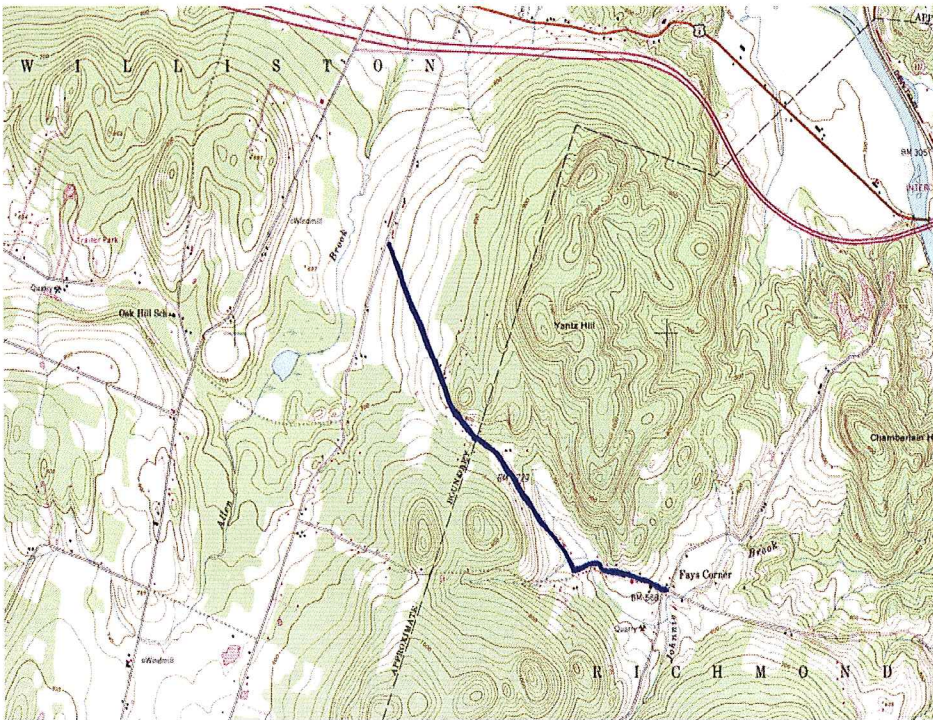


*Final Report  
(Draft)*

# EAST HILL ROAD - CAPACITY & TRANSPORTATION IMPROVEMENT PLAN

*Prepared for:*  
**Town of Richmond**

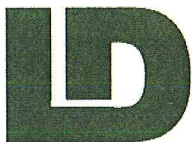


*Prepared for:*  
**Town of Williston**



**November 2006**

*Submitted by:*



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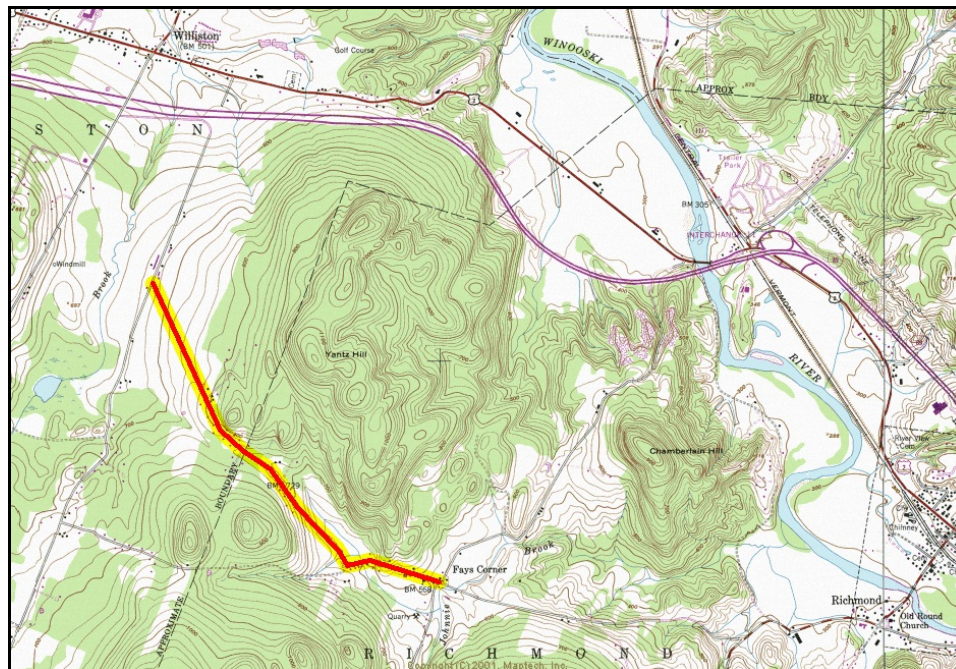
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**1. INTRODUCTION**

East Hill Road is located in and links the Towns of Richmond and Williston (the Towns). Figure 1 shows its location relative to other local roads and town lines. Recent years have seen experienced increased traffic volumes and speeds on East Hill Road; resulting in numerous complaints from residents concerning safety. At the same time, the Towns have also identified that non-local traffic is using East Hill Road as a through route in order to bypass existing points of congestion in Richmond Village and to access commercial and employment centers in Williston.

Lamoureux & Dickinson Consulting Engineers, Inc. (L&D) was engaged by the Towns to prepare a Capacity & Transportation Improvement Plan (CTIP) for East Hill Road. The purpose of the CTIP is to provide the Towns a basis for planning their future capital improvement programs, making reclassification requests to the Vermont Agency of Transportation (VTrans) and implementing highway improvements along East Hill Road and at its key intersections.

**Figure 1 - East Hill Road Location Map**



## **2. ROADWAY & SURVEY INFORMATION**

East Hill Road is a Class 3 town highway connecting Hinesburg Road in Richmond to South Road in Williston. It is 2.1 miles in length, of which approximately 1.2 miles are in Richmond (TH #17) and 0.9 miles are in Williston (TH #23). The easterly terminus of East Hill Road at Hinesburg Road is locally referred to as Fays Corner. Hinesburg Road also connects to Huntington Road; leading into and accessing US Route 2 in Richmond Village. Hinesburg and Huntington Roads have historically been the primary travel routes between Richmond and those two respective towns, and both are Class 2 town highways. Fays Corners also is the southerly terminus of Kenyon Road; commonly used as a short-cut to I-89 Exit 11 in Richmond.

On its westerly end, East Hill Road terminates at South Road, a Class 3 town highway in Williston. From South Road, Oak Hill Road connects to US Route 2 in Williston Village.

East Hill Road also provides access for numerous residential properties, many of which are accessed via other intersecting town highways and private roads. Intersecting town highways include Christmas Hill (TH #18) and Sherwood Forest Roads (TH #52) in Richmond and Yantz Hill Road (TH #55) in Williston. Private roads include Daniel and Deer Creek Lanes in Richmond, and Forty Acres and Benoit Lanes in Williston. Altogether, over 100 residential properties access either directly or indirectly onto East Hill Road.

Survey data for East Hill Road and its surrounding area was obtained from high resolution aerial photography and topographic mapping performed in 2004 by the Chittenden County Metropolitan Planning Organization (CCMPO). This mapping provides the basis for evaluating existing geometric & topographic conditions, identifying adjoining land-uses, locating environmental constraints and developing recommended roadway and intersection improvement plans; all of which are presented in the following sections.

Like most town highways, East Hill Road has a public right-of-way width of 49.5 feet (3 rods). The purpose of a public right-of-way is not only to accommodate the roadway, but also to provide adequate width for drainage, grade changes and utilities. Unless specific survey data is available indicating otherwise, the right-of-way is centered on the roadway itself.

### 3. EXISTING CONDITIONS

Figures 2-5 (located in the map pocket) show aerial photo views of East Hill Road and its surroundings. For reference purposes a baseline has been established along the centerline of the roadway and stationed at 100 ft intervals. Existing traffic signs, culverts, grades, wetlands and 100-year floodplain are also shown on these figures.

#### Geometrics & Surface Condition

East Hill Road was reportedly a gravel road until 1975±. Little, if any, other significant modifications or improvements other than routine repaving and culvert replacement have been made since that time. The existing pavement is approximately 22 ft wide, edge to edge, with little or no gravel shoulder beyond. The pavement surface is in generally good condition, with some longitudinal cracking towards the outer edge in certain areas.



Except for the Christmas Hill Road intersection and a steep grade and two sharp curves to the east of that intersection, the overall horizontal alignment of the roadway is generally straight. Vertically, however, there are several other crest locations that limit sight distances.

#### Traffic Volumes

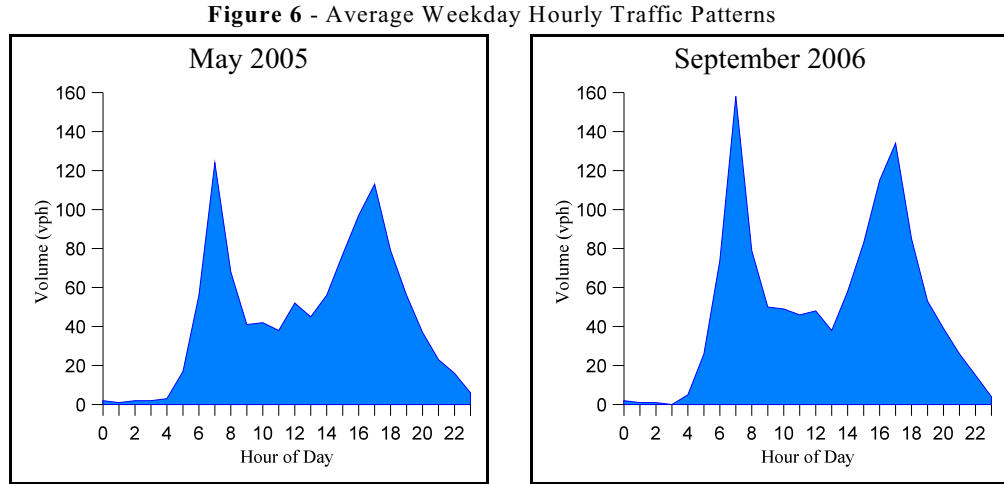
Existing traffic data for East Hill Road was gathered from recent traffic counts performed by the CCMPO. This data includes manual turning movement counts performed in 2003 at key intersections together with a week-long automatic traffic count and speed survey performed in 2005. Historical traffic count data from VTrans was also examined. To add to this data, this office performed additional automatic traffic counts specifically for this study.

Available historical traffic data for East Hill Road is limited. VTrans performed week-long automatic traffic recorder counts in 1986 and again in 2002. CCMPO also performed similar counts in 2002 and May 2005. Lastly, this office performed a count in September 2006. Table 1 shows the results of those counts; which have been adjusted to annual averages using daily adjustment factors from continuous count stations maintained by VTrans on state highways.

**Table 1 - Annual Average Daily Traffic**

<b>Year</b>	<b>AADT (vpd)</b>
1986	340
2002	1,000
2005	1,100
2006	1,200

Figure 6 compares the average weekday traffic patterns by hour from the 2005 and 2006 traffic counts.



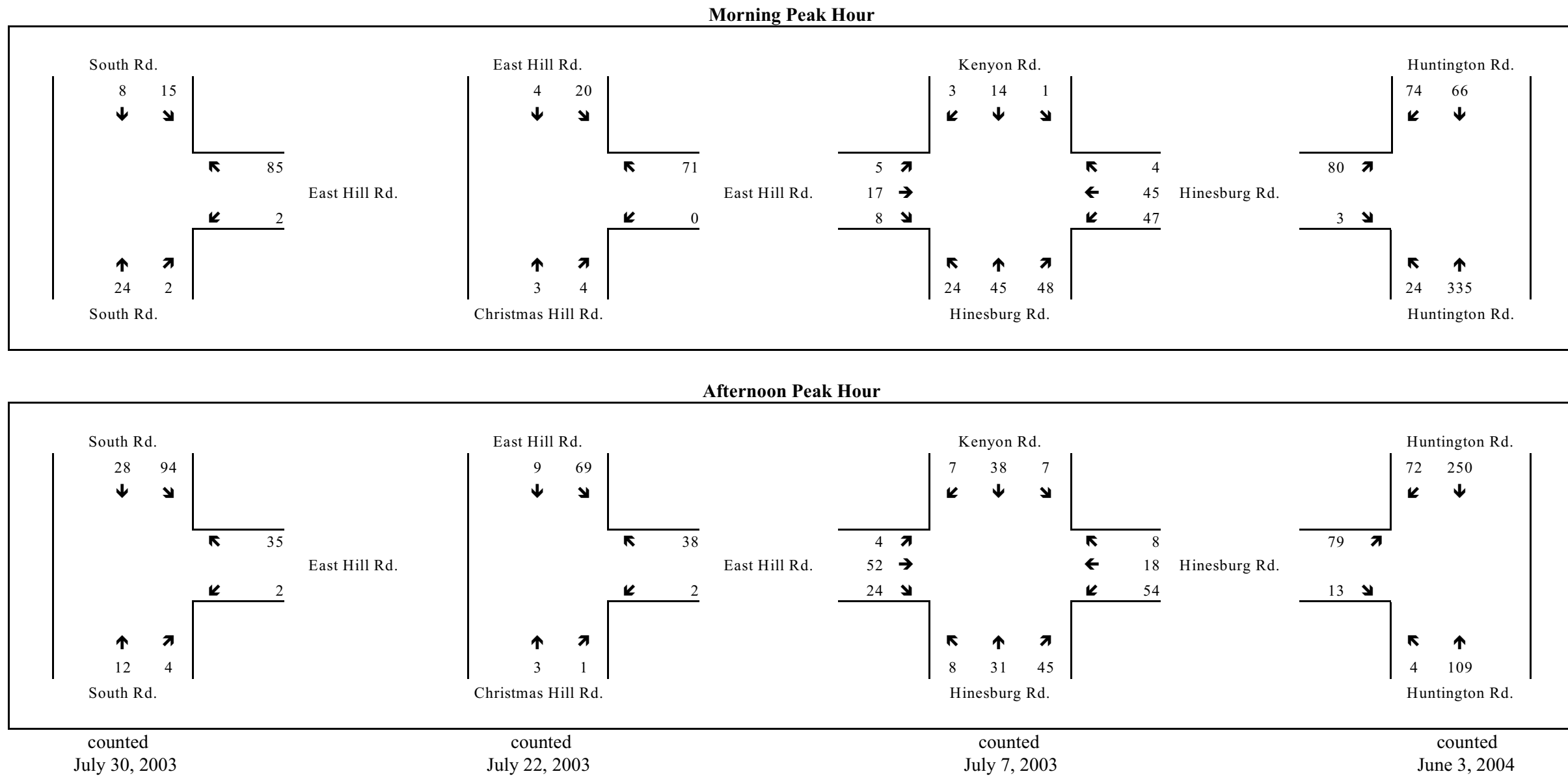
The primary difference between the two graphs in Figure 6 is that the Bridge Street bridge over the Winooski River in Richmond village was restricted to one-way traffic and weight-posted in the summer of 2006. The resulting diversion of traffic using East Hill Road as an alternate route is particularly evident during the morning and afternoon peak hours.

Figure 7 shows the morning and peak hour traffic patterns at key East Hill Road intersections and at the Huntington / Hinesburg Road intersection. The East Hill Road intersections were counted in July 2003, and the Huntington / Hinesburg Road intersection counted in June 2004. This data again shows the strong influence of external commuter traffic during peak traffic periods.

Forecasts of future traffic volumes on East Hill Road are essential to determining whether capital improvements will be warranted and the nature of those improvements. Examining historical AADT's on East Hill Road, as well as other nearby town highways (Huntington Road, Hinesburg Road and South Road) indicates annual growth rates in the 6-8% range up through the late 1990's. From 2000 to date, those rates have moderated considerably, and have been  $\pm 3\%$  annually.

In comparison, the annual traffic growth rate on East Hill Road between 1986 and 2002 has been considerably higher; just over 12% per year. Between 2002 and 2005, that fell to 3.3% annually. Most recently, in 2006, the Bridge St. bridge restriction in Richmond Village has caused yet another spike in traffic volumes on East Hill Road.

**Figure 7 - Weekday Peak Hour Turning Movement Volumes**





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Future traffic growth on East Hill Road has two components. One is the development potential and the resulting “local” trips that would be generated. The other component results from the “external” trips which are using East Hill Road as a connector between their ultimate origins and destinations.

With respect to additional local trips, input from local planning and zoning officials indicates that the future growth potential in the way of residential development along East Hill Road itself is rather limited. It is estimated that there remain approximately 20 potentially developable parcels that would access directly or indirectly onto East Hill Road. Given the geographic spread of those parcels, their trip making patterns are estimated to be split east and west. Thus, while 20 additional homes over the next 20 year period are estimated to generate 200 daily vehicle trips, it is estimated that the resulting traffic increase at any given location may only be 100 vehicles per day. Over a 20 year period, that contributes less than ½ of 1% to the annual traffic growth rate.

With respect to external trip growth, VTrans is estimating statewide annual growth rates of 1.3% per year on state highways in rural areas over the next 20 year period (2005 -2025). In comparison, regional population projections for the outlying areas of Chittenden County forecast a ±3% annual growth rate. Figure 8 shows the primary “catchment” area contributing to external trips using East Hill Road. Barring significant changes in driving habits in forthcoming years, it is our opinion that East Hill Road traffic growth will mimic the projected population growth of this geographic area<sup>1</sup>. The resulting growth trend, historical and future, is shown in Figure 9.

Based on the foregoing, we estimate that East Hill Road will be traveled by almost 2,000 vehicles per day in the year 2025, a 67% increase from existing 2006 traffic volumes.

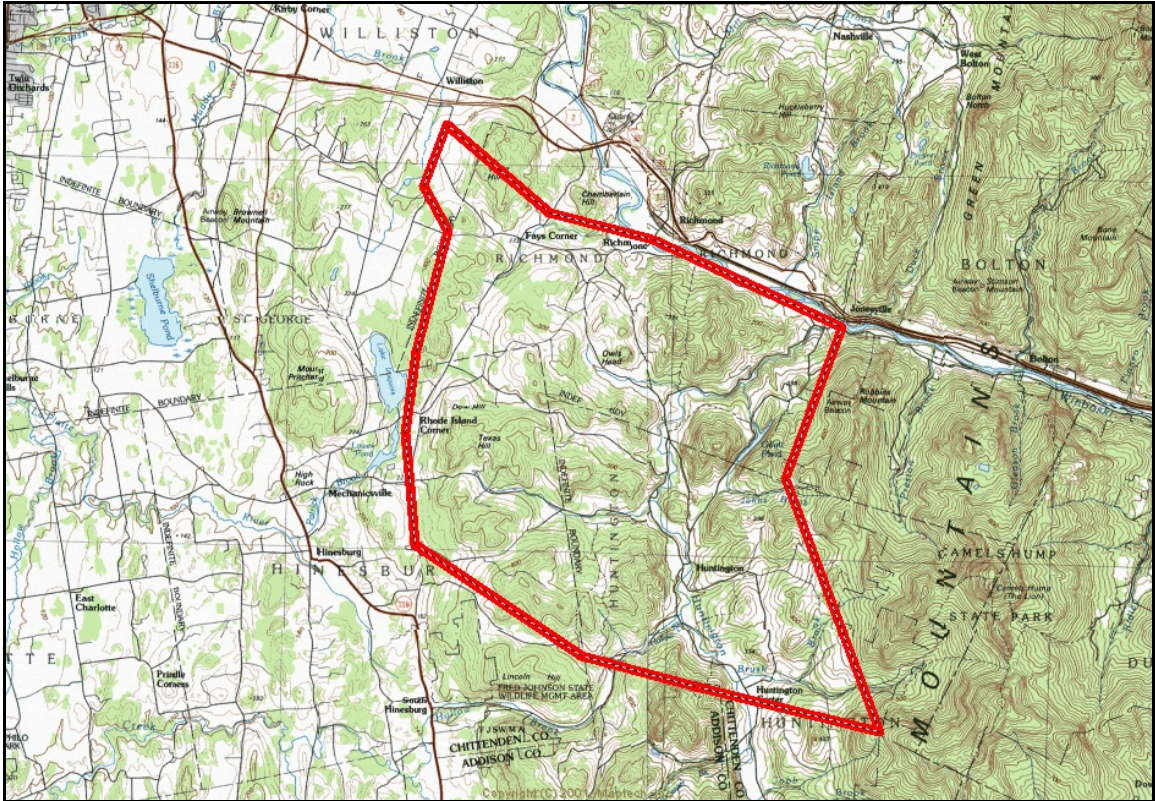
It is also important to point out that peak hour traffic volumes exhibit greater sensitivity to travel times and traffic congestion conditions than do daily volumes. This is graphically illustrated in Figure 6, where most of the traffic growth between 2005 and 2006 occurred during the peak hours, as opposed to off-peak periods. Thus, while daily traffic volumes are projected to increase by 3% per year, it is likely that peak hour growth rates will be higher. Future peak hour levels of traffic congestion in Richmond Village and the efforts undertaken to manage those conditions will be the primary factors influencing this.

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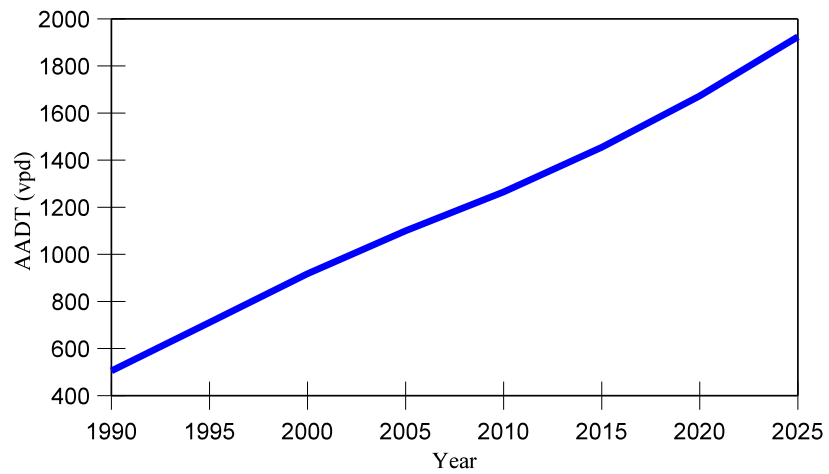
<sup>1</sup> Travel demand, as reflected by vehicle ownership and average vehicle mileage driven per person, increased significantly through the 1990's, but peaked around 2000 and has since dropped a bit. With changing demographics resulting in a more elderly population (we drive less as we get older) and other factors, current forecasts are that future automobile traffic growth will consist of population growth rather than increased per capita vehicle use, as has occurred in the past.

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**Figure 8 - East Hill Road Catchment Area**



**Figure 9 - Projected East Hill Road Daily Traffic Growth**



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**Truck Traffic**

As is standard practice on local highways, East Hill Road and its connecting roads are posted at 24,000 pounds maximum weight for trucks. While most modern trucks exceed that weight when loaded, overweight permits are routinely granted in order to allow access by service vehicles, e.g. garbage trucks and fuel delivery trucks, to local residents. On local highways, trucks generally make up approximately 5% of the daily traffic.

Of greater concern are trucks which elect to use East Hill Road as an alternate route to bypass posted weight restrictions on the state highway system and on those town highways on which heavier trucks are allowed. Very large trucks, such as tandems, tri-axles and tractor-trailers, are particularly problematic due to their disproportionate wheel loadings (compared to passenger cars and light trucks). High numbers of such vehicles can damage the road base and pavement, resulting in increased maintenance and even necessitating rebuilding the road if too much damage occurs.

The 2005 CCMPO traffic count included vehicle classification data, i.e. the numbers of cars vs. trucks. In that count, just over 4% of the traffic stream were trucks. In comparison, in the September 2006 count by this office, that increased to 14%; presumably in large part due to the recent Bridge St. bridge weight posting.

East Hill Road is also routinely used during the warmer months by recreational bicyclists. While they are too light to register on a traffic counter, they are frequently observed traveling singly or in groups. Local residents and officials report that East Hill Road is part of a loop popular with bicyclists.



**Vehicular Speeds**

East Hill Road traffic speeds is a major concern of local residents and officials. The same automatic traffic recorder counts which have been discussed above for their volume and vehicle classification data also provide speed data. All of the counts cited above by the CCMPO and this office have identified prevailing speeds exceeding the posted 35 mph speed limit. Table 2 summarizes the data collected from the 2005 and 2006 counts.

Advisory speed warning plaques presently exist at the Christmas Hill Road intersection and corner. This is a very sharp corner that presently has a 25 mph advisory speed. There is also a 25 mph advisory speed warning placard located on the westbound approach of the steep grade and curves located just to the east of Christmas Hill Road. Advisory speed plaques are meant to indicate the maximum safe speed that a turn or curve can be negotiated. The *MUTCD*<sup>2</sup> defines this as the speed corresponding to a 16 degree reading on a ball bank indicator.

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<sup>2</sup> *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, 2003

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**Table 2 - Speed Survey Data**

	2005		2006	
	Eastbound	Westbound	Eastbound	Westbound
Average Speed	38 mph	40 mph	37 mph	36 mph
85 <sup>th</sup> Percentile Speed	43 mph	46 mph	42 mph	41 mph
% of Vehicles > 35 mph	69%	83%	66%	62%
10 mph Pace Speed	31-40 mph	36-45 mph	31-40 mph	31-40 mph
% of Vehicles in Pace	66%	67%	70%	71%

To check the posted advisory speed, we drove through the Christmas Hill Road corner in both directions at various speeds. We observed that the maximum speeds resulting in a 16 degree reading were in the 17-18 mph range. Based on these readings, it appears that the existing 25 mph advisory speed at this location should be reduced to 15 mph.

Similar ball bank indicator readings were performed on the grade and curves located just to the east of Christmas Hill Road. At this location, we observed that the maximum speed corresponding to a 16 degree reading on the ball bank indicator equaled 25 mph. Accordingly, this portion of East Hill Road should also be signed with an advisory speed (if the speed limit is not otherwise reduced).

The *MUTCD* also specifies different warning signs for turns (W1-1 & W1-3) and curves (W1-2 & W1-4). The foregoing letter/number combinations in parentheses are *MUTCD* sign designations. A curve is defined as an horizontal alignment having an advisory speed greater than 30 mph. Where the advisory speed is 30 mph or less, a turn sign shall be used. The existing curve warning signs (W1-4) in advance of the steep grade and curves should be replaced with turn warning signs (W1-3).

**Sight Distances**

Vehicular speeds are also important in assessing whether adequate sight distances exist. There are several different types of sight distances which are important to providing safe conditions for all roadway users, whether they be vehicles, bicycles or pedestrians. Accordingly, the AASHTO Green Book<sup>3</sup> includes recommendations for minimum sight distances. Providing excellent sight distances can also inadvertently create the opposite effect. For example, long stretches of straight open road, such as what exists on East Hill Road's west end, often results in higher speeds and drivers not paying as much attention to the driving task.

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<sup>3</sup> *A Policy on Geometric Design of Highways and Streets*, American Association of State and Highway Transportation Officials, 2004

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The first sight distance critical to maintaining safe traffic conditions is commonly known as the safe stopping sight distance. This is the distance that is required for a driver to perceive a potential problem, such as an object in the roadway, react to it and make a controlled stop. At a speed of 35 mph on a level grade, this distance equals 250 ft. At higher prevailing speeds, such as 45 mph, this distance increases to 360 ft. On a 6% grade, such as what exists on sections of East Hill Road, those distances increase to 270 ft and 400 ft, respectively, in the downhill direction and reduce to 240 ft and 345 ft, respectively, in the uphill direction.

The second important sight distance is known as intersection sight distance. This distance is provided at intersections and driveways in order to permit safe turning movements without creating major disruptions to efficient traffic flow. In this respect, AASHTO intersection sight distance standards are sufficient to permit a vehicle entering the roadway from a side street or a driveway to be able to accelerate in front of an oncoming vehicle without causing that vehicle to reduce its speed by more than 30% of its initial speed. In other words, providing intersection sight distances based on a 35 mph speed means that an oncoming vehicle might have to momentarily reduce its speed to 25 mph should a car exit a driveway or intersection in front of it.

Intersection sight distances differ, depending on the specific turn movement being made and the direction of oncoming traffic. The most commonly used scenario is the left turn from the side street with traffic approaching from the right. For this, 7.5 seconds of visibility time is provided at prevailing speeds. For 35 mph, the resulting sight distance equals 390 ft. For 45 mph, it increases to 500 ft. At driveways and intersections, the desired sight lines for these distances would be measured from a point 15 ft back from the edge of East Hill Road. This is intended to provide a sight triangle that does not require one to “nose” out into the roadway.

There are many locations along East Hill Road where available sight distances are inadequate for the prevailing speeds. These include many private driveways, the area near Sherwood Forest Road, two sharp vertical crests between Sherwood Forest Road and Deer Creek Lane, the Christmas Hill Road intersection (particularly for left-turns onto Christmas Hill Road), and the hill and curves east of Christmas Hill Road. Suggested measures to improve sight distances at those locations will be discussed in Section 4.



### Crash History

Crash histories for East Hill Road were requested from VTrans. During the most recent five-year period (2000 - 2004), a total of six crashes were reported; all since 2002. The year 2002 is important to note due to the implementation of a new statewide crash reporting system that year. That new system resulted in a tripling in the number of reported crashes from 2001 to 2002. The following year, 2003, saw another 30% increase due to the new system. Essentially, this data might more accurately reflect a three-year crash history.

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Two of the crashes occurred on the Williston portion; one of which was at the South Road intersection. The exact location of the second one cannot be determined, but involved a rear end collision caused in part by a visibility obstruction. The remaining four crashes occurred on the Richmond portion; one at Sherwood Forest Road, and the others at #806, #1049 and #1156. Five of the six crashes involved single vehicles; two of which were noted as being caused in part by driving too fast for conditions and another which was caused by slippery road conditions. Of the six crashes, only one resulted in an injury; the remainder were property damage only.

Input from the Richmond Police Department indicates that Fays Corner sees a higher number of crashes than does East Hill Road. To assist the Town in improving safety at Fays Corner, VTrans performed a Road Safety Audit Review at that intersection in July 2004. The resulting recommended improvements are discussed in Section 4.

**Environmental Conditions**

Future physical improvements to East Hill Road must consider potential impacts to sensitive environmental, historic and cultural resources. The key is to avoid creating impact(s) where possible, and where necessary; minimize them. Areas of potential impacts include:

- Agricultural Soils
- Endangered Species Habitat
- Floodplain
- Historic & Archeological Sites
- Water Quality
- Wetlands

**Agricultural Soils**

Locations of important agricultural soil map units along East Hill Road include the first ½ mile extending from South Road at the Siple Farm in Williston, 400 ft ± at the Yantz Hill Road intersection, two pockets totaling 600 ft ± of the low-lying area on both sides of the Christmas Hill Road intersection and the last ¼ mile approaching Fays Corners in Richmond.

**Endangered Species Habitat**

The Nongame & Natural Heritage Program of the Vermont Fish & Wildlife Department was contacted and requested to identify any known locations of endangered species habitat. Their database does not show any endangered species being located in the immediate vicinity of East Hill Road.

**Floodplain**

There are two unnamed streams on the easterly (Richmond) side of East Hill Road. The first, draining from the Christmas Hill area, crosses East Hill Road just to the north of Christmas Hill Road. This stream then joins another one draining the Yantz Hill area before crossing East Hill Road again just east of Christmas Hill Road. This latter location, extending upstream to the confluence of the two streams, has been previously mapped as being a 100-year floodplain.

Another area of localized flooding, while not mapped as floodplain, is located in Williston at East Hill Road's intersection with South Road. At this location, there is a small stream draining from east to west that crosses under East Hill Road and then crosses South Road in separate culverts. The culverts themselves appear to be undersized<sup>4</sup>. That, combined with the lack of elevation drop between the two culverts, causes flooding to occur during significant rain events. When that happens, water overflows the roadway at the intersection and drains into the nearby manure pit of the Siple Farm. This quickly causes the manure pit to fill and overflow; resulting in large quantities of pollution being released into downstream waters. To correct this problem, O'Leary-Burke recommended certain intersection and drainage improvements, which will be discussed in the following section.

#### **Historic & Archeological Sites**

Both the State Historic Preservation Office and the VTrans Archeological and Historic Resources office were contacted concerning historic and archeological sites along East Hill Road. They indicated that there are unlikely to be any archeological sites along East Hill Road that already haven't been disturbed by roadside ditching or grading. There are also no known structures of historic significance. The wetland/floodplain area bordering the Christmas Hill Road intersection, however, is considered to be archeologically sensitive, and would require further investigation if major road improvements or realignments are undertaken in that area. A copy of the state archeological sensitivity mapping is included in Appendix A.

#### **Water Quality**

Being located in a rural area, runoff from East Hill Road drains off the roadway itself onto surrounding land. Where the land slopes away (down) from the roadway, this runoff occurs predominantly as overland sheet flow. In other areas, where the land slopes up from the roadway, road runoff is collected in open roadside swales and channeled to culverts that ultimately discharge the water to land that slopes away.

The water quality impacts of road runoff are minimized by maintaining vegetated roadsides and swales. Where grades are steep or water velocities are high, stone lining or rip-rap is often installed along roadside swales and at culvert outlets in order to prevent erosion.

Strategies for minimizing the water quality impacts of road runoff in rural areas include:

- Choosing culvert locations to minimize the volume of water that has to be managed at any one location and to minimize downstream erosion.
- Making sure that culverts are properly sized for storm events.
- Periodic inspection and cleaning of culverts and swales.

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<sup>4</sup> report by O'Leary-Burke Civil Associates, dated May 12, 2006

**Wetlands**

Figures 2-5 also show existing wetlands located immediately adjacent to East Hill Road. This mapping is based on a field reconnaissance performed by this office together with consulting the National Wetland Inventory Maps. Wetlands in Vermont are classified into three classes. Under federal regulations, all three categories come under the jurisdiction of the Army Corps of Engineers (ACOE), however, the lowest classification (Class 3) is not regulated by the State.

Federal regulations permit wetland impacts up to a maximum of 3,000 sq ft without notifying the ACOE. Once that threshold is exceeded, however, the ACOE has to be notified, and up to 1 acre (43,560 sq ft) may be impacted with their approval under a General Permit. Impacts exceeding 1 acre require an ACOE Individual Permit; which is a very involved and detailed process. On the other hand, under state regulations, any impact to a significant (Class 1 or 2) wetland or its buffer area (50 ft for Class 2) requires a Conditional Use Determination from the State Wetlands Office.

The National Wetland Inventory Maps show significant (Class 2) wetlands existing along East Hill Road in several locations. The first is at the South Road/East Hill Road intersection, including the swale and surrounding low area on the north side extending east of the existing culvert crossing (Sta 1+50 to Sta 4+00). Further southeast along East Hill Road, there is another area of Class 2 wetland on both sides starting at Sherwood Forest Road and extending eastward (Sta 48+00 to Sta 53+00). Southeast of Sta 53+00, the wetlands on the northerly side transition to outside the existing right-of-way due to increasing side slopes. Lastly, Class 2 wetlands exist immediately adjacent to East Hill Road on both sides of the Christmas Hill Road intersection (Sta 83+00 to Sta 92+00).

Additionally, the large low-lying field on the south side of East Hill Road (Sta 2+00 to Sta 28+00) appears to be a Class 3 wetland, and that would need to be more precisely delineated should any road improvements be considered along this section.



## **4. ROADWAY & INTERSECTION IMPROVEMENT PLANS**

### **General Design Criteria**

Roadway design standards for categorized by the functional classification of the road. The primary functional classes include arterial highways, collector roads and local roads. The two major considerations in a road's functional classification are mobility and land access. An arterial road is designed to provide greater mobility (higher traffic volumes and speeds) at the expense of providing land access. The opposite is true for a local road, and collector roads fall in the middle.

Although East Hill Road's primary function is land access; it also provides a secondary function of mobility linking locally important external origins and destinations. Thus, it is our opinion that East Hill Road presently functions as a minor collector road.

The Vermont State Design Standards (VSDES) were adopted by VTrans in 1997 in order to allow greater flexibility than the AASHTO design standards in road design. The stated purposes of the Vermont State Design Standards are to:

- Provide clear technical direction to the designers of transportation projects in Vermont.
- Achieve roadway and bridge designs which provide access, mobility and safety for users, and which are also sensitive to the social and environmental context of Vermont.

The key decision necessary in designing a roadway is in selecting an appropriate design speed. For collector roads, the VSDES permit design speeds of 25 to 50 mph, depending on terrain, driver expectancy and other characteristics. Generally speaking, the design speed is normally equal to the posted speed limit. The design speed may be up to 10 mph lower than the posted speed limit, provided that appropriate warnings (e.g. speed advisory plaques) are posted. This later situation is typically reserved for critical locations such as curves or corners where reducing them would create major impacts to existing historical, scenic and/or environmental resources.

What is the appropriate design speed for East Hill Road? It is presently posted at 35 mph. On the other hand, *MUTCD* standards state that the speed limit "should be within 5 mph of the 85<sup>th</sup> percentile speed of free-flowing traffic", which on East Hill Road ranges between 40-45 mph. Further, Vermont guidelines state that the speed limit should not be lower than the low number of the 10 mph pace speed and not greater than the 85<sup>th</sup> percentile speed or the high number of the 10 mph pace speed, whichever is lower, minus 3 mph. Based on the speed survey data shown in Table 2, those guidelines give a permissible speed limit range of 30 - 37 mph. We would round the latter down to 35 mph.

Considering the foregoing, we recommend using 35 mph as the design speed for all of East Hill Road in Williston and most of it in Richmond. The only exception is the section between Christmas Hill Road extending to the top of the hill towards Fays Corners, for which we recommend using a 25 mph design speed.

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Based on those design speeds, Table 3 shows the VSDS recommended cross-sections for East Hill Road.

**Table 3 - Recommended Cross-Sections**

	2006		2025	
Design Speed (mph)	25	35	25	35
AADT (vpd)	1,200		2,000	
Travel Lane Width (ft)	9	9	10	10
Shoulder Width (ft)	2	2	3	3
Total Pavement Width (ft)	22	22	26	26

As can be seen in the above table, for the ranges examined, traffic volumes exert a greater influence on the recommended roadway cross-section than does the design speed. On rural roadways such as East Hill Road, the foregoing roadway cross-section widths are considered adequate to provide for safe shared use of the roadway shoulder by bicyclists and pedestrians.

Another important geometric design element is the horizontal clearance or “clear zone”. A clear unobstructed roadside is highly desirable for safety reasons. The clear zone represents an area alongside the roadway that is normally kept clear of trees, utility poles and other obstructions, and should have not greater than a 1:3 cut or fill slope. Generally speaking, for the existing and projected traffic volumes and speeds shown above, 12-14 ft clear zones are recommended on each side of the roadway. Where steeper side slopes exist and/or suitable clear zones cannot be provided, the installation of guard rail is recommended.



**Posted Speed Limit**

There are several established guidelines for setting speed limits. One is that to effectively enforce a speed limit, the public must believe that it is reasonable. Setting the speed limit too low does not necessarily reduce speeds, but rather can encourage speeding.

A second established guideline is that speed zones should not be established to warn motorists of hazardous conditions. Rather, it is preferable to set one speed limit, and use advisory speeds as needed at curves, hills and other hazardous conditions.

It has been suggested that East Hill Road’s posted speed limit of 35 mph should be reduced. It is our opinion that 35 mph is an appropriate speed limit for East Hill Road based on the character of the area served, its overall geometric alignment and its functional classification.

**Recommended Improvements**

Specific recommendations for future improvements to East Hill Road include:

**Overall**

As indicated in Table 3, widening of East Hill Road is recommended in order to more safely accommodate the projected future traffic volumes. This would normally be accomplished by extending the existing pavement 2 ft on each side. However, in selected areas where ledge, other obstacles or environmental considerations exist, this widening may be shifted all or in part to one side. Existing topographical and drainage constraints within the existing right-of-way may also result in widening specific sections and bypassing others.

While widening, addressing inadequate sight distances and establishing adequate clear zones along an existing roadway are intended to provide greater safety, these improvements can inadvertently encourage higher speeds. To prevent that may require greater speed enforcement and/or the installation of traffic calming measures. Examples of the latter that might be appropriately applied to East Hill Road include the installation of neckdowns, speed humps and speed tables at selected locations.

We also recommend that the existing center lines be supplemented with edge lines on both sides to delineate 9 ft wide travel lanes and 2 ft wide shoulders. While normally not provided on rural roads having less than daily traffic volumes less than 3,000 vpd, experience has shown that edge lines improve safety by providing better driver guidance during low-visibility conditions. They can also be used to create a traffic calming effect due to the perception of a narrower traveled way. Safety for pedestrians and bicyclists is also improved by having a designated paved shoulder.

**South Road/East Hill Road Intersection (Sta 0 to Sta 2)**

Figure 10 shows the recommended realignment of this intersection. This realignment provides greater safety due to the 90 degree alignment as opposed to the existing 45 degree angle. It also closes up the wide expanse of pavement that presently exists; thereby promoting lower cornering speeds and better compliance with the stop sign on the East Hill Road approach.

This improvement also improves the hydraulic capacity of the stream channel presently crossing East Hill and South Roads and replaces the two existing culverts with one; thereby correcting the periodic flooding that presently occurs. This improvement also corrects the related water pollution that occurs from the nearby Siple farm manure pit during flood events.



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**Sherwood Forest Road Intersection (Sta 48 to Sta 50)**

The existing ledge outcrop on the north side of East Hill Road directly opposite Sherwood Forest Road represents a significant roadside safety hazard in addition to limiting available sight distances for westbound traffic through this section. We recommend that it be cut back to provide the recommended clear zone from the roadway.



**Flatten Vertical Crests**

There are several vertical crests in East Hill Road where sharp vertical curvature limits available sight distances to less than desired. These are located at roughly Sta 39, Sta 53, Sta 61 and Sta 69. Figures 11-13 show the estimated scope of work necessary to provide adequate sight distances at these locations. In each case, a grade reduction of only 1-2 ft at the crest would greatly improve the available sight distances.

The top of the steep grade east of Christmas Hill Road also has very limited sight distances. The recommended improvements in that area are discussed separately below.

**Christmas Hill Road Intersection (Sta 96 to Sta 98)**

This intersection is one of the most hazardous locations along East Hill Road, and also the location having the most constraints limiting possible improvements. Local residents report frequent occurrences of vehicles skidding across adjacent lawns due to not anticipating the sharpness of this corner. Appropriate warning signs are in place and maintained by the Town, but as noted earlier, the existing 25 mph advisory speed is too high for the corner. Instead, based on ball bank indicator readings, 15 mph represents a more appropriate speed.

Christmas Hill Road is presently the stop-sign controlled approach to this intersection. Those vehicles have ample sight distances in both directions. However, traffic turning left onto Christmas Hill Road suffers from severely limited sight lines due to the presence of a vegetation and a picket fence on the inside of the corner. There is also no street lighting at or near this intersection to help improve night-time visibility.



With the environmental constraints and the number of residential properties bordering this intersection, it is our opinion that it would be difficult and costly to improve this corner to provide a 25 mph design speed. This would require increasing the centerline radius to 200 ft, as illustrated on Figure 14; necessitating the purchase and demolition of the existing residential property on the inside of the corner.

While Figure 14 shows a desirable long-term realignment of this corner, immediate short-term improvements are also needed. To that end, we have developed the improvements shown in Figure 15 in order to improve the advance warning given to motorists approaching this intersection, to improve its night-time visibility and to better guide vehicles around the corner itself. New traffic control devices shown in Figure 15 to improve traffic operations and safety at this corner include:

- Install new 15 mph speed advisory placards (W13-1).
- Replace existing turn warning signs (W1-1) with new turn/intersection warning signs (W1-10)<sup>5</sup>.
- Install new turn speed signs (W13-5) as near as possible to the point of curvature on both sides of the corner.
- Paint new centerlines and edgelines to provide 10 ft wide lanes in the corner itself (increased from 9 ft width to help compensate for vehicle off-tracking through the corner). Consider using durable pavement markings in the corner for increased visibility during adverse weather conditions and durability.
- Instead of breaking the centerline and outside edgeline at the intersection itself, use single dotted lines (2' line/4'gap) for both to provide better guidance around corner.
- Provide minimum 2 ft wide paved shoulders outside of the travel lanes.
- Work with the adjacent landowner on the inside of the corner to improve sight lines.
- Install a street light at the intersection to improve night-time visibility.

#### Steep Grade and Curves (Sta 92 to Sta 96)

As noted earlier, we recommend that this section be posted with a 25 mph advisory speed. At that speed, the minimum safe stopping sight distance is reduced by almost 100 ft compared to that for a 35 mph speed (155 ft vs. 250 ft on a flat grade). Figure 15 (located in map pocket) illustrates a possible realignment and improvement to this section based on a 25 mph design speed. The improvements shown to the upper portion of this hill are likely to require blasting to remove existing bedrock under the roadway. This will require careful planning and execution to avoid damaging nearby structures and private water supplies.



New traffic control devices shown in Figure 15 to improve traffic operations and safety in this area include:

- Install a new 25 mph speed advisory placard (W13-1) on the existing warning sign at Sta 89+/-.
- Replace existing reverse curve warning signs (W1-4) with new reverse turn warning signs (W1-3).
- Paint new centerlines and edgelines to provide 10 ft wide lanes through this area (increased from 9 ft wide to help compensate for vehicle off-tracking through the corners). Consider using durable

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<sup>5</sup> The W1-10 sign designation is somewhat generic; numerous curve/turn and intersection alignments are possible.

pavement markings in the corner for increased visibility during adverse weather conditions and durability.

- Provide minimum 2 ft wide paved shoulders outside of the travel lanes.

### Fays Corner

A Road Safety Audit Review (RSAR) was performed at this intersection in July 2004. Participants included various VTrans sections, the Town of Richmond and the CCMPO. The RSAR identified a number of areas in which traffic safety and operation could be improved at this intersection, some of which have since been implemented. As part of this study, it was requested that we review the RSAR and current conditions at this corner. The following summarizes our observations and recommendations:



- It appears that the RSAR recommended traffic signs have been installed; greatly improving the advance warnings and information needed by motorists to safely negotiate this corner.
- Existing pavement markings, however, are badly worn or non-existent in the corner & intersection; we recommend replacing with durable markings and adding edge lines.
- The island in Kenyon Road remains. We recommend removing that island and constructing a new single Kenyon Road approach.
- We also recommend the installation of a street light at this corner to help improve night-time visibility.

Figure 16 illustrates current traffic control devices and conditions at Fays Corners together with showing new pavement markings and the Kenyon Road approach island removed.

## 5. TOWN HIGHWAY CLASSIFICATION

Title 19 of Vermont State Statutes governs town highways and identifies four classes of town highways. Class 1 is reserved for US and VT numbered state highways. Class 2 includes those town highways selected as the most important highways in each town. These are essentially the “trunk lines” linking towns and also connecting to other state highways and/or Class 1 town highways. Class 3 includes the remaining local roads normally maintained and open for year-round travel by a standard passenger car. The last category, Class 4, is reserved for those town highways which are not maintained for year-round travel by a standard passenger car.

Title 19 also spells out the required process for reclassifying town highways. In most cases this process is entirely local, i.e. only requires town approval. However, to reclassify a town highway from Class 3 to Class 2 also requires VTrans approval. For that, VTrans has established the following guidelines<sup>6</sup>:

- a) Serves the region.
- b) Minimum three rods (49.5 ft) right-of-way (must be certified by Selectboard).
- c) 70 points needed (classification rating).
- d) Total mileage of Class 2 town highways to total mileage of Class 2 and 3 town highways should not exceed 25%.
- e) Paved typical: 22 ft shoulder to shoulder.
- f) A request for reclassification cannot terminate at a town line. If the road travels through two towns, approval from both towns is required.

With respect to its classification rating, we find that East Hill Road qualifies for 76 points. The criteria included in the rating calculation include the following:

- |                                                                     |           |
|---------------------------------------------------------------------|-----------|
| 1. Traffic AADT (max. 40 points)                                    |           |
| over 400 vehicles per day                                           | 40 points |
| 2. Geographic Features (max. 20 points)                             |           |
| a) Town to Town                                                     | 10 points |
| b) Land Access                                                      | 5 points  |
| 3. Economic Features (max. 20 points)                               |           |
| c) School Bus & Rural Free Delivery Route                           | 6 points  |
| 4. Traffic Classification and State of Improvement (max. 10 points) |           |
| a) Paved (22 ft typical)                                            | 10 points |
| b) Through traffic                                                  | 5 points  |
| 5. National Defense and Public Service (max. 15 points)             |           |
| b) Alternate Route (3-10 mi) floods, etc.                           | 5 points  |

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<sup>6</sup> *Handbook for Local Officials*, VTrans, 2004.

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Copies of pertinent pages and forms from the VTrans guidelines concerning reclassification are enclosed as Appendix B.

Because East Hill Road already has a 22 ft wide paved roadway width, reclassifying it from Class 3 to Class 2 will not in itself require any physical improvements. Similarly, speed limits are not affected by whether a town highway is classified as Class 2 or Class 3.

In Williston, the 1.22 mile northerly section of South Road that links East Hill Road to Oak Hill Road would also need to be reclassified along with East Hill Road. South Road is presently a Class 3 town highway over its entire length. This northerly section, though, essentially provides the same functions as does East Hill Road.

The primary benefit to the Towns gained by reclassifying East Hill Road and the aforementioned section of South Road comes in the form of additional state highway aid to offset the increased maintenance costs associated with higher volumes of through traffic using those roads. On a per mile basis, a Class 2 highway receives approximately 2.7 times the amount of state aid that a Class 3 highway receives. Table 4 shows the additional state highway aid, in year 2006 dollars, that would result from reclassification.

**Table 4 - 2006 State Highway Aid Comparison**

Town	2006 Total State Highway Aid	2006 State Aid per Mile		Additional Annual State Highway Aid from Reclassification
		Class 2	Class 3	
Richmond	\$107,556	\$4,029.65	\$1,466.20	\$3,076
Williston	\$147,659			\$5,383

Additionally, there is an annual appropriation for grants to municipalities specifically for reconstructing and/or resurfacing Class 2 town highways. This program is administered by VTrans, and the annual appropriation is allocated after consideration of applications submitted by eligible municipalities.



## **6. PUBLIC INVOLVEMENT**

This study was initiated with a project kick-off meeting on May 24, 2006 with local officials from both Richmond and Williston attending. That was followed by a Public Meeting at the Richmond Town Offices as part of the Richmond Selectboard's July 5, 2006 meeting

Notices for the July 5<sup>th</sup> Public Meeting were distributed to local officials and media. Notices were also directly mailed to residents of East Hill Road and its surrounding roads. The resulting Public Meeting was very well attended by approximately 35 residents. Additionally, a number of phone calls and emails were received before the meeting itself from others who could not attend.

The overriding concern voiced at the Public Meeting related to the speed of traffic using East Hill Road and the corresponding adverse effect that has on safety. Comments received at this meeting included:

- Traffic volumes have doubled.
- Too much traffic traveling too fast.
- Many other users of East Hill Road - bicyclists, pedestrians, joggers. Existing conditions are dangerous for them.
- East Hill Road should be residential.
- Reduce speeds by greater enforcement. Use mobile speed cart.
- Advisory speed signs are not enforceable. Change to enforceable signs.
- People are not aware of how bad Christmas Hill Road corner is.
- Exiting from Deer Creek Lane is difficult due to limited sight distances.
- Section from Christmas Hill Road to Fays Corners is bad.
- Richmond bridge issues are causing trucks and other vehicles to use secondary roads.
- Sight distances are inadequate at numerous driveways. Town regulations (Richmond) require 10 ft of sight distance per mph.
- A four-way stop should be installed at Fays Corners.
- Poor drainage near Deer Creek Lane is washing gravel onto yard.
- The lack of shoulders makes East Hill Road unsafe for other users, e.g. pedestrians.
- Why is it necessary to upgrade East Hill Road to Class 2?
- Speed limit should be lowered to reduce speeds. Everyone knows that they can exceed the speed limit without being ticketed.
- Why should Richmond & Williston tax dollars be used to make it more convenient for people from other towns to use East Hill Road?

A second Public Meeting, similar to the first, will be held after this draft report is reviewed by Town officials, to review the final study results and obtain public input and feedback. Comments from that Public Meeting will be incorporated into the final report.

## 7. NEXT STEPS

The next steps for the Towns of Richmond and Williston involves developing an overall roadway maintenance/improvement strategy for East Hill Road, gaining public acceptance of that strategy, and securing the necessary funding.

With regards to an overall maintenance/improvement strategy, it is important to separate potential improvements into two categories: a) short-term improvements that can be accomplished within a 1-2 year time frame and within the constraints of the Towns' annual road maintenance funds, and b) long-term improvements that require special capital funding (i.e. bonding) on the part of the Towns or state funding through VTrans. Table 5 presents an initial breakdown of potential short-term and long-term improvements.

**Table 5 - Short-Term vs. Long-Term Improvements**

<b>Town &amp; Improvement</b>	<b>Short-Term</b>	<b>Long-Term</b>
<b><u>Richmond</u></b>		
Improve Sight Distances at Driveways	X	
New Warning & Advisory Speed Signs	X	
Christmas Hill Rd. Intersection	X	
Realign Steep Grade/Curves (Sta 92 - Sta 96)		X
Improve Sight Distances at Driveways	X	
Flatten Vertical Crests		X
Remove Ledge at Sherwood Forest Rd.	X	
Widen East Hill Rd. & Shoulders		X
<b><u>Williston</u></b>		
Realign East Hill Rd. / South Rd. Intersection		X
Improve Sight Distances at Driveways	X	
Widen East Hill Rd. & Shoulders		X

Public acceptance of the above-recommended improvements is critical. Clearly, local residents along East Hill Road are concerned with increasing traffic volumes and with vehicles not observing the posted speed limit. That needs to be balanced with providing a roadway and roadside environment that minimizes the occurrence and severity of crashes, and safely accommodates other users in addition to vehicular traffic. We believe that introducing traffic calming measures to East Hill Road will help create the desired balance of safety and function.

Additionally, whether to reclassify East Hill Road as a Class 2 town highway represents a major decision which will require joint approval from both Towns. Such a reclassification could be viewed as further encouraging more non-local traffic to use East Hill Road. On the other hand, the recent Bridge St.

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bridge problems in Richmond illustrate how traffic congestion conditions in Richmond village directly effect East Hill Road. It is our opinion that regardless of whether East Hill Road is Class 2 or Class 3, once residents of neighboring towns identify it as being quicker (time-wise) than other alternate routes, it is likely to become their preferred route.

Accordingly, we recommend that reclassification be further examined in conjunction with an assessment of whether one or more of the long-term improvements identified in Table 5 might qualify for state funding from the Class 2 Town Highway or the LTF (Local Transportation Facilities) programs. Utilizing state and federal funds to construct long-term improvements will also require defining specific projects for inclusion on the CCMPO's Transportation Improvement Plan (TIP) for Chittenden County.

Other non-traditional sources of project funding should also be explored. For example, the Vermont Agency of Natural Resources administers a grant program (Vermont Better Backroads Grants) that can be used to correct an existing road erosion problem or to conduct a road erosion inventory and create a capital budget plan to fix the identified problems. Additionally, because Williston is a designated MS4 (Municipal Separate Storm Sewer System) municipality, funding opportunities may exist to help correct the flooding and associated water pollution that occurs at the intersection with South Road.