

DICKINSON STREET ALTERNATIVES ANALYSIS



- Prepared for:
Town of Jericho

- Submitted by:
Resource Systems Group
October 2007



R | S | G INC.
RESOURCE SYSTEMS GROUP, INC.

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INTRODUCTION

The Dickinson Street Alternatives Analysis study was conducted to evaluate the preliminary feasibility of improving Dickinson Street to accommodate two-way vehicular traffic as envisioned in the Underhill Flats planning charrette.

This report was prepared by Resource Systems Group, Inc for the Town of Jericho as part of a technical assistance grant awarded to the Town by the Chittenden County Metropolitan Planning Organization (CCMPO). The study findings will be used by the Town as part of their future planning and redevelopment of the Underhill Flats area.

The study included review of the existing traffic conditions along Dickinson Street and at the two termini at VT Route 15 and River Road. Traffic volumes were projected out to 2021 using a 15-year analysis period. The roadway alternatives developed were evaluated under the future traffic conditions. Public comments were obtained on the roadway alternatives at a public meeting and are included in the study report.

The Dickinson Street Alternatives study report is divided into the following sections:

This report contains the following major sections:

- Introduction and study area overview;
- Existing highway and traffic conditions;
- Traffic projections;
- Improvement alternatives;
- Future conditions;
- Evaluation matrix; and
- Conclusions and Recommendations.

BACKGROUND & STUDY AREA OVERVIEW

The Dickinson Street study area is located along the northern edge of the Town of Jericho in the area considered part of, or associated with Underhill Flats. The two schools and the Deborah Rawson Memorial Library are located along the eastern edge of the study area on Steam Mill Road¹. VT 15 is on the western side of the study area. The study vicinity is shown in Figure 1.

¹ Steam Mill Road was the former name of the segment of road between VT 15 and the Dickinson/River Road intersection. It has since been called simply River Road. For the ease of description in this study this segment will be referred to as Steam Mill Road.



Currently, the predominant flow of traffic between River Road and VT 15 uses Steam Mill Road and its intersection with VT 15. Dickinson Street is currently one-way from VT 15 towards River Road and is used by a small amount of traffic.

As Figure 1 demonstrates, Dickinson Street has the same alignment as River Road. The goal of the traffic pattern change to allow two-way traffic on Dickinson Street is to redirect through trips¹ between River Road and VT 15 from Steam Mill Road onto Dickinson Street. The overall concept was identified in an April 2006 design charrette organized by the Towns of Jericho and Underhill and consisted of:

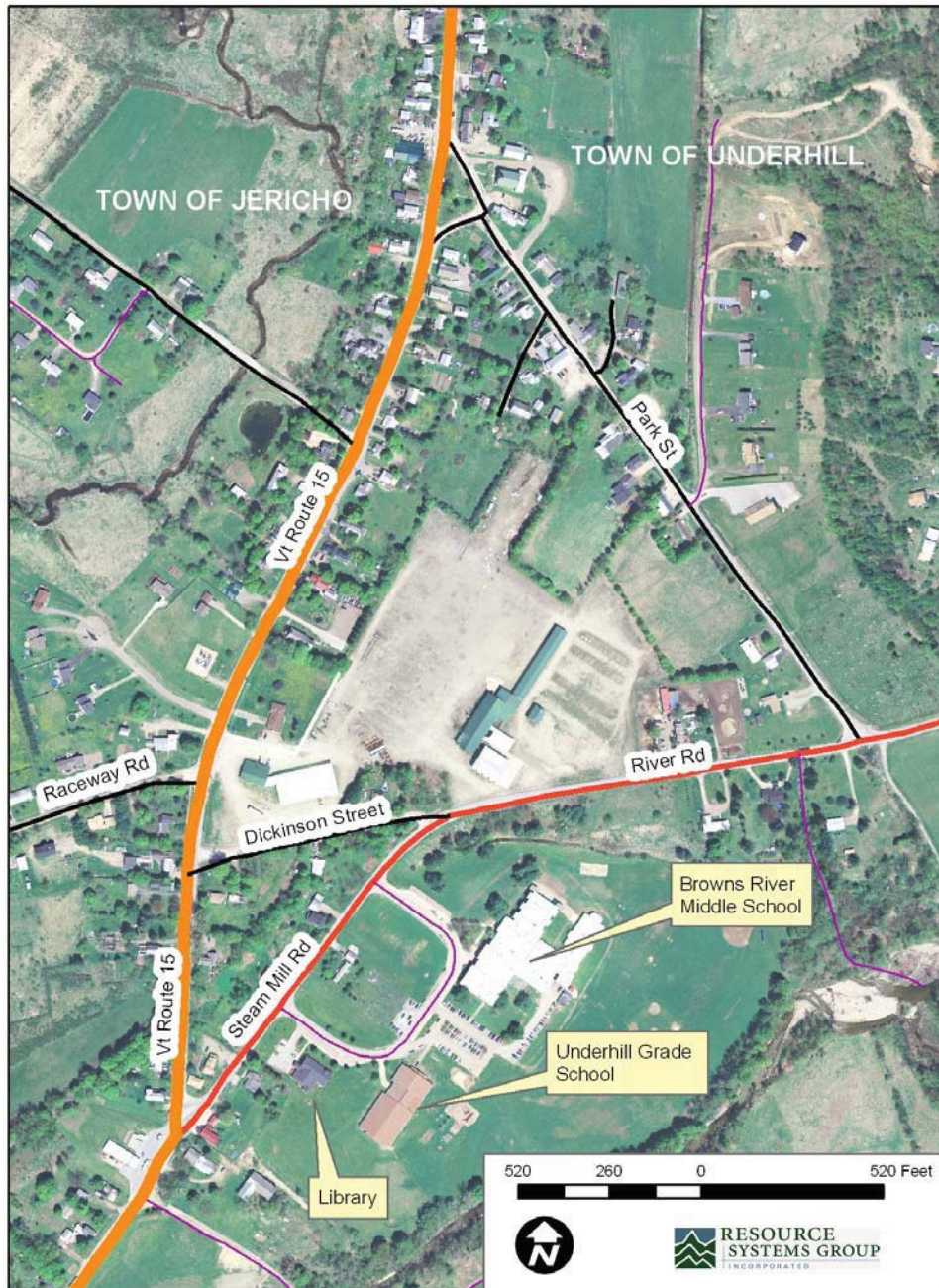
- Allowing two-way traffic on Dickinson Street;
- Aligning Dickinson Street with River Road to create a direct connection to VT 15 for through traffic; and
- Realigning the River Road-Steam Mill Road intersection. The purpose of this change is to make Steam Mill Road a minor street approach designed in a manner that allows access to the school, library, and homes while discouraging through traffic between VT 15 and River Road.

Figure 1 also shows the Villeneuve property which occupies most of the land between Park Street, River Road, Dickinson Street, and VT 15. During the Charrette, several teams focused on development options for the Villeneuve property. All of the concepts included a mix of residential, retail, and commercial development, a network of internal streets, and the alignment of Dickinson Street with River Road to provide a direct connection to VT 15 for through traffic. The alternatives presented in this study are designed to accommodate traffic generated from the assumed development on the Villeneuve property, as well as background growth, and other developments in Jericho identified in the 2004 Jericho Transportation Study.

¹ Through Trips refer to the vehicles that pass through the study area without beginning or ending their trip within the study area.



Figure 1: Study Area



EXISTING CONDITIONS

This section describes the highway and traffic conditions found within the study area.



ROADWAY CONDITIONS

Dickinson Street is a one-way (eastbound), narrow dirt road (approximately 15 feet wide) connecting VT 15 on the west and the Steam Mill Road/River Road intersection on the east. A wide asphalt sidewalk connects from the schools, across Steam Mill Road at the Dickinson Street intersection, across Dickinson, and then proceeds east along the north side of River Road. There are no pedestrian facilities along Dickinson Street. Dickinson Street is shown in Figure 2.

Figure 2: Dickinson Street (Looking East)



Steam Mill Road and River Road are 24 foot wide two-way paved rural collectors. The shoulder widths do not meet state standards to accommodate bicycle travel. Figure 3 shows River Road from the intersection of Dickinson Street.



Figure 3: River Road (Looking East)

FUNCTIONAL CLASS

The Federal Highway Administration's roadway functional classification system is organized as a hierarchy of facilities, based on the degree to which the roadway serves mobility and access to adjacent land uses. As shown in Figure 4, freeways and interstate highways, at the top of the hierarchy, are devoted exclusively to vehicle mobility, with no direct access to adjacent land. Arterials and Collectors provide both mobility and access to adjacent land uses. The local road system is devoted exclusively to providing local access, with limited capacity and relatively slow speeds.

Figure 5 shows the functional classification for the roadways in the study area. VT 15 is classified as a rural minor arterial. Steam Mill Road and River Road are both classified as a major rural collector. Dickinson Street is classified as a rural local road.

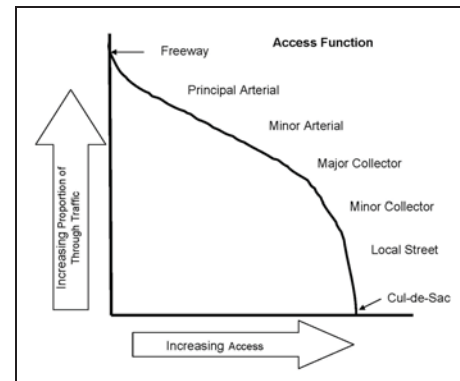
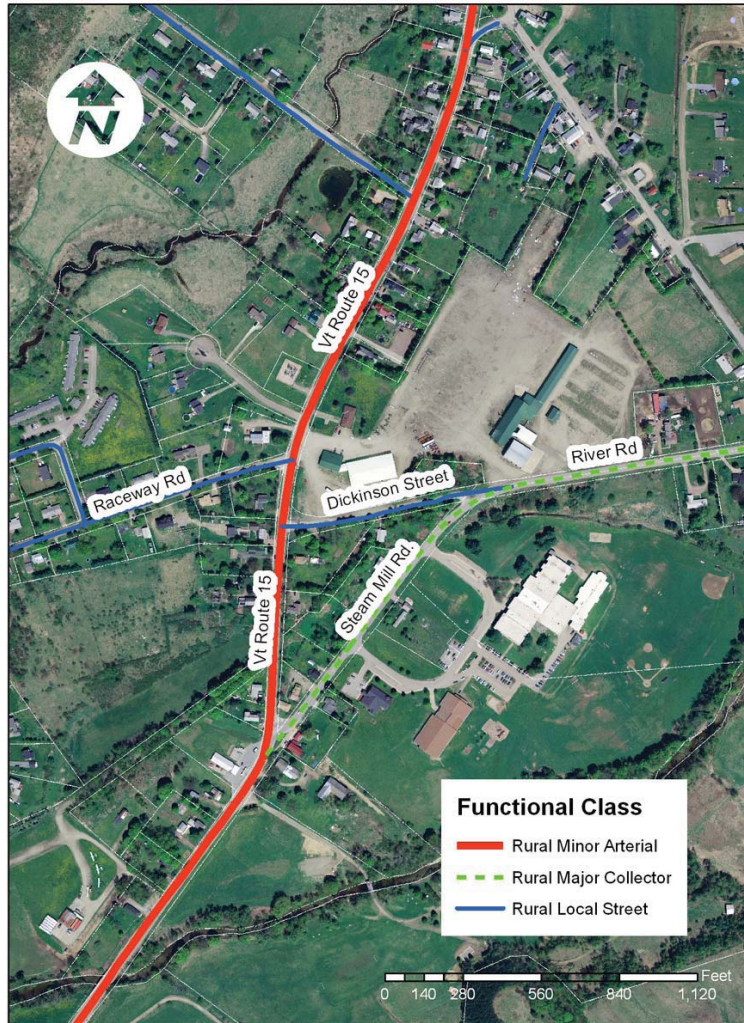
Figure 4: Conceptual Roadway Functional Hierarchy

Figure 5: Functional Class of Study Roads



Functional class is used to determine the design characteristics of highways and streets. Design elements such as lane and shoulder widths, vertical and horizontal grades, and access to adjacent land use are all included in the Vermont State Standards for Roads and Streets.

Table 1 highlights some of the primary design elements used in the Dickinson Street roadway alternatives evaluation.



Table 1: Design Parameters for Study Roads¹

Design Feature	Rural Minor Arterial	Rural Collector	Rural Local Roads
<i>Design Speeds</i>	30-55 mph, occasionally 25 mph	25-50 mph	25-50 mph
<i>Lane Widths</i>	11-12 feet 11 ft used primarily. 12 ft used only when speeds are 55 mph.	9 - 11 feet 11 ft used when ADT is greater than 2,000	7-11 feet 9 foot lane widths are suggested for ADT of 400 to 1500
<i>Shoulder Widths</i>	Varies from 3 to 5 ft depending on ADT. 5 ft when ADT exceeds 4,000.	2 ft minimum. 3 ft when ADT exceeds 1,500.	2 foot shoulder is suggested for the highway with ADT of 400 to 1500
<i>Minimum Shoulder Widths to Accommodate Bicycle Travel</i>	2 ft minimum. 3 ft and 4 ft used when ADT exceeds 4,000 depending on speed.	2 ft minimum, 3 ft recommended when ADT exceeds 1,500.	Bicycle travel should be accommodated by the 2 foot shoulder without curbs for low speed, low volume streets.

Additional considerations in the design chosen for the Dickinson Street reconstruction include the proximity to the elementary and middle school and the desire to develop the Underhill Flats area into a mixed-use higher density village. Wider shoulders and the shared use path support the efforts of the Safe Routes to School program, while the 11 foot lanes discourage high travel speeds reinforcing a village setting.

Existing Vehicle Ground Counts and Design Hour Traffic Volumes

Resource Systems Group conducted traffic counts during the AM and PM peak hours at the VT 15 intersections with Steam Mill Road, Dickinson Street, and Raceway Road, and at the driveway to the Browns River Middle School on Wednesday October 11, 2006 from 3:00-6:00 PM and on Thursday, October 12, 2006 from 7:00-9:00 AM. School was in session on those days and a soccer game was going on during the afternoon count. Turning movements at the Dickinson Street intersection with River Road and Steam Mill Road were derived from the counts at the other intersections.

The ground counts have been increased by a factor of 1.068 for the PM peak and 1.095 for the AM peak to represent the 2006 design hour volume (DHV)². The design hour adjustment factors were estimated using the Alternative DHV Determination Method recommended by VTrans³. The adjustment factor is calculated by comparing the traffic from an intersection count to the design hour volume derived from a nearby automatic traffic recorder. The specific calculations are contained in Attachment B.

¹ Table derived from the VAOT State Standards, 22 October 1997.

² The DHV is the 30th highest hour of traffic for the year and is used as the design standard in Vermont.

³ Page 4-9, "Continuous Traffic Counter Grouping Study and Regression Analysis Based on 2005 Traffic Data"; Vermont Agency of Transportation Policy and Planning Division Traffic Research Unit; March 2006.



Traffic volume figures are included in the following section.

TRAFFIC PROJECTIONS

The alternatives analysis was prepared to assess future year 2021 conditions. This 15 year timeframe from the 2006 base analysis year was selected by the project steering committee. The projected traffic volumes account for:

- Regional background growth;
- Traffic from anticipated development in the Town of Jericho;
- Traffic from assumed development of the Villeneuve property; and
- The change in traffic pattern due to the realignment of Dickinson Street with River Road.

Each of the components is described in detail below.

Background Traffic Growth

Even if no development occurs in Underhill Flats or the Town of Jericho, traffic is expected to increase through the study area due to growth in surrounding towns and regions. A background growth factor of 1.19 was used to adjust the 2006 DHV volumes to 2021. The growth rate was applied to traffic entering and exiting the study area including growth at the schools and library along Steam Mill Road.

This factor represents the projected statewide average growth for rural primary and secondary highways and is specified in the 2005 VTrans *Continuous Traffic Counter Grouping Study and Regression Analysis*.

Traffic Growth from Anticipated Development in the Town of Jericho

The Town of Jericho conducted a town wide transportation study in 2004 that assumes 340 new homes and 200 new jobs will locate in the Town by 2015. These assumptions were developed at a joint meeting of the Jericho Selectboard and Planning Commission held during the summer of 2004¹. The new homes and jobs are spread throughout Town and include 25 new housing units and 50 new employees in Underhill Flats.

The growth in housing units and employment included in the 2004 Jericho Transportation Study for Underhill Flats has been assumed by RSG to occur on the Villeneuve property. The Villeneuve

¹ For additional detail on the growth assumptions, see Pages 37-39 in the "Town of Jericho Transportation Study"; November 30, 2004; prepared by RSG for the Town of Jericho. Available in electronic format on <http://www.ccmppo.org/communities/jericho/>



property is the large open area north of Dickinson Street. It is comprised of 3 individual parcels. The 2006 village design charrette considered the mixed-use development of the Villeneuve property.

To avoid double counting of the traffic assumed from the Villeneuve property (described in more detail below), the traffic generated by the 25 new homes and 50 employees has been subtracted from the trip generation attributed to the town wide growth assumptions. Attachment B shows how this adjustment has been made.

Villeneuve Property Trip Generation and Assignment

There are no formal plans or pending zoning applications at this time for the larger Villeneuve property. A restaurant has been proposed, for initial review by the Town, for one of the smaller Villeneuve parcels. For the purpose of this study, trip generation from the Villeneuve property is based on the development assumptions provided in Table 2. The amount of development shown was estimated by Trudell Consulting Engineers (TCE) based on the available acreage and is similar to the intensity put forth in some of the concepts developed during the Charrette held in April of 2006.

The Villeneuve property includes three lots (see adjacent figure). The development assumptions provided by TCE for Lot 1 included a low estimate of 15 dwelling units (per existing zoning) and a high estimate of 60 units. RSG conferred with the Town Planner who agreed that it was appropriate to assume the higher estimate of 60 units for use in this study.

Average trip generation rates from the Institute of Transportation Engineer's *Trip Generation 7th Edition* were applied to the development assumptions to estimate the amount of traffic entering and exiting each Villeneuve lot.



Table 2: Assumed Development and Trip Generation Estimate for the Villeneuve Property

AM PEAK HOUR

Lot	Description	Size	ITE Land Use Code	Trip Generation Rates			Trip Gen. - Vehicles/Hour		
				AM Rate	% In	% Out	AM-IN	AM-OUT	AM-Total
1	Single Family Homes	60 Dwelling Units	210	0.75	25%	75%	11	34	45
2	Restaurant	6.0 1,000 Square Ft.	932	11.52	52%	48%	36	33	69
3	Convenience Store & Gas Station	4.0 1,000 Square Ft.	853	45.58	50%	50%	91	91	182
3	Hardware/Paint Store	13.4 1,000 Square Ft.	816	1.08	50%	50%	7	7	14
Totals for AM							146	165	311

PM PEAK HOUR

Lot	Description	Size	ITE Land Use Code	Trip Generation Rates			Trip Gen. - Vehicles/Hour		
				PM Rate	% In	% Out	PM-IN	PM-OUT	PM-Total
1	Single Family Homes	60 Dwelling Units	210	1.01	63%	37%	38	22	61
2	Restaurant	6.0 1,000 Square Ft.	932	10.92	61%	39%	40	26	66
3	Convenience Store & Gas Station	4.0 1,000 Square Ft.	853	60.61	50%	50%	121	121	242
3	Hardware/Paint Store	13.4 1,000 Square Ft.	816	4.84	47%	53%	30	34	65
Totals for PM							230	204	433

Traffic generated by the assumed development on the Villeneuve property was distributed through the study intersections based on current traffic patterns in Underhill Flats. Table 3 shows the distribution of trips entering and exiting the Villeneuve property from points north, south, and east of Underhill Flats as shown in the schematic presented in Figure 6. The percentages in Table 3 were calculated from the ground counts conducted in October 2006 by RSG.

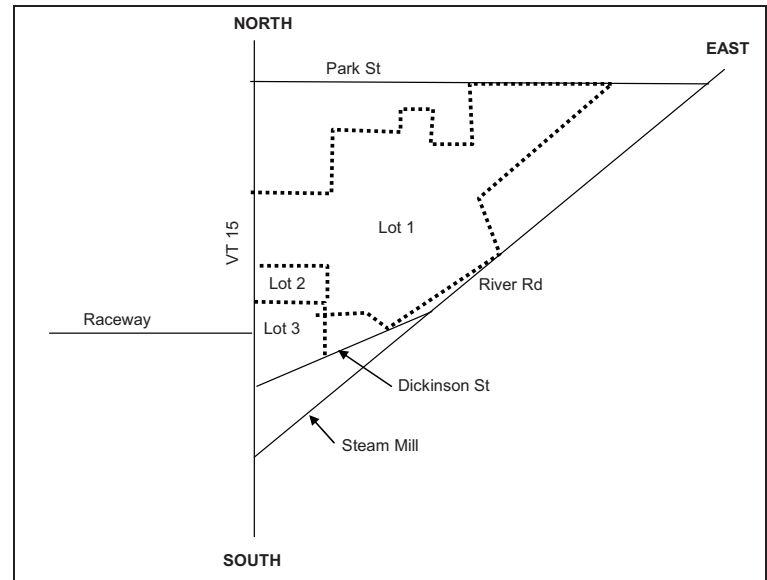
As an example, Table 3 indicates that during the PM peak hour, 70% of traffic entering the Villeneuve property would come from points south of Underhill Flats. The assignment assumes that the traffic will follow the shortest path from points south to Lots 1, 2, or 3. The distribution assignment of new trips assumes that Dickinson Street provides two-way traffic and that Steam Mill Road is not attractive for any trips to and from the Villeneuve property.



Table 3: Trip Distribution Assumptions

AM Distribution	Enter From	Exit To
North	55%	13%
South	26%	78%
East	19%	9%

PM Distribution	Enter From	Exit To
North	21%	45%
South	70%	35%
East	9%	20%

Figure 6: Traffic Assignment Network Schematic

Other key assumptions regarding the assignment of trips to and from the Villeneuve property are:

- Lot 1 will have access to Park Street and Dickinson Street. All trips between Lot 1 and points north and east of Underhill Flats are assigned to the Park Street access. All trips between Lot 1 and points south are assigned to the Dickinson Street access.
- Lot 2 will have one access point on VT 15. All trips between Lot 2 and points east are assigned on a route that follows Dickinson Street to the VT 15 access (rather than Park Street to the VT 15 access).
- Lot 3 will have full access to VT 15 and Dickinson Street. The assignment assumes that 75% of the traffic to and from the south will use the Dickinson Street access, and the balance will use the VT 15 access.

The assignment does not account for the effect of the internal road network suggested in all of the Charrette concept plans because its location within the Villeneuve property and its access points to the streets are not yet determined. In addition, no trip reductions have been applied for pass by trips or the benefits of mixed use development¹. Therefore the trip generation and assignment provides a

¹ Pass by trips occur at retail developments would reduce the trip generation of the hardware store, restaurant, and convenience store. Pass by trips exist on a roadway before a development occurs, but turn into the project once it is complete. As such, they do not add new trips to the adjacent roadways but do increase the number of vehicles entering and exiting an existing or proposed driveway. Mixed use developments tend to reduce overall vehicle trip generation because people can park in one



somewhat conservative (higher) estimate of the traffic added to the study area due to the assumed level of development.

Attachment B contains specific assignments for each lot during the AM and PM peak hours.

Diversion of Steam Mill Road Through Traffic to Dickinson Street

One of the goals of this project is to remove through traffic from Steam Mill Road which provides direct access to the Brown's River Middle School, public library, and several homes. Therefore, the traffic forecasts used in this study assume that all through traffic traveling between River Road and VT 15 will be diverted from Steam Mill Road to Dickinson Street.

This assumption is justified because (1) Dickinson Street provides a more direct route between VT 15 and River Road, (2) the intersection of VT 15 with Dickinson Street will be designed to accommodate the additional traffic at minimal delay, (3) the Steam Mill Road intersection with River Road will be reconfigured in a manner that allows access to the school, library, and homes, but does not provide the quickest route to VT 15, and (4) the Steam Mill Road intersection with VT 15 will not be improved or changed in way that reduce delay for vehicles. Future planning efforts may consider modifications to the VT 15 - Steam Mill Road intersection to further decrease through traffic.

Through traffic on Steam Mill Road was estimated using the traffic counts conducted in October of 2006 by RSG at the driveways to the Brown's Middle School and library. The amount of through traffic using Steam Mill Road was estimated by comparing the counts conducted at the VT 15-Steam Mill Road intersection and the traffic entering and exiting the school's driveways.

Attachment B shows the change in traffic volumes at each study intersection resulting from the diversion of through traffic from Steam Mill Road to Dickinson Street.

Final 2021 Design Traffic Volumes

Attachment B contains schematics that show specific turning movements and changes resulting from each of the steps described above. The following figures present the 2006 volumes as a reference point and the 2021 traffic volumes used to analyze and design the alternatives.

location and access several destinations, or do not need to use a car at all if the live in the development are close enough to walk or cycle to jobs, services, restaurants, etc.



Figure 7: 2006 AM Peak Hour – Existing Alignments and Traffic Pattern

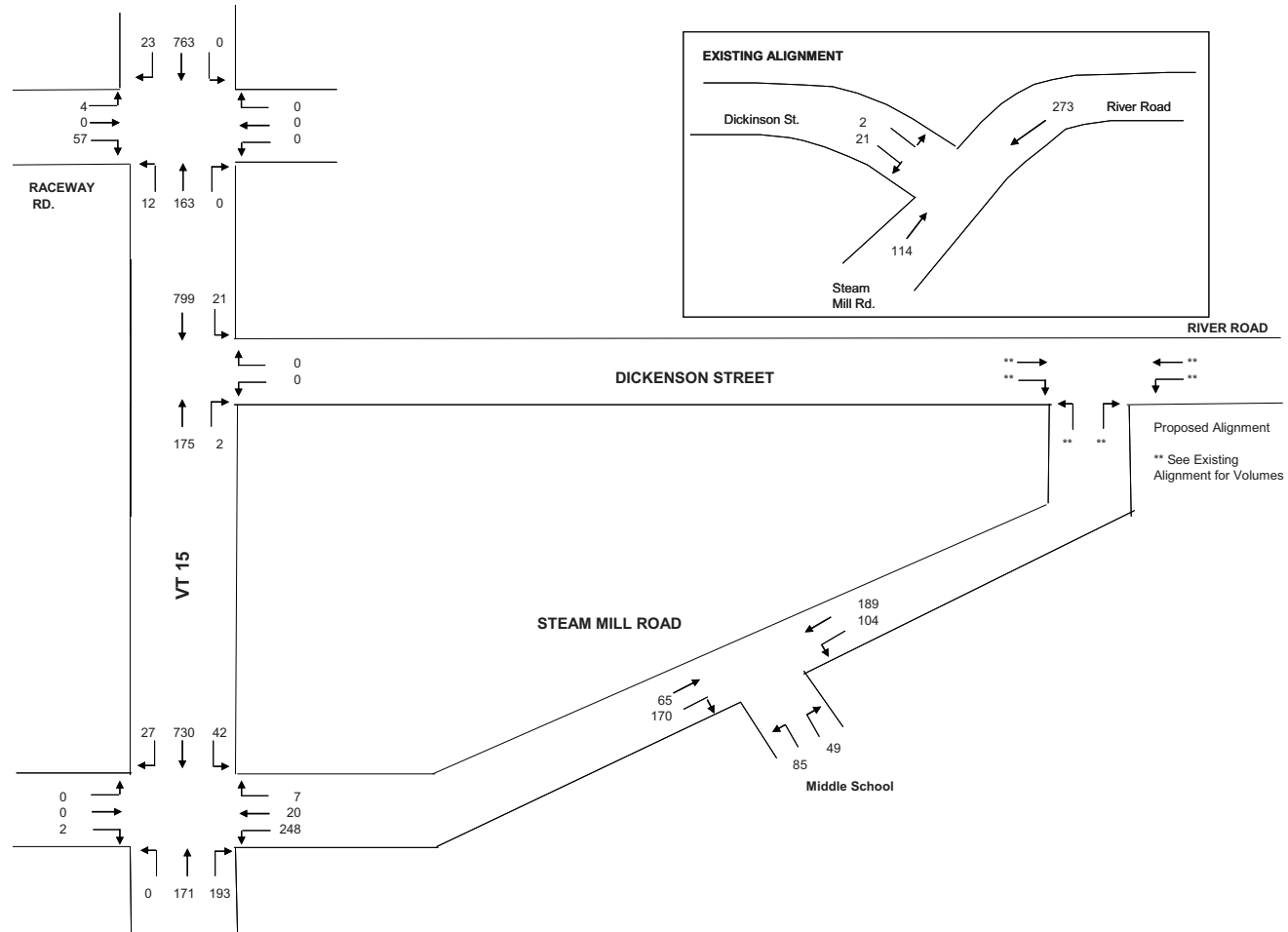


Figure 8: 2021 AM Design Volumes - Dickinson Street and Raceway Road Separate

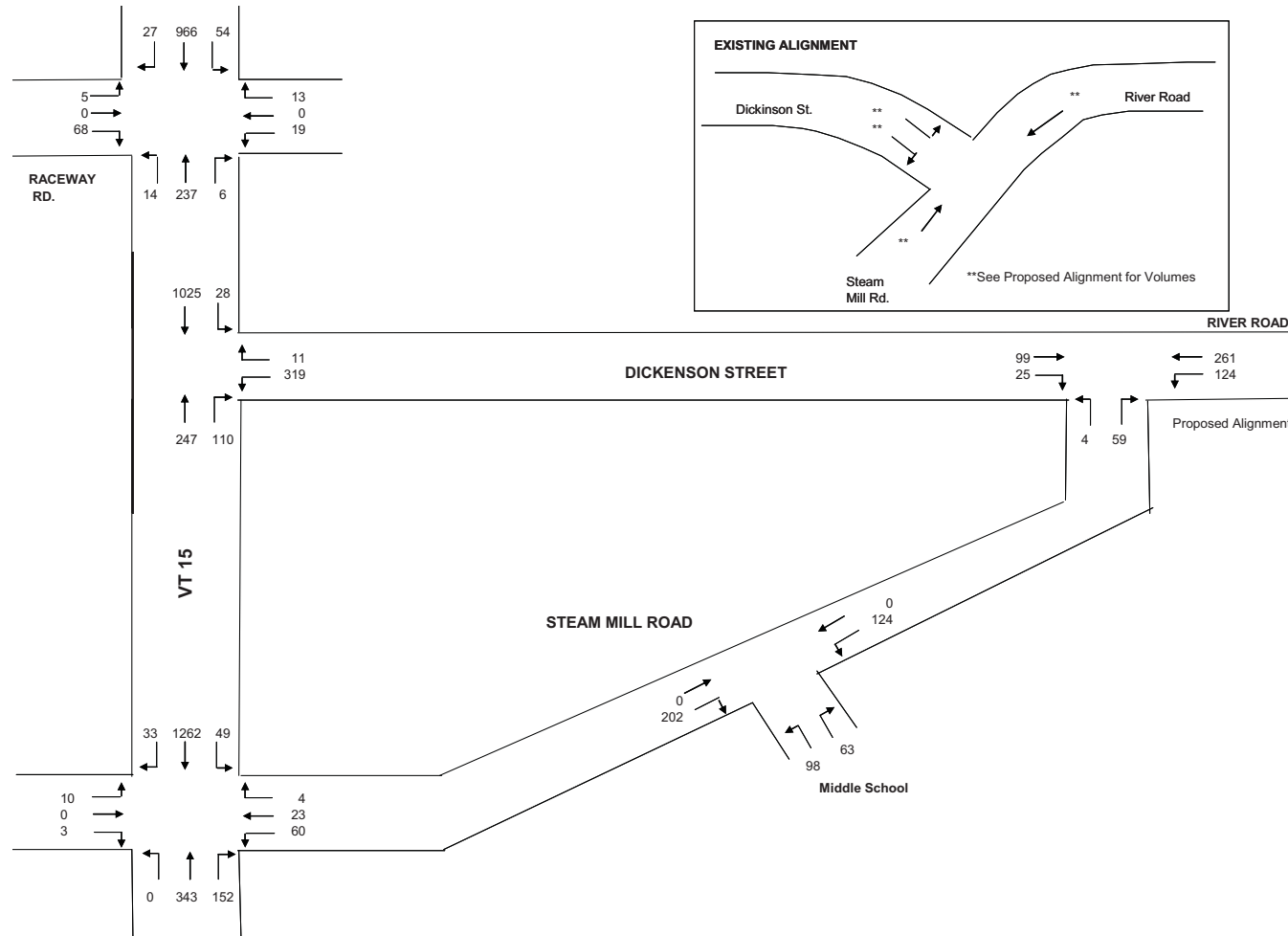


Figure 9: 2006 PM Peak Hour – Existing Alignments and Traffic Pattern

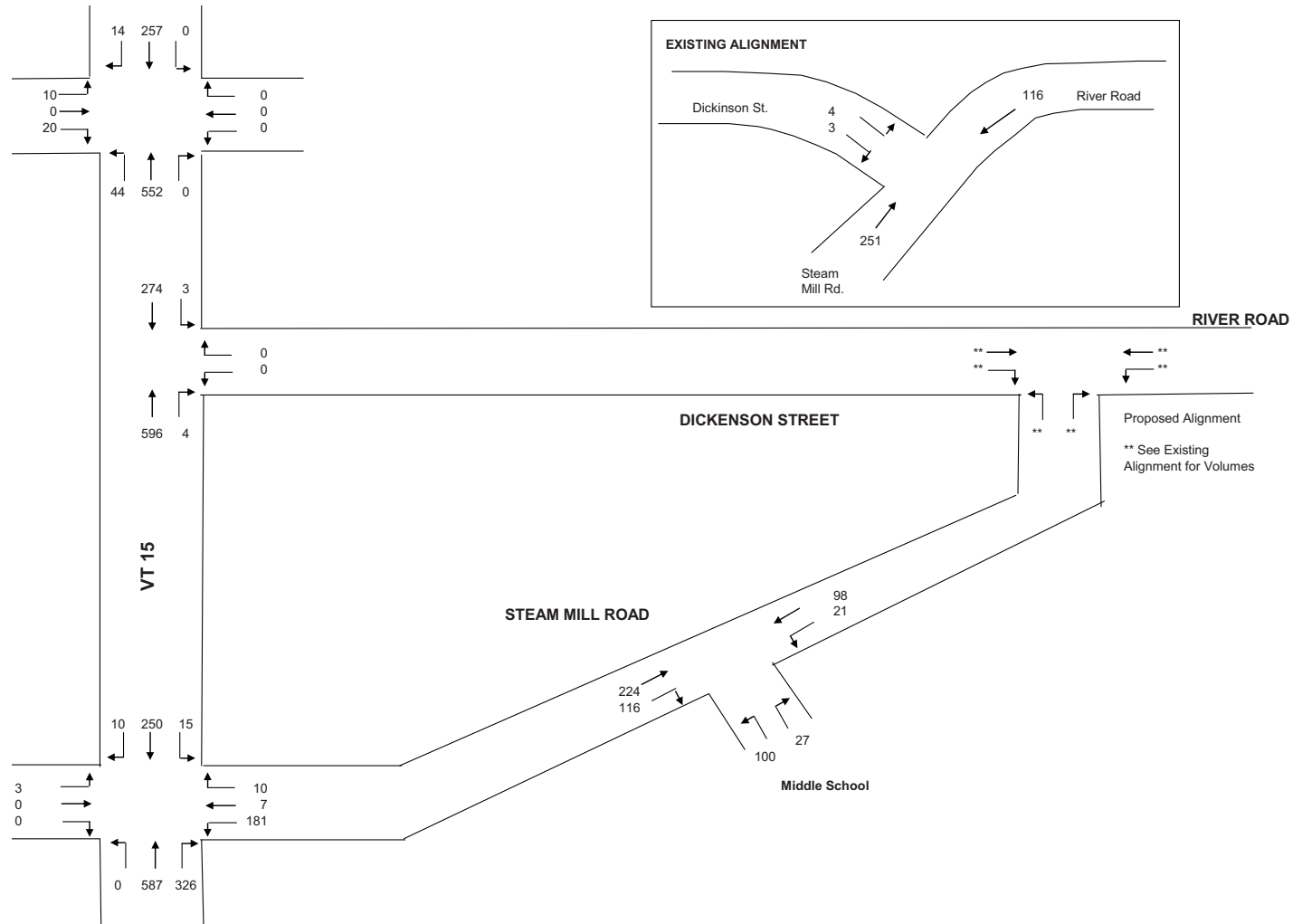
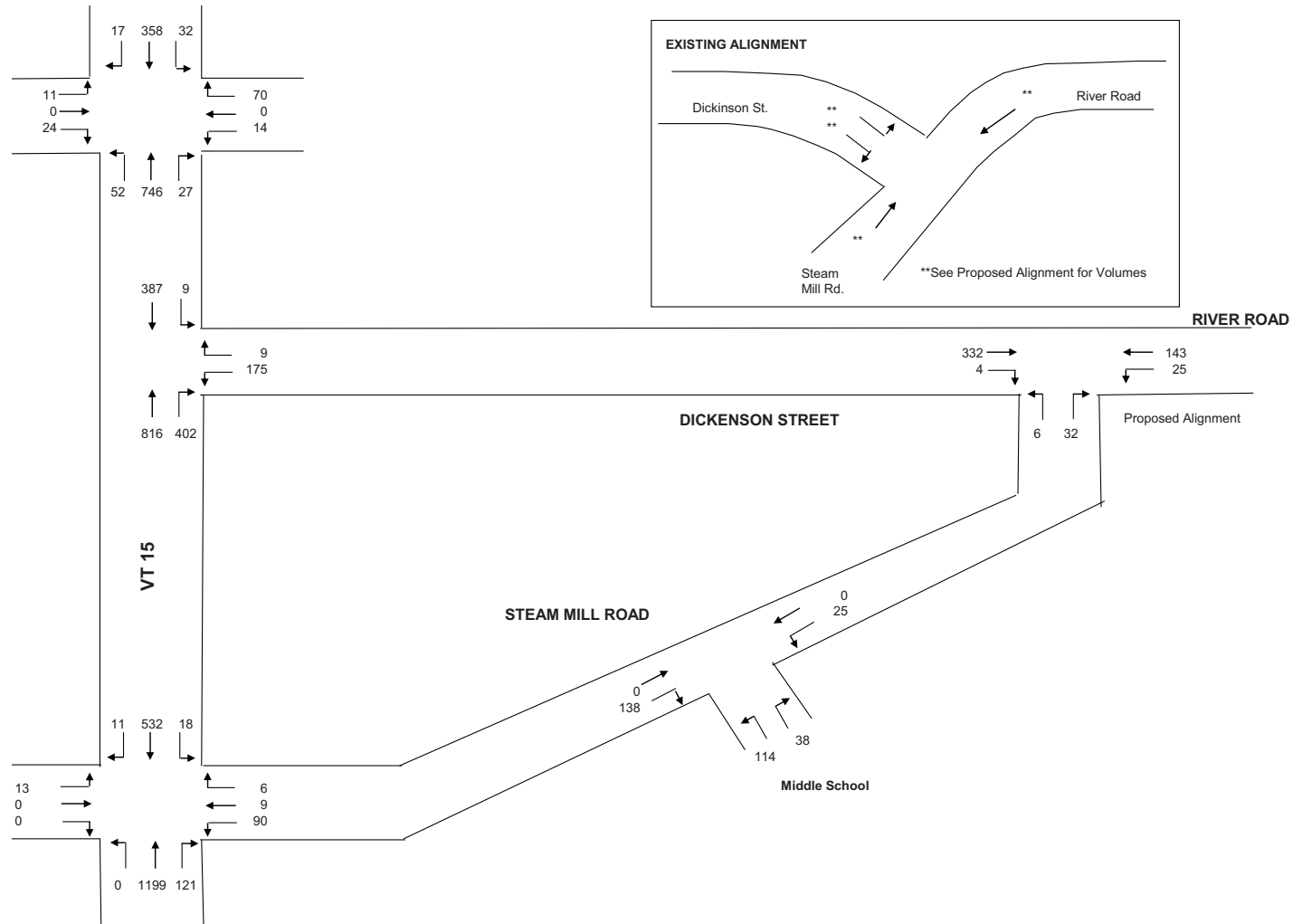


Figure 10: 2021 PM Design Volumes - Dickinson Street and Raceway Road Separate



IMPROVEMENT ALTERNATIVES

The assumed two-way traffic pattern along Dickinson Street will require upgrading the cross section of Dickinson Street and changes to the VT 15-Dickinson Street and Dickinson Street-River Road-Steam Mill Road intersections.

Dickinson Street will be re-classified as a rural collector. The typical design characteristics include:

- 11 foot wide travel lanes with 4 foot wide shoulders
- 25 mph design speed
- No curbing
- 8 foot wide shared use path along north side of street

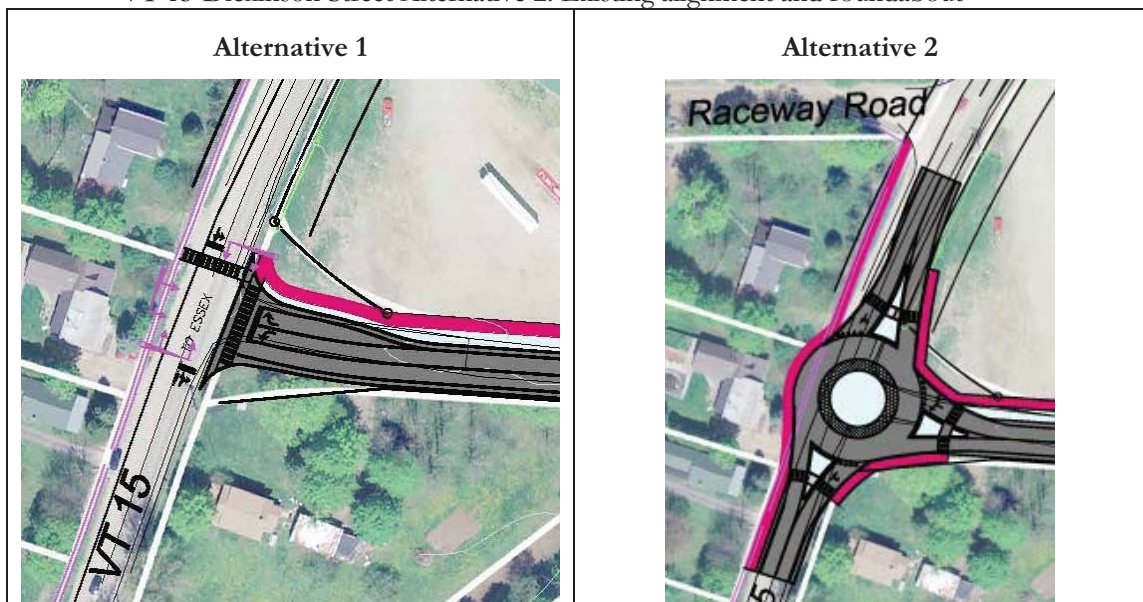
These criteria will transform Dickinson Street into a multi-modal street capable of accommodating bikes, vehicles, and pedestrians within a slow speed, rural environment.

The roadway cross section will be the same for each alternative. Therefore, the alternatives analysis focuses on the intersections.

Design concepts have been developed to aid in cost estimation and traffic operational analysis. These diagrams are concepts only and final designs require further engineering analysis including but not limited to: right of way verification; topographic survey; and environmental resource assessment.

The following alternatives are evaluated for the VT 15-Dickinson Street intersection:

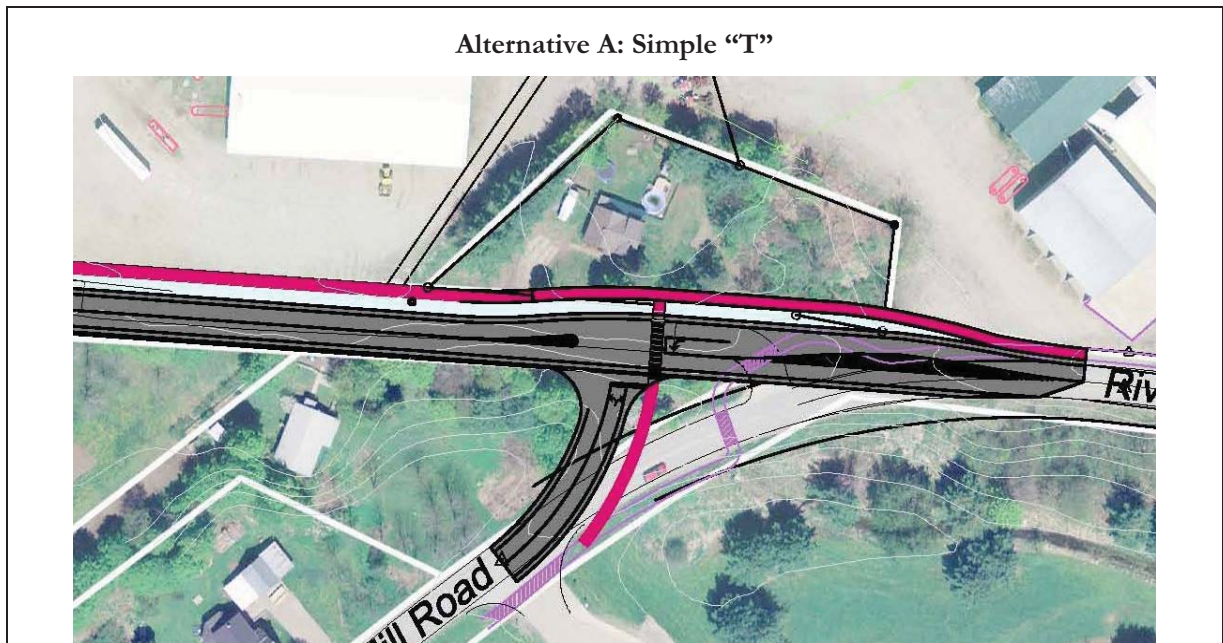
- VT 15-Dickinson Street Alternative 1: Existing alignment and traffic signal
- VT 15-Dickinson Street Alternative 2: Existing alignment and roundabout



The intersection would be designed, traffic signal or roundabout, to accommodate up to 73 foot (total length) trucks along VT 15 and up to 55 foot length trucks¹ into and out of Dickinson Street.

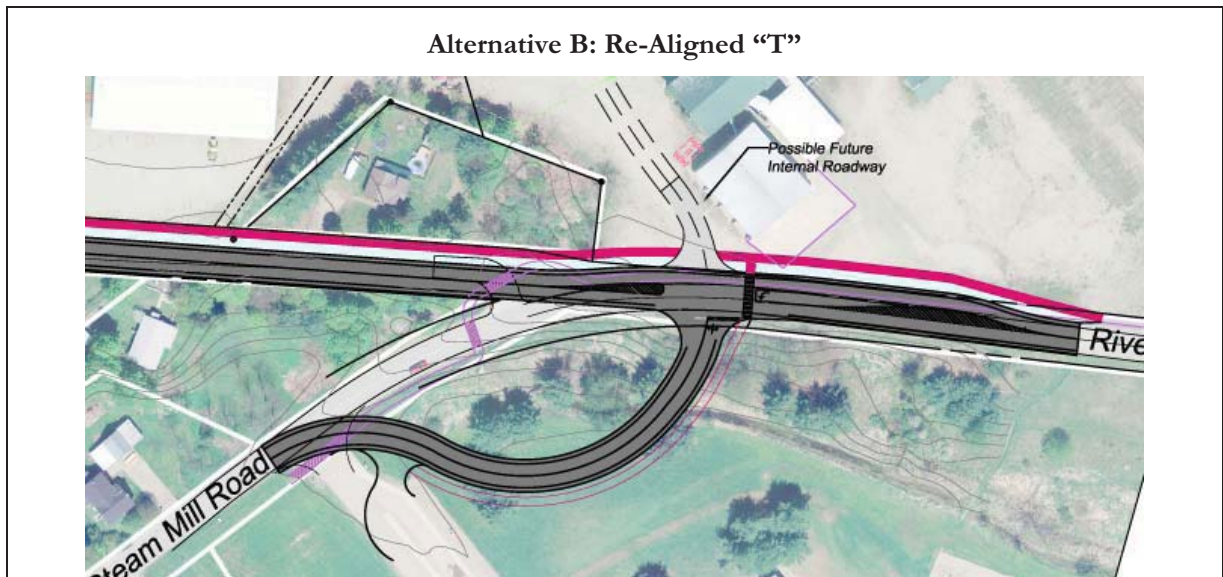
The following two alternatives are evaluated for the Steam Mill Road intersection with River Road and Dickinson Street:

- Steam Mill Road Intersection Alternative A: Steam Mill Road is stop controlled and realigned to the west. The alignment could be shifted further east to provide access to the Villeneuve Property similar to that shown in Alternative B; and
- Steam Mill Road Intersection Alternative B: Steam Mill Road is stop controlled and realigned to the east. This alignment could result in a four-way intersection with a new street serving potential development on the Villeneuve property. The re-aligned Steam Mill Road increases the length of Steam Mill Road and slows vehicles down by creating a 25 mph horizontal curve.



¹ AASHTO designated WB-67 and WB-55 respectively





The VT 15-Dickinson Street and Steam Mill Road alternatives are mutually exclusive. In other words, VT 15-Dickinson Street Alternative 1 could be combined with Steam Mill Road Alternatives A or B, VT 15-Dickinson Street Alternative 2 could be combined with Steam Mill Road Alternatives A or B, resulting in a total of four potential combinations.

In addition to the two VT 15-Dickinson Street Alternatives an option that re-aligned Dickinson Street with Raceway Road was investigated. The new four-way intersection could be controlled by either a traffic signal or a roundabout. The Steering Committee decided that the impacts of re-aligning Dickinson Street were too significant to be carried forward in the analysis as part of this technical assistance study. Sketches for the re-alignment alternatives are included in Appendix A.

FUTURE ANALYSIS

The traffic operations for the four intersection options for the Dickinson Street improvement alternatives were evaluated during the 2021 AM and PM peak hours.

Level-of-Service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. The 2000 Highway Capacity Manual (HCM) defines six grades to describe the level-of-service at an intersection. Level-of-service is based on the average delay per vehicle.

Table 4 shows the various level-of-service grades, qualitative descriptions, and quantitative definitions for unsignalized and signalized intersections.



Table 4: LOS Criteria for Intersections

LOS	CHARACTERSTICS	SIGNALIZED DELAY (sec)	UNSIGNALIZED DELAY (sec)
A	Little or no delay	< 10.0	< 10.0
B	Short delays	10.1-20.0	10.1-15.0
C	Average delays	20.1-35.0	15.1-25.0
D	Long delays	35.1-55.0	25.1-35.0
E	Very long delays	55.1-80.0	35.1-50.0
F	Extreme delays	80.0<	50.1<

The most recent VTrans policy on LOS (that was in use when this study began) states that, principal and minor arterials in urban or village areas will generally be designed for a level of service C or better. However, in heavily developed urban areas, reduced level of service criteria such as D or E may be appropriate as judged on a case by case basis. In addition to Level of Service, volume to capacity (V/C) ratio, and vehicle queues were evaluated for each movement.

For this project, LOS D or better is an appropriate design target because the study intersections are located within the village of Underhill Flats. On 31 May 2007 the Vermont Agency of Transportation adopted a new LOS policy. As a planning study that assesses projected future conditions in 2021, it is logical that the LOS D remains an appropriate design threshold within the context of this study.

Synchro (v7), a traffic analysis software package from Trafficware, was used to estimate delay and the associated level of service at the study intersections. The software uses procedures that are consistent with those specified in the 2000 Highway Capacity Manual.

EXISTING TRAFFIC OPERATIONS

Table 5 shows the AM and PM Peak Hour traffic operations at the study intersections.

Table 5: Level of Service for 2006 with Existing Configurations

Intersection Approach and Lanes	Link Length (ft)	2006 AM				2006 PM			
		LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)
VT15-Dickinson Street		<i>Unsignalized One-Way In</i>				<i>Unsignalized One-Way In</i>			
WB - Dickinson Street									
NB - VT 15	664	A	0	0.11	0	A	0	0.38	0
SB - VT 15	144	A	0.4	0.02	1	A	0.1	0.00	0
VT 15 - Raceway Road									
EBL - Raceway Road	410	C	23	0.02	2	C	22	0.05	4
EBR - Raceway Road	410	C	17	0.17	15	A	10	0.03	2
WB - Development	252	A	0	0.00	0	A	0	0.00	0
NB - VT 15	144	A	1	0.02	1	A	1	0.04	3
SB - VT 15	478	A	0	0.00	0	A	0	0.00	0
VT15-Steam Mill Road									
WB-Steam Mill Road	496	A	10	0.01	1	B	15	0.03	2
WBL-Steam Mill Road	50	F	223	1.33	376	F	79	0.88	177
NB - VT 15		A	0	0.23	-	A	0	0.58	0
SB - VT 15	664	A	1	0.04	3	A	1	0.02	2



Table 5 shows the level of service for existing 2006 traffic volumes at the intersections as currently configured. The one movement that does not satisfy the LOS D target is the left turn from Steam Mill Road onto VT 15. This movement operates at LOS F during the morning and afternoon peak hours. All other movements operate above the LOS D threshold.

FUTURE TRAFFIC OPERATIONS

Table 6 and Table 7 present the LOS, V/C ratios, and vehicle queue lengths (in feet) during the 2021 AM and PM peak hours.

In addition to the signalized design alternative shown in Alternative 1 for the VT 15 – Dickinson Street intersection, these tables present the unsignalized analysis that were not carried further into the design concept phase of analysis because of poor performance.



Table 6: 2021 LOS - Study Intersections Capacity and Congestion – AM Peak Hour

Intersection Approach and Lanes	Link Length (ft)	2021 AM				2021 AM				2021 AM				2021 AM			
		LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)
VT15-Dickinson Street		<i>No Signal, VT 15 approaches are single lane.</i>				<i>No Signal, Add left turn lane to southbound VT 15</i>				<i>Traffic Signal, All Approaches have one lane</i>				<i>Roundabout</i>			
WBR - Dickinson Street	570	B	10	0.02	542	B	10	0.02	553	C	27	0.01	7	B	28	0.26	48
WBL - Dickinson Street		F	822	2.66	541	F	822	2.66	533	D	53	0.88	203	<i>Not Applicable</i>			
NB - VT 15	664	A	0	0.02	1	B	10	0.02	1	A	6	0.00	84	A	5	0.19	31
SB - VT 15	144	A	0	0.23	22	A	8	0.03	-	C	23	0.00	167	A	9	0.764	288
SBL - VT 15	100	<i>Not Applicable</i>				A	0	0.23	10	<i>Not Applicable</i>				<i>Not Applicable</i>			
VT 15 - Raceway Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, All approaches have one lane</i>				<i>No Signal, All approaches have one lane</i>							
EBL - Raceway Road	410	E	45	0.06	5	E	45	0.06	5	E	50	0.06	139				
EBR - Raceway Road	410	C	23	0.27	41	C	23	0.27	40	C	23	0.27	346				
WB - Development	252	F	57	0.34	21	F	57	0.34	22	F	66	0.38	142				
NB - VT 15	144	A	1	0.02	15	A	1	0.02	16	A	1	0.02	32				
SB - VT 15	478	A	1	0.05	27	A	1	0.05	27	A	1	0.05	420				
VT15-Steam Mill Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, Add left turn lane to southbound VT 15</i>				<i>No Signal, All approaches have one lane</i>							
WB-Steam Mill Road	496	B	11	0.01	262	B	11	0.01	231	B	11	0.01	329				
WBL-Steam Mill Road	50	F	589	1.86	74	F	568	1.82	70	F	9540	105.59	73				
NB - VT 15		A	0	0.32	-	A	0	0.32	-	A	0	0.32	-				
SB - VT 15	664	A	3	0.05	37	A	0	0.83	-	A	3	0.05	49				
SBL - VT 15	100	<i>Not Applicable</i>				A	9	0.05	14	<i>Not Applicable</i>							
River Road - Steam Mill Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, Add left turn lane to River Road</i>				<i>No Signal, Add left turn lane to River Road</i>							
WB - River Road	1172	A	3	0.09	936	A	0	0.17	918	A	0	0.17	-				
WBL - River Road	100	<i>Not Applicable</i>				A	8	0.09	48	A	8	0.09	15				
NB - Steam Mill Road	478	A	10	0.08	49	A	10	0.08	39	A	10	0.08	28				



Table 7: 2021 LOS - Study Intersections Capacity and Congestion – PM Peak Hour

Intersection Approach and Lanes		2021 PM				2021 PM				2021 PM				2021 PM			
		LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)	LOS	Delay (Seconds)	v/c	Avg. Queue Length (ft)
VT15-Dickinson Street		<i>No Signal, VT 15 approaches are single lane.</i>				<i>No Signal, Add left turn lane to southbound VT 15</i>				<i>Traffic Signal, All Approaches have one lane</i>				<i>Roundabout</i>			
WBR - Dickinson Street	570	C	20	0.04	497	C	20	0.04	480	C	31	0.01	8	B	38	0.25	50
WBL - Dickinson Street		F	342	1.54	514	F	342	1.54	510	D	39	0.64	100	<i>Not Applicable</i>			
NB - VT 15	664	C	20	0.04	23	C	20	0.04	13	C	33	0.99	622	A	5	0.62	182
SB - VT 15	144	A	0	0.78	50	A	0	0.78	-	A	6	0.44	92	A	5	0.275	48
SBL - VT 15	100	<i>Not Applicable</i>				B	12	0.02	10	<i>Not Applicable</i>				<i>Not Applicable</i>			
VT 15 - Raceway Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, All approaches have one lane</i>				<i>No Signal, All approaches have one lane</i>							
EBL - Raceway Road	410	F	61	0.16	9	F	61	0.16	9	F	Err	4.94	9				
EBR - Raceway Road	410	B	11	0.04	18	B	11	0.04	16	B	11	0.04	16				
WB - Development	252	D	27	0.36	81	D	27	0.36	46	F	Err	3.35	48				
NB - VT 15	144	A	1	0.05	35	A	1	0.05	28	A	1	0.05	35				
SB - VT 15	478	A	1	0.04	105	A	1	0.04	20	A	4	0.11	67				
VT15-Steam Mill Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, Add left turn lane to southbound VT 15</i>				<i>No Signal, All approaches have one lane</i>							
WB-Steam Mill Road	496	D	26	0.04	408	D	26	0.04	422	D	26	0.04	422				
WBL-Steam Mill Road	50	F	835	2.41	74	F	824	2.38	73	F	1023	2.78	66				
NB - VT 15		A	0	0.84	5	A	0	0.84	4	A	0	0.84	449				
SB - VT 15	664	A	1	0.04	46	A	0	0.35	-	A	1	0.04	74				
SBL - VT 15	100	<i>Not Applicable</i>				B	13	0.04	9	<i>Not Applicable</i>							
River Road - Steam Mill Road		<i>No Signal, All approaches have one lane</i>				<i>No Signal, Add left turn lane to southbound VT 15</i>				<i>No Signal, All approaches have one lane</i>							
WB - River Road	1172	A	1	0.02	627	A	0	0.09	616	A	0	0.09					
WBL - River Road	100	<i>Not Applicable</i>				A	8	0.02	16	A	8	0.02	8				
NB - Steam Mill Road	478	B	11	0.06	58	B	11	0.06	50	B	11	0.06	20				



Table 6 and Table 7 presents the traffic conditions during the projected 2021 AM and PM peak hours. The design volumes are shown in Figure 8 and Figure 10. The traffic operations are presented assuming different types of control (stop control, traffic signal, or roundabout) and lane configurations (addition of left turn lanes on the through streets).

The results in Table 6 lead to the following observations:

- The left turn from Dickinson Street to VT 15 will experience long delays if it is controlled by a stop sign.
- Both a traffic signal and a roundabout will provide acceptable LOS at the VT 15-Dickinson Street intersection during the AM and PM peak hours.
- The realigned approach of Steam Mill Road to Dickinson Street/River Road is projected to operate at an acceptable LOS in the AM and PM peak hours as a stop-controlled intersection. The projected traffic volumes satisfy the warrants for a left turn lane from River Road to Steam Mill Road.
- The left turn movement from Steam Mill Road to VT 15 is projected to operate at LOS F even though the through traffic is diverted to Dickinson Street. Poor LOS on the Steam Mill Road approach to VT 15 may be frustrating for drivers exiting from the school and homes, but it will also further discourage 'through' traffic from using Steam Mill Road. Drivers will naturally balance out their level of delay and safety over time by selecting which intersection they would prefer to make a left onto VT 15 through a traffic signal (or roundabout) at the VT 15-Dickinson Street intersection.
- The delay for left turns from Steam Mill Road to VT 15 increases when the traffic signal is assumed at VT 15-Dickinson Street. If the traffic signal is not installed, traffic flow will be random along VT 15 and will provide more gaps. Installation of a traffic signal at the VT 15-Dickinson Street intersection may reduce the number of gaps in VT 15 southbound traffic passing by the Steam Mill Road intersection. The traffic signal will release regular platoons of traffic from (1) VT 15 southbound through traffic and (2) traffic turning left from Dickinson Street. Gaps will be created as the traffic signal changes phases, but the flow will no longer be random.
- The delay for left turns from Raceway Road to VT 15 increases when the traffic signal is assumed at VT 15-Dickinson Street. If the traffic signal is not installed, traffic flow will be random along VT 15 and will provide more gaps. Installation of a traffic signal at the VT 15-Dickinson Street intersection may reduce the number of gaps in VT 15 northbound traffic passing by the Raceway Road intersection.



General Findings

- Projected traffic volumes satisfy the warrants for a left turn lane from VT 15 into Dickinson Street. Projected traffic volumes also satisfy two traffic signal warrants. Left turn lanes are not necessary on VT 15 if a traffic signal is installed.
- Though the traffic signal at VT 15-Dickinson Street causes additional delay at the VT 15-Raceway Road and the VT 15 – Steam Mill Road intersections, the upgraded intersection can improve overall vehicle operations for those using Steam Mill Road and River Road. The VT 15-Dickinson/River Road route accommodates a significant volume of through traffic as well a significant amount of school related traffic with reasonable levels of delay. The benefit to the traffic using the Dickinson/River Road network should be weighed against the impacts to the Raceway Road traffic.

EVALUATION MATRIX

The Dickinson Street alternatives were evaluated as to their affect on the following project metrics:

- Transportation performance;
- Right of Way (ROW) Impacts;
- Bicycle/Pedestrian Access;
- Support Community Character;
- Improve Safety; and
- Protect and Enhance the Environment.

Evaluation Matrix Legend

++ Supports Goal	- Somewhat Opposes Goal
+ Somewhat Supports Goal	-- Opposes Goal
0 Neutral	

The evaluation matrix legend shows the key for the evaluation matrix. “+”s indicate positive attributes while the “-“ indicates a negative attribute. The “0” indicates that the element has both positive and negative attributes. The evaluation matrix can aid in the comparison of alternatives, but it is not a tool in which to evaluate A vs B, it is instead a tool to evaluate A vs existing and B vs existing.

Table 8 shows the evaluation matrix for the east end of Dickinson Street at the River Road – Steam Mill Road intersection.



Table 8: Evaluation Matrix for the Steam Mill Road/River Road Intersection

		River Road - Steam Mill	
Technical Information	Description	<i>Simple "T"</i>	<i>Re-Aligned "T"</i>
	Transportation Performance	LOS A on the Steam Mill Road approach.	LOS A on the Steam Mill Road approach. Additional travel time because of the increased travel distance.
	ROW Impacts	Small amount of ROW would be required to create the minor T intersection.	Requires additional ROW and significant earth work.

Evaluation Criteria		+	+
	<i>Bicycle/Pedestrian Access</i>	Improves the marked pedestrian path across River Road. The path connects from the school to the River Road path.	Improves the marked pedestrian path across River Road. The path connects from the school to the River Road path.
	<i>Support Community Character</i>	No change	Requires ROW from the school. The longer road alignment would further discourage through vehicles from using Steam Mill Road.
	<i>Improve Safety</i>	Improves vehicle safety by providing an exclusive left-turn lane into Steam Mill Road and improves pedestrian safety by creating a marked pedestrian crossing on River Road.	Improves vehicle safety by providing an exclusive left-turn lane into Steam Mill Road and improves pedestrian safety by creating a marked pedestrian crossing across River Road.
<i>Protect and Enhance the Environment</i>	Negligible change in impervious surface.	0	- Larger impervious surface area increases stormwater run-off. Larger distance traveled increases vehicle emissions. May impact wetlands and will require significant amounts of fill.

Table 9 shows the evaluation matrix for the west end of Dickinson Street at the VT 15 – Dickinson Street intersection.



Table 9: Evaluation Matrix for the VT 15-Dickinson Street Intersection

		VT 15 - Dickinson	
Technical Information	Description	"T" Intersection	Roundabout
	Transportation Performance	All movements have acceptable levels of delay. Potential blocking of Raceway Rd during peak periods.	Excellent operations for all movements.
	ROW Impacts	Limited ROW impacts depending on how the signal is designed for the west side of VT 15.	Requires varying amounts of ROW depending on the exact alignment.
Evaluation Criteria	<i>Bicycle/Pedestrian Access</i>	+ Improves accessibility by providing pedestrian phasing and signaling pedestrian movements.	+ Improves accessibility by providing clearly marked crosswalks at the intersection approaches.
	<i>Support Community Character</i>	+ The signal creates a pedestrian crossing enhancing safety and mobility within the study area.	+ Calms traffic on VT 15 through Village.
	<i>Improve Safety</i>	+ Improves safety for vehicular traffic exiting Dickinson Street and creates a pedestrian phase across VT 15.	+ Single Lane Roundabouts improve vehicular and pedestrian safety.
	<i>Protect and Enhance the Environment</i>	0 Similar impervious land area.	0 Larger impervious surface area increases stormwater run-off. Reduced vehicle delays decrease emissions from idling cars.

Cost estimates were derived that relate the relative cost differences between the design alternatives. As earlier noted, the intersection options at the ends of Dickinson Street are mutually exclusive. As such, four total alternatives are possible for the Dickinson Street alternative ranging from a high cost of \$1,600,000 to a low cost of 1,100,000.



The high cost estimate of \$1,600,000 includes the cost of constructing the re-aligned “T” intersection of Steam Mill Road. The re-aligned road requires a significant amount of fill, and new roadway construction. This alternative cost estimate includes either a traffic signal or a roundabout on the west intersection with VT 15.

The low estimate of \$1,100,000 includes either a roundabout or a traffic signal at the intersection of VT 15 and the simple “T” alignment on the east end of Dickinson Street.

These cost estimates do not include any potential right of way that might be required and are expressed in 2007 dollars. Project costs involving right of way and environmental mitigation can increase project costs significantly above the rough ‘order of magnitude’ costs estimated in this study.

PUBLIC INPUT

A public meeting was included as part of the technical assistance study to review the alternatives developed and provide guidance for moving forward toward implementation. The meeting was held 13 June 2007 at the Browns River Middle School in Jericho. The meeting was well attended by both residents of Jericho and Underhill. Below presents highlights from the meeting:

- Support was strong for improvements to Dickinson Street and a traffic signal at VT 15 to improve access onto VT 15.
- Concern was raised about the implications of improving Dickinson Street regarding traffic flow changes on Steam Mill Road and Park Street.
- The 19% growth in background traffic was applied to all traffic entering and exiting the study area including school and library traffic on using Steam Mill Road.
- The next stage in the process would be for the Town of Jericho to move forward with the selectboard to decide on funding sources and the size of the project. The Town Selectboard will ultimately make a decision on what improvements will be made.
- Comments suggested the desire for additional traffic analysis that focuses on vehicle speed reduction, traffic calming, routing of vehicles, and overall circulation in the Underhill/Riverside Flats area.
- Cost estimates do not include any right of way acquisition. The costs include all other estimates based on the most recent bid prices available from VTrans.

The full list of questions and comments with responses is included in Attachment C.

CONCLUSIONS AND RECOMMENDATIONS

The Town of Jericho is interested in changing the traffic pattern along River Road, Dickinson Street, Steam Mill Road, and VT 15 in Underhill Flats. The overall concept was identified in an April 2006 Charrette and consists of:

- Allowing two-way traffic on Dickinson Street;



- Aligning Dickinson Street with River Road to create a direct connection to VT 15 for through traffic; and
- Realigning the River Road-Steam Mill Road intersection.

This report presents traffic forecasts, traffic analyses, and preliminary concept plans for the VT 15-Dickinson Street and Dickinson Street-River Road-Steam Mill Road intersections and evaluates the effect of the traffic changes on the VT 15-Steam Mill Road intersection.

KEY FINDINGS

- The VT 15-Dickinson Street intersection should be controlled with a traffic signal or a roundabout by the analysis year 2021. Traffic volumes should be monitored to determine when the intersection would meet applicable signal warrants.
- A traffic signal or a single lane roundabout would provide acceptable level of service for 2021 conditions at the VT 15-Dickinson Street intersection.
- Poor LOS and long vehicle queues is projected at the Steam Mill Road approach to VT 15 for all scenarios. Delay may be frustrating for drivers exiting from the school and homes, but it will also further discourage through traffic from using Steam Mill Road.
- A left turn lane is recommended from River Road to Steam Mill Road. The intersection will operate with acceptable LOS as a stop controlled intersection along Steam Mill Road.
- The reconstruction of Steam Mill Road into the re-aligned “T” intersection would cost approximately \$1,600,000. This cost includes the installation of either a traffic signal or a roundabout at the intersection with VT 15. The estimate does not include right of way acquisition.
- The reconstruction of Steam Mill Road into the simple “T” intersection would cost approximately \$1,100,000. This cost includes the installation of either a traffic signal or a roundabout at the intersection with VT 15. The estimate does not include right of way acquisition.

