

Intersection Study  
for the US 5 / VT 5A / VT 105 Intersection  
in the  
Town of Derby, Vermont

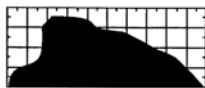


Prepared

for the

Town of Derby  
and the  
Northeast Vermont Development Association

Prepared by:



**SUMMIT ENGINEERING, INC**  
*Engineers + Surveyors + Planners + Landscape Architects*

50 Joy Drive P.O. Box 2225  
South Burlington, VT 05407-2225

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**Summit Engineering, Inc.**

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## I. PROJECT PURPOSE AND NEED

This purpose and need statement has been prepared based on contact, meetings and discussions regarding the history and needs of the project with various parties including state and local representatives. As result of these contacts it has been determined that the primary focus of proposed intersection improvements will be to improve intersection safety, improve Level of Service and to maintain pedestrian circulation. Each of these focal points are based on the following initial investigations:

**Safety** - Past reports by the Vermont Agency of Transportation (VAOT), that analyzed accident data from 2001 to 2005 to determine high accident locations (HAL's) throughout the state highway system has ranked the section of US-5 in which this intersection lies as 279<sup>th</sup> of 616 of those that made the list. Although the location of the accidents in this section were concentrated at the intersection, the number of accidents did not make the list of intersection specific HAL's as they did not meet the required actual/critical accident ratio determined by the VAOT. Three of the sixteen accidents in the accident study section included personal injury, with the remaining twelve being vehicle damage only. Seven of the accidents were rear-end collisions, twelve noted "No improper driving". Four cited "made improper turn" or "failure to keep in proper lane". Ten accidents were in the eastbound direction, four were northbound, one was southbound and one was westbound.

**Level of Service (LOS)** - Manual turning movement traffic counts conducted by the VAOT in April, 2002 have been obtained and analyzed with respect to the current LOS. Due to the high amount of traffic that is typically generated during the months when school is in session, and the presence of elementary, secondary and college in the immediate vicinity, our preliminary analysis has used the 2002 data with factors added to estimate the volumes for the peak period of the current year. To help substantiate this approach, a manual count during the AM peak hour of the 2002 count was duplicated on June 26, 2003 and verified that there is significantly less overall traffic and traffic queuing when schools are not in session. The analysis of the intersection in its current configuration indicates a good overall LOS due to the relatively high volume of unrestricted traffic passing through on US 5. However, volume of vehicles turning left into Lyndonville from VT 114 at the stop condition produces an LOS of "F" (worst level) that creates a queue length of greater than 14 vehicles during the peak period. This back-up has been verified by conversations with the local contacts that indicate that at times it is still worse than the traffic analysis model may lead us to believe. This queue length will compound the LOS by conflicting with the entrances to the trailer park.

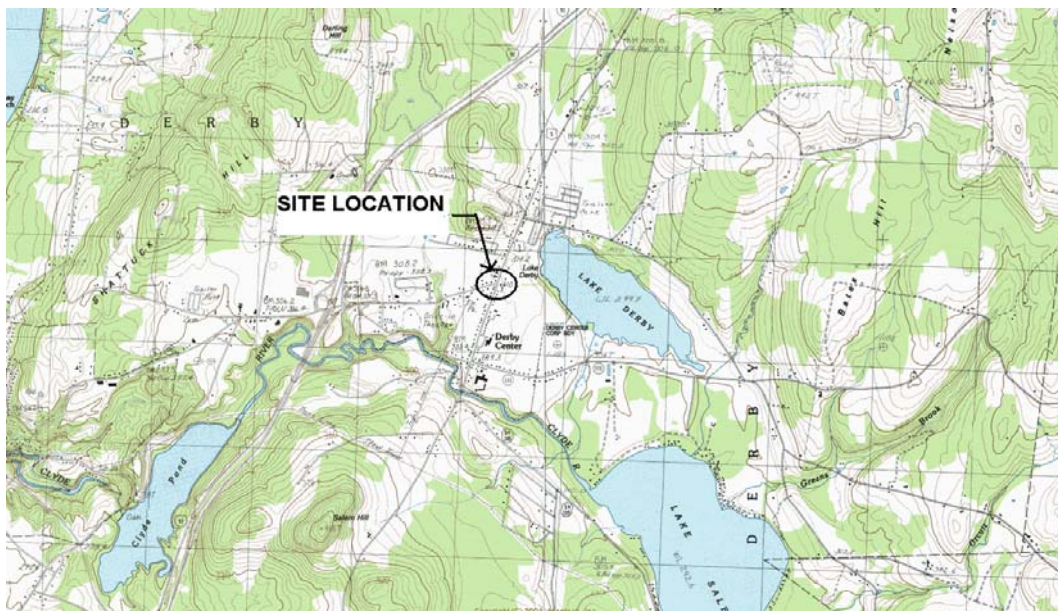
**Pedestrian Circulation** - Observations of pedestrian movements at the site during the peak traffic hour indicate that there are no conflicts with vehicles. The pedestrian count from turning movement counts acquired from Vermont Agency of Transportation (VTrans) was low with a total of 37 pedestrians over a 12 hour count period in summer 2006. Of these 9 were from the west, 11 from the north and 19 from the south. During the count performed by Summit Engineering during the peak PM period, we observed no pedestrians and one bicyclist. Currently there are sidewalks extending from the intersection southward on each side of the road and to the north on the east side of the road only. The existing intersection has significant

shoulders for bicyclists. The proximity of both residential and commercial development in the proximity of the intersection and the Village setting define the need to improve and extend the sidewalks where possible.

### **Purpose and Need Statement**

The purpose of this project is to improve the safety and Level of Service (LOS) of motorists and pedestrians through the intersection of US Route 5 and VT Route 105 in the Town of Derby, Vermont. The project is to continue to maintain adequate access to abutting properties and their current uses. The project conceptual design conforms to Vermont Agency of Transportation design standards, ADA requirements and AASHTO guidelines and performs the following functions:

1. Increase the LOS to motor vehicles turning left at the stop intersection on US 5/VT 105 east bound without adversely affecting the over all LOS of the entire intersection or that of other movements.
2. Increase the overall safety of the intersection. This will include both addressing of conflicts between vehicles traveling through on public routes and conflicts in the vicinity of the intersection with vehicles entering the public Right-of-way from private drives.
3. Provide traffic calming of vehicular traffic southbound on US 5 through the intersection onto eastbound VT 105 as it enters the village setting.
4. Increase the pedestrian and alternative transportation above what presently exist in the intersection.



## II. INTRODUCTION

Historically, the intersection of Routes US 5, VT 105 and VT 5A at the north end of Derby Village, Vermont has been a point of concern with respect to motorist safety and peak hour congestion. In particular, there have been sixteen reported accidents during a five year span at this intersection and the US 5 east bound (left turning) turning movement currently experiences a an 88 second delay or level of service F associated with the peak-hour commuting traffic. Both residential and commercial development in the area has exceeded the maintenance and expansion of pedestrian facilities in the village area. The increase in vehicular traffic and degradation of pedestrian facilities has worked to allow the state highways to dominate the village and degrade the character it once had.

The traffic through the intersection is typified by the high percentage of commuting as well as being the confluence of VT 105 and 5A at the US 5 transportation corridor. Routes 5 and 105 are major corridors for trucks into the Northeast Kingdom with VT 5A serving as a major access to Interstate I-91 from each of these corridors. Modifications to the intersection over the years in efforts to improve both safety and capacity have been limited to pavement markings and signage. US 5 also acts as a regional conduit into Canada for loads that exceed the I-91 weight limits.

## III. PROJECT DESCRIPTION

The Northeastern Vermont Development Association (NVDA) in collaboration with the Village of Derby selected Summit Engineering, Inc. to study the intersection of routes US 5, VT 5A and VT 105 to identify shortcomings and opportunities for improvement. The scope of work for the study is to address the needs of residents, businesses, pedestrians, bicyclists and motorists given the existing conditions. The overall concept behind this project is to conduct a planning study for new intersection improvements. The intent of this study is to document the current conditions and to solicit local input for motorist and pedestrian needs and any areas of concern. In addition, this study will investigate any opportunities and constraints to development, such as natural and cultural resources, develop specific projects and estimate preliminary project costs. The product for this study will be a planning document that will enable the NVDA and the Town to apply for either transportation enhancement funding or other sources of funding, as they become available.

In May 2006, Resource Systems Group and NVDA completed a comprehensive Route 5 Corridor Study which documented future impacts to this intersection and adjacent roadways. The specific purpose of this study is to look at what addition opportunities may be available for improvements to this intersection that may not have been considered in the 2006 study. The specific scope of work for this project includes:

- Preparation of a Purpose and Need statement.
- Preparation of and accurate base plan to overlay the proposed alternatives.
- Identification and prioritization of improvements.
- Cost estimates for implementing proposed improvements.
- Public involvement process.
- Assessment of historic, archaeological and environmental constraints.
- Assessment of right-of-way constraints and issues.
- Documentation of overall project issues and feasibility.



#### IV. EXISTING CONDITIONS

**Safety** - The High Crash Location Report by the Vermont Agency of Transportation, 2001-2005, prepared in June 2007, describing high accident locations (HAL's) throughout the state highway system has ranked the section of US 5 in which this intersection falls as 279<sup>th</sup> of 616 (The intersection alone did not have an accident rate high enough to make the HAL list).

**Accident History** - From 2001 to 2005 - 16 accidents, 4 with injuries. Varying style of accidents - Rear end, opposite direction sideswipe, angle crash. Contributing circumstances dominated by failure to yield, inattention, following too closely.

**Survey Information** – No new survey information was conducted in the preparation of the proposed intersection improvement plans. Existing digital orthophoto information and field measurements were used to prepare the existing conditions plan. The plan information was field checked for accuracy and modified where necessary for the purpose of the intersection study.

**Utility Information** – Above ground utility information, primarily power poles, and hydrants were field located in the vicinity of the intersection. Addition survey and utility research will be necessary at the next stage of project development.

**Right-of-Way** - Right-of-Way information as noted on the proposed improvement plans are believed to be accurate based upon exiting physical features only. These lines shall not be relied upon for the purposes related to the acquisition of land and rights to construct this project. No boundary survey of the R.O.W. or other property has been performed. The R.O.W. information as shown was provided by the VTrans District Office in a plan entitled “R.O.W. Plan for Vermont Route 105 and U.S. 5 Intersection” dated April 21, 1997. As noted on the referenced plan the R.O.W. is to be considered approximate (see Appendix D).





**Project Setting** - VT-105 east/west through the intersection is defined as a Minor Arterial. US-5 north/south is defined as a Major Collector. VT-105 is defined as a Designated Truck Route. US-5 and VT 105 are congruent from Newport to the subject intersection. East of the intersection, VT 105 is also US-5A. At the intersection there is found:

- A one-way stop condition.
- Two lanes entering a T-intersection from the branch. Southbound unopposed through and right, northbound unopposed through and eastbound stop condition.
- Branch meets run at approximately 60 degree angle. This provides an obstacle to eastbound right turns and north bound left turns.
- Branch is on a moderate (approx 5%) uphill grade. This provides a limitation to acceleration into the traffic stream which would be magnified in winter conditions.
- Southwestern quadrant dominated by Convenience store/gas station with little or no access limitations and no pedestrian facilities.
- Island installed by VAOT to better define the limits of the traveled way.
- Lane markings and painted islands to aid in geometry. Attempt to square the intersection.
- Encroachment of traveled way outside of R.O.W. on both corners. Based on approximate R.O.W. description provided by VAOT.



- Sidewalks on east side of north/south run.
- Curbs (in poor condition).
- Posted 35 mph speed limit.

#### V. LOCALLY IDENTIFIED PROBLEMS

Two meetings were held to discuss the project with representatives of the state of Vermont, Village of Derby, Town of Derby, Regional Planning and the public. The initial meeting with the Steering Committee on May 14, 2007 outlined the needs of Village to restore the village character, improve pedestrian and bicycle facilities and improve the Level-of-Service of vehicles passing through the intersection.

Identified at the meeting were the desire to modify placement and access of the existing convenience store on the southwest corner, which has grown to define the character of the area and hinder pedestrian movement due to its limited vehicular control and lack of sidewalks. Discussion included the idea of relocating the building to the north to facilitate the redesign of the intersection geometry to a right angle. Currently the angle of the intersection is approximately 60 degrees, which provides a geometric advantage for the movement of vehicles from the north but hinders those from the south. Observations made at the intersection indicate that this geometry (along with the traffic volume) is a significant factor in the vehicle queuing and delays that are experienced. The design improvements that include the addition of an island and continued modifications to the pavement markings have not remedied the problems.

The corner occupied by the convenience store is devoid of pedestrian facilities. Acknowledging that there is little pedestrian traffic through the intersection, it is reasonable to think that there would be more if the facilities were provided. Also, regardless of the amount of pedestrian and bicycle traffic, the safety for what does exist needs to be taken into account. Observations at the site confirmed that there is little pedestrian traffic and that the sidewalks that are in place have not been maintained well. The juxtaposition of residential and commercial growth is important to consider in planning for the future.

Directly to the east of the village is a significant snowmobile trail that accesses the VT 105 corridor. Snowmobiles, although not required to be provided for directly, represent a significant amount of traffic to the convenience store for both food and fuel.

The second meeting, announced to invite participation by the public, was held on August 29, 2007. Along with the members of the steering committee that attended the initial meeting, this meeting was attended by a few local residents (see attached sign-in sheet). With the presentation of the design alternatives that were prepared, the primary discussion involved the movement of trucks and the impact to adjacent properties. Prior to the meeting, I took the opportunity to meet with the owner of the convenience store who voiced strong opinions against the need for any changes to the intersection. He stated that he never sees any queuing problems or pedestrians. He needs all the access he can get and the addition of sidewalks or traffic islands would only hurt his business. Two unidentified patrons who said that they live in Derby agreed with his assessment.

## VI. REVIEW OF US 5 CORRIDOR STUDY (MAY 19, 2006)

recommendations for this intersection. In review of this report we note the following aspects of this report for consideration:

- Lowering of the currently posted speed limit of 35 mph for VT 105 in Derby Village should be considered to better reflect the village atmosphere.
- The subject intersection was one of three in the US 5 Newport/Derby corridor to experience a Level-of-Service D or worse during the peak period and was the only one of these that the analysis described queuing extending beyond available storage capacity.
- The US 5 Eastbound left turn at the intersection was identified as having a LOS 'F' in the PM peak period. This movement represented the worst LOS in the US 5 corridor study.
- Construction of new sidewalks and crosswalks along US 5 west of the subject intersection was recommended to improve accessibility between Derby Center Village retail and residential uses.
- The recommendation was made to Install a new traffic signal with a second left turn lane on the eastbound US 5 approach (Alt. #3 with an additional lane). Signal warrants are met.
- The analysis suggested the long-term recommendation of additional turn lanes for all approaches.
- The long-term recommendations included widening to 4 lanes with median for the US 5 corridor between I-91 and the subject intersection.

## VII. CONCEPTUAL ALTERNATIVES

Three alignment options were investigated based on community input. (refer to the attached plans) Each typical was developed for a specific section of the project depending on available right of way, topography, use, and potential impacts to surrounding properties. These typicals were developed using the *Vermont Pedestrian and Bicycle Facility Planning and Design Manual*, the *AASHTO Design Guide for the Development of Bicycle Facilities*, and the *AASHTO Policy on Geometric Design of Highways and Streets* as guidelines. The movement of WB-67 design vehicles (large semi trucks) has been checked using AutoTurn computer software. The following narrative is intended to accompany the attached plans.

### A. Alternative I – Three Way Stop

This alternative creates a three-way stop to benefit the vehicles traveling on US 5 to continue north with better LOS by creating breaks in the southbound traffic stream. Pedestrian access is improved by the addition of sidewalks along the convenience store property and limiting its access to three openings. Pedestrians crossing US 5 to the north are aided with the addition of an island giving them refuge between lanes of traffic and improved pavement markings. The control of vehicle access to the convenience store is done using curb cuts that follow the VAOT standards and have been placed to maintain the current circulation to the fueling stations and parking. This alternative stays within the current pavement limits and requires minimal additional R.O.W. taking, mostly on the convenience store lot.

The total LOS of the intersection is improved from the existing F in the PM peak hour to B. This is facilitated by the creation of gaps in north/south traffic to allow the northbound US 5 traffic to go through.

#### **B. Alternative II – Two Way Stop**

This alternative adds a stop condition to the US 5 southbound vehicles that allows for improved gaps to the advantage of the northbound left-turning vehicles which are experiencing the LOS F delays. Similar to Alternative I, this alternative considers a different island configuration which greatly shortens the length of the cross walk across US 5 and maintains a small island to provide refuge for pedestrians in the cross-walk as well as further limiting the vehicles entering the convenience store. The total LOS for the intersection is increased to B with this alternative. As with the previous alternative, additional R.O.W. is required only on the convenience store parcel. Significant green space is created on the northwest corner of the intersection. Although each alternative will accommodate the movement of AASHTO WB-67 design vehicles, this alternative provides less clearance from the edges of the traveled way and is expected to provide a higher degree of traffic calming as a result. Where the clearance from the wheel paths to the curbs is minimal, mountable sloped curbs are to be called for.

#### **C. Alternative III – Three Way Stop with Signals**

This alternative combines the geometry of Alternative II with the addition of traffic signals. The total LOS of the intersection is improved from the existing F in the PM peak hour to B. The installation of signals can also be done with Alternative #1 but fits the Alternative #2 geometry better. Actuated signals with pavement loop detectors would be able to continually adjust the signal timings to account for fluctuations in the traffic volumes in the various approaches throughout the day.

#### **D. Preferred Alternative**

In addition to the public meeting and a steering committee meeting, the project was presented to the Town of Derby in a public hearing on August 29, 2007. The purpose of these meetings and presentations was to solicit input from the community and to help reach a consensus on a preferred alternative. At this time there does not appear to be a preferred alternative. The Evaluation Matrix prepared and included at the end of this report does not evaluate the “Do-Nothing” alternative.

### **VIII. NATURAL RESOURCES**

The alternatives were reviewed for potential impacts to natural resources. On-site observations as well as existing resource mapping were used to make these assessments. It should be noted that the project is located within adjacent roadways and for the most part within the existing road right-of-ways (with the exception of new pedestrian facilities). There are not any impacts to surrounding natural resources. This is a preliminary assessment and that once an actual design is completed and the impacts are more clearly defined, these resources should be re-evaluated.

**Wetlands** – There are no mapped wetlands within the project area that are protected by either state or federal regulations.

**Flood Zones** – It does not appear that this project could impact the 100-year flood zone of the Clyde River or the surrounding tributaries. The State of Vermont, Agency of Natural Resources, Flood Plain Manager should be consulted once a survey and design are completed. The Town should also investigate the effect of sidewalks on flood hazard regulations and on the availability of coverage through federal insurance programs. Sidewalks generally do not inhibit water flow and have little effect on flood capacity.

**Hazardous Waste** – There are eighteen sites listed in the Department of Environmental Conservation’s *Vermont Hazardous Sites List* for Derby. It appears that two may be in the vicinity of the proposed project. Of those, Site 941616 is the Derby Corner Mini Mart at the intersection of US 5 and VT 105. The project status is that a gasoline underground storage tank investigation was completed, annual groundwater monitoring is ongoing and it appears that the petroleum contaminated soil treatment was completed. Site 941632 is identified as “Nelson Farm, Main Street, Derby”, to which the precise location and status is indeterminate. As this project progresses, additional coordination with DEC for each of these sites is will be required. The current status of any contamination remediation will have to be reviewed in conjunction with any proposed design at the time of implementation. The information from the Vermont Active Hazardous Sites List for these sites is included in the appendix.

## IX. CULTURAL RESOURCES

The proposed alternatives were reviewed for potential impacts to cultural resources. On site observations and material available from the Vermont Division for Historic Preservation were used to make these assessments. In addition, Deborah Noble Associates reviewed the alternatives to access any potential impacts archaeological or historical resources

**Historic** – Historic resources are defined and protected under Section 4(f) of the U.S. Department of Transportation Act and under Section 106 of the National Historic Preservation Act. Due to the nature of the project, it is not anticipated that significant historical resources will be impacted. Please refer to the attached report from Deborah Noble Associates describing the likelihood of impacting any potential historical resources (Appendix I).

**Archaeological** – Archaeological resources are defined and protected under Section 106 of the 1966 National Historic Preservation Act and assessed in compliance with 10 V.S.A. Chapter 151, 6086 (a)(8) [Act 250]. Due to the nature of the project, it is not anticipated that significant archaeological resources will be impacted. Please refer to the previous report from Resource Systems Group, Inc. describing the likelihood of impacting any potential archeological resources.

## X. COST ESTIMATES and MAINTENANCE

Each alternative was reviewed for preliminary construction cost estimates using pricing data provided by the VAOT. These estimates are intended for planning or budgetary purposes only.

The cost estimates include Engineering, Municipal Project Management, and Construction Inspection costs. Traffic Control, Mobilization and Utilities were all estimated as percentages of the unit cost for the material quantities. Generally the cost estimates represent a good comparative representation of what would be expected for construction costs if the alternative were built today. The majority of the yearly maintenance costs for this type of a facility consists of snow removal. Assuming the sidewalks would need to be plowed 30 times per year, costs could range between \$3,000.00 to \$8,000.00. Many communities include the cost of snow removal in their yearly road maintenance budget and sub-contract for this service especially if the municipality does not already have sufficient equipment for snow removal.

Depending on the use and construction of the sidewalk, after approximately five to ten years, minor repairs such as cracks, chips, etc. may also need to be included in a yearly maintenance budget.

Alternative #1 – Three-Way Stop	\$ 420,500
Alternative #2 – Two-Way Stop	\$ 414,500
Alternative #3 – Three-Way Stop with Signal	\$ 596,700
Alternative #4 – Do Nothing	\$ 0

These costs do not include that for the acquisition of R.O.W. which appears to be necessary for the installation of sidewalks on the lot occupied by the convenience store. Considering that the improvements could be considered beneficial to the property and that the land is otherwise unusable, the cost of R.O.W. should be minimal as compared to the construction costs for the project.

## XI. PROJECT TIMELINE

A realistic timeframe for completion of this project is approximately two to three years. Assuming that the project is selected for construction level funding in the Spring of 2008, the survey, design and permitting could occur throughout the Summer of 2008 and the project could be ready for construction in the Spring of 2010. However, that may be a somewhat optimistic timeframe given that temporary construction easements will be necessary and that the project will need a Categorical Exclusion clearance from the Federal Highway Administration. Both of these tasks may take longer than several months and could potentially delay the project for another construction season, (Spring 2011).

Currently, the most popular funding source for these type of project is the Transportation Enhancements Program (which requires a 20% local match).

## XII. RECOMMENDATIONS

We recommend that Alternative #3 be considered to proceed to the next step of development. This step will include a detailed survey of the alignments, the development of an existing conditions plan with detailed Rights-of-Way as well as the preliminary, final design and construction plans. At each step of project development it will be important to continue to involve the community with the opportunity for input into the design. We also recommend that

the steering committee continue to meet to guide the development of the project. This committee could generate an application for construction level funding and coordinate the communities match and agreements for right of way. This alternative includes the highest cost of those considered and, with signals installed, can be adjusted for the current conditions with periodic updates when growth in the area is realized.

This alternative will improve the safety and service to motorists, and pedestrians, relieve automobile and pedestrian conflicts and provide for alternative transportation between existing, residential, recreational and municipal centers. This project meets the purpose and need statement and is compatible with local and regional plans, both of which encourage the development of safe transportation opportunities.



XIII. EVALUATION MATRIX

<b>EVALUATION MATRIX US 5 VT 105 Intersection Study</b>				
<p>The following evaluation matrix contains a list of potential issues and concerns with all possible affected parties who may have a concern with a proposed alignment. (A [No] in a space indicates that there are no apparent concerns, impacts or permits required, and a [Yes] indicates that there is a concern associated with the alternative, or a permit may be required.) Cost estimates are conceptual and intended for planning purposes only.</p>				
		<b>Option I Three Way Stop</b>	<b>Option II Two Way Stop</b>	<b>Option III Three Way Stop w/Lights</b>
<b>COSTS</b>	<b>TOTAL (approximately)</b>			
<b>IMPACTS</b>	Agricultural Lands	No	No	No
	Archaeological	Possible	Possible	Possible
	Historic, Structural and Sites	Possible	Possible	Possible
	Hazardous Materials	No	No	No
	Threat & Endanger Species	No	No	No
	Public Lands	No	No	No
	LWCF – Section 6(f)	No	No	No
	Noise	No Change	No Change	No Change
	Floodplain	No	No	No
	Fish & Wildlife	No	No	No
	Wetlands	No	No	No
<b>LOCAL &amp; REGIONAL ISSUES</b>	Concerns	Improves Safety	Improves Safety	Improves Safety
	Community Character	Improved	Improved	Improved
	Economic Impacts	No	No	No
	Conf. To Regional Plan	Yes	Yes	Yes
	Satisfies Purpose & Need	Yes	Yes	Yes
<b>PERMITS</b>	Act 250	Possible	Possible	Possible
	401 Water Quality	No	No	No
	404 COE Permit	No	No	No
	Stream Alteration	No	No	No
	Conditional Use Deter.	No	No	No
	Stormwater Discharge	No	No	No
	Lakes & Ponds	No	No	No
	T & E Species	No	No	No
	SHPO	Possible	Possible	Possible
<b>OTHER</b>	NEPA – Categorical Excl.	Yes	Yes	Yes
	Utility relocation	Yes	Yes	Yes
	Land Acquisition	Yes	Yes	Yes



