# JERICHO TRANSPORTATION STUDY

**MAY 2015**

**PREPARED FOR:**
TOWN OF JERICHO, VT

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# 1.0 INTRODUCTION

The *2015 Jericho Transportation Study* investigates and assesses the existing transportation system, estimates and evaluates future conditions, and presents a capital plan. The study will be used by the Jericho Planning Commission as it updates the Municipal Plan, the Development Review Board to assist with project review, and the Selectboard as it updates the Capital Improvement Program and considers changes to the Impact Fee Schedule adopted in 2009.

A second report entitled the *2015 Jericho Bicycle and Pedestrian Facility Master Plan* has also be developed specifically to address non-motorized transportation issues. While a cursory review of this subject is provided herein, please refer to the *Bicycle and Pedestrian Facility Master Plan* for more detail on these subjects.

This study compiles past transportation plans and studies, describes the characteristics of the transportation system, and evaluates performance under existing conditions. Transportation system characteristics such as roadway travel lane and shoulder widths, intersection lane geometries, speed limits, and provisions for pedestrians and bicyclists were inventoried to document existing conditions. The transportation network was analyzed for intersection performance, capacity analysis, safety, and suitability for pedestrians and bicyclists.

A Local Concerns public meeting was held in December 2013 in order to gain insight as to the public's perspective on transportation issues throughout the Town. A summary of comments and concerns from the first public meeting is provided in Appendix A.

Future conditions and issues are identified and summarized in Section 4. Roadway segments and intersections were evaluated based on future year 2035 conditions. Section 5, the capital plan, concludes the plan with a matrix describing potential improvements, their estimated costs and a timeline for planning purposes.

## 1.1 | STUDY AREA

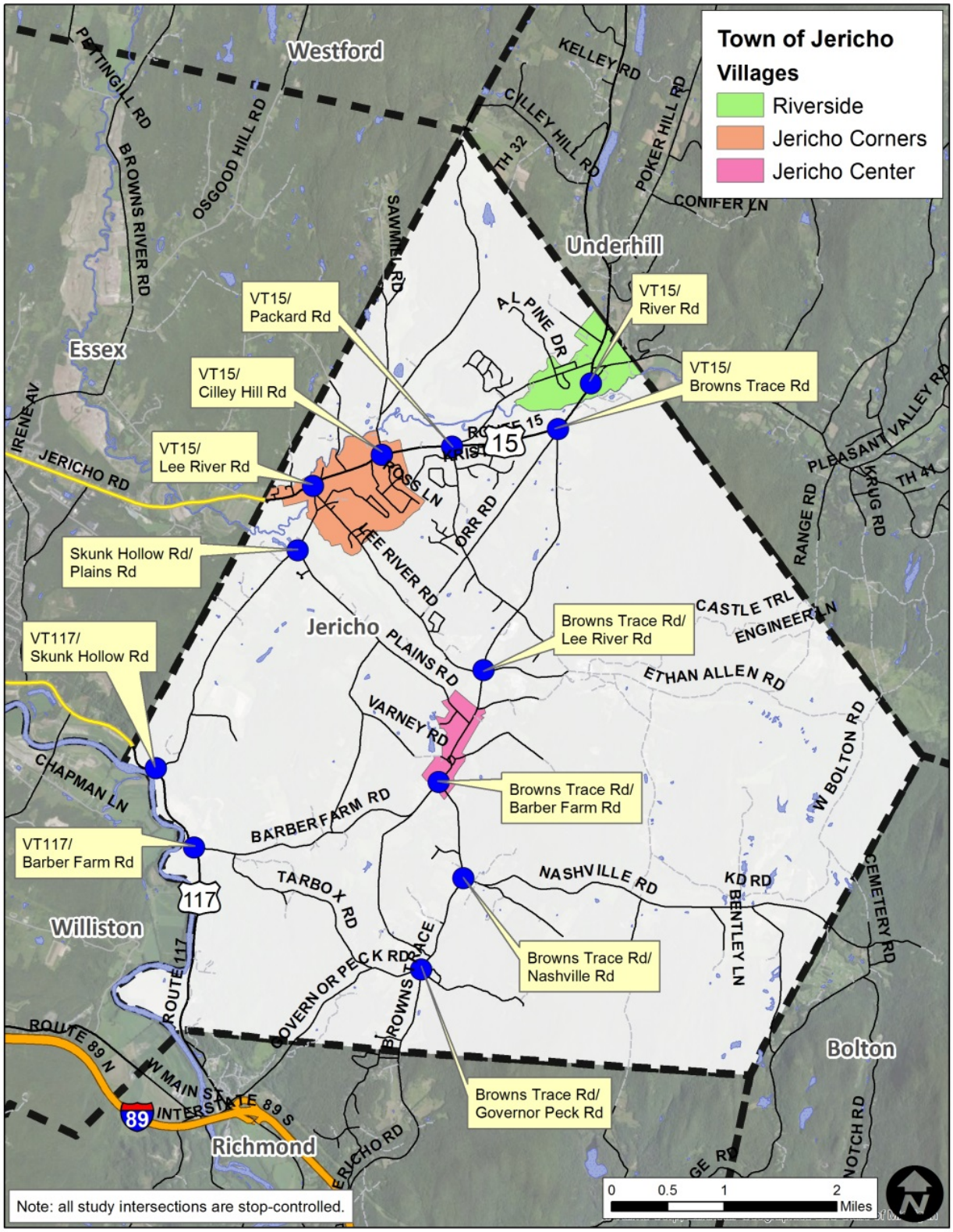
According to the 2010 Census, the Town of Jericho's population is just over 5,000, which represents zero growth when compared with the number of residents reported in the 2000 Census. The State of Vermont's population estimates for Vermont indicate that Jericho's population is projected at between 5,051 and 5,173 in 2020, which represents approximately one to three percent growth over 2010.[1] This range is provided to account for uncertainties related to future economic conditions in the state and nationwide.

The Town of Jericho is comprised of three village centers in the areas of Jericho Center, Jericho Corners, and Riverside ("The Flats"). In close proximity of the village centers lie schools, town buildings, and other services of the town. The three village centers, public schools and most municipal facilities are connected by a triangle of roads (Lee River Road, Browns Trace Road and VT 15). The existing transportation network currently serves predominantly passenger vehicles and trucks. Sidewalks currently exist in Jericho Corners, Jericho Center, and Riverside, but only cover limited stretches and do not interconnect for regional access.

Figure 1-1 shows the study area and identifies intersections analyzed in more detail in subsequent sections.

[1] *Vermont Population Projections – 2010 – 2030*, State of Vermont – Agency of Commerce and Community Development, August 2013.

**FIGURE 1-1: STUDY AREA**



# 2.0 REVIEW OF PAST STUDIES AND PLANS

Several locations within the Town of Jericho have been studied for infrastructure improvements, safety analysis, and pedestrian/bicycling issues. The documents and studies shown in Table 2-1 were reviewed and relevant sections are summarized below (items 1-7). Studies specific to bicycle and pedestrian facilities are reviewed in the *Bicycle and Pedestrian Facility Master Plan* (items 8-11).

**TABLE 2-1: EXISTING PLAN AND STUDY REVIEW**

| | Date | Report Title | Prepared By | Sponsor |
|---|---|---|---|---|
| **1** | *2004* | *Jericho Transportation Study* | *RSG* | *Town of Jericho* |
| **2** | 2013 | Chittenden County ECOS Plan | CCRPC | CCRPC |
| **3** | 2012 | Jericho Park-and-Ride Feasibility Study and Alternatives Evaluation | Lamoureux & Dickinson | CCRPC |
| **4** | 2011 | Mount Mansfield Union High School to Jericho Center Multimodal Connection | VHB | Town of Jericho |
| **5** | 2011 | Dickinson Street Improvements Scoping Report | Stantec | CCRPC |
| **6** | 2011 | Comprehensive Town Plan | Town of Jericho | Town of Jericho |
| **7** | 2008 | Road Safety Audit Review – Browns Trace Road, Town of Jericho | CCRPC | VTrans |
| **8** | 2010 | Jericho Center Boardwalk | Town of Jericho | Town of Jericho |
| **9** | 2008 | Jericho Elementary School Pedestrian Circulation Study | RSG | CCRPC |
| **10** | 2008 | Regional Bicycle – Pedestrian Plan Update | Wilbur Smith Associates | CCRPC |
| **11** | 2014 | VT15 Bicycle/Pedestrian Scoping Study | Lamoureux & Dickinson | Town of Jericho |

## 2.1 | JERICHO TRANSPORTATION STUDY, TOWN OF JERICHO (NOVEMBER 2004)

The Jericho Transportation Study investigated and assessed the existing transportation system, evaluated future conditions, and presented a list of recommendations. The study was used by the Jericho Planning Commission for Municipal Plan updates, Development Review Board project review, and the Selectboard for updates to the Capital Plan and consideration of the development of an Impact Fee Schedule. The transportation network was analyzed for intersection performance, capacity analysis, safety, and suitability for pedestrians and bicyclists.

*This 2004 Jericho Transportation Study serves as the basis for the current study.*

The outcome of the *2004 Jericho Transportation Study* included a number of recommended intersection modifications, pedestrian and bicycle facility improvements, and planning and policy actions. These recommended improvements, along with the implementation status, are shown in Table 2-2.

**TABLE 2-2. 2004 JERICHO TRANSPORTATION STUDY RECOMMENDATIONS**

| Location | Recommendation | Status |
|---|---|---|
| Browns Trace Road & Lee River Road | Study possible configurations for intersection improvement. | This intersection was studied as part of a 2008 Road Safety Audit Review for Browns Trace Road by the CCRPC. A possible improvement recommendation at the time was to remove the bi-directional slip lane and make it a traditional four-way intersection. This should be studied further. |
| Browns Trace Road, between VT-15 and Lee River Road | Change the Highway Functional Class of Browns Trace Road north of Lee River Road to Major Collector to include this section on the Federal Aid System. | Completed. |
| Jericho Center | Design and implement traffic calming and other infrastructure improvements proposed as part of the Jericho Transportation Subcommittee and the Walkable Communities Grant. | Permanent radar feedback signs installed. |
| Jericho Center | Create roundabouts at the intersections of Browns Trace Road/Lee River Road and Browns Trace Road/Barber Farm Road to achieve speed reduction in Jericho Center. | No progress. |
| Jericho Corners | Traffic calming, burying utility lines, historic district signage, sidewalk upgrade, enhance sidewalks with faux brick and textured surface. | New sidewalks installed along VT 15. |
| Jericho Corners | Identify appropriate crossing locations and design in conjunction with sidewalk improvements. | Completed. Additional crosswalks are desired but are not warranted per VTrans. |
| Town of Jericho | Extend regional bike path through Jericho, paralleling VT 15. Support CCRPC's proposal for the shared use path. | Mount Mansfield Union High School to Jericho Center Multimodal Connection study completed in 2011 by CCRPC to develop conceptual path alignment. Town awarded $249,000 in Transportation Enhancement funds in 2012 for phase 1. Jericho Center Boardwalk Project study completed in 2010. |
| Town of Jericho | Require bike racks and other storage in new developments and subdivisions. | No progress. |
| Town of Jericho | Designate bicycle priority routes in Town Plan | Bicycle and Pedestrian Master Plan completed in 2015. |
| Town of Jericho | Evaluate costs and benefits of widening shoulders in order to meet cross-section guidelines stated in the Vermont Pedestrian and Bicycle Facility Design Manual. | See 2015 Bicycle and Pedestrian Master Plan for potential cost estimates. Further scoping needed. |
| Town of Jericho | Adopt official policies and procedures for determining if a gravel road should be paved. | No progress. Could be included in the update of public works specs. |
| Town of Jericho | Design guidelines should be created to ensure desired outcomes of roadway reconstruction of local facilities to meet objectives stated in the Town Plan. | To be included in update of public work specs. |
| | | |

| Location | Recommendation | Status |
|---|---|---|
| Town of Jericho | Install Park & Ride lots and provide feeder lines to the mainline CCTA bus service. | In 2011 the CCRPC completed a regional Park and Ride & Intercept Facility Plan. CCTA began transit service along Rt. 15 from Burlington to Jeffersonville in Fall 2013 with park & ride lots in each community served, including Jericho in Riverside at the corner of VT Rt. 15 and Dickinson St. |
| Riverside | Install sidewalks along VT 15 in Riverside village center. | Completed on western side from Jolley's to town line; eastern side needs sidewalk. Potential funding programs include VTrans Bike/Ped Program, Transportation Alternatives Program, and CCRPC Sidewalk Grant program. |
| VT 117 / Barber Farm | Implement intersection improvements to address poor sight distance and unsafe geometry. | No progress. |
| VT 117 between Barber Farm Rd and North Williston Rd | Travel lane and shoulder widening. | No progress. |
| VT 15 / Browns Trace Rd | Evaluate different design alternatives which include a traffic signal, turn lanes, and a roundabout. | VTrans to install traffic signal and a westbound left-turn lane (HSIP# 07-057); construction FY 2016 |
| VT 15 / Lawrence Heights | Relocate power pole and re-grade existing bank. | Completed with streetscape study. |
| VT 15 / Lee River Rd | Implement intersection improvements consistent with scoping study | Completed. |
| VT 15 / River Rd | Intersection improvements to address heavy congestion and poor LOS | Last addressed in 2011 Dickinson St. study |
| VT 15 between Jericho Corners and Riverside | Travel lane and shoulder widening | New sidewalks and streetlights installed along Route 15 from Browns River north to Post Office and Jericho Elementary School |
| Town of Jericho between Jericho Corners and Riverside | Explore possible new connections to improve accessibility for residents. | No progress. |

## 2.2 | CHITTENDEN COUNTY ECOS PLAN, CCRPC (JUNE 2013)

The ECOS Project – "A Sustainable Future for Chittenden County", represents a once-in-a-generation opportunity to engage citizens, organizations and municipalities in a conversation about the future of our communities and the region as a whole. The major product of this project is an updated and enhanced 2013 Regional Plan for Chittenden County, which includes the Metropolitan Transportation Plan (MTP) and the Comprehensive Economic Development Strategy (CEDS). The Plan, adopted in June 2013, is designed to develop a common vision, analyze existing trends, and prioritize and implement regional actions that will help make our community a more healthy, inclusive and prosperous community.

The MTP is the region's principal transportation planning document and sets regional transportation priorities. It consists of short- and long-range strategies to address transportation needs and that lead to the development of an integrated, inter-modal transportation system that facilitates the efficient movement of people and goods.

The general issues identified related to the Town of Jericho revolve around two of nine key corridors that pass through the town limits on VT 15 and VT 117:

- The Northeast Corridor: Essex Junction to the County line along VT 128 and VT 15
- The Eastern Corridor: US 2, I-89, VT 117, and the Burlington and Essex Junction rail line east to the County line

In these two corridors, the following corridor strategies/projects are identified to address future anticipated congestion as well as bicycle, pedestrian, and transit deficiencies:

- VT 15/Browns Trace intersection improvements; *status - VTrans plans to install a traffic signal and a westbound left-turn lane in FY 2016.*
- VT 15 Footbridge; *status – VTrans plans to complete this project in FY 2015, which will close a major gap in Jericho Center's sidewalk network.*
- CCTA Cambridge Route and new/improved park-and-rides; s*tatus – CCTA initiated this route, called the Jeffersonville Commuter, in October 2013 with stops in Jericho Corners and in Riverside.*

### 2.3 | JERICHO PARK-AND-RIDE FEASIBILITY STUDY AND ALTERNATIVES EVALUATION, CCRPC (MARCH 2012)

Following the release of the 2011 *Chittenden County Park-and-Ride and Intercept Facility Plan* by the Chittenden County Regional Planning Commission (CCRPC), the Town of Jericho identified five possible locations for park-and-ride facilities. The sites were selected along the two major commuting corridors in town: VT Route 15 and Browns Trace Road. A primary consideration for the selection of these five locations was the thought that a park-and-ride could be quickly and easy developed at one or more of the sites.

Following the evaluation of the five sites, the top two sites, Site B (Mt Mansfield Unitarian Universalist Church) and Site C (Packard Road Town Site) were studied in further detail including cost estimates. The results of the evaluation were presented to the Selectboard in 2012 for further consideration and options continue to be evaluated by the CCRPC. In the meantime, some commuter parking has been secured in Riverside to serve CCTA's Jeffersonville Commuter).

### 2.4 | MOUNT MANSFIELD UNION HIGH SCHOOL TO JERICHO CENTER MULTIMODAL CONNECTION, TOWN OF JERICHO (JULY 2011)

The purpose of this study was to identify and evaluate potential infrastructure improvements that would improve and encourage non-motorized transportation between Jericho Center and the Mount Mansfield Union High School, which are approximately one mile apart. The study resulted in a proposed project, called the Browns Trace Road Bicycle/Pedestrian Path and Sidewalk Extension. This project would construct a bicycle/pedestrian path along Browns Trace Road, beginning at Pratt Road and extending to Plains Road. It would also construct sidewalk/shoulders from Plains Road to the existing sidewalk in Jericho Center. Phase 1 of this project, from Jericho Center to Pratt Road, is fully funded and is slated for construction in summer 2015.

### 2.5 | DICKINSON STREET IMPROVEMENTS SCOPING REPORT, CCRPC (JUNE 2011)

The Dickinson Street Improvement Scoping Report was developed to study improvements to Dickinson Street that would divert traffic from River Road and its intersection with VT 15 while considering future development. As the Town has developed the long term planning for this area and as traffic volumes have

increased, there has been an interest in diverting traffic from River Road and the nearby school facilities by making Dickinson Street a two-way street and realigning the Dickinson Street/River Road intersection to promote through traffic.

In 2011, the Town Selectboard met and endorsed two-way operations on Dickinson Street with no signal at VT 15. A traffic signal may eventually be installed once traffic volumes on Dickinson Street and VT 15 increase to the point where it becomes necessary.

### 2.6 | COMPREHENSIVE TOWN PLAN, TOWN OF JERICHO (FEBRUARY 2011)

The Comprehensive Plan is a policy document authorized in Title 24 Vermont Statutes Annotated, Chapter 117, Section 4381. It is a reflection of the aspirations of Jericho's citizens for the future of the town. The Plan utilized the *Jericho Transportation Study* (2004) as the basis for the development of the Transportation chapter. The three primary goals related to transportation encompass multi-modal mobility, environmental and community sensitivity, and safety:

- Jericho's transportation network will be appropriately maintained, managed, and upgraded to accommodate new growth
- Facilities for alternative modes of transportation such as bicycling, walking, and carpooling are provided
- Jericho's roads are designed to be sensitive to their natural and historical context and to promote the safety and livability of surrounding neighborhoods

### 2.7 | ROAD SAFETY AUDIT REVIEW – BROWNS TRACE ROAD, TOWN OF JERICHO, VAOT (JULY 2008)

The Road Safety Audit Review (RSAR) for Browns Trace Road between Bolger Hill Road and Lee River Road was conducted by an independent, multi-discipline team in order to assess safety issues. This segment of roadway was selected for review based on crash data obtained from the Vermont Agency of Transportation (VAOT, also VTrans) for the years 2001 to 2006. The following safety concerns were identified and considered in the RSAR:

- Limited corner sight distance to the left when stopped at the Plains Road approach
- The conspicuity of the approach to the intersection on Plains Road could be improved
- Potential of edge drop-offs that could eventually cause motorists to lose control
- Information pertaining to emergency vehicles is too far from the area of concern in the northbound direction
- The operation of the Lee River Road intersection is unusual

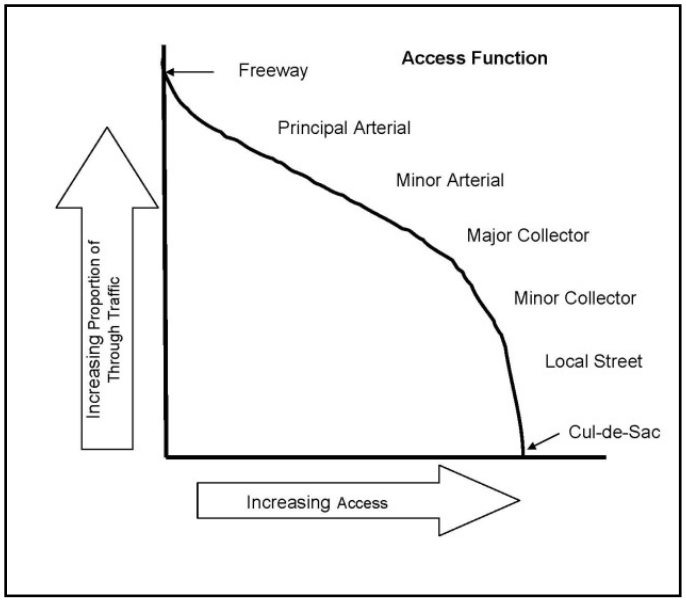
In order to address these safety concerns, the RSAR recommended a number of immediate and short-term measures to be implemented by the Town of Jericho. Measures included new/modified signage, speed limit zone review, brush clearance/tree pruning, repainting and/or relocation of pavement markings, and intersection realignment.

# 3.0 TRANSPORTATION SYSTEM CHARACTERISTICS AND PERFORMANCE

## 3.1 | FUNCTIONAL CLASSIFICATION

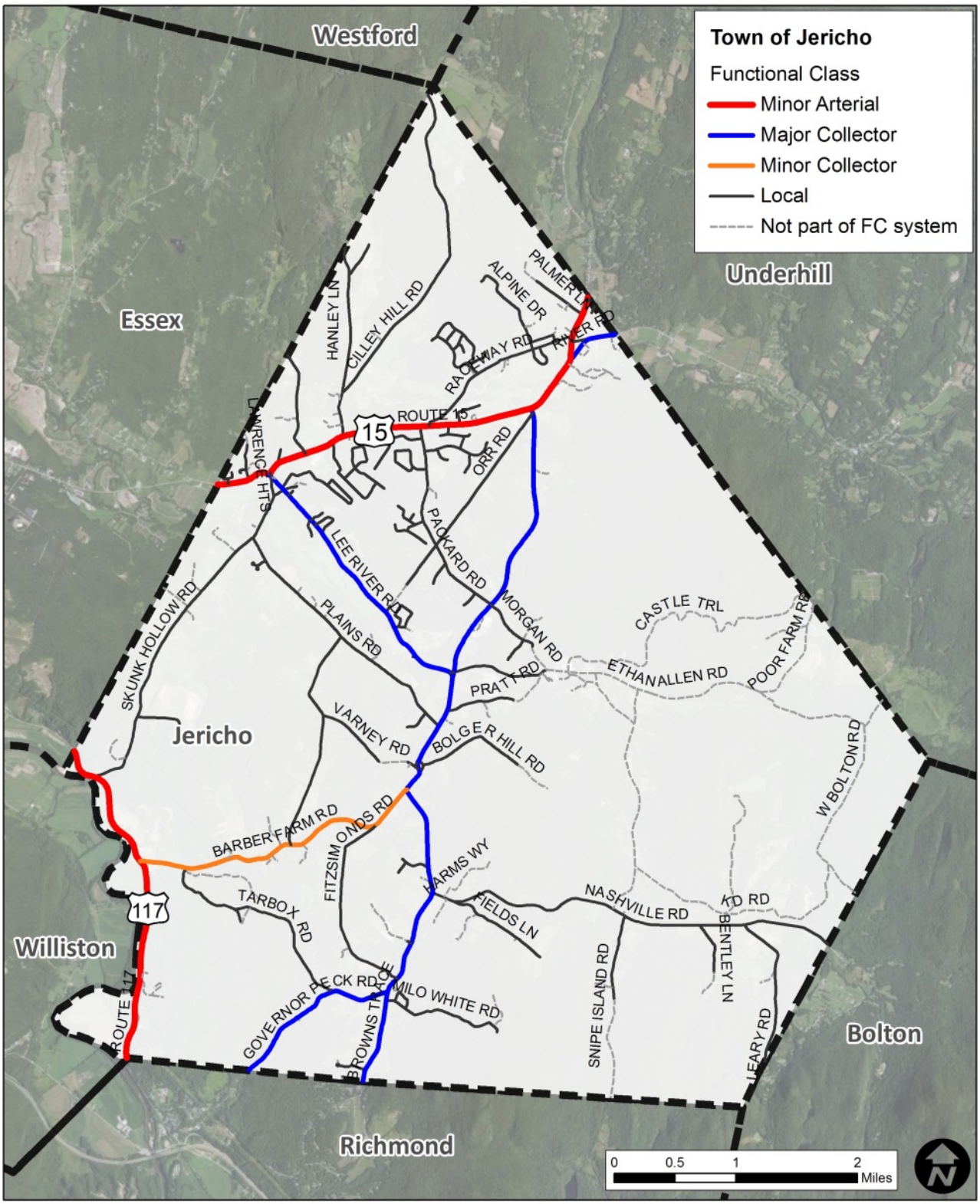
The highway functional classification system, depicted in Figure 3-1, is organized as a hierarchy of facilities, based on the degree to which the roadway facility serves mobility (through traffic) and access to adjacent land uses. Interstate highways, at the top of the hierarchy, are devoted exclusively to mobility, with no direct access to adjacent land. Arterials and Collectors provide both mobility and access. The local road system is devoted exclusively to providing local access, with limited capacity and relatively slow speeds.

**FIGURE 3-1: CONCEPTUAL ROADWAY FUNCTIONAL HIERARCHY**




The study roadways shown in Figure 3-2 depict the town network consisting of state owned highways, minor arterials, major collectors, minor collectors, and local streets. VT 15 and VT 117 are state owned facilities and are classified as minor arterials. The function of a minor arterial is to provide mobility for through traffic and some level of access to adjacent land and as a collector for the local street system. The remaining roadways displayed represent town highways that are classified as major collectors, minor collectors, and local roads.

**FIGURE 3-2: STUDY AREA FUNCTIONAL CLASSIFICATION**



In the absence of interstates or principal arterials, VT 15 and VT 117 carry a significant amount of through-traffic, which has a negative impact on the quality of life in Jericho Corners and Riverside.

Functional classification is used to determine which roads comprise the Federal Aid system. All roadways classified as major collector, major/minor arterials, and interstate are part of the Federal Aid system. As part of the Federal Aid system, roadways are eligible for a higher percentage of federal funds if reconstruction is required. In addition, the Vermont Agency of Transportation (VTrans) collects important information on Federal Aid Roads such as crash data and highway sufficiency ratings. In the *2004 Jericho Transportation Study*, it was recommended that the segment of Browns Trace Road between Lee River Road and VT 15 be re-classified from a Minor Collector to a Major Collector. This recommendation, along with the conversion of Skunk Hollow Road and Nashville Road from Minor Collectors to Local roadways, has since been implemented and is reflected in the current functional classification map shown in Figure 3-2.

## 3.2 | JURISDICTION AND STANDARDS

The public highway network in Vermont consists of roads owned by either the state or a municipality. Roads owned by municipalities are classified as Class 1, 2, 3, or 4 town highways. A Class 1 Town Highway has a VT or US route number and is an important part of the state's arterial network, but is owned and maintained by the municipality through which it passes.

There are no Class 1 Town Highways in Jericho. VT 15 and VT 117 in Jericho are owned and maintained by VTrans. The primary traffic corridors in Jericho are Class 2 Town Highways, such as Browns Trace Road, Lee River Road, and Barber Farm Road. The highway jurisdictions in the Town of Jericho are shown in Figure 3-3. No changes have occurred in highway jurisdiction since publication of the *2004 Jericho Transportation Study*.

VTrans has well documented standards for planning, design and construction of improvements to highways as associated amenities with their rights of way and jurisdiction (State Highways). In particular the *Vermont State Standards* dictate geometric standards for roadways, while the *Vermont Pedestrian and Bicycle Facility Planning and Design Manual* provides additional guidance for conditions for the facilities used by bicycles and pedestrians, including roadways or road shoulders.

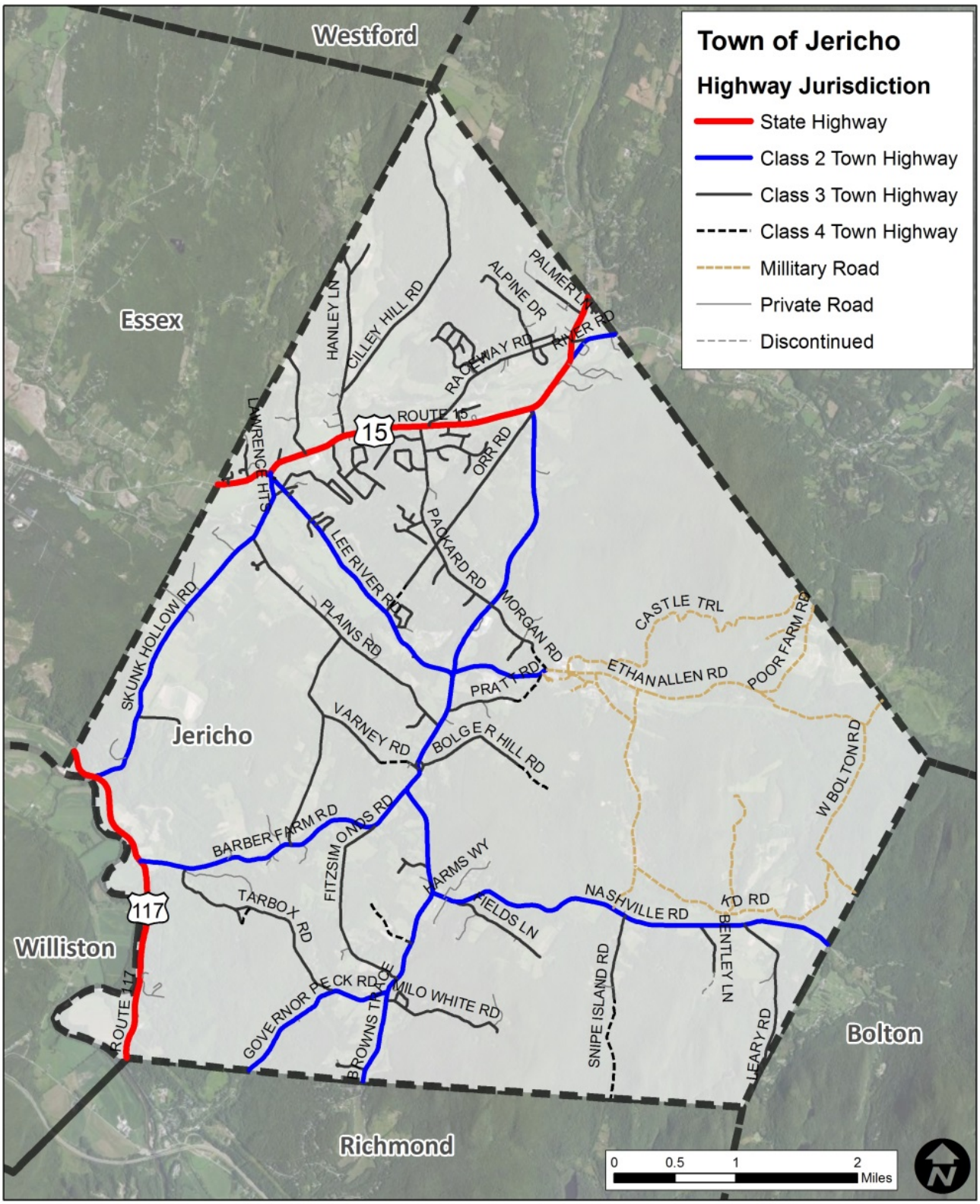
The Town of Jericho also has Public Work Standards that include geometric considerations, and the Town Selectboard recently adopted the VTrans road and bridge standards (Feb 2013).

There are additional state and federal standards that apply to most projects which are mentioned where appropriate throughout this document and in the *Jericho Bicycle and Pedestrian Facility Master Plan*.

## 3.3 | COMPLETE STREETS – ACT 34

The Vermont Legislature passed Complete Streets Legislation (Act 34) which became effective on July 1, 2011. Its purpose is to ensure the needs of all transportation users, regardless of their age, ability or preferred mode of transportation, be considered in all phases of transportation projects. Any transportation improvements within the Town should comply with the Complete Streets law. The full text of Act 34, as well as a project reporting form, is included in Appendix I.

**FIGURE 3-3: STUDY AREA HIGHWAY JURISDICTION**



## 3.4 | ACCESS MANAGEMENT

Access permits from VTrans are required on state highways, while access to the local road system is controlled by the town.

VTrans has established an Access Management Program that assigns all segments of the State's Highway System into one of six access management categories. Table 3-1 describes the Access Management categories. The standards provide the basis for access permitting on state highways and are used in the planning and development of VTrans roadway construction projects. Existing highways are not required to meet the design standards, but the standards are applied to all new access permits and construction projects.

The Access Management Program Guidelines have two sections:

- Section One: describes the characteristics of each access category in terms of functional classification and average annual daily traffic (AADT) and the associated access management standards. The access management standards specify whether or not direct access to adjacent property is permitted, the type of driveway design factors to be considered, and the type of turning movement allowed (Traffic Operations).
- Section Two: Assuming a permit application satisfies the requirements of Section One, Section Two of the Access Management Program Guidelines provides specific geometric standards for driveway width and turning radii, surfacing and pavement markings, need for turn lanes, corner sight distance, spacing between driveways, and corner clearances between driveways and intersections with public streets.

**TABLE 3-1: VTRANS ACCESS MANAGEMENT CATEGORIES**

| Access Category | Highway Functional Class (AADT) | Degree of Access Control | Direct Property Access | Driveway Controls | Traffic Operations Allowed | Design Features |
|---|---|---|---|---|---|---|
| 1 | Principal Arterials (Interstate) | Full | No | NA | Access at Interchanges Only with Public Hwys | Grade-Separated Interchanges |
| 2 | [1] Principal Arterials (Non-Interstate – LA) [2] Other Principal Arterials (LA) [3] Limited Access (LA) Major collectors | Full to Partial | No-Except by Access Rights | NA or Location | Access at Intersections with Public Highways | At-Grade or Grade-Separated at 1/2 to 1 Mile Intervals |
| 3 | [1] Principal Arterials (Non LA)<br>[2] Other Principal Arterials (Non LA)<br>[3] Minor Arterials (>5000 AADT)<br>[4] Non-Limited Access Major Collectors on State Hwy & Class I TH's (>5000 AADT) | [1] Mandatory Restrictions to operations<br>[2] Design Features<br>[3] Land Use Issues | Deny, Restrict or Allow | NA or Number, Spacing and Location | NA or May Limit Turning Movements | [1] Physical Barriers<br>[2] Signal Spacing Requirements<br>[3] Left and/or Right Turn Lanes Required<br>[4] Spacing of Public Hwy Intersection (1/4 to ½ Mile) |
| 4 | [1] Minor Collectors<br>[2] Minor Arterials on State Hwy or Class I TH's (<5000 AADT)<br>[3] Non-Limited Access Major Collectors on State Hwy & Class I TH's (<5000 AADT) | [1] Design Features<br>[2] Land Use Issues | Yes | Number, Spacing and Locations | [1] All Turns In & Out<br>[2] May Limit Turning Movements | Spacing of Public Highway Intersection (1/4 to ½ Mile) |
| 5 | Frontage or Service Roads | [1] Design Features<br>[2] Land Use Issues | Yes | Number & Location | All Turns In & Out | Signal Spacing (No Less Than 300 Feet) |
| 6 | "Urban" Sections of Highways | [1] Design Features<br>[2] Land Use Issues | Deny, Restrict or Allow | Number, Spacing & Location | [1] All Turns In & Out<br>[2] May Limit Turning Movements | Signal Spacing (No Less Than 500 Feet) |

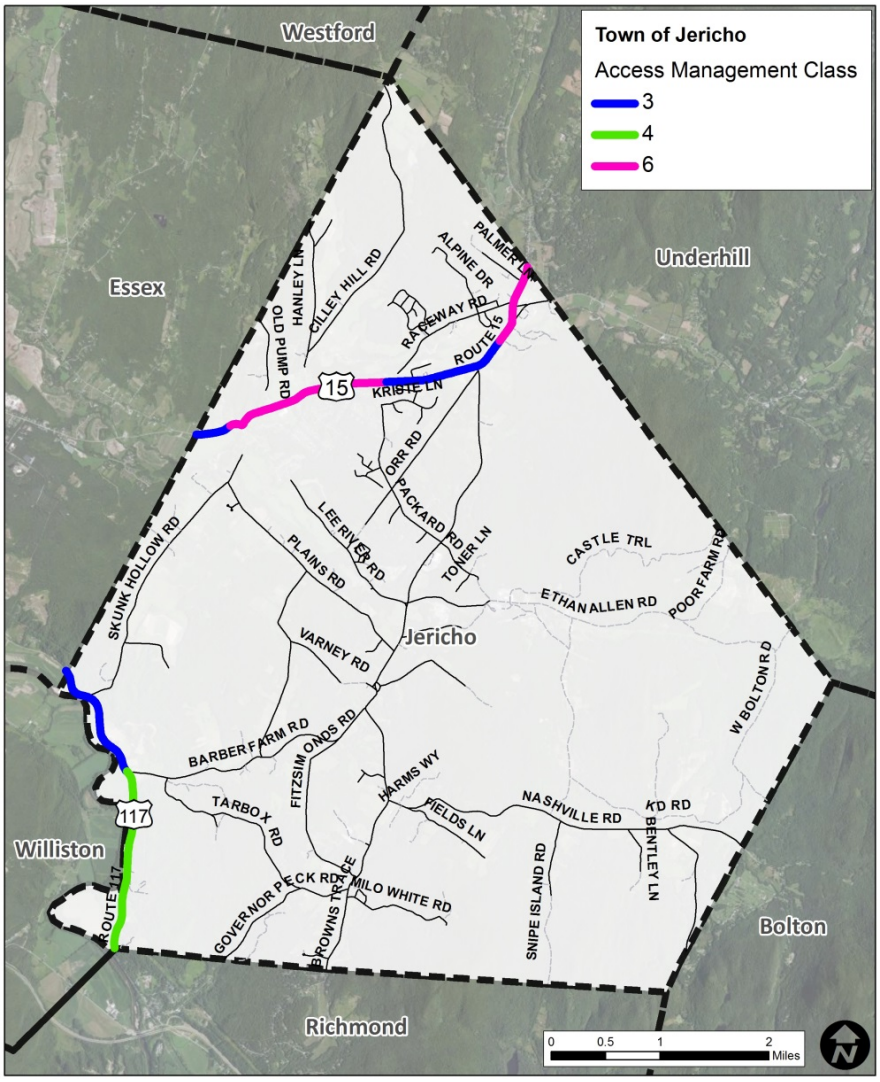
The access management categories found along the study highways are shown in Figure 3-4. VTrans Access Management Categories only apply to state highways. VT 117 north of Barber Farm Road in Jericho is designated as Access Category 3; VT 117 south of Barber Farm Road is designated as Category 4. The Access Management Category designation along VT 15 varies between Class 6 in the village centers and Class 3 for the segments outside the village centers. Since the *2004 Jericho Transportation Study* was completed, more of VT 15 between Jericho and Underhill has been designated as Class 3, and VT 117 south of Barber Farm Road has been reclassified from Class 3 to Class 4.

The key provisions of VTrans categories relevant to the Town of Jericho are:

- Only one access per parcel is allowed; and
- Direct access to VT 15 or VT 117 may be denied if safe access can be provided on a local street.

Access to local roadways is controlled by the Town through its zoning and subdivision regulations.

**FIGURE 3-4: ACCESS MANAGEMENT ON JERICHO STATE HIGHWAYS**

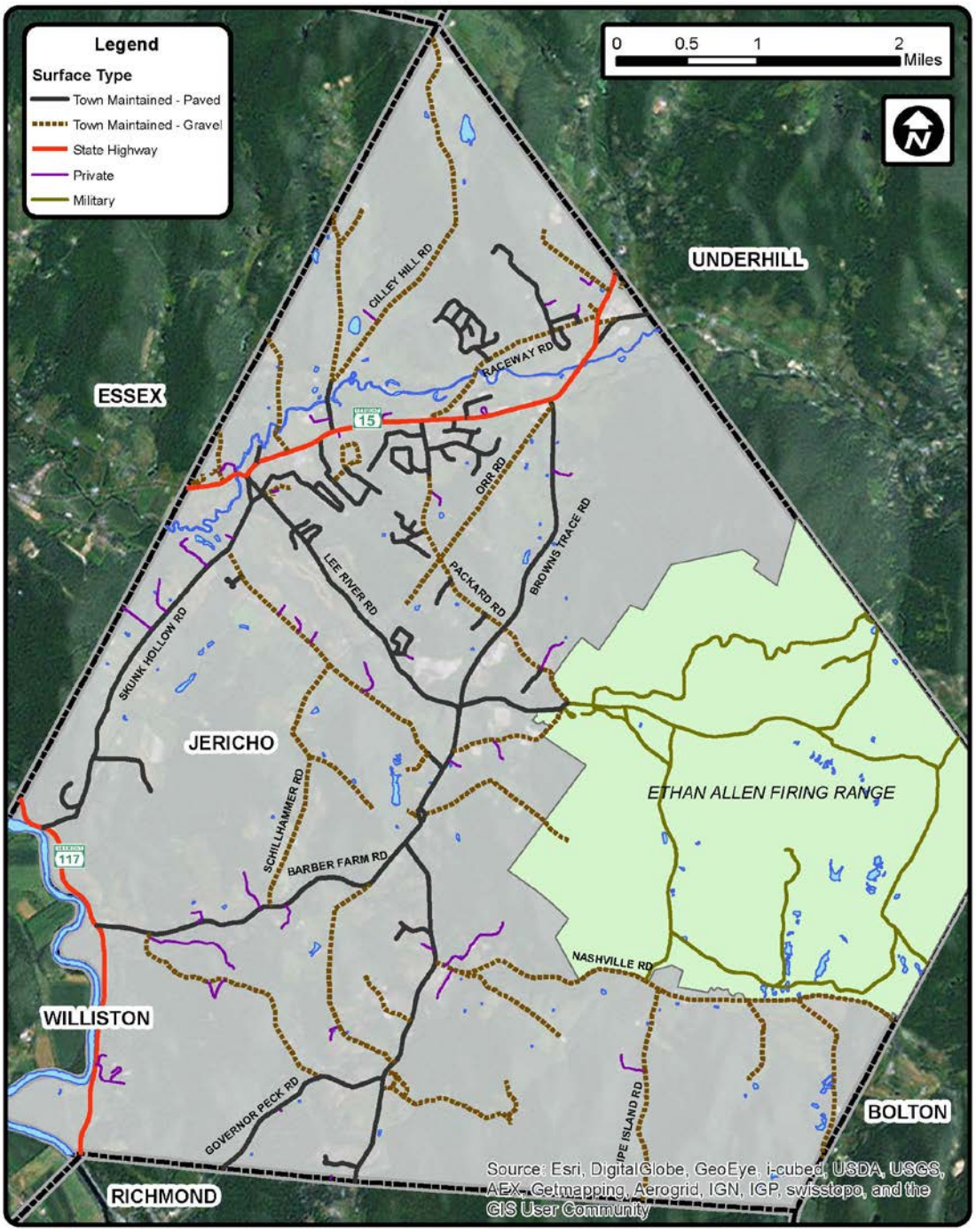


## 3.5 | ROADWAY CONDITIONS

### ROADWAY SURFACE

The Town of Jericho maintains a total network of approximately 64 miles of roadways. Approximately 34 miles are unpaved gravel roadways, and the remaining 30 miles of roadway are paved. Figure 3-5 depicts the existing roadway surface types in the Town of Jericho (larger map included in Appendix F).

**FIGURE 3-5: ROADWAY SURFACE TYPES IN JERICHO**



## PAVEMENT CONDITION AND WIDTH

CCRPC staff updated the PAVER data for the Town of Jericho in August 2014. PAVER is a pavement management system that rates the roadway surface on a scale of 1-100, called the Pavement Condition Index (PCI). This scale presents the quality of the surface conditions where the score of 100 is the best (brand new surface) and a score of 1 represents the worst quality. Note that PAVER only covers the town highways and therefore does not analyze state highways VT 15 and VT 117, private roads, or roads in the Ethan Allen Firing Range.

The system-wide average rating for paved and gravel roads in the Town was 68 and 95.55, respectively.[2] As noted in PAVER, paved and gravel roads are rated using different methodologies, and therefore direct comparisons between the condition of paved and gravel roads is not recommended. Compared with conditions reported in the *2004 Jericho Transportation Study*, paved road conditions have improved by approximately 16 percent and by approximately 22 percent on gravel roads. Figures 3-6 and 3-7 show the pavement condition index for paved and gravel roads, respectively. Larger maps are in Appendix F.

[2] An updated PCI assessment was completed by the CCRPC in 2014 for paved and gravel roadways in Jericho, which is reflected in the PCI average reported here.

**FIGURE 3-6: PAVEMENT CONDITION INDEX, 2014 – PAVED ROADS**

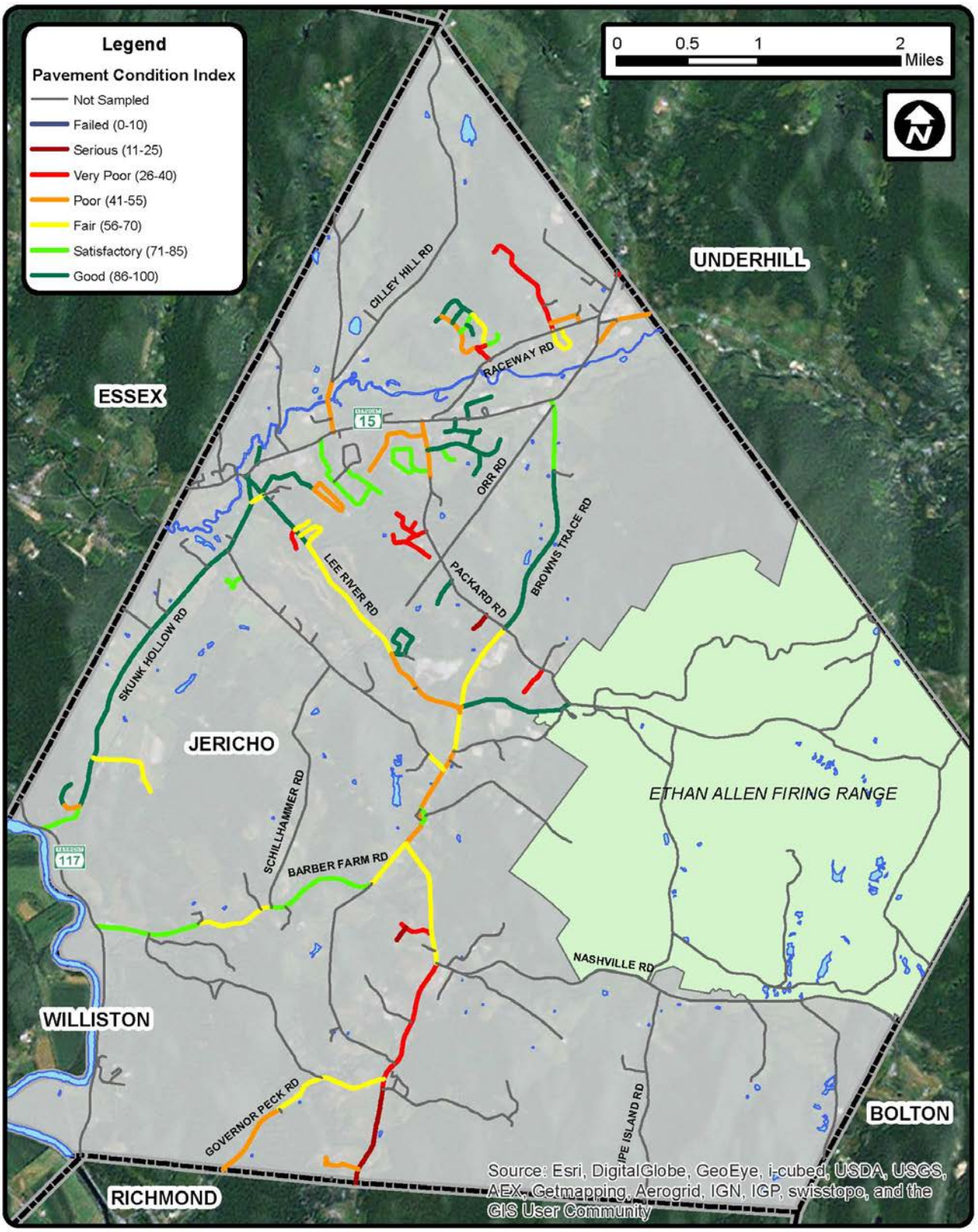


**FIGURE 3-7: PAVEMENT CONDITION INDEX, 2014 – GRAVEL ROADS**

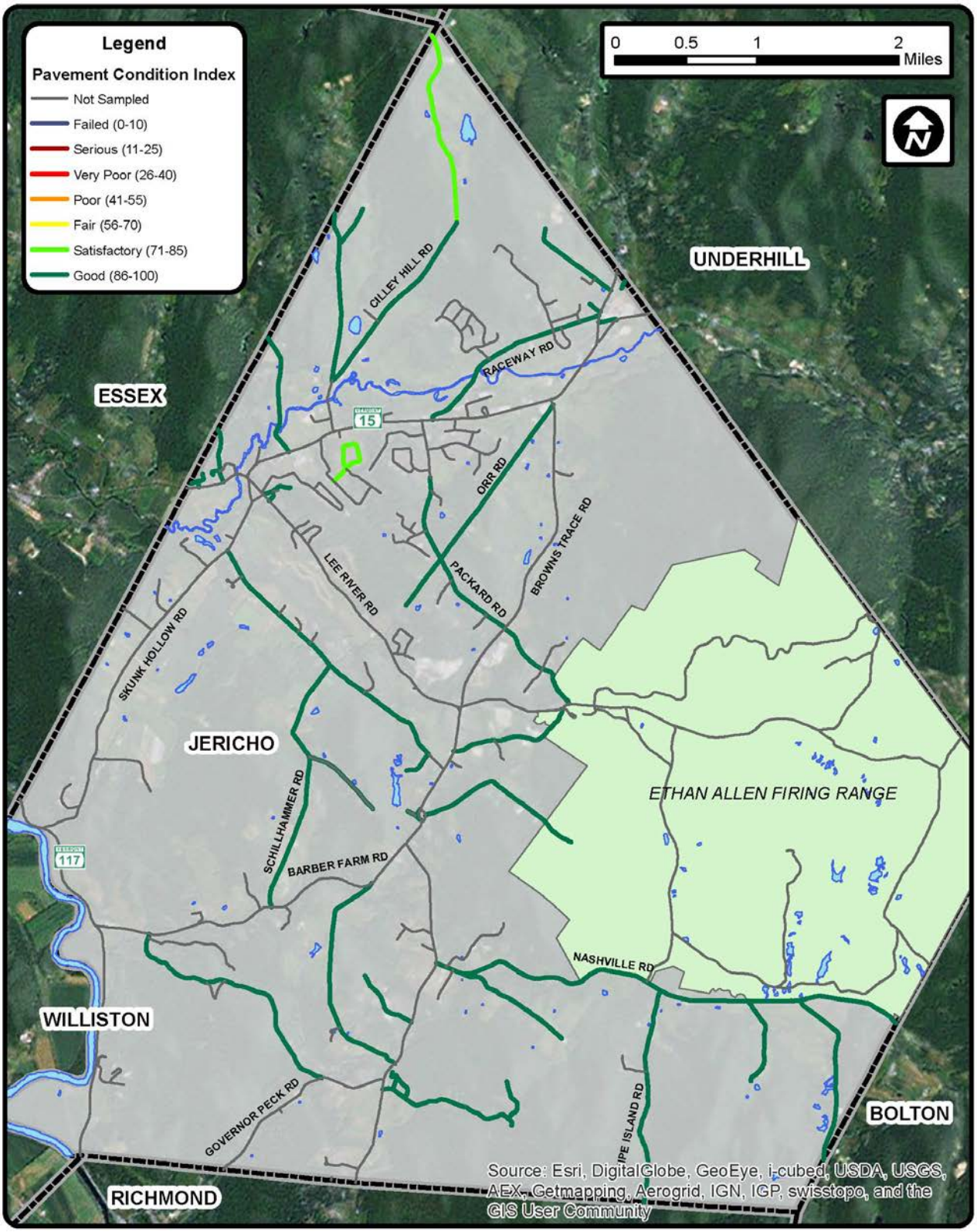
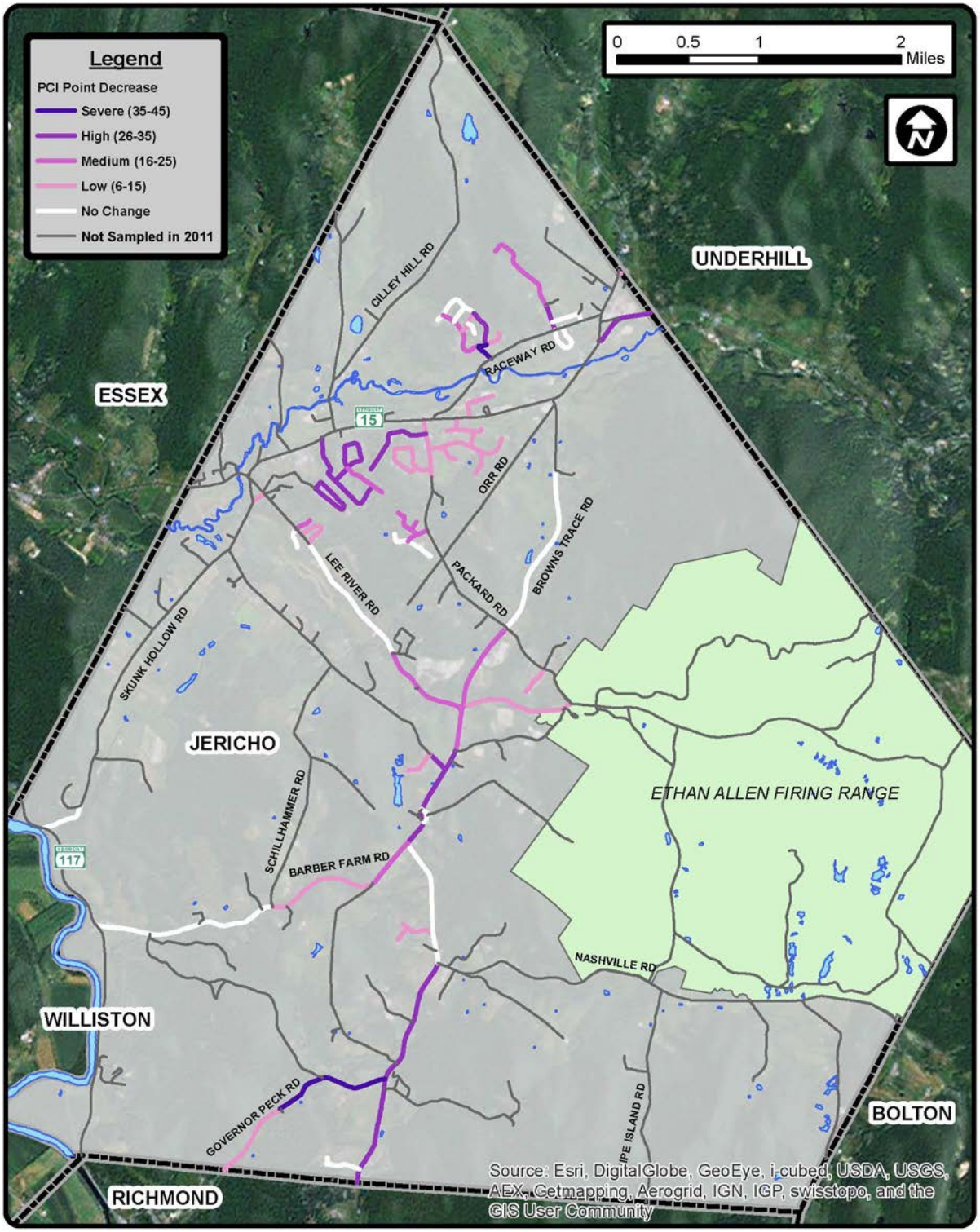


Figure 3-8 shows roadways that have deteriorated from 2011 to 2014 (i.e., a decrease in PCI). Each category represents a 10-point increment. Any roadway with a decrease (or increase) of 5 or fewer points is indicated as "no change."

**FIGURE 3-8: PAVEMENT DETERIORATION, 2011-2014**



Two roadways experienced "severe" deterioration (a decreased PCI score of 34-45) since 2011: Foothills Drive (off Raceway Road near Ridge Road) and Governor Peck Road (from Browns Trace Road to Forestry Road). Foothills Drive had a PCI score of 78 in 2011 and a 2014 PCI score of 34. Governor Peck Road was repaved in 2011, which would give it a PCI score of 100, but it has since deteriorated to a PCI score of 62.

Roadways that experienced "high" deterioration (PCI decrease of 26-35) include:

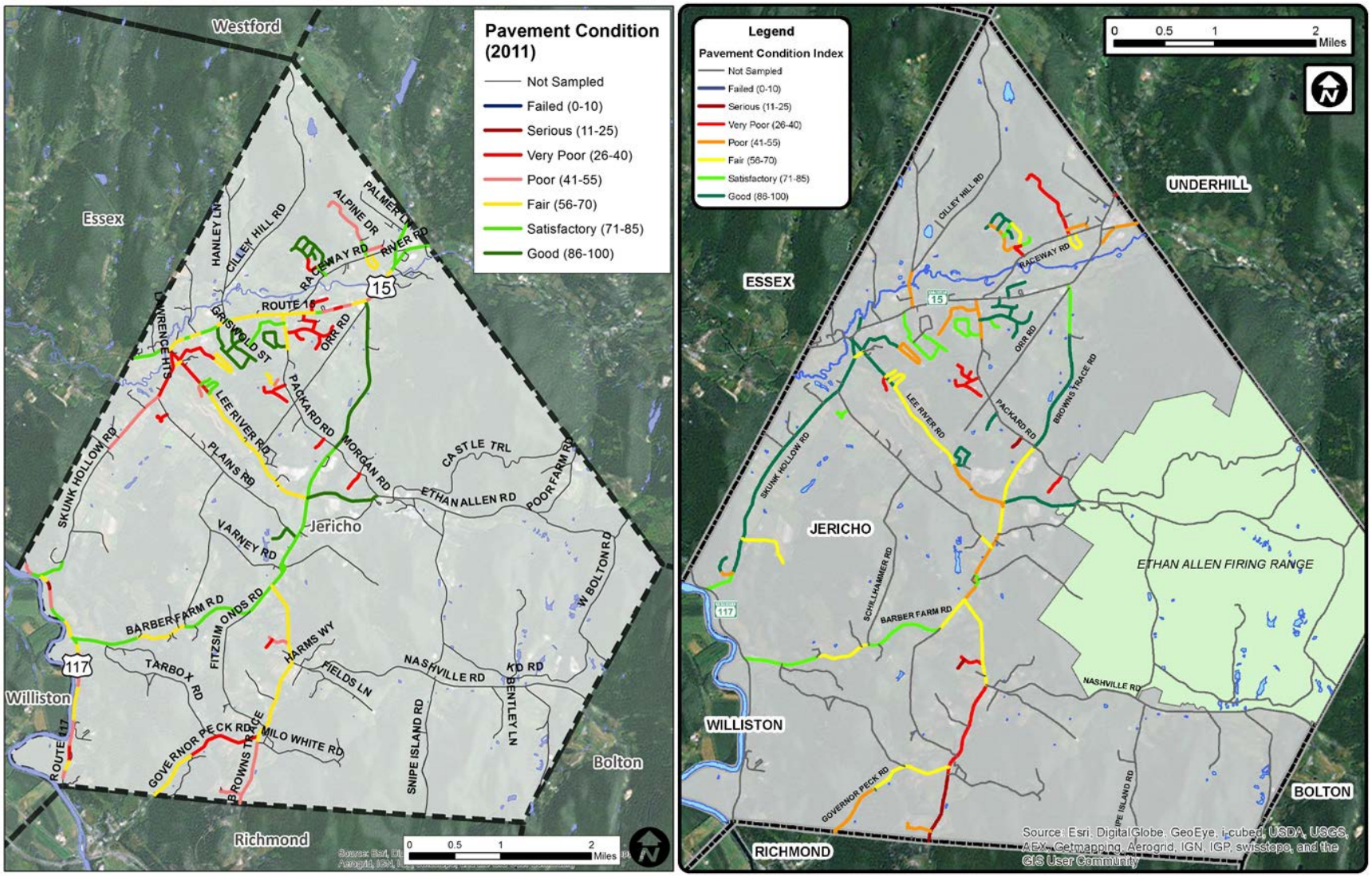
- Browns Trace Road from town line to Milo White Road
- Browns Trace Road from Milo White Road to Nashville Road
- Browns Trace Road from Barber Farm Road to Pratt Road
- Sunnyview Drive (end of road loop)
- Pinehurst Drive from Packard Road to end of pavement
- Snowflake Drive from Griswold Street to Snowflake Drive
- Foothills Drive from Ridge Road to West View Drive
- Griswold Street from VT 15 to Ross Lane
- River Road from VT 15 to town line
- Plains Road from Browns Trace Road to end of pavement
- Willow Lane from Raceway Road to Xenophon Drive

Some sections of roadways greatly improved their PCI score due to resurfacing since 2011, which is not symbolized on the map:

- Sunnyview Drive
- Lee River Road
- Plains Road
- Skunk Hollow Road
- Autumn Court
- Kristen Lane
- South Main Street
- North Main Street

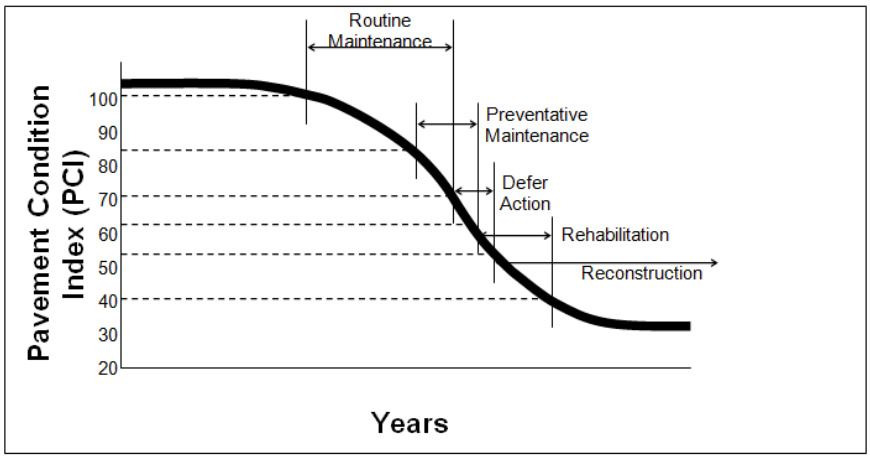
Figure 3-9 is a side-by-side comparison of the pavement condition index for 2011 and 2014 conditions.

**FIGURE 3-9: PAVEMENT CONDITION INDEX, 2011 AND 2014**



There is a greater return on investment for maintaining roads through routine maintenance rather than focusing resources on those roadways in the worst condition. Figure 3-10 presents the types of maintenance and improvement strategies that provide the highest return on investment for a given pavement condition index.

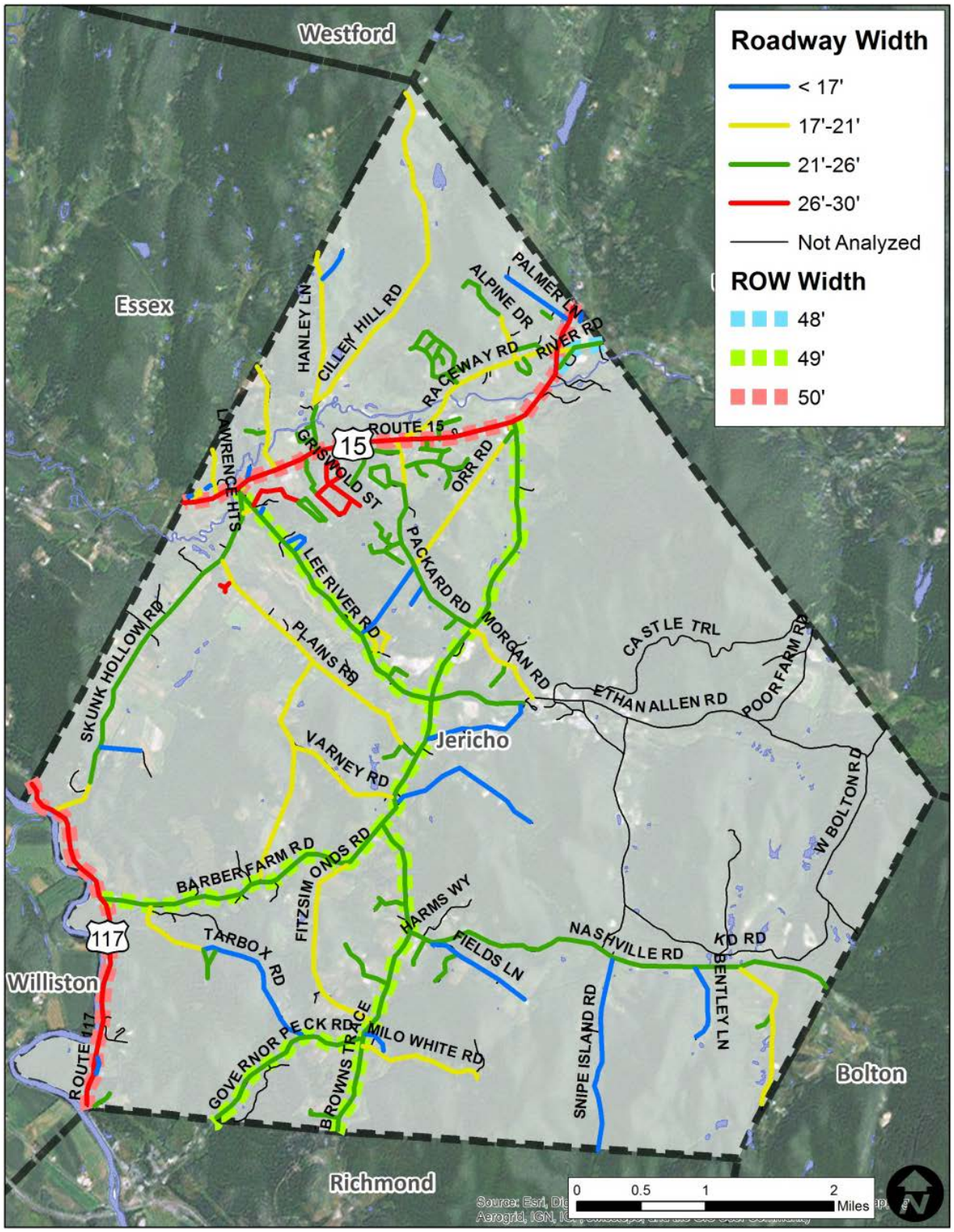
**FIGURE 3-10: PAVEMENT CONDITION INDEX**




Appendix G is a Pavement Management Systems (PMS) analysis from RSG staff that describes a recommended five-year paving plan based on the Town's PCI data. The fundamental concept behind current state of the practice in PMS analysis is that it is less expensive to maintain a good road in good condition over time than it is to repair a poor road once it has begun to fail. A PMS system that prioritizes maintenance of good roads first and reconstructs poor roads as funds allow ultimately results in a roadway network that is in a better state of repair and costs less money to maintain over time. This memo will assist the Town in prioritizing funding for roadway maintenance to maximize benefits in a cost-effective manner.

The pavement condition survey also provided an inventory of roadway and shoulder widths for all town-maintained roadways. As seen in Figure 3-11, primary roadways within the Town of Jericho vary in width from 22 to 24 feet from pavement edge to pavement edge. For the most part, shoulder widths are less than one-foot wide. State Highways VT 15 and VT 117 are typically 28-feet wide from pavement edge to pavement edge, often with one- to two-foot wide shoulders. Some stretches of VT 15 have been upgraded to provide approximately three-foot wide shoulders. Right-of-way (ROW) widths, which range from 48 to 50 feet, are also shown for Minor Arterials, Major Collectors, and Minor Collectors.

**FIGURE 3-11: ROADWAY AND RIGHT-OF-WAY (ROW) WIDTHS**



### PAVING OPTIONS

As traffic volumes continue to increase, the decision to pave a gravel roadway will become an increasingly debated topic. While there is an abundance of guidance available from a number of research institutions throughout the country, there are no set established rules for volume levels that dictate when roads should be paved.[3] Instead, the decision to pave rests more with expectations of convenience and usability. According to the Jericho Town Plan, surveys conducted in 1988 and 2000 showed that the majority of residents were opposed to wide scale paving efforts and widening of existing facilities in fear of promoting increased vehicle speeds. The guidance provided by the Vermont Local Roads Program does suggest, however, that a threshold of 500 AADT be used to determine when a roadway should be considered for paving, but also mentions that roadways with much higher AADT can work well as non-paved gravel facilities.

Under existing traffic conditions, Nashville Road exceeds the 500 AADT threshold for gravel roads. Other local roads including Raceway Road, Packard Road, Orr Road, and Plains Road all have volumes approaching or marginally exceeding the 500 AADT threshold set by the Vermont Local Roads Program.

The Town Plan also states in Goal 9.3 that if a roadway is to be altered, including paving improvements, the road shall not:

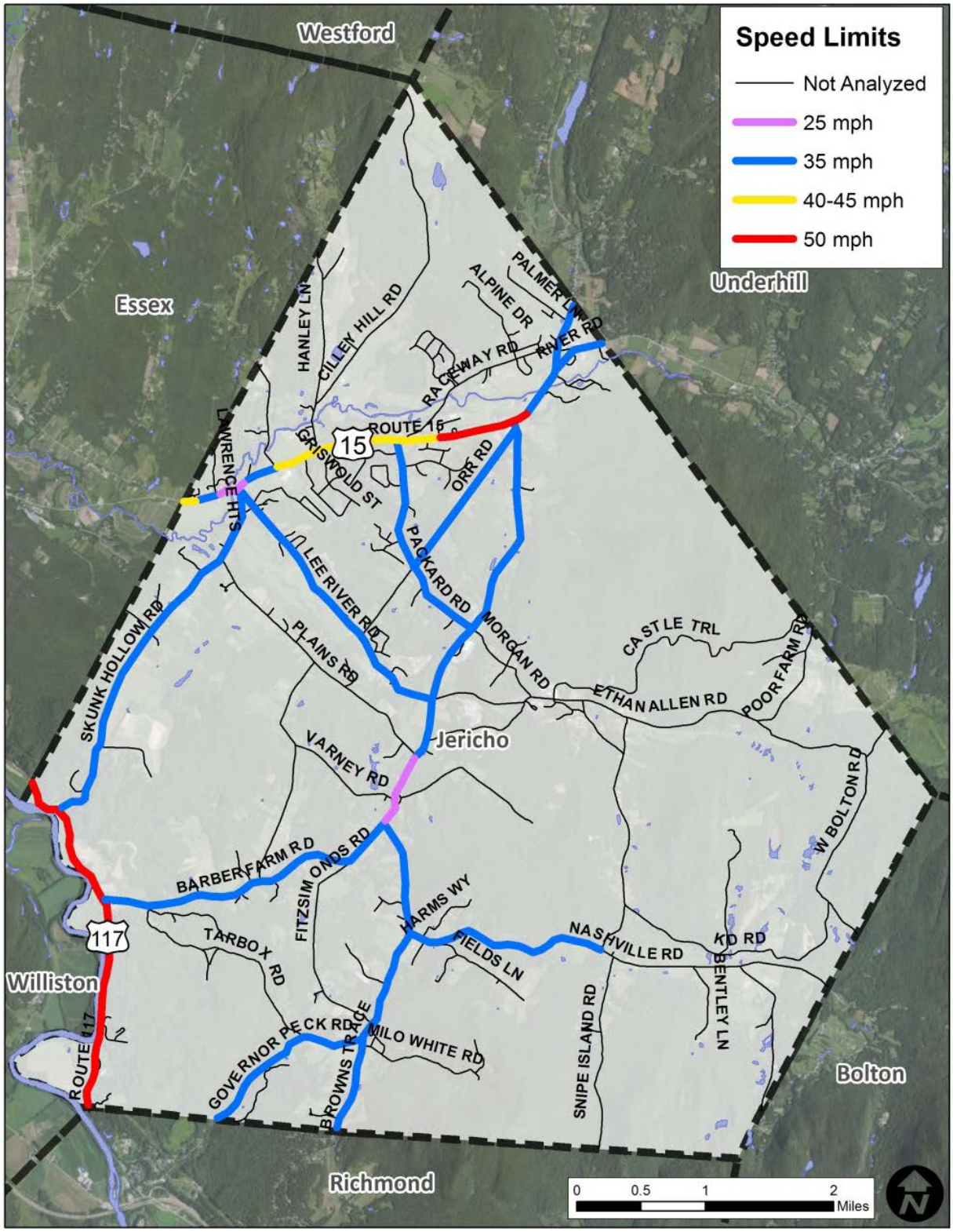
- Degrade aesthetics of the area;
- Degrade the safety of alternative transportation including pedestrian and bicycle traffic;
- Increase vehicle speed; and
- Increase through traffic volume.

## 3.6 | POSTED SPEED LIMITS

The speed limits within the Town of Jericho are between 25 and 50 miles per hour (mph). State Highways VT 15 and VT 117 have the highest speed limits in the town with 50 mph zones. The posted speed limit on VT 15 varies widely through the town with the lowest speed being 25 mph through Jericho Corners and 35 mph through Riverside. VT 117 maintains a 50-mph limit for the entire stretch in Jericho, though around the corner at Barber Farm Road a 40-mph advisory speed limit is posted. Posted speed on the remaining town highways is 35 mph except for a segment of Browns Trace Road through the village area of Jericho Center, which has a speed limit of 25 mph. The Class 2 roadways of Nashville Road (gravel) and Skunk Hollow Road also have a speed limit of 35 mph. Figure 3-12 displays the speed limits found along the roadways investigated.

[3] *When to Pave a Gravel Road*, Fact Sheet T-110, Vermont Local Roads Program

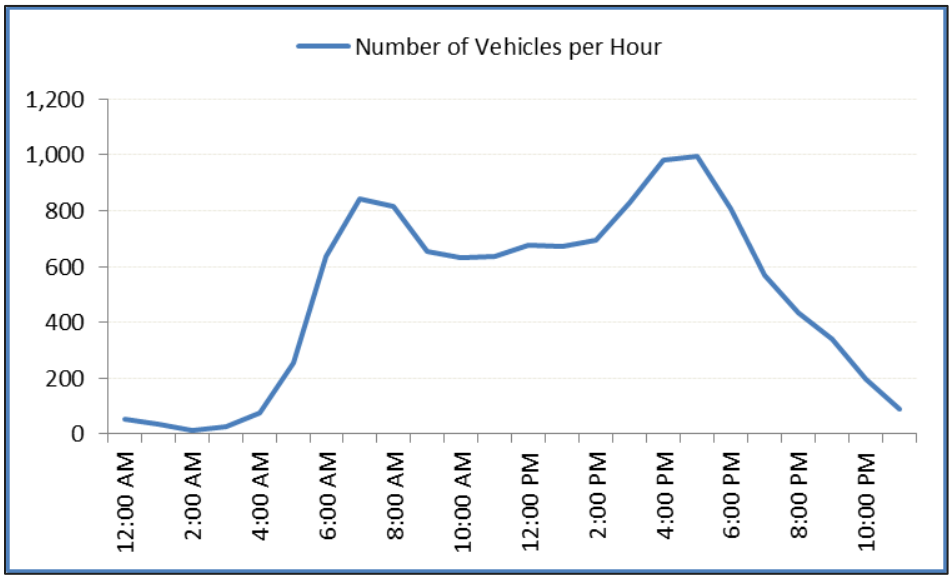
**FIGURE 3-12: POSTED SPEED LIMITS**



## 3.7 | TRAVEL CHARACTERISTICS

Existing travel patterns found throughout the Town of Jericho demonstrate that a significant number of vehicles pass through to other communities within Chittenden County. This flow of commuter travel creates significant peaking of traffic during the AM and PM peak hours, as shown in Figure 3-13. The hourly volumes were recorded on VT 15 north of Lee River Road in 2011 and are meant to be representative of the relative variation of traffic found throughout the Town.

**FIGURE 3-13: HOURLY TRAFFIC VOLUMES ON VT 15**




### JOURNEY TO WORK

The residents of Jericho work in a number of towns within Chittenden County, but also other locations inside and outside of Vermont. The majority of commuters work within Chittenden County in Burlington and Essex. The third largest destination of employment is the Town of Jericho itself. Table 3-2 shows the locations of employment for the residents of Jericho. This information has been obtained as part of the US Census Bureau's 2010 Census.

**TABLE 3-2: JOURNEY TO WORK DATA**

| Place of Work | Employed Persons Living in Jericho | % of Total |
|---|---|---|
| ***Chittenden County*** | ***2,560*** | ***90.7*** |
| Bolton Town | 9 | 0.3 |
| Buels Gore | 0 | |
| Burlington City | 611 | 21.7 |
| Charlotte Town | 0 | |
| Colchester Town | 126 | 4.5 |
| Essex Town | 539 | 19.1 |
| Hinesburg Town | 3 | 0.1 |
| Huntington Town | 0 | |
| Jericho Town | 427 | 15.1 |
| Milton Town | 17 | 0.6 |
| Richmond Town | 45 | 1.6 |
| St. George Town | 0 | |
| Shelburne Town | 22 | 0.8 |
| South Burlington City | 390 | 13.8 |
| Underhill Town | 51 | 1.8 |
| Westford Town | 5 | 0.2 |
| Williston Town | 283 | 10.0 |
| Winooski City | 32 | 1.1 |
| | | |
| ***Addison County*** | ***11*** | ***0.4*** |
| ***Franklin County*** | ***22*** | ***0.8*** |
| ***Lamoille County*** | ***50*** | ***1.8*** |
| ***Washington County*** | ***85*** | ***3.0*** |
| ***Rest of VT*** | ***45*** | ***1.6*** |
| ***Other*** | ***48*** | ***1.7*** |
| **Total** | **2,821** | **100.0** |

Source: 2006-2010 5-year ACS County-to-County Worker Flows

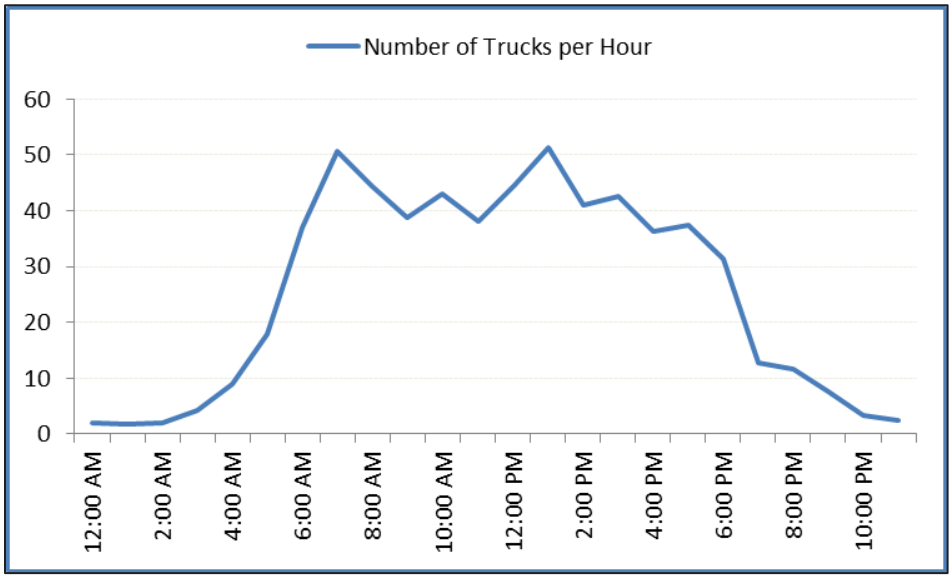
Compared to the journey-to-work data cited in the *2004 Jericho Transportation Study* the total number of employed persons living in Jericho has increased by 2.6 percent, and the share of employed persons living in Jericho traveling beyond Chittenden County for employment increased by 2.6 percent, meaning that Jericho residents are generally traveling farther from home for their jobs.

## TRUCK TRAVEL

The minor arterials of VT 15 and VT 117 provide the most direct route for through traffic in Jericho. These state routes carry significant amounts of truck traffic, which can negatively impact traffic operations for other vehicles and alternative modes of travel. A Heavy Truck is a defined as a single tractor-trailer truck with 3 or more axles or a multi-trailer truck with 5 or more axles (FHWA Vehicle Classes 8-13).

As shown in Figure 3-14 truck traffic on VT 15 (north of Lee River Road) peaks in the morning between 7:00 and 8:00 a.m. (same as the peak for all vehicles), and during the afternoon between 1:00 and 2:00 p.m. During the afternoon peak, truck volumes account for approximately 7.6 percent of all traffic on the road.

**FIGURE 3-14: HOURLY HEAVY TRUCK VOLUMES ON VT 15**




## 3.8 | TRAFFIC VOLUMES

A key input to measuring roadway conditions is the traffic volumes through intersections and along road segments. Using data obtained from the CCRPC and VTrans, volumes were established for the study network shown in Figure 1-1. These counts were adjusted to the design hour volume (DHV) for 2015. The design hour volume is defined as the 30th highest hour of traffic over the course of the year and is, as its name implies, used for the analysis and design of highway facilities.

The adjustment factors were developed using traffic data from VTrans continuous count stations which collect traffic volumes 24 hours per day, 365 days of the year. A second adjustment accounts for increases in near term background traffic stemming from general regional growth between the year the count was conducted and 2015.

### INTERSECTIONS

Intersection control throughout the roadway network relies solely on stop and yield signs. There are currently no traffic signals or roundabouts in the town, although VTrans is planning to install a traffic signal at the intersection of VT 15 and Browns Trace Road beginning in Fiscal Year 2016.

Table 3-3 describes the type of intersection control and operation at each of the study intersections. The major roadway is listed first and the minor roadway second.

**TABLE 3-3: STUDY INTERSECTION GEOMETRIES**

| Intersection | Control Type | Separate Turn Lanes on Minor Roadway |
|---|---|---|
| VT 15 / Lee River Road | 1-Way Stop/Yield | Yes |
| VT 15 / Cilley Hill Road | 1-Way Stop | No |
| VT 15 / Packard Road | 1-Way Stop | No |
| VT 15 / Browns Trace Road | 1-Way Stop | No |
| VT 15 / River Road | 1-Way Stop | Yes |
| Browns Trace Road / Lee River Road | 2-Way Stop | Yes |
| Browns Trace Road / Barber Farm Road | 1-Way Stop/Yield | Yes |
| Browns Trace Road / Nashville Road | 1-Way Stop | No |
| Browns Trace Road / Governor Peck Road | 1-Way Stop | Yes |
| VT 117 / Skunk Hollow Road | 1-Way Stop | Yes |
| VT 117 / Barber Farm Road | 1-Way Stop | No |
| Skunk Hollow Road / Plains Road | 3-Way Stop | No |

The 12 study intersections were analyzed for year 2015 conditions for capacity and level of service. Using the Highway Capacity Manual methodology for unsignalized intersections, several measures of effectiveness were recorded to reflect near-term conditions.

Level of Service (LOS) is the standard measure used to quantify the operational performance of intersections and road segments as perceived by the driver. The grades A, B, C, D, E and F are the five possible LOS ratings. An LOS A indicates that the facility is operating exceptionally well with free flow, while an LOS F indicates that demand exceeds capacity. There is no consensus of what LOS is acceptable, thus most agencies develop their own criteria reflecting their own individual needs.

The VTrans policy on level of service is:

- LOS C is desirable for rural facilities;
- LOS D is desirable for urban facilities; and
- LOS E or F may be permitted in an urban setting if the remedy, such as adding new lanes, would significantly impact the surrounding natural or built environment.

Level of service for both signalized and stop-controlled intersections is measured in terms of average delay per vehicle and has been calculated according to chapters 16 and 17 of the 2000 Highway Capacity Manual (HCM). The delay, referred to as control delay, includes the time required to slow down when approaching an intersection, the time a vehicle is stopped, the time required for a line of vehicles (the queue) to move up to the intersection, and the time required to accelerate. Table 4-7: Unsignalized Intersection LOS and Delay 3-4 presents the relationship between LOS and control delay. As stated previously no traffic signals currently exist in Jericho.

**TABLE 3-4: UNSIGNALIZED INTERSECTION LEVEL OF SERVICE (LOS) AND DELAY**

| LOS | Characteristics | Seconds of Delay |
|---|---|---|
| A | Little or no delay | < 10 |
| B | Short delays | > 10 and < 20 |
| C | Average delays | > 20 and < 35 |
| D | Long delays | > 35 and < 55 |
| E | Very long delays | > 55 and < 80 |
| F | Extreme delays | > 80 |

Table 3-5 presents the existing (2015) LOS and delay for the 12 study intersections. The results are broken down by movement so that those movements that are causing significant delay can be identified and addressed. As indicated in the results, all movements operate at LOS C or better in the morning (AM) and afternoon (PM) peak hours except for the following:

- VT 15/River Road: left turns from River Road onto westbound VT 15 (AM and PM Peaks, LOS F)

Compared to the *2004 Jericho Transportation Study*, which projected 2015 conditions as part of the future conditions analysis, the intersection operating conditions are generally better than previously projected. The one exception is the failing intersection of VT 15 and River Road, which the *2004 Jericho Transportation Study* also projected to fail in 2015. Notably, traffic conditions did not deteriorate to the extent previously projected at the following two locations:

- VT 15/Lee River Road: projected LOS F for left turn onto VT 15 from Lee River Road for both AM and PM peaks; actual is LOS C
- VT 15/Browns Trace Road: projected LOS F for left turn onto VT 15 from Browns Trace Road during the PM peak; actual is LOS C

**TABLE 3-5: STUDY INTERSECTION LOS AND DELAY RESULTS – 2015**

| | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|
| | LOS | Delay (sec) | Volume/ Capacity | LOS | Delay (sec) | Volume/ Capacity |
| **VT 15 / Lee River Rd** | | | | | | |
| EB, VT15 | A | 0 | 0.16 | A | 0 | 0.46 |
| WB, VT15 | A | 2 | 0.06 | A | 2 | 0.07 |
| NB, Lee River Rd | C | 16 | 0.23 | C | 25 | 0.43 |
| **VT 15 / Cilley Hill Rd** | | | | | | |
| EB, VT15 | A | 1 | 0.02 | A | 1 | 0.03 |
| WB, VT15 | A | 0 | 0.53 | A | 0 | 0.25 |
| SB, Cilley Hill Rd | C | 19 | 0.16 | C | 17 | 0.1 |
| **VT 15 / Packard Rd** | | | | | | |
| EB, VT15 | A | 0 | 0.15 | A | 0 | 0.42 |
| WB, VT15 | A | 0 | 0.01 | A | 1 | 0.04 |
| NB, Packard Rd | C | 20 | 0.33 | C | 19 | 0.12 |
| **VT 15 / Browns Trace Rd** | | | | | | |
| EB, VT15 | A | 0 | 0.16 | A | 0 | 0.37 |
| WB, VT15 | A | 6 | 0.3 | A | 3 | 0.11 |
| NB, Browns Trace Rd | C | 22 | 0.4 | C | 24 | 0.53 |
| **VT 15 / River Rd** | | | | | | |
| EB, VT15 | A | 1 | 0.02 | A | 1 | 0.05 |
| WB, VT15 | A | 1 | 0.03 | A | 0 | 0.01 |
| NB, River Rd | F | 595 | 1.27 | F | 66 | 0.66 |
| **Browns Trace Rd / Lee River Rd** | | | | | | |
| EB, Lee River Rd | C | 23 | 0.32 | B | 11 | 0.06 |
| WB, Ethan Allen Rd | C | 19 | 0.04 | B | 12 | 0.07 |
| NB, Browns Trace Rd | A | 2 | 0.04 | A | 1 | 0.02 |
| SB, Browns Trace Rd | A | 0 | 0.01 | A | 0 | 0.00 |

| | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|
| | LOS | Delay (sec) | Volume/ Capacity | LOS | Delay (sec) | Volume/ Capacity |
| **Browns Trace Rd / Barber Farm Rd** | | | | | | |
| EB, Barber Farm Rd | C | 16 | 0.19 | B | 12 | 0.16 |
| NB, Browns Trace Rd | A | 1 | 0.03 | A | 0 | 0.01 |
| SB, Browns Trace Rd | A | 0 | 0.29 | A | 0 | 0.14 |
| **Browns Trace Rd / Nashville Rd** | | | | | | |
| WB, Nashville Rd | B | 13 | 0.2 | B | 11 | 0.09 |
| NB, Browns Trace Rd | A | 0 | 0.15 | A | 0 | 0.16 |
| SB, Browns Trace Rd | A | 0 | 0.01 | A | 3 | 0.04 |
| **Browns Trace Rd / Governor Peck Rd** | | | | | | |
| EB, Governor Peck Rd | B | 12 | 0.12 | B | 12 | 0.29 |
| NB, Browns Trace Rd | A | 1 | 0.02 | A | 1 | 0.01 |
| SB, Browns Trace Rd | A | 0 | 0.2 | A | 0 | 0.09 |
| **VT 117 / Skunk Hollow Rd** | | | | | | |
| WB, Skunk Hollow Rd | B | 12 | 0.28 | B | 13 | 0.09 |
| NB, VT117 | A | 0 | 0.16 | A | 0 | 0.18 |
| SB, VT117 | A | 1 | 0.02 | A | 4 | 0.13 |
| **VT 117 / Barber Farm Rd** | | | | | | |
| WB, Barber Farm Rd | C | 16 | 0.46 | B | 14 | 0.18 |
| NB, VT117 | A | 0 | 0.15 | A | 0 | 0.23 |
| SB, VT117 | A | 1 | 0.03 | A | 3 | 0.08 |
| **Skunk Hollow Rd / Plains Rd*** | | | | | | |
| Overall | A | 8 | - | A | 8 | - |
| WB, Plains Rd | A | 8 | - | A | 7 | - |
| NB, Skunk Hollow Rd | A | 8 | - | A | 8 | - |
| SB, Plains Rd | A | 8 | - | A | 8 | - |

* Note: HCM 2000 methodology does not provide V/C ratios for all-way stop-controlled intersections.

## ROADWAY SEGMENTS

Year 2015 Average Annual Daily Traffic (AADT) volumes were developed using the CCRPC and VTrans count data for the roadway network. The current AADT counts were projected using VTrans growth factors to represent near term year 2015 volumes. Figure 3-15 and Table 3-6 display the study segments and the associated 2015 AADT. The highest AADT in Jericho occurs on VT 15, where traffic ranges from approximately 7,000 vehicles per day near the Underhill town line to nearly 12,000 vehicles per day near the Essex town line.

**FIGURE 3-15: 2015 ANNUAL AVERAGE DAILY TRAFFIC (AADT)**

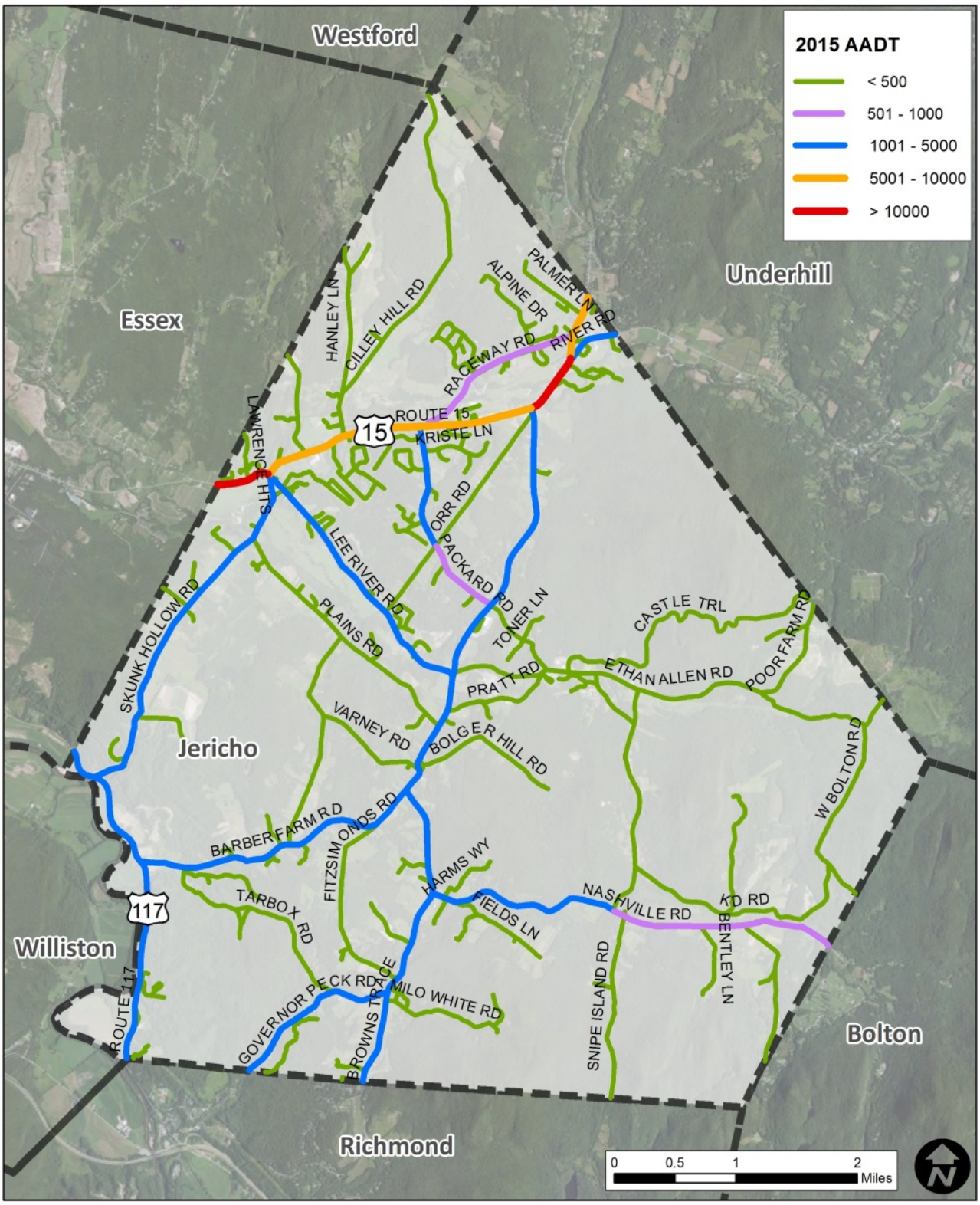


**TABLE 3-6: 2015 AADT FOR SELECTED ROADWAY SEGMENTS**

| Roadway Segment | AADT |
|---|---|
| **VT 15** | |
| Essex Town Line to Lee River Rd | 11,750 |
| Lee River Rd to Browns Trace Rd | 9,100 |
| Browns Trace Rd to River Rd | 10,400 |
| River Rd to Underhill Town Line | 7,050 |
| **VT 117** | |
| Essex Town Line to Barber Farm Rd | 5,000 |
| Barber Farm Rd to Richmond Town Line | 4,600 |
| **Browns Trace Rd** | |
| Richmond Town Line to Nashville Rd | 3,900 |
| Nashville Rd to Barber Farm Rd | 3,900 |
| Barber Farm Rd to Lee River Rd | 4,100 |
| Lee River Rd to Packard Rd | 3,500 |
| Packard Rd to VT 15 | 3,100 |
| **Governor Peck Rd** | |
| Richmond Town Line to Tarbox Rd | 2,500 |
| Tarbox Rd to Browns Trace Rd | 3,300 |
| **Lee River Rd** | |
| Browns Trace Rd to Owens St/Buxton Ln | 1,600 |
| Owens St/Buxton Ln to VT 15 | 3,900 |
| **Packard Rd** | |
| VT 15 to Orr Rd | 1,650 |
| Orr Rd to Browns Trace Rd | 700 |
| **Nashville Rd** | |
| Browns Trace Rd to Snipe Island Rd | 1,250 |
| Snipe Island Rd to Bolton Town Line | 650 |
| **River Rd** from VT 15 to Underhill Town Line | 3,300 |
| **Barber Farm Rd** | 1,750 |
| **Skunk Hollow Rd** | 1,900 |
| **Raceway Rd** | 600 |

* Note: AADT < 500 is not reported

## 3.9 | BICYCLE AND PEDESTRIAN NETWORK

This section provides a summary of existing pedestrian and bicycle facilities in the Town of Jericho. For additional detail on design standards and typical cross sections, please refer to the *2015 Jericho Bicycle and Pedestrian Facility Master Plan*.

The Town of Jericho has made a commitment to provide support for alternative transportation modes of travel, as stated in the Town Plan. The *CCRPC Regional Pedestrian/Bicycle Plan* (2008) mentions several changes that are in the planning stages for the Town including creating an off-road shared-use path running parallel to VT 15, and establishing an extensive on-road bicycle network. Existing and proposed bicycle and pedestrian facilities are shown in Figure 3-16 and described below.

### PEDESTRIAN FACILITIES

The existing pedestrian network in Jericho consists of 1.33 miles of slab-based concrete sidewalks and 0.94 miles of asphalt sidewalks. Pedestrian facilities are concentrated in the Town's three villages (Jericho Corners, Jericho Center, and Riverside), in addition to an informal network of paths connecting Jericho Elementary School to surrounding neighborhoods. There are also recreational trail networks concentrated at Mobbs Farm

and Mills Park. There are no existing paved multi-use off-road facilities located within the town, although one is proposed that would generally follow VT 15 and continue west to Essex and east to Underhill.

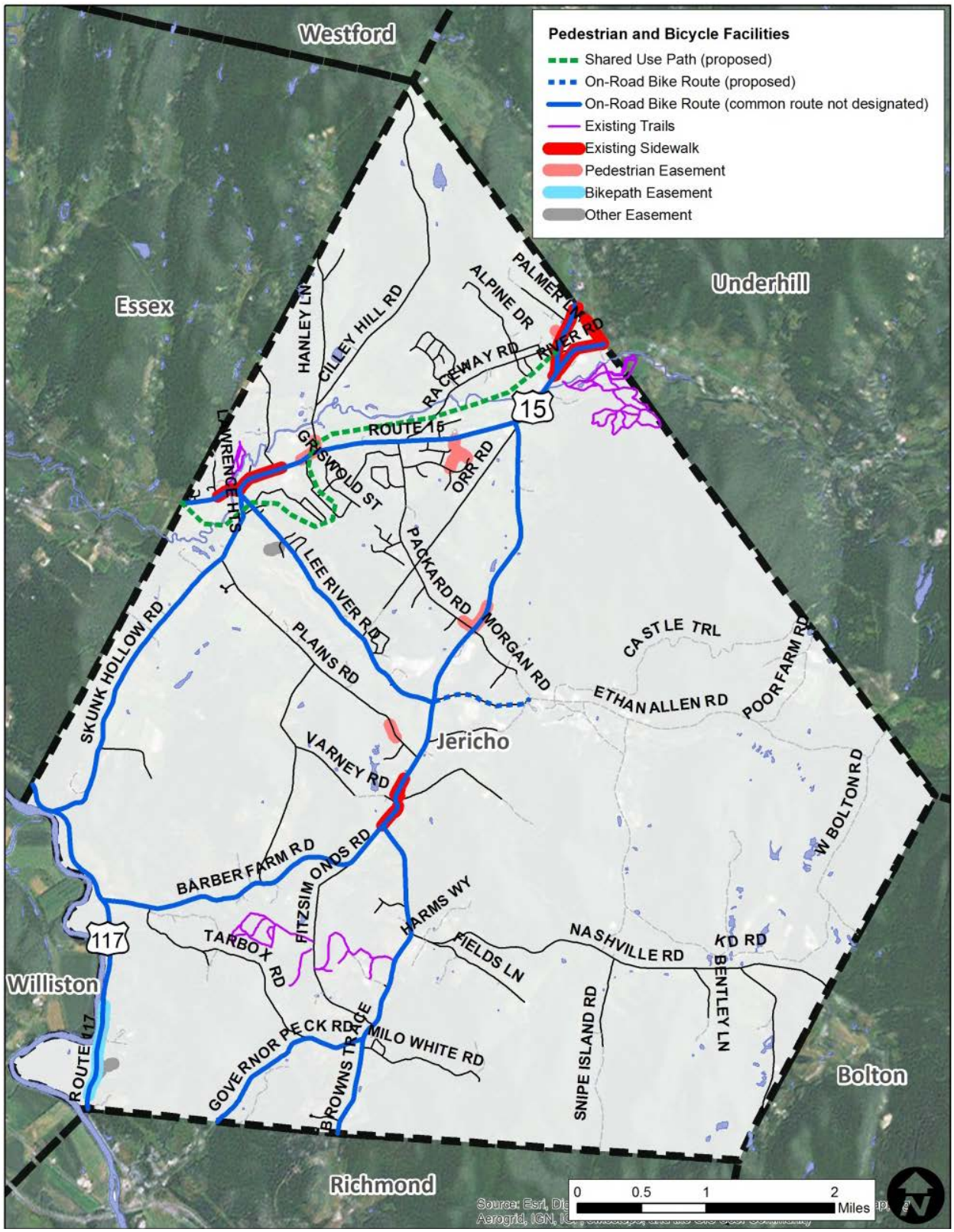
In 2014 CCRPC staff conducted a sidewalk inventory and analysis to determine the condition of the existing sidewalk infrastructure. Overall, Jericho's sidewalks are in "good" condition, with a few segments in Riverside and Jericho Corners rated in "fair" condition. For a complete description of the inventory process and results, please refer to the *2015 Jericho Bicycle and Pedestrian Facility Master Plan*.

### BICYCLE FACILITIES

State Highways VT 15 and VT 117 and all Class 2 Town Highways in the Town of Jericho have been identified in the CCRPC's *Regional Pedestrian/Bicycle Plan* as recommended on-road bicycle routes. None of these facilities currently meet the design criteria established for such use[4].

[4] *Vermont Pedestrian and Bicycle Facility Planning and Design Manual* (VTrans, 2002); *Vermont State Standards for the Design of Transportation Construction, Reconstruction, and Rehabilitation of Freeways, Roads, and Street* (VTrans, 1997)

**FIGURE 3-16: PEDESTRIAN AND BICYCLE FACILITIES – EXISTING AND PROPOSED**



## 3.10 | TRANSIT SERVICE AND PARK-AND-RIDE FACILITIES

The nearest formal park-and-ride sites are located to the west in Essex near the intersection of VT 15 and VT 128 and to the south in Richmond at Exit 11 (I-89). Several potential sites were evaluated in the *Jericho Park-and-Ride Feasibility Study and Alternatives Evaluation* (2012) and the development of a site in Jericho is a top CCRPC scoping priority. The site will feature pedestrian and bicycle linkages and will capture Underhill, Jericho, and Lamoille County travelers.

The Chittenden County Transportation Authority (CCTA) began operating transit service in the Town of Jericho on October 14, 2013. The Jeffersonville Commuter travels between Jeffersonville and Burlington along VT 15 with stops in Jericho Corners (at the post office) and in Riverside (at Dickinson Street). Service consists of two weekday trips corresponding with the morning and afternoon commute peaks. Parking is available at the Riverside stop location where a park and ride has been established by agreement between CCTA and the property owner. Both locations are connected to sidewalks for pedestrian access; bicyclists must use on-road, shared facilities.

## 3.11 | SAFETY ANALYSIS

The last five years of crash data for the Town of Jericho was requested from VTrans in order to evaluate the number, type, and contributing factors of crashes. For the 2008-2012 period, there were a total of 128 reported crashes involving 65 injuries and one fatality. The fatality occurred along Lee River Road south of Jericho Corners, between Lafayette Drive and Skyview Drive in January 2008. The top two crash types involved either a single vehicle (33 percent) or rear-end collisions (27 percent). The top five contributing factors were:[5]

- Failure to keep in proper lane (30 percent);
- Driving too fast for conditions (21 percent);
- Followed too closely (20 percent);
- Inattention (19 percent); and
- Failed to yield right-of-way (17 percent).

### HIGH-CRASH LOCATIONS

High crash locations (HCLs) are road segments or intersections where the number of crashes are greater than five per year or the rate of crashes exceeds a critical ratio (measured in accidents per million vehicles) known as the critical rate. High crash locations are based on VTrans criteria because of the consistency across the state in reporting and analysis methodologies. HCLs in Jericho are depicted in Figure 3-17.

As shown in the figure, there are no high-crash intersections in Jericho, which is consistent with the findings of the *2004 Jericho Transportation Study*, which reviewed crash data for the 1997-2001 period. However, the absence of identified High Crash Intersections does not necessarily mean that no safety concerns exist, as this information only pertains to crashes that have been recorded and documented, and does not include near-misses or undocumented crashes.

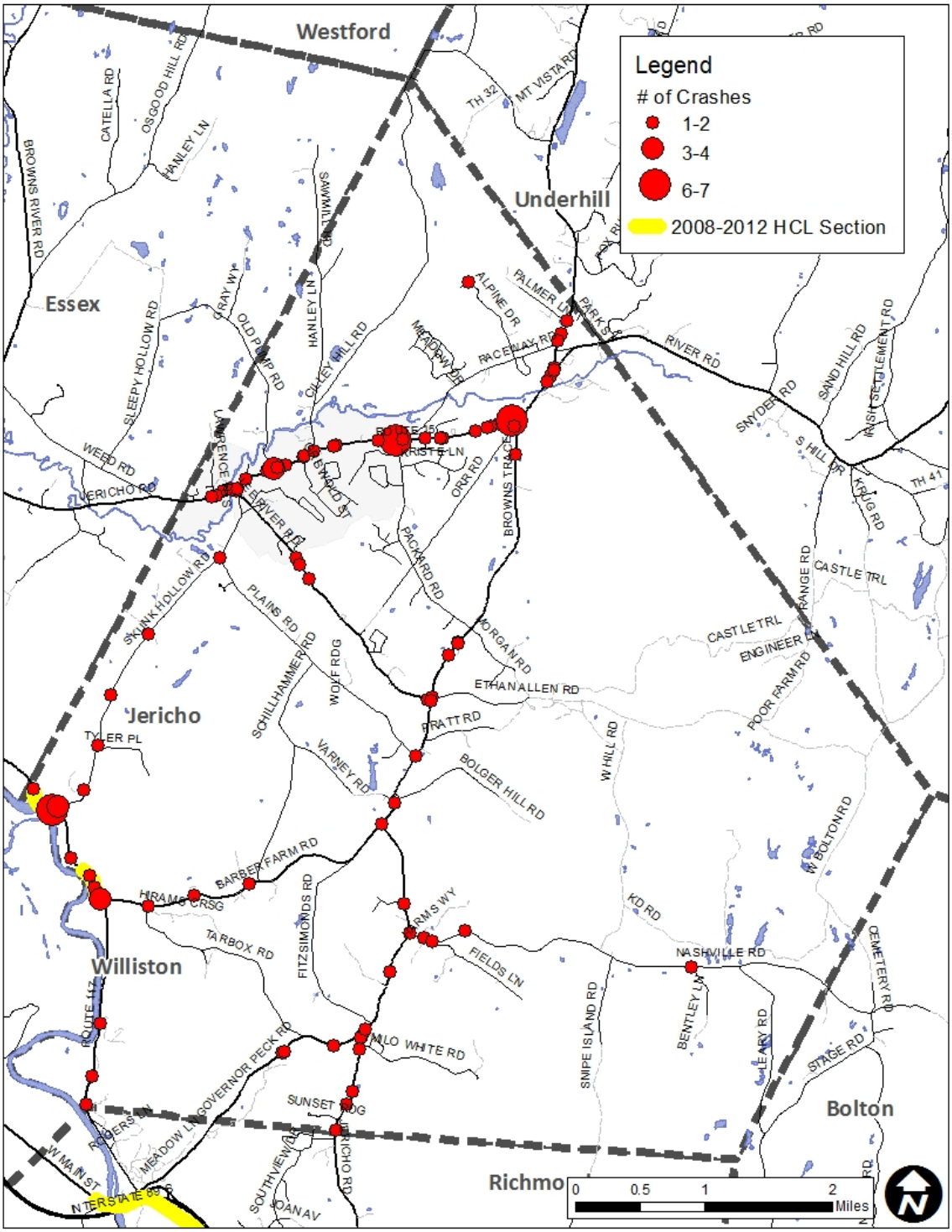
Two high-crash segments were identified:

- VT 117 near Skunk Hollow Road
- VT 117 near Barber Farm Road

[5] Some crashes have more than one contributing factor.

These two segments were not identified as high-crash segments in the *2004 Jericho Transportation Study*. See future conditions discussion and recommendations on pages 42-44 for more on these HCL locations.

**FIGURE 3-17: HIGH CRASH LOCATIONS AND SECTIONS 2008-2012**



# 4.0 FUTURE CONDITIONS

This section of the report outlines expectations for future development and consequently future traffic conditions. A summary of comments and concerns from the first public meeting is provided in Appendix A.

## 4.1 | FUTURE DEVELOPMENT EXPECTATIONS

Growth in **housing** units in Jericho has been highly variable in the recent past, generally following economic conditions. Housing growth averaged about 18 units per year from the mid 90's to the mid 00's, decreased from 2009-2011, but rebounded to 12 units in 2013. Using the findings of the *Town of Jericho Build-Out Analysis and Timescope*[6] future housing growth is expected, on average, to be 12 units per year.

With input from the Town planning staff, future **commercial** development was determined by assessing reasonable expected development of open or underutilized parcels in the commercially zoned districts by completing a parcel-by-parcel analysis following current zoning rules. A maximum total of 225,000 square feet of retail, office or light manufacturing space resulted. It was then assumed that 30% of the total potential development would be built in this transportation study's timeframe (20 years).

In addition to the general growth assumptions mentioned above, reasonable projections for the **Riverside Development** proposed on the Villeneuve property on the north side of Dickinson Street, which is currently in the planning, permitting and design process, was assumed to be completed by 2035.

## 4.2 | NEW TRIP GENERATION FROM EXPECTED DEVELOPMENTS

Table 4-1 shows the number of **housing** units built in each zoning district since 1990, and resulting rate of growth per year. Future growth was rebalanced between districts to more accurately reflect current trends. The bottom of this table shows the resulting trips generated by this growth in each district.

**TABLE 4-1: RESIDENTIAL GROWTH, RESULTING TRIPS BY ZONING DISTRICT & TOTAL**

| | Zoning District | | | | | | |
|---|---|---|---|---|---|---|---|
| | **AG** | **COM** | **FOR** | **RR** | **VCTR** | **VIL** | TOTAL |
| New Housing Units since 1990 | 107 | 15 | 8 | 82 | 91 | 113 | 416 |
| growth rate: units / year | 4.7 | 0.7 | 0.3 | 3.6 | 4.0 | 4.9 | 18 |
| expected future growth rate | 4.7 | 0.7 | 0.3 | 3.6 | 1.5 | 1.4 | 12 |

| | **AG** | **COM** | **FOR** | **RR** | **VCTR** | **VIL** | TOTAL |
|---|---|---|---|---|---|---|---|
| portion | 38% | 5% | 3% | 29% | 12% | 12% | 100% |
| Housing Units | 92 | 13 | 7 | 70 | 30 | 28 | 240 |

| | trips per unit | **AG** | **COM** | **FOR** | **RR** | **VCTR** | **VIL** | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Trips PM | 0.8 | 74 | 10 | 5 | 56 | 24 | 23 | 192 |
| Trips AM | 0.65 | 60 | 8 | 4 | 46 | 19 | 18 | 156 |

**Commercial** development is expected largely in the commercially zoned districts, including the planned Riverside Development area. Peak hour trip estimation was based on ITE[7] trip estimates for each type of commercial land use, as Table 4-2 details.

[6] March2013 CCRPC
[7] Trip Generation, Institute of Transportation Engineers, 9th Edition

**TABLE 4-2: AVERAGE TRIP RATES* BY COMMERCIAL LAND USE**

| | Average AM Peak Trip Rates | Average PM Peak Trip Rates |
|---|---|---|
| retail | 3 | 4 |
| office | 2 | 2 |
| light manufacture | 1 | 1 |

**vehicle trips per 1,000 s. f. of new building space*

Table 4-3 shows the peak hour trips estimated due to expected future commercial development, summed for the maximum total potential development ("Total Trips"), and estimated at 30% of development for the 2035 planning year ("30% in 20 years").

**TABLE 4-3: TRIPS GENERATED BY FUTURE COMMERCIAL DEVELOPMENT**

| | AM Peak | PM Peak | AM in | AM out | PM in | PM out |
|---|---|---|---|---|---|---|
| retail | 334 | 445 | 50% | 50% | 50% | 50% |
| office | 153 | 153 | 88% | 12% | 17% | 83% |
| light manufacture | 35 | 35 | 90% | 10% | 30% | 70% |
| Total Trips | 521 | 633 | 61% | 39% | 39% | 61% |
| **30% in 20 yrs** | **156** | **190** | **96** | **60** | **74** | **116** |

Table 4-4 shows the peak hour trips estimated for the Riverside Development. These assumptions were derived from the Dickinson Street Scoping Report[8]. Note that while that report had specific development components that are likely to change as those plans progress, the magnitude of the development (and expected trips) appears reasonable.

**TABLE 4-4: PEAK HOUR TRIPS FROM THE PROPOSED RIVERSIDE DEVELEOPMENT**

| Peak Hour | In | Out | Total |
|---|---|---|---|
| AM | 142 | 185 | 327 |
| PM | 265 | 228 | 493 |

Table 4-5 summarizes all of the total expected future development vehicle trips assumed for the future conditions traffic analysis.

**TABLE 4-5: TOTAL FUTURE DEVELOPMENT TRIPS**

| | Peak Hour | Enter | Exit | Total |
|---|---|---|---|---|
| housing | AM | 41 | 115 | 156 |
| | PM | 123 | 69 | 192 |
| Riverside | AM | 142 | 185 | 327 |
| | PM | 265 | 228 | 493 |
| commercial | AM | 96 | 60 | 156 |
| | PM | 74 | 116 | 190 |
| | TOTAL | 740 | 774 | 1514 |

[8] 2011 CCRPC

For analysis purposes these trips were determined to have origin/destination points at a location central to each zoning district (or parcel, in the case of Riverside), and trips were then distributed throughout the network based on these points (see Appendix B for additional details). Expected future intersection performance is discussed in Section 4.5.

## 4.3 | RESULTING TRAFFIC GROWTH EXPECTATIONS

For the purpose of determining growth expectations, the analysis in this report relies on the housing and employment growth detailed in sections 4.1 and 4.2. A summary of resulting future AADT (average annual daily traffic) along various roadways throughout the Town is presented in Table 4-6.

**TABLE 4-6: EXPECTED CHANGE IN TRAFFIC VOLUMES (AADT) DUE TO DEVELOPMENT**

| Roadway Segment | 2015 | 2035 | change |
|---|---|---|---|
| **VT 15** | | | |
| Essex Town Line to Lee River Rd | 11,750 | 14,957 | 27% |
| Lee River Rd to Browns Trace Rd | 9,100 | 12,133 | 33% |
| Browns Trace Rd to River Rd | 10,400 | 13,532 | 30% |
| River Rd to Underhill Town Line | 7,050 | 8,944 | 27% |
| **VT 117** | | | |
| Essex Town Line to Barber Farm Rd | 5,000 | 5,513 | 10% |
| Barber Farm Rd to Richmond Town Line | 4,600 | 5,271 | 15% |
| **Browns Trace Rd** | | | |
| Richmond Town Line to Nashville Rd | 3,900 | 4,619 | 18% |
| Nashville Rd to Barber Farm Rd | 3,900 | 4,685 | 20% |
| Barber Farm Rd to Lee River Rd | 4,100 | 4,946 | 21% |
| Lee River Rd to Packard Rd | 3,500 | 4,358 | 25% |
| Packard Rd to VT 15 | 3,100 | 3,860 | 25% |
| **Governor Peck Rd** | | | |
| Richmond Town Line to Tarbox Rd | 2,500 | 2,738 | 10% |
| Tarbox Rd to Browns Trace Rd | 3,300 | 3,614 | 10% |
| **Lee River Rd** | | | |
| Browns Trace Rd to Owens St/Buxton Ln | 1,600 | 1,600 | 0% |
| Owens St/Buxton Ln to VT 15 | 3,900 | 4,639 | 19% |
| **Packard Rd** | | | |
| VT 15 to Orr Rd | 1,650 | 1,885 | 14% |
| Orr Rd to Browns Trace Rd | 700 | 800 | 14% |
| **Nashville Rd** | | | |
| Browns Trace Rd to Snipe Island Rd | 1,250 | 1,506 | 21% |
| Snipe Island Rd to Bolton Town Line | 650 | 783 | 21% |
| **River Rd** from VT 15 to Underhill Town Line | 3,300 | 4,431 | 34% |
| **Barber Farm Rd** | 1,750 | 2,002 | 14% |
| **Skunk Hollow Rd** | 1,900 | 2,499 | 32% |
| **Raceway Rd** | 600 | 698 | 16% |

## 4.4 | OTHER MODES

### WALKING

Increases in pedestrian traffic tend to follow the construction of newer, better, and safer facilities. New facilities are most likely placed where short trips, which are attractive to walkers, are likely, for example where housing is concentrated, or near commercial or institutional land uses (stores restaurants, schools, offices, etc.). New sidewalk facilities in Jericho are currently planned in the Village Center, in the Riverside development, and as extensions of other existing facilities. Wider road shoulders throughout the Town have the benefit of making bicycling safer and more attractive, as well as serving infrequent pedestrian traffic in less dense areas.

### BICYCLE TRAVEL

The expected increase in vehicular traffic on Jericho's local roads with sub-standard (narrow) shoulders will make bicycle travel less safe and less desirable as a means of transportation. This situation will be most critical on Lee River Road and Browns Trace Road. Both are commonly used as bicycle routes and are projected to have an average increase in vehicle traffic of 20-30% during the twenty-year planning horizon.

Please see the *Jericho Bicycle and Pedestrian Facility Master Plan* for a more thorough analysis of walking and biking in the Town of Jericho.

## 4.5 | LEVEL OF SERVICE ANALYSIS

Level of Service (LOS) is the standard measure used to quantify the operational performance of intersections and road segments as perceived by the driver. Please refer to Section 3-7 for a detailed explanation of LOS, as well as VTrans LOS Policy. Table 4-7, repeated from that section, presents the relationship between LOS and control delay. No traffic signals currently exist in Jericho.

**TABLE 4-7: UNSIGNALIZED INTERSECTION LOS AND DELAY**

| LOS | Characteristics | Seconds of Delay |
|---|---|---|
| A | Little or no delay | < 10 |
| B | Short delays | > 10 and < 20 |
| C | Average delays | > 20 and < 35 |
| D | Long delays | > 35 and < 55 |
| E | Very long delays | > 55 and < 80 |
| F | Extreme delays | > 80 |

Note that roadways in Jericho are classified as rural. In addition, VTrans LOS policy notes that unsignalized intersections with sideline volumes less than 100 vehicles per hour (or 150 for 2 lane approaches) should be judged by the volume / capacity ratio (v/c). A v/c ratio of less than 1.0 indicates there is still capacity for more traffic, although delays could be long.

Future traffic growth expectations discussed in Section 4-3 were added to existing traffic and analyzed at the 12 study intersections for future traffic performance. Results from this analysis are shown in Table 4-8. Intersection approaches with Levels of Service E, or worse, have been highlighted in blue. For a comparison to performance under existing conditions, please see Table 3-5 in Section 3.

**TABLE 4-8: ESTIMATED FUTURE CONGESTION SUMMARY FOR STUDY INTERSECTIONS**

| Intersection | 2035 AM LOS | 2035 AM Delay | 2035 AM v/c | 2035 PM LOS | 2035 PM Delay | 2035 PM v/c |
|---|---|---|---|---|---|---|
| **VT-15/ River Road** | | | | | | |
| EB, along VT-15 | B | 10 | 0.03 | A | 8 | 0.06 |
| WB, along VT-15 | A | 8 | 0.03 | B | 11 | 0.01 |
| NB Left, from River Road | F | >100 | 1.75 | F | >100 | 1.24 |
| NB Right, from River Road | A | 10 | 0.00 | C | 16 | 0.02 |
| **VT-15/ Browns Trace Road** | | | | | | |
| EB, along VT-15 | - | - | - | - | - | - |
| WB, along VT-15 | A | 10 | 0.37 | B | 11 | 0.18 |
| NB, from Browns Trace Road | F | 92 | 0.83 | F | >100 | 1.02 |
| **VT-15/ Packard Road** | | | | | | |
| EB, along VT-15 | - | - | - | - | - | - |
| WB, along VT-15 | A | 8 | 0.02 | B | 10 | 0.06 |
| NB, from Packard Road | E | 40 | 0.60 | D | 32 | 0.24 |
| **VT-15/ Cilley Hill Road** | | | | | | |
| EB, along VT-15 | B | 11 | 0.02 | A | 9 | 0.04 |
| WB, along VT-15 | - | - | - | - | - | - |
| SB, from Cilley Hill Road | D | 27 | 0.27 | D | 28 | 0.21 |
| **VT-15/ Lee River Road** | | | | | | |
| EB, along VT-15 | - | - | - | - | - | - |
| WB, along VT-15 | A | 8 | 0.09 | B | 11 | 0.12 |
| NB Left, from Lee River Road | E | 40 | 0.43 | F | >100 | 0.81 |
| NB Right, from Lee River Road | B | 11 | 0.10 | E | 38 | 0.69 |
| **Skunk Hollow Road/ Plains Road** | | | | | | |
| WB,along Plains Road | A | 8 | 0.05 | A | 8 | 0.04 |
| NB, from Skunk Hollow Road | A | 8 | 0.08 | A | 9 | 0.29 |
| SB, along Plains Road | A | 9 | 0.26 | A | 8 | 0.13 |
| **VT-117/ Skunk Hollow Road** | | | | | | |
| WB, from Skunk Hollow Road | B | 13 | 0.32 | C | 15 | 0.16 |
| NB, along VT-117 | - | - | - | - | - | - |
| SB, along VT-117 | A | 8 | 0.02 | A | 9 | 0.15 |
| **VT-117/ Barber Farm Road** | | | | | | |
| WB, from Barber Farm Road | C | 19 | 0.52 | C | 17 | 0.23 |
| NB, along VT-117 | - | - | - | - | - | - |
| SB, along VT-117 | A | 8 | 0.03 | A | 9 | 0.09 |
| **Browns Trace Road/ Lee River Road/ Ethan Allen Road** | | | | | | |
| EB, from Lee River Road | D | 26 | 0.32 | B | 14 | 0.07 |
| WB, from Ethan Allen Road | C | 18 | 0.03 | B | 12 | 0.07 |
| NB, along Browns Trace Road | A | <1 | - | A | <1 | - |
| SB, along Browns Trace Road | C | 22 | 0.72 | B | 11 | 0.24 |
| **Browns Trace Road/ Barber Farm Road** | | | | | | |
| EB Left, from Barber Farm Road | C | 19 | 0.23 | B | 14 | 0.21 |
| EB Right from Barber Farm Road | B | 11 | 0.01 | A | 10 | 0.03 |
| NB, along Browns Trace Road | A | 9 | 0.03 | A | 8 | 0.01 |
| SB, along Browns Trace Road | - | - | - | - | - | - |
| **Browns Trace Road/ Nashville Road** | | | | | | |
| WB, from Nashville Road | B | 14 | 0.24 | B | 12 | 0.13 |
| NB, along Browns Trace Road | - | - | - | - | - | - |
| SB, along Browns Trace Road | A | 8 | 0.01 | A | 8 | 0.05 |
| **Browns Trace Road/ Governor Peck Road** | | | | | | |
| EB, from Governor Peck Road | B | 13 | 0.14 | B | 13 | 0.34 |
| NB, along Browns Trace Road | A | 8 | 0.02 | A | 8 | 0.01 |
| SB, along Browns Trace Road | - | - | - | - | - | - |

## 4.6 | DEFICIENCIES AND POTENTIAL IMPROVEMENTS

This section outlines the various congestion and safety issues identified, along with potential solutions and adjoining property impacts from these improvements.

### INTERSECTION CONGESTION ISSUES:

Expected congestion issues under future conditions highlighted in Table 4-8, and their potential remedies, are summarized as follows:

1. **VT 15/ River Road:** This intersection exhibits excessive delay (LOS F) for the River Road approach in both the existing and future condition. As recommended in the Dickinson Street Scoping Report, a traffic signal would improve the delay, resulting in an overall Level of Service of B/C in the AM/PM Peak hour (2035). No additional lanes would be required, however ancillary features such as signal poles and power connections may require small easements from abutting property owners.
2. **VT 15/ Packard Road:** The Packard Road approach delay at this location is expected to fall in LOS E in the AM peak hour, and the sideline volume is 150 vehicles. Since the v/c ratio is well below 1.0 (at 0.60) a second lane on this approach may be warranted in the future. This widening would likely impact slightly the Town-owned property on the southeast corner.
3. **VT 15/ Brown's Trace:** This intersection exhibits excessive delay (LOS F) for the River Road approach in the future condition. A traffic signal is likely[9] warranted, and would improve the delay, resulting in an overall Level of Service of A/B in the AM/PM Peak hour (2035). No road widening would be necessary in this case, however the additional signal equipment may fall outside of the right of way. Shoulder widening to conform to state standards may also impact the property to the north.
4. **VT 15/ Lee River Road:** This intersection exhibits excessive delay (LOS F) for the Lee River Road approach in the future condition. A traffic signal with a westbound left turn lane are likely warranted, and would greatly decrease the delay, resulting in an overall Level of Service of B/B in the AM/PM Peak hour (2035).

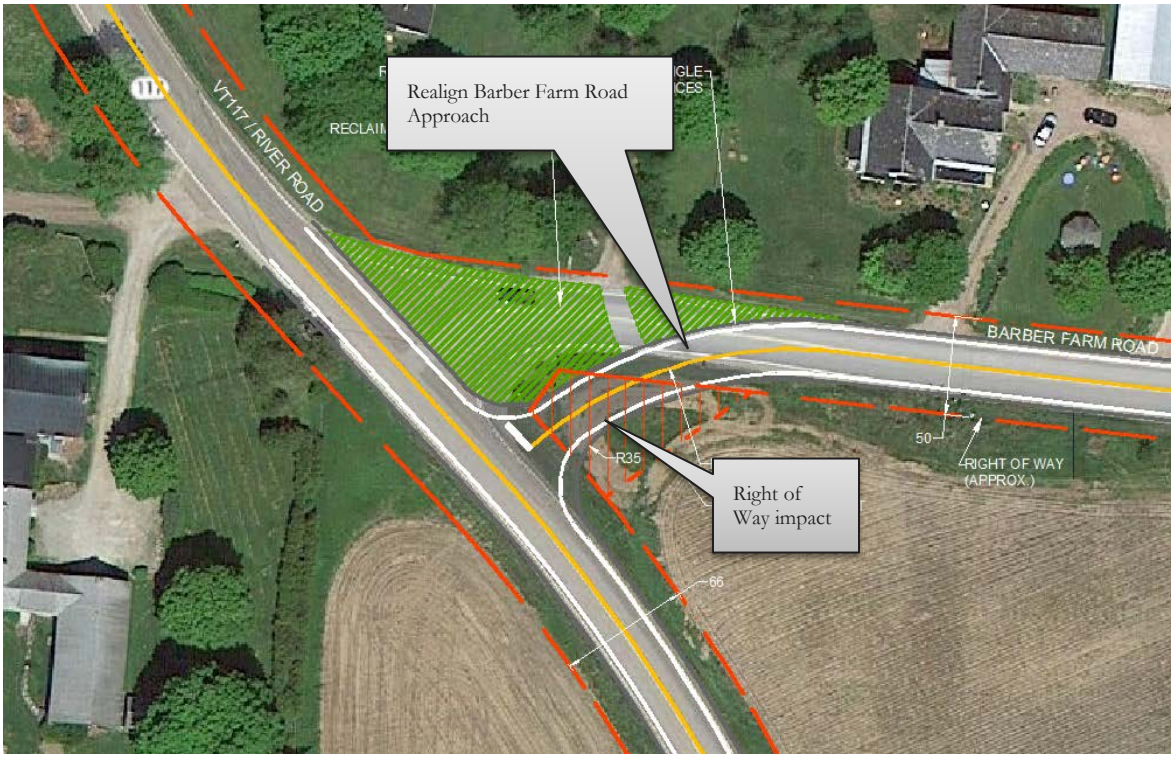
### SAFETY ISSUES - HIGH CRASH LOCATIONS (HCL)

The following road segments have been identified by VTrans as High Crash Locations[10], as noted in Section 3-10. A discussion of the crash types and potential remedies for each is as follows:

5. **VT 117 Segment[11] adjacent to Barber Farm Road**. Of the 8 crashes experienced over 5 years, 2 were attributed to "failure to yield" which is indicative of poor sight distances, and 3 were attributed to "failure to stay in lane" while turning, also indicative of poor sight distances and poor alignment. On review, the curving nature of VT 117 leads to poor sight distance from the north approach, and the sharp skew angle of the side road are likely mitigating causes and should be remedied. Figure 4-1 shows a preferred conceptual alignment. In addition, a southbound left turn lane on VT 117 may be warranted here.

[9] Traffic signal warrants require a 12 hour traffic counts. A full warrant analysis is beyond the scope of this report.
[10] 2008 - 2012
[11] Mile marker 0.869 to 1.169. HCL#442.

**FIGURE 4-1: REALIGNMENT AT BARBER FARM ROAD / VT 117 INTERSECTION***

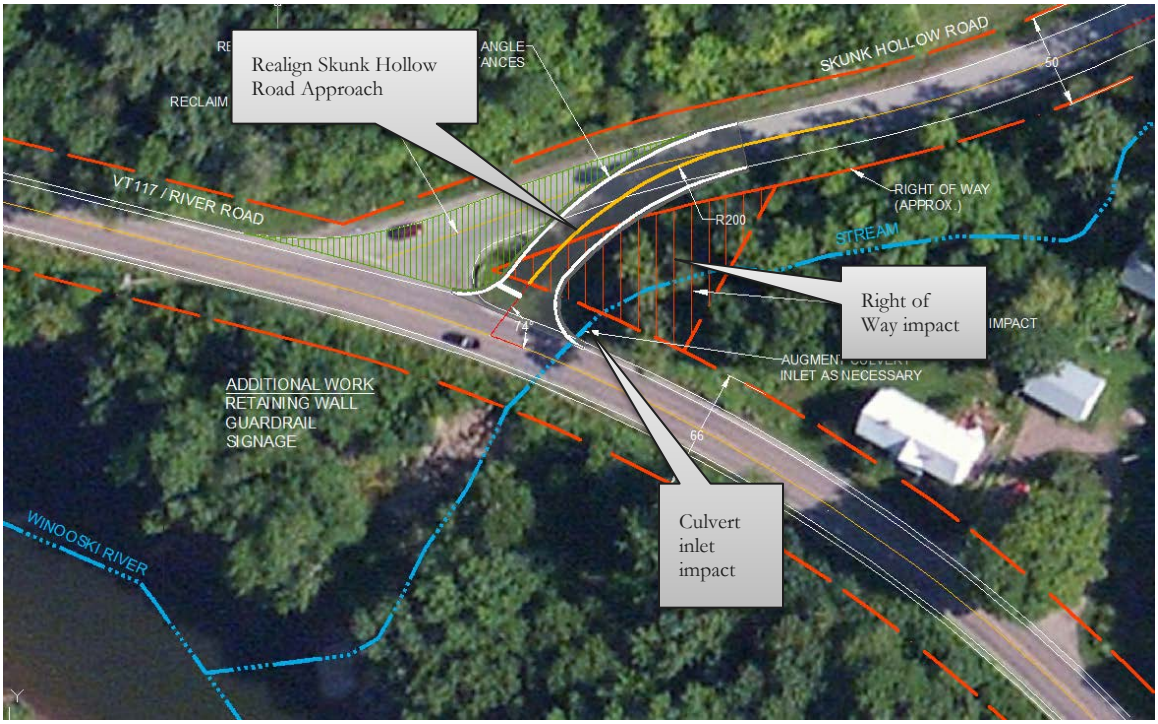



*for more detail please see larger scale version in Appendix D

6. **VT 117 Segment[12] adjacent to Skunk Hollow Road**. Of the 8 crashes experienced over 5 years, 4 were attributed to "failure to yield" which is indicative of poor sight distances, and 3 were attributed to "failure to stay in lane" while turning, also indicative of poor sight distances and poor alignment. On review, the sharp skew angle of the side road is a likely cause and should be remedied. Figure 4-2 shows a preferred conceptual alignment. In addition, a southbound left turn lane on VT 117 may be warranted here.

[12] Mile marker 0.069 to 0.369 HCL#451.

**FIGURE 4-2: REALIGNMENT AT SKUNK HOLLOW / VT 117 INTERSECTION***




*for more detail please see larger scale version in Appendix D

## OTHER SAFETY ISSUES:

RSG revisited safety issues detailed in the 2008 VTrans Road Safety Audit Review of Brown's Trace from Bolger Hill to Lee River Road (see Section 2.10) and relevant findings include:

7. Finding: The operation of the Lee River Road intersection is unusual, stopping the higher volume roadway (southbound Browns Trace). Potential remedies for this intersection are outlined in Figure 4-3 (conventional 2-way stop , 4-legged intersection) and Figure 4-4 (conventional single lane roundabout). Both of these solutions would improve predictability and safety at this location.

**FIGURE 4-3: POTENTIAL REMEDY #1: 4-WAY REALIGNMENT**

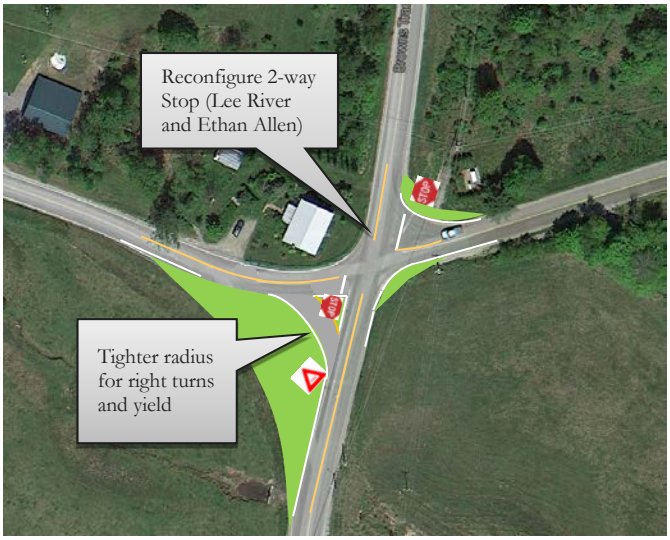
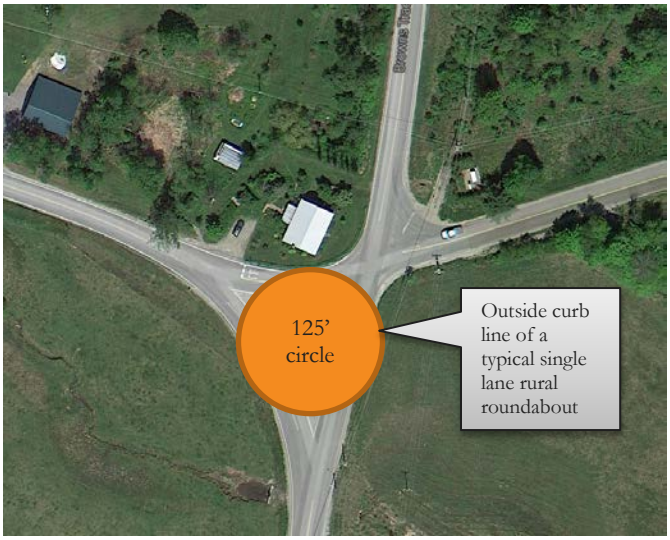



**FIGURE 4-4: POTENTIAL REMEDY #2: LONG TERM - SINGLE LANE ROUNDABOUT**




## SUMMARY OF DEFICIENCIES AND RIGHTS-OF-WAY IMPACTS

Improvement recommendations are summarized in Table 4-9. Multiple recommendations are shown for some locations, which should be considered complementary. Adding turn lanes increases safety by removing turning traffic from the main stream of traffic, however their impacts and costs can be substantial. In particular, the turn lanes recommended at Lee River / VT 15, and Skunk Hollow / VT 117 are likely to have complications beyond the scope of this report. A scoping study for each location is needed to determine potential alternatives and any associated impacts. Appendix E presents preliminary auxiliary turn lane warrants.

**TABLE 4-9: SUMMARY OF POTENTIAL INTERSECTION IMPROVEMENTS**

| | Location | Deficiency | Alternative | Existing or Future | Properties Impacted |
|---|---|---|---|---|---|
| 1 | VT 15/ River Rd. | Congestion | traffic signal | Existing | TBD (slight) |
| 2 | VT 15 / Packard Road | Congestion | Add lane on side road | Future | 1 |
| 3 | VT 15/ Brown's Trace | Congestion | traffic signal | Future | TBD (0-2) |
| 4 | VT 15/ Lee River Road | Congestion | traffic signal | Future | TBD (2-3) |
| | | | left turn lane | Existing | TBD (3-5) |
| 5 | Skunk Hollow / VT117 | HCL (safety) | realignment | Existing | 1 |
| | | | left turn lane | Existing | TBD (0-2) |
| 6 | Barber Farm / VT117 | HCL (safety) | realignment | Existing | 1 |
| | | | left turn lane | Existing | TBD (0-2) |
| 7 | Brown's Trace / Lee River Road | Safety | realignment | Existing | 0 |
| | | | roundabout | Existing | 1 |

TBD-to be determined during engineering & design

# 5.0 CAPITAL PLAN

## 5.1 | RECOMMENDATIONS, EXPECTED CAPITAL COSTS & IMPLEMENTATION

### INTERSECTION IMPROVEMENTS

Table 5-1 presents a list of specific recommendations for potential projects to address the existing and future issues identified in this study. The recommendations include intersection modifications, and planning and policy actions. The recommendations include projects identified from previous studies and additional projects or studies resulting from the findings of this analysis. Suggestions are general except where specific improvements have been described in greater detail from previous studies. The recommendations presented are listed in no particular order and do not suggest a priority.

For improvements related to bicycle and pedestrian facilities, please refer to the separate report entitled, *Jericho Bicycle and Pedestrian Facility Master Plan*.

Almost every recommendation requires some additional planning, design, and/or engineering work before implementation. The "next steps" column describes the action that is necessary to keep the recommendation moving forward and "lead party" identifies the entity responsible for taking action.

**TABLE 5-1: INTERSECTION IMPROVEMENT – TIME FRAME, NEXT STEPS AND TOTAL COST**

| | Location | Recommendation / Alternative | Time frame (2) | Next step | Lead | 2nd party | Total Cost |
|---|---|---|---|---|---|---|---|
| 1 | VT 15 / River Road | traffic signal | short | scoping | VTrans | Town-RPC | $400,000 |
| 2 | VT 15 / Packard Road | Add lane on side road | long | monitor | VTrans | Town-RPC | $50,000 |
| 3 | VT 15 / Brown's Trace (1) | traffic signal & westbound turn lane | short | PE | VTrans | Town-RPC | $1.2M |
| 4 | VT 15 / Lee River Road | traffic signal | long | monitor | VTrans | Town-RPC | $500,000 |
| | | left turn lane | | | | | |
| 5 | Skunk Hollow Road / VT117 | realignment | short | scoping | VTrans | Town-RPC | $500,000 |
| | | left turn lane | | | | | |
| 6 | Barber Farm Road / VT117 | realignment | short | scoping | VTrans | Town-RPC | $200,000 |
| | | left turn lane | | | | | |
| 7 | Brown's Trace / Lee River Road | realignment | short | scoping | Town | RPC | $300,000 |
| | | roundabout | | | | | $500,000 |

(1) FY14-17 TIP (FY16 construction)
(2) short (1-5 yr.), medium (5-10 yr.), or long term (more than 10 years)

## ROAD MAINTENANCE

The goal of road maintenance is to provide a good surface and minimize the rate of deterioration, while providing predictability and safety for users.

Essential management tasks include:

1. Maintaining a good inventory of various infrastructure (roads, culverts, signs, drainage features, structures, etc.), equipment (trucks, tools, etc.), and their condition.
2. Regular inspection
3. Determination of maintenance requirements
4. Resource planning and prioritization
5. Monitoring of the effectiveness of work

Maintenance includes routine (mowing, clearing drainage channels, etc.), recurring (spot repairs, potholes, etc.), periodic (regrading, repaving, reconstruction, replacing structures, etc.) and urgent tasks (restoring storm damage, removing fallen trees, etc.). As described in Section 3, Figure 3-10 presents the types of maintenance and improvement strategies that provide the highest return on investment for a given pavement condition index.

Particularly important is the management and control of water. The following strategies are essential to maintaining good roads:

Drainage is the most important aspect of a road's condition. The road base (the underlying granular material) should be free to drain to the sides via exposed ditches or underdrains. The base should also be comprised of suitable material that is both structurally sound, and porous enough to drain freely. When road base is contaminated by too many fine particles, it will not drain (or drains too slowly), trapping water that compromises the structural integrity and heaves when frozen, thus also compromising the surface. If the road surface and drainage are maintained properly, the road base can last indefinitely.

Surface maintenance – Road surfaces should be maintained to slope from the center to the edge at generally 2-3%. This minimizes the amount of water on the road during and after events, thus increases safety and reduces water penetration.

As described in Section 3-5, the system-wide average PCI (pavement condition index) for paved and gravel roads in the Town was 68 and 95.55, respectively. Compared with conditions reported in the *2004 Jericho Transportation Study*, paved road conditions have improved by approximately 16 percent and by approximately 22 percent on gravel roads. While many roads have experienced "high" or "severe" deterioration since 2011, others have improved through repaving projects.

It is recommended that the Town focus resources on preventative and routine maintenance for roads with a PCI of 56 ("fair") or higher, rather than trying to address roads rated from "poor" to "failed." As shown in Figure 3-10, certain types of maintenance and improvement strategies provide a higher return on investment for a given pavement condition index. Trying to fix the worst roads first is a waste of resources; when those roadways are repaved, the Town can then follow a routine maintenance strategy to protect the investment in the new surface.

See Section 3.5 for a complete description of the 2014 PAVER analysis for both paved and gravel roads, and Appendix F for maps of the PAVER analysis.

Appendix G is a Pavement Management Systems (PMS) analysis that describes a recommended five-year paving plan based on the Town's PCI data. This memo will assist the Town in prioritizing funding for roadway maintenance to maximize benefits in a cost-effective manner.

A PMS is a tool used to assist Town administrators in their prioritization of roadway improvements. Such tools are intended to be used in concert with local knowledge of roadway conditions, issues, and politics to help inform Town decisions on roadway maintenance project selection. The PMS tool ranks roadway segments in terms of the potential for future cost savings based on the current condition, projected future condition, recommended improvements, improvement costs, and daily traffic volumes. The PMS analysis is focused on arterials and connector roadways, and projects are prioritized starting with those that would result in the largest future cost savings, and then on road projects that serve the highest number of vehicles per day. Table 5-3 displays the recommended road projects and estimated costs and Figure 5-1 shows the change in PCI values if the recommended improvements are implemented.

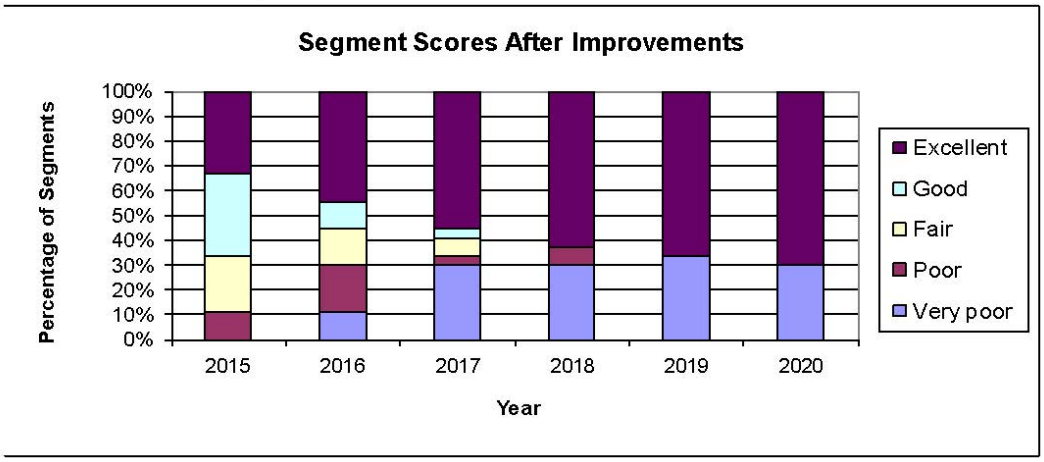
**TABLE 5-2: RECOMMENDED ROADWAY PROJECTS, 2016-2020**

| | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | Project | Cost | Project | Cost | Project | Cost | Project | Cost | Project | Cost |
| BROWNS TRACE | 13 | Overlay | $92,775 | | | | | | | | |
| BROWNS TRACE | 141 | | | | | | | Reclaim | $251,698 | | |
| BROWNS TRACE | 78 | | | | | | | | | Reclaim | $280,635 |
| RIVER RD | 39 | | | | | Reclaim | $154,928 | | | | |
| BROWNS TRACE | 31 | Overlay | $86,050 | | | | | | | | |
| BROWNS TRACE | 160 | | | Crack Fill | $18,168 | | | Crack Fill | $19,275 | | |
| BROWNS TRACE | 133 | Crack Fill | $7,403 | | | Crack Fill | $7,854 | | | Crack Fill | $8,333 |
| JERICHO CENTER CIR | 140 | | | Overlay | $11,582 | | | | | | |
| GOVERNOR PECK RD | 176 | Overlay | $81,410 | | | | | | | | |
| ETHAN ALLEN RD | 201 | | | | | | | Crack Fill | $12,690 | | |
| BARBER FARM RD | 114 | | | Reclaim | $127,925 | | | | | | |
| SKUNK HOLLOW RD | 180 | Crack Fill | $4,734 | | | Crack Fill | $5,022 | | | Crack Fill | $5,328 |
| PLAINS RD | 76 | | | | | | | | | Crack Fill | $9,457 |
| BARBER FARM RD | 128 | | | | | Overlay | $74,648 | | | | |
| BARBER FARM RD | 16 | | | Overlay | $78,296 | | | | | | |
| | | **$272,372** | | **$235,972** | | **$242,453** | | **$283,664** | | **$303,752** | |

**FIGURE 5-1: PAVEMENT CONDITION WITH RECOMMENDED IMPROVEMENTS**

Segment Grade, with Projects: Paved Segments

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| ADT Weighted average: | 65 | 61 | 58 | 61 | 66 | 72 |
| VMT Weighted average: | 65 | 63 | 60 | 61 | 67 | 73 |
| Overall average: | 68 | 63 | 60 | 61 | 62 | 65 |




The VTrans Vermont Local Roads Program (http://vermontlocalroads.org/) is an excellent resource providing training, guidance and other resources for municipal staff to aid in management of their roadways.

### *Paved Roads*

Important elements of maintaining paved roads includes:

Patching and potholes – Regular filling of potholes and patching discrete areas of failed pavement are essential for water control and preservation of a good road structure.

Crack sealing is a valuable strategy for maintain the integrity of the surface, keeping water and carried fines out of the base material, increasing the lifespan of both surface and base material.

Reclaiming – When the base material performs poorly (i.e. rutting, shifting) the longevity of the road surface will be prematurely compromised, thus wasting the second most expensive component of a roadway. Excavating and replacing the base is the most expensive action possible, but will ultimately provide the best results. An alternative is to grind the old pavement into the base material (typically to a depth of 10-15 inches), thus redistributing the mix of large and small aggregate into a sound and hopefully porous condition. Substantial savings over replacement is mainly due to reduced material handling. Additional aggregate and compounds are typically necessary to add to the mix in order to provide a long lasting road base. VTrans regularly chooses this strategy with good success, and their Pavement Management Unit should be consulted to ensure that the right strategy of depth and material is used for the particular situation.

### *Unpaved Roads*

Unpaved (dirt or gravel) road maintenance is also heavily skewed to drainage control, through both sideslope and ditching maintenance. This should be a primary, ongoing task. Sediment control is an important aspect as well, due to the potential for pollution of natural areas adjacent to the roadway.

Key issues to consider in cost effective unpaved road maintenance include:

- *When it makes sense to pave gravel (dirt) roads?* This is typically an economic question which involves a life cycle analysis to include frequency of use, intensity of maintenance, the cost of upgrading the road, including adequate base material and drainage, and the expected lifespan of the new road. (See Appendix H for more information).

- *When to replace the base material?* Base material of gravel (dirt) roads can vary widely. What is acceptable on a moderate sloped road with good underlying natural soils may be completely unacceptable elsewhere. Again, a life cycle comparison of maintenance (grading / ditching / vehicle wear and tear) to replacing base material is useful in this decision.

- *How frequently to grade the road?* In order to keep a road surface reasonably passable, grading is necessary at least a few times per year. Variables include the physical conditions (base material, slope, ditching, etc.) and the travel volume. Good records of what has worked in the past, and locations/condition of trouble areas is key in management of this task.

Several references specific to unpaved road maintenance include:

- The Massachusetts Unpaved Roads BMP Manual, 2011, by the Berkshire Regional Planning Commission http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/dirtroad.pdf
- UNH Technology Transfer Center, Unpaved Roads website (various resources provided) http://www.t2.unh.edu/unpaved-roads
- Vermont Better Backroads Manual, 1995, Northern Vermont & George D. Aiken Resource Conservation and Development (RC&D) Councils http://vtransengineering.vermont.gov/sites/aot_program_development/files/2009%20Better%20Backroads%20Manual.pdf

## OTHER GENERAL RECOMMENDATIONS

Traffic calming measures, which help keep vehicle speeds near or below the speed limit, are often desirable, particularly in village areas where more conflicts typically exist. Options include:

- **Speed Tables** – on local neighborhood streets these provide effective means of speed control. These are not recommended on arterials or collector roads or where there is heavy truck traffic. The positive effects should be weighed against the cost and maintenance, including the effects on drainage or snow plowing operations, on a case by case basis.
- **Radar Speed feedback signs** – this equipment is typically installed at the gateways to village areas or speed zones. There are currently RSFS's at the Jericho Elementary and on the southern approach to Jericho Center.
- **Pavement striping/markings** – often used as a warning in speed/school zones, for dangerous curves or intersection approaches may include closely spaced transverse markings, chevrons or the approaching speed limit.
- **Gateways** – features of gateways vary but are intended to help provide a visual clue that the driving environment and appropriate speed has changed. They do not work well alone, but must be

accompanied by other features such as sidewalks, on street parking, and / or a significant increase in development density.

- **Signage** – such as share the road or speed limit. The simplest and least expensive measure.

Typical costs for these features are listed in Table 5-2.

**TABLE 5-3: TRAFFIC CALMING MEASURE ALTERNATIVE COSTS**

| | Alternative | Cost* |
|---|---|---|
| 1 | speed tables (1) | $4,000 |
| 2 | radar speed feedback | $3,000 |
| 3 | striping | |
| | transverse markings | $2,000 |
| | converging chevrons | $2,000 |
| | speed limit in pavement | $200 |
| 4 | reduced speed limits | $0 |
| 5 | gateways | $2-5000 |
| 6 | signage | $200 |

(1) not recommended on arterials or collectors
**per installation / location*

## PLANNING RECOMMENDATIONS

In addition to the recommended capital improvements, there are several planning and policy changes that could help the Town plan and manage future transportation facility and maintenance needs.

- Consider Master Planning requirements for parcels in the Village Center, Village and Commercial zoning districts.
- Consider the adoption of an Official Map to identify future potential transportation connections
- Update Public Work specifications to adopt a wider variety of street types and to include pedestrian features. Improve driveway and private road standards to reduce damage to town roads caused by storm runoff from private parcels and to lessen their impact on natural systems.
- Consider further restrictions on development in the Agricultural district to lessen the burden on the Town's rural transportation network.
- Consider updating Road Impact Fees to assist in funding future deficiencies in the transportation system.

## 5.2 | FUNDING OPPORTUNITIES

The "next steps" identified in Table 5-1 may be funded using Town of Jericho, CCRPC, or VTrans resources as follows (see Appendix H for a more extensive guide to funding opportunities):

### *Town of Jericho Funding*

- Capital Budget and Program - A municipal capital budget and program, often referred to as a "capital improvement program," is a locally adopted fiscal management tool that schedules needed capital projects – including proposed road and infrastructure improvements or land acquisitions – for the coming fiscal year, and for the following five-year period. It also identifies estimated costs and sources of financing for each project – which may include local property taxes, impact fees, state funding, and other available loan and grant programs.

### *Chittenden County RPC Funding Programs*

- Annual Work Program Planning Assistance Program – This program provides funds for conducting a variety of traffic engineering and transportation planning studies. The CCRPC maintains a list of consultants that are made available to CCRPC members as requested. Projects typically require that municipalities contribute 20% local match towards the cost of a study. http://www.ccrpcvt.org/workplan/

- CCRPC Transportation Improvement Program and State Transportation Improvement Program - Every project that uses federal funds in Chittenden County must be listed on the CCRPC's Transportation Improvement Program (TIP) as well as the statewide version managed by VTrans (STIP). The TIP is a prioritized, fiscally-constrained, and multi-year list of federally-funded, multimodal transportation projects and operations in Chittenden County. All projects in the TIP must be prioritized at the regional level and have clearly identified funding sources. The TIP authorizes the implementing agency (e.g., Vermont Agency of Transportation) to obligate federal funds for listed projects and operations over a three year period. The TIP is typically adopted annually by the CCRPC Board of Directors and amended periodically throughout the year. A project needs to be sufficiently defined, usually through the CCRPC's Project Development Program, before it is added to the TIP.

### *Vermont Agency of Transportation Funding Programs*

- VTrans Transportation Alternatives (TA) Program - The TA Program provides funds for construction, planning and design of eligible projects including bicycle/pedestrian, Safe Routes to School, some environmental mitigation, and other types of projects. The TA program provides funds to either develop scoping (feasibility) studies or to develop projects that lead to construction. All projects must demonstrate a strong transportation link. There is a required sponsor funding match of 20% for construction projects and 50% for scoping studies. http://vtransengineering.vermont.gov/sections/ltf/transportationalternatives

- VTrans Bicycle and Pedestrian Program – A statewide competitive grant program that provides funding for either a scoping study or a design/construction project of approved bike and pedestrian projects. The program funds vary from year to year and awards require a 10% local match. http://vtransengineering.vermont.gov/sections/ltf/bike_ped

### *State of Vermont Department of Housing and Community Development*

- Municipal Planning Grant - The Municipal Planning Grant Program encourages and supports planning and revitalization for local municipalities in Vermont. Awarded annually and administered by the Department of Housing and Community Development, the Municipal Planning Grant Program works to strengthen Vermont by funding local planning initiatives that support statewide planning goals. Municipalities with a confirmed planning process may apply for any dollar amount between $2,500 and $8,000 without a local match requirement. Any grant amount above $8,000 will require a local cash match. The maximum amount of grant funds provided is $20,000. http://accd.vermont.gov/strong_communities/opportunities/funding/municipal_planning_grants/

This transportation study is intended to provide the Town of Jericho with information about the existing transportation system, estimates and analyses about anticipated future conditions, and a capital plan for which to base planning and management decisions. The study can be used to assist with project development review, to update the Capital Improvement Program, and to consider changes to the Impact Fee Schedule adopted in 2009.