximately double the agency size as well as the region's local financial commitment to transit service. In addition, with the exception of Jay Peak and Burke Mountain resorts, most of the development remains in the development phase. Ideally transit service would begin either at the same time that the proposed projects open, or shortly afterwards.

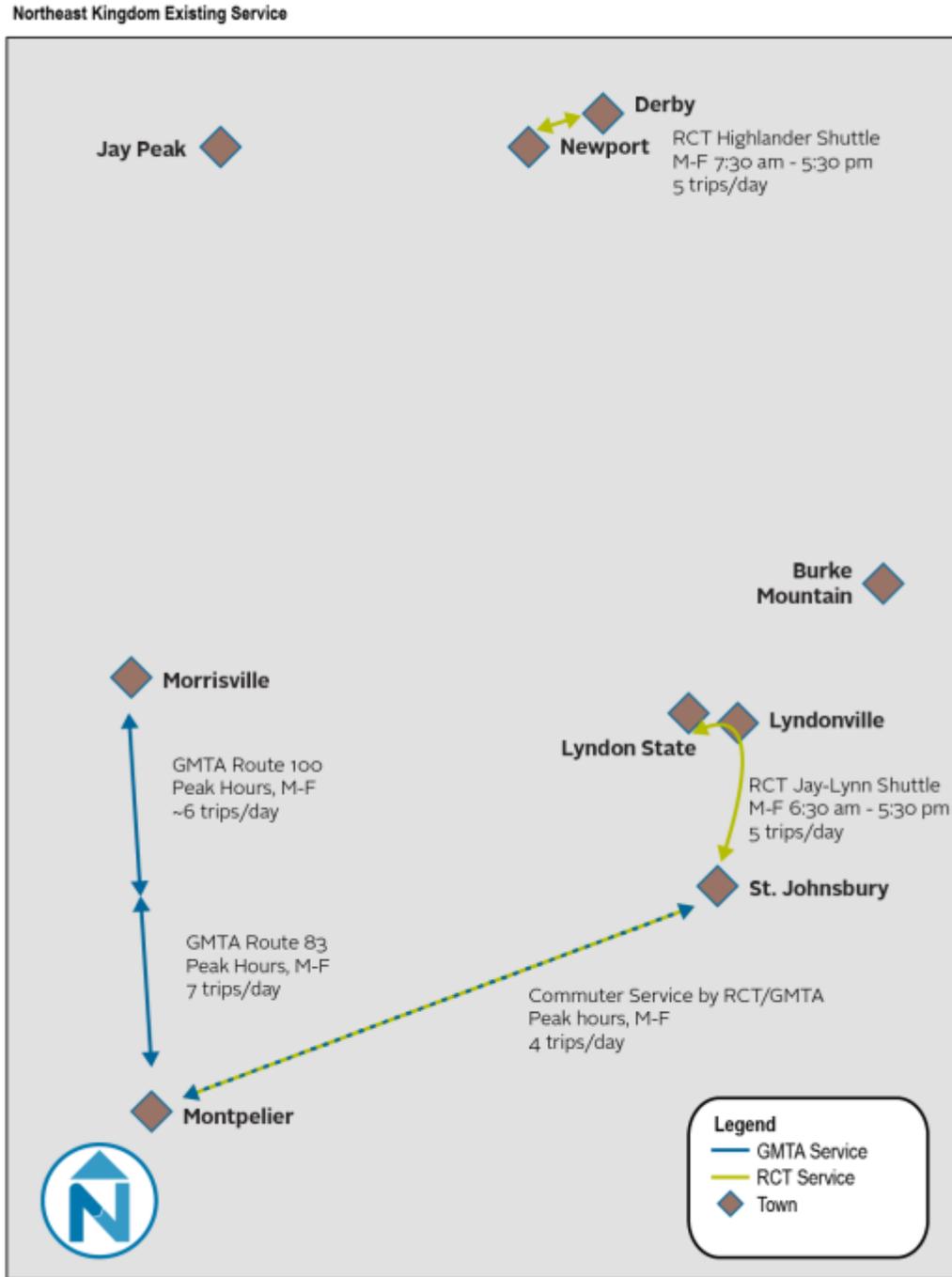
## **Recommended Phasing/Service Development**

As discussed, transit service, especially fixed route service, in the Northeast Kingdom is limited. RCT operates two local shuttles (Highland Shuttle and Jay-Lyn Shuttle) and one shared commuter route between St. Johnsbury and Montpelier (see Figure 1). Given the existing service network is so sparse and anticipated challenges with raising funds, the study team recommends a phased approach that expands existing transit services first, together with key links to existing employment markets (Jay Peak and Burke Mountain) and then adding additional links as development occurs and the demand for service increases. Adopting a phased approach also gives transit providers an opportunity to build capacity, raise funds, develop capital resources (vehicles) and prepare for an expanded service network.

The current level of interest in transit service and employment activity at Jay Peak, Burke Mountain and the Newport/Derby area suggest expanded transit services could be successful in the short-term, with some service available during the winter months only. Existing and new services that have potential in the short-term include strengthening connections between 1) Newport and Derby; and 2) St. Johnsbury and Lyndonville. Short-term opportunities to expand service into new markets during peak periods include service between Newport and Jay Peak and Lyndonville and Burke Mountain (see Figure 3). As services attract ridership and funding, services may be expanded to year-round operations.

As development projects in the Newport and Derby area move from planned projects to construction and development, the region should likewise begin planning for regional transit services. These new services include regional connections between Morrisville and Jay Peak; and St. Johnsbury and Newport (see Table 3). Service to Littleton, New Hampshire is also likely a need for the Northeast Kingdom in the future.

Figure 1 Existing Transit Services (Schematic)



**Table 2: Proposed Service Expansion and Indicative Costs**

Link	Proposed Service Schedule	Approximate Frequency	Indicative Annual Cost
<b>Newport-Jay Peak</b>	Daily Winter months only	60	\$150,000
<b>Newport-Derby</b>	Monday - Saturday	30	\$206,000
<b>Lyndonville-St. Johnsbury</b>	Monday – Saturday	+4 trips per day	\$76,600
<b>Lyndonville – Burke Mountain</b>	Friday – Sunday Winter months only	60	\$45,000
<b>Lyndonville-Newport</b>	Daily	120	\$240,000
<b>Morrisville-Jay Peak</b>	Friday - Saturday Winter months only	5 trips per day	\$66,000

Source: Nelson\Nygaard Consulting Associates

**Table 3: Proposed Phasing of Transit Service Development**

Year 1		Year 3		In line with Development
<b>Newport-Derby</b> Enhance existing service Operate Monday – Saturday with 30 minute service (dedicate one vehicle)				
<b>Lyndonville-St. Johnsbury</b> Enhance existing service Increase service to hourly Monday – Saturday (dedicate one vehicle)				
<b>Newport-Jay Peak</b> Operate daily service during winter season (Thanksgiving to Easter) only		<b>Newport-Jay Peak</b> Operate daily service year-round (demand permitting)		
<b>Lyndonville – Burke Mountain</b> Operate 10:00 am – 10:00 pm Friday – Sunday year-round		<b>Lyndonville – Burke Mountain</b> Operate daily (demand permitting)		
				<b>Lyndonville-Newport</b> Monday – Friday
				<b>Morrisville-Jay Peak</b> Friday - Sunday

Source: Nelson\Nygaard Consulting Associates

**Figure 2 Proposed Transit Service Network – Full Build Out (Schematic)**

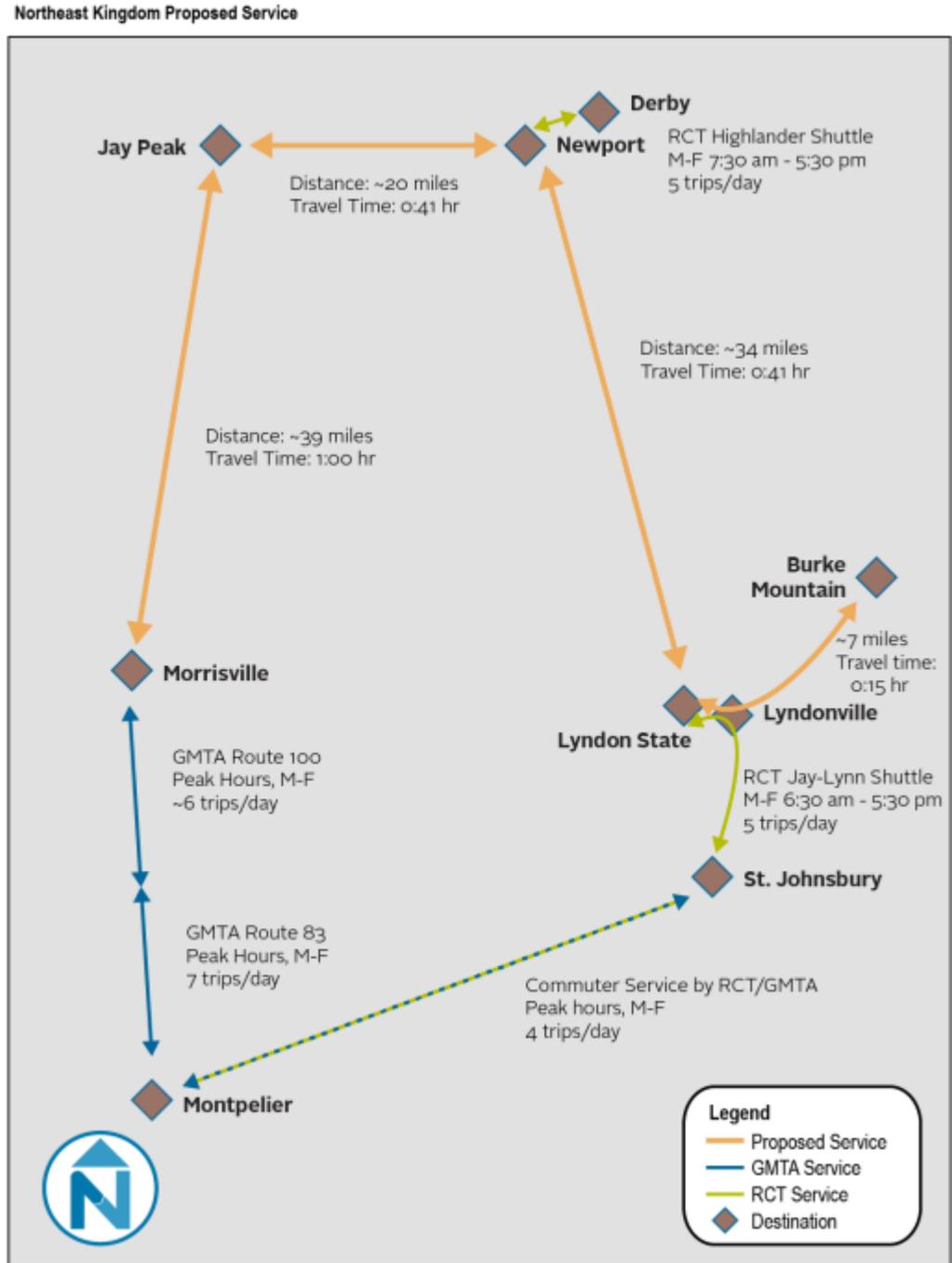
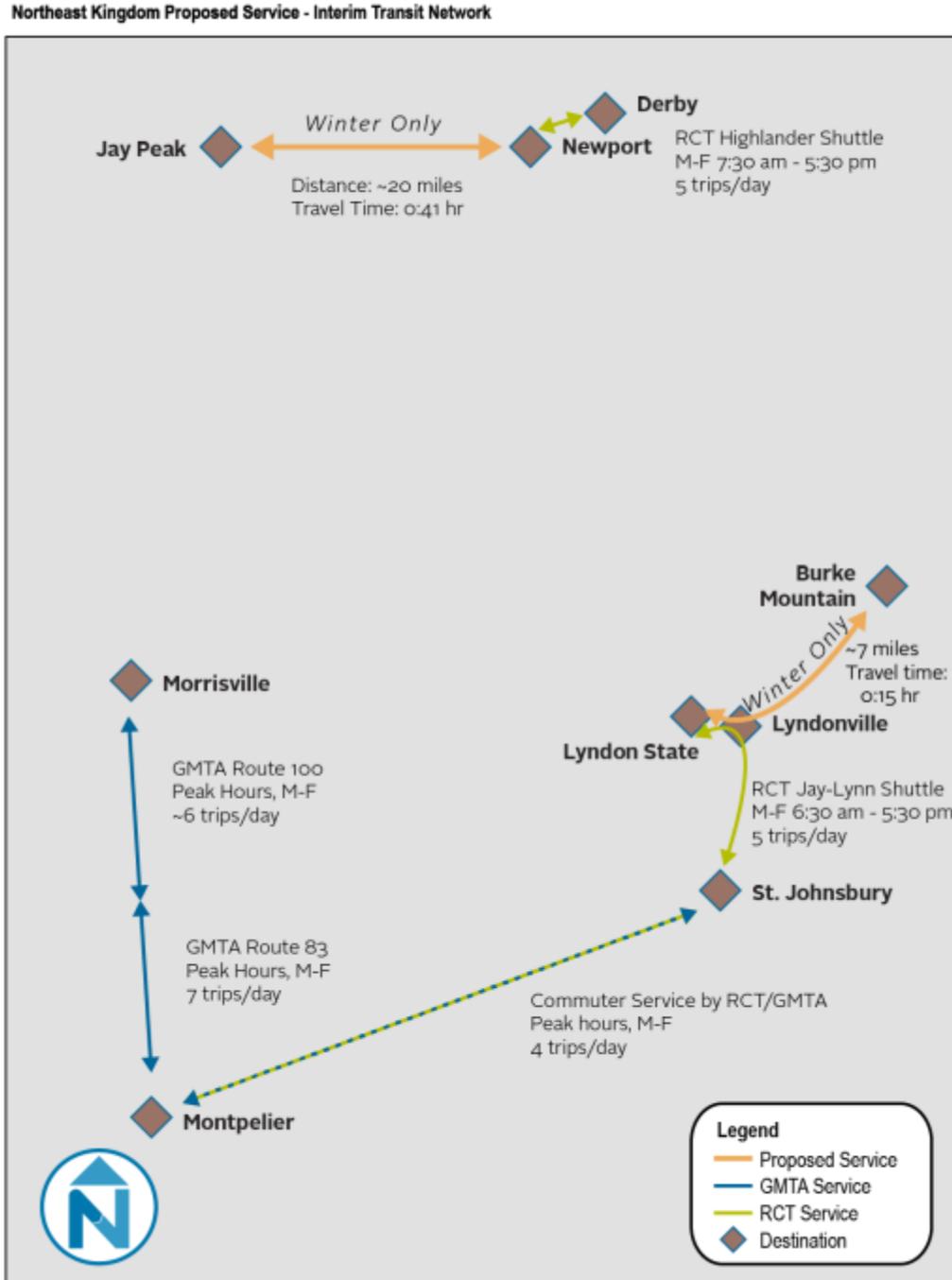


Figure 3 Potential Interim Transit Service Network (Schematic)



## Service Considerations – Need for Complementary Paratransit

Transit agencies providing fixed route transit service must also provide complementary paratransit service to individuals are unable to use fixed route service due to a disability; this requirement is part of the Americans with Disability Act (ADA). There are exceptions to ADA service, including for “commuter bus service”. The Federal Transit Administration (FTA) defines commuter bus service as “fixed route bus service characterized by service predominantly in one direction during peak periods, limited stops, use of multi-ride tickets and routes of extended length, usually between the central business district and outlying suburbs. Commuter bus may also include other service, characterized by a limited route structure, limited stops and a coordinated relationship to another mode of transportation<sup>2</sup>.”

Under this definition, some of the proposed services would potentially be exempt from providing ADA complementary paratransit service, but other routes would not. Our initial assessment suggests that all routes except for the Highlander Shuttle (Newport to Derby); the Jay-Lyn Shuttle; and the Lyndonville to Burke Mountain Shuttle could reasonably be characterized as commuter routes, given the route length and limited stops even if they operate throughout the day. This assessment, however, should be discussed in more detail with the Vermont Agency of Transportation prior to implementation.

For the three routes where ADA paratransit is likely necessary, RCT currently operates existing shuttle services as deviated fixed route. Deviated fixed route service allows for door-to-door complementary paratransit service and fulfills the ADA requirement. There are advantages and disadvantages associated with operating service as deviated fixed route, however. The advantage is that it fulfills the ADA requirement and gives the service some flexibility to travel off-route as needed. The disadvantage is that the route is not as fast and direct as it would otherwise be and as a result is less attractive to some riders.

At this point in the analysis, our preliminary recommendation is to review existing ridership and consider the number of deviations used on the routes. If deviations are common, then some services may be transitioned to fixed route service with complementary paratransit provided as an additional service. If deviations are not common, or only used during certain time periods, then the services may continue to operate as deviated fixed-route service.

## Service Considerations – Fares

Another consideration is fares. RCT currently operates its service fare free, except for commuter routes that travel longer distances and are jointly operated with the Green Mountain Transit Authority (GMTA). For many smaller and more rural transit systems, the cost of collecting fares combined with the impact on federal funds (see section on funding) outweighs the benefit of charging a fare. This strategy is consistent with several of RCT’s peer agencies in Vermont<sup>3</sup>.

National experience suggests that transit service operating fare free will attract more riders, especially in small towns and rural areas. Continuing to operate fare free may be effective for the services recommended as part of this study, especially if services are oriented towards employers and employer help fund the service. In nearly every case, if an institution or employer contributes

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<sup>2</sup> [http://www.adaportal.org/Transportation/DOT\\_TAM/Part\\_37\\_A\\_37\\_3.html](http://www.adaportal.org/Transportation/DOT_TAM/Part_37_A_37_3.html)

<sup>3</sup> Fare free systems include Advance Transit (AT), Addison County Transit Resources (ACTR), parts of the Green Mountain Transit Agency (GMTA), and the MOOver.

to transit service operations, its affiliates are entitled to ride the service for free. There are also several tourist oriented transit routes that operate fare free, even when other routes have a fare. At the same time, however, several of the recommended routes are long and would be targeted towards commuters, which would make fares more reasonable and potential raise some funds to support the service. In addition, if transit routes are fare free, ADA complementary paratransit service must also be provided fare free<sup>4</sup>, which can encourage use of the service. As some of these services progress towards implementation, the question of charging a fare should be revisited.

## FUNDING OPPORTUNITIES

### Overview

Funding transit services is a perennial challenge. Providing transit service is expensive and requires capital funds to purchase and maintain vehicles, as well as operating funds to pay for fuel, insurance, and driver wages. Transit agencies also have expenses associated with administration and reporting, marketing and planning. Passenger fares can help off-set the some of the cost of service, but to date, no transit system in the United States collects enough fares from riders to cover the cost of operating the service.

Most transit services are funded through a combination of federal, state and local funds, plus revenues from fares, advertisements, and service contracts. Federal and state funds are typically divided according to capital and operating grants. Capital funds can be used to purchase vehicles and develop infrastructure such as bus stops and shelters. Historically, federal programs have paid for up to 80% of capital costs, while the State of Vermont has provided an additional 10%. In the past, therefore, many of Vermont's transit projects only needed to raise 10% of the capital costs.

Operating funds, while also funded through a combination of federal, state and local resources have different cost sharing requirements. The federal government historically supported transit services in rural areas with 50% of the operating costs, net of fares<sup>5</sup>. The State of Vermont has historically provided about 30% of the operating costs, with funds for new services usually provided through a competitive grant program. Local entities, therefore, used to provide roughly 20% of service costs. Local funds were raised through contributions from municipalities and institutions, service contracts and to a lesser extent, advertisement revenues. Passenger fares have also been an important revenue source for some agencies. However, as discussed, federal grants typically cover 50% of the operating costs, net of fares, so that fare revenues will partially reduce the amount of federal funding available.

The future availability of federal and state funds is not well known. The current federal legislation governing transportation spending, Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) expires in October, 2014. At the time this report was written (April 2014), the future of MAP-21 is not known. Thus the availability of funding for rural transit programs is also unclear. In general,

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<sup>4</sup> Federal statute limits the charge for ADA complementary paratransit service to twice the fixed route fare. If the service is provided fare free, no fares may be charged to paratransit users.

<sup>5</sup> Net of fare refers to the calculation where, if the total cost of service is \$100,000 (for example) and \$10,000 is collected from fares, federal grants can be used to cover \$45,000 of the costs. This amount is half of the cost after fare revenue has been taken into consideration.

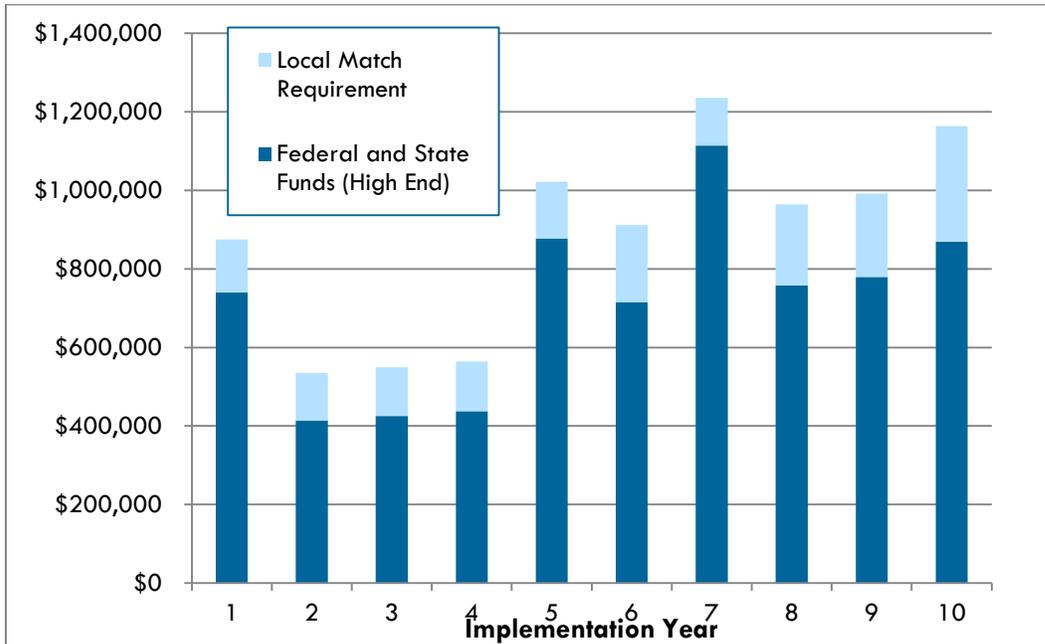
however, federal transportation programs appear to be “level funding” programs, which make identifying funding for new projects challenging.

## **Service Costs**

Operating all six of the transit services identified in this memo would require nearly \$900,000 in the first year, including capital (purchase four vehicles) and operating costs. The availability of federal and state funding, as discussed, is not known. Given the uncertainty associated of funding available from federal and state sources, two scenarios were developed. The high end assumes federal and state funds will account for roughly 85% of service costs in year one (including both capital and operating costs) (see Figure 4); while the low end scenario assumes federal and state funds will account for 40% of service costs in year one (also including both capital and operating costs) (see Figure 5).

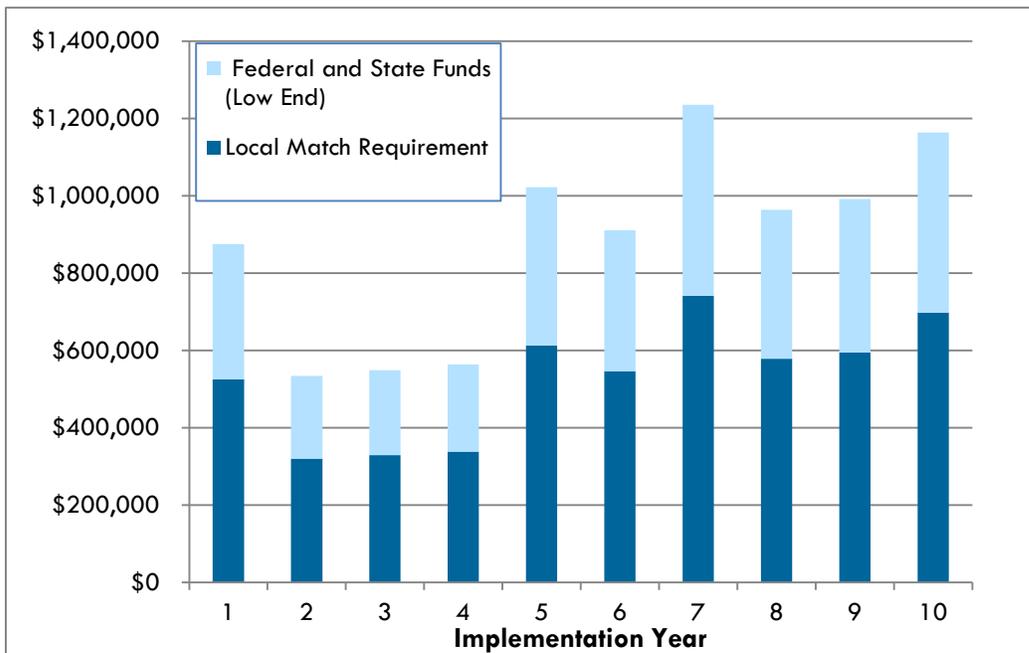
The impact of these assumptions on local matching requirements is significant. If federal and state funds can continue with their historic funding levels, communities in the Northeast Kingdom would need to raise between \$120,000 and \$150,000 annually for the first five years and beginning in year 6, the local match requirement would increase to \$200,000 and more. If federal and state sources are available to fund 40% of the service development costs, local funding needs are \$500,000 in the first year, decreasing for a few years and then increasing again in year 5 to more than \$600,000.

**Figure 4: Transit Services Costs by Year with High End Assumptions about Federal Funds**



Source: Nelson\Nygaard Consulting Associates

**Figure 5: Transit Services Costs by Year with High End Assumptions about Federal Funds**



Source: Nelson\Nygaard Consulting Associates

## Raising Local Matching Funds

Finding local matching resources is among the most challenging aspects of initiating and sustaining local transit services in Vermont, as well as for communities around the country. Most Vermont towns do not have authority to implement local option taxes, which means transit services rarely have dedicated revenues and typically compete with other government services for general fund allocations.

### Fares

Currently, with the exception of jointly-operated services, RCT provides its transit services fare-free. This is an agency decision and this analysis is not designed to analyze that practice. However, as a reference, using indicative ridership forecasts, fares are expected to be able to raise between \$10,000 and \$20,000 per year. Given the federal transit funding formulas, this may equate to between \$5,000 and \$10,000 towards the annual cost of service.

### Municipal Funds

Indeed, most transit agencies in Vermont raise local funds to support transit by collecting contributions from local municipalities, having service contracts with other organizations needing transportation services and developing partnerships with area employers and developers. In the Northeast Kingdom, most towns are small and most also receive only a small amount of transit service. Consequently, no single community has sufficient resources to support the entire local match. A strategy used by other Vermont transit agencies has been to collect some money from as many communities as possible in order to maximize the amount of revenue collected. Many agencies employ a “fair share” formula that tries to share the costs of the service based on population, employment and the amount and type of service provided. The actual terms of the formula can be developed jointly by the participating communities. In general, assuming 10 communities in the Northeast Kingdom would receive service as part of this expanded proposal, it may be reasonable to collect up to \$7,500 from the larger communities and up to \$2,500 from the smaller ones. Assuming five larger communities and five smaller ones, revenues could amount to roughly \$50,000, about 20% of the needed local match.

### Partnerships

Another source of funding for transit agencies in Vermont is through partnerships with major employers and trip generators, especially in cases where the employers and resorts directly benefit from the service. The services proposed as part of this analysis are designed specifically to link major employers – including projects in downtown Newport, Derby, Jay and Burke – with the surrounding communities to provide transportation alternatives, so the employers can be assured of a reliable, stable workforce.

Vermont transit agencies have used different approaches to working with ski resorts and employers (see call out boxes); some include grants provided through the chamber of commerce, while others are direct contributions from the resorts. Generally speaking, if employers are sometimes willing to make contributions to the cost of operating services, their employees and patrons would ride for free. This may make any assumptions about fare revenues irrelevant because the majority of riders are anticipated to be associated with these groups.

## Partnerships with Local Institutions

At the recommendation of the NVDA Steering Committee, the study team researched relationships between transit agencies and other private institutions, summarized below.

### Advance Transit (AT)

Advance Transit (AT) operates service in the Upper Valley region near Dartmouth College and including communities in Vermont and New Hampshire. AT receives a significant portion of its funding from “institutional support”, with partner institutions contributing just over 30% of AT’s 2012 operating budget, a significant increase from 11.3% in FY 1997 (see Figure 6). AT has had long time agreements with Dartmouth Hitchcock Medical Center, Dartmouth College and Dartmouth Medical School and the Town of Hanover to provide transit service. It is worth noting that all three of these entities have very limited parking and look to transit to help alleviate both parking and traffic congestion. AT provides its service fare free to these facilities as well as the entire community, in part due to these partnerships.

**Figure 6: Advance Transit Local Partnerships (2012)**

Partner	Amount Contributed	Services Provided
Dartmouth Hitchcock Medical Center (DHMC)	\$675,000	<ul style="list-style-type: none"> <li>▪ Parking Shuttles</li> <li>▪ Supplemental Service on Existing Route</li> <li>▪ Fixed Route System Support</li> <li>▪ System-wide fare for Dartmouth employees, faculty, students and visitors</li> </ul>
Dartmouth College and Dartmouth Medical School	\$370,000	<ul style="list-style-type: none"> <li>▪ Dartmouth-Downtown Shuttle</li> <li>▪ Fixed Route System Support</li> <li>▪ Supplemental Service on Existing Route</li> <li>▪ System Wide Free Fare</li> </ul>
Town of Hanover	\$80,611	<ul style="list-style-type: none"> <li>▪ Offset cost of Dartmouth-Hanover Shuttle</li> </ul>

Source: AT Website

Advance Transit also has a significant base of contributions from local businesses, individuals and foundations, representing about 2.5% of their operating revenue of 4.3 million in FY 2012. These donations, however, are tied to AT’s “Keep It Free” fund.

In addition, there is a potentially new partner coming to the table to support employment oriented transportation. Hypertherm, a company with 1,400 employees in the Upper Valley (Town of Lebanon), is working with local transit providers (including AT but also potentially another regional operator) to provide service along New Hampshire’s Route 120 between the Towns of Claremont and Lebanon. Hypertherm has expressed interest in the route and in providing some funds if federal money becomes available. The potential to coordinate the service with the company’s shift times is helping to make the service appealing for the company to fund.<sup>6</sup>

<sup>6</sup> Based on April conversations with the Upper Valley TMA.

## Chittenden County Transportation Authority (CCTA)

The Campus Area Transportation Management Association (CATMA) operates as a Transportation Management Association (TMA) for the “Hill” institutions in Burlington, including the University of Vermont (UVM), Fletcher Allen Health Care (FAHC) and Champlain College. The Hill institutions fund CATMA and CATMA in turn, helps provide transportation alternatives including parking shuttles and coordinating on-campus transportation.

In a separate effort, CATMA coordinates the Unlimited Access program that provides UVM and Champlain College students with unlimited access to Chittenden County Transportation Authority (CCTA) transit service. The program is funded through a combination of institutional support and student fees. Riders swipe their ID cards in CCTA fareboxes and ride for free. At the end of each month, CATMA gathers the ridership information and provides an invoice to UVM and Champlain.<sup>7</sup> The Unlimited Access program not only helps fund CCTA through fares, it increases ridership which allows CCTA to access increased funding. The Unlimited Access program is included in the CCTA’s farebox and advertising revenue budget line item, which makes up about 23% of total operating funds.<sup>8</sup> The partnership has worked well since 2003 and CATMA sees it continuing for the foreseeable future.

## Partnerships with Ski Resorts

To learn more about the relationship between transit agencies and ski areas in rural areas, the study team spoke to three operators in the midst of the ski season in other Vermont locations. All had at least one route that operated to the base of one or multiple ski resorts, and received some financial support from those resorts.

## Green Mountain Transit Authority (GMTA)

- **Service to Mountain:** The GMTA operates a seasonal service linking the town of Stowe and Stowe Mountain Resort, called the Mountain Road Shuttle.
- **Local Match:** Local revenue to operate the route came from Stowe Mountain Resort (\$47,500), Stowe Area Association (\$16,633), and the Town of Stowe (\$35,700), meaning about 36% of the cost of the service was covered by “local” sources (municipal and private).
- **Remaining Costs:** A variety of state and federal grant funds through VTrans
- **Future Outlook:** Some of the funding was required under Vermont’s Act 250 – however that requirement has a maximum. In the meantime, transit operating costs will continue to increase, so the funding will be an ongoing discussion.

## Deerfield Valley Transit (MOOVer)

- **Service to Mountain:** The MOOVer operates ten routes that serve Mount Snow by linking to towns and condominium communities.
- **Local Match:** Mount Snow’s Condo Association provides about 8% of funding for the route, while other recent developments provide 18% more, for a total of 26% of the

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<sup>7</sup> Program description derived from April conversations with CATMA.

<sup>8</sup> From CCTA’s 2010 Transit Development Plan, <http://cctaride.org/ccta-resources/transportation-documents/>

service costs. No additional local funding is required, including contributions from area municipalities.

- **Remaining Costs:** CMAQ funding
- **Future Outlook:** The condo associations are paying the same rate they would pay a private operator to connect to the mountain – something they will want for the foreseeable future. Moreover, positive working relationships amongst the players make this a fairly sustainable funding source.

### **Marble Valley Regional Transit District (MVRTD)**

- **Service to Mountain:** MVRTA operates the Diamond Express to Pico and Killington, as well as shuttles on the mountain, bring people from condos and housing to the base of the mountains (lifts).
- **Local Match:** Killington, who owns and operates Pico as well, pays 100% of the cost of the on-mountain shuttles. Revenues raised through the contracted service can be used as local match and support local year-round service. The resort also pays 20% (the entire local match) of the Diamond Express Route. This money pays for the extra service hours operated in the winter and also serves as local matching funds for year-round service. In addition, the Town of Killington pays a small amount to MVRTD.
- **Remaining Costs:** Federal 5311 funding
- **Future Outlook:** Killington has included bus shelters in its planned buildout, and is working with MVRTD on their design.

### **Additional Information:**

- Multiple interviewees mentioned **Vermont's Act 250**, which requires developers to mitigate potential traffic conflicts
- **Positive working relationships** are key to securing and maintaining these funding resources
- The incorporation of **bus shelters and/or pick-up drop-off areas** serve as a permanent link between the mountain and the service and are important to incorporate thoughtfully as resorts consider expansion plans.

## APPENDIX C: TRANSIT ROUTE PROFILES

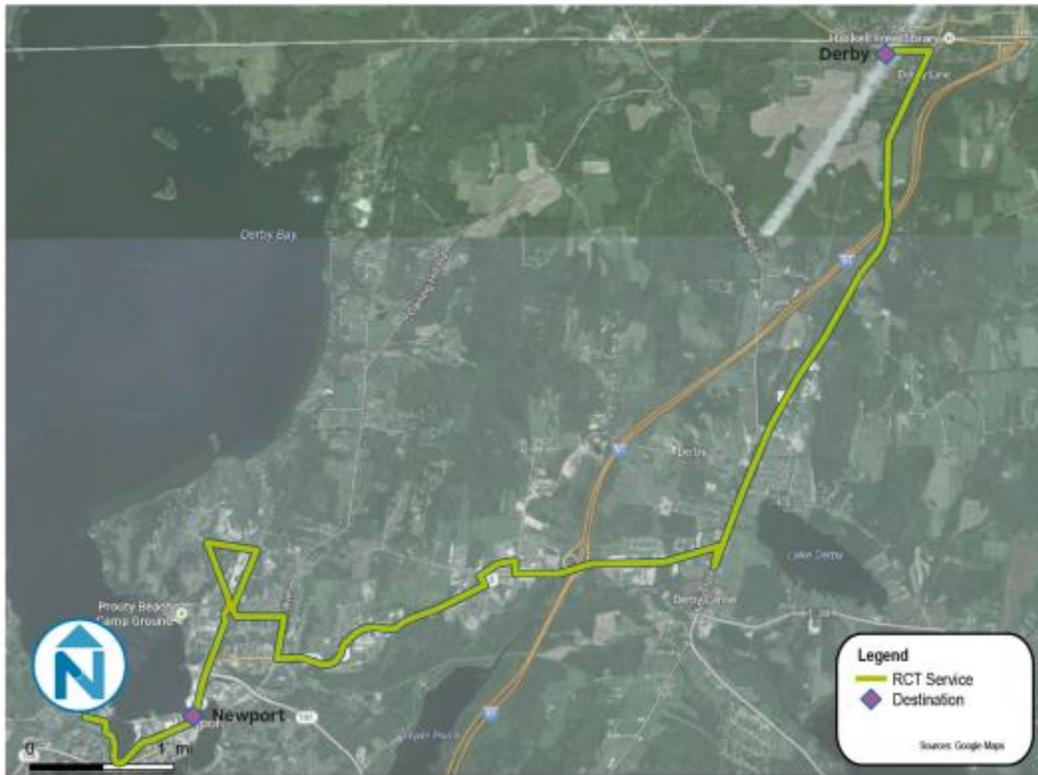


## APPENDIX C: ROUTE PROFILES

NEWPORT-DERBY CENTER (HIGHLANDER SHUTTLE)	
<b>Existing Service</b>	<ul style="list-style-type: none"> <li>▪ Current service operated Monday through Saturday</li> <li>▪ Four round trips per day on weekdays</li> <li>▪ Two round trips on Saturday morning</li> <li>▪ Operates as deviated fixed-route (allows vehicles to travel off-route)</li> <li>▪ Ridership ~5 passengers/revenue vehicle hour</li> </ul>
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Employment growing in downtown Newport and Derby Center</li> <li>▪ Services and shopping expanding with Wal-Mart Super Center in Derby Center and in downtown Newport</li> <li>▪ Tourism opportunities in Jay Peak and Newport</li> </ul>
<b>Proposal: Enhance Existing Service</b>	<ul style="list-style-type: none"> <li>▪ Travel between downtown Newport and Derby Center</li> <li>▪ Monday through Friday - 7:00 am to 7:00 pm</li> <li>▪ Saturday 8:00 am to 6:00 pm</li> <li>▪ Half hourly service – depart on the hour and half-past</li> <li>▪ Dedicate one vehicle to service all day – expect small vehicle with capacity for up to 16 passengers</li> <li>▪ Assumed to operate fare-free</li> </ul>
<b>Opportunities/ Challenges</b>	<ul style="list-style-type: none"> <li>▪ Existing service has low ridership but offers limited service only</li> <li>▪ Half-hour service will attract more riders but still limited appeal to “choice” riders</li> <li>▪ Can be operated as deviated fixed-route so service provides its own ADA paratransit</li> <li>▪ Connects with proposed Newport – Jay Peak and Newport to Lyndonville service</li> <li>▪ Ideally create transit center/hub in downtown Newport</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ <b>Estimated Annual Cost: \$205,000 (not including vehicle)</b></li> <li>▪ Potential Revenue Sources:                             <ul style="list-style-type: none"> <li>– Contributions from Wal-Mart, North Country Hospital and other major employers</li> </ul> </li> </ul>
<b>Timeline</b>	<ul style="list-style-type: none"> <li>▪ Ideally timed to begin with Newport – Jay Peak service commences and when Wal-Mart Super Center opens</li> </ul>

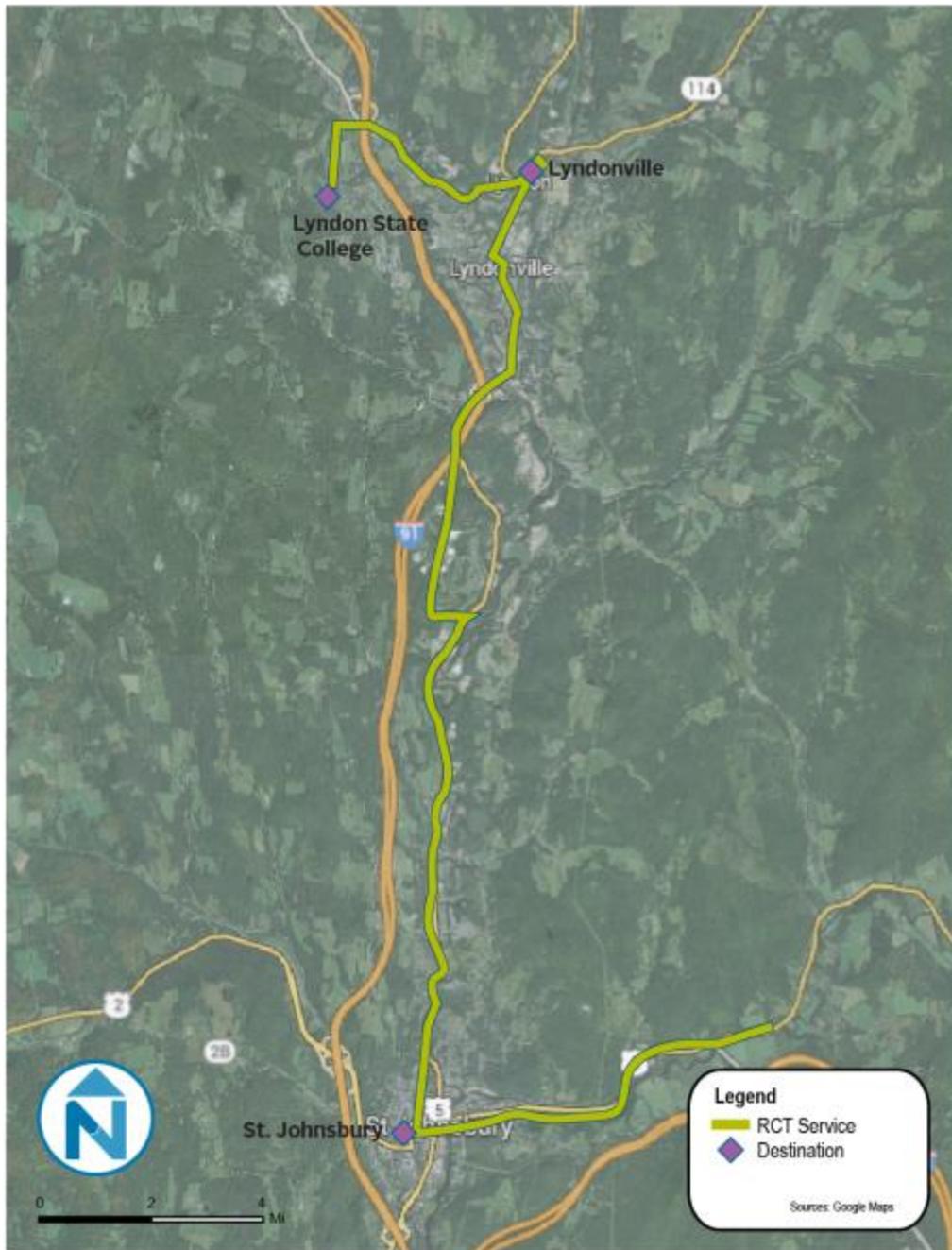
**Northeast Kingdom Transit Analysis**  
Northeast Kingdom Development Authority

DRAFT Newport to Derby Existing Service



<b>ST. JOHNSBURY – LYNDONVILLE (JAY-LYN SHUTTLE)</b>	
<b>Existing Service</b>	<ul style="list-style-type: none"> <li>▪ Jay-Lyn Shuttle and Jay-Lyn Express</li> <li>▪ Five shuttle trips and two express trips on weekdays</li> <li>▪ Two round trips on Saturday morning</li> <li>▪ Jay-Lyn Shuttle is operated as deviated fixed-route (allows vehicles to travel off-route)</li> <li>▪ Ridership ~8 passengers/revenue vehicle hour</li> </ul>
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Employment – increases access to employers along Route 5, downtown St. Johnsbury</li> <li>▪ Increases connections to growing markets in Lyndonville, Burke Mountain and Newport; additional connections to Derby and Jay Peak</li> </ul>
<b>Proposal: Expand Existing Service</b>	<ul style="list-style-type: none"> <li>▪ Operate as enhanced Express service between downtown St. Johnsbury and Lyndonville</li> <li>▪ Expand existing service –from two round trips to six round trips (+4 hours of service per day)</li> <li>▪ Add six Saturday express trips, timed to meet Burke Mountain service. Operate during winter months only.</li> <li>▪ Assumed to operate fare-free</li> </ul>
<b>Opportunities/Challenges</b>	<ul style="list-style-type: none"> <li>▪ Designed as an overlay to strengthen existing service, but will not serve destinations east of downtown St. Johnsbury</li> <li>▪ Would not require ADA complementary paratransit service if operated as express service</li> <li>▪ Will need a transit hub or “super stop” in Lyndonville</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ <b>Estimated Annual Cost: \$76,500 (not including vehicles)</b></li> <li>▪ Costs include cost of additional service only (+4 daily trips)</li> <li>▪ Potential Revenue Sources:                             <ul style="list-style-type: none"> <li>– Contracts with Lyndon State College</li> <li>– Contributions from major employers</li> </ul> </li> </ul>
<b>Timing</b>	<ul style="list-style-type: none"> <li>▪ ASAP</li> </ul>

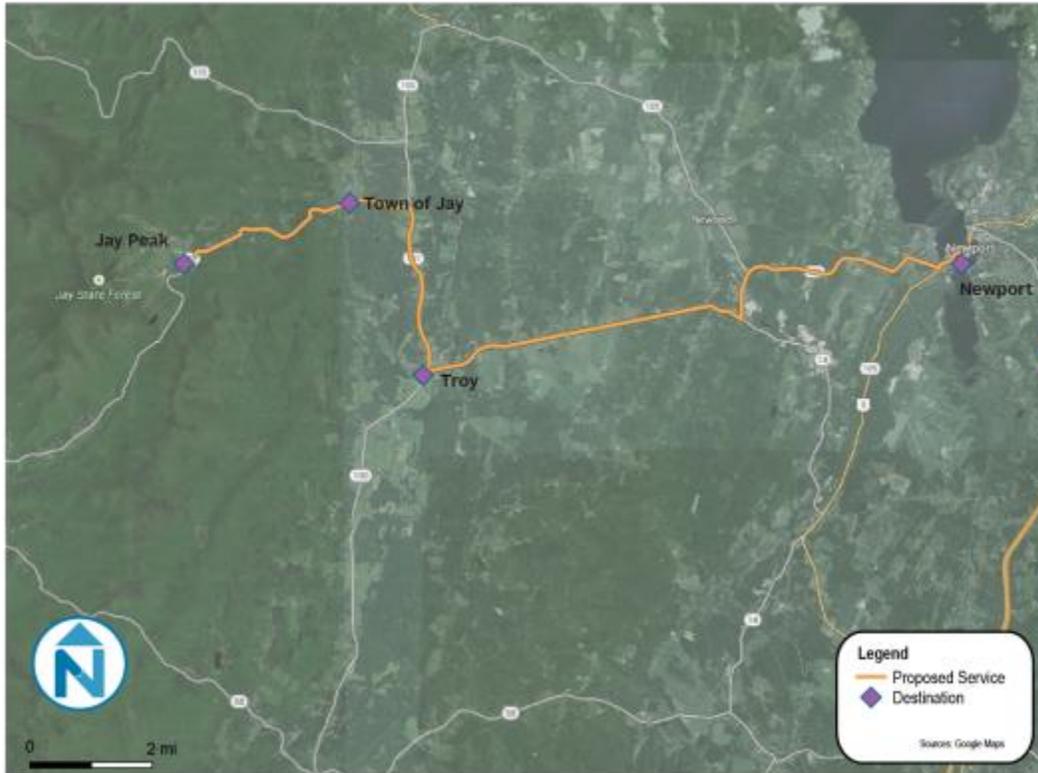
DRAFT Lyndonville to St. Johnsbury Existing Service



<b>JAY PEAK - NEWPORT</b>	
<b>Existing Service</b>	<ul style="list-style-type: none"> <li>▪ No service exists today, but there is shuttle service on site at Jay Peak Ski Resort</li> <li>▪ Some employees park at remote lot and ride shuttle to base lodge</li> </ul>
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Employment – already considerable during winter months and more growth is planned in next 3-5 years</li> <li>▪ Tourism – people staying at Jay Peak Resort can get to Newport for shopping and dining</li> <li>▪ Need is strongest during winter weekends, especially holiday weekends</li> </ul>
<b>Service Proposal</b>	<ul style="list-style-type: none"> <li>▪ Operate between Newport and Jay Peak</li> <li>▪ Hourly service daily 6:30 AM– 10:30 PM</li> <li>▪ Operate winter months between Thanksgiving and Easter</li> <li>▪ Connect with service from Newport to Derby and future services between Newport and Lyndonville</li> <li>▪ Operate with small vehicles with capacity for up to 16-18 riders. May need to use larger vehicles as service gains momentum</li> </ul>
<b>Opportunities/Challenges</b>	<ul style="list-style-type: none"> <li>▪ Requires extensive marketing and branding to be successful; will need support of Jay Peak Resort</li> <li>▪ Unlikely to require ADA complementary paratransit</li> <li>▪ Supporting infrastructure needed in Newport and Jay Peak including shelters, signage, and online information</li> <li>▪ Should be coordinated with Jay Peak shuttle service and designed to meet Jay Peak shift times</li> <li>▪ May be implemented as part of employee transportation plan. Contributions to service would allow employees to ride for free</li> <li>▪ Need consider fares</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ <b>Estimated Annual Cost: \$ 148,000 (operating only)</b></li> <li>▪ Potential Revenue Sources:                             <ul style="list-style-type: none"> <li>– Contributions from Jay Peak</li> <li>– Contributions from local communities</li> </ul> </li> </ul>
<b>Timeline</b>	<ul style="list-style-type: none"> <li>▪ ASAP</li> </ul>

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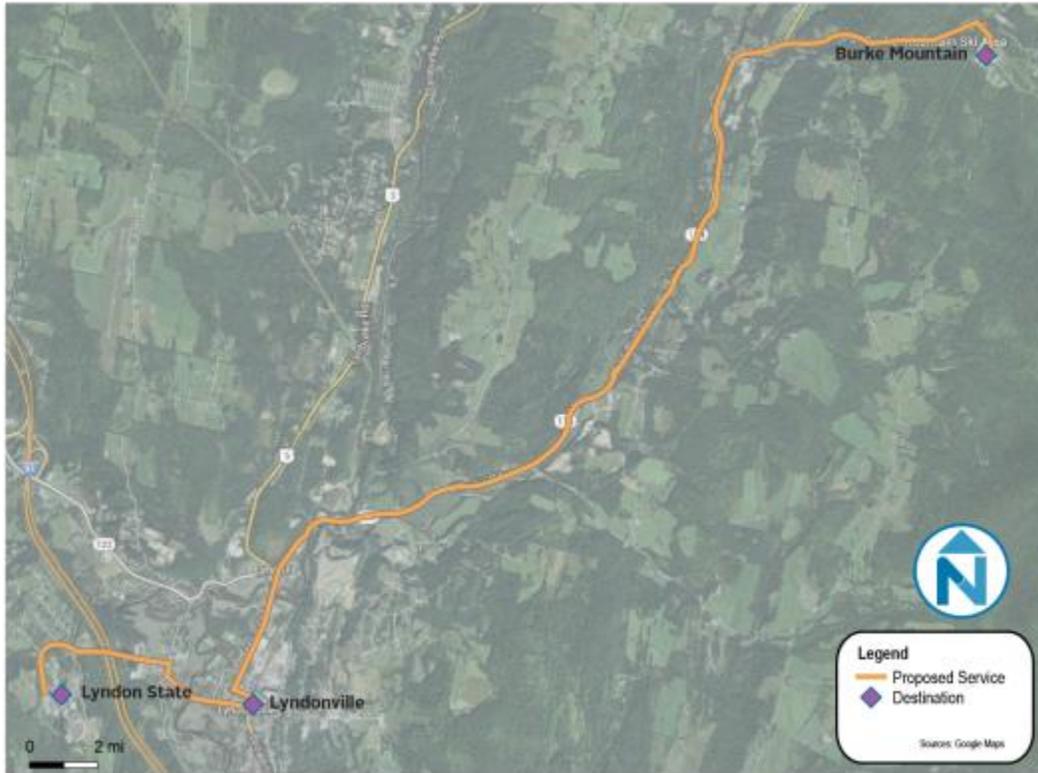
DRAFT Jay Peak to Newport Proposed Service



<b>LYNDON STATE COLLEGE – LYNDONVILLE – BURKE MOUNTAIN</b>	
<b>Existing Service</b>	<ul style="list-style-type: none"> <li>▪ No service available today</li> <li>▪ Will build on Jay-Lyn Shuttle that provides service between St. Johnsbury , Lyndonville and Lyndon State College</li> </ul>
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Employment – main need is access to growing job market in downtown Newport and Derby Center</li> <li>▪ Shopping/services – growing need for access to Wal-Mart Super Center in Derby Center</li> </ul>
<b>Service Proposal</b>	<ul style="list-style-type: none"> <li>▪ Operate during winter months only (Thanksgiving to Easter)</li> <li>▪ Fridays, Saturdays and Sunday</li> <li>▪ Dedicate single vehicle (60 minute service)</li> <li>▪ Operate half day on Friday and all day on Saturdays and Sundays (8:00 am to 10:00 pm)</li> <li>▪ Stop at Lyndon State College, Lyndonville and Burke Mountain only</li> </ul>
<b>Opportunities/Challenges</b>	<ul style="list-style-type: none"> <li>▪ Will require partnerships with Lyndon State College and Burke Mountain Resort to be successful</li> <li>▪ May need to offer service with deviations or offer ADA paratransit service</li> <li>▪ Best implemented with park and ride or “super stop” in downtown Lyndonville, so riders can connect with Jay-Lyn Express</li> <li>▪ Should be timed to link to other proposed connections including service to Newport and St. Johnsbury</li> <li>▪ May be duplicative with a handful of Jay-Lyn Shuttle trips on Fridays; however, the Lyndon State to Burke Mountain Service would largely operate on weekends when the Jay-Lyn Shuttle does not operate</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ <b>Estimated Annual Cost: \$45,000 (operating only)</b></li> <li>▪ Potential Revenue Sources:                             <ul style="list-style-type: none"> <li>– Lyndon State College; Burke Mountain Resort</li> </ul> </li> </ul>
<b>Timeline</b>	<ul style="list-style-type: none"> <li>▪ ASAP</li> <li>▪ Best implemented in conjunction with expanded St. Johnsbury to Lyndonville service</li> </ul>

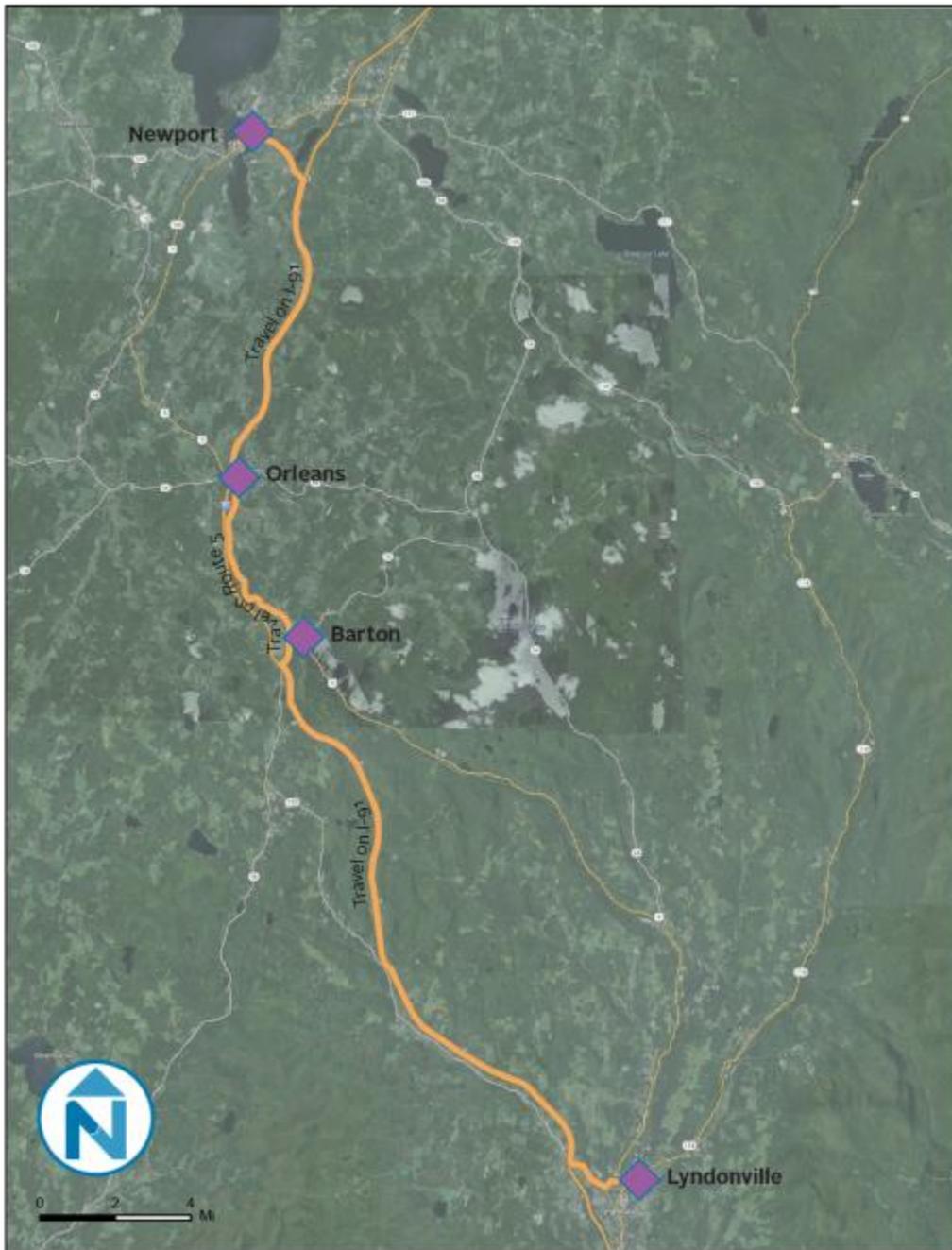
**Northeast Kingdom Transit Analysis**  
Northeast Kingdom Development Authority

DRAFT Lyndon State to Lyndonville to Burke Mountain



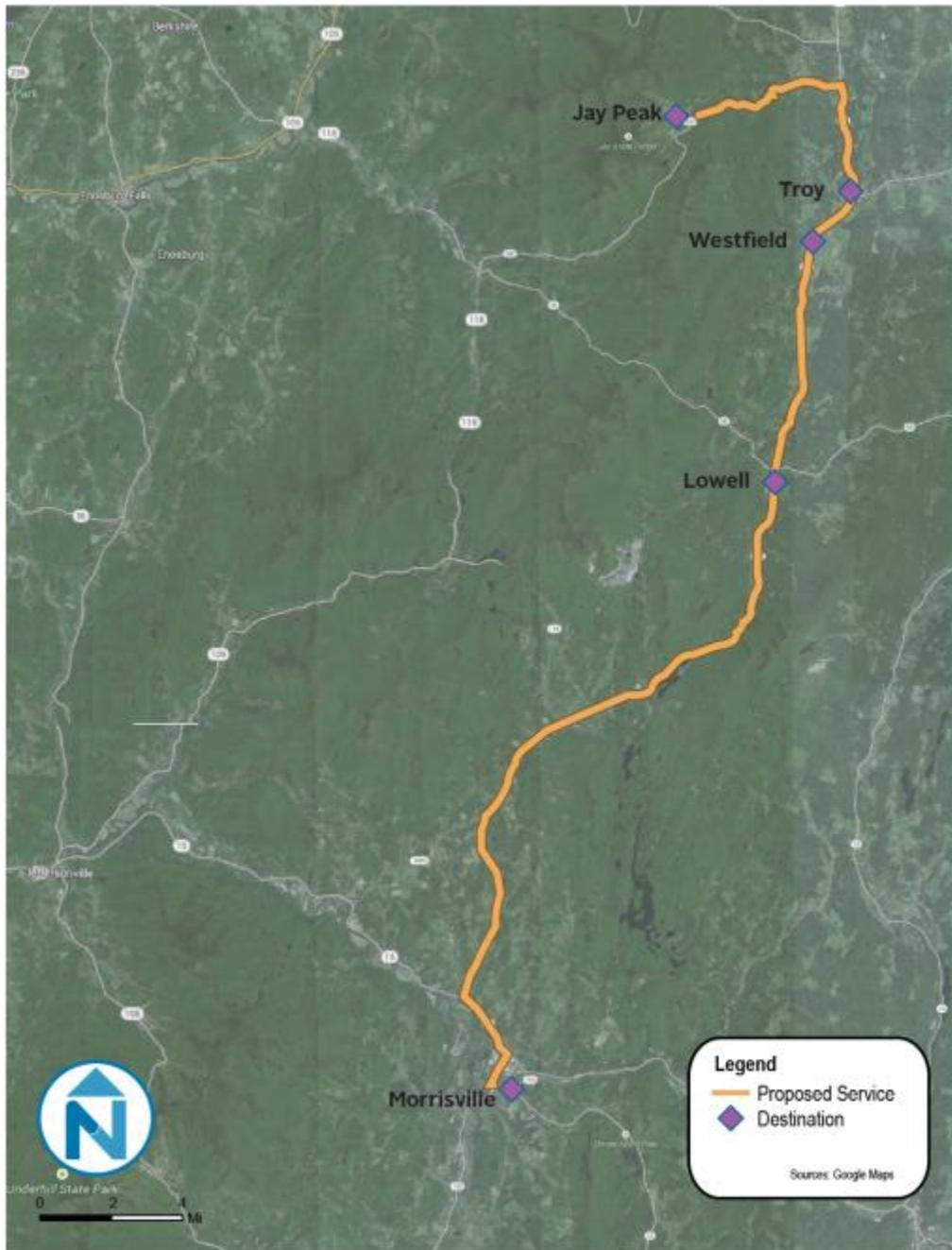
<b>LYNDONVILLE – NEWPORT</b>	
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Increasing employment in Newport and existing employment in Lyndonville/St. Johnsbury increases demand for travel between destinations</li> <li>▪ Additional growth in service sectors – both shopping and services in Newport and Derby but also in St. Johnsbury</li> <li>▪ Newport to Lyndonville service will be critical links to make connections to other destinations (Jay Peak, Burke Mountain and St. Johnsbury)</li> </ul>
<b>Service Proposal</b>	<ul style="list-style-type: none"> <li>▪ Currently recommended as hourly service, operated daily between 6:00 AM and 7:00 PM</li> <li>▪ Operate via I-91 with stops in Barton and Orleans</li> <li>▪ May be phased in and started with peak period service until demand builds</li> <li>▪ Suggested as year round service</li> </ul>
<b>Opportunities/Challenges</b>	<ul style="list-style-type: none"> <li>▪ Will require extensive marketing to be successful, including outreach with employers to ensure service is timed to meet employer schedules</li> <li>▪ Will require capital investment in “super stops” or area where passengers transfer to other routes</li> <li>▪ Must be timed to facilitate connections in Newport with service to Jay Peak and Derby and in Lyndonville to connect with service to Burke Mountain and St. Johnsbury</li> <li>▪ Starts to build regional transit network will support employment</li> <li>▪ Ideally implemented with other services and expanded development in Newport</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ <b>Estimated Annual Cost: \$172,000</b></li> </ul>
<b>Timing</b>	<ul style="list-style-type: none"> <li>▪ Phase II service</li> </ul>

DRAFT Lyndonville to Newport Proposed Service



<b>MORRISVILLE – JAY PEAK</b>	
<b>Emerging Need and Area Benefits</b>	<ul style="list-style-type: none"> <li>▪ Employment – expanded job market in downtown Newport, Jay Peak Resort and Derby Center</li> <li>▪ Connection from Morrisville will provide access between Central Vermont and Northeast Kingdom</li> </ul>
<b>Service Proposal</b>	<ul style="list-style-type: none"> <li>▪ Limited service (5 trips per day) between Morrisville and Jay Peak, timed to meet key shift start times</li> <li>▪ Stops in Lowell and Troy</li> <li>▪ Timed to meet Montpelier – Morrisville service</li> <li>▪ Suggested for winter season only (Thanksgiving to Easter)</li> </ul>
<b>Opportunities/Challenges</b>	<ul style="list-style-type: none"> <li>▪ Jay Peak scheduled to become largest employer in northern Vermont; jobs pay range makes low cost commuting option essential</li> <li>▪ Long route means service will have high operating costs</li> <li>▪ Demand not warrant investment in service; vanpool may address demand in short term</li> </ul>
<b>Costs and Funding</b>	<ul style="list-style-type: none"> <li>▪ Annual Cost: \$66,000</li> <li>▪ Estimated Local Share: \$33,000</li> </ul>
<b>Timeline</b>	<ul style="list-style-type: none"> <li>▪ Phase II service</li> <li>▪ Best implemented after development is open and short term transit services are operating successfully</li> </ul>

DRAFT Jay Peak to Morrisville Proposed Service



## APPENDIX D: ESTIMATED TRANSIT SERVICE COSTS AND PHASING



**Northeast Kingdom Transit Analysis**  
Northeast Kingdom Development Authority

## APPENDIX D: ESTIMATED SERVICE COSTS AND PHASING

Indicative Budget for Proposed Northeast Kingdom Transit Service Network										
Year	1	2	3	4	5	6	7	8	9	10
Vehicles required for service	4	4	4	4	6	6	6	6	6	6
Vehicle Purchases	\$300,000				\$156,091		\$318,456			\$164,053
Signage; Stops; Shelters	\$100,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000	\$ 25,000
Fund Capital Reserve		\$ 20,000	\$ 20,000	\$ 20,000		\$ 20,000		\$ 20,000	\$ 20,000	
<b>Total</b>	<b>\$400,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$181,091</b>	<b>\$45,000</b>	<b>\$343,456</b>	<b>\$45,000</b>	<b>\$45,000</b>	<b>\$189,053</b>
Estimate Local Match	\$40,000	\$ 22,500	\$ 22,500	\$ 22,500	\$ 18,109	\$ 22,500	\$ 2,500	\$ 22,500	\$ 22,500	\$ 18,905
Capital Fund Balance		\$ 20,000	\$ 40,000	\$ 60,000	\$ 41,891	\$ 61,891	\$ 59,391	\$ 79,391	\$ 99,391	\$ (80,486)
New Vehicles	4				2					2
Replacement Vehicles							4			
Cost per vehicle	\$75,000	\$75,750	\$76,508	\$77,273	\$78,045	\$78,826	\$79,614	\$80,410	\$81,214	\$82,026
<b>Operating Costs</b>										
Newport to Derby	\$205,920	\$212,098	\$218,461	\$225,014	\$231,765	\$238,718	\$245,879	\$253,256	\$260,853	\$268,679
JayLyn Express	\$76,560	\$78,857	\$ 81,223	\$ 83,659	\$ 86,169	\$ 88,754	\$ 91,417	\$ 94,159	\$ 96,984	\$ 99,893
Jay Peak to Newport	\$ 147,840	\$152,275	\$ 156,843	\$ 161,549	\$ 166,395	\$ 171,387	\$ 176,529	\$ 181,825	\$ 187,279	\$ 192,898
LSC-Lyndonville-Burke	\$44,880	\$46,226	\$47,613	\$49,042	\$50,513	\$52,028	\$53,589	\$55,197	\$56,853	\$58,558
Newport to Lyndonville					\$ 240,240	\$ 247,447	\$ 254,871	\$ 262,517	\$ 270,392	\$ 278,504
Morrisville to Jay Peak					\$ 66,000	\$ 67,980	\$ 70,019	\$ 72,120	\$ 74,284	\$ 76,512
<b>Total Costs</b>	<b>\$475,200</b>	<b>\$489,456</b>	<b>\$504,140</b>	<b>\$519,264</b>	<b>\$841,082</b>	<b>\$866,314</b>	<b>\$892,304</b>	<b>\$919,073</b>	<b>\$946,645</b>	<b>\$975,044</b>
Local Match	\$95,040	\$97,891	\$100,828	\$103,853	\$168,216	\$173,263	\$178,461	\$183,815	\$189,329	\$195,009
Cost escalation	1.03 services									
	1.01 vehicles									
Assume Existing Levels of Federal and State Support (High End)										
<b>Total Costs (Capital and Operating)</b>	<b>\$875,200</b>	<b>\$534,456</b>	<b>\$549,140</b>	<b>\$564,264</b>	<b>\$1,022,172</b>	<b>\$911,314</b>	<b>\$1,235,760</b>	<b>\$964,073</b>	<b>\$991,645</b>	<b>\$1,164,097</b>
Local Match Requirement	\$135,040	\$120,391	\$123,328	\$126,353	\$144,434	\$195,763	\$121,570	\$206,315	\$211,829	\$294,400
Federal and State Funds	\$740,160	\$414,065	\$425,812	\$437,911	\$877,738	\$715,551	\$1,114,190	\$757,758	\$779,816	\$869,697
Assume Reduced Levels of Federal and State Support (Low End)										
<b>Total Costs (Capital and Operating)</b>	<b>\$875,200</b>	<b>\$534,456</b>	<b>\$549,140</b>	<b>\$564,264</b>	<b>\$1,022,172</b>	<b>\$911,314</b>	<b>\$1,235,760</b>	<b>\$964,073</b>	<b>\$991,645</b>	<b>\$1,164,097</b>
Local Match Requirement	\$525,120	\$320,674	\$329,484	\$338,558	\$613,303	\$546,789	\$741,456	\$578,444	\$594,987	\$698,458
Federal and State Funds	\$350,080	\$213,782	\$219,656	\$225,706	\$408,869	\$364,526	\$494,304	\$385,629	\$396,658	\$465,639

# APPENDIX E: US 5/COVENTRY STREET ALTERNATIVE RECOMMENDATION



## US 5/COVENTRY STREET

*As mentioned in the Implementation Plan section of the report, this alternative recommendation was developed for the US 5/Coventry Street, but not selected as the preferred alternative due to input from the steering committee, but provided in the appendix for future reference.*

Based on the location of these intersections at a primary gateway into Newport, the projected traffic volumes, and physical constraints, we recommend signaling the US 5/Causeway/Railroad Square intersection and instituting a “road diet” along Main Street between Railroad Square and Coventry Street. The proposed Main Street “road diet” would consist of reducing the current four lanes of travel to three and installing a raised center median to eliminate crossing movements and provide more of a gateway feel. In both directions the entering roadway would only have one lane and the exiting roadway would have two lanes. This reconfiguration is shown below in Figure E1 and would provide nearly the same capacity as the current four-lane section, but with increased shoulder width (3-5'; bicycle accessible) and a raised (and potentially landscaped) center median.

In Section 3, it was discussed that this segment of roadway is classified by VTrans as a High Crash Location Section. The installation of a raised center median combined with a reconfiguration of all driveways along this section of US 5 into right in/right out accesses will reduce the number of possible conflict points, which in turn reduces the number of potential future crashes. Additionally, this raised center median will increase pedestrian safety by allowing a refuge point in the middle of the roadway and reduces the total number of lanes pedestrians will need to cross.





respectively) from projected development. This represents a 21% and 34% increase in traffic volume at this intersection for 2019 and 2024, respectively.

**Figure E3: Level-of-Service Results (US 5/Coventry Street)**

Newport Intersections	2014 No Build			2019 Signal Opt.			Peak Hour 2019 Build + RSG			2024 Signal Opt.			2024 Build + RSG		
	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c	LOS	Delay	v/c
 <b>3. US 5 / Coventry St</b>															
Overall	C	30	0.56	C	34	0.64	D	37	0.67	D	40	0.71	D	44	0.76
EB, along US 5	C	33	-	D	37	-	D	39	-	D	38	-	D	44	-
WB, along US 5	C	26	-	C	28	-	C	23	-	D	40	-	C	32	-
NB, exiting Coventry St	C	32	-	D	40	-	D	54	-	D	42	-	E	60	-
SB, exiting Lane St	D	35	-	D	44	-	E	70	-	E	56	-	F	94	-

The road diet enhancements could be constructed as a single project or broken into two phases to confirm the effectiveness of the lane reduction and median using striping before making longer-term curbing improvements to “lock-in” the roadway cross-section more permanently. Under this phased approach, the first phase would involve restriping US 5 to accommodate the proposed lane striping configuration, without the installation of a permanent center median. If it is decided that this is preferable to the existing configuration, the city of Newport could then move forward with phase 2, which would consist of the installation of a curbed center median and reconfiguration and closure of identified parking lot accesses.

