Blakely Road / Laker Lane
Colchester, Vermont

Intersection Scoping Study
October 16, 2013

Prepared for:

Town of Colchester

CHITTENDEN COUNTY RPC
Communities Planning Together

Prepared by:

LAMOUREUX & DICKINSON
Consulting Engineers, Inc.

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The preparation of this report has been financed in part through grant(s) from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

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1.0 INTRODUCTION

1.1 Background

This scoping study of the Blakely Road / Laker Lane intersection is sponsored by the Town of Colchester and the Chittenden County Regional Planning Commission (CCRPC). Previous studies of this intersection include a Scoping Study of the VT Route 127 corridor in Colchester by Dufresne-Henry in October 2001. That was performed as a follow up to the Route 127 Corridor Study completed by Dubois & King in 1998. The Dufresne-Henry Scoping Study examined specific locations along Route 127 that had previously been identified as having the highest priority and need for improvement.

The Blakely Road / Laker Lane intersection was identified as one of the critical intersections, with a need for additional turning lanes. Alternatives were developed at that time and analyzed for a potential construction year of 2003, a design year of 2013 plus a design year of 2018 that included four different construction scenarios for the Circumferential Highway (CIRC). There have been no improvements made to the intersection since the 2001 Scoping Study was completed. The original design year is now less than a year away and further construction of the original CIRC was essentially put on indefinate hold in May 2011. In its place, the CCRPC is coordinating, on behalf of the State, a process to identify projects and planning activities which would aid in meeting the original Purpose and Need of the CIRC, which broadly stated are to increase mobility, reduce congestion, improve safety and promote economic development.

Since May 2011, CCRPC staff has been coordinating with VTrans and the "CIRC Communities" (Colchester, Essex, Essex Junction, and Williston) to identify CIRC Alternative Projects. During this process the Town of Colchester requested that the Blakely Road / Laker Lane intersection scoping study be updated based on current traffic volumes and conditions without the CIRC. The preferred alternative from this Scoping Study will then be included as one of the CIRC Alternative projects.

1.2 Study Area

This study focuses on the Blakely Road / Laker Lane intersection and its approaches. Figure 1 shows the location of the project study area.

FIGURE 1 – STUDY AREA

2.0 EXISTING CONDITIONS

2.1 Functional Classification

Blakely Rd is a Class 2 town highway (TH #3), and is also a federal aid urban street (FAU 5600) and part of Vermont Route 127. Blakely Rd functions as an urban minor arterial, and is a key commuter route linking Malletts Bay and the north end of Burlington with other parts of Colchester, Winooski, Essex and other destinations in northern Chittenden County.

Laker Ln is owned by the Colchester School District, a public entity, however it is not a town highway. Its sole function is to provide access to the Colchester High School and adjacent recreational facilities.

2.2 Traffic Control

Traffic is presently controlled by a stop sign on the Laker Ln approach to Blakely Rd. There is a flashing beacon (intersection control beacon) at the intersection with a red indication for Laker Ln and yellow indications for Blakely Rd that operates during the school year.

The posted speed limit on Laker Ln is 25 mph. The posted speed limit is 35 mph on Blakely Rd; however, this segment of roadway is located within a designated school zone. During the school year, a school zone speed limit of 25 mph exists from 7:00 am to 3:30 pm on weekdays. The school speed zone is identified by flashing school zone speed limit assemblies located on Blakely Rd and Malletts Bay Avenue.

2.3 Roadway Geometry

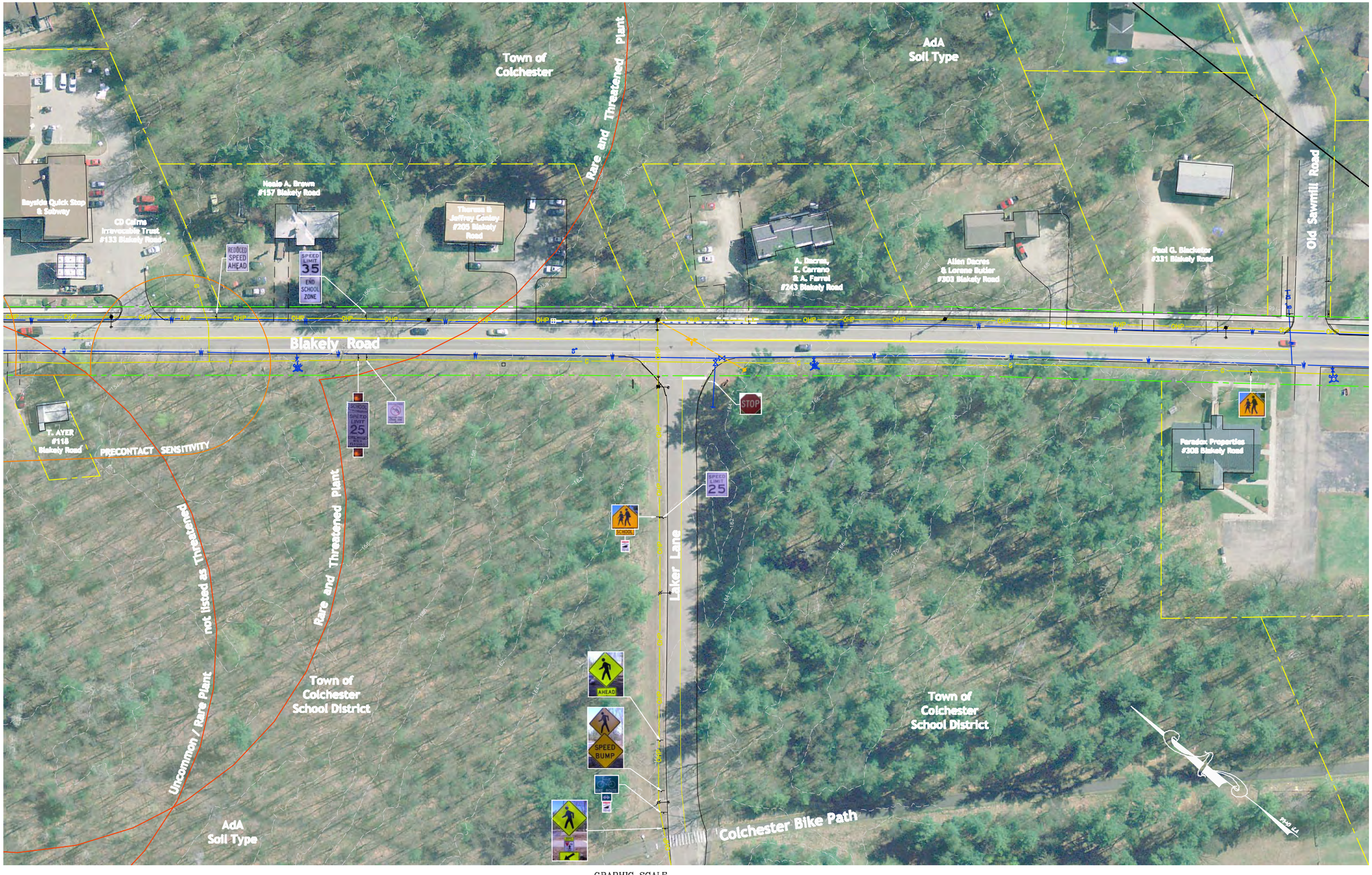
The through lanes on Blakely Rd are 11 ft wide with 4 ft wide paved shoulders. There is a painted double yellow centerline and white painted edge lines along both sides.

Laker Ln is a 28 ft wide paved roadway. There was a single yellow centerline and stop bar pavement markings on Laker Lane at the time of the site inventory performed for this study in the spring of 2012.

Figure 2 shows the existing geometry at the intersection.

Available intersection sight distances from Laker Ln extend just over 1,000 ft to the west to the Blakely Road / West Lakeshore Drive signalized intersection. To the east (toward the schools and Town office), available intersection sight distances extend well over 1,400 feet to the Malletts Bay Avenue intersection. These sight distances exceed AASHTO recommended intersection sight distances of 390 ft and 335 ft for vehicles turning left and right from Laker Ln (based on the posted speed limit of 35 mph).

Laker Lane & Blakely Road Intersection



Lamoureux & Dickinson
Consulting Engineers, Inc.
14 Mosse Drive, Essex, VT 05452
802-878-4450 www.LDengineering.com

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

FIGURE 2
EXISTING CONDITIONS

2.4 Roadway Alignment & Topography

Blakely Rd is relatively straight and level as it travels past the Laker Lane intersection. Laker Ln is also relatively flat at the intersection and straight for the first 480 feet to the Colchester Bike Path crossing. After the bike path crossing Laker Ln has a slight curve to the east as it enters the high school parking lot.

2.5 Drainage / Hydraulics

Drainage from both Blakely Rd and Laker Ln generally runs off the pavement into roadside swales and/or low areas. Stormwater then infiltrates into the prevailing sandy soils in the immediate area of the intersection. There is a 24 " corrugated metal pipe (CMP) drywell storm structure on the north side of Blakely Rd located approximately 130 ft west of the intersection. The survey / base plans prepared by Dufresne-Henry in 2001 indicate that an unknown length of perforated pipe leads out of the drywell structure toward the driveway to the east. This pipe was observed to be full of sediment during a site visit conducted with Town staff on April 25, 2012. There are culverts under the driveways along Blakely Rd. There are no other storm structures, pipes or storm ponds within the immediate area of the intersection.

2.6 Bicycle and Pedestrian Facilities

There is a 5 ft wide concrete sidewalk along the north side of Blakely Rd. There are no sidewalks on Laker Ln. As mentioned previously, the Colchester Bike Path crosses Laker Ln approximately 480 ft south of the intersection. The Colchester Bike Path links Bayside Park plus the Malletts Bay Elementary, Colchester Middle and Colchester High Schools with other areas of Colchester to the east and north. Even with the nearby Bike Path, Blakely Rd continues to be used by bicyclists, and is classified as a "common route not designated" on-road facility in the CCRPC Regional Pedestrian and Bicycle Plan. The existing 4 ft wide paved shoulders provide adequate width for use of the shoulder by bicycles (the minimum paved shoulder width for bicycle use is 3 ft[1,2]).

2.7 Utilities

Overhead electric, telephone and cable lines (Green Mountain Power, Fairpoint and Comcast) run along utility poles located on the north side of Blakely Rd and the west side of Laker Ln. There is also a utility pole with a street light located at the southwest corner of the intersection also serving as one of the poles supporting the overhead flashing beacon.

There are municipal (Colchester Fire District #2) water mains along both sides of Blakely Rd just outside the edge of pavement (8" and 4" mains on the south and north sides, respectively). There is also a natural gas line (Vermont Gas) along the south side of Blakely Rd.

2.8 Right-of-Way

Blakely Rd has a 66 ft (4 rod) wide right-of-way. Laker Ln does not have a designated right-of-way as it is part of the Colchester High School property. There is also a 60 ft wide strip of land located directly opposite Laker Ln that accesses the former Hazelett parcel now owned by the Town of Colchester. That parcel is currently undeveloped, and its future use and access requirements have yet to be determined.

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1 Pedestrian and Bicycle Facility Planning and Design Manual, VTrans, 2002, Fig. 4-17 & Table 4-10

2 Vermont State Standards, VTrans, 1997, Table 4.7

2.9 Land Use

The surrounding land use immediately adjacent to the the intersection consists of single and multi-family residential buildings. To the west on Blakely Rd are recreational and commercial uses, and to the east on Blakely Rd and south on Laker Ln are the Malletts Bay Elementary, Colchester Middle and Colchester High Schools.

2.10 Traffic Volumes

Automatic traffic recorder counts on Blakely Rd are performed (generally every two years) by VTrans at count station D453, located 0.1 mile east of East Lakeshore Dr. The most recent count at D453 was performed in 2009. Data from that count is summarized in Table 1.

TABLE 1 - Traffic Volume Summary

AADT	Peak Hour Volumes		Daily Trucks	Peak Trucks
	AM	PM		
10,300 vpd	802 vph	1,113 vph	4.1%	3.5%

L&D conducted morning and afternoon peak hour turning movement counts at the intersection on April 4, 2012. These counts were factored to design hour traffic volumes using data from continuous traffic count (CTC) station D040, located nearby on US Route 7 in Colchester. The design hour volume (DHV) is the 30th highest hourly traffic volume that occurs on a roadway in a given year. This volume is used to evaluate traffic congestion conditions. The design hour volume was calculated using the DHV calculation guidelines published by VTrans. Figure 3 shows the adjusted year 2012 morning, mid-afternoon (school peak) and afternoon peak hour traffic volumes at this intersection. The raw count and DHV calculations are included in **Appendix 1**.

Considerable traffic congestion occurs at this intersection during the peak 15-20 minute periods immediately before and after the school day as students and buses arrive at and depart the High School. These short periods of intense activity are noticably more congested than during the remainder of the morning and mid-afternoon peak hours.

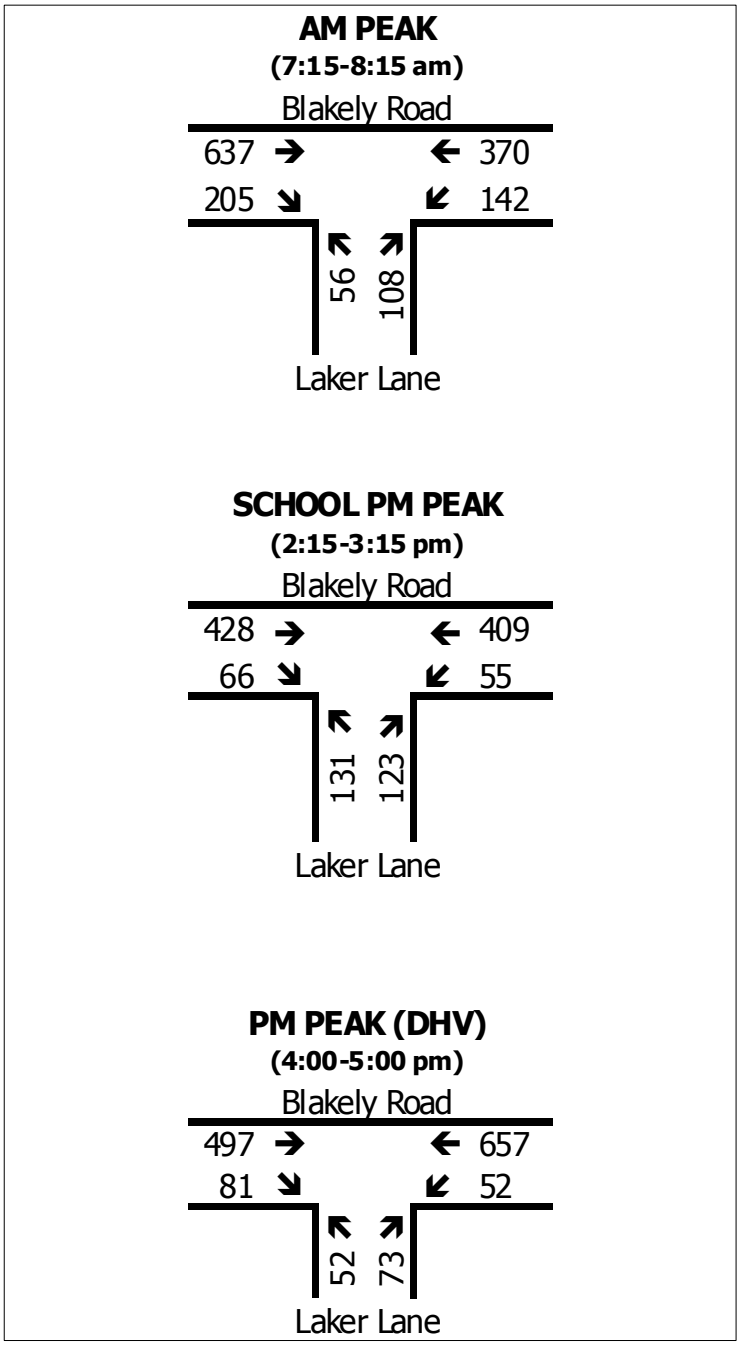
2.11 Future Traffic Growth

Average annual daily traffic volumes on Blakely Rd decreased approximately 6% between 2001 and 2009. This is similar to the statewide average for urban highways in Vermont which showed a 4% decrease in traffic volumes from 2006 to 2011.

VTrans is currently projecting zero short term (5-year) and long term (20-year) growth rates on highways located in urban areas. Colchester's population has also shown no growth in recent years, even with continued development within the Town. In an effort to be conservative however, a 5% overall growth factor has been applied to the 2012 DHV's to develop a 10-year (2022) future projection for use in analyzing the alternatives in this study.

Figure 3 also shows projected year 2022 peak hour volumes at this intersection.

FIGURE 3 – Peak Hour Volumes



2.12 Congestion Analysis

Levels of service (LOS) at intersections are determined by the average control delay; measured in seconds per vehicle. The methodology for analyzing LOS is established by the *Highway Capacity Manual* (*HCM*)[3]. Table 2 summarizes the LOS/delay criteria for unsignalized intersections. The analyses themselves were performed using *Synchro/SimTraffic* software. *SimTraffic* was used to model unsignalized traffic conditions, as it appears to provide delay and queue results more reflective of actual observed conditions than the traditional *HCM* based unsignalized intersection capacity analyses.

TABLE 2 – Intersection Level of Service Criteria

Level of Service	Avg. Delay (sec/veh)		Level of Service	Avg. Delay (sec/veh)	
	Signalized	Unsignalized		Signalized	Unsignalized
A	≤10	≤10	D	≤55	≤35
B	≤20	≤15	E	≤80	≤50
C	≤35	≤25	F	>80	>50

VTrans' Level of Service Policy[4] establishes the desired LOS standards for the state highway system. At unsignalized intersections having a single lane side street approach and 100 vph or greater side street approach volume[5], the VTrans level of service policy establishes LOS D as the desired design target for the minor street approach. Laker Lane has a single approach lane and over 100 vph exiting traffic during all three peak hours; so the LOS D standard is applicable.

Table 3 summarizes the level of service, average delay (in seconds) and the maximum queue length calculated during the morning, mid-afternoon (school) and afternoon peak hours. As described previously, the traffic volumes observed during the April 2012 turning movement count were converted to design hour volumes (DHV) and factored to 2022 year volumes for the purpose of these analyses.

Rather than simply modeling existing geometric conditions, the capacity analyses presented in Table 3 were developed through a series of model runs with both free flow conditions on Blakely Rd as well as a yield condition for eastbound and westbound Blakely Rd traffic. This was done as a result of observations made while conducting the turning movement counts at this intersection. During the counts, we observed that significant queues would develop on Balekly Rd when eastbound and westbound drivers would stop and hold up traffic behind them to allow vehicles to turn left into and out of Laker Ln. When this occurs (and it occurs somewhat randomly), the level of service for vehicles on Blakely Rd drops significantly. For modeling purposes it was assumed that this yield condition occurs 25% of the time during the peak hours.

[3] *Highway Capacity Manual*, Transportation Research Board, 2010

[4] *Highway Design "Level of Service" Policy*, Vermont Agency of Transportation, May 31, 2007

[5] ≥150 vph on two lane side street approaches

It should be noted that the level of service for Laker Lane is also an average of the left- and right-turns because there is officially only one lane on this approach. Actual delays experienced by some right-turning vehicles may be less than shown if the right-turning vehicle is able to slip around vehicles waiting to turn left. This is possible only when there are two or less left-turning vehicles in the queue.

TABLE 3 – Existing Conditions
Intersection Capacity Analysis Results

Approach/Movement	AM Peak (7:00-8:00)			School Peak (2:15-3:15)			PM Peak (DHV) (4:00-5:00)		
	LOS	Delay	Max Q	LOS	Delay	Max Q	LOS	Delay	Max Q
Blakely Road									
EB Thru/Right	C	25	155'	B	15	55'	C	18	135'
WB Thru/Left	D	30	405'	B	15	190'	C	20	275'
Laker Lane									
NB Left/Right	F	375	820'	D	26	225'	C	23	145'

Detailed level of service calculations are included in **Appendix 2**.

2.13 Safety Analysis

VTrans maintains a database of crash data throughout the State which is used to develop critical rates for roadway segments and intersections. If the actual crash rate at an intersection is higher than the critical rate it is classified as a high crash location (HCL). The most recent VTrans High Crash Intersection Listing for the 2006-2010 time period does not list the Blakely Road / Laker Lane intersection as a High Crash Intersection. A review of the crashes that have occurred within the operational area (200 ft) of the intersection in the last five years (2006 – 2010) shows ten crashes on Blakely Rd and five crashes on Laker Ln. Table 4 provides a summary of the types of crashes, time of day and weather.

Nine of these crashes were rear end collisions; with most of them occurring on clear days during the afternoon peak period. Most of these rear end crashes were vehicles travelling either eastbound or westbound on Blakely Rd who didn't realize the car in front of them was stopped or stopping. Westbound vehicles could be stopped to wait to make a left-turn onto Laker Ln. Eastbound vehicles, however, should not be stopped on Blakely Rd at Laker Ln for any reason. Chief Charles Kirker of the Colchester Police Department indicated that vehicles stopping on Blakely Rd to let traffic exit from Laker Ln is the primary safety issue that he sees at this intersection.

TABLE 4 – 2006–2010 Crash Data

	Total #	Type of Crash					
		Rear-end	Opp. Dir. Sideswipe	Thru Moves Broadside	Left and Thru Broadside	Right and Thru Sideswipe	Single Vehicle Crash
Total Crashes	14	9	2	0	0	0	3
Weather							
Clear	8	-	-	-	-	-	-
Cloudy	4	6	1	-	-	-	1
Rain	1	2	-	-	-	-	2
Snow	0	1	-	-	-	-	-
Unknown	1	-	1	-	-	-	-
Time of Day							
6 am - 9 am (morning peak)	3	-	2	-	-	-	1
9 am – 3 pm (daytime off-peak)	4	2	-	-	-	-	2
3 pm - 6 pm (afternoon peak)	5	5	-	-	-	-	-
6 pm – 6 am (evening/night)	2	2	-	-	-	-	-

2.14 Signal Warrant Analysis

The *Manual on Uniform Traffic Control Devices* (*MUTCD*) provides nine warrants to be examined when determining if a traffic signal should be installed at an intersection. The first three warrants are related to volumes at the intersection and include tables and charts with minimum volume requirements to evaluate the eight-hour, four-hour and peak-hour traffic volumes at the intersection.

Existing traffic volumes and lane geometry do not meet the eight-hour volume warrant but do meet the four-hour and peak hour warrants. Figures 4 and 5 illustrate the results of the four hour and peak hour signal warrant analyses for intersections having single lane approaches (1 Lane & 1 Lane).

FIGURE 4

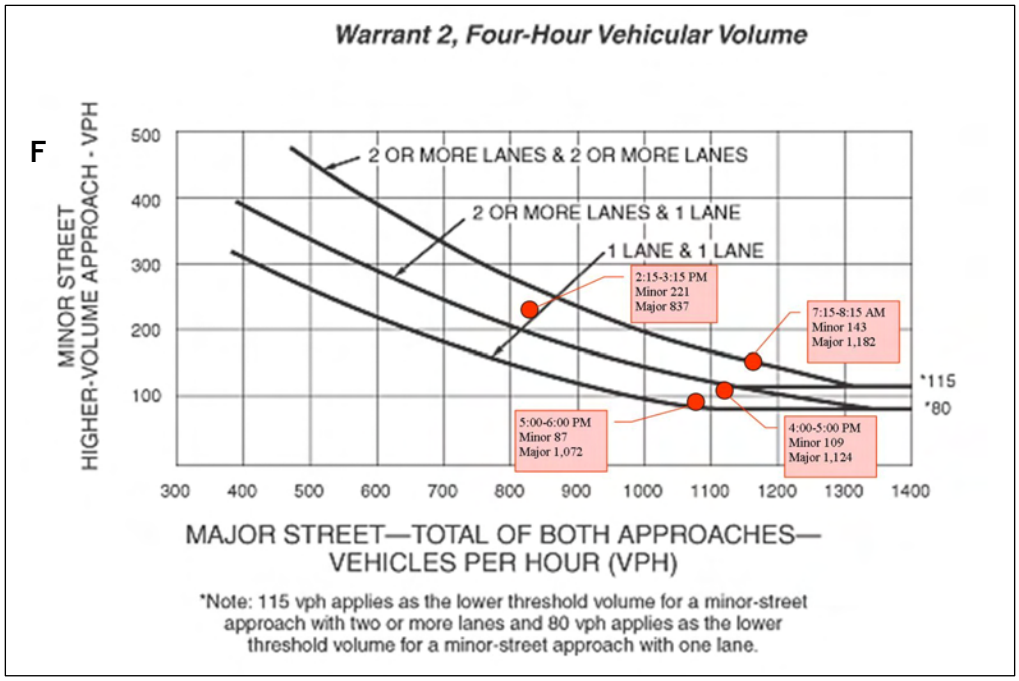
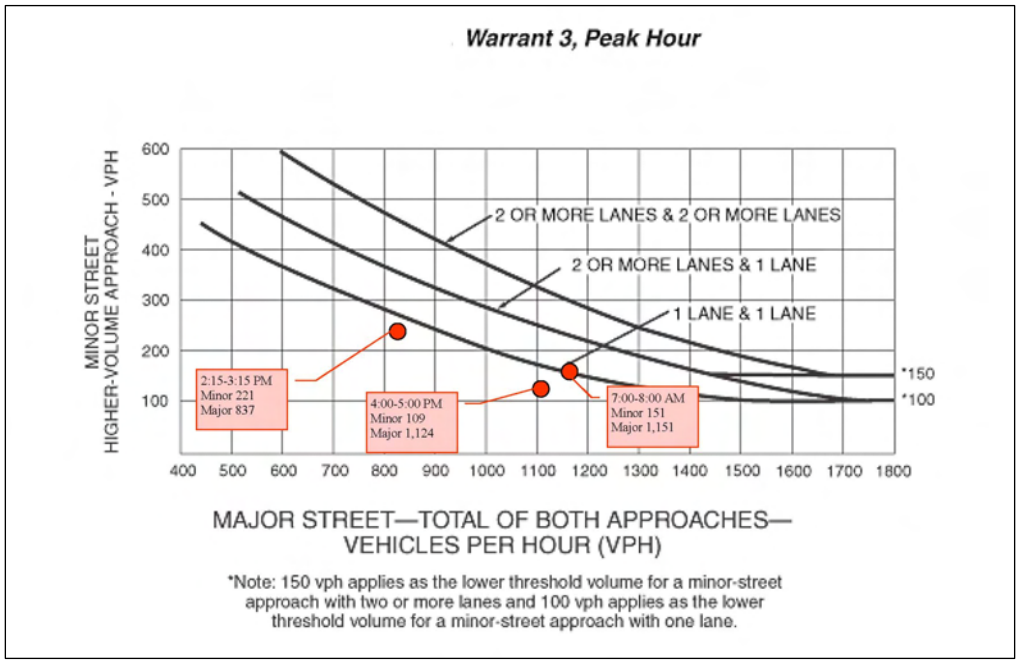


FIGURE 5



Warrant 4 is the Pedestrian Volume Warrant. This warrant is satisfied if there are 100 or more pedestrians crossing the major street during at least four hours of the day. Few pedestrians were observed during the peak hour counts at this intersection, therefore this warrant is not satisfied.

Warrant 5 is the School Crossing Warrant and requires a minimum of 20 students during the highest crossing hour to be satisfied. Although this is a school access, this warrant is not satisfied. There is some pedestrian traffic between the High School and the nearby Bayside Quick Stop / Subway, however, we understand that the students tend to walk on the paved shoulder along the south side of Blakely Rd and cross right in front of the store.

Warrant 6 is the Coordinated Signal System Warrant and is not satisfied by conditions at this intersection.

Warrant 7, Crash Experience, is satisfied when five or more reportable crashes have occurred within a 12-month period of the type that are susceptible to correction by a traffic signal. As mentioned previously there were fifteen reported crashes at this intersection in the five-year period from 2006-2010. Six of the fifteen crashes occurred in 2007, however since that time there have only been 2 or 3 crashes per year. Of the six crashes that occurred in 2007, four were rear end collisions and 2 were single vehicle crashes. These are not crashes of the type that are susceptible to correction by installation of a signal. The Crash Experience Warrant is therefore not satisfied.

Warrants 8 and 9 are the Roadway Network and Grade Crossing warrants which do not apply to this intersection.

As stated in the *MUTCD*, meeting signal warrants does not mean a traffic signal should always be installed. A more detailed engineering study should be conducted to determine if the signal will improve overall conditions at the intersection. It should also be noted that the volume related signal warrants were analyzed for existing geometry which includes one lane on the major and minor street approaches. If a right-turn lane is added to the minor street (Laker Ln) in the future, the volume related signal warrants would no longer be met. This is because the right-turn volume is typically subtracted from the minor street volume when a separate right-turn lane exists. With the right turn volume subtracted, the minor street volume would no longer meet the four-hour and peak-hour volume related signal warrants.

2.15 Turn Lane Warrant Analysis

Exclusive turn lanes at intersections can help to reduce crashes particularly in higher speed locations. Warrant analyses for both left- and right-turn lanes were conducted for this intersection using 2012 DHV's. The warrant analyses use VTrans protocol based on the Harmelink method. The analyses indicate that an exclusive left-turn lane with a length of 125 ft is warranted on Blakely Rd during the morning peak hour. The pm peak hour volumes also meet the warrants for this exclusive left-turn lane. An exclusive right-turn lane is warranted on Blakely Rd during the morning peak hour at the posted speed of 35 mph, but not at the school zone speed limit of 25 mph.

2.16 Environmental and Cultural Resources

Flood Plains
The project area is outside the area designated on the FEMA flood maps as the 100 year floodplain of Lake Champlain.

Wetlands
There are no Vermont State Wetland Inventory mapped wetlands in the vicinity of the study intersection.

Lakes/Ponds/Streams/Rivers
Lake Champlain (Malletts Bay) is located approximately 1,200 ft west of the intersection. There are no ponds, streams or rivers within the project area.

Fish and Critical Wildlife Habitat
A review of the Vermont Agency of Natural Resource Environmental Interest Locator map indicates that there are no known critical wildlife habitats in the project area. Fish habitat in Malletts Bay would not be directly impacted by improvements at the intersection as there would be no direct stormwater discharges from the intersection to the lake.

Rare and Endangered Species
Based on the Vermont Agency of Natural Resource Environmental Interest Locator map, there is a rare and threatened plant on both sides of Blakely Road to the west of this intersection. There is also an uncommon/rare but not threatened plant in this area as well.

Errol Briggs, from William D. Countryman Environmental Assessment and Planning, previously reviewed the area for the VT 127 Scoping Study. In his letter dated January 13, 2000, Mr. Briggs indicated that yellow panic grass (Dichanthelium xanthophysum) was located near the intersection of Blakely Rd and Lakeshore Dr. He mentions that this species was formerly listed as threatened under the Vermont Endangered Species Law but is no longer a protected species. He also mentions that according to the Vermont Heritage Program, an area classified as a pine-oak-heath sandplain forest occurs to the east of the Lakeshore Drive / Blakely Road intersection. He notes however, that given the existing development along Blakely Road at this point, it is unlikely that reconstruction of the highway will affect this area.

Stormwater
The only nearby property with a current Stormwater Discharge Permit is the Colchester High School. Improvements at this intersection would not impact that existing permit.

Hazardous Waste Liabilities
A review of the Vermont Agency of Natural Resource Environmental Interest Locator map indicates that there are two hazardous waste sites near the project area. One is at Bayside Quickstop (near the corner of Blakely Rd and Lakeshore Dr) and the other is at Colchester High School. Bayside Quickstop had gasoline contamination from underground storage tanks and received a Site Management Activity Complete designation in 1996. Colchester High School had heating oil contamination from an underground storage tank that was pulled and cleaned in 2002. As of July 2006 the contaminated soils had been stockpiled on site and were being monitored. Both sites are located outside the limits of the project area, and should therefore not be impacted by the proposed improvement alternatives.

Historic & Archaeological Resources

A report on historic and archaeological resources was developed by Hartgen Archaeological Associates (HAA) for the VT Route 127 Scoping Study. The report, dated February 2000, identified an area of pre-contact sensitivity near the Blakely Road / Lakeshore Drive intersection. This area is located on the south side of Blakely Rd at the far eastern end of the project area. HAA indicated that this area is sensitive for pre-contact resources due to its proximity to Malletts Bay and a known nearby pre-contact site. They recommended that any disturbance in this area associated with reconstruction of the intersection be further assessed by a Phase IB field reconnaissance.

Public Lands – 4(f) & 6(f) Properties

Potential 4(f) properties in the project area (defined as any property with archaeological or historical significance, wildlife or waterfowl refuge, public parks or recreation areas) include:

- Bayside Park at the intersection of Lakeshore Dr and Blakely Rd;
- The Colchester Bike Path; and
- Lands surrounding the Colchester High School currently being used for community recreational purposes.

Section 6(f) properties are those public lands which were purchased and/or developed through the use of federal Land and Water Conservation Funds. Bayside Park is the only nearby property to which this would apply.

3.0 PROJECT PURPOSE AND NEED

3.1 Purpose

The purpose of making improvements to the Blakely Road / Laker Lane intersection is to:

- Provide safe and efficient travel for vehicles on Blakely Road;
- Provide safe and efficient acccess to the Colchester High School via Laker Ln, and;
- Safely accommodate bicycles and pedestrians at the intersection.

3.2 Need

The need for improvements to the Blakely Road / Laker Lane intersection is based on the following deficiencies:

- Queues of vehicles that form on Blakely Rd during peak hours created by vehicles waiting to turn left onto Laker Ln as well as vehicles holding up traffic behind them to let vehicles exit Laker Lane; and
- Rear end crashes on Blakely Rd due to unexpected vehicles stopped at the intersection.
- Although the primary bicycle and pedestrian route is the nearby Colchester Transportation Path, there is a need to accommodate pedestrians and bicyclists who use the existing sidewalks and roadway shoulders to travel through this intersection.

4.0 ALTERNATIVES INVESTIGATION

4.1 Description of Alternatives

No Build Alternative

One option always included in an intersection study is the "Do Nothing" alternative. This no build alternative would result in existing conditions being maintained at the intersection as shown in Figure 2 and described in previous sections.

Advantages: This alternative involves no cost.

Disadvantages: The "Do Nothing" alternative does not meet the purpose and need for the project.

Build Alternative 1

Alternative 1 would involve the widening of Blakely Rd to provide an 125 ft long westbound left-turn lane and an 125 ft long eastbound right-turn lane to separate Blakely Rd through traffic from vehicles turning onto Laker Lane. Figure 6 illustrates this alternative.

Advantages: Alternative 1 would reduce queuing of thru traffic on Blakely Rd and thereby improve the level of service for thru traffic. Right- and left-turning vehicles on Blakely Rd would no longer hold up through traffic behind them to let traffic exit from Laker Ln.

Disadvantages: This alternative may make it more difficult for vehicles exiting Laker Ln during peak periods because Blakely Rd traffic will no longer yield as it does presently.

Build Alternative 2

Alternative 2 adds to Alternative 1 with the installation of a traffic signal at the intersection. Figure 7 illustrates this alternative.

Advantages: Alternative 2 reduces delay for vehicles exiting from Laker Ln onto Blakely Rd. This alternative also permits the installation of pedestrian signals should a sidewalk on Laker Ln be added in the future.

Disadvantages: Delays experienced by through traffic on Blakely Rd would increase due to all traffic being stopped by the traffic signal as opposed to just westbound traffic being stopped behind a left-turning vehicle. Alternative 2 is the more costly alternative and would also result in additional yearly maintenance costs.

Other Alternatives

It should be noted that a roundabout alternative was considered as part of this study and discussed with the study committee. The study committee did not consider the need for improvements at this intersection to be sufficient to warrant the greater impacts and increased costs associated with constructing a roundabout.

4.2 Design Criteria

Design Vehicle
When developing the revised geometry for Alternatives 1 and 2 to accommodate the turning movements for large trucks, a WB-50 design vehicle was utilized. This is the largest truck anticipated to be turning into and out of Laker Ln making deliveries to the High School.

Lane & Shoulder Widths
Using the Vermont State Design Standards, the recommended roadway cross-section for Blakely Rd is based on three primary criteria; its functional classification, its traffic volumes, and the design speed of its traffic. Although Blakely Rd is an urban minor arterial, it is of "rural" type construction (no curbs). The recommended minimum lane and shoulder widths for a rural minor arterial having a 35 mph design speed and a 400+ vph DHV are 11 ft and 5 ft, respectively[6].

Bicycle / Pedestrian Accommodations
As noted earlier, the recommended minimum paved shoulder width along Blakely Rd for use by bicycles equals 3 ft. This is important, as the shoulder width beyond that needed to adequately accommodate bicyclists need not necessarily be paved (e.g. a 3 ft paved shoulder plus a 2 ft graded gravel shoulder to the outside of that would satisfy the above 5 ft recommended shoulder width). On the other hand, should the paved shoulders be designated as "bicycle lanes", their minimum width would be 4 ft, with 5 ft being the preferred width[7].

Bicycle and pedestrian accommodations already exist at this intersection in the form of sidewalks plus 4 ft wide paved shoulders. Pedestrian crosswalks and sidewalks along Laker Lane are not provided at this intersection. Pedestrian travel to and from the High School is instead accommodated by the Colchester Bike Path.

Compliance with Complete Streets Legislation
The CCRPC in collaboration with its member municipalities, state and local partners have historically taken a multimodal approach to transportation planning. The Vermont Legislature sought to further encourage these best practices with the passing of 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 transportation projects. Similar to past projects, the needs of all transportation users have been considered for this project, and where appropriate, have been accommodated within the design of the build alternatives as seen throughout Section 4.0. It is therefore determined this scoping project is in compliance with the complete streets legislation.

Signs & Pavement Markings
Standards for the placement, design and retroreflectivity of traffic signs, signals and pavement markings are outlined in the *MUTCD*. The proposed build alternatives will be designed to conform to current *MUTCD* requirements.

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[6] Vermont State Standards, VTrans, 1997, Table 4.3

[7] Pedestrian and Bicycle Facility Planning and Design Manual, VTrans, 2002, Fig. 4-6 & Table 4-7

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Consulting Engineers, Inc.
14 Mens Drive, Essex, VT 05453
802-878-4450 www.LDengineering.com

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

FIGURE 6
ALTERNATIVE 1

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GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

FIGURE 7
ALTERNATIVE 2

4.3 Evaluation of Alternatives

Traffic Operations
Table 5 summarizes the level of service and average delay using 2022 projected peak hour volumes for Alternative 1. The analyses were conducted with the addition of eastbound and westbound exclusive turn lanes on Blakely Rd. As can be seen in the table, this alternative would eliminate most of the current delays experienced by Blakely Rd through traffic at this intersection.

TABLE 5 - Alternative 1
Intersection Capacity Analysis Results - 2022

Approach/Movement	AM Peak (7:00-8:00)			School Peak (2:15-3:15)			PM Peak (DHV) (4:00-5:00)		
	LOS	Delay	Max Q	LOS	Delay	Max Q	LOS	Delay	Max Q
Blakely Road									
EB Thru	C	20	13'	A	8	0'	B	15	0'
EB Right	C	20	34'	A	5	9'	B	15	8'
WB Thru	B	13	0'	A	5	0'	C	17	0'
WB Left	C	23	119'	A	7	58'	C	20	67'
Laker Lane									
NB Left/Right	D	29	221'	C	24	218'	C	18	127'

Further reduction in projected Laker Ln delays could be obtained by adding an exclusive right-turn lane to eliminate traffic exiting in that direction from having to wait behind left-turning vehicles. However, vehicles in multiple exiting lanes often impede each other's sight lines as one pulls forward to see better, and could cause a potentially hazardous condition. Considering that Laker Ln levels of service and delays shown in Table 5 meet the VTrans Level of Service Policy without it, the additional lane exiting Laker Ln is not included in the proposed Build Alternatives.

Table 6 summarizes the levels of service and average delay anticipated for 2022 peak hour volumes with the signal proposed for Alternative 2. These analyses have been conducted assuming that westbound left-turns from Blakely Rd entering the High School will operate under permitted left-turn phasing (R/Y/G circular signal indications) instead of protected left-turn phasing (R/Y/G arrow signal indications). Future capability to provide protected left-turn phasing can easily be incorporated into the final design of the traffic signal. Similarly, an exclusive pedestrian phase could also be added at this intersection, but has not been included in the analyses. With the relatively low volume of pedestrians crossing at this intersection, there would be little effect on the levels of service and delays shown.

TABLE 6 - Alternative 2
Intersection Capacity Analysis Results - 2022

Approach/Movement	AM Peak (7:00-8:00)			School Peak (2:15-3:15)			PM Peak (DHV) (4:00-5:00)		
	LOS	Delay	Max Q	LOS	Delay	Max Q	LOS	Delay	Max Q
Blakely Road									
EB Thru	A	10	319'	A	9	200'	A	6	177'
EB Right	A	5	26'	A	6	19'	A	4	15'
WB Thru	A	6	124'	A	9	187'	B	10	315'
WB Left	A	7	127'	A	6	32'	A	4	21'
Laker Lane									
NB Left/Right	B	13	70'	B	11	120'	B	13	62'

Right-of-Way Acquisition / Easements
It is unlikely that the either Alternative 1 or 2 would involve any right-of-way acquisition and/or construction easements from the residential properties on the north side of Blakely Rd opposite Laker Ln. Additionally, it might be possible during the final design of Alternatives 1 or 2 to shift the proposed improvements to the south to minimize impacts to the existing sidewalk or needed relocation of existing overhead utilities on the north side of Blakely Rd.

Both Alternatives 1 and 2 will likely require permanent and temporary construction easements from the Colchester High School parcel on the south side of Blakely Rd for the construction of the proposed right-turn lane entering Laker Ln and for stormwater disposal.

Impacts to Natural & Cultural Resources
There are no major environmental impacts anticipated as a result of constructing either Alternative 1 or 2.

Permitting Requirements

Act 250 - An Act 250 permit may be required. Normally, highway and intersection improvement projects undertaken by municipalities are not subject to Act 250 if they involve less than 10 acres of area. However, at this intersection, the Colchester High School parcel is already under Act 250 jurisdiction. Any proposed land disturbance outside of the Blakely Rd right-of-way involving that parcel will require amending the High School's Act 250 permit. Even without any such disturbance, with Laker Ln being the sole highway access to the High School, it is also possible that Act 250 may require that the High School's Act 250 permit be amended should the proposed improvements be deemed to create a material change in any of the Act 250 criteria.

Stormwater - A stormwater permit would not be required for either of the build alternatives because neither propose to add more than 5,000 sf of new impervious surface to the intersection.

NEPA - Should this project proceed to design and construction using State and Federal funding, it must conform to the National Environmental Policy Act (NEPA), which requires documentation of impacts through either an Environmental Impact Statement (EIS), Environmental Assessment (EA) or, in the most abbreviated form, a Categorical Exclusion (CE). This intersection reconstruction project will most likely be eligible for a CE environmental clearance.

Other Permits - Since there are no streams, wetlands or natural habitats known to exist that would be impacted by the intersection reconstruction, none of the following permits are expected to be applicable: 401 Water Quality, 404 Corps of Engineers, Stream Alteration, Conditional Use, Shoreline Encroachment or Endangered/Threatened Species.

Initial Estimates of Potential Costs
Preliminary opinions of potential costs for Alternatives 1 and 2 are shown in Table 7.

TABLE 7 – Initial Estimates of Potential Costs

	Alternative	
	1	2
Construction	$250,000	$500,000
Engineering (PE & CE) (20%)	$50,000	$100,000
Subtotal	$300,000	$600,000
Contingency (20%)	$60,000	$120,000
Total	$360,000	$720,000

In addition to the above costs, operation and maintenance of a traffic signal in Alternative 2 will add an estimated $2,000 per year to the above costs. This represents an additional yearly cost associated with Alternative 2 over and above Alternative 1.

Evaluation Matrix
Table 8 presents an evaluation matrix summarizing the natural/cultural resource impacts and permitting issues associated with each of the alternatives. There are little, if any, differences in impacts or permitting requirements between the two alternatives.

Alternatives Presentation Meetings
An alternatives presentation meeting was held on October 24, 2012 with VTrans planning and design staff. Notes from this meeting are included in **Appendix 3**.

Local alternatives presentation meetings were held as part of Colchester Selectboard meetings on November 13, 2012 and May 14, 2013. Invite letters were mailed to all adjacent property owners. Public notices were also posted at the Town Offices, posted on the Town's website and circulated to local media to advertise the meeting. Copies of the notice, minutes and comments from these meetings are included in **Appendix 4**.

TABLE 8 - Evaluation Matrix

	Do Nothing Existing Conditions	Alternative 1 Additional Turn Lanes	Alternative 2 Turn Lanes & Traffic Signal
Natural & Cultural Resources			
Agricultural Land	N/A	N/A	N/A
Wetlands	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Existing Vegetation	No Impact	No Impact	No Impact
Biological Resources	N/A	N/A	N/A
Areas of Scenic Beauty	N/A	N/A	N/A
Archaeological / Historical	No Impact	No Impact	No Impact
Hazardous Waste	N/A	N/A	N/A
Flood Hazard	N/A	N/A	N/A
4(f) Property	N/A	N/A	N/A
6(f) Property	N/A	N/A	N/A
Permit Issues			
Act 250	No	Possible	Possible
Stream Alteration	No	No	No
Stormwater Disch. Permit	No	No	No
Wetlands CUD	No	No	No
Endangered/Thrtnd Species	No	No	No
Army Corps of Engineers	No	No	No
401 Water Quality	No	No	No
Archaeological/Historical	No	No	No
Categorical Exclusion	No	Yes	Yes
Section 4(f)	No	No	No
Section 6(f)	No	No	No
Construction Gen. Permit	No	Yes	Yes
Local Permits	No	Yes	Yes

5.0 PREFERRED ALTERNATIVE

Alternative 1 provides improved traffic movement at this intersection during all three peak periods, and meets the objectives outlined in the Purpose and Need Statement.

The traffic signal proposed in Alternative 2 provides a significant improvement over existing conditions with regard to the level of service and average delay being experienced by vehicles exiting Laker Lane during peak hours. The signal would however result in an increase in delay for vehicles on Blakely Road which currently do not have to stop at this intersection. It is our opinion that the relatively short duration of school-related traffic congestion during the morning and mid-afternoon peak periods is not by itself sufficient justification for the installation of a traffic signal at this intersection.