

# ***U.S. 7 / Exchange Street Intersection: Traffic and Safety Improvements***

## ***Scoping Study***

***September 29, 2004***

Submitted to:

***Addison  
County  
Regional  
Planning  
Commission***

Submitted by:



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# ***Introduction***

The Transportation Advisory Committee of the Addison County Regional Planning Commission (ACRPC) selected Dufresne-Henry to study the intersection of U.S. Route 7 / Exchange Street and Happy Valley Road. The study reviews existing conditions, determines needs, evaluates alternatives and recommends improvements. Land development and traffic increases have raised delays and safety concerns at this intersection. The following are alternatives evaluated in this report:

- No Action
- Signal Alternative 1A
- Signal Alternative 1B
- Roundabout Alternative

# ***Purpose and Need Statement***

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## ***Purpose***

The purpose of the Exchange Street / Happy Valley Road / U.S. 7 Intersection project is to improve the safety and operation of the intersection and enhance the “Gateway to Middlebury.”

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## ***Need***

Currently U.S. 7 is one of Vermont's major north/south transportation corridors that functions as a principle arterial. U.S. 7 is currently the throughway and the two side streets are maintained by stop signs. The following notable issues/deficiencies define the need for improvements:

- ◆ Improve sight distance and safety for turning vehicles.
- ◆ Reduce delay on Exchange Street approach.
- ◆ Accommodate growth of Middlebury and on Exchange Street.
- ◆ Provide a gateway to Middlebury.

# ***Project Location***

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## ***Intersection Description***

U.S. Route 7 is one of Vermont's major north / south transportation corridors. It functions as a principle arterial, is state owned and maintained, and has an average annual daily traffic (AADT) of approximately 10,200 vehicles. Exchange Street provides access to the Middlebury industrial area and is an alternative route connecting Middlebury Village and U.S. Route 7 North. The intersection forms the northern gateway to Middlebury. Figure 1 shows the existing project location for this intersection.



*Photograph 1: Happy Valley Road, Route 7 and Exchange Street Intersection in Middlebury, Vermont.*



Figure 1: Existing Project Location Plan for the Exchange Street / Happy Valley / Route 7 Intersection.



# Background Information

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## Existing Issues

### Roadway

This area of U.S. 7 was reconstructed in 1973 by Vermont Agency of Transportation (VTRANS) with 12 foot lanes and 8 foot shoulders. The Route 7 approaches are located on a 5° horizontal curve with approximately 400 ft corner sight distance. The Happy Valley Road approach is an inclined grade with limited sight distance. The posted speed limit is 50 mph on Route 7 and 40 mph on Exchange Street. The U.S. 7 North approach has “intersection ahead” and “trucks entering” posted warning signs.

### Community Character

Family homes and nearby businesses are located close to this intersection. The nearby businesses are located in the Middlebury Industrial on Exchange Street, explaining the high percentage of truck traffic (8%) on this road and on Route 7. Speed, safety and high commuter traffic volumes affect the character of this intersection, the northern gateway of Middlebury. The Bridge School (grades 1-6) on Exchange Street is also located adjacent to the intersection. The intersection area experiences frequent joggers on Exchange Street.



*Photograph 2: This photograph was taken looking south on Route 7 at the project intersection.*

### ***Sight Distance***

The corner sight distance on Exchange Street is approximately 400 feet. Recommended guidelines (AASHTO) state that 550 feet is appropriate for a speed of 50 mph on the opposing travelway.

### ***Accidents***

VTRANS 5 year accident listings indicate one accident in 1997 and one in 1998.

### ***Existing Utilities***

The following utilities are known to exist in the project area:

- ◆ Gas
- ◆ Underground electric
- ◆ Sanitary sewer and water
- ◆ Overhead power, telephone, cable and a high-voltage transmission line crossing just north of the intersection

### ***Right-of-Way***

The U.S. 7 R.O.W. width is approximately 66 feet wide. The R.O.W. on both Exchange Street and Happy Valley's is 50 feet wide. Refer to the plans for a more approximate location of the boundary.

### ***Environmental***

There is an adjacent area to the northwest corner that contains a sensitive wetland.



*Photograph 3: Turning left from Exchange Street north onto Route 7. The known wetland is located in the left corner of this photograph.*

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## Traffic Volumes

A 12-hour traffic count was performed by Dufresne-Henry on April 2, 2004 at the Exchange Street / Happy Valley / Route 7 intersection in Middlebury, Vermont. This count was converted to the year 2006 and 2016 Design Hour Volumes based on the daily variation of a VTrans continuous count station on Route 7. Using this projected data, the following tasks were performed with the results located in the subsequent sections:

- ◆ Morning and afternoon traffic data was compiled, and adjusted to obtain Design Hour Volumes (DHV) and Peak Hour Factors (PHF) for the construction (2006) and design years (2016).
- ◆ Trip generation volumes for the Industrial Park were conducted and added to the projected 2016 volumes using the ITE Trip Generation Manual and input from the Town of Middlebury.
- ◆ MUTCD signal warrants were reviewed for 12-hour traffic counts using TEAPAC software.
- ◆ Signalized intersection performance was analyzed using SYNCHRO software for AM and PM peak hours.
- ◆ Roundabout performance was analyzed using RODEL software for AM and PM peak hours.

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## Traffic Analysis Methodology

The traffic analysis process used for this report is the Highway Capacity Methodology. This practice is a way of comparing intersection congestion at certain times of the day. The level of service (LOS) characterizes the operating conditions of the facility in terms of traffic performance measures related to speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. The levels of service range from level of service A (least congested) to level of service F (most congested).

The following text and tables outline the general definitions of these levels of service for unsignalized, roundabout and signalized intersections.

Level of Service	General operating conditions
A	Free Flow
B	Reasonably Free Flow
C	Stable Flow
D	Approaching unstable flow
E	Unstable Flow
F	Forced or breakdown flow

Unsignalized and Roundabout Level of Service Criteria (sec)				
A	< OR =	10	seconds	
B	>	10	and	< OR = 15
C	>	15	and	< OR = 25
D	>	25	and	< OR = 35
E	>	35	and	< OR = 50
F	>	50		

*\*Roundabouts are similar to unsignalized intersections because drivers have higher expectations for lower delay and are less likely to appreciate waiting longer.*

Signalized Level of Service Criteria (sec)				
A	< OR =	10	seconds	
B	>	10	and	< OR = 20
C	>	20	and	< OR = 35
D	>	35	and	< OR = 55
E	>	55	and	< OR = 80
F	>	80		

## Signal Warrant Performance

Signal warrant analysis using TEAPAC software (MUTCD methodology) indicates that a traffic signal is warranted for this intersection in 2006 and in 2016. Reduced signal warrants assume that the intersection is in a built up area of an isolated community with a population of 10,000 or less or speed limit is greater than 40 mph.

Intersection	2006 Signal Warrants	2006 Reduced Signal Warrants	2016 Signal Warrants	2016 Reduced Signal Warrants
Exchange Street / Happy Valley / Route 7	No	Yes	Yes	Yes



## Signalized Intersection Performance

An optimized intersection signalized analysis using SYNCHRO 6 indicates that overall intersection LOS will be A for 2006 AM & PM peak hours, A for the 2016 AM peak hour and C for the 2016 PM peak hour. Adding a left-turn lane on Exchange Street will result in an overall intersection LOS of A for 2006 and B for 2016 (see tables below). See attached documents for SYNCHRO analysis output.

### Intersection: Exchange St/Happy Hollow/Route 7

Year 2006 Signalized Capacity Analysis - Level of Service (LOS) and sec of delay		
APPROACH (existing conditions)	AM	PM
EB (Exchange St) Left, Right, & Thru	B (12)	B (12)
WB (Happy Hollow) Left, Right, & Thru	B (14)	B (11)
NB (Rte 7) Left, Right, & Thru	A (3)	A (7)
SB (Rte 7) Left, Right, & Thru	A (4)	A (6)
<b>Overall Intersection &amp; Sec Delay</b>	<b>A (4)</b>	<b>A (7)</b>

Year 2016 Signalized Capacity Analysis - Level of Service (LOS) and sec of delay		
APPROACH (without designated LTL)	AM	PM
EB (Exchange St) Left, Right, & Thru	B (14)	D (35)
WB (Happy Hollow) Left, Right, & Thru	B (17)	B (15)
NB (Rte 7) Left, Right, & Thru	A (4)	C (23)
SB (Rte 7) Left, Right, & Thru	A (10)	B (13)
<b>Overall Intersection &amp; Sec Delay</b>	<b>A (8)</b>	<b>C (22)</b>

Year 2016 Signalized Capacity Analysis - Level of Service (LOS) and sec of delay		
APPROACH (with designated LTL)	AM	PM
EB (Exchange St) Left Right, & Thru	B (20) A (8)	C (27) A (6)
WB (Happy Hollow) Left, Right, & Thru	B (17)	B (15)
NB (Rte 7) Left, Right, & Thru	A (4)	B (15)
SB (Rte 7) Left, Right, & Thru	A (9)	A (9)
<b>Overall Intersection &amp; Sec Delay</b>	<b>A (8)</b>	<b>B (14)</b>

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## *Roundabout Intersection Performance*

Roundabout capacity analysis using RODEL was performed for the 2016 AM and PM peak hours. The analysis indicates that a roundabout will provide a LOS of A for the 2016 AM & PM peak hours. See attached documents for RODEL analysis output.

**Intersection:**

**Exchange St/Happy Hollow/Route 7**

<b>Year 2016 Roundabout Capacity Analysis - Level of Service (LOS)</b>		
	<b>RODEL AM</b>	<b>RODEL PM</b>
Level of Service	A	A
Average Delay in seconds	7.9	7.5
Approach and Average Queue	NA - 2 cars	SA - 2 cars

# ***Design Criteria***

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## ***Design Criteria***

The following page organizes the existing and proposed design criteria for this intersection.

# Design Criteria

Functional Classification: Principal Arterial (019-3)

Construction Year: 2006

Design Year: 2016

## TRAFFIC AND REGULATORY DATA:

TWLT lane (Charles to Mary Hogan North)

2000 AADT: 14,600 (ATR Sta A179, just north of Mary Hogan South)

2015 AADT: +6% (Group II, based on previous 5 yrs)

Roundabout (Creek Road)

2000 AADT: 14,600 (ATR Sta A179)

2015 AADT: +6% (Group II)

%T 7%

Boulevard (Creek to Boardman)

2000 AADT: 13,200 (ATR Sta A011, just north of Boardman St.)

2015 AADT: +18% (Group III, based on previous 5 yrs at A018)

Turning Movement Volumes: use 1998 Corridor Management Study data (adjusted for design year)

Posted Speed Limit: 50 MPH - U.S. Route 7

40 MPH - west of U.S. Route 7

40 MPH - east of U.S. Route 7

Design Speed: same as posted speed (VSS § 3.3)

Clear Zone: 40 mph: 16 ft. (min.)

50 mph: 24 ft. (min.)

## GEOMETRY:

Driveways	<i>existing</i>	<i>proposed</i>	<i>reference</i>
Width – Residential	varies	24 ft. (max)	VSS B71M
Width - Commercial	varies	40 ft. (max)	
<b>U.S. Route</b>	<i>existing</i>	<i>proposed</i>	<i>reference</i>
Overall roadway width	42-44 ft.	same.	AASHTO 2000
Travel lane width	12 ft.	12 ft.	
Shoulder/bike lane width	8-10 ft.	same	
Curb	none	yes	
Sidewalks/paths	none	none	
<b>Exchange Street</b>	<i>existing</i>	<i>proposed</i>	<i>reference</i>
Overall roadway width	42-44 ft.	same.	AASHTO 2000
Travel lane width	12 ft.	12 ft.	
Shoulder/bike lane width	4 ft.	same	
Curb	none	none	
Sidewalks/paths	none	none	
<b>Happy Hollow Street</b>	<i>existing</i>	<i>proposed</i>	<i>reference</i>
Overall roadway width	42-44 ft.	same.	AASHTO 2000
Travel lane width	12 ft.	12 ft.	
Shoulder/bike lane width	0 ft.	2 ft	
Curb	none	none	
Sidewalks/paths	none	none	
<b>Roundabout</b>	<i>existing</i>	<i>proposed</i>	<i>reference</i>
Overall roadway width	42-44 ft.	varies	FHWA and Wallwork
Travel lane width	12 ft.	n/a	
Circulatory width	n/a	16 ft.	
Shoulder width	8-10 ft.	n/a	
Inscribed circle diameter	n/a	118 ft.	
Design Vehicle	n/a	WB-67 (WB-20)	
Center island diameter	n/a	46 ft.	
Tree belt width	n/a	n/a	
Sidewalk width	n/a	n/a	
Approach speeds	50 MPH (N&S) 40 MPH (W&E)	40 MPH (N&S) same	
Design speed	n/a	20 mph	
Curb	none	yes	

# ***Interim Safety Measures***

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## ***Comprehensive Interim Safety Measures***

Making improvements to a corridor or intersection takes a number of years for the process of identifying funding, obtaining necessary properties, preparing engineering documents and performing construction. With this in mind, the following items are some interim safety measures that may be performed quicker than a larger project may take.

- ◆ Reduce speed limit in the area which would require a traffic study and traffic committee approval.
- ◆ Place a temporary Traffic Signal.
- ◆ Install a flashing blinking yellow and red light at the intersection.
- ◆ Add signage stating: caution, intersection ahead, and/or flashing beacon.
- ◆ Educate the community on what a roundabout is and how to use one.
- ◆ Add lighting to the intersection.
- ◆ Widen the road to accommodate a left turning lane on Exchange Street.
- ◆ Minimize the shrubbery and grade the south-west corner of the intersection to increase corner sight distance. The land between the road and the overhead utility lines (or existing R.O.W.) could be graded. Regular upkeep rimming the foliage would maintain a safe sight distance here.

# ***Alternatives Evaluation***

Three alternatives have been pursued by the Town of Middlebury and the Regional Planning Commission. The following alternatives are described in more detail in the following sections:

No Action  
Signal Alternative 1A  
Signal Alternative 1B  
Roundabout Alternative

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## ***No Action***

The No Action Alternative is a decision that would end further action following this study for the Exchange Street / Happy Valley / Route 7 intersection improvement. This alternative leaves the intersection in its current condition and it assumes that any normal maintenance would continue.

### ***Advantages***

This alternative has no initial cost. This alternative has no construction or related traffic delays.

### ***Disadvantages***

This alternative does not satisfy the purpose and need statement for this project. It does nothing to improve the existing known concerns that affect motorists such as the increase in traffic volumes and delay, accommodation of a high percentage of trucks or improving the known sight deficiencies.

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## ***Signal Alternative 1A***

Proposed improvements are as follows:

- ◆ Widen Exchange Street to include left turn lane
- ◆ Install actuated signal system
- ◆ Increase the corner sight distance on Exchange Street
- ◆ Widen and add a striped median on the Happy Valley Approach

### ***Order of Magnitude of Cost***

\$480,000 - This is the cost to improve the Exchange Street / Happy Valley Road / Route 7 intersection and add the stated traffic signals. A plan of this improvement is shown at the end of this section.

### ***Advantages***

- ◆ This alternative has least cost initially.
- ◆ There is less construction and associated disturbance required than a roundabout.
- ◆ A signalized intersection is a common installation in the state of Vermont so typical drivers will understand how it functions and how a traffic signal commonly works.
- ◆ Safety is improved due to the increased corner sight distance.

### ***Disadvantages***

- ◆ Periodic maintenance is required for the traffic signal.
- ◆ A signalized intersection has a higher number of conflicting traffic movements.
- ◆ A signalized intersection has lower potential capacity than the roundabout.
- ◆ Signalized intersections have the potential for drivers to run red lights. This is a serious hazard due to the openness of such a design.
- ◆ Vehicles can drive at higher speeds when the signal is on the green phase.

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## ***Signal Alternative 1B***

- ◆ Install actuated signal system
- ◆ Increase the corner sight distance on Exchange Street
- ◆ Widen Exchange Street to include left turn lane
- ◆ Maintain existing approach at Happy Valley Road

### ***Order of Magnitude of Cost***

\$420,000 - This is the cost to improve the Exchange Street / Happy Valley Road / Route 7 intersection and add the stated traffic signals.

### ***Advantages***

- ◆ This alternative is cheaper initially.
- ◆ There is less construction and associated disturbance required than a roundabout.
- ◆ A signalized intersection is common practice in the state of Vermont so typical drivers will understand how it functions and how a traffic signal commonly works.
- ◆ Traffic on all approaches will be safer due to the geometry redesign to line up the east-west lanes. The corner sight distance will be improved on Exchange Street.

### ***Disadvantages***

- ◆ Periodic maintenance is required for the traffic signal.
- ◆ A signalized intersection has a higher number of conflicting traffic movements.
- ◆ A signalized intersection has lower potential capacity than the roundabout.
- ◆ Signalized intersections have the potential for drivers to run red lights. This is a serious hazard due to the openness of such a design.
- ◆ With this geometry, the east-west corridor lanes do not line up.
- ◆ Vehicles can drive at higher speeds when the signal is on the green phase.

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### ***Roundabout Alternative***

- ◆ Install a conventional roundabout.
- ◆ Establish splitter islands a minimum of 200' on the Rt. 7 approaches.
- ◆ Address the need for a gateway to Middlebury.
- ◆ Improve delay to less than the existing condition.

The Roundabout Alternative is designed to slow cars substantially that are traveling north and south on Route 7. This alternative requires the post speed limit and approach speeds be reduced to 40 mph due to the changing characteristics and increase and anticipated development of the area. The estimated average speed through the intersection will be designed for 20 mph. This alternative will provide traffic calming.

### ***Order of Magnitude of Cost***

\$710,000 - This cost includes the improvement of the Happy Valley Road approach, approximate land acquisition costs, regrading of the Route 7 southern approach and of the roundabout intersection area.

### ***Roundabout Background Information***

A modern roundabout is a circular traffic intersection that allows for continuous movement of traffic through the intersection at low speeds. These low speeds result in greater efficiency and lower accident rates. Modern roundabouts include these general characteristics:

- ◆ Priority is given to the traffic already in the roundabout, as opposed to a traffic circle that gives priority to entering vehicles.
- ◆ The design of the roundabout lowers vehicle speeds to a maximum of 20 miles per hour.
- ◆ Vehicles entering a roundabout are required to yield to traffic already in the circle.
- ◆ All intersection legs are allowed to operate simultaneously, which increases the capacity of the intersection.
- ◆ By reducing the number and duration of stops, a roundabout intersection should reduce traffic noise levels, air pollution and vehicle fuel consumption.



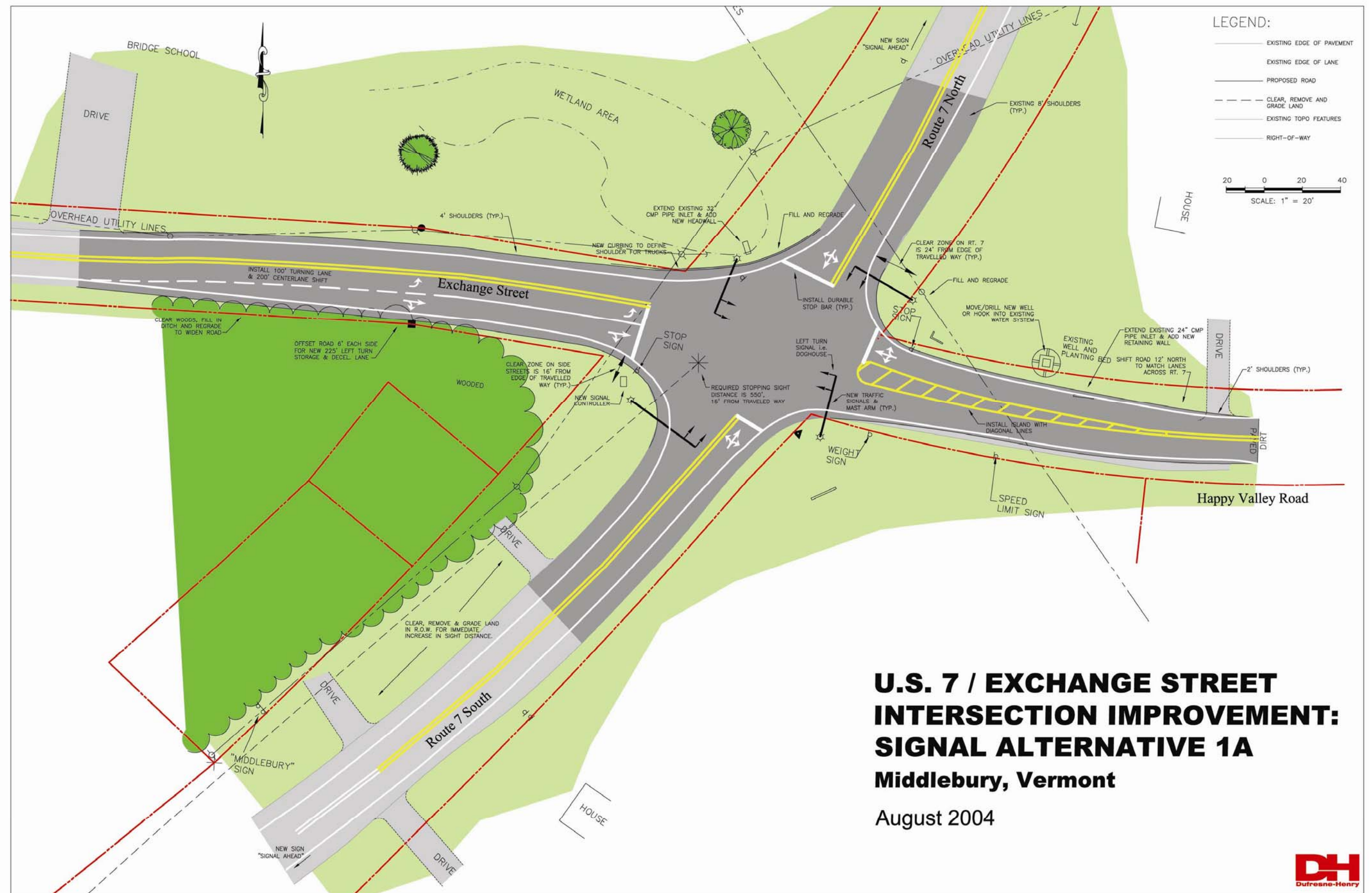
Bicyclists traveling in the roundabout can easily merge into a roundabout lane at low speeds, which precludes cars from attempting to pass the bicycle.

### ***Advantages***

- ◆ Creates and provides a visual and practical traffic calming approach
- ◆ Landscaping can be incorporated into the central island of the roundabout and on the raised splitter islands. The resulting design creates a gateway into the Town of Middlebury.
- ◆ All intersection legs are allowed to operate simultaneously, which increases the capacity of the intersection.
- ◆ Extended splitter island treatments encourage drivers to slow down before reaching the roundabout, effectively achieved through a combination of geometric design and other design treatments.
- ◆ A roundabout has a high vehicle capacity and delay is minimized.
- ◆ Improves the pedestrian environment by providing splitter islands which act as pedestrian refuges. Pedestrians could cross one lane of traffic at a time as opposed to two or three lanes of traffic in a signalized condition.
- ◆ As a result of reducing the number and duration of stops, vehicles are more energy efficient, less air polluting, and reduce traffic noise levels, especially during non-peak hours.
- ◆ Fewer and less severe accidents are expected following installation. Typically 39% reduction of total crashes, 76% reduction of injury crashes and 89% reduction of fatal and incapacitating crashes (New York State DOT Roundabout Design Unit, Howard McCulloch, [www.highwaysafety.org](http://www.highwaysafety.org)).

### ***Disadvantages***

- ◆ Roundabouts have a higher initial cost than a signalized intersection.
- ◆ There is low public acceptance before construction.
- ◆ Public education may be necessary for smooth transition and proper driver behavior. Many motorists may feel that US 7 has the right-of-way when the vehicle in the roundabout has the right of way.
- ◆ Traffic disruptions may be more significant during construction.
- ◆ Winter maintenance costs are higher than a conventional intersection.
- ◆ A 20 mph roundabout is not desirable in a 50 mph zone. This alternative requires reducing the posted speed on approaches to 40 mph.
- ◆ For VTrans acceptance, it may require the Class I section of US 7 be extended to include this intersection.
- ◆ It restricts left hand turns to driveway on US 7 south approach.





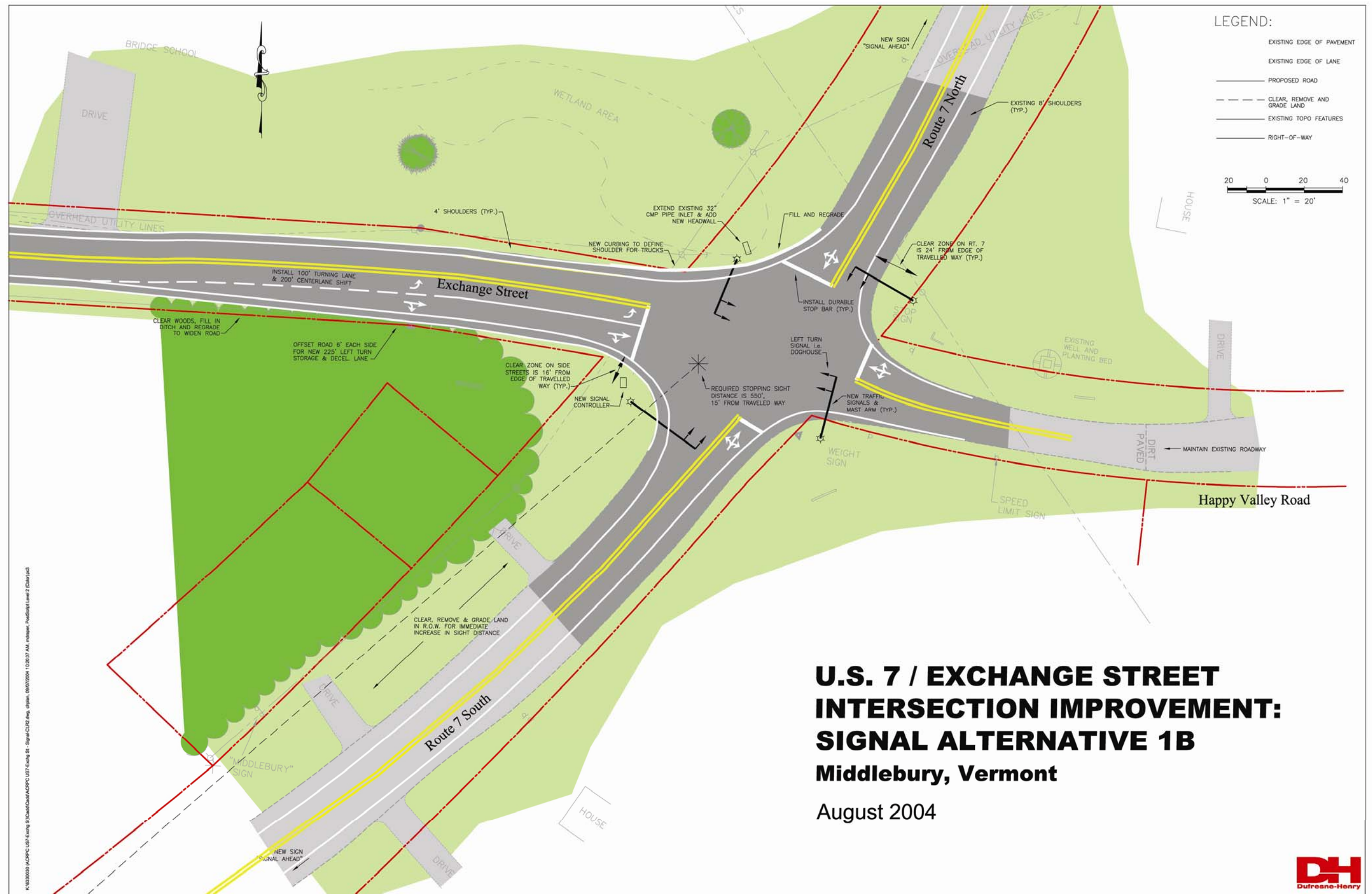


Figure 3: Signal Alternative 1B Design Plan.



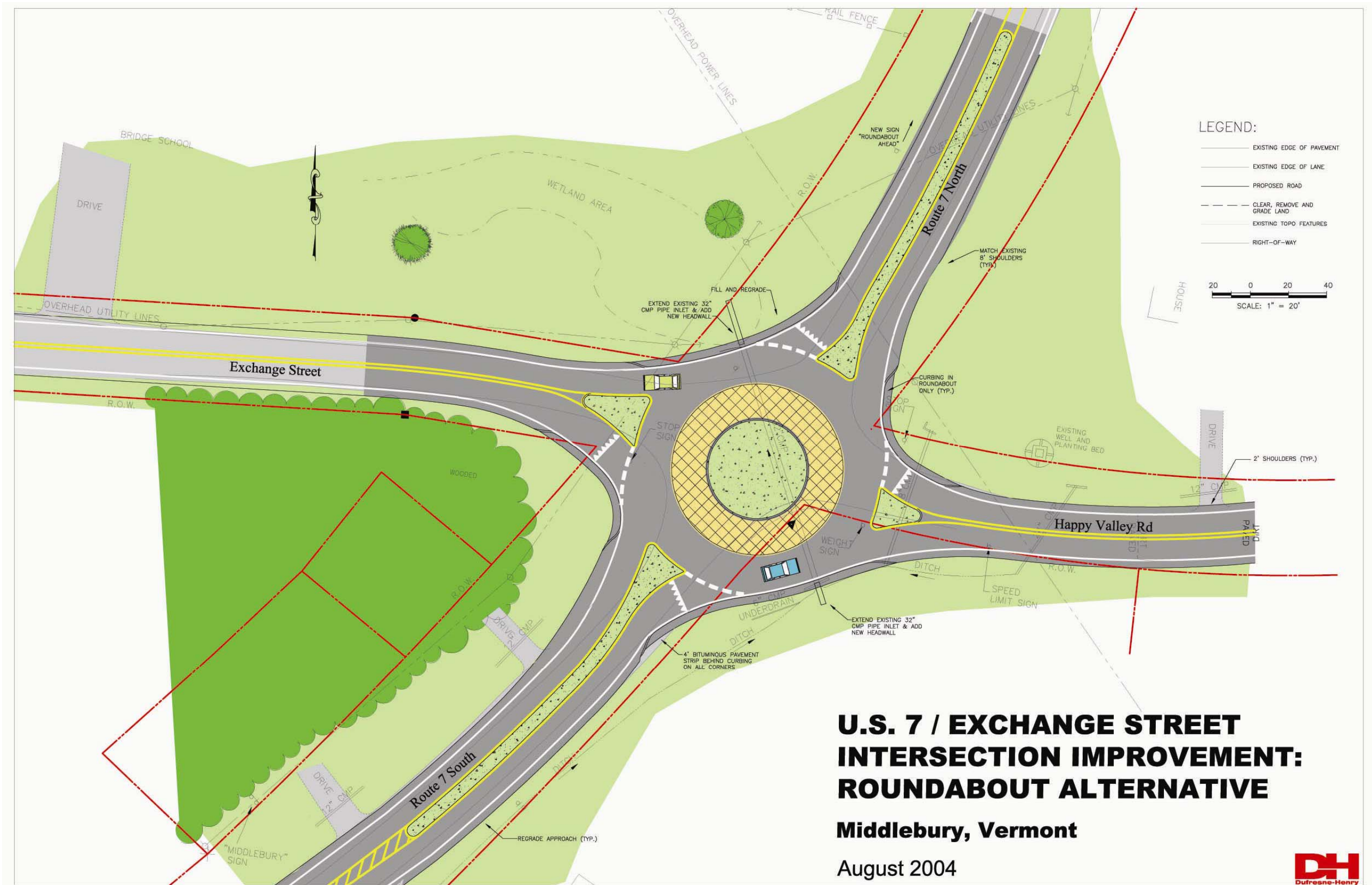


Figure 4: Roundabout Alternative Design Plan.

## ***Evaluation Matrix***

The future intersection improvement design process will encounter the need for various permits and applications as well as various funding sources. The matrix table, on the following page, summarizes the various impacts expected for the three alternatives.

**EXCHANGE STREET / HAPPY VALLEY / ROUTE 7 INTERSECTION  
EVALUATION MATIX**

		INTERSECTION		
		SIGNALIZED 1A	SIGNALIZED 1B	ROUNDBABOUT
<b>Cost</b>	~ Estimated Cost ~	\$480,000	\$420,000	\$710,000
<b>Impacts</b>	Agricultural	None	None	None
	Archaeological	Possible	Possible	Possible
	Historic Structures, Sites and Districts	Possible	Possible	Possible
	Hazardous Materials	None	None	None
	Floodplain	None	None	None
	Fish and Wildlife	No Sig. Change	No Sig. Change	No Sig. Change
	Rare, Threatened and Endangered Species	No	No	No
	Public Lands - Section 4(f)	No	No	No
	LWCF - Section 6(f)	No	No	No
	Noise	Same	Same	Same
	Wetlands	Possible	Possible	Possible
<b>Local and Regional Issues</b>	Right-of-way	Approx. ¼ acre	Approx. ¼ acre	Approx. 1 acre
	Satisfies Local Concerns	No	No	Yes
	Enhanced Community Character	No	No	Yes
	Economic Impacts	Same	Same	Same
	Conformance to Regional Transportation Plan	No	No	Yes
	Provides Traffic Calming	No	No	Yes
	Satisfies Purpose and Need Statement	Yes	Yes	Yes
<b>Permits</b>	VTrans Access Permit	Yes	Yes	Yes
	Act 250	No	No	No
	401 Water Quality	Yes	Yes	Yes
	404 COE Permit	Yes	Yes	Yes
	Stream Alteration	No	No	No
	Conditional Use Determination	Yes	Yes	Yes
	Stormwater Discharge	Yes	Yes	Yes
	Lakes and Ponds	No	No	No
	SHPO (Historic and Archaeological)	No	No	No
<b>Engineering</b>	Typical Section	12' lanes, 12' turning lanes E/W approaches, 8' shoulders	12' lanes, 12' turning lane on west approach, 8' shoulders	12' lanes, 4' shoulders
	Traffic Safety	Enhanced	Enhanced	Enhanced
	Bicycle/Pedestrian Access	Shoulders	Shoulders	Shoulders
	Curbs	No	No	Yes
	Drainage Improvements	Yes	Yes	Yes
	Utility	Poles are maintained	Poles are maintained	Poles are moved
	Posted Speed	50	50	50

# ***Public Meetings***

Public meetings in association with this study were held that focused on presenting alternatives and soliciting local concerns and comments from the community. These meetings were held in conjunction with the Middlebury Town Selectboard Meetings.

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## ***Alternatives Presentation – August 10, 2004***

The Town of Middlebury presented an overview of the project history and outlined the purpose of the meeting. Dufresne-Henry provided details on three proposed alternatives for the Exchange Street / Happy Valley / Route 7 intersection. The meeting was attended by local residents, Selectboard members, the consultant and local government officials from the Town.

The purpose of the alternatives presentation was to gather public opinion and to identify their preferred alternative. People from the community, the Board and the Town stated their viewpoints, the vast majority in favor of the roundabout alternative. The Town Selectboard held two votes following the discussion on the alternatives. The first vote was 7-0, stating that the Selectboard identified a critical need of traffic control at this intersection. The second vote was 7-0, stating that the best solution for this need for traffic control is the roundabout alternative. Minutes from this meeting are included in the Appendix. Minutes from meetings prior to this with the Steering Committee are also located in the Appendix.

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## ***Public Meetings – September 29, 2004***

The purpose of this meeting was to solicit comments on the Draft Scoping Study dated September 7, 2004. This meeting was noticed in the Addison Independent and held as an agenda item of a Middlebury Selectboard meeting. There was no public comment but concerns from the Agency were discussed and are included in Appendix E. Some of these comments are incorporated in the Final Report text. The board of selectmen passed a motion to approve the draft report.

# ***Conclusions and Recommendations***

Based on the evaluations of alternatives, public comments, and the endorsement from the Town of Middlebury Selectboard, the staff at the ACRPC and the Town of Middlebury recommend the Roundabout Intersection to move forward to the next phase of the project. It is recognized this Roundabout Alternative costs more and will likely have a longer development process, but provides a greater value in operation, aesthetics and safety.



# ***Appendix Summary***

## **Appendix A: Meeting Minutes**

Project Kick-off Mtg. #1, March 15, 2004  
Pre-Alternatives Meeting, July 9, 2004  
Alternatives Presentation, August 10, 2004

## **Appendix B: Correspondence**

Phone Log: Mark Smith with Dick Hosking, General Comments and Concerns, March 30, 2004

## **Appendix C: Traffic**

Original Traffic Counts for AM and PM, April 2, 2004  
VTrans Special Tube Count, Fax from Maureen Carr, 2004/01/05  
Summary Sheet of Original Counts with Truck Percentages, June 2004  
Original and Projected 2006, and 2016 Traffic Volumes, June 9, 2004  
Industrial Park Expansion, Fax from Fred Dunnington, 5-13-04  
Trip Generation of proposed development, from the ITE Trip Generation Handbook, 7<sup>th</sup> Generation  
-Industrial Park, General Office Building and Free-Standing Discount Store  
New Development Volume Distributions  
Summary of Adjusted Peak Volumes with Added New Development, June 2004  
Signal Warrant Output, June 2004  
Signal Warrant Analysis Results  
Synchro Signalization Analysis Results for 2006 (projected) and 2016 (projected with new development)  
Rodel Roundabout Analysis Results for 2016 AM and PM (projected with new development)  
Sight Distance Summary, July 29, 2004

## **Appendix D: Conceptual Cost Estimates**

Assumptions for Conceptual Cost Estimate, August 10, 2004  
Conceptual Cost Estimate Items of Work, August 10, 2004

## **Appendix E: Draft Scoping Study Comments**



# ***Appendix A – Meeting Minutes***

Middlebury Route 7 / Exchange St.  
Middlebury, VT

## Meeting Minutes

### Dufresne-Henry, Inc.

55 Green Mountain Drive, P.O. Box 2246  
South Burlington, Vermont 05407  
Tel: 802-864-0223 Fax: 802-864-0165  
e-mail: firstinitial.lastname@dufresne-henry.com

Meeting: **Project Kick-off – Mtg #1**  
Meeting Date: **March 15, 2004**  
Project No.: **6330030**

Team Meeting					
Date	Start	End	Next Meeting	Next Time	Prepared by
03-15-04	2:00 PM	3:30 PM	TBD	TBD	Greg Edwards

Attended By	Copies To
Town: Dan Werner, Fred Dunnington, Don Keeler, Dean George ACRPC: Garrett Dague State: Tamsen Benjamin DH: Greg Edwards, Mark Smith	All attendees VTrans: Dick Hosking, DTA

*If content contained within is not complete, accurate, or in context, please notify Dufresne-Henry of such discrepancy within ten (10) days of this record.*

Item	Summary of Meeting
Items Discussed	
1-1	Project History: US Route 7 in the project area was reconstructed and widened in approximately 1974 by the Vermont Agency of Transportation. Shortly thereafter the Middlebury Industrial Park extended Exchange Street and created the Exchange Street leg of the subject intersection. Over the last 30 years, the Industrial Park has expanded to 45 businesses, Fred Dunnington provided a list of these. The Industrial Park is subject to an Act 250 Permit, thus the plans for expanded use of the individual lots typically require and Act 250 review. In some instances, this has triggered the need for a traffic impact study. To date, significant intersection improvements have not been required due to these developments. The Town does have a concern that eventually the Industrial Park development will be curbed due to the needed improvements at the intersection. These improvements will be borne by this sole development or parcel. A copy of a traffic study associated with a parcel development was provided to Dufresne-Henry (DH). This intersection was also a part of a US Route 7 Corridor Study conducted by the Addison County Regional Planning Commission (ACRPC) in the late 1990's. DH has a copy of this study and will it will be reviewed and studied in the project development.

1-2	<p>Existing Concerns: Noted concerns include the following:</p> <ol style="list-style-type: none"><li>1. Limited corner site distance on the Exchange Street approach.</li><li>2. Limited traffic gaps on US Route 7 during peak periods for traffic entering from the sidelines, particularly for the Exchange Street left turning traffic.</li><li>3. Excessive speeds on US Route 7.</li><li>4. The potential for severe accidents.</li><li>5. Delays or queuing on Exchange Street at shift changes.</li><li>6. Significant truck traffic associated with the Industrial Park.</li><li>7. Potential for significant development producing additional traffic.</li></ol>
1-3	<p>Existing and Projected Traffic Volumes: DH will conduct a 12 hour turning movement count at the intersection. These volumes will be adjusted using the States daily and seasonal adjustments. Background growth will be developed using adjacent VTrans continuous count stations to account for potential traffic growth due to Industrial Park development. Fred will provide the acreage and zone use for the undeveloped Industrial Park parcels. DH will include the trips generated from this development in the projected traffic volumes.</p>
1-4	<p>Accidents History: DH will obtain an accident listing from VTrans. The Town will request an accident listing from the Middlebury Town Police and forward it to DH.</p>
1-5	<p>Project Schedule: It is anticipated traffic counts will be completed by early April and the survey within the next three to four weeks pending weather conditions. Traffic Analysis completed by April 15<sup>th</sup> and the signalized and unsignalized intersection and roundabout alternatives will be developed and distributed by May 1<sup>st</sup> with a review meeting and alternatives presentation to follow.</p>
	<p>Next meeting (#2) will be approximately in mid-May, TBD.</p>

**Middlebury Rt. 7 - Exchange St  
Intersection Improvements  
Burlington, Vermont**

**Meeting Minutes**

**Dufresne-Henry, Inc.**

55 Green Mountain Drive, P.O. Box 2246

South Burlington, Vermont 05407

Tel: 802-864-0223 Fax: 802-864-0165

e-mail: firstinitial.lastname@dufresne-henry.com

Meeting: Pre-Alternatives Meeting

Meeting Date: July 9, 2004

Project No.: 6330030

Team Meeting					
Date	Start	End	Next Alt. Meeting with Selectboard	Next Time	Prepared by
7-9-04	9:00 a.m.	10:30 a.m.	August 10, 2004	7:00 p.m.	Stephanie Zehler

Attended By	Copies To
<b>Town:</b> Dan Werner, Fred Dunnington, Don Keeler, Bill Finger <b>ACRPC:</b> Garrett Dague <b>VTrans District 5, DTA:</b> Dick Hosking <b>DH:</b> Greg Edwards, Mark Smith, Stephanie Zehler	Attendees <b>Town:</b> Dean George <b>State:</b> Tamsen Benjamin

*If content contained within is not complete, accurate, or in context, please notify Dufresne-Henry of such discrepancy within ten (10) days of this record.*

Item	Summary of Meeting	
	Items Discussed	Action/Response
1	<b>Review Traffic Analysis and Results.</b> Greg Edwards outlined the Purpose and Need Statement regarding the project, discussed the Level of Service (LOS) at the Exchange St-Route 7 Intersection and explained the signal warrant analysis. Mark Smith explained how the LOS design criteria for a roundabout and a signalized intersection are different.	DH will place a table with the LOS interpretation (delay ranges) and a note of explanation into the report. Seconds of delay will be provided for each approach and DH will consider providing the maximum capacity for each alternative.

Item	Summary of Meeting	
	Items Discussed	Action/Response
2	<p><b>Review Alternative Plans: Signalized Alternative.</b> Greg Edwards described the elements for an effective signalized alternative pointing out design considerations such as:</p> <ol style="list-style-type: none"> <li>Placing the signal mast poles outside the clear zone to avoid using guardrail</li> <li>Potentially lowering the speed limit on Route 7 to improve the stopping sight distance in all directions</li> <li>Refining lane geometry</li> <li>Adding new mast arm poles for signals</li> <li>Explaining the drawing plan of full build versus a minimum build scenario</li> </ol>	<p>DH will create a third alternative plan for the Alternatives meeting that takes out the striped island on Happy Valley Road, thereby maintaining the existing approach configuration. This third plan would also allow the signal to be called on demand and add curbing to minimize trucks driving off of the road shoulders. DH will provide corner sight distance line and estimate stopping sight distance for the Happy Valley approach.</p>
3	<p><b>Review Alternative Plans: Roundabout Alternative.</b> Greg Edwards described the elements and operation of the roundabout then noted the following considerations:</p> <ol style="list-style-type: none"> <li>Since it is under yield control a major advantage to the user and the environment is continuous flow, no stopping. Yield-only is particularly beneficial during off-peak periods.</li> <li>Roundabout initial cost is higher than the signal option due to more roadway reconstruction.</li> <li>Roundabout promotes less gas consumption, reduces emissions and delay especially during off-peak periods.</li> <li>Roundabout slows traffic introducing an entrance to Middlebury urban compact.</li> </ol>	<p>Shoulders need to be a minimum of 4' wide for bicyclist use.</p> <p>The design plan with short raised islands may not slow or warn traffic appropriately. The following are adaptations to the islands that would help slow vehicles before they enter the intersection:</p> <ul style="list-style-type: none"> <li>longer raised islands</li> <li>a painted island before the raised deflection islands leading to the roundabout</li> <li>narrowing and/or deflecting travel lanes</li> </ul> <p>It is important to note that before installing a roundabout, extensive roundabout education is required in a new area. This may include a roundabout demonstration, handing out brochures on how drivers must operate, or showing a video of a roundabout in action on public access TV.</p>

Item	Summary of Meeting	
	Items Discussed	Action/Response
4	<p><b>Determine specifics of Alternatives Presentation Meeting.</b> The next meeting held will be the Alternatives Presentation. It was suggested that this meeting also be part of biweekly Selectboard Meeting on a Tuesday evening (so as to gain the Selectboard endorsement). Dates available are July 27th, Aug 10th, Aug 24th. August 10th was decided upon for the Alternatives Meeting.</p>	<p>DH will:</p> <ul style="list-style-type: none"> <li>• Prep for meeting</li> <li>• Edit current plans</li> <li>• Create the minimized signal alternative</li> <li>• Develop itemized cost estimate</li> <li>• Provide an appropriate comparison of the signal and roundabout alternatives</li> <li>• Prepare color plans for presentation</li> <li>• Add 1973 slope rights to the Topo file</li> <li>• Send plots to Fred for display in the town office hallway</li> <li>• Give handouts to Fred for people in the town office</li> </ul> <p>Town will:</p> <ul style="list-style-type: none"> <li>• Introduce the meeting on Aug. 10th</li> <li>• Put meeting notices out: a public notice, an article, a date and time for the meeting on Aug 10th on the community calendar</li> </ul>
5	<p><b>Discuss Interim Safety Measures.</b> A list of suggested safety measures were discussed.</p>	<p>Edit the safety measures and present at the alternatives presentation meeting.</p>
A.	<p><b>The following questions and comments were brought up or discussed throughout the meeting. Replies are shown to the right.</b></p> <p>Is there accident history in the area?</p>	<p>Yes, but this location is not designated as a High Accident Location (HAL).</p>
B.	<p>What is the truck percentage at this intersection?</p>	<p>The truck percentage on the 3 major traveled legs is 8%. Happy Valley Road's truck percentage is 2%.</p>
C.	<p>How long does typical signal equipment last before it needs replacement?</p>	<p>Dick stated that a signal should last approximately 20 years before it needs replacing.</p>



Item	Summary of Meeting	
	Items Discussed	Action/Response
D.	How would the roundabout alternative be funded? The signalized alternative?	<p>Roundabout alternative: 80%-10%-10% (Fed-State-Local)</p> <p>Signal Alternative: 100% (Federal)</p>
E.	What is the cost of each alternative?	<p>The following costs are approximated estimates based on other projects that have been itemized:</p> <ul style="list-style-type: none"> <li>• Roundabout alternative: ~\$400,000</li> <li>• Signal Alternative: ~\$300,000</li> </ul>
F.	What situation does the Roundabout intersection present for pedestrians and bicyclists?	<p>There are very few pedestrians in this location. However, high school teams run up this road. It would be wise to find a way to accommodate pedestrians and bicyclists in the roundabout, perhaps with a shoulder on the other side of the curb. Vehicles are going slower as they maneuver through the roundabout.</p>
G.	Is there curbing for either Alternative?	<p>Yes, there are curbs within the limits of the roundabout alternative. No, there are currently not curbs for the signal alternative. However, it was noted that curbing on the signal alternative would be beneficial to denote the shoulder for trucks.</p>
H.	Have the wetlands been delineated?	<p>The wetlands have not been delineated. Note that a manmade drainage ditch is not a wetland and is not required to have a permit. Extending a culvert requires a permit. Impact areas over 3000 square feet require a VSCOE.</p>
I.	Do we need additional right-of-way for both of these Alternatives?	<p>Yes, additional right-of-way is needed for both Alternatives for any physical changes to the intersection. The town may wish to obtain the triangular piece of property currently owned by a doctors' office to assist with reconstructing the intersection.</p>

Item	Summary of Meeting	
	Items Discussed	Action/Response
J.	Could someone get a plow template (17' wide) and run this through the roundabout design to see the anticipated effect?	Yes, DH can refer to the Autoturn program for a plow template.
K.	What is needed to warrant a flashing beacon?	Traffic accidents and traffic volumes.
L.	Who will attend this Alternatives Meeting?	Consensus from people of which alternative is preferred will most likely come from: <ul style="list-style-type: none"><li data-bbox="1003 562 1136 594">• School</li><li data-bbox="1003 600 1235 632">• Industrial Park</li><li data-bbox="1003 638 1433 669">• Happy Valley Road Residents</li></ul>

**Middlebury Route 7 / Exchange St.  
Middlebury, VT**

## Meeting Minutes

### Dufresne-Henry, Inc.

55 Green Mountain Drive, P.O. Box 2246

South Burlington, Vermont 05407

Tel: 802-864-0223 Fax: 802-864-0165

e-mail: firstinitial.lastname@dufresne-henry.com

Meeting: **Alternatives Presentation**

Meeting Date: **August 10, 2004**

Project No.: **6330030**

### Alternatives Presentation Meeting Summary

Date	Start	End	Next Meeting	Next Time	Prepared by
8-10-04	7:30 PM	8:15 PM	TBD	TBD	Stephanie Zehler

Attended By	Copies To
Middlebury Town Selectboard Members of the Public Town: Dan Werner, Fred Dunnington, Don Keeler, Dean George ACRPC: Garrett Dague DH: Greg Edwards, Stephanie Zehler	Attendees on the committee.  VTrans: Dick Hosking, DTA  State: Tamsen Benjamin

*If content contained within is not complete, accurate, or in context, please notify Dufresne-Henry of such discrepancy within ten (10) days of this record.*

Item	Summary of Meeting
<b>Items Discussed</b>	
1-1	Project History: US Route 7 in the project area was reconstructed and widened in approximately 1974 by the Vermont Agency of Transportation. Shortly thereafter the Middlebury Industrial Park extended Exchange Street and created the Exchange Street leg of the subject intersection. Over the last 30 years, businesses on Exchange Street have grown in number to over 45. The Town does have a concern that eventually the Industrial Park and other Exchange St. business development will be curbed due to the level of service at the Rt. 7 intersection. It is not fair, nor practicable for needed improvements to be borne by the next individual business that is expanding. Dufresne-Henry was hired by the RPC to review this intersection and provide intersection improvement alternatives for the Town to discuss with the State.

1-2	<p><b>PURPOSE:</b></p> <p>Improve the Safety and Operation of the Intersection and Enhance the "Gateway to Middlebury."</p> <p><b>NEEDS:</b></p> <ul style="list-style-type: none"><li>◆ Improve sight distance and safety for turning vehicles.</li><li>◆ Reduce delay on Exchange Street approach.</li><li>◆ Accommodate growth of Middlebury and Exchange Street.</li><li>◆ Provide gateway to Middlebury.</li></ul>
1-3	<p>Presentation of Alternative 1A and 1B: Signalized</p> <ul style="list-style-type: none"><li>◆ Install actuated signal system</li><li>◆ Increase corner sight distance</li><li>◆ Add turn lane on Exchange Street approach</li></ul>
1-4	<p>Presentation of Alternative 2: Roundabout</p> <ul style="list-style-type: none"><li>◆ Construct Roundabout with curbed splitter islands</li><li>◆ Improve sight distance</li><li>◆ Widening for roundabout</li><li>◆ Extend existing culvert</li></ul>
1-5	<p>Project Needs:</p> <ul style="list-style-type: none"><li>◆ Reduce Delay</li><li>◆ Increase Corner Sight Distance</li><li>◆ Safety for turning vehicles</li><li>◆ Enhance gateway</li><li>◆ Accommodate traffic growth</li></ul>
1-6	<p>Impacts:</p> <ul style="list-style-type: none"><li>◆ Adjacent Property</li><li>◆ Right-of-Way</li><li>◆ Environmental</li><li>◆ Economic</li><li>◆ Community character</li><li>◆ Regional Plans</li><li>◆ Utilities</li></ul>

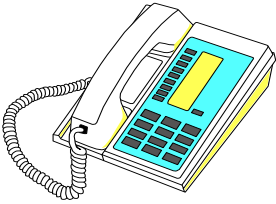
1-7	<p>Operations:</p> <ul style="list-style-type: none"><li>◆ Speed</li><li>◆ Accidents</li><li>◆ Maintenance</li><li>◆ Energy efficiency</li><li>◆ Public acceptance/education</li></ul>
1-8	<p>Cost:</p> <ul style="list-style-type: none"><li>◆ Construction</li><li>◆ Engineering</li><li>◆ R.O.W.</li><li>◆ Total</li><li>◆ Project Timeline</li></ul>
1-9	<p>Comments and Questions:</p> <p><b>Chief Hanley</b> - He supports the roundabout, this is a great spot for one. There may be runners and joggers at this location, but these people would not stop for a pedestrian phase at a signal. A large reason for not having a signal is the impatience that drivers have while waiting. It is best for vehicles to travel slowly; this is the best method for traffic calming. I am not supportive of any type of signalization. The roundabout is clearly the best alternative.</p> <p><b>Dean George</b> - He is a strong advocate for roundabouts. Since the 1990's, the roundabout alternative has been supported at this location. One concern is although the AOT has supported this alternative in the past, now it may not be so well supported by the current District Administrator. The roundabout is a fantastic way to solve a lot of problems here.</p> <p><b>Don Keeler</b> - When we discussed this option at the last meeting, AOT funding sounded like it was more readily available for a signal than for a roundabout alternative.</p> <p><b>Fred Dunnington</b> – The Board will need to lobby in Montpelier for its preferred alternative.</p> <p><b>Bill Perkins</b> - We will have to put pressure on Montpelier to make this happen. I have seen roundabouts around the world; in England they work great and here in Vermont too.</p>

1-9	<p><b>Don Keeler</b> - There are lots of joggers in this area that come up from Exchange Street.</p> <p><b>Bill Perkins</b> - Probably 20 joggers a day.</p> <p><b>Dean George</b> - With speeds of 20mph, it is easier to deal with pedestrians.</p> <p><b>Fred Dunnington</b> - With the roundabout alternative, one only has to cross one travel lane at a time. With the signal alternative, pedestrians have to cross two or three travel lanes to cross RT 7.</p> <p><b>Charlotte Tate</b> - The roundabout alternative gives me a warm feeling to have this type of entryway with so much green space. Someone could maintain that center space with nice plantings and really make a nice entrance to the Town.</p> <p><b>Don Keeler</b> – We do already have slope rights on the corners. (Other - But we will still need to acquire property rights for either alternative.)</p> <p><b>Fred Dunnington</b> – If AOT provided funding more readily for signals and the preferred roundabout was only to be funded at a more distant future date, would the SelectBoard wait? What does the Selectboard see as the urgency of this Intersection?</p> <p><b>John Tenny</b> – The Town should start with the property acquisition.</p> <p><b>Fred Dunnington</b> - The state property acquisition process should be used in this matter. But, yes, we can start talking with property owners now.</p> <p><b>John Tenny</b> - See the needs of the project and talk with property owners.</p> <p><b>Don Keeler</b> - We know the signal is going to work. The roundabout is nice. But look at the funding associated with this. AOT states that roundabouts can cost much more than a signalized intersection.</p> <p><b>Peg Martin</b> - Roundabouts work very well in other spots such as Montpelier and Brattleboro. She prefers to push for the roundabout. The intersection is never going to change if you put a signal there.</p> <p><b>Greg Edwards</b> - AOT has typically supported roundabouts in urban areas with slower speeds such as Montpelier, Manchester, Harford and Middlebury. This area around Exchange Street-Route 7 is going to be more developed in 20 years. Roundabouts in higher speed locations is an issue and requires careful consideration.</p>
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1-9	<p><b>Dean George</b> - There are people at the AOT who support roundabouts, not everyone in AOT has reservations with them there.</p> <p><b>Public comment-</b> Why is this particular spot been chosen for a roundabout and not the southern gateway?</p> <p><b>John Tenny</b> - The funding for the southern project is not certain. At the Exchange Street-Route 7 Intersection, the traffic numbers are higher, the intersection is already warranted and there are more businesses moving in. There is growing concern that the industrial park would not be able to grow and/or would halt due to this intersection not being adequate level of service.. In due time, the Town may lose the opportunity to choose a traffic control device at this location due to urgency.</p> <p><b>Fred Dunnington</b> – What is the urgency of this project to the Town Selectboard versus the southern roundabouts?</p> <p><b>Dean George</b> - They are separate issues.</p> <p><b>Peg Martin</b> - The southern roundabouts are a much more expensive project than this intersection. We can make this work in a discreet manner versus changing a whole area.</p> <p><b>Fred Dunnington</b> - In reality, if the roundabout alternative takes a few more years than a signalized intersection, who will support this? Peg, John, Bill P. indicated they would.</p> <p><b>Don Keeler</b> - This is a dangerous intersection, it is a known problem that we need to do something soon.</p> <p><b>Peg Martin</b> - We can increase the visibility at this location for sure now.</p> <p><b>Bill Perkins</b> - Driving this intersection 4-10x a day, there is a lot of impatience of drivers, as the Chief said earlier. One needs to wait for the proper break in traffic before you go across. We should clear the trees now.</p> <p><b>John Tenny</b> - The proper way to proceed is perhaps with these two actions:</p> <ol style="list-style-type: none"><li>1) The Town Selectboard has identified a critical need of traffic control at this intersection. (voted 7-0 in favor)</li><li>2) The best solution for this need for traffic control is the roundabout alternative. (voted 7-0 in favor)</li></ol>
1-10	<p>Dufresne-Henry will provide the DRAFT Report in the fall of 2004.</p>

# ***Appendix B – Correspondence***





## Dufresne-Henry, Inc.

P.O. Box 2246, 1025 Airport Drive  
South Burlington, VT 05407  
Telephone: (802) 864-0223  
Fax: (802) 864-0165

### TELEPHONE CONVERSATION LOG

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By: Mark Smith

Project No: 6330030

Date: 3-30-04

Time: 9 am

Individual: Dick Hosking

Title: VTrans District 5 DTA

Phone No.: 655-1580

Subject: general comments and concerns for possible intersection improvements at Exchange St. and Rte. 7 in Middlebury

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#### Items Discussed:

Maintainability in winter:

- area of Rte 7 is plowed by a tandem truck (needs 17 ft. width where curbed both sides)
- small roundabouts are too constrictive for these vehicles
- no left-hand plows for pushing snow to middle of a roundabout are available to DTA
- windrow of snow will be left across Rte 7 approaches to a roundabout
- cleanup after storm requires different equipment than what's available to District
- account for snow melt from center island of roundabout – don't want freezing across road
- may need cooperation from Town for plowing

Need to control speed on Rte 7:

- possibly narrow shoulder on Rte 7 for traffic calming
- roundabout design speed may be 25 mph, but Rte 7 will still dominate – making it hard to get out from Exchange St.

Traffic:

- problem is only in peak hours
- Rte 7 is part of the state Truck Network – must plan for 53 foot trailers (WB67)

Sight Distance:

- no matter what: remove the mound to the south of intersection (west side)
- for roundabout alternative - must be able to see features clearly from approaches

#### Comments or Actions Required:

Find a turning template for a tandem truck with a plow, if possible.

# ***Appendix C - Traffic***



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Rt 7 North Approach		2		18		34		3		19		35		4		20		36	
		Right onto Exchange St				Straight south on Rt 7				Left onto Happy Valley Rd									
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Truck	Tractor Trailers	Bus	15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes		
D. Draper	6:00	15	0	2		24	5	3		0	0	0		6:00	5	5	49		
	6:15	3	2	0		30	0	2		0	0	0		6:15	2	2	37		
	6:30	11	0	0		55	3	3		1	0	0		6:30	3	3	73		
	6:45	18	1	0		69	6	1		1	0	0		6:45	7	1	96		
	7:00	14	1	1		59	2	1		0	0	0		7:00	3	2	78		
	7:15	23	1	0		69	4	0		1	0	0		7:15	5	0	98		
	7:30	21	0	1		101	0	4		0	0	0		7:30	0	5	127		
	7:45	30	1	0		137	2	2		1	0	0		7:45	3	2	173		
	8:00	33	1	0		98	3	2		1	0	0		8:00	4	2	138		
	8:15	34	0	1		113	8	1		0	0	0		8:15	8	2	157		
	8:30	16	2	1		88	2	2		0	0	0		8:30	4	3	111		
	8:45	18	1	0		81	3	2		1	0	0		8:45	4	2	106		
	9:00	17	0	0		64	6	2		1	0	0		9:00	6	2	90		
	9:15	15	1	2		75	3	4		0	0	0		9:15	4	6	100		
	9:30	16	2	0		79	6	1		1	0	0		9:30	8	1	105		
	9:45	13	4	0		77	2	5		1	1	0		9:45	7	5	103		
	10:00	15	0	3		63	6	1		1	1	0		10:00	7	4	90		
	10:15	15	0	2		70	7	4		1	0	0		10:15	7	6	99		
	10:30	9	2	0		60	6	0		0	0	0		10:30	8	0	77		
	10:45	13	4	0		66	9	3		0	0	0		10:45	13	3	95		
	11:00	11	2	1		63	5	2		0	0	0		11:00	7	3	84		
	11:15	10	2	0		56	4	2		1	0	0		11:15	6	2	75		
	11:30	18	2	2		67	8	2		2	0	0		11:30	10	4	101		
	11:45	15	3	0		72	5	0		3	0	0		11:45	8	0	98		
															TOTAL	139	65	2360	

Trucks	5.89	%
Trailer Trucks	2.75	%
Total Trucks	8.64	%



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Happy Valley  
Approach

Approach		6	22	38		7	23	39		8	24	40						
		Right onto Rt 7, north				Straight on Exchange, west				Left onto Rt 7, south								
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus	15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes	
D. Draper	6:00	0	0	0		1	0	0		0	0	0		6:00	0	0	1	
	6:15	0	0	0		1	0	0		0	0	0		6:15	0	0	1	
	6:30	1	0	0		2	0	0		0	0	0		6:30	0	0	3	
	6:45	0	0	0		2	0	0		1	0	0		6:45	0	0	3	
	7:00	2	0	0		1	0	0		0	0	0		7:00	0	0	3	
	7:15	1	0	0		0	0	0		0	0	0		7:15	0	0	1	
	7:30	1	0	0		3	0	0		1	0	0		7:30	0	0	5	
	7:45	0	0	0		3	0	0		0	0	0		7:45	0	0	3	
	8:00	0	0	0		0	0	0		1	0	0		8:00	0	0	1	
	8:15	2	0	0		2	0	0		1	0	0		8:15	0	0	5	
	8:30	0	0	0		1	0	0		2	0	0		8:30	0	0	3	
	8:45	1	0	0		2	0	0		2	0	0		8:45	0	0	5	
	9:00	0	0	0		1	0	0		0	0	0		9:00	0	0	1	
	9:15	1	0	0		2	0	0		0	0	0		9:15	0	0	3	
	9:30	1	0	0		1	0	0		1	0	0		9:30	0	0	3	
	9:45	0	0	0		1	0	0		2	0	0		9:45	0	0	3	
	10:00	1	0	0		1	0	0		0	0	0		10:00	0	0	2	
	10:15	1	0	0		1	1	0		0	0	0		10:15	1	0	3	
	10:30	0	0	0		1	0	0		2	0	0		10:30	0	0	3	
	10:45	0	0	0		0	0	0		0	0	0		10:45	0	0	0	
	11:00	0	0	0		2	0	0		0	0	0		11:00	0	0	2	
	11:15	1	0	0		0	0	0		1	0	0		11:15	0	0	2	
	11:30	1	0	0		3	0	0		0	0	0		11:30	0	0	4	
	11:45	1	0	0		1	0	0		1	0	0		11:45	0	0	3	
														TOTAL	1	0	63	

PEAK  
PEAK  
PEAK  
PEAK  
10

Trucks	1.59	%
Trailer Trucks	0.00	%
Total Trucks	1.59	%



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Rt 7 South Approach

10 26 42 11 27 43 12 28 44

Observer	15 min period begins	Right onto Happy, east				Straight on Rt 7, north				Left onto Exchange, west				15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes
		Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus				
D. Draper	6:00	0	0	0		29	1	2		0	0	0		6:00	1	2	32
	6:15	0	0	0		32	3	2		2	0	0		6:15	3	2	39
	6:30	1	0	0		61	0	0		3	0	1		6:30	0	1	66
	6:45	0	0	0		38	2	0		6	2	0		6:45	4	0	48
	7:00	0	0	0		56	3	1		1	0	1		7:00	3	2	62
	7:15	0	0	0		63	3	2		6	0	0		7:15	3	2	74
	7:30	0	0	0		66	3	2		2	0	0		7:30	3	2	73
	7:45	1	1	0		64	2	0		5	0	0		7:45	3	0	73
	8:00	0	1	0		64	2	1		3	3	0		8:00	6	1	74
	8:15	1	0	0		58	3	2		8	3	0		8:15	6	2	75
	8:30	1	0	0		74	6	2		8	0	0		8:30	6	2	91
	8:45	0	0	0		52	4	2		9	0	0		8:45	4	2	67
	9:00	0	0	0		44	5	0		3	2	0		9:00	7	0	54
	9:15	0	0	0		56	7	4		2	1	1		9:15	8	5	71
	9:30	1	0	0		61	4	5		0	1	1		9:30	5	6	73
	9:45	0	0	0		61	3	4		3	0	1		9:45	3	5	72
	10:00	0	0	0		75	2	2		4	0	1		10:00	2	3	84
	10:15	0	0	0		57	5	3		3	0	0		10:15	5	3	68
	10:30	1	1	0		55	3	0		1	1	1		10:30	5	1	63
	10:45	0	0	0		80	9	4		1	1	0		10:45	10	4	95
	11:00	1	0	0		67	4	1		0	0	1		11:00	4	2	74
	11:15	0	0	0		79	9	4		2	0	1		11:15	9	5	95
	11:30	2	0	0		57	2	2		6	0	0		11:30	2	2	69
	11:45	2	0	0		54	3	5		2	0	0		11:45	3	5	66
<b>TOTAL</b>															<b>105</b>	<b>59</b>	<b>1658</b>

<b>Trucks</b>	<b>6.33</b>	<b>%</b>
<b>Trailer Trucks</b>	<b>3.56</b>	<b>%</b>
<b>Total Trucks</b>	<b>9.89</b>	<b>%</b>



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Exchange Street  
Approach

Approach		14	30	46		15	31	47		16	32	48					
		Right onto Rt 7, north				Straight on Happy, east				Left onto Rt 7, north							
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus	15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes
D. Draper	6:00	0	0	0		0	0	0		2	1	0		6:00	1	0	3
	6:15	0	3	1		0	0	0		4	0	0		6:15	3	1	8
	6:30	1	1	0		1	0	0		1	0	0		6:30	1	0	4
	6:45	1	2	0		2	0	0		0	1	0		6:45	3	0	6
	7:00	0	0	0		0	0	0		4	0	0		7:00	0	0	4
	7:15	1	0	1		0	0	0		2	2	1		7:15	2	2	7
	7:30	2	0	0		0	0	0		5	1	0		7:30	1	0	8
	7:45	0	0	0		1	0	0		4	0	0		7:45	0	0	5
	8:00	5	0	0		1	0	0		11	1	0		8:00	1	0	18 PEAK
	8:15	9	0	1		0	0	0		6	1	0		8:15	1	1	17 PEAK
	8:30	2	0	2		0	0	0		8	1	3		8:30	1	5	16 PEAK
	8:45	3	0	0		0	0	0		13	1	1		8:45	1	1	18 PEAK
	9:00	3	0	0		0	0	0		7	1	1		9:00	1	1	12 69
	9:15	3	0	1		0	0	0		12	0	1		9:15	0	2	17
	9:30	2	0	0		0	0	0		9	1	0		9:30	1	0	12
	9:45	4	0	0		1	0	0		13	0	2		9:45	0	2	20 PEAK
	10:00	2	0	1		0	0	0		15	5	1		10:00	5	2	24 PEAK
	10:15	3	0	0		1	0	0		13	1	1		10:15	1	1	19 PEAK
	10:30	4	1	2		0	0	0		20	2	1		10:30	3	3	30 PEAK
	10:45	4	1	0		1	0	0		10	2	0		10:45	3	0	18 93
	11:00	0	0	0		0	0	0		10	2	1		11:00	2	1	13
	11:15	3	2	0		1	0	0		11	0	1		11:15	2	1	18
	11:30	5	0	2		1	0	0		11	3	1		11:30	3	3	23
	11:45	4	1	0		2	0	0		10	0	2		11:45	1	2	19
TOTAL															37	28	339

<b>Trucks</b>	<b>10.91</b>	<b>%</b>
<b>Trailer Trucks</b>	<b>8.26</b>	<b>%</b>
<b>Total Trucks</b>	<b>19.17</b>	<b>%</b>

# SUMMARY SHEET

AM	# Cars	Truck	actor Trail	al Vehicles
Page 1	2156	139	65	2360
Page 2	62	1	0	63
Page 3	1494	105	59	1658
Page 4	274	37	28	339

4420



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
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VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Rt 7 North Approach		2		18		34		3		19		35		4		20		36	
		Right onto Exchange St				Straight south on Rt 7				Left onto Happy Valley Rd									
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Truck	Tractor Trailers	Bus	15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes		
M. Draper	12:00	16	6	2		78	5	0		0	0	0		6:00	11	2	107		
	12:15	15	2	1		74	5	3		2	0	0		6:15	7	4	102		
	12:30	14	1	2		57	5	2		0	0	0		6:30	6	4	81		
	12:45	11	0	3		66	4	2		1	0	0		6:45	4	5	87		
	13:00	5	1	1		80	2	2		0	0	0		7:00	3	3	91		
	13:15	9	0	1		75	5	1		1	0	0		7:15	5	2	92		
	13:30	9	1	4		83	2	6		0	0	0		7:30	3	10	105		
	13:45	12	0	1		82	5	1		0	0	0		7:45	5	2	101		
	14:00	8	2	4		70	2	1		0	0	0		8:00	4	5	87		
	14:15	18	0	0		75	1	1		2	0	0		8:15	1	1	97		
	14:30	7	0	0		92	4	1		0	0	0		8:30	4	1	104		
	14:45	11	0	0		79	5	2		0	0	0		8:45	5	2	97		
	15:00	9	3	0		73	2	0		0	0	0		9:00	5	0	87		
	15:15	14	0	0		74	3	0		2	0	0		9:15	3	0	93		
	15:30	12	0	1		88	1	3		0	0	0		9:30	1	4	105		
	15:45	14	2	1		103	3	1		2	0	0		9:45	5	2	126		
	16:00	15	1	0		88	0	2		1	0	0		10:00	1	2	107		
	16:15	14	0	1		84	2	0		0	0	0		10:15	2	1	101		
	16:30	16	0	1		74	0	1		0	0	0		10:30	0	2	92		
	16:45	12	1	0		82	1	0		0	0	0		10:45	2	0	96		
	17:00	11	0	0		84	1	2		1	0	0		11:00	1	2	99		
	17:15	6	2	0		85	1	0		0	0	0		11:15	3	0	94		
	17:30	5	0	1		85	2	2		0	0	0		11:30	2	3	95		
	17:45	4	0	0		96	2	0		0	0	0		11:45	2	0	102		
															TOTAL	85	57	2348	

<b>Trucks</b>	<b>3.62</b>	<b>%</b>
<b>Trailer Trucks</b>	<b>2.43</b>	<b>%</b>
<b>Total Trucks</b>	<b>6.05</b>	<b>%</b>





VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Happy Valley Approach		6	22	38	7				23	39	8	24	40				
		Right onto Rt 7, north				Straight on Exchange, west				Left onto Rt 7, south				15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus				
M. Draper	12:00	0	0	0		2	0	0		0	0	0		6:00	0	0	2
	12:15	0	0	0		2	0	0		1	0	0		6:15	0	0	3
	12:30	0	0	0		0	0	0		0	0	0		6:30	0	0	0
	12:45	2	0	0		1	0	0		2	0	0		6:45	0	0	5 PEAK
	13:00	0	0	0		2	0	0		0	0	0		7:00	0	0	2 PEAK
	13:15	0	0	0		1	0	0		0	0	0		7:15	0	0	1 PEAK
	13:30	1	0	0		2	0	0		1	0	0		7:30	0	0	4 PEAK
	13:45	0	0	0		1	1	0		1	0	0		7:45	1	0	3 12
	14:00	0	0	0		0	0	0		0	0	0		8:00	0	0	0
	14:15	0	0	0		1	0	0		0	0	0		8:15	0	0	1
	14:30	0	0	0		0	0	0		1	0	0		8:30	0	0	1
	14:45	1	0	0		0	0	0		0	0	0		8:45	0	0	1
	15:00	0	0	0		1	0	0		1	0	0		9:00	0	0	2 PEAK
	15:15	0	0	0		4	0	0		1	0	0		9:15	0	0	5 PEAK
	15:30	3	0	0		2	0	0		0	0	0		9:30	0	0	5 PEAK
	15:45	2	0	0		0	0	0		0	0	0		9:45	0	0	2 PEAK
	16:00	0	0	0		0	0	0		1	0	0		10:00	0	0	1 14
	16:15	1	0	0		0	0	0		0	0	0		10:15	0	0	1
	16:30	1	0	0		0	0	0		0	0	0		10:30	0	0	1
	16:45	0	0	0		1	0	0		0	0	0		10:45	0	0	1
	17:00	0	0	0		1	0	0		0	0	0		11:00	0	0	1
	17:15	2	0	0		5	0	0		0	0	0		11:15	0	0	7
	17:30	1	0	0		1	0	0		0	0	0		11:30	0	0	2
	17:45	0	0	0		2	0	0		0	0	0		11:45	0	0	2
														TOTAL	1	0	53

Trucks	1.89	%
Trailer Trucks	0.00	%
Total Trucks	1.89	%



VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT  
April 2, 2004

Rt 7 South Approach		10		26		42		11		27		43		12		28		44	
Observer	15 min period begins	Right onto Happy, east				Straight on Rt 7, north				Left onto Exchange, west				15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes		
		Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus						
M. Draper	12:00	1	0	0		75	7	3		4	0	1		6:00	7	4	91		
	12:15	2	0	0		69	9	0		6	0	0		6:15	9	0	86		
	12:30	0	0	0		74	6	3		2	0	0		6:30	6	3	85		
	12:45	1	0	0		65	6	1		4	1	0		6:45	7	1	78		
	13:00	1	0	0		72	5	1		2	0	0		7:00	5	1	81		
	13:15	0	0	0		58	4	1		4	2	0		7:15	6	1	69		
	13:30	0	0	0		78	5	1		3	0	0		7:30	5	1	87		
	13:45	0	0	0		72	5	2		1	2	0		7:45	7	2	82		
	14:00	1	0	0		83	5	1		4	0	1		8:00	5	2	95		
	14:15	0	0	0		87	6	3		4	0	0		8:15	6	3	100		
	14:30	1	0	0		102	2	5		4	0	0		8:30	2	5	114		
	14:45	1	0	0		89	2	1		4	0	1		8:45	2	2	98		
	15:00	1	0	0		105	2	1		4	1	0		9:00	3	1	114		
	15:15	0	0	0		123	3	1		6	0	0		9:15	3	1	133		
	15:30	0	0	0		132	4	3		3	0	0		9:30	4	3	142		
	15:45	0	0	0		122	5	0		3	0	1		9:45	5	1	131		
	16:00	0	0	0		104	2	2		3	1	0		10:00	3	2	112		
	16:15	0	0	0		98	4	1		1	3	0		10:15	7	1	107		
	16:30	0	0	0		113	2	1		1	0	0		10:30	2	1	117		
	16:45	1	0	0		103	1	0		4	0	0		10:45	1	0	109		
	17:00	2	0	0		138	2	0		1	0	0		11:00	2	0	143		
	17:15	0	0	0		100	4	2		0	0	0		11:15	4	2	106		
	17:30	0	0	0		96	1	1		1	0	0		11:30	1	1	99		
	17:45	0	0	0		82	0	0		0	0	0		11:45	0	0	82		
															TOTAL	102	38	2461	

Trucks	4.14	%
Trailer Trucks	1.54	%
Total Trucks	5.69	%



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Middlebury, VT

April 2, 2004  
Weather: AM- PM-

VEHICLE TURNING MOVEMENT COUNT  
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Middlebury, VT  
April 2, 2004

Exchange Street Approach		14	30	46	15				31	47	16				32	48			
		Right onto Rt 7, north				Straight on Happy, east				Left onto Rt 7, north				15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes		
Observer	15 min period begins	Passenger cars	Truck	Tractor Trailer	Bus	Passenger cars	Tractor Trailers	Truck	Bus	Passenger cars	Truck	Tractor Trailer	Bus	15 min period begins	Trucks	Trailer Trucks	Total per 15 minutes		
M. Draper	12:00	10	0	0		5	0	0		28	0	1		6:00	0	1	44		
	12:15	6	4	0		1	0	0		15	3	1		6:15	7	1	30		
	12:30	2	0	1		2	0	0		18	1	1		6:30	1	2	25		
	12:45	1	1	0		0	0	0		9	0	1		6:45	1	1	12		
	13:00	7	1	1		1	0	0		19	2	0		7:00	3	1	31		
	13:15	6	2	0		0	0	0		14	4	0		7:15	6	0	26		
	13:30	3	0	0		0	0	0		8	1	2		7:30	1	2	14		
	13:45	4	0	1		0	0	0		12	1	0		7:45	1	1	18		
	14:00	10	0	1		0	0	0		35	0	2		8:00	0	3	48	PEAK	
	14:15	4	4	0		0	0	0		20	1	1		8:15	5	1	30	PEAK	
	14:30	6	0	0		1	0	0		17	0	2		8:30	0	2	26	PEAK	
	14:45	6	1	0		2	0	0		11	2	2		8:45	3	2	24	PEAK	
	15:00	4	0	1		1	0	0		25	0	0		9:00	0	1	31	128	
	15:15	8	0	1		2	0	0		21	1	2		9:15	1	3	35		
	15:30	13	0	0		3	0	0		21	0	0		9:30	0	0	37		
	15:45	4	0	1		3	0	0		25	0	0		9:45	0	1	33		
	16:00	9	1	1		1	0	0		24	0	1		10:00	1	2	37		
	16:15	0	0	1		3	0	0		25	1	0		10:15	1	1	30		
	16:30	8	0	1		0	0	0		28	1	0		10:30	1	1	38	PEAK	
	16:45	0	0	0		1	0	0		26	0	0		10:45	0	0	27	PEAK	
	17:00	8	0	0		3	0	0		31	1	1		11:00	1	1	44	PEAK	
	17:15	5	0	0		5	0	0		21	0	0		11:15	0	0	31	PEAK	
	17:30	1	0	0		1	0	0		15	0	0		11:30	0	0	17	140	
	17:45	1	0	0		1	0	0		10	1	0		11:45	1	0	13		
														TOTAL	34	27	701		

Trucks	4.85	%
Trailer Trucks	3.85	%
Total Trucks	8.70	%

SUMMARY SHEET

PM	# Cars	# Trucks	# Tractor Trailers	Total Vehicles
Page 1	2206	85	57	2348
Page 2	52	1	0	53
Page 3	2321	102	38	2461
Page 4	640	34	27	701

5563

**SUMMARY SHEET**  
**Traffic Data**

**#6330030**  
**ACRPC US7-Exchg St**

<b>PM</b>	<b># Cars</b>	<b># Trucks</b>	<b># Tractor Trailers</b>	<b>Total Vehicles</b>
<b>Page 1</b>	<b>2206</b>	<b>85</b>	<b>57</b>	<b>2348</b>
<b>Page 2</b>	<b>52</b>	<b>1</b>	<b>0</b>	<b>53</b>
<b>Page 3</b>	<b>2321</b>	<b>102</b>	<b>38</b>	<b>2461</b>
<b>Page 4</b>	<b>640</b>	<b>34</b>	<b>27</b>	<b>701</b>
				<b>5563</b>

**Trucks**                      **3.99**                      **%**  
**Trailer Trucks**                      **2.19**                      **%**  
**Total Trucks**                      **6.18**                      **%**

<b>AM</b>	<b># Cars</b>	<b># Trucks</b>	<b># Tractor Trailers</b>	<b>Total Vehicles</b>
<b>Page 1</b>	<b>2156</b>	<b>139</b>	<b>65</b>	<b>2360</b>
<b>Page 2</b>	<b>62</b>	<b>1</b>	<b>0</b>	<b>63</b>
<b>Page 3</b>	<b>1494</b>	<b>105</b>	<b>59</b>	<b>1658</b>
<b>Page 4</b>	<b>274</b>	<b>37</b>	<b>28</b>	<b>339</b>
				<b>4420</b>

**Trucks**                      **6.38**                      **%**  
**Trailer Trucks**                      **3.44**                      **%**  
**Total Trucks**                      **9.82**                      **%**

	<b># Cars</b>	<b># Trucks</b>	<b># Tractor Trailers</b>	<b>Total Vehicles</b>
<b>TOTAL</b>	<b>9205</b>	<b>504</b>	<b>274</b>	<b>9983</b>

**Trucks**                      **5.05**                      **%**  
**Trailer Trucks**                      **2.74**                      **%**  
**Total Trucks**                      **7.79**                      **%**

6336030. SH  
GAE  
JBL  
mcs



State of Vermont  
Agency of Transportation  
National Life Building  
Drawer 33  
Montpelier, VT  
05633-5001

# VTrans

Working to Get You There

**PROGRAM DEVELOPMENT DIVISION  
FAX COVER SHEET  
(802) 828-2334 FAX NUMBER)**

TO: Jon Lenuohl, DH

FROM: Maureen Carr

DATE: 1/5/04

SUBJECT: Middlebury Traffic Counts

TOTAL PAGES: 4 (including this sheet)

COMMENTS: Jon - I am faxing you three Automatic  
Traffic Recorder counts done in the US7/Exchange St/  
Happy Valley Rd area. \* We have not done a  
turning movement count at that intersection

Give me a call at 828-3091, or e-mail at  
maureen.carr@state.vt.us if you have  
questions.

Thanks



Run Date: 2004/01/05

Vermont Agency of Transportation  
 Technical Services Division  
 Traffic Research Unit  
 Special Count - Volume

2001

Site ID: S6A048		URBAN/LOCAL SYSTEM										Town: Middlebury		Count Type: VOLUME		Final AADT: 2100														
Functional Class:		URBAN/LOCAL SYSTEM										Counter Type: Tube		Route No: NONE																
Location: Middlebury: Exchange St 1.0 mi N of Elm St														Daily																
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	Factor	MADTACF	Adj. Vol.		
2001/09/26 Wed															228	258	262	179	85	47	37	23	8	12	1135	0.93	0.97	0.98	1006	
2001/09/27 Thu	21	8	0	11	11	54	103	194	275	153	179	191	259	221	232	225	253	186	105	49	19	18	16	21	2804	0.92	0.97	0.98	2470	
2001/09/28 Fri	16	2	2	7	11	56	94	179	230	140	190	203	303	198	201	233	204	173	87	57	35	15	12	16	2666	0.85	0.97	0.98	2176	
2001/09/29 Sat	22	7	2	8	3	9	18	77	80	104	123	131	112	95	109	106	101	67	52	47	18	21	13	4	1329	1.06	0.97	0.98	1349	
2001/09/30 Sun	6	2	4	3	4	8	4	21	26	46	58	75	62	61	59	59	64	50	34	27	20	14	5	8	720	1.34	0.97	0.98	920	
2001/10/01 Mon	5	2	6	4	12	66	88	188	266	163	188	198	232	212	218	265	278	209	92	40	23	13	7	21	2795	0.95	0.95	0.98	2503	
2001/10/02 Tue	18	6	4	7	13	56	87	188	281	152	154	195	274	254	242	262	240	206	94	66	35	24	12	14	2868	0.94	0.95	0.98	2520	
2001/10/03 Wed	22	6	2	9	15	55	116	202	264	159	178	197	267	221											1713	0.93	0.95	0.98	1497	
Average:	16	5	3	7	10	43	73	150	200	131	153	170	246	180	184	201	200	153	78	48	27	18	10	14						

Hours Averaged:		Sun *	Mon *	Tue *	Wed *	Thu *	Fri *	Sat *	Weekday	Weekend	All Days**	Average Peak Volume:		Preliminary AADT: 2100	
Average Volume:		24	24	24	24	24	24	24	120	48	168	AM Peak***: 258		Poll Site:	
		720	2785	2868	2848	2804	2868	1329	2797	1025	2290	PM Peak***: 278		Poll Group: Urban	

\* Averaging by hour(0-23), then by day of week (Sun-Sat)

\*\* Adjusted Average Day equals 517 \* Avg Weekday + 217 \* Avg Weekend Day

\*\*\* AM PM Peak Average Volumes are only from the weekday days



Run Date: 2004/01/05

Vermont Agency of Transportation  
 Technical Services Division  
 Traffic Research Unit  
 Special Count - Volume

2002

Final AADT: 9700  
 Route No: US7

Site ID: S6A012  
 Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER  
 Location: US7: 0.35 mi S of TH73/TH9 HARTY VALLEY RD

Town: Middlebury  
 Count Type: CLASS  
 Counter Type: Tube

Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	Daily Factor	MADTACF	Adj. Vol.
2002/09/16 Mon																832	902	853	528	364	270	211	166	80	4206	0.95	0.96	3857
2002/09/17 Tue	48	24	21	22	49	143	368	654	866	635	562	505	813	609	720	863	934	836	819	304	352	208	117	87	10389	0.95	0.96	9532
2002/09/18 Wed	33	27	16	36	46	140	381	631	871	654	594	828	601	619	756	836	932	868	641	435	316	246	144	95	10549	0.94	0.96	9523
2002/09/19 Thu	74	29	16	24	39	129	341	657	891	623	620	820	669	809	713	840	883	933	818	442	384	301	142	105	10702	0.91	0.96	9416
2002/09/20 Fri	74	40	22	48	47	128	333	640	824	690	652	868	736	710	848	932	953	950	739	558	393	382	273	160	11800	0.85	0.96	9887
2002/09/21 Sat	86	42	33	34	30	67	135	282	419	571	642	790	859	788	719	718	753	744	827	481	370	312	235	140	9885	1.08	0.96	10227
2002/09/22 Sun	105	45	32	18	27	36	82	157	274	434	493	826	719	617	643	684	628	564	468	347	244	177	109	58	7584	1.35	0.96	9825
2002/09/23 Mon	39	23	17	23	45	141	371	614	836	614	546	653	689	680	732										8013	0.98	0.96	5536
Average:	67	33	22	30	40	112	287	519	712	603	587	654	688	659	733	815	854	828	606	429	333	262	169	104				

Hours Averaged:	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sat	Weekday	Weekend	All Days**	Average Peak Volume:	AM Peak***: 863	PM Peak***: 938	Poll Site:	Poll Group: Urban
Average Volume:	7584	10219	10389	10549	10702	11800	9865	10732	8725	8725	10158					

\* Averaging by hour(0-23), then by day of week (Sun-Sat)

\*\* Adjusted Average Day equals 517 \* Avg Weekday + 217 \* Avg Weekend Day

\*\*\* AM, PM Peak Average Volumes are only from the weekday days



Run Date: 2004/01/05

Vermont Agency of Transportation

Technical Services Division

Traffic Research Unit

Special Count - Volume

2002

US7 Between Happy Valley RD & New Haven TL

Site ID: S6A105

Functional Class: URBAN:PRINCIPAL ARTERIAL - OTHER

Location: Middlebury: US7

Town: Middlebury

Count Type: VOLUME

Counter Type: Tube

Final AADT: 10200

Route No: US7

Location: Middlebury, US7		Counter Type: Tube													Daily			Adj.											
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	Factor	MADTACF	Vol.	
2002/09/16 Mon																935	1044	871	597	401	287	228	168	85	4717	0.96	0.95	0.97	4171
2002/09/17 Tue	63	25	24	27	55	170	455	769	985	737	687	717	687	732	777	927	1038	979	700	428	372	218	122	86	11791	0.96	0.95	0.97	10465
2002/09/18 Wed	40	34	21	38	44	168	456	747	973	787	713	744	702	681	828	895	1060	982	700	477	327	253	146	99	11915	0.95	0.95	0.97	10478
2002/09/19 Thu	81	30	17	23	54	167	431	776	1003	744	717	721	702	681	787	934	968	1045	668	479	394	317	149	106	11972	0.94	0.95	0.97	10419
2002/09/20 Fri	79	40	28	53	57	175	389	728	912	785	788	777	854	778	948	1046	1071	1032	817	589	413	404	281	167	13209	0.84	0.95	0.97	10212
2002/09/21 Sat	98	42	38	38	30	86	178	310	472	632	719	895	901	846	774										6057	0.93	0.95	0.97	5223

Hours Averaged:	Sun*	Mon*	Tue*	Wed*	Thu*	Fri*	Sat*	Weekday	Weekend	All Days**	Average Peak Volume:	Preliminary AADT: 10200
Average Volume:	9	4717	11791	11915	11972	13209	6057	105	9681	11521	AM Peak***: 968 PM Peak***: 1054	Poll Site: P6A041 Poll Group: Rural Primary and Secondary

\* Averaging by hour(0-23), then by day of week (Sun-Sat)  
 \*\* Adjusted Average Day equals 5/7 \* Avg Weekday + 2/7 \* Avg Weekend Day  
 \*\*\* AM, PM Peak Average Volumes are only from the weekday days

# Middlebury - Exchange Street - Route 7 Intersection

**Project Name:** Middlebury - Exchange Street - Route 7 Intersection  
**Purpose:** Finding Peak Hour Adjustment Volumes  
**Project Number:** 6330030  
**Calculated by:** SRZ  
**Date:** 8-Apr-04  
**Updated:** 9-Jun-04

Dufresne-Henry

55 Green Mountain Drive  
P.O. Box 2246  
South Burlington, VT 05407

VEHICLE TURNING MOVEMENT COUNT April 2, 2004  
Route 7/Exchange St/Happy Valley Rd  
Middlebury, VT

#630030  
4/8/2004  
SRZ

## Original Counted Data 2004

n/a

Original Data from April 2, 2004

## 2006 DHV

1.102 x 1.07

Adjustment Factor 2004 to 2006 = 1.179

## 2016 DHV

1.102 x 1.25

Adjustment Factor 2004 to 2016 = 1.378

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
7:45	31	141	1	0	3	0	2	66	5	0	1	4	37	166	1	0	4	0	2	78	6	0	1	5	43	194	1	0	4	0	3	91	7	0	1	6
8:00	34	103	1	0	0	1	1	67	6	5	1	12	40	121	1	0	0	1	1	79	7	6	1	14	47	142	1	0	0	1	1	92	8	7	1	17
8:15	35	122	0	2	2	1	1	63	11	10	0	7	41	144	0	2	2	1	1	74	13	12	0	8	48	168	0	3	3	1	1	87	15	14	0	10
8:30	19	92	0	0	1	2	1	82	8	4	0	12	22	108	0	0	1	2	1	97	9	5	0	14	26	127	0	0	1	3	1	113	11	6	0	17
8:45	19	86	1	1	2	2	0	58	9	3	0	15	22	101	1	1	2	2	0	68	11	4	0	18	26	119	1	1	3	3	0	80	12	4	0	21
9:00	17	72	1	0	1	0	0	49	5	3	0	9	20	85	1	0	1	0	0	58	6	4	0	11	23	99	1	0	1	0	0	68	7	4	0	12
9:15	18	82	0	1	2	0	0	67	4	4	0	13	21	97	0	1	2	0	0	79	5	5	0	15	25	113	0	1	3	0	0	92	6	6	0	18
9:30	18	86	1	1	1	1	1	70	2	2	0	10	21	101	1	1	1	1	1	83	2	2	0	12	25	119	1	1	1	1	1	96	3	3	0	14
9:45	17	84	2	0	1	2	0	68	4	4	1	15	20	99	2	0	1	2	0	80	5	5	1	18	23	116	3	0	1	3	0	94	6	6	1	21
10:00	18	70	2	1	1	0	0	79	5	3	0	21	21	83	2	1	1	0	0	93	6	4	0	25	25	96	3	1	1	0	0	109	7	4	0	29
10:15	17	81	1	1	2	0	0	65	3	3	1	15	20	95	1	1	2	0	0	77	4	4	1	18	23	112	1	1	3	0	0	90	4	4	1	21
10:30	11	66	0	0	1	2	2	58	3	7	0	23	13	78	0	0	1	2	2	68	4	8	0	27	15	91	0	0	1	3	3	80	4	10	0	32
10:45	17	78	0	0	0	0	0	93	2	5	1	12	20	92	0	0	0	0	0	110	2	6	1	14	23	107	0	0	0	0	0	128	3	7	1	17
11:00	14	70	0	0	2	0	1	72	1	0	0	13	17	83	0	0	2	0	1	85	1	0	0	15	19	96	0	0	3	0	1	99	1	0	0	18
11:15	12	62	1	1	0	1	0	92	3	5	1	12	14	73	1	1	0	1	0	108	4	6	1	14	17	85	1	1	0	1	0	127	4	7	1	17
11:30	22	77	2	1	3	0	2	61	6	7	1	15	26	91	2	1	4	0	2	72	7	8	1	18	30	106	3	1	4	0	3	84	8	10	1	21
11:45	18	77	3	1	1	1	2	62	2	5	2	12	21	91	4	1	1	1	2	73	2	6	2	14	25	106	4	1	1	1	3	85	3	7	3	17
12:00	24	83	0	0	2	0	1	85	5	10	5	29	28	98	0	0	2	0	1	100	6	12	6	34	33	114	0	0	3	0	1	117	7	14	7	40
12:15	18	82	2	0	2	1	2	78	6	10	1	19	21	97	2	0	2	1	2	92	7	12	1	22	25	113	3	0	3	1	3	107	8	14	1	26
12:30	17	64	0	0	0	0	0	83	2	3	2	20	20	75	0	0	0	0	0	98	2	4	2	24	23	88	0	0	0	0	0	114	3	4	3	28
12:45	14	72	1	2	1	2	1	72	5	2	0	10	17	85	1	2	1	2	1	85	6	2	0	12	19	99	1	3	1	3	1	99	7	3	0	14
13:00	7	84	0	0	2	0	1	78	2	9	1	21	8	99	0	0	2	0	1	92	2	11	1	25	10	116	0	0	3	0	1	107	3	12	1	29
13:15	10	81	1	0	1	0	0	63	6	8	0	18	12	95	1	0	1	0	0	74	7	9	0	21	14	112	1	0	1	0	0	87	8	11	0	25
13:30	14	91	0	1	2	1	0	84	3	3	0	11	17	107	0	1	2	1	0	99	4	4	0	13	19	125	0	1	3	1	0	116	4	4	0	15
13:45	13	88	0	0	2	1	0	79	3	5	0	13	15	104	0	0	2	1	0	93	4	6	0	15	18	121	0	0	3	1	0	109	4	7	0	18
14:00	14	73	0	0	0	0	1	89	5	11	0	37	17	86	0	0	0	0	1	105	6	13	0	44	19	101	0	0	0	0	1	123	7	15	0	51
14:15	18	77	2	0	1	0	0	96	4	8	0	22	21	91	2	0	1	0	0	113	5	9	0	26	25	106	3	0	1	0	0	132	6	11	0	30
14:30	7	97	0	0	0	1	1	109	4	6	1	19	8	114	0	0	0	1	1	129	5	7	1	22	10	134	0	0	0	1	1	150	6	8	1	26
14:45	11	86	0	1	0	0	1	92	5	7	2	15	13	101	0	1	0	0	1	108	6	8	2	18	15	119	0	1	0	0	1	127	7	10	3	21
15:00	12	75	0	0	1	1	1	108	5	5	1	25	14	88	0	0	1	1	1	127	6	6	1	29	17	103	0	0	1	1	1	149	7	7	1	34
15:15	14	77	2	0	4	1	0	127	6	9	2	24	17	91	2	0	5	1	0	150	7	11	2	28	19	106	3	0	6	1	0	175	8	12	3	33
15:30	13	92	0	3	2	0	0	139	3	13	3	21	15	108	0	4	2	0	0	164	4	15	4	25	18	127	0	4	3	0	0	192	4	18	4	29
15:45	17	107	2	2	0	0	0	127	4	5	3	25	20	126	2	2	0	0	0	150	5	6	4	29	23	147	3	3	0	0	0	175	6	7	4	34
16:00	16	90	1	0	0	1	0	108	4	11	1	25	19	106	1	0	0	1	0	127	5	13	1	29	22	124	1	0	0	1	0	149	6	15	1	34
16:15	15	86	0	1	0	0	0	103	4	1	3	26	18	101	0	1	0	0	0	121	5	1	4	31	21	119	0	1	0	0	0	142	6	1	4	36
16:30	17	75	0	1	0	0	0	116	1	9	0	29	20	88	0	1	0	0	0	137	1	11	0	34	23	103	0	1	0	0	0	160	1	12	0	40
16:45	13	83	0	0	1	0	1	104	4	0	1	26	15	98	0	0	1	0	1	123	5	0	1	31	18	114	0	0	1	0	1	143	6	0	1	36
17:00	11	87	1	0	1	0	2	140	1	8	3	33	13	103	1	0	1	0	2	165	1	9	4	39	15	120	1	0	1	0	3	193	1	11	4	45
17:15	8	86	0	2	5	0	0	106	0	5	5	21	9	101	0	2	6	0	0	125	0	6	6	25	11	119	0	3	7	0	0	146	0	7	7	29
17:30	6	89	0	1	1	0	0	98	1	1	1	15	7	105	0	1	1	0	0	116	1	1	1	18	8	123	0	1	1	0	0	135	1	1	1	21
17:45	4	98	0	0	2	0	0	82	0	1	1	11	5	116	0	0	2	0	0	97	0	1	1	13	6	135	0	0	3	0	0	113	0	1	1	15



**Smith, Mark**

**From:** Fred Dunnington [fdunnington@town.middlebury.vt.us]  
**Sent:** Thursday, May 13, 2004 2:14 PM  
**To:** Smith, Mark  
**Subject:** RE: Industrial Acreage

Mark -

Call me when you have the stuff that was faxed in your hand - so we can resolve any questions.

The zoning is all Industrial, except for the following areas which are General Commercial: The lots south of Agri -Mark / Cabot, and the area east of Exchange St. (the 35 acre piece and 7 acre piece marked on the Project location Map faxed to you.

Fred

Fred S. Dunnington fdunnington@town.middlebury.vt.us  
<mailto:fdunnington@town.middlebury.vt.us>  
Middlebury Town Planner  
Zoning Administrative Officer  
94 Main St. Municipal Building  
Middlebury VT 05753  
(802) 388-8106  
(802) 388-4364 fax  
Town web site: www.middlebury.govoffice.com <<http://www.middlebury.govoffice.com>>

-----Original Message-----

From: Smith, Mark [SMTP:Mark.Smith@dufresne-henry.com]  
Sent: Thursday, April 29, 2004 1:37 PM  
To: fdunnington@town.middlebury.vt.us  
Subject: Industrial Acreage

Any luck with an estimate of acreage for Exchange St.?

The zoning description would help too. I assume you expect a mix of commercial, light industrial and manufacturing uses in these areas.

Thanks.

Mark C. Smith, P.E.  
Dufresne-Henry  
Engineers, Planners, Landscape Architects  
and Environmental Scientists

vox: 802.864.0223 fax: 864.0165 auto:383.0186  
55 Green Mountain Drive / Post Office Box 2246  
South Burlington, Vermont USA 05407-2246

mark.smith@dufresne-henry.com <mailto:mark.smith@dufresne-henry.com>

www.dufresne-henry.com



6330030

# TOWN OF MIDDLEBURY

94 MAIN STREET, MIDDLEBURY, VT 05753

## FAX TRANSMITTAL SHEET

TO: Mark Smith

FAX: 864-0165

FROM FAX #: 802-388-4364

### DEPARTMENT AND TELEPHONE NUMBER LISTED BELOW:

— TOWN MANAGER'S OFFICE  
802-388-8100

— BOOKKEEPING  
802-388-8101

X ZONING OFFICE  
802-388-8105

— RECREATION  
802-388-4041

— POLICE DEPT.  
802-388-3191

— BILLING OFFICE  
802-388-4047

— TOWN CLERK  
802-388-~~8100~~ 8102

— TREATMENT PLANT  
802-388-0498

— LISTER'S OFFICE  
802-388-8108

— PUBLIC WORKS  
802-388-4045

— LIBRARY  
802-388-4095

— OTHER

DATE: 5-13-04 # OF PGS (INCLUDING COVER) 6

NOTES:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



SIGNED: Beth Dow for Fred Dannington  
MUNICIPAL BUILDING 802-388-4041\*  
FAX 802-388-4364  
POLICE DEPARTMENT 802-388-3191\*  
PUBLIC WORKS DEPARTMENT 802-388-4045  
WASTEWATER TREATMENT PLANT 802-388-0498  
\* TDD AVAILABLE

864-0226

PHELPS ENGINEERING, INC. • MIDDLEBURY, VERMONT

# **INDUSTRIAL PARK EXPANSION**

Middlebury, Vermont

MASTER PLAN

January 1997



**PHELPS ENGINEERING, INC. • MIDDLEBURY, VERMONT**

**TABLE 1**  
**Middlebury Industrial Park Expansion**  
**Existing Industrial Area Data**

Tax Parcel Number	Lot Name	Use Type (Note 1)	Lot (Acres) (Note 2)	Bldg. (sq. ft.) (Note 3)	Parking Avail.	Parking Used (Note 4)	Businesses within Building	Employees Full Time	Part Time	Average Water Use (gal/day)
4023	Anthony Neri	C/I	4	7,500	80	50	Vermont Soap Works	6		238
4023.001	Anthony Neri (Building only)	C/I		15,500			Vermont Organic Creamery Rebound Video Service Vermont Quality Products Dynamite Radio Inc.	2 2 8 3	<Est.	702 188 777 41
4054	Michael Rainville	C/I	4.4	6,500	26	14	Maple Landmark Woodcraft	15		112
4058	Gieger of Austria	C/I	18.5	45,600	123	45	Gieger of Austria Inc.	60		1,028
4062	Agri-Mark Inc. (Cabot)	C/I	34.1	54,000	50	23	Cabot Creamery	70		134,657
4064.003	Lawrence W. Miller II	C/I	9.8	14,304	31	15	Otter Creek Brewing Inc.	33		3,740
21037.001	Frederick Danforth	C/I	0.12	8,050	58	32	Danforth Pawterer	50		581
4023.002	Anthony Neri (Building only)	I		7,500			Middlebury Vending	40		275
4027.001	Maxwell E. Eaton, Jr.	I	3.5	7,500	38	23	Otter Creek Awnings	24	13	152
4055	VT Industrial Park (Carrara)	I	8.49	14,884	188	73	Highland Press VEMAS Questech Metals	4 38 72		475 Included ^ Included ^
4057	William Holdman	I	4.1	12,816	70	30	William P Holdman Inc	30	10	280
4059	H.R. Funk Trust and H. Funk	I	12.4	49,806	82	43	CPC of Vermont Inc	72	32	2,773
4050.01	VT Industrial Park (Carrara)	I	4.48	10,880	30	14	Older Jack	19		4,783
4063	Agri-Mark Inc.	I	5.8	10,355	16	5	Agri-Mark Inc.	See Cabot		7,051
4064.002	Casella Associates	I	10.1	8,750	24	10	Casella Waste Management	15		113
4069	Addison County Asphalt Prod.	I	5.3	2,633	5	1	Addison County Asphalt Prod.	2		777
21030	Bourdeau Feeds	I	4.5	12,046	22	12	Bourdeau & Bushey	14		254
21041	Rogers Fuels Inc.	I	1.2	4,308	18	6	Rogers Fuels Inc.	5		30
21043	Agway Feeds	I	7	27,000	57	32	Agway Feed Division Agway Truck Plant Agway Fertilizer	10 3 5		92  431
21044	Louis Quesnot	I	5.2	5,740	13	13	Middlebury Packing Co.	6		3,767
4025	VT Industrial Park (Carrara) Carbra Building	O	3.1	17,120	88	42	Agency of Human Services Dept. of Employ & Trg. Vocational Rehabilitation Off. Addison Cty. Court Diversion	40 Included ^ Included ^ Included ^	<Est.	524 Included ^ Included ^ Included ^
4028	Yankee Farm Credit	O	3.5	6,002	35	19	Champlain Valley Farm Credit Porter Medical Orthopedics	4 6	2	172 Included ^
4056	National Bank of Middlebury	O	4.43	4,000	17	6	National Bank of Middlebury	12		92
4060	David F. Folino	O	4.65	8,485	25	20	Concentrated Knowledge	25		84
4052	Bridge School	C	3.5	12,500	35	2	Bridge School	5	<Est.	459
4064.001	Carpenter Enterprises	C	5.92	9,000	17	9	Champlain Valley Equip. Inc.	9	3	133
4073	VFW	C	4.4	7,100	105	6	VFW Post 7823	5		408
4075.001	Steven Hare	C	4.62	14,231	80	32	Vermont Sun Sports & Fitness	13		2,454
21037	William R. Jackson	C	1.2	11,947	32	17	William R. Jackson	5	<Est.	550
21045	Agway Inc.	C	4.9	20,017	61	4	Agway Building Supply	10		310
21042	Roch R. Macintyre	R	2.2	875	2	0	Residential	0		2
4027	Otter Valley Equip. (Carrara)	U	7.1				Open Lot	0		
4045	Middlebury College	U	90	< Note 5			Open Lot	0		
4053	Otter Valley Equip. (Carrara)	U	34.86				Open Lot	0		
4061	VT Industrial Park (Carrara)	U	3.9				Open Lot	0		
4064	Middlebury College	U	9.2				Open Lot	0		
4075	VT Industrial Park (Carrara)	U	40.58				Open Lot	0		
21047	F.R. Churchill and Sons	U	2.4				Open Lot	0		
21060	Town of Middlebury	U	0.2				Open Lot (Sewer Main)	0		

**Note 1:** C/I= Commercial-Industrial Combined Use

I=Industrial

O=Office Use Only

C=Commercial

R=Residential

U=Undeveloped Lot

**Note 2:** Source: Town of Middlebury Tax Maps

**Note 3:** Source: Town of Middlebury Listers Office

**Note 4:** Counted on 7/18/96 between 9:00 and 11:00 A.M.

**Note 5:** Total lot size=239.7 acres; 90 acres in Industrial Zone, balance is outside Industrial Zone



**TABLE 2**  
**Middlebury Industrial Park Expansion**  
**Statistics from Existing Industrial Area Data**

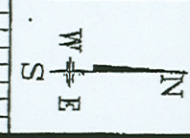
<b>Number of Lots</b>			<b>Parking Spaces Available</b>		
Total Lots	37		Total Parking Spaces Available	1,447	
Undeveloped Lots	8		Comm.-Ind. Combined Parking Avail.	378	
Developed Lots	29		Industrial Parking Available	571	
Comm.-Ind. Combined Use Lots	6		Office Use Only Parking Available	185	
Industrial Lots	12		Commercial Parking Available	331	
Office Use Only Lots	4		Residential Parking Available	2	
Commercial Lots	6				
Residential Lots	1				
<b>Acreage</b>			<b>Average Parking Spaces Available Per Acre</b>		
Total Acreage	373.53		Total Parking Spaces Available Per Acre	7.8	
Undeveloped Lots Acreage	188.04		Comm.-Ind. Combined Parking Avail./Ac.	5.3	
Developed Lots Acreage	185.49		Industrial Parking Available per Acre	7.9	
Comm.-Ind. Combined Use Acreage	71.02		Office Use Only Parking Avail. per Acre	10.6	
Industrial Acreage	72.05		Commercial Parking Available per Acre	13.5	
Office Use Only Acreage	15.88		Residential Parking Available per Acre	0.9	
Commercial Acreage	24.54				
Residential Acreage	2.2				
<b>Average Acreage per Lot</b>			<b>Number of Employees</b>		
Total Average Acreage/Lot	10.1		Total Number of Employees	798	
Undeveloped Lots Average Acreage/Lot	23.5		Comm.-Ind. Combined Use Employees	247	
Developed Lots Average Acreage/Lot	6.4		Industrial Employees	412	
Comm.-Ind. Combined Use Avg. Ac./Lot	11.8		Office Use Only Employees	89	
Industrial Average Acreage/Lot	6.0		Commercial Employees	50	
Office Use Only Average Acreage/Lot	3.9				
Commercial Average Acreage/Lot	4.1				
Residential Average Acreage/Lot	2.2				
<b>Building Area (Sq.Ft.)</b>			<b>Average Number of Employees Per Acre</b>		
Total Building Area	437,049		Total Avg. Number of Employees/Acre	4.3	
Comm.-Ind. Comb. Use Avg. Bldg. Area	151,454		Comm.-Ind. Comb. Use Employees/Acre	3.5	
Industrial Building Area	174,318		Industrial Employees/Acre	5.7	
Office Use Only Building Area	35,607		Office Use Only Employees/Acre	5.7	
Commercial Building Area	74,795		Commercial Employees/Acre	2.0	
Residential Building Area	875				
<b>Average Building Area Per Acre (Sq.Ft.)</b>			<b>Water Usage-Including Cabot (GPD)</b>		
Total Building Area/Acre	2,356		Total Water Usage	186,969	
Comm.-Ind. Comb. Use Avg. Bldg. Area/Acre	2,133		Comm.-Ind. Comb. Use Water Usage	141,287	
Industrial Average Building Area/Acre	2,419		Industrial Water Usage	20,496	
Office Use Only Average Bldg. Area/Acre	2,271		Office Use Only Water Usage	872	
Commercial Average Building Area/Acre	3,048		Commercial Water Usage	4,312	
Residential Average Building Area/Acre	388				
<b>Building Lot Coverage (%)</b>			<b>Avg. Water Usage Per Acre-Including Cabot (GPD/Acre)</b>		
Total Building Lot Coverage	5.4%		Total Average Water Usage per Acre	900	
Comm.-Ind. Comb. Use Lot Coverage	4.9%		Comm.-Ind. Combined Use Water/Acre	1,888	
Industrial Building Lot Coverage	5.6%		Industrial Average Water Usage/Acre	284	
Office Use Only Building Lot Coverage	5.2%		Office Use Only Avg. Water Usage/Acre	56	
Commercial Building Lot Coverage	7.0%		Commercial Average Water Usage/Acre	176	
Residential Building Lot Coverage	0.9%				
<b>Water Usage-Excluding Cabot (GPD)</b>			<b>Avg. Water Usage Per Acre-Excluding Cabot (GPD/Acre)</b>		
Total Water Usage	25,261		Total Average Water Usage per Acre	174	
Comm.-Ind. Comb. Use Water Usage	6,830		Comm.-Ind. Combined Use Water/Acre	180	
Industrial Water Usage	13,445		Industrial Average Water Usage/Acre	203	
Office Use Only Water Usage	872		Office Use Only Avg. Water Usage/Acre	56	
Commercial Water Usage	4,312		Commercial Average Water Usage/Acre	176	





CONCEPTUAL  
FOR REVIEW

REVISIONS



THE DRAWING FOR THIS PROJECT SHALL NOT BE REPRODUCED OR ALTERED IN ANY MANNER WITHOUT THE WRITTEN APPROVAL AND AUTHORITY OF THE ENGINEER. ANY REVISIONS SHALL BE MADE BY THE ENGINEER AND NOTED IN THE REVISION BLOCK.

PHILIPS ENGINEERING, INC.  
SCALE: 1"=200'  
DATE: 1/24/87

**PHILIPS ENGINEERING, INC.**  
FROG HOLLOW MILL  
3 Mill St., P.O. Box 367  
Middlebury, Vt. 05753  
Telephone (802) 888-7829

DR. BY: J. R.  
CHKD. BY: R. P.

SHEET NO.  
3 OF 3

DWG. NO.  
9855

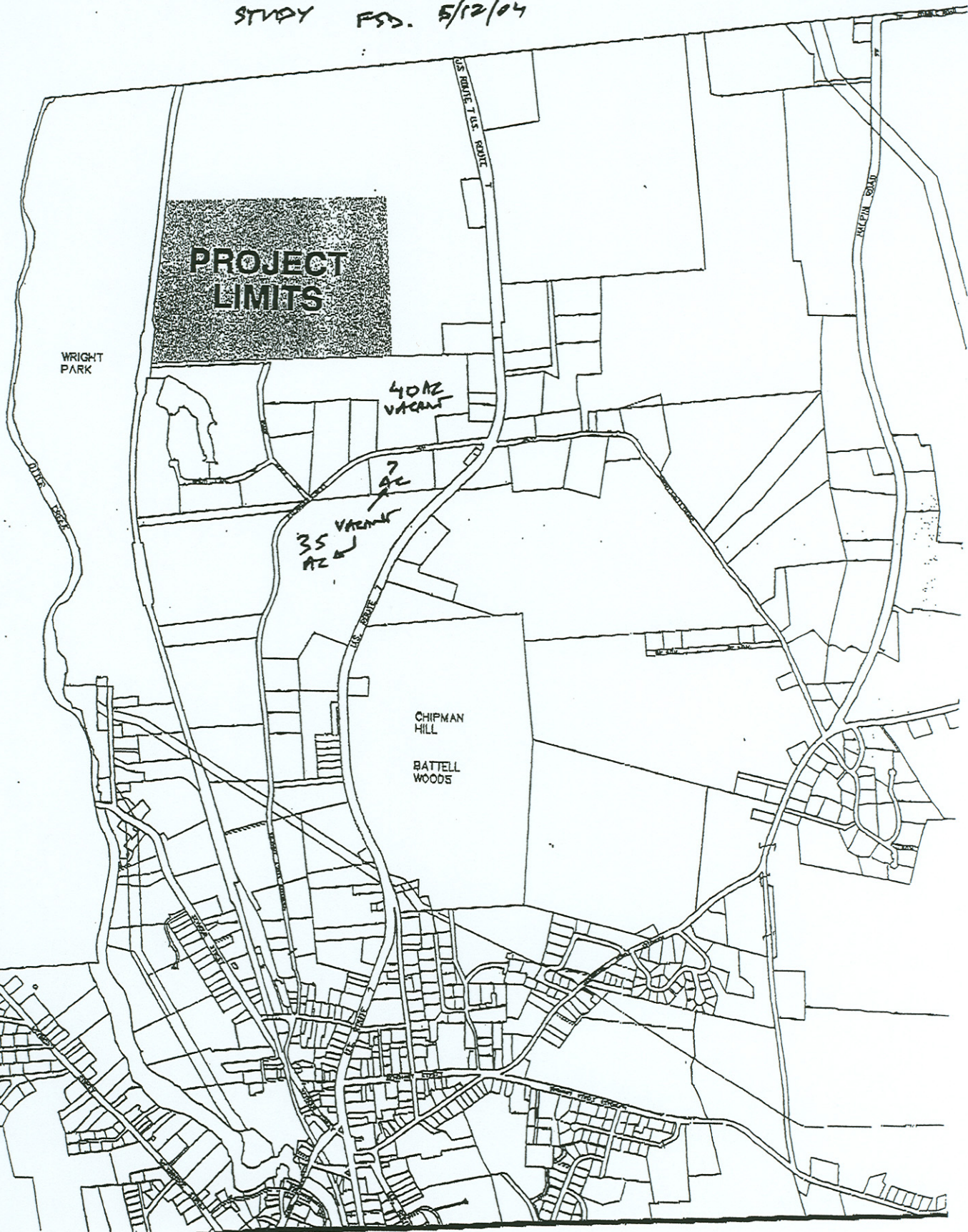
**TOWN OF MIDDLEBURY**  
**INDUSTRIAL PARK EXPANSION**  
**MIDDLEBURY, VERMONT**

CONCEPTUAL PLAN



# PROJECT LOCATION MAP

\* NOTE 82 AC VACANT  
IN ADDITION TO THIS  
STUDY FSD. 5/12/04



Middlebury  
#6330030  
May 17 2004  
SRZ - Burlington

### **Industrial Park Trip Generations**

#### **7th Gen: Land Use 130 pg 132**

Industrial parks contain a number of industrial or related facilities. They are characterized by a mix of manufacturing, service and warehouse facilities with a wide variation in the proportion of each type of use from one location to another. Many industrial parks contain highly diversified facilities - some with a large number of small businesses and others with one or two dominant industries.

#### **Assumptions:**

271,000 SF of floor space

AM Weekday Peak Hour for Street  
222 vehicle trip ends

82 % Entering  
18 % Exiting

PM Weekday Peak Hour for Street  
251 vehicle trip ends

21 % Entering  
79 % Exiting

Middlebury  
#6330030  
May 17 2004  
SRZ - Burlington

**General Office Building  
Trip Generations**

**7th Gen: Land Use 710 pg 1149**

A general office building houses multiple tenants, it is a location where affairs of businesses, commercial or industrial organizations, or professional persons or firms are conducted. An office building or buildings may contain a mixture of tenant services such as a bank or savings and loan institution, a restaurant or cafeteria, and service retail facilities.

Assumptions:  
20,000 SF office building

AM Weekday Peak Hour for Street 52 vehicle trip ends  88 % Entering 12 % Exiting
--

PM Weekday Peak Hour for Street 101 vehicle trip ends  17 % Entering 83 % Exiting
---

Middlebury  
#6330030  
May 17 2004  
SRZ - Burlington

**Free-Standing Discount Store  
Trip Generations**

**7th Gen: Land Use 815 pg 1347**

The discount stores in this category are free-standing stores with off-street parking. They usually offer a variety of customer services, centralized cashiers and a wide range of products. They typically maintain long store hours 7 days a week. The stores included in this land use are often the only ones on the site, but they can also be found in mutual operation with a related or unrelated garden center and/or service station. Free standing discount stores are also sometimes found as separate parcels within a retail complex with their own dedicated parking.

**Assumptions:**

35 acres of land

Commercial avg. 3048 SF per acre

107,000 SF Floor Area

AM Weekday Peak Hour for Street  
~90 vehicle trip ends

66 % Entering  
34 % Exiting

PM Weekday Peak Hour for Street  
~540 vehicle trip ends

50 % Entering  
50 % Exiting



## DUFRESNE-HENRY

PREPARED BY Stephanie Zehler DATE 5/19/04 PROJECT NO. #6330030  
CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. 1 OF 5  
ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SUBJECT \_\_\_\_\_

Total New (Am)  
Traffic Generated

%s approximated from Bruno  
Associates Analysis, 1997

Am weekday Peak

Indus 222 → 82% enter → 182  
→ 18% exit → 40

TOTAL ENTER  
287

Office 52 → 88% enter → 46  
→ 12% exit → 6

TOTAL EXIT  
77

BigBox 90 → 66% enter → 59  
→ 34% exit → 31

PREPARED BY

Stephanie Zehler

DATE

5/18/04

PROJECT NO.

#6330030

CALCULATIONS CHECKED BY

DATE

SHEET NO.

2 OF 5

ASSUMPTIONS / METHODS CHECKED BY

DATE

SUBJECT

TOTAL NEW (PM)  
TRAFFIC GENERATED

%'s approximated from  
Bruno Associates Analysis,  
1997

Pm Weekday Peak

Industrie 251  $\rightarrow$  21% enter  $\rightarrow$  53  
 $\rightarrow$  79% exit  $\rightarrow$  198

TOTAL ENTER

340

Office 101  $\rightarrow$  17% enter  $\rightarrow$  17  
 $\rightarrow$  83% exit  $\rightarrow$  84

TOTAL EXIT

552

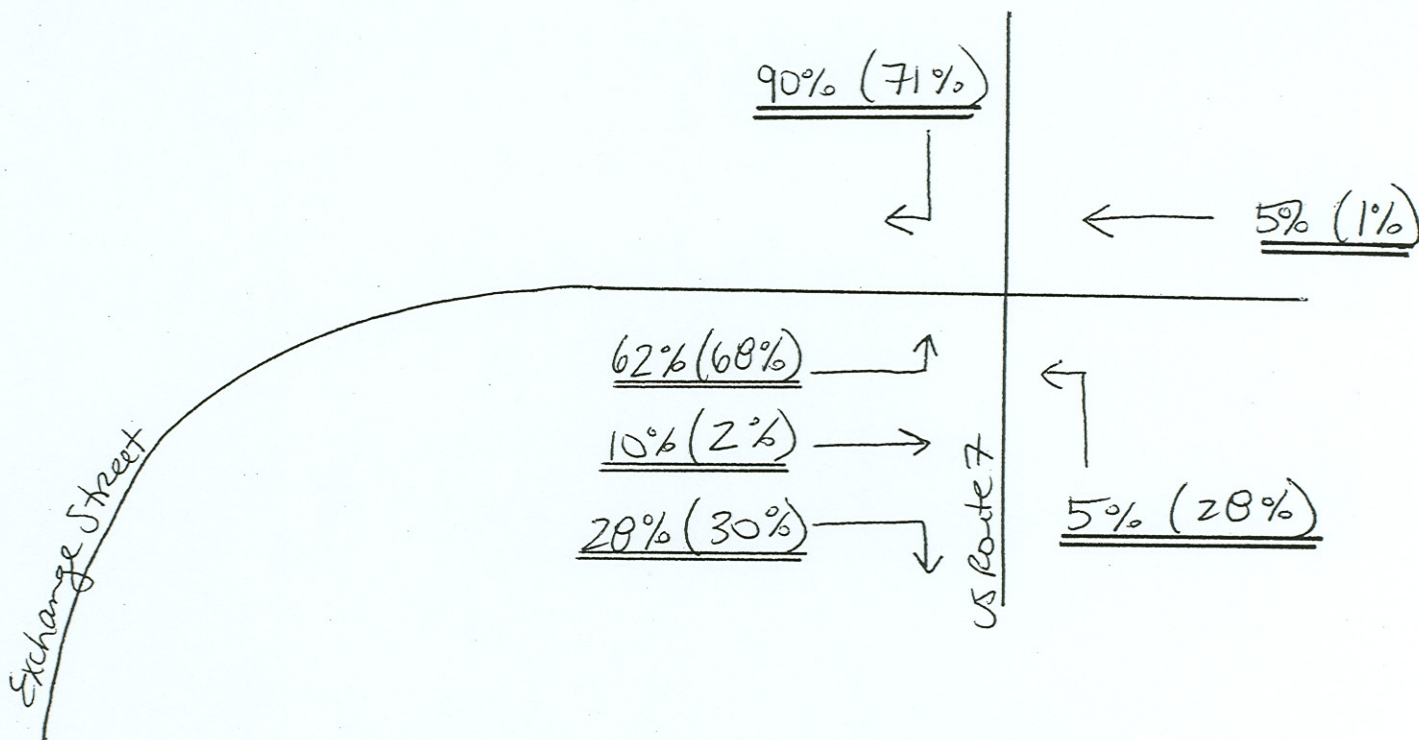
BigBox 540  $\rightarrow$  50% enter  $\rightarrow$  270  
 $\rightarrow$  50% exit  $\rightarrow$  270



PREPARED BY Stephanie Zehler DATE 5/10/04 PROJECT NO. #6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. 3 OF 5  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

Approximated %'s  
for Traffic Analysis

Taken from Bruno Associates  
Analysis, 1997  
Adjusted 1997 Counts



### Exiting Traffic

54	62%	(94)	(68%)
9	10%	(3)	(2%)
24	28%	(4)	(30%)
<u>87</u>		<u>138</u>	

### Entering Traffic

144	90%	(71)	(71%)
8	5%	(1)	(1%)
8	5%	(28)	(20%)
<u>160</u>		<u>100</u>	

### LEGEND

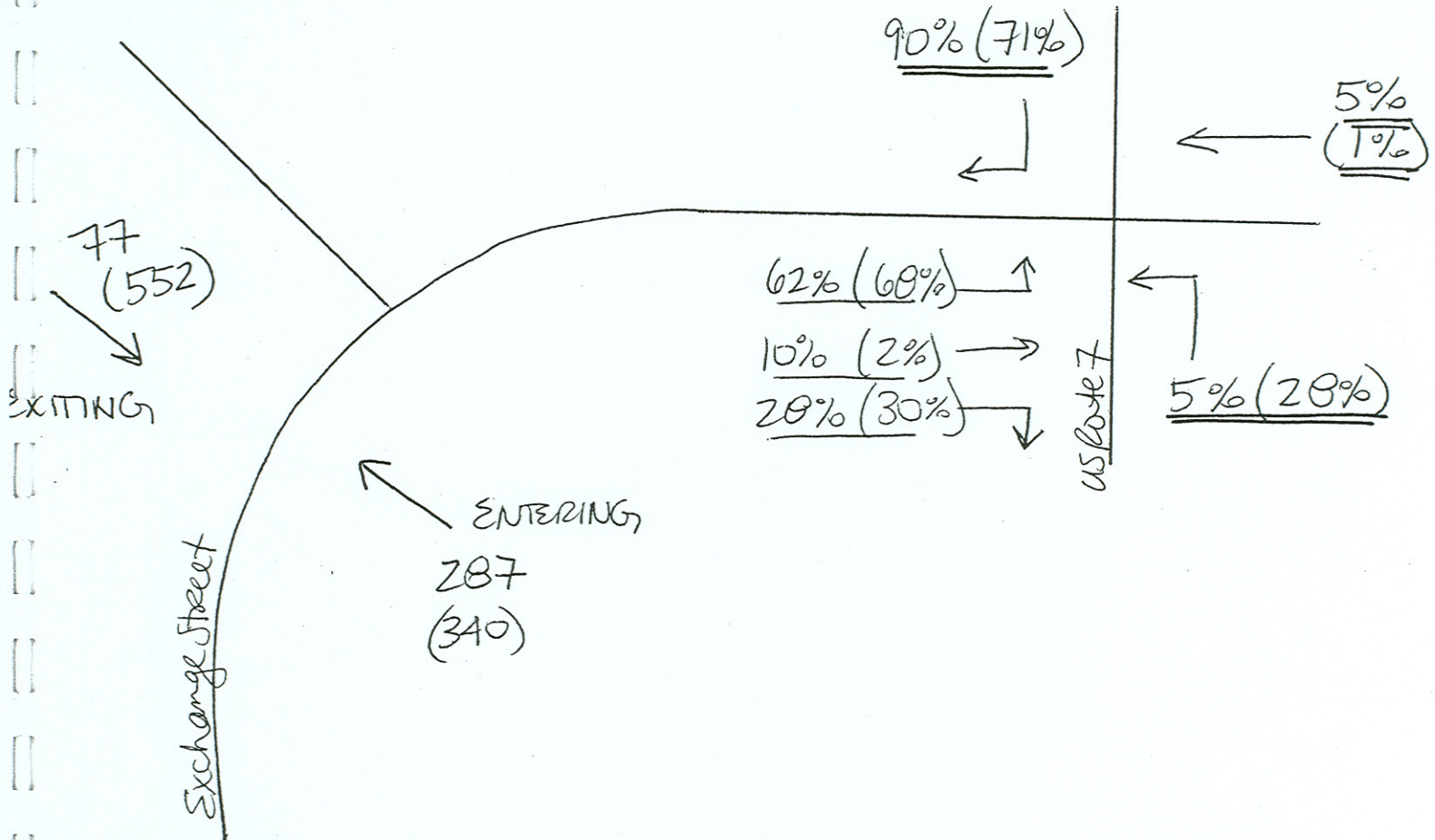
000 Am  
(000) Pm  
 == Entering Traffic  
 == Exiting Traffic



PREPARED BY Stephanie Zehler DATE 5/10/04 PROJECT NO. #6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. 4 OF 5  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

Approximated %'s  
for Traffic Analysis

Taken from Bruno Associates  
Analysis, 1997  
Adjusted 1997 Counts



### Exiting Traffic

54	62%	(94)	(68%)
9	10%	(3)	(2%)
24	28%	(41)	(30%)
<u>87</u>		<u>(138)</u>	

### Entering Traffic

144	90%	(71)	(71%)
8	5%	(1)	(1%)
8	5%	(28)	(20%)
<u>160</u>		<u>100</u>	

### LEGEND

Am  
(Pm)

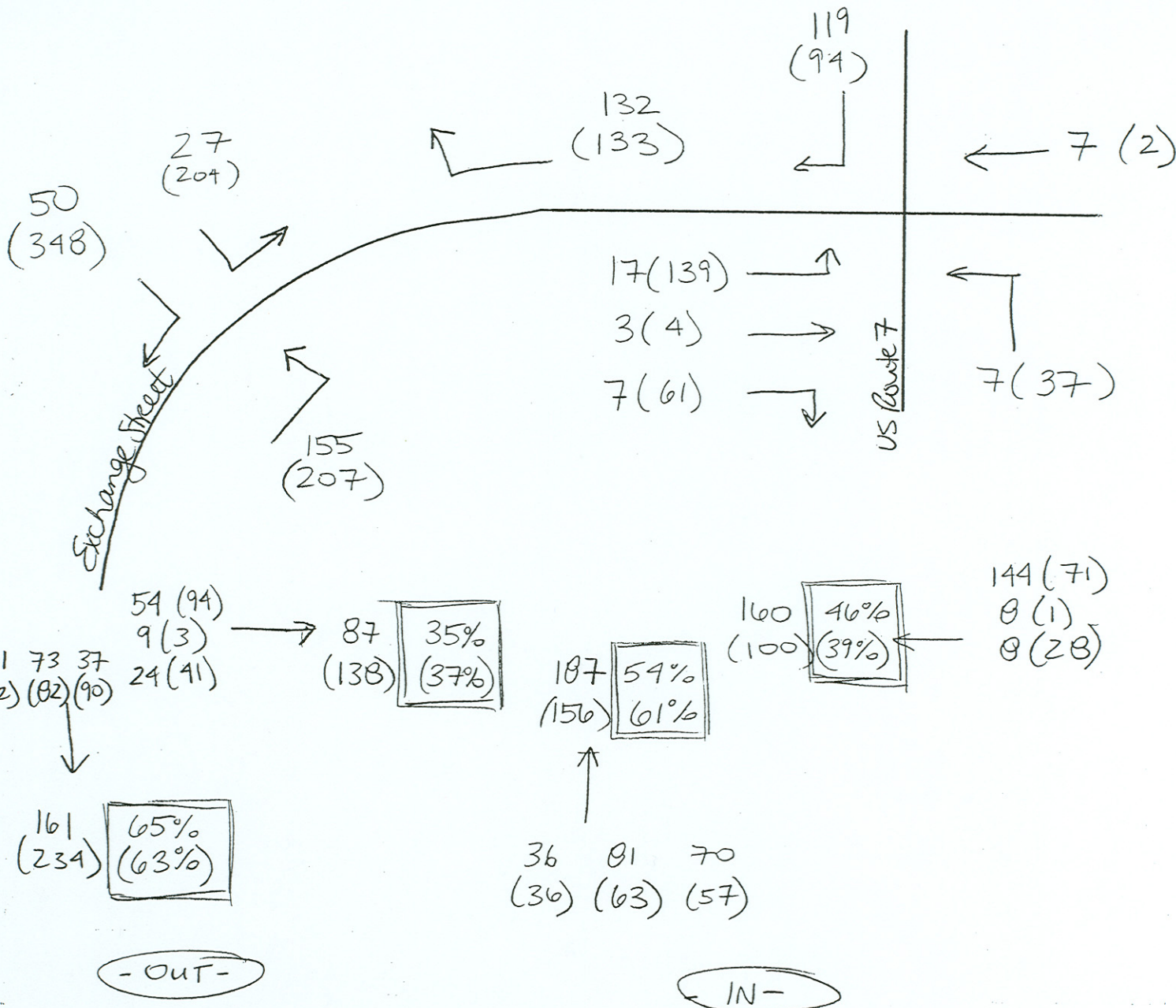
== Entering Traffic  
 — Exiting Traffic



PREPARED BY Stephanie Zehler DATE 5/19/04 PROJECT NO. #6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. 5 OF 5  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

Projected Traffic  
with Development

In & out of New Development  
000 Am  
(000) PM  
(Based on Bruno %)



SKZ

DUFRESNE-HENRY

PREPARED BY Stephanie Zehler DATE 5/18/04 PROJECT NO. 6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. 2 OF 3  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

Industrial Park  
Trip Generations

271,000 SF

Landuse 130  
Page 132

Am Weekday Peak Hr For Street

$$Ln(T) = 0.77 Ln(X) + 1.09$$

$$T = 222 \text{ vehicle end trips}$$

82% entering  
18% exiting

Pm Weekday Peak Hr For Street

$$T = 0.77(X) + 42.11$$

$$T = 251 \text{ vehicle end trips}$$

21% entering  
79% exiting

General office  
Building Trip Generations

29,000 SF

Landuse 710  
Page 1149

Am Weekday Peak Hr For Street

$$Ln(T) = 0.80 Ln(X) + 1.55$$

$$Ln(T) = 3.947$$

$$T = 52 \text{ vehicle end trips}$$

88% entering  
12% exiting

Pm Weekday Peak Hr For Streets

$$T = 1.12 (X) + 78.81$$

$$T = 101 \text{ vehicle end trips}$$

17% entering  
83% exiting



PREPARED BY

Stephanie Zehler

DATE

5/19/04

PROJECT NO.

6330030

CALCULATIONS CHECKED BY

DATE

SHEET NO.

3 OF 3

ASSUMPTIONS / METHODS CHECKED BY

DATE

SUBJECT

Free-Standing Discount  
Store Trip Generations

107,000 SF

Land Use 815  
Page 1347Am weekday Peak HR For Street~90 vehicle trip ends  
from graph  
approximated66% entering  
34% exitingPm weekday Peak HR For Street~540 vehicle trip ends  
from graph  
approximated50% entering  
50% exiting

PREPARED BY Stephane Zehler DATE 5/20/04 PROJECT NO. #6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

AM 2006  
PEAK

Rt 7  
North

140 540 2



change St

41 → ↑

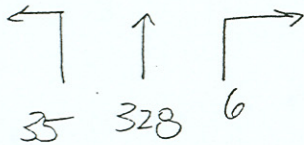
← 2 ↑

2 →

← 7

22 ↘

↘ 5



35 328 6

PM 2006  
PEAK

Rt 7  
North

71 432 6



112 → ↑

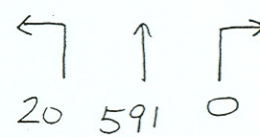
← 6 ↑

11 →

← 7

45 ↘

↘ 2



20 591 0

AM 2016  
PEAK  
w/o development

Rt 7  
North

164 631 3



change  
street

48 → ↑

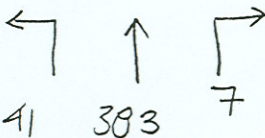
← 3 ↑

3 →

← 8

26 ↘

↘ 6



41 383 7

PM 2016  
PEAK  
w/o development

Rt 7  
North

83 501 7



131 → ↑

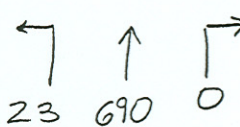
← 7 ↑

12 →

← 8

52 ↘

↘ 3

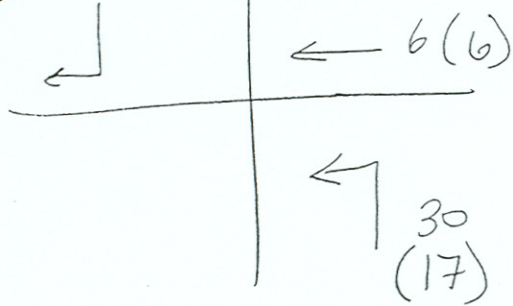


23 690 0

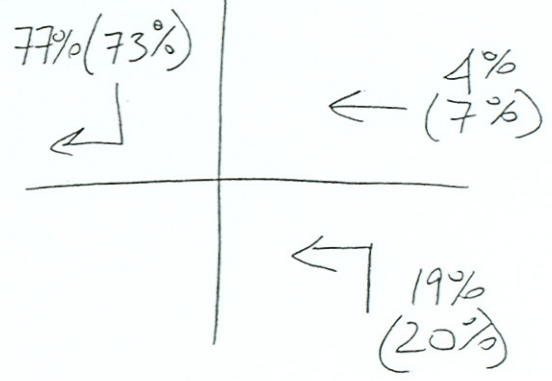


PREPARED BY Stephanie Zehler DATE 5/20/04 PROJECT NO. #6330030  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

Am/pm Volumes  
 original) (60)



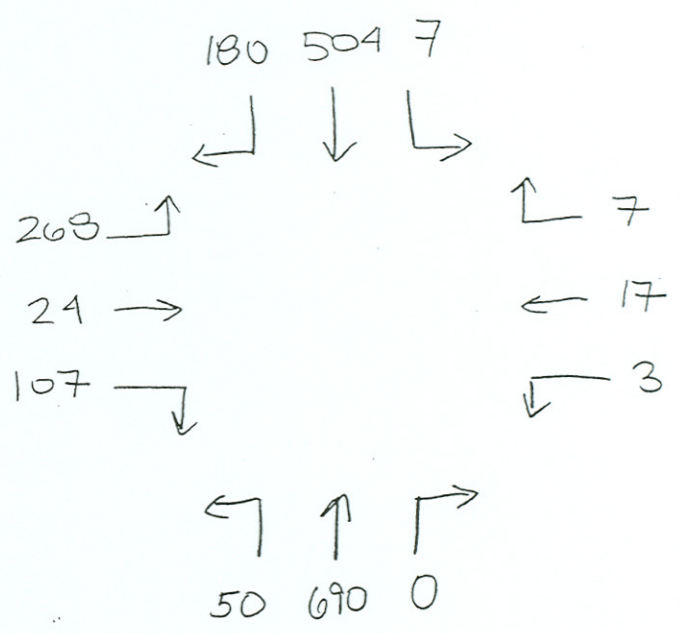
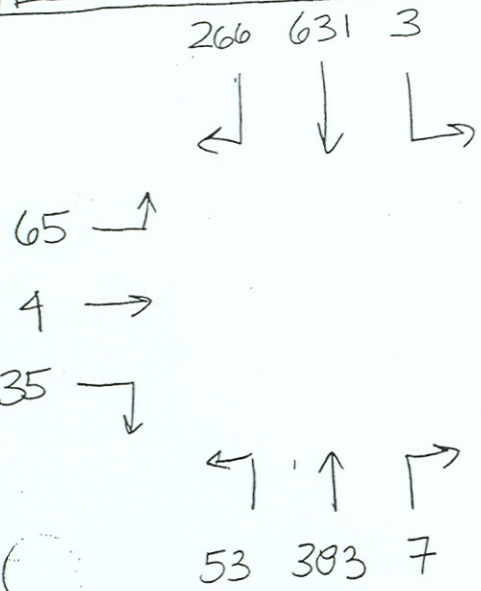
Am/pm Percentages



Am	PM
119 (77%)	60 (73%)
6 (4%)	6 (7%)
30 (19%)	17 (20%)
155	83

Am/pm Distributed Adjusted Volumes w/ Development Volumes

These are the volumes to be used in the Synchro (LOS) program, for 2016.



53 383 7

50 690 0

Am

pm

## Middlebury - Exchange Street - Route 7 Intersection

### AM Adjusted Peak Volumes for 2006

	1	2	3	4	5	6	7	8	9	10	11	12	
7:45	37	166	1	0	4	0	2	78	6	0	1	5	299
8:00	40	121	1	0	0	1	1	79	7	6	1	14	272
8:15	41	144	0	2	2	1	1	74	13	12	0	8	299
8:30	22	108	0	0	1	2	1	97	9	5	0	14	261
	<b>140</b>	<b>540</b>	<b>2</b>	<b>2</b>	<b>7</b>	<b>5</b>	<b>6</b>	<b>328</b>	<b>35</b>	<b>22</b>	<b>2</b>	<b>41</b>	<b>1132</b>

### PM Adjusted Peak Volumes for 2006

	1	2	3	4	5	6	7	8	9	10	11	12	
15:15	17	91	2	0	5	1	0	150	7	11	2	28	314
15:30	15	108	0	4	2	0	0	164	4	15	4	25	341
15:45	20	126	2	2	0	0	0	150	5	6	4	29	344
16:00	19	106	1	0	0	1	0	127	5	13	1	29	303
	<b>71</b>	<b>432</b>	<b>6</b>	<b>6</b>	<b>7</b>	<b>2</b>	<b>0</b>	<b>591</b>	<b>20</b>	<b>45</b>	<b>11</b>	<b>112</b>	<b>1302</b>

### AM Adjusted Peak Volumes for 2016 w/out development

	1	2	3	4	5	6	7	8	9	10	11	12	
7:45	43	194	1	0	4	0	3	91	7	0	1	6	350
8:00	47	142	1	0	0	1	1	92	8	7	1	17	318
8:15	48	168	0	3	3	1	1	87	15	14	0	10	350
8:30	26	127	0	0	1	3	1	113	11	6	0	17	305
	<b>164</b>	<b>631</b>	<b>3</b>	<b>3</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>383</b>	<b>41</b>	<b>26</b>	<b>3</b>	<b>48</b>	<b>1323</b>

### PM Adjusted Peak Volumes for 2016 w/out development

	1	2	3	4	5	6	7	8	9	10	11	12	
15:15	19	106	3	0	6	1	0	175	8	12	3	33	367
15:30	18	127	0	4	3	0	0	192	4	18	4	29	398
15:45	23	147	3	3	0	0	0	175	6	7	4	34	402
16:00	22	124	1	0	0	1	0	149	6	15	1	34	354
	<b>83</b>	<b>504</b>	<b>7</b>	<b>7</b>	<b>8</b>	<b>3</b>	<b>0</b>	<b>690</b>	<b>23</b>	<b>52</b>	<b>12</b>	<b>131</b>	<b>1521</b>

### AM Adjusted Peak Volumes created by new Development 2016

	1	2	3	4	5	6	7	8	9	10	11	12	
7:45 to 8:45	<b>102</b>	-	-	-	<b>5</b>	-	-	-	<b>12</b>	<b>9</b>	<b>1</b>	<b>17</b>	<b>146</b>

### PM Adjusted Peak Volumes created by new Development 2016

	1	2	3	4	5	6	7	8	9	10	11	12	
3:15 to 4:15 PM	<b>97</b>	-	-	-	<b>9</b>	-	-	-	<b>27</b>	<b>55</b>	<b>12</b>	<b>137</b>	<b>337</b>

### AM Adjusted Peak Volumes for 2016 including new Development

	1	2	3	4	5	6	7	8	9	10	11	12	
7:45 to 8:45	<b>266</b>	<b>631</b>	<b>3</b>	<b>3</b>	<b>13</b>	<b>6</b>	<b>7</b>	<b>383</b>	<b>53</b>	<b>35</b>	<b>4</b>	<b>65</b>	<b>1469</b>

### PM Adjusted Peak Volumes for 2016 including new Development

	1	2	3	4	5	6	7	8	9	10	11	12	
3:15 to 4:15 PM	<b>180</b>	<b>504</b>	<b>7</b>	<b>7</b>	<b>17</b>	<b>3</b>	<b>0</b>	<b>690</b>	<b>50</b>	<b>107</b>	<b>24</b>	<b>268</b>	<b>1858</b>

# Signal Varrant Output JUNE 04 MCS

## Raw Data

① 2004 AWV  $\times 1.036$

## Add Ind Park Growth

② 2006 AWV  $\times 1.066$

③ 2016 AWV  $\times 1.245$

① & ② now

③ later



PREPARED BY MCS DATE 4/8/04 PROJECT NO. \_\_\_\_\_  
 CALCULATIONS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_ SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
 ASSUMPTIONS / METHODS CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SUBJECT \_\_\_\_\_

ADJUST COUNTS TO DHV

		<u>2002 ADT</u>	<u>DHV *</u>	<u>PM PEAK HOV6</u>	<u>DHV/ C FACTOR</u>
RTE 7	S. APPR	9700 (AD12)	1050	925	1.13
RTE 7	N APPR	10,200 (AD5)	1100	1030	1.068

$$K = 0.108$$

$$\text{AVG FACTOR} = \boxed{1.102}$$

$$\text{COUNT} \times \text{FACTOR} = \text{DHV}_{2002}$$

$$\text{DHV}_{2002} \times 1.07 = \text{DHV}_{2006}$$

$$\text{DHV}_{2002} \times 1.25 = \text{DHV}_{2014}$$

$$\times 1.04 = \text{DHV}_{2004}$$

$$\text{DHV} \times \frac{1}{1.106} = \text{AWV}$$

FOR SIGNAL WARRANTS

$$\text{COUNT} \times \frac{1.102 \times 1.07}{1.106} =$$

$$\frac{1.102 \times 1.25}{1.106} =$$

$$1.034 (2004)$$

$$1.066 (2006)$$

$$1.245 (2016)$$



Site ID:  
Town:  
Location:

P6A041  
New Haven  
New Haven: US7 0.3 mi S of VT17

APRIL  
avg/AWD= 1.063

AADT: 6900  
Route No: US7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.79	1.33	0.87	1.03	1.00	1.02	0.98		1.09	0.97	0.81	1.28
2	0.96	0.98	1.03	0.98	1.00	1.33	0.97	0.91	1.27	0.97	1.01	0.97
3	0.95	1.43	1.35	0.98	0.88	1.06	0.93	1.06	1.02	0.91	1.24	0.92
4	0.89	1.00	1.06	0.98	0.98		1.62	1.20	1.00	0.84	0.99	0.88
5	1.06	1.02	1.04	0.87	1.23	1.01	0.98	1.03	0.99	0.92	0.93	0.91
6	1.35	0.94	0.99	1.03	1.06	0.98	1.05	0.93	0.91	1.15	0.94	0.88
7	1.03	0.92	0.97	1.38	1.01	0.89	1.22	0.88	1.06	0.95	0.89	0.95
8	0.90	0.87	0.86	1.04	0.97	1.01	1.01	0.87	1.25	0.95	0.79	1.39
9	0.91	0.99	0.95	1.01	0.96	1.29	0.96	0.83	1.06	0.94	0.98	0.98
10	0.92	1.38	1.29	0.97	0.89	1.03	0.96	0.98	1.00	0.89	1.24	0.90
11	0.86	1.07	1.00	0.94	0.98	0.97	0.95	1.25	1.01	0.85	0.98	0.89
12	1.03	0.93	0.96	0.85	1.14	1.00	0.89	1.00	0.97	0.93	0.92	0.96
13	1.36	0.98	0.92	1.03	1.08	0.95	1.02	0.96	0.89	1.11	0.89	0.79
14	0.95	0.89	0.88	1.31	1.03	0.90	1.13	0.90	1.01	0.96	0.88	1.19
15	0.95	0.81	0.78	0.97	0.98	0.84	1.00	0.92	1.35	0.96	0.81	1.31
16	0.91	0.94	0.91		0.99	1.00	0.96	0.89	0.96	1.01	1.01	0.93
17	0.92	1.38	1.16	0.92	0.89	1.06	0.97	1.05	0.96	0.96	1.97	0.84
18	0.84	1.02	1.10	0.90	1.03	0.98	0.90	1.24	0.95	0.89	1.27	0.84
19	0.98	0.93	0.99	0.85	1.15	0.94	0.88	1.02	0.94	1.06	0.95	0.84
20	1.27	0.92	1.00	1.03	1.02	0.93	1.00	0.96	0.84	1.31	0.88	0.90
21	1.01	0.90	0.99	1.29	0.96	0.92	1.18	0.93	0.93	1.06		1.06
22	0.94	0.86	0.89	1.01	0.94	1.12	1.04	0.93	1.28	0.99	0.84	1.23
23	0.91	1.00	1.04	0.99	0.91	1.28	0.95	0.86	1.02		1.19	0.87
24	0.99	1.32	1.37	0.99	0.82	1.03	0.92	1.14	0.97	0.98	1.34	1.08
25	0.83	1.02	1.02	0.97	0.96	0.95	0.90	1.25	0.95	0.93	0.91	2.04
26	1.00	0.95	1.14	0.88	1.12	0.98	0.87	1.07	0.92	1.22	0.83	1.14
27	1.31	0.98	0.97	0.97	1.23	0.94	1.04	1.06	0.88	1.30	0.90	0.94
28	0.93		0.90	1.36	0.95	0.86	1.20	1.10	0.92	1.07	1.45	1.08
29	0.94		0.87	1.03	0.97	1.06	0.99	1.07	1.23	1.08	1.14	1.41
30	0.95		1.09	0.94	1.01	1.26	0.95	1.00	1.02	1.07	1.13	0.92
31	1.15		1.18		0.91		0.93			1.11		1.06
MADT to AADT	1.14	1.10	1.09	1.04	0.95	0.91	0.88	0.82	0.95	0.94	1.12	1.12

if MADT = 1.00

$$\therefore \frac{\text{MADT}}{\text{MAWT}} = 1.063$$

(= avg of grey #6)

$$\begin{aligned} \text{AAWT} &= \text{MAWT} \times \frac{\text{AADT}}{\text{MADT}} \sim \frac{\text{AAWT}}{\text{MAWT}} \\ &= 1.063 \times 1.04 \\ &= 1.106 \end{aligned}$$

#6330030  
USF-Exch St  
4/8/04 SRZ

119 458 2  
↙ ↓ ↘

35 ↗  
2 →  
19 ↘

↗ 2  
← 6  
↘ 4

↙ ↑ ↘  
30 278 5

Am PEAK  
7:45 - 8:45

60 366 5  
↙ ↓ ↘

95 ↗  
9 →  
38 ↘

↗ 5  
← 6  
↘ 2

Pm PEAK  
3:15 - 4:15

↙ ↑ ↘  
17 501 0



## C: Rural Primary and Secondary

	Short Term Growth 1997 to 2002 20 Year Growth 2002 to 2022										1.04 1.35 2008	
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1997	1.00											
1998	1.01	1.00										
1999	1.02	1.01	1.00									
2000	1.02	1.02	1.01	1.00								
2001	1.03	1.02	1.02	1.01	1.00							
2002	1.04	1.03	1.02	1.02	1.01	1.00						
2003						1.02	1.00					
2004						1.04	1.02	1.00				
2005						1.05	1.03	1.02	1.00			
2006						1.07	1.05	1.03	1.02	1.00		
2007						1.09	1.07	1.05	1.03	1.02	1.00	
2008						1.11	1.09	1.07	1.05	1.03	1.02	1.00
2009						1.12	1.10	1.08	1.07	1.05	1.03	1.02
2010						1.14	1.12	1.10	1.08	1.07	1.05	1.03
2011						1.16	1.14	1.12	1.10	1.08	1.06	1.05
2012						1.18	1.15	1.14	1.12	1.10	1.08	1.06
2013						1.19	1.17	1.15	1.13	1.11	1.10	1.08
2014						1.21	1.19	1.17	1.15	1.13	1.11	1.10
2015						1.23	1.21	1.19	1.17	1.15	1.13	1.11
2016						1.25	1.22	1.20	1.18	1.16	1.14	1.13
2017						1.26	1.24	1.22	1.20	1.18	1.16	1.14
2018						1.28	1.26	1.24	1.22	1.20	1.18	1.16
2019						1.30	1.28	1.25	1.23	1.21	1.19	1.17
2020						1.32	1.29	1.27	1.25	1.23	1.21	1.19
2021						1.33	1.31	1.29	1.27	1.25	1.23	1.21
2022						1.35	1.33	1.30	1.28	1.26	1.24	1.22
2023						1.37	1.34	1.32	1.30	1.28	1.26	1.24
2024						1.39	1.36	1.34	1.32	1.29	1.27	1.25
2025						1.40	1.38	1.36	1.33	1.31	1.29	1.27
2026						1.42	1.40	1.37	1.35	1.33	1.31	1.29
2027						1.44	1.41	1.39	1.37	1.34	1.32	1.30
2028						1.46	1.43	1.41	1.38	1.36	1.34	1.32
2029						1.47	1.45	1.42	1.40	1.38	1.35	1.33
2030						1.49	1.46	1.44	1.42	1.39	1.37	1.35
2031						1.51	1.48	1.46	1.43	1.41	1.39	1.36
2032						1.53	1.50	1.47	1.45	1.43	1.40	1.38
2033						1.54	1.52	1.49	1.47	1.44	1.42	1.40
2034						1.56	1.53	1.51	1.48	1.46	1.43	1.41
2035						1.58	1.55	1.52	1.50	1.47	1.45	1.43
2036						1.60	1.57	1.54	1.52	1.49	1.47	1.44
2037						1.61	1.58	1.56	1.53	1.51	1.48	1.46
2038						1.63	1.60	1.57	1.55	1.52	1.50	1.48
2039						1.65	1.62	1.59	1.57	1.54	1.51	1.49
2040						1.67	1.64	1.61	1.58	1.56	1.53	1.51
2041						1.68	1.65	1.63	1.60	1.57	1.55	1.52
2042						1.70	1.67	1.64	1.62	1.59	1.56	1.54
2043						1.72	1.69	1.66	1.63	1.61	1.58	1.55
2044						1.74	1.71	1.68	1.65	1.62	1.60	1.57
2045						1.75	1.72	1.69	1.67	1.64	1.61	1.59
2046						1.77	1.74	1.71	1.68	1.65	1.63	1.60
2047						1.79	1.76	1.73	1.70	1.67	1.64	1.62

## DHV DETERMINATION BASED ON AADT AND HIGHWAY CLASS

AADT	Interstate	General	Recreational
50	80	65	145
100	90	70	150
150	95	75	155
200	100	80	165
250	105	85	170
300	115	95	175
350	120	100	180
400	125	105	190
450	130	110	195
500	140	115	200

Project 6330030 ACRPC US7-Exchg St  
 2006 Projected Traffic Data from Friday April 2, 2004  
 SRZ

07/08/04  
 16:39:37

WARRANTS/TEAPAC[Ver 2.02.14] - MUTCD Warrant Analysis

Conditions Used for Warrant Analysis	2003 MUTCD
Major Street Direction	NorthSouth
Number of Lanes in North-South direction	1
Number of Lanes in East-West direction	1
Approach speed on major street is greater than 40 mph	No
Isolated community has population less than 10,000	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to improve conditions	No
Number of accidents correctable by a signal	0
Peak hour stop sign delay for worst minor approach (veh-hours)	0
Number of accidents correctable by a multi-way stop	0
Peak hour average delay for all minor approaches (sec/veh)	0

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 1A Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1400	1145	945	1300	1045	800	Req.
Minor Volume	152	149	137	122	98	95	76	73	150
Major Volume	1013	1029	845	763	702	756	734	875	500
Warrant Met?	Yes	No	No	No	No	No	No	No	8

Number of 1-hour periods meeting the warrant 1  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1A IS NOT MET <<

Warrant 1B Analysis - 8-Hour Interruption of Continuous Traffic

Start Time	1500	1600	1400	1130	1700	1300	945	800	Req.
Minor Volume	145	142	137	120	111	95	98	73	75
Major Volume	994	898	845	767	983	756	702	875	750
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	8

Number of 1-hour periods meeting the warrant 6  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1B IS NOT MET <<

Warrant 1A Analysis (80%) - 8-Hour Minimum Vehicular Volume

Start Time	1545	1445	1345	1645	1130	1230	945	800	Req.
Minor Volume	148	135	131	126	120	100	98	73	120
Major Volume	953	928	833	1005	767	708	702	875	400
Warrant Met?	Yes	Yes	Yes	Yes	Yes	No	No	No	8

12--full warrant .txt

Number of 1-hour periods meeting the warrant	5
--	---

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□

Project 6330030 ACRPC US7-Exchg St  
 2006 Projected Traffic Data from Friday April 2, 2004  
 SRZ

07/08/04  
 16:39:37

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 1B Analysis (80%) - 8-Hour Interruption of Continuous Traf

Start Time	1500	1600	1400	1200	1700	1000	1300	1100	Req.
Minor Volume	145	142	137	115	111	96	95	77	60
Major Volume	994	898	845	765	983	718	756	705	600
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of 1-hour periods meeting the warrant									10

Warrant 1C Analysis - 8-Hour Combination of Warrants

80% of Warrants 1A and 1B are met	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce delays	No

>> WARRANT 1C IS NOT MET <<

Warrant 2 Analysis - 4-Hour Vehicular Volume

Start Time	1545	1445	1645	1345	1145	945	1245	1045	Req.
Minor Volume	148	135	126	131	122	98	89	76	-
Minor Reqrmt	112	118	99	145	164	180	171	172	<--
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	4

Number of 1-hour periods meeting the warrant	3
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 2 IS NOT MET <<

Warrant 3A Analysis - Peak Hour Delay

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	152	149	118	114	107	104	98	73	100
Total Volume	1178	1182	989	889	866	850	811	962	800
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	1

Number of 1-hour periods meeting the warrant	6
Signal will not seriously disrupt progressive traffic flow	Yes
Delay for worst minor approach (must be at least 4 veh-hours)	0

>> WARRANT 3A IS NOT MET <<

□

Project 6330030 ACRPC US7-Exchg St  
 2006 Projected Traffic Data from Friday April 2, 2004  
 SRZ

07/08/04  
 16:39:37

# WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

## Warrant 3B Analysis - Peak Hour Volume

Start Time	1515	1615	1400	1145	945	1300	1045	800	Req.
Minor Volume	152	149	137	122	98	95	76	73	-
Minor Reqrmt	201	196	260	295	319	298	306	246	<--
Warrant Met?	No	No	No	No	No	No	No	No	1
Number of 1-hour periods meeting the warrant									0
Signal will not seriously disrupt progressive traffic flow									Yes
>> WARRANT 3B IS NOT MET <<									

## Warrant 7 Analysis - Crash Experience

80% of warrant 1A or 1B is met	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce accidents	No
Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT 7 IS NOT MET <<	

## Summary of MUTCD Traffic Signal Warrant Analysis

Warrant 1A 8-Hour Minimum Vehicular Volume	NOT MET
Warrant 1B 8-Hour Interruption of Continuous Traffic	NOT MET
Warrant 1C 8-Hour Combination of Warrants	NOT MET
Warrant 2 4-Hour Vehicular Volume	NOT MET
Warrant 3A Peak Hour Delay	NOT MET
Warrant 3B Peak Hour Volume	NOT MET
Warrant 7 Crash Experience	NOT MET
>> Traffic Signal Warrant is NOT MET <<	

# WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

## Warrant A Analysis - Interim Measure for Signal

If signal warrants are met, a temporary multi-way stop is allowed	
>> WARRANT A IS NOT MET <<	

## Warrant B Analysis - Crash Experience

Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT B IS NOT MET <<	

□

SRZ

## WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

## Warrant C Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1630	1400	1130	945	1230	800	1045	Req.
Minor Volume	165	159	140	132	109	108	87	56	200
Major Volume	1013	1021	845	767	702	708	875	553	300
Warrant Met?	No	No	No	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									120
Average major volume for 8 highest minor hours									811
Delay for all minor approaches (must be at least 30 sec/veh)									0

&gt;&gt; WARRANT C IS NOT MET &lt;&lt;

## Warrant D Analysis - 8-Hour Combination of Warrants

Start Time	1515	1630	1400	1130	945	1230	800	1045	Req.
Minor Volume	165	159	140	132	109	108	87	56	160
Major Volume	1013	1021	845	767	702	708	875	553	240
Warrant Met?	Yes	No	No	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									120
Average major volume for 8 highest minor hours									811
Number of correctable accidents (must be 4 or more per year)									0
Delay for all minor approaches (must be at least 24 sec/veh)									0

&gt;&gt; WARRANT D IS NOT MET &lt;&lt;

## Summary of MUTCD Multi-way Stop Warrant Analysis

Warrant A	Interim Measure for Signal	NOT MET
Warrant B	Crash Experience	NOT MET
Warrant C	8-Hour Minimum Vehicular Volume	NOT MET
Warrant D	8-Hour Combination of Warrants	NOT MET

&gt;&gt; Multi-way Stop Warrant is NOT MET &lt;&lt;



Project 6330030 ACRPC US7-Exchg St  
 2006 Projected Traffic Data from Friday April 2, 2004  
 SRZ

06/17/04  
 12:27:50

WARRANTS/TEAPAC[Ver 2.02.14] - MUTCD Warrant Analysis

Conditions Used for Warrant Analysis	2003 MUTCD
Major Street Direction	NorthSouth
Number of Lanes in North-South direction	1
Number of Lanes in East-West direction	1
Approach speed on major street is greater than 40 mph	Yes
Isolated community has population less than 10,000	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to improve conditions	No
Number of accidents correctable by a signal	0
Peak hour stop sign delay for worst minor approach (veh-hours)	0
Number of accidents correctable by a multi-way stop	0
Peak hour average delay for all minor approaches (sec/veh)	0

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 1A Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	152	149	118	114	107	104	98	73	105
Major Volume	1013	1029	866	767	748	736	702	875	350
Warrant Met?	Yes	Yes	Yes	Yes	Yes	No	No	No	8

Number of 1-hour periods meeting the warrant 5  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1A IS NOT MET <<

Warrant 1B Analysis - 8-Hour Interruption of Continuous Traffic

Start Time	1545	1445	1345	1645	1145	945	1245	1045	Req.
Minor Volume	148	135	131	126	122	98	89	76	53
Major Volume	953	928	833	1005	763	702	736	734	525
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8

Number of 1-hour periods meeting the warrant 10  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1B IS MET <<

Warrant 1A Analysis (80%) - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	152	149	118	114	107	104	98	73	84
Major Volume	1013	1029	866	767	748	736	702	875	280
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	8

13---2006 - reduced warrant text.txt  
Number of 1-hour periods meeting the warrant (56% allowed) 7

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Project 6330030 ACRPC US7-Exchg St  
2006 Projected Traffic Data from Friday April 2, 2004  
SRZ

06/17/04  
12:27:50

# WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

## Warrant 1B Analysis (80%) - 8-Hour Interruption of Continuous Traf

Start Time	1630	1530	1430	1130	1330	1230	1030	930	Req.
Minor Volume	149	146	123	120	119	100	84	79	42
Major Volume	1021	994	897	767	805	708	703	742	420
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of 1-hour periods meeting the warrant (56% allowed)									10

## Warrant 1C Analysis - 8-Hour Combination of Warrants

80% of Warrants 1A and 1B are met (56% allowed)	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce delays	No

>> WARRANT 1C IS NOT MET <<

## Warrant 2 Analysis - 4-Hour Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	1015	915	Req.
Minor Volume	152	149	118	114	107	104	85	77	-
Minor Reqrmt	60	60	60	63	65	66	70	65	<--
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	4
Number of 1-hour periods meeting the warrant									9
Signal will not seriously disrupt progressive traffic flow									Yes

>> WARRANT 2 IS MET <<

## Warrant 3A Analysis - Peak Hour Delay

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	152	149	118	114	107	104	98	73	100
Total Volume	1178	1182	989	889	866	850	811	962	800
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	1
Number of 1-hour periods meeting the warrant									6
Signal will not seriously disrupt progressive traffic flow									Yes
Delay for worst minor approach (must be at least 4 veh-hours)									0

>> WARRANT 3A IS NOT MET <<

□

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 3B Analysis - Peak Hour Volume

Start Time	1630	1530	1430	1330	1145	945	1045	1245	Req.
Minor Volume	149	146	123	119	122	98	76	74	-
Minor Reqrmt	79	81	91	114	126	144	135	208	<--
Warrant Met?	Yes	Yes	Yes	Yes	No	No	No	No	1
Number of 1-hour periods meeting the warrant									4
Signal will not seriously disrupt progressive traffic flow									Yes
>> WARRANT 3B IS MET <<									

Warrant 7 Analysis - Crash Experience

80% of warrant 1A or 1B is met	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce accidents	No
Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT 7 IS NOT MET <<	

Summary of MUTCD Traffic Signal Warrant Analysis

Warrant 1A 8-Hour Minimum Vehicular Volume	NOT MET
Warrant 1B 8-Hour Interruption of Continuous Traffic	MET
Warrant 1C 8-Hour Combination of Warrants	NOT MET
Warrant 2 4-Hour Vehicular Volume	MET
Warrant 3A Peak Hour Delay	NOT MET
Warrant 3B Peak Hour Volume	MET
Warrant 7 Crash Experience	NOT MET
>> Traffic Signal Warrant is MET <<	

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

Warrant A Analysis - Interim Measure for Signal

If signal warrants are met, a temporary multi-way stop is allowed	
>> WARRANT A IS MET <<	

Warrant B Analysis - Crash Experience

Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT B IS NOT MET <<	

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## WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

## Warrant C Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1500	1600	1400	1130	1700	945	1230	800	Req.
Minor Volume	159	146	140	132	123	109	108	87	140
Major Volume	994	898	845	767	983	702	708	875	210
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									126
Average major volume for 8 highest minor hours									847
Delay for all minor approaches (must be at least 30 sec/veh)									0

&gt;&gt; WARRANT C IS NOT MET &lt;&lt;

## Warrant D Analysis - 8-Hour Combination of Warrants

Start Time	1515	1630	1400	1130	945	1230	800	1045	Req.
Minor Volume	165	159	140	132	109	108	87	56	160
Major Volume	1013	1021	845	767	702	708	875	553	240
Warrant Met?	Yes	No	No	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									120
Average major volume for 8 highest minor hours									811
Number of correctable accidents (must be 4 or more per year)									0
Delay for all minor approaches (must be at least 24 sec/veh)									0

&gt;&gt; WARRANT D IS NOT MET &lt;&lt;

## Summary of MUTCD Multi-way Stop Warrant Analysis

Warrant A	Interim Measure for Signal	MET
Warrant B	Crash Experience	NOT MET
Warrant C	8-Hour Minimum Vehicular Volume	NOT MET
Warrant D	8-Hour Combination of Warrants	NOT MET

&gt;&gt; Multi-way Stop Warrant is MET &lt;&lt;



Project 6330030 ACRPC US7-Exchg St  
 2016 Projected Traffic Data from Friday April 2, 2004  
 SRZ

07/08/04  
 16:41:21

WARRANTS/TEAPAC[Ver 2.02.14] - MUTCD Warrant Analysis

Conditions Used for Warrant Analysis	2003 MUTCD
Major Street Direction	NorthSouth
Number of Lanes in North-South direction	1
Number of Lanes in East-West direction	1
Approach speed on major street is greater than 40 mph	No
Isolated community has population less than 10,000	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to improve conditions	No
Number of accidents correctable by a signal	0
Peak hour stop sign delay for worst minor approach (veh-hours)	0
Number of accidents correctable by a multi-way stop	0
Peak hour average delay for all minor approaches (sec/veh)	0

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 1A Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1545	1445	1345	1645	1145	945	1245	1045	Req.
Minor Volume	172	159	153	148	146	117	105	89	150
Major Volume	1118	1088	975	1177	900	823	865	863	500
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	8

Number of 1-hour periods meeting the warrant 3  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1A IS NOT MET <<

Warrant 1B Analysis - 8-Hour Interruption of Continuous Traffic

Start Time	1500	1600	1400	1200	1700	1000	1300	1100	Req.
Minor Volume	169	165	162	138	130	114	111	91	75
Major Volume	1166	1052	990	899	1152	842	888	832	750
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8

Number of 1-hour periods meeting the warrant 10  
 Signal will not seriously disrupt progressive traffic flow Yes

>> WARRANT 1B IS MET <<

Warrant 1A Analysis (80%) - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	177	174	140	133	127	124	117	87	120
Major Volume	1189	1205	1014	899	881	868	823	1027	400
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	No	No	8

Number of 1-hour periods meeting the warrant 6

□

Project 6330030 ACRPC US7-Exchg St  
2016 Projected Traffic Data from Friday April 2, 2004  
SRZ

07/08/04  
16:41:21

# WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

## Warrant 1B Analysis (80%) - 8-Hour Interruption of Continuous Traf

Start Time	1630	1530	1430	1130	1330	1230	1030	930	Req.
Minor Volume	174	171	146	143	138	119	98	95	60
Major Volume	1195	1166	1051	906	944	832	826	870	600
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of 1-hour periods meeting the warrant									10

## Warrant 1C Analysis - 8-Hour Combination of Warrants

80% of Warrants 1A and 1B are met	No
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce delays	No

>> WARRANT 1C IS NOT MET <<

## Warrant 2 Analysis - 4-Hour Vehicular Volume

Start Time	1515	1615	1130	1415	1315	945	800	1230	Req.
Minor Volume	177	174	143	140	133	117	87	86	-
Minor Reqrmt	81	80	124	98	125	148	96	205	<--
Warrant Met?	Yes	Yes	Yes	Yes	Yes	No	No	No	4

Number of 1-hour periods meeting the warrant	5
Signal will not seriously disrupt progressive traffic flow	Yes

>> WARRANT 2 IS MET <<

## Warrant 3A Analysis - Peak Hour Delay

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	177	174	140	133	127	124	117	87	100
Total Volume	1383	1383	1159	1042	1021	1006	954	1133	800
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	1

Number of 1-hour periods meeting the warrant	7
Signal will not seriously disrupt progressive traffic flow	Yes
Delay for worst minor approach (must be at least 4 veh-hours)	0

>> WARRANT 3A IS NOT MET <<

□

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 3B Analysis - Peak Hour Volume

Start Time	1615	1500	1400	1145	945	1300	1045	800	Req.
Minor Volume	174	169	162	146	117	111	89	87	-
Minor Reqrmt	149	159	208	235	270	240	252	197	<--
Warrant Met?	Yes	Yes	No	No	No	No	No	No	1
Number of 1-hour periods meeting the warrant									2
Signal will not seriously disrupt progressive traffic flow									Yes
>> WARRANT 3B IS MET <<									

Warrant 7 Analysis - Crash Experience

80% of warrant 1A or 1B is met	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce accidents	No
Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT 7 IS NOT MET <<	

Summary of MUTCD Traffic Signal Warrant Analysis

Warrant 1A 8-Hour Minimum Vehicular Volume	NOT MET
Warrant 1B 8-Hour Interruption of Continuous Traffic	MET
Warrant 1C 8-Hour Combination of Warrants	NOT MET
Warrant 2 4-Hour Vehicular Volume	MET
Warrant 3A Peak Hour Delay	NOT MET
Warrant 3B Peak Hour Volume	MET
Warrant 7 Crash Experience	NOT MET
>> Traffic Signal Warrant is MET <<	

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

Warrant A Analysis - Interim Measure for Signal

If signal warrants are met, a temporary multi-way stop is allowed	
>> WARRANT A IS MET <<	

Warrant B Analysis - Crash Experience

Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT B IS NOT MET <<	

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## WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

## Warrant C Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1630	1400	1130	945	1230	800	1045	Req.
Minor Volume	194	186	165	158	131	130	106	65	200
Major Volume	1189	1195	990	906	823	832	1027	649	300
Warrant Met?	No	No	No	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									142
Average major volume for 8 highest minor hours									951
Delay for all minor approaches (must be at least 30 sec/veh)									0

&gt;&gt; WARRANT C IS NOT MET &lt;&lt;

## Warrant D Analysis - 8-Hour Combination of Warrants

Start Time	1500	1600	1400	1130	1700	945	1230	800	Req.
Minor Volume	187	169	165	158	145	131	130	106	160
Major Volume	1166	1052	990	906	1152	823	832	1027	240
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									149
Average major volume for 8 highest minor hours									994
Number of correctable accidents (must be 4 or more per year)									0
Delay for all minor approaches (must be at least 24 sec/veh)									0

&gt;&gt; WARRANT D IS NOT MET &lt;&lt;

## Summary of MUTCD Multi-way Stop Warrant Analysis

Warrant A	Interim Measure for Signal	MET
Warrant B	Crash Experience	NOT MET
Warrant C	8-Hour Minimum Vehicular Volume	NOT MET
Warrant D	8-Hour Combination of Warrants	NOT MET

&gt;&gt; Multi-way Stop Warrant is MET &lt;&lt;



Project 6330030 ACRPC US7-Exchg St  
 2016 Projected Traffic Data from Friday April 2, 2004  
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06/17/04  
 12:28:50

## WARRANTS/TEAPAC[Ver 2.02.14] - MUTCD Warrant Analysis

Conditions Used for Warrant Analysis	2003 MUTCD
Major Street Direction	NorthSouth
Number of Lanes in North-South direction	1
Number of Lanes in East-West direction	1
Approach speed on major street is greater than 40 mph	Yes
Isolated community has population less than 10,000	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to improve conditions	No
Number of accidents correctable by a signal	0
Peak hour stop sign delay for worst minor approach (veh-hours)	0
Number of accidents correctable by a multi-way stop	0
Peak hour average delay for all minor approaches (sec/veh)	0

## WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

## Warrant 1A Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	177	174	140	133	127	124	117	87	105
Major Volume	1189	1205	1014	899	881	868	823	1027	350
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	8
Number of 1-hour periods meeting the warrant									7
Signal will not seriously disrupt progressive traffic flow									Yes

&gt;&gt; WARRANT 1A IS NOT MET &lt;&lt;

## Warrant 1B Analysis - 8-Hour Interruption of Continuous Traffic

Start Time	1630	1530	1430	1130	1330	1230	1030	930	Req.
Minor Volume	174	171	146	143	138	119	98	95	53
Major Volume	1195	1166	1051	906	944	832	826	870	525
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of 1-hour periods meeting the warrant									10
Signal will not seriously disrupt progressive traffic flow									Yes

&gt;&gt; WARRANT 1B IS MET &lt;&lt;

## Warrant 1A Analysis (80%) - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	1015	915	Req.
Minor Volume	177	174	140	133	127	124	100	92	84
Major Volume	1189	1205	1014	899	881	868	821	877	280
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8

15---2016 - reduced warrant text.txt  
Number of 1-hour periods meeting the warrant (56% allowed) 9

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Project 6330030 ACRPC US7-Exchg St  
2016 Projected Traffic Data from Friday April 2, 2004  
SRZ

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# WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

## Warrant 1B Analysis (80%) - 8-Hour Interruption of Continuous Traf

Start Time	1515	1615	1415	1315	1115	1215	1015	915	Req.
Minor Volume	177	174	140	133	127	124	100	92	42
Major Volume	1189	1205	1014	899	881	868	821	877	420
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Number of 1-hour periods meeting the warrant (56% allowed)									11

## Warrant 1C Analysis - 8-Hour Combination of Warrants

80% of Warrants 1A and 1B are met (56% allowed)	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce delays	No

>> WARRANT 1C IS NOT MET <<

## Warrant 2 Analysis - 4-Hour Vehicular Volume

Start Time	1630	1530	1430	1130	1330	1230	1030	930	Req.
Minor Volume	174	171	146	143	138	119	98	95	-
Minor Reqrmt	60	60	60	60	60	60	60	60	<--
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	4
Number of 1-hour periods meeting the warrant									10
Signal will not seriously disrupt progressive traffic flow									Yes

>> WARRANT 2 IS MET <<

## Warrant 3A Analysis - Peak Hour Delay

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	177	174	140	133	127	124	117	87	100
Total Volume	1383	1383	1159	1042	1021	1006	954	1133	800
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	1
Number of 1-hour periods meeting the warrant									7
Signal will not seriously disrupt progressive traffic flow									Yes
Delay for worst minor approach (must be at least 4 veh-hours)									0

>> WARRANT 3A IS NOT MET <<

□

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Traffic Signal

Warrant 3B Analysis - Peak Hour Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	177	174	140	133	127	124	117	87	-
Minor Reqrmt	75	75	79	90	95	98	109	79	<--
Warrant Met?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	1
Number of 1-hour periods meeting the warrant									8
Signal will not seriously disrupt progressive traffic flow									Yes
>> WARRANT 3B IS MET <<									

Warrant 7 Analysis - Crash Experience

80% of warrant 1A or 1B is met	Yes
Signal will not seriously disrupt progressive traffic flow	Yes
Trials of other remedies have failed to reduce accidents	No
Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT 7 IS NOT MET <<	

Summary of MUTCD Traffic Signal Warrant Analysis

Warrant 1A 8-Hour Minimum Vehicular Volume	NOT MET
Warrant 1B 8-Hour Interruption of Continuous Traffic	MET
Warrant 1C 8-Hour Combination of Warrants	NOT MET
Warrant 2 4-Hour Vehicular Volume	MET
Warrant 3A Peak Hour Delay	NOT MET
Warrant 3B Peak Hour Volume	MET
Warrant 7 Crash Experience	NOT MET
>> Traffic Signal Warrant is MET <<	

WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

Warrant A Analysis - Interim Measure for Signal

If signal warrants are met, a temporary multi-way stop is allowed	
>> WARRANT A IS MET <<	

Warrant B Analysis - Crash Experience

Number of correctable accidents (must be 5 or more per year)	0
>> WARRANT B IS NOT MET <<	

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## WARRANTS/TEAPAC[Ver 2.02.14] - Warrant Analysis for Multi-way Stop

## Warrant C Analysis - 8-Hour Minimum Vehicular Volume

Start Time	1515	1615	1415	1315	1115	1215	945	800	Req.
Minor Volume	194	178	145	143	140	138	131	106	140
Major Volume	1189	1205	1014	899	881	868	823	1027	210
Warrant Met?	Yes	Yes	Yes	Yes	Yes	No	No	No	8
Average minor volume for 8 highest minor hours									147
Average major volume for 8 highest minor hours									988
Delay for all minor approaches (must be at least 30 sec/veh)									0

&gt;&gt; WARRANT C IS NOT MET &lt;&lt;

## Warrant D Analysis - 8-Hour Combination of Warrants

Start Time	1500	1600	1400	1130	1700	945	1230	800	Req.
Minor Volume	187	169	165	158	145	131	130	106	160
Major Volume	1166	1052	990	906	1152	823	832	1027	240
Warrant Met?	Yes	Yes	Yes	No	No	No	No	No	8
Average minor volume for 8 highest minor hours									149
Average major volume for 8 highest minor hours									994
Number of correctable accidents (must be 4 or more per year)									0
Delay for all minor approaches (must be at least 24 sec/veh)									0

&gt;&gt; WARRANT D IS NOT MET &lt;&lt;

## Summary of MUTCD Multi-way Stop Warrant Analysis


Warrant A	Interim Measure for Signal	MET
Warrant B	Crash Experience	NOT MET
Warrant C	8-Hour Minimum Vehicular Volume	NOT MET
Warrant D	8-Hour Combination of Warrants	NOT MET

&gt;&gt; Multi-way Stop Warrant is MET &lt;&lt;















EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.954			0.981			0.998			0.972	
Flt Protected		0.969			0.982			0.995				
Satd. Flow (prot)	0	1602	0	0	1768	0	0	1721	0	0	1736	0
Flt Permitted		0.849			0.939			0.913			0.999	
Satd. Flow (perm)	0	1404	0	0	1690	0	0	1579	0	0	1734	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			2			2			39	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	41	2	22	5	7	2	35	328	6	2	540	140
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	43	2	23	5	7	2	37	345	6	2	568	147
Lane Group Flow (vph)	0	68	0	0	14	0	0	388	0	0	717	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0	0.0	20.0	20.0	0.0	40.0	40.0	0.0	40.0	40.0	0.0
Total Split (%)	33%	33%	0%	33%	33%	0%	67%	67%	0%	67%	67%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)		9.0			9.0			61.6			61.6	
Actuated g/C Ratio		0.11			0.11			0.82			0.82	
v/c Ratio		0.38			0.07			0.30			0.50	
Uniform Delay, d1		21.2			26.7			2.0			2.4	
Delay		11.5			14.2			2.8			3.4	
LOS		B			B			A			A	
Approach Delay		11.5			14.2			2.8			3.4	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)		15			4			23			51	
Queue Length 95th (ft)		41			16			63			140	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												

EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7


												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 60												
Actuated Cycle Length: 75.3												
Natural Cycle: 60												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.50												
Intersection Signal Delay: 3.8						Intersection LOS: A						
Intersection Capacity Utilization 60.2%						ICU Level of Service B						

Splits and Phases: 3: Happy & US Rt 7

 ø2	 ø4
40 s	20 s
 ø6	 ø8
40 s	20 s













EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.964			0.946						0.981	
Flt Protected		0.968			0.993			0.998			0.999	
Satd. Flow (prot)	0	1617	0	0	1724	0	0	1729	0	0	1750	0
Flt Permitted		0.798			0.972			0.980			0.995	
Satd. Flow (perm)	0	1333	0	0	1687	0	0	1698	0	0	1743	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		33			6						24	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	112	11	45	2	7	6	20	591	0	6	432	71
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	118	12	47	2	7	6	21	622	0	6	455	75
Lane Group Flow (vph)	0	177	0	0	15	0	0	643	0	0	536	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0	0.0	20.0	20.0	0.0	35.0	35.0	0.0	35.0	35.0	0.0
Total Split (%)	36%	36%	0%	36%	36%	0%	64%	64%	0%	64%	64%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)		11.3			11.3			34.2			34.2	
Actuated g/C Ratio		0.21			0.21			0.66			0.66	
v/c Ratio		0.58			0.04			0.57			0.46	
Uniform Delay, d1		15.3			10.1			5.1			4.3	
Delay		11.5			10.9			7.0			5.8	
LOS		B			B			A			A	
Approach Delay		11.5			10.9			7.0			5.8	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)		27			2			83			45	
Queue Length 95th (ft)		84			13			230			139	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												

EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7


												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 55												
Actuated Cycle Length: 51.7												
Natural Cycle: 55												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.58												
Intersection Signal Delay: 7.1						Intersection LOS: A						
Intersection Capacity Utilization 73.8%						ICU Level of Service C						

Splits and Phases: 3: Happy & US Rt 7

 ø2	 ø4
35 s	20 s
 ø6	 ø8
35 s	20 s

EXCHANGE STREET - US7  
DUFRESNE-HENRY













Lanes, Volumes, Timings  
3: Happy & US Rt 7

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.964			0.986						0.965	
Flt Protected		0.968			0.988			0.997				
Satd. Flow (prot)	0	1617	0	0	1787	0	0	1728	0	0	1723	0
Flt Permitted		0.781			0.916			0.924			0.994	
Satd. Flow (perm)	0	1305	0	0	1657	0	0	1601	0	0	1713	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		29			3						40	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	268	24	107	7	17	3	50	690	0	7	504	180
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	282	25	113	7	18	3	53	726	0	7	531	189
Lane Group Flow (vph)	0	420	0	0	28	0	0	779	0	0	727	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	28.0	28.0	0.0	28.0	28.0	0.0	42.0	42.0	0.0	42.0	42.0	0.0
Total Split (%)	40%	40%	0%	40%	40%	0%	60%	60%	0%	60%	60%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)		22.0			22.0			34.6			34.6	
Actuated g/C Ratio		0.34			0.34			0.53			0.53	
v/c Ratio		0.91			0.05			0.91			0.78	
Uniform Delay, d1		18.8			12.7			13.6			11.2	
Delay		35.3			14.4			22.5			13.2	
LOS		D			B			C			B	
Approach Delay		35.3			14.4			22.5			13.2	
Approach LOS		D			B			C			B	
Queue Length 50th (ft)		159			7			275			192	
Queue Length 95th (ft)		#327			23			#516			323	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												







EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7


												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 70												
Actuated Cycle Length: 64.8												
Natural Cycle: 70												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.91												
Intersection Signal Delay: 21.7							Intersection LOS: C					
Intersection Capacity Utilization 121.5%							ICU Level of Service H					
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 3: Happy & US Rt 7

	
ø2	ø4
42 s	28 s
	
ø6	ø8
42 s	28 s













EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7







												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.954			0.982			0.998			0.960	
Flt Protected		0.970			0.987			0.994				
Satd. Flow (prot)	0	1604	0	0	1778	0	0	1719	0	0	1714	0
Flt Permitted		0.826			0.946			0.842			0.999	
Satd. Flow (perm)	0	1366	0	0	1704	0	0	1456	0	0	1713	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		37			3			2			63	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	65	4	35	6	13	3	53	383	7	3	631	266
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	68	4	37	6	14	3	56	403	7	3	664	280
Lane Group Flow (vph)	0	109	0	0	23	0	0	466	0	0	947	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0	0.0	20.0	20.0	0.0	40.0	40.0	0.0	40.0	40.0	0.0
Total Split (%)	33%	33%	0%	33%	33%	0%	67%	67%	0%	67%	67%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)		10.1			10.1			57.5			57.5	
Actuated g/C Ratio		0.13			0.13			0.77			0.77	
v/c Ratio		0.51			0.10			0.41			0.71	
Uniform Delay, d1		19.9			25.0			2.9			4.0	
Delay		13.4			16.6			4.0			9.7	
LOS		B			B			A			A	
Approach Delay		13.4			16.6			4.0			9.7	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)		25			7			36			99	
Queue Length 95th (ft)		56			20			106			#478	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												

EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7


















												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 60												
Actuated Cycle Length: 74.3												
Natural Cycle: 60												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.71												
Intersection Signal Delay: 8.3							Intersection LOS: A					
Intersection Capacity Utilization 99.9%							ICU Level of Service E					
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 3: Happy & US Rt 7

					
ø2	ø4	ø6	ø4	ø6	ø8
40 s	20 s	20 s	20 s	20 s	20 s
40 s	20 s	20 s	20 s	20 s	20 s













EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7







												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.865			0.982			0.998			0.960	
Flt Protected	0.950				0.987			0.994				
Satd. Flow (prot)	1646	1499	0	0	1778	0	0	1719	0	0	1714	0
Flt Permitted	0.742				0.956			0.842			0.999	
Satd. Flow (perm)	1286	1499	0	0	1722	0	0	1456	0	0	1713	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		37			3			2			63	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	65	4	35	6	13	3	53	383	7	3	631	266
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	68	4	37	6	14	3	56	403	7	3	664	280
Lane Group Flow (vph)	68	41	0	0	23	0	0	466	0	0	947	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0	0.0	20.0	20.0	0.0	40.0	40.0	0.0	40.0	40.0	0.0
Total Split (%)	33%	33%	0%	33%	33%	0%	67%	67%	0%	67%	67%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	9.9	9.9			9.7			61.0			61.0	
Actuated g/C Ratio	0.13	0.13			0.12			0.81			0.81	
v/c Ratio	0.42	0.19			0.11			0.39			0.67	
Uniform Delay, d1	32.1	3.0			26.7			2.4			3.3	
Delay	19.4	8.2			16.8			3.5			8.5	
LOS	B	A			B			A			A	
Approach Delay		15.1			16.8			3.5			8.5	
Approach LOS		B			B			A			A	
Queue Length 50th (ft)	24	1			7			36			98	
Queue Length 95th (ft)	48	21			20			98			#465	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												

EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 60												
Actuated Cycle Length: 74.9												
Natural Cycle: 60												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.67												
Intersection Signal Delay: 7.6						Intersection LOS: A						
Intersection Capacity Utilization 97.4%						ICU Level of Service E						
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												



















Splits and Phases: 3: Happy & US Rt 7

					
ø2	ø4	ø6	ø4	ø6	ø8
40 s	20 s	20 s	20 s	20 s	20 s
40 s	20 s	20 s	20 s	20 s	20 s















EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7







												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			3%			3%			-3%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.877			0.986						0.965	
Flt Protected	0.950				0.988			0.997				
Satd. Flow (prot)	1646	1520	0	0	1787	0	0	1728	0	0	1723	0
Flt Permitted	0.739				0.944			0.925			0.994	
Satd. Flow (perm)	1281	1520	0	0	1708	0	0	1603	0	0	1713	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		113			3						51	
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.98	0.98	0.98
Link Speed (mph)		40			40			50			50	
Link Distance (ft)		1424			1464			1327			1392	
Travel Time (s)		24.3			25.0			18.1			19.0	
Volume (vph)	268	24	107	7	17	3	50	690	0	7	504	180
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	8%	8%	2%	2%	2%	8%	8%	8%	8%	8%	8%
Adj. Flow (vph)	282	25	113	7	18	3	53	726	0	7	531	189
Lane Group Flow (vph)	282	138	0	0	28	0	0	779	0	0	727	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phases	4	4		8	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	21.0	21.0	0.0	21.0	21.0	0.0	39.0	39.0	0.0	39.0	39.0	0.0
Total Split (%)	35%	35%	0%	35%	35%	0%	65%	65%	0%	65%	65%	0%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	14.8	14.8			14.8			31.8			31.8	
Actuated g/C Ratio	0.27	0.27			0.27			0.58			0.58	
v/c Ratio	0.82	0.28			0.06			0.84			0.71	
Uniform Delay, d1	18.6	2.7			13.1			9.2			7.5	
Delay	26.8	6.0			14.7			14.4			8.6	
LOS	C	A			B			B			A	
Approach Delay		20.0			14.7			14.4			8.6	
Approach LOS		B			B			B			A	
Queue Length 50th (ft)	92	6			6			200			131	
Queue Length 95th (ft)	#206	42			22			#432			235	
Internal Link Dist (ft)		1344			1384			1247			1312	
50th Up Block Time (%)												

EXCHANGE STREET - US7  
DUFRESNE-HENRY

Lanes, Volumes, Timings  
3: Happy & US Rt 7

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)												
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												
Intersection Summary												
Area Type:	Other											
Cycle Length: 60												
Actuated Cycle Length: 54.7												
Natural Cycle: 60												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.84												
Intersection Signal Delay: 13.4							Intersection LOS: B					
Intersection Capacity Utilization 113.3%							ICU Level of Service G					
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 3: Happy & US Rt 7

					
ø2	ø4	ø6	ø4	ø6	ø8
39 s	21 s	21 s	21 s	21 s	21 s
39 s	21 s	21 s	21 s	21 s	21 s

### 2016 AM and PM Rodel Roundabout Analysis with 50% Confidence Level

17:6:04		ACRPC-RTE 7 AND EXCHANGE STREET						21		
E	(m)	4.50	4.20	4.50	4.20	TIME PERIOD		min	90	
L'	(m)	10.00	10.00	10.00	10.00	TIME SLICE		min	15	
V	(m)	3.90	3.60	3.90	3.60	RESULTS PERIOD		min	15 75	
RAD	(m)	25.00	25.00	25.00	25.00	TIME COST		\$/hr	15.00	
PHI	(d)	30.00	30.00	30.00	30.00	FLOW PERIOD		min	15 75	
DIA	(m)	40.00	40.00	40.00	40.00	FLOW TYPE		pcu/veh	PCU	
GRAD SEP		0	0	0	0	FLOW PEAK		am/op/pm	<b>AM</b>	
LEG NAME		PCU	FLOWS (1st exit 2nd etc...U)			FLOF	CL	FLOW RATIO		FLOW TIME
RTE 7 NA		1.05	003	631	267	0	1.00	<b>50</b>	0.75 1.125 0.75	15 45 75
EXCHANGE		1.05	035	004	035	0	1.00	<b>50</b>	0.75 1.125 0.75	15 45 75
RTE 7 SA		1.05	007	383	053	0	1.00	<b>50</b>	0.75 1.125 0.75	15 45 75
HAPPY EA		1.05	003	013	006	0	1.00	<b>50</b>	0.75 1.125 0.75	15 45 75
MODE 2										
FLOW		veh	858		70	422	21			
CAPACITY		veh	1244		717	1116	946		AVDEL	s 7.9
AVE DELAY		mins	0.16		0.09	0.09	0.06		L O S	A
MAX DELAY		mins	0.24		0.12	0.11	0.08		VEH HRS	3.0
AVE QUEUE		veh	2		0	1	0		COST	\$ 45.0
MAX QUEUE		veh	3		0	1	0			
F1mode	F2direct	F3peak	CtrlF3rev	F4fact	F6stats	F8econ	F9prnt	F10run	Es	

28:5:04		ACRPC-RTE 7 AND EXCHANGE STREET						13		
E	(m)	4.50	4.20	4.50	4.20	TIME PERIOD		min	90	
L'	(m)	10.00	10.00	10.00	10.00	TIME SLICE		min	15	
V	(m)	3.90	3.60	3.90	3.60	RESULTS PERIOD		min	15 75	
RAD	(m)	25.00	25.00	25.00	25.00	TIME COST		\$/hr	15.00	
PHI	(d)	30.00	30.00	30.00	30.00	FLOW PERIOD		min	15 75	
DIA	(m)	40.00	40.00	40.00	40.00	FLOW TYPE		pcu/veh	PCU	
GRAD	SEP	0	0	0	0	FLOW PEAK		am/op/pm	PM	
LEG NAME		PCU	FLOWS (1st exit 2nd etc...U)			FLOF	CL	FLOW RATIO		FLOW TIME
RTE 7 NA		1.08	180	504	7 0	1.00	50	0.75 1.125 0.75	15 45 75	
EXCHANGE		1.08	107	24 268	0	1.00	50	0.75 1.125 0.75	15 45 75	
RTE 7 SA		1.08	0 690	50 0		1.00	50	0.75 1.125 0.75	15 45 75	
HAPPY EA		1.03	7 17	3 0		1.00	50	0.75 1.125 0.75	15 45 75	
MODE 2										
FLOW	veh		640	369	685	26				
CAPACITY	veh		1210	898	1089	675	AVDEL s 7.5			
AVE DELAY	mins		0.10	0.11	0.15	0.09	L O S A			
MAX DELAY	mins		0.14	0.16	0.22	0.12	VEH HRS 3.6			
AVE QUEUE	veh		1	1	2	0	COST \$ 53.5			
MAX QUEUE	veh		1	1	2	0				

# 2016 AM and PM Rodel Roundabout Analysis with 85% Confidence Level

17:6:04		ACRPC-RTE 7 AND EXCHANGE STREET						22				
E	(m)	4.50	4.20	4.50	4.20	TIME PERIOD			min	90		
L'	(m)	10.00	10.00	10.00	10.00	TIME SLICE			min	15		
V	(m)	3.90	3.60	3.90	3.60	RESULTS PERIOD			min	15 75		
RAD	(m)	25.00	25.00	25.00	25.00	TIME COST			\$/hr	15.00		
PHI	(d)	30.00	30.00	30.00	30.00	FLOW PERIOD			min	15 75		
DIA	(m)	40.00	40.00	40.00	40.00	FLOW TYPE			pcu/veh	PCU		
GRAD	SEP	0	0	0	0	FLOW PEAK			am/op/pm	<b>AM</b>		
LEG NAME		PCU	FLOWS (1st exit 2nd etc...U)			FLOF	CL	FLOW RATIO			FLOW TIME	
RTE 7 NA		1.05	003	631	267	0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
EXCHANGE		1.05	035	004	035	0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
RTE 7 SA		1.05	007	383	053	0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
HAPPY EA		1.05	003	013	006	0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
MODE 2												
FLOW		veh	858	70	422	21						
CAPACITY		veh	1108	582	981	811	AVDEL			s	12.0	
AVE DELAY		mins	0.26	0.12	0.11	0.07	L O S				B	
MAX DELAY		mins	0.42	0.16	0.15	0.10	VEH HRS				4.6	
AVE QUEUE		veh	4	0	1	0	COST			\$	68.6	
MAX QUEUE		veh	5	0	1	0						
F1mode	F2direct	F3peak	CtrlF3rev	F4fact	F6stats	F8econ	F9prnt	F10run	Esc			

17:6:04		ACRPC-RTE 7 AND EXCHANGE STREET						23			
E	(m)	4.50	4.20	4.50	4.20	TIME PERIOD			min	90	
L'	(m)	10.00	10.00	10.00	10.00	TIME SLICE			min	15	
V	(m)	3.90	3.60	3.90	3.60	RESULTS PERIOD			min	15 75	
RAD	(m)	25.00	25.00	25.00	25.00	TIME COST			\$/hr	15.00	
PHI	(d)	30.00	30.00	30.00	30.00	FLOW PERIOD			min	15 75	
DIA	(m)	40.00	40.00	40.00	40.00	FLOW TYPE			pcu/veh	PCU	
GRAD	SEP	0	0	0	0	FLOW PEAK			am/op/pm	<b>PM</b>	
LEG NAME		PCU	FLOWS (1st exit 2nd etc...U)			FLOF	CL	FLOW RATIO			FLOW TIME
RTE 7 NA		1.08	180	504	7 0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
EXCHANGE		1.08	107	24	268 0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
RTE 7 SA		1.08	0	690	50 0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
HAPPY EA		1.03	7	17	3 0	1.00	<b>85</b>	0.75	1.125	0.75	15 45 75
MODE 2											
FLOW		veh	640	369	685	26					
CAPACITY		veh	1079	766	957	537			AVDEL	s	10.6
AVE DELAY		mins	0.14	0.15	0.23	0.12			L O S		B
MAX DELAY		mins	0.19	0.22	0.37	0.16			VEH HRS		5.1
AVE QUEUE		veh	1	1	3	0			COST	\$	76.2
MAX QUEUE		veh	2	1	4	0					
F1mode	F2direct	F3peak	CtrlF3rev	F4fact	F6stats	F8econ	F9prnt	F10run	Esc		

# U.S. 7 / EXCHANGE STREET INTERSECTION TRAFFIC & SAFETY IMPROVEMENT MIDDLEBURY, VT

- Sight Distance Summary -

**Stopping Sight Distance (SSD) = brake reaction distance + braking distance**

brake reaction distance = distance traversed by the vehicle from the instant the driver sees an object until the brakes are applied

braking distance = the distance needed to stop the vehicle from the instant brake application

Stopping Sight Distance @ 50 mph = 425'

With a 3% downgrade = **446'**

Stopping Sight Distance @ 40 mph = 305'

(With a 3% downgrade = 315') n/a

**Decision Sight Distance (DSD) = the sight distance needed for a driver to detect an unexpected or otherwise difficult-to-perceive information source or condition in a roadway environment that may be visually cluttered, recognize the condition or its potential threat, select an appropriate speed and path, and initiate and complete the maneuver safely and efficiently.**

50 mph

Stop on rural road = 465'

Stop on urban road = 910'

40 mph

Stop on rural road = 330'

Stop on urban road = 690'

**Intersection Sight Distance (ISD) = Case B1 = Left Turn From Stop on Minor Road**  
**Case B = Intersections with Stop Control on the Minor Road**

Intersection Sight Distance @ 50 mph = **555'**

Intersection Sight Distance @ 40 mph = 445'

NOTE: ISD from a turn on stop should equal the SSD of the other vehicle to have sufficient sight distance to anticipate and avoid collisions.

NOTE: Intersection sight distances should exceed stopping sight distance along major road.

**Therefore, 555' (ISD) should equal or exceed 446' (SSD).**



# ***Appendix D – Conceptual Cost Estimates***

## **Middlebury – Exchange Street Cost Estimate Assumptions**

**Project Number 6330030**

**Middlebury, VT**

Written by: MBL, August 3, 2004

Checked by: SRZ, August 10, 2004

### **1. US Rt. 7/Exchange St./Happy Hollow Rd. Roundabout**

Length = 300 ft (south)

Length = 200 ft (north)

Length = 200 ft (east-west)

#### Common excavation

- It is assumed that 4' (48") will be excavated on the southern approach for the entire 300' length. Assume 21" of excavation and 8" of excavated pavement for southern approach, the Roundabout area, and the Eastern approach. 29" will be excavated for all earth areas to accommodate for the roundabout construction. Full reconstruction will occur for the Roundabout area, the southern approach (300') and the eastern approach (120').

- For the northern approach, the 200' island will be boxcut. The road will remain as is. The East and West approach islands will be reconstructed with the roundabout area.

Pavement removal - assume the eastern approach pavement is fully removed, reconstructed, graded and paved over, 120' length.

Gravel backfill - assume each quadrant has fill added to it.

Grading - it is assumed that all areas being reconstructed or excavated will need grading. Also in this estimate is grading on each of the shoulders where new topsoil will be placed.

Stone - assume stone will be placed on the reconstructed eastern approach and the new widened roadway areas for the west approach.

Emulsified asphalt - will be located over the entire project area at approximately 2" depth.

Bit pavement - will be located over the east approach and west widened areas.

Curbing will be assumed as follows:

- Sloped Granite Curbing at the truck apron and the corners

- Vertical Granite Curbing on the inside of the roundabout and at the islands.

Assume 2 new drainage pipe extensions (32" dia.) and 2 new headwalls under the roundabout.

The truck apron will be 8" depth of stamped concrete.

4" Topsoil will be assumed. Grading along with seeding, fertilizing and topsoil will extend out to 30' from edge of roadways.

## **2. US Rt. 7/Exchange St./Happy Hollow Rd. Intersection - Widened Roadways and Signalization**

Length = 150 ft (north-south)

Length = 300 ft (west)

Length = 225 ft (east)

Common excavation - assume none on North and South approaches, 21" on the East Approach with 8" pavement removal and 29" ~7.5' either side of the western approach for the widened roadway. It is assumed that 29" of the existing grassy areas at the intersection corners will be excavated to accommodate for the intersection expansion construction. The 29" includes 5" pavement, and an 18" gravel base. The east approach is widened approximately 10'

Pavement removal - assume the eastern approach is fully reconstructed, graded and paved over.

Gravel backfill - assume each quadrant but the SE area has fill added to it. Also, the west approach, southern area requires regarding of this sloped ditch area.

Grading - it is assumed that all areas being reconstructed or excavated will need grading. Also in this estimate is grading on each of the shoulders where new topsoil will be placed.

Stone - assume stone will be placed on the reconstructed eastern approach and under the new widened roadway areas for the west approach.

Emulsified asphalt - will be located over the entire area at approximately 2" depth.

Bit pavement - will be located over the east approach and west widened areas.

Vertical granite curbing will be assumed as follows:

Vertical Granite Curbing at the NW corner of the intersection to define shoulders for trucks.

Assume 2 new drainage pipe extensions (32" dia., 15' long) and 2 new headwalls.

4" Topsoil will be assumed. Grading along with seeding, fertilizing and topsoil will extend out to 30' from edge of roadways.

## **3. US Rt. 7/Exchange St./Happy Hollow Rd. Intersection With New Signalization (1B)**

Assume same as intersection #2, other than the following:

Length = 120 ft (north)

Length = 150 ft (south)

Length = 300 ft (west)

Length = 120 ft (east)

East approach is not widened but it will be fully reconstructed.

Assume new drainage pipe extensions for both sides, for cost estimation only.

The southeastern and northeastern corners will not be widened; the radius will remain as is.

**US Rt 7 - Exchange St. Intersection**
**Project Number 6330030**

Calculated by: GAE Sept 27, 2004

Checked by: SRZ Aug 10 2004

**Intersection Alternatives**
**Middlebury, VT**
**8/10/2004**

NOTE: Property Impacts, ROW acquisition, and design services not included.

<b>Signalized Intersection with Widened Roadways</b>					
<b>Item</b>	<b>Pay Item</b>	<b>Units</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Total Cost</b>
<b>Removal Items</b>					
Common Excavation	203.15	CY	\$ 10	893	\$ 8,930
Pavement Removal	203.28	CY	\$ 15	89	\$ 1,335
<b>New Items</b>					
Gravel Backfill for Slope Stabilization	203.35	CY	\$ 12	1067	\$ 12,804
Fine Grading - Subbase	203.4	SY	\$ 1	6539	\$ 6,539
Subbase of DGC Stone	301.35	CY	\$ 16	686	\$ 10,976
Emulsified Asphalt	404.65	Ton	\$ 30	497	\$ 14,910
Bituminous Pavement	406.25	Ton	\$ 45	431	\$ 19,395
Vertical Granite Curb	616.21	LF	\$ 25	100	\$ 2,500
Traffic Signals	-	lump sum	-	1	\$ 150,000
<b>New Additional Items</b>					
Pavement Markings: Street (White)	708.08	LF	\$ 1.50	1960	\$ 2,940
Pavement Markings: Street (Yellow)	708.08	LF	\$ 1.50	3180	\$ 4,770
Pavement Markings: Symbols	646.5	each	\$ 51	7	\$ 357
Pavement Markings: Stop Bars	646.46	LF	\$ 4	90	\$ 360
Topsoil	651.35	CY	\$ 30	400	\$ 12,000
Seed, Fertilizer and Mulch	NA	30% topsoil cost	NA	NA	\$ 3,960
Landscaping	NA	total	\$ 5,000	1	\$ 5,000
Headwalls	NA	EA	\$ 2,000	2	\$ 4,000
32" CMP Pipe	601	LF	\$ 60.00	15	\$ 900
<b>Intersection A</b>					
Subtotal				\$	261,676
Mobilization (10%)				\$	26,168
Contingency (25%)				\$	65,419
<b>Total</b>				<b>\$</b>	<b>353,000</b>
2006 Construction Adj. (10%)				\$	35,300
<b>Total</b>				<b>\$</b>	<b>388,000</b>
<b>Say</b>				<b>\$</b>	<b>400,000</b>
<b>Preliminary Engineering</b>				<b>\$</b>	<b>60,000</b>
<b>R.O.W.</b>				<b>\$</b>	<b>20,000</b>
<b>Total</b>				<b>\$</b>	<b>480,000</b>

NOTE: Property Impacts, ROW acquisition, and design services not included.

Roundabout					
Item	Pay Item	Units	Unit Cost	Quantity	Total Cost
<b>Removal Items</b>					
Common Excavation	203.15	CY	\$ 10	3131	\$ 31,310
Pavement Excavation	203.28	CY	\$ 15	607	\$ 9,105
<b>New Items</b>					
Gravel Backfill for Slope Stabilization	203.35	CY	\$ 12	1263	\$ 15,156
Fine Grading - Subbase	203.4	SY	\$ 2	10803	\$ 21,606
Subbase of DGC Stone	301.35	CY	\$ 16	1960	\$ 31,360
Emulsified Asphalt	404.65	Ton	\$ 30	530	\$ 15,900
Bituminous Pavement for Road	406.25	Ton	\$ 45	740	\$ 33,300
4' Pav't Behind Curbing	406.25	Ton	\$ 40	46	\$ 1,840
Sloped Granite Curb	616.20	LF	\$ 20	658	\$ 13,160
Vertical Granite Curb	616.21	LF	\$ 25	1173	\$ 29,325
Truck Apron: Stamped Concrete	618.11	SY	\$ 30	471	\$ 14,130
<b>New Additional Items</b>					
Pavement Markings: Street (White)	708.08	LF	\$ 1.50	2060	\$ 3,090
Pavement Markings: Street (Yellow)	708.08	LF	\$ 1.50	3680	\$ 5,520
Pavement Markings: Triangles	SRZ #	EA	\$ 34	24	\$ 816
Topsoil	651.35	CY	\$ 30	843	\$ 25,290
Seed, Fertilizer and Mulch	NA	30% topsoil cost	NA	NA	\$ 8,346
Landscaping	-	total	\$ 20,000	1	\$ 20,000
Headwalls	NA	EA	\$ 4,000	2	\$ 8,000
32" CMP Pipe	601	LF	\$ 60.00	70	\$ 4,200
Lighting	-	EA	\$ 2,000.00	12	\$ 24,000
Misc (10%)					\$ 50,000
<b>Roundabout</b>					
Subtotal				\$	365,454
Mobilization (10%)				\$	36,545
Contingency (25%)				\$	91,363
<b>Total</b>				<b>\$</b>	<b>493,000</b>
2006 Construction Adj. (10%)				\$	49,300
<b>Total</b>				<b>\$</b>	<b>542,000</b>
<b>Say</b>				<b>\$</b>	<b>550,000</b>
<b>Preliminary Engineering</b>				<b>\$</b>	<b>100,000</b>
<b>R.O.W. (3/4 acre)</b>				<b>\$</b>	<b>60,000</b>
<b>Total</b>				<b>\$</b>	<b>710,000</b>



# ***Appendix E – Draft Scoping Study Comments***

**Edwards, Greg**

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**From:** Zehler, Stephanie  
**Sent:** Wednesday, September 22, 2004 9:45 AM  
**To:** Edwards, Greg  
**Subject:** FW: US 7/ Exchange Street scoping study

Comments from Dick Hosking regarding US7/Exchange Street, below.

-----Original Message-----

**From:** Benjamin, Tammy [mailto:Tammy.Benjamin@state.vt.us]  
**Sent:** Tuesday, September 21, 2004 2:58 PM  
**To:** Zehler, Stephanie  
**Cc:** Garrett Dague  
**Subject:** FW: US 7/ Exchange Street scoping study

Here are the District Transportation Administrator's comments.

Garrett, I plan on attending the public meeting and will let you know what other VTrans personnel may be attending.

-----Original Message-----

**From:** Hosking, Dick  
**Sent:** Tuesday, September 21, 2004 11:15 AM  
**To:** Benjamin, Tammy; Perkins, John  
**Cc:** Dill, David; Scott, David; Allen, Chad  
**Subject:** US 7/ Exchange Street scoping study

I have reviewed the Scoping Study and offer the following comments from the Operations side.

**Signals**

Under the disadvantages, it is stated that "Continuous maintenance is required for the traffic signal". This is misleading. Our new designs using mast arms and LED signal faces have reduced our maintenance requirements tremendously.

**Roundabouts**

Add the following under disadvantages

- Winter Maintenance costs for a roundabout can be significantly higher than a conventional intersection. Snow removal in the storm requires that the plow vehicle to circle through the roundabout moving snow to the right which then plugs the intersecting legs which then must be cleaned out. The roundabout will add 10 - 15 minutes to the time to complete a route. This may reduce the level of service on the remaining parts of the route. Snow removal after the storm may require the removal of snow with loaders and trucks. Snow removal during heavy snow events may require the deployment of special equipment which is located on the other side of town.
- Placing a 20 MPH roundabout in a 50 MPH zone is not desirable.
- Educating drivers on how to use a roundabout is a challenge. Most motorists may feel that US 7 has the right of way when in fact it is the vehicle in the roundabout that has the right of way.

9/29/2004

**In my opinion, the introduction of a roundabout at this location should only be done if the Class 1 section of US 7 is extended to the north to include this intersection.**



## Edwards, Greg

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**From:** Benjamin, Tammy [Tammy.Benjamin@state.vt.us]  
**Sent:** Wednesday, September 29, 2004 1:56 PM  
**To:** Edwards, Greg  
**Cc:** Garrett Dague  
**Subject:** FW: Rt. 7/Exchange St. alternatives

Greg, these are other comments by VTrans, too.

-----Original Message-----

**From:** Perkins, John  
**Sent:** Thursday, July 08, 2004 2:20 PM  
**To:** Benjamin, Tammy  
**Cc:** Nyquist, Bruce; Byrne, Bernard  
**Subject:** RE: Rt. 7/Exchange St. alternatives

Is a signal warranted at this location? This location is almost a mile from Middlebury compact limits in a 50 MPH zone. This intersection is too far out to function as a Gateway.

If signal is warranted it should be fully actuated and all left turns will run on a protective phase. The signal shall not be placed on flash during off peak times. The tree clearing on the SW approach is excessive as this signal will not run on flash during off peak times.

You need to state how many acres of wetland will be affected in the roundabout option. The RAB needs to be designed for oversized loads and a WB 67 vehicle as US 7 is a truck rte and our oversized load rte.

We need to see a book on this proposed project.

## Edwards, Greg

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**From:** Benjamin, Tammy [Tammy.Benjamin@state.vt.us]  
**Sent:** Wednesday, September 29, 2004 1:58 PM  
**To:** Edwards, Greg  
**Cc:** Garrett Dague  
**Subject:** FW: Exchange St. Mtg. Minutes August 10th

Greg, another comment made earlier on.

-----Original Message-----

**From:** Perkins, John  
**Sent:** Wednesday, September 01, 2004 10:17 AM  
**To:** Benjamin, Tammy  
**Subject:** RE: Exchange St. Mtg. Minutes August 10th

They have something written and we need to see it. I believe that I have seen pieces of it. The cost at 200 K for the RAB is not the 800K we would estimate. This is also a 50MPH zone that is not appropriate for a RAB.

9/29/2004



**Edwards, Greg**

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**From:** Benjamin, Tammy [Tammy.Benjamin@state.vt.us]  
**Sent:** Wednesday, September 29, 2004 1:58 PM  
**To:** Edwards, Greg  
**Cc:** Garrett Dague  
**Subject:** FW: US 7/Exchange Street Intersection Alternatives

Another one. I'm sorry, I should have put these all together for you.

-----Original Message-----

**From:** Perkins, John  
**Sent:** Wednesday, September 15, 2004 9:31 AM  
**To:** Benjamin, Tammy; Nyquist, Bruce  
**Subject:** RE: US 7/Exchange Street Intersection Alternatives

I gave the book to Bruce.

The intersections as designed are way too wide. A WB 67 should be able to get around a 60 foot radius coming from a 12 foot lane and 8 foot shoulder. Move stop bars up. Guard rail for the signal post is needed and is not a problem.

Need to look at pavement limits, if you are not doing anything you don't need to repave.

Emulsified asphalt is a fog coat on existing pavement of .02 gal /sy.

Need to look at ROW costs with RAB. With splitter island to south it looks like you limit access to properties on SW to right in right out.

-----Original Message-----

**From:** Benjamin, Tammy  
**Sent:** Wednesday, September 15, 2004 8:39 AM  
**To:** Perkins, John  
**Subject:** US 7/Exchange Street Intersection Alternatives

Hi John. Any other comments on the report?