FINAL REPORT
INTERSECTION STUDY

Vermont Route 22A & Panton Road
City of Vergennes, Vermont

May 9, 2011

Prepared for:

Addison County
REGIONAL PLANNING COMMISSION

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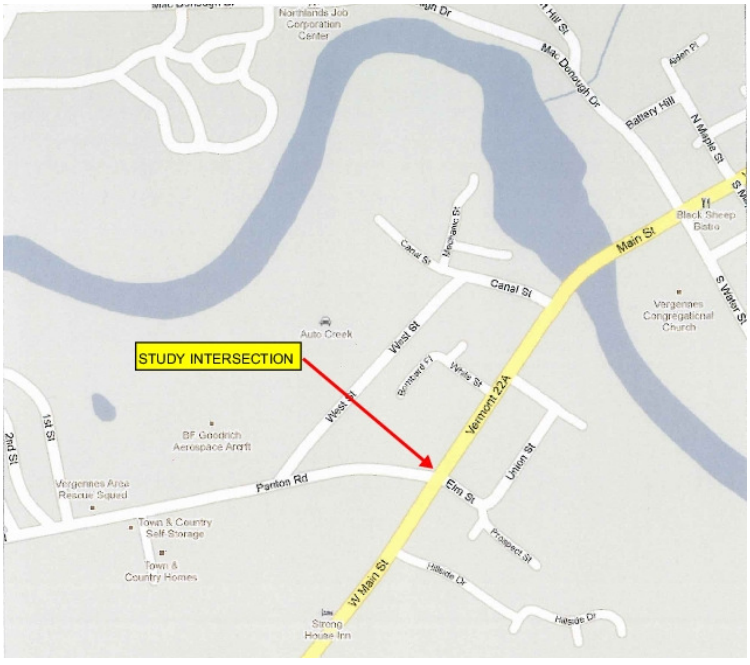
1.0 INTRODUCTION

The Vermont Route 22A / Panton Road intersection in the City of Vergennes is located in the southwest corner of the City. Route 22A (West Main Street at this intersection) is a Class 1 city street within the City and a rural minor arterial outside of the City. Route 22A is western Vermont's primary traffic corridor for both private and commercial traffic to and from points in New York. Panton Road is a Class 2 city street serving a major Addision County employer, Goodrich Aerospace, and as a major link for travel to and from the neighboring Town of Panton. High turning movement volumes at this intersection during weekday peak hours routinely create considerable delays and traffic congestion. Figure 1 shows the location of this intersection.

Continued economic vitality and growth of the City of Vergennes necessitates a comprehensive plan to implement a long-term traffic solution at this intersection. L&D was engaged to prepare this Intersection Study to assist in developing such a plan.

This Intersection Study begins with information collected about the existing intersection which has been collected from field surveys, traffic counts and from local and state agencies. Various alternatives are then presented which were developed to address the needs of the intersection.

Figure 1 – Project Location



2.0 PURPOSE AND NEED STATEMENT

2.01 Purpose

The purpose of a future intersection improvement project at this location will be to reduce existing levels of peak hour traffic congestion, to provide increased multi-modal accessibility, and to improve the safety of the intersection for vehicular traffic, bicyclists and pedestrians.

2.02 Need

The intersection is considered deficient. Needs include:

- Traffic Congestion - This intersection is located on a major travel corridor linking northern Vermont with New York state. A major Addision County employer, Goodrich Aerospace, is also located nearby on Panton Road. The resulting traffic volumes and conflicting turning movements are heavy during both morning and afternoon peak hours resulting in very long delays and queues on Panton Road. Intersection capacity analyses indicate that the Panton Road approach experiences level of service F during both the morning and afternoon peak hours.

- Limited Multi-Modal Capabilities – Existing sidewalks extend northerly from this intersection along both sides of Route 22A (West Main St). Those sidewalks have historically linked this area with the downtown area and other community destinations on the opposite side of Otter Creek. The nearby Gateway project on the riverfront has also increased local pedestrian activity. It is anticipated that additional future residential development of properties along West Main Street, Panton Road and Hopkins Road to the south will generate additional pedestrian activity through this intersection.

  Panton Road lacks adequate accommodations for pedestrians and bicyclists. The nearby presence of a major regional employer on Panton Road generates considerable pedestrian and jogging activity along Panton Road as well as through this intersection and along West Main St. This intersection also serves as a gathering point and school bus stop for local elementary and high school students from adjacent residential areas.

- Economic Development – Safe uncongested travel through this intersection is required to maintain the existing economic vitality of Vergennes and its surrounding communities, to provide better access to existing businesses and industry located on Panton Road, and to facilitate future economic development within the City of Vergennes.

3.0 EXISTING CONDITIONS

3.01 Character of Project Area

Existing land-uses surrounding this intersection and its approaches are predominantly residential with older homes set well back from the roadway along Route 22A. This area is zoned as Medium Density Residential, with the immediate surrounding area also designated in the City Plan as a Historic Neighborhood. This land-use pattern changes proceeding westerly on Panton Road, with the homes being located much closer to the roadway, and the area transitioning to commercial/industrial land-uses and zoning.

3.02 Design Speed

Posted speed limits in the immediate vicinity of this intersection are 30 mph on Route 22A and on Panton Road. Given the functional classifications and traffic volumes (see below), those are appropriate design speeds as well.

FIGURE 2 - View of Intersection Looking North

3.03 Functional Classification

The Vermont Agency of Transportation (VTrans) has classified this section of Route 22A as a rural minor arterial highway. Arterial roads generally provide the fastest method of travel (mobility) and are usually designed with long-distance travel in mind. However, being located in the built up area of the City of Vergennes, this particular section of Route 22A has many characteristics of a major urban street. Route 22A is also one of Vermont's most heavily used trucking corridors. Although part of the state highway system, Route 22A is owned and maintained by the City as a Class 1 town highway. Ordinary maintenance of Class 1 town highways is the responsibility of the municipality, however the state is responsible for scheduled pavement resurfacing and for the center line pavement markings.

Panton Road is owned and maintained by the City as a Class 2 town highway. In Vermont, Class 2 highways are those town highways selected as the most important highways in each town. Class 2 town highways are the trunk lines of improved highways from town to town and to places which by their nature have more than normal amounts of traffic Reinforcing this, Panton Road has also been classified by VTrans as a major collector (MC0186). Collector roads are used to connect between local and arterial roads, and are usually designed to provide a balance between access and mobility.

Based on the functional classes and traffic volumes of Route 22A and Panton Road, this intersection qualifies for all three types of investment categories (reconstruction, rehabilitation or preservation) under VTrans' Level of Improvement Policy.

3.04 Traffic Volumes

Approximately 11,000 vehicles travel through this intersection on an average day. Of that number, over 1,000 vehicles travel through it during the afternoon peak hour on a typical weekday. Morning peak hour volumes are considerably less (700± vph).

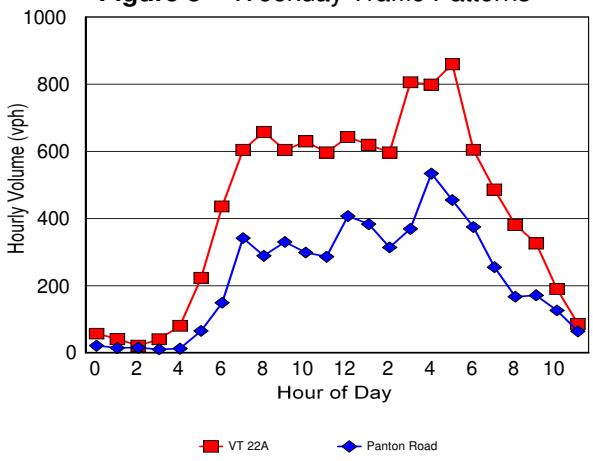
A 12-hour turning movement count was performed by the VTrans at this intersection on July 2-3, 2007. Additionally, 7-day automatic traffic recorder counts (ATR) were performed in July 2008 just north of the intersection on Route 22A (ATR A020) and in July 2007 on Panton Road (ATR A201). Data from these counts was used to calculate year 2010 annual average daily traffic volumes (AADT) on each of the four approaches to the intersection (Table 1). From those AADT's, existing design hour volumes (DHV) were then calculated. The DHV is the 30th highest hourly volume that occurs annually. Accepted transportation engineering practice is to design highways and intersections with sufficient capacity to accommodate the DHV. Table 1 summarizes the resulting traffic volumes.

Table 1 – Annual Average Daily Traffic Volumes

Approach	AADT (vpd)	DHV (vph)
Route 22A (north)	9,900	1,100
Route 22A (south)	5,800	660
Panton Rd (west)	5,100	580
Elm St (east)	200	25

Figure 3 illustrates hourly traffic patterns on Route 22A and Panton Road, as calculated from the above ATR traffic counts. From the turning movement count, the weekday morning (AM) and afternoon (PM) peak hour were calculated to occur from 8:00-9:00 am and 3:30-4:30 pm, respectively.

Figure 3 – Weekday Traffic Patterns



A high number of vehicles passing through this intersection are large trucks due to its location on a major trucking route linking northern Vermont with New York state. As part of the ATR A020 count performed by VTrans in 2008, the types of vehicles were also classified. The results show 7.25% of the total traffic on Route 22A north of this intersection are trucks, with 3.5% of those being "heavy" trucks (semi-trailers). The resulting daily truck volumes equal 720 total, of which approximately 350 are semi-trailer trucks. These truck volumes are 2008 volumes, and are somewhat less than earlier reported in the 2006 Route 22A / South Water St. / MacDonough Dr. study.

Additionally, traffic counts were performed by the ACRPC to identify traffic volumes using Canal and West Streets to bypass this intersection. Those counts showed 200± vph using Canal and West Streets during weekday morning and afternoon peak hours. The directions of this traffic are predominantly eastbound (towards Route 22A) during the morning peak hour and westbound (towards Panton Road) during the afternoon peak hour. Outside of those two peak hour periods, overall volumes are generally less than 100 vph and more or less evenly distributed by direction.

3.05 Horizontal Alignment

VT Route 22A and Panton Road intersect at approximately a 65 degree angle. There are no significant horizontal curves on either roadway approaching the intersection. Directly opposite Panton Road is Elm Street, which intersects with Route 22A at a 90 degree angle.

3.06 Terrain & Vertical Alignment

The topography of the intersection area is generally sloping towards Otter Creek to the north. Route 22A through this intersection is descending at a ±3% grade. Near Hillside Drive, approximately 400 ft south of the intersection on Route 22A, the grade is steeper; ranging between 6-8%. The Panton Road approach is relatively flat. There are no significant side slopes, cuts or fills in the surrounding terrain.

3.07 Right of Way Information

Available right-of-way information indicates that Route 22A has a 99 ft (6 rod) wide historical right-of-way through this intersection. Panton Road has a 66 ft (4 rod) wide historical right-of-way in the City of Vergennes, however, it appears that this right-of-way narrows in the immediate vicinity of this intersection. Under state statutes, lacking any definitive data or mapping otherwise, the right-of-way in this area is presumed to be 49.5 ft (3 rod) centered on the existing roadway per 19 V.S.A. §32.

3.08 Roadway Width

All four approaches to this intersection are single lane approaches. Table 2 summarizes the existing approach geometry.

Table 2 – Existing Approach Geometry

Street	Shoulder & Lane Widths (ft)
VT Route 22A	0-14-14-0
Panton Road	0-12-12-0
Elm Street	0-11-11-0

3.09 Sight Distances

Available intersection sight distances from Panton Road and Elm Street exceed AASHTO recommended distances of 335 ft for a posted speed limit of 30 mph. Additionally, the AASHTO recommended minimum safe stopping sight distance of 200 ft (215 ft on the downhill grade of Route 22A) is available on all four approaches.

3.10 Traffic Control Devices

Both Panton Road and Elm Street are stop sign controlled. The existing stop signs are supplemented by a single overhead flashing beacon that flashes yellow on Route 22A and red on the two side streets. Painted pavement markings include double yellow painted centerlines on Route 22A and Panton Road, crosswalks across all but the southerly Route 22A approach, and stop bars on the two side streets. Route signs, direction and distance signs, and travel information signs are also provided on the Route 22A approaches. Many of the existing directional and crosswalk traffic signs appear to be out-of-date with respect to recent revisions in the MUTCD, and will need to be replaced and upgraded in the near future. We also note that the Panton Road crosswalk is located behind the stop bar, not in front of it as is conventional practice.

3.11 Pedestrian & Bicycle Facilities

Sidewalks are provided along both sides of Route 22A and on the north sides of Panton Road and Elm Street. The sidewalks are of 4 ft and 5 ft wide concrete construction. Elm Street also has a very narrow (3 ft wide) concrete sidewalk on its south side. There are no bicycle lanes or marked shoulders on any of the intersection approaches. Painted crosswalks on the east, north and west approaches provide for pedestrian movement through this intersection.

3.12 Utilities

Existing municipal water and sewer mains are located on all four approaches to this intersection. There are also overhead wires and utility poles on all four approaches. Those overhead utilities include: Green Mountain Power (electrical), Fairpoint (telephone) and Comcast (cable).

3.13 Stormwater Drainage

Stormwater runoff from the roadways and immediate area surrounding this intersection is collected in a system of open ditches, inlets and underground storm drain pipes; ultimately discharging to Otter Creek to the north. Route 22A extending north from this intersection and Elm Street are curbed; the remaining approaches have open drainage.

3.14 Crash History

Crash data for 2004-2008 was obtained from VTrans. Only two crashes were reported at this intersection during that five-year period. Both crashes were rear-end collisions involving vehicles traveling in the northbound direction on VT 22A, and resulted in property damage only (no injuries). No accidents were reported at this intersection in 2009.

3.15 Intersection Capacity & Levels of Service

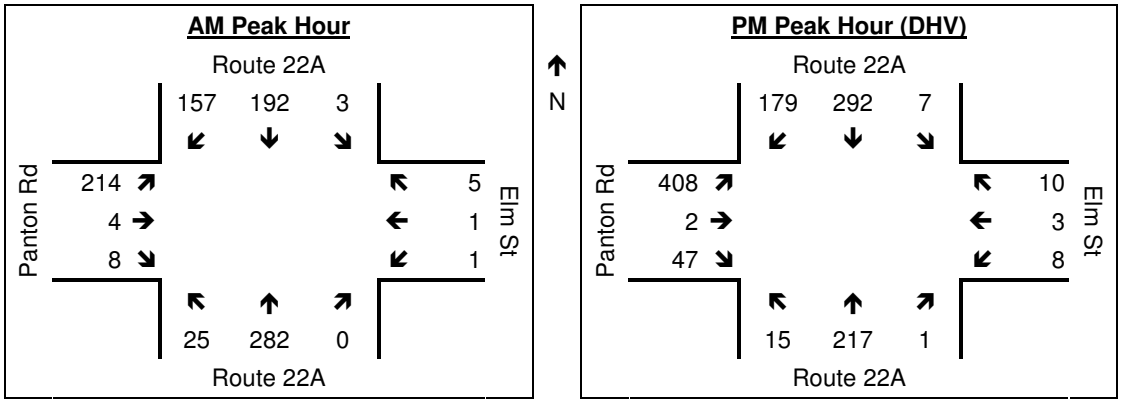
The capacity of the intersection and its existing level of service rating was determined by performing a multi-way stop intersection capacity analysis using the procedures outlined in the *Highway Capacity Manual (HCM)*[1]. The criteria for levels of service at intersections are outlined in Table 3. For this intersection, the desired level of service design target is LOS D[2]. In addition, no individual lane or approach should experience volume/capacity (v/c) ratios exceeding 1.0.

Table 3 - Intersection Level of Service Criteria

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

To determine existing levels of service, the observed morning and afternoon peak hour traffic volumes of the June 2008 turning movement count were adjusted to reflect year 2010 design hour conditions (30th highest hour annually). Figure 4 illustrates the estimated year 2010 peak hour volumes. Intersection capacity analyses were then performed for both the morning and afternoon peak hour time periods. The results of these analyses are shown in Table 4. Copies of the intersection capacity analyses for these and subsequent scenarios are included in **Appendix B**.

Figure 4 – 2010 Peak Hour Volumes



[1] *Highway Capacity Manual*, Transportation Research Board, 2000
[2] Highway Design "Level of Service" Policy, Vermont Agency of Transportation, May 31, 2007

Table 4 - Existing (2010) Levels of Service

	AM				PM (DHV)			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT/TH/RT	A	8	0.02	≤25	A	8	0.01	<25
SB LT/TH/RT	A	8	0.00	≤25	A	8	0.01	<25
Elm Street								
WB LT/TH/RT	B	11	0.01	≤25	B	13	0.04	<25
Panton Road								
EB LT/TH/RT	D	26	0.57	100	F	397	1.18	1,225

The above results indicate that this intersection experiences poor levels of service, very long delays and overflowing queues during the weekday PM peak hour time period.

3.16 Natural Resources

The Agency of Natural Resources Environmental Interest Locator does not show any existing significant wetlands, any rare, threatened or endangered species, any significant natural communities or hazardous waste sites in the immediate area of this intersection. No Vermont Land and Water Conservation Fund projects are located adjacent to or near this intersection.

3.17 Archeological and Historic Resources

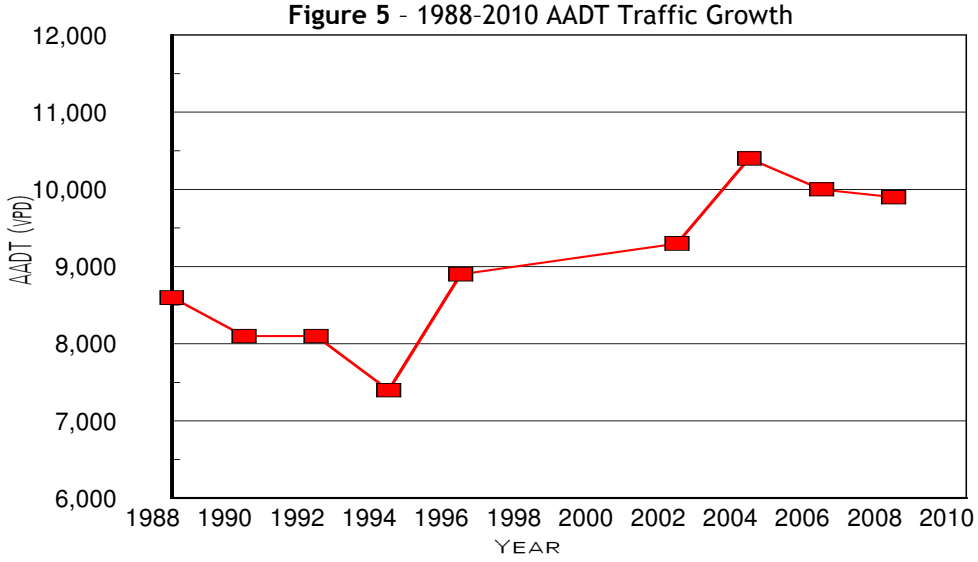
An examination of the archeological and historic sensitivity of this intersection and its surrounding lands is included in **Appendix A**. As noted earlier, the study area in the immediate vicinity of this intersection is located in a locally designated historic district. Although much of the area immediately surrounding this intersection has been previously disturbed by roadway, drainage and utility construction (particularly within the existing highway right-of-ways), there are several small area that have not been disturbed and thus have some remaining archeological sensitivity.

4.0 FUTURE CONDITIONS

4.01 Background Traffic Growth

Figure 5 illustrates the growth in daily traffic volumes on Route 22A north of this intersection since 1988. Recent years have witnessed a decline in daily volumes. This pattern has occurred statewide; and is largely attributable to higher energy prices and a slowing economy.

Figure 5 – 1988-2010 AADT Traffic Growth



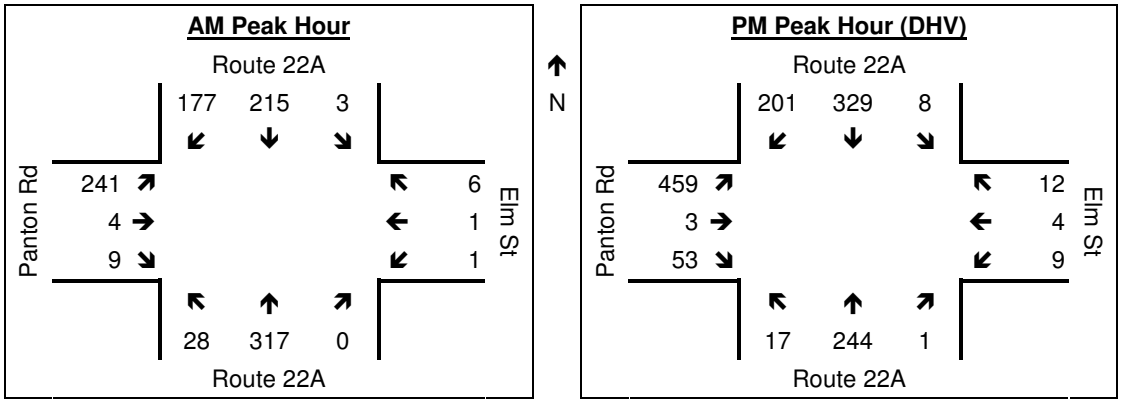
Future traffic conditions in this updated study will be examined using a 20 year projection from 2010 to 2030. The first step in developing future traffic projections is to identify an appropriate background traffic growth rate. VTrans has developed statewide growth rates for primary and secondary rural highways based on regression analyses of CTC (continuous count stations) statewide. For this location, the current VTrans projections (based on 2008 traffic data) estimate a 20 year growth rate of 14%; equivalent to 0.7% annually[3]. No growth was applied to Elm St. as it is a dead-end local street. Table 5 and Figure 6 illustrate the projected future traffic volumes.

Table 5 – Future (2030) Annual Average Daily Traffic Volumes

Approach	AADT (vpd)	DHV (vph)
Route 22A (north)	11,300	1,250
Route 22A (south)	6,600	750
Panton Rd (west)	5,800	660
Elm St (east)	200	25

[3] *Continuous Traffic Counter Grouping Study and Regression Analysis*, VTrans, March 2009

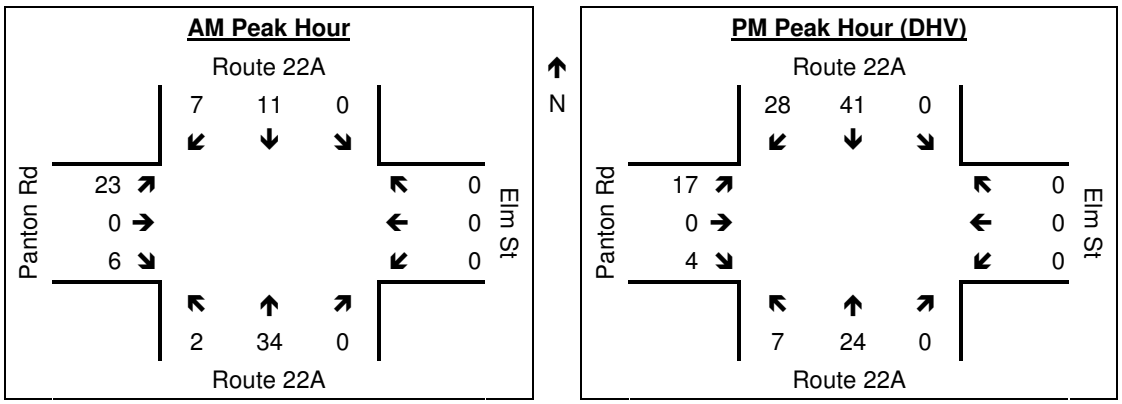
Figure 6 – 2030 Peak Hour Volumes (with only background growth)



4.02 Other Major Developments

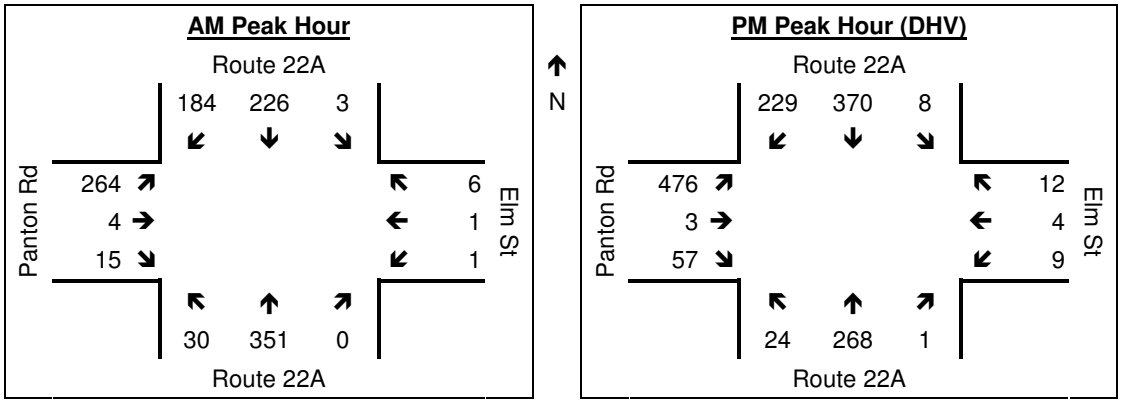
Several major developments have been proposed in the immediate area surrounding this intersection but not yet constructed, and others are in discussion stages. Of particular interest is the relatively large amount of land available for future development on Panton Road. For the purpose of this study, 125 new residential units (50 on Panton Road plus 75 south of this intersection on Route 22A) were identified as being in the "pipeline". Figure 7 illustrates the estimated PM peak hour turning movement patterns of the 125 future residential units.

Figure 7 – Other Major Development Peak Hour Trips



This added traffic represents an additional 9% growth on the westerly Panton Road approach and an additional 10% growth on the northerly Route 22A approach during the PM peak hour. Figure 8 illustrates the resulting projected 2030 peak hour volumes with both background growth and other major developments.

Figure 8 – 2030 Peak Hour Volumes (with other major development)



5.0 ALTERNATIVES

5.01 Alternative A - Existing Conditions (NO-BUILD)

Figure 9 shows the existing geometric conditions at the intersection. This alternative would retain existing conditions, except that future traffic congestion conditions and delays would continue to increase. Additional capacity analyses were performed for projected 2030 DHV conditions, the results of which are shown in Table 6.

Table 6 – Alternative A 2030 PM Peak Hour Levels of Service

	AM				PM (DHV)			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT/TH/RT	A	8	0.03	≤25	A	9	0.02	<25
SB LT/TH/RT	A	8	0.00	≤25	A	8	0.01	<25
Elm Street								
WB LT/TH/RT	B	12	0.05	≤25	C	15	0.07	<25
Panton Road								
EB LT/TH/RT	F	73	0.87	300	F	1537	1.83	3,200

Given the above levels of service and delays, it should also be reasonably anticipated that traffic safety will be adversely impacted by motorists becoming impatient. This alternative is obviously the least costly option, but is not responsive at all to the purpose and need statement for this intersection.

5.02 Alternative B (ALL-WAY STOP CONTROL)

The potential benefits of changing from two-way to all-way stop control were also examined. This alternative would retain the existing intersection geometry and single lane approaches. The obvious drawback is that all traffic on Route 22A, including trucks would have to stop; creating considerable additional noise impacts. Future levels of service with this alternative are shown in Table 7.

Table 7 – Alternative B 2030 PM Peak Hour Levels of Service

	AM				PM (DHV)			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT/TH/RT	C	18	-	-	C	22	-	-
SB LT/TH/RT	C	17	-	-	F	282	-	-
Elm Street								
WB LT/TH/RT	A	10	-	-	B	12	-	-
Panton Road								
EB LT/TH/RT	C	15	-	-	F	151	-	-
Overall	**C**	**17**			**F**	**177**		

5.03 Alternative C (TWO-WAY STOP CONTROL WITH IMPROVED GEOMETRY)

The basic intent of this alternative is to modify the existing geometry and lane assignments at this intersection to minimize conflicts and delays caused by specific turning movements, notably left-turns. This alternative is further separated into Alternative C1, realigning and widening Panton Road only, and Alternative C2, widening both Panton Road and Route 22A to include left-turn lanes. Future levels of service for both Alternative C1 and C2 are shown in Table 8. While offering some improvement over Alternative A, these two alternatives do not provide sufficient additional capacity to eliminate congested traffic conditions during the afternoon peak hour.

Alternative C1

Figure 10 illustrates Alternative C1. The proposed improvements associated with this alternative include adding an exclusive right-turn lane on the eastbound Panton Road approach.

Alternative C2

Figure 11 illustrates Alternative C2. The proposed improvements associated with this alternative include adding an exclusive right-turn lane on the eastbound Panton Road approach and exclusive left-turn lanes on both Route 22A approaches. The latter are shown in this alternative even though the results of left-turn lane warrant analyses for both AM and PM peak hour time periods indicates that there are not sufficient left-turns to warrant their installation.

Table 8 – Alternatives C1 & C2 2030 PM Peak Hour Levels of Service

	AM				PM (DHV)			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT	A	8	0.03	≤25	A	9	0.02	<25
NB TH/RT	A	8	0.00	≤25	A	8	0.01	<25
SB LT/TH/RT	A							
Elm Street								
WB LT/TH/RT	B	12	0.05	≤25	C	15	0.07	<25
Panton Road								
EB LT	F	63	0.83	261	F	1342	1.72	2,655
EB TH/RT	B	11	0.03	≤25	B	12	0.11	<25

5.04 Alternative D (TRAFFIC SIGNAL CONTROL)

This alternative proposes to signalize this intersection. Analysis of existing traffic volumes and turning movement volumes indicate that both the four-hour volume and peak-hour volume warrants[4] are satisfied when the 70% factor is applied for a community of 10,000 or less population. Not applying the 70% factor results in only the four-hour warrant being satisfied. Copies of the warrant analyses are enclosed in Appendix C.

For the purpose of the following capacity analyses, no approach widening or additional turn lanes were included in this alternative, although the additional turn lanes shown in Alternative C1 or C2 would certainly provide additional capacity and improved safety. The proposed scope of Alternative D is illustrated in Figure 12.

The results of the capacity analyses for Alternative D are shown in Table 9. They indicate that this alternative would restore desired levels of service to this intersection during both the morning and afternoon peak hours.

[4] *Manual on Uniform Traffic Control Devices (MUTCD),* Federal Highway Administration, 2009

Table 9 – Alternative D 2030 PM Peak Hour Levels of Service

	AM				PM (DHV)			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT/TH/RT	A	7	0.48	200	B	12	0.45	150
SB LT/TH/RT	A	7	0.46	200	C	26	0.86	425
Elm Street								
WB LT/TH/RT	A	10	0.01	≤25	A	8	0.03	≤25
Panton Road								
EB LT/TH/RT	B	16	0.67	150	C	33	0.90	425
Overall	**A**	**9**	**0.55**		**C**	**26**	**0.88**	

A traffic signal at this intersection would normally be designed to operate in what is known as the "full-actuated" mode. A signal operating in this mode uses traffic detectors to sense vehicles arriving on the respective approaches and cycles the signal accordingly. During times, e.g. off-peak hours, when there are no vehicles arriving on two side streets, Panton Rd. and Elm St., the signal would remain green (dwell) on Route 22A; thus minimizing delays to Route 22A traffic and more importantly, minimizing trucks stopping. We also understand that video detection technology has the capability to detect an oncoming truck. With that feature, the signal could then extend the green on Route 22A accordingly to avoid having to stop that vehicle. The signal can also be programmed to flash during off-peak hours to avoid stopping Route 22A traffic altogether during those times.

Alternative D, installing a traffic signal at this intersection, would restore desired levels of service to this intersection during both the morning and afternoon peak hours.

5.05 Alternative E (ROUNDABOUT)

Figure 13 shows the conceptual geometry of a roundabout at this intersection. This alternative involves the construction of a 140 ft diameter single-lane roundabout with a truck off-tracking apron. The center of the roundabout would be a 70 ft diameter landscaped circular island. To the outside of that will be a 15 ft truck apron, a 17 ft wide circulating lane and a 3 ft shoulder.

Roundabouts offer considerable traffic congestion and safety benefits over other forms of traffic control, including signalization, and are finding increased acceptance throughout the U.S. In Vermont, recently installed roundabouts include ones in Middlebury, Montpelier and East Barre. Because vehicles at roundabouts are traveling at slow-speeds and in the same direction, the number and severity of crashes are both significantly reduced. Pedestrians also find crossing at roundabouts safer because the splitter islands allow pedestrians to only have to deal with one direction of traffic at a time.

The roundabout capacity analysis methodology from NCHRP Report 572 was used to analyze the capacity and levels of service of a roundabout at this intersection. The advantage of using this methodology over other previously used methods is that it is the result of an extensive study of actual traffic conditions at existing U.S. roundabouts. Table 10 shows the results of the capacity analyses for Alternative E.

Table 10 – Alternative E 2030 PM Peak Hour Levels of Service

	AM				**PM (DHV)**			
	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)	LOS	Avg. Delay (sec/veh)	v/c Ratio	95% Queue (ft)
Route 22A								
NB LT/TH/RT	A	7	0.44	173	A	9	0.42	53
SB LT/TH/RT	A	5	0.38	45	A	7	0.56	90
Elm Street								
WB LT/TH/RT	A	6	0.01	≤25	A	7	0.05	≤25
Panton Road								
EB LT/TH/RT	A	6	0.32	35	B	15	0.70	145

Alternative E, constructing a roundabout at this intersection, would restore desired levels of service to this intersection during both the morning and afternoon peak hours.

6.0 PROJECT COSTS

6.01 Cost Estimates

Table 11 presents "order of magnitude" opinions of probable costs for each of the five build alternatives. The cost of Alternative D - Signalization does not include any roadway widening on Route 22A or Panton Road from Alternatives C1 or C2. The costs shown below will need to be further refined as part of future project scoping and design.

Table 11 – Preliminary Opinion of Probable Costs

	Alternative				
	B	**C1**	**C2**	**D**	**E**
Right-of-Way	$0	$20,000	$20,000	$0	$300,000
Construction	$1,400	$80,000	$200,000	$250,000	$1,000,000
Contingency (20%)	$200	$20,000	$44,000	$50,000	$260,000
Project Management (5%)	$100	$5,000	$11,000	$15,000	$65,000
Engineering Design (10%)	$150	$10,000	$22,000	$30,000	$130,000
Construction Inspection (15%)	$150	$15,000	$33,000	$35,000	$195,000
Total	**$2,000**	**$150,000**	**$330,000**	**$380,000**	**$1,950,000**

Because roundabouts offer improved safety, reduced delays and lower operation and maintenance costs, their total life-cycle costs are typically lower than signalized intersection alternatives.

Figure 9 Alternative A - Existing Conditions (No-Build)

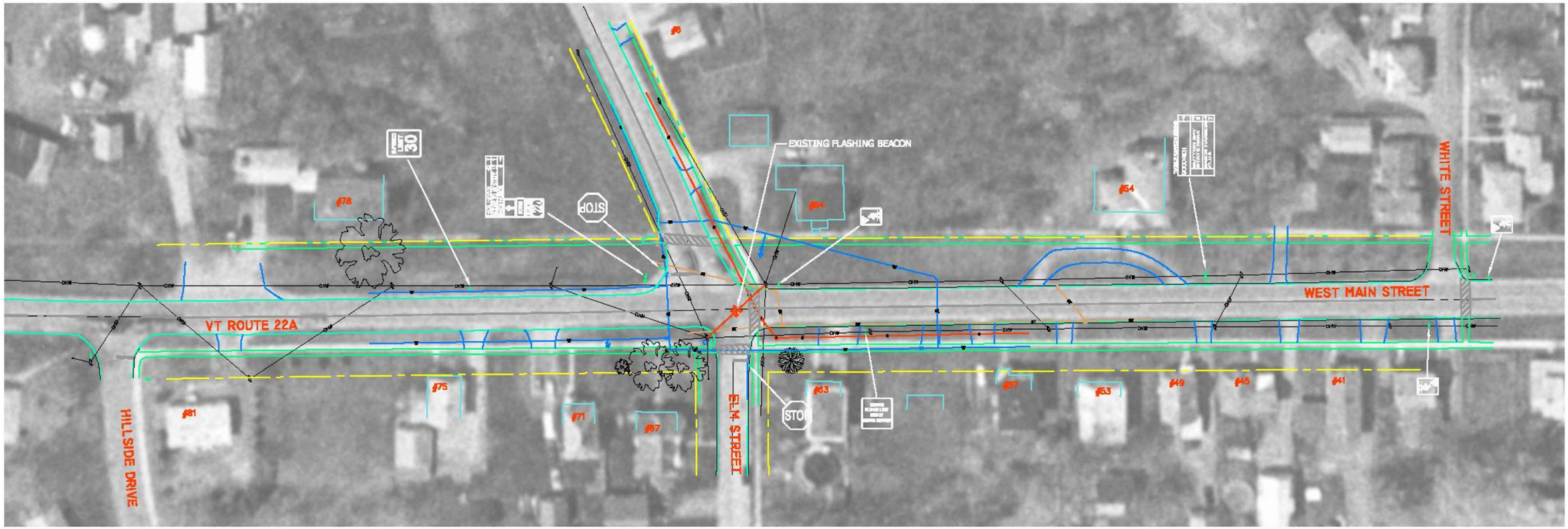


Figure 10 Alternative C1 – Two-Way Stop Control w/ Panton Road Widening

Figure 11 Alternative C2 – Two-Way Stop Control w/ Route 22A and Panton Road Widening

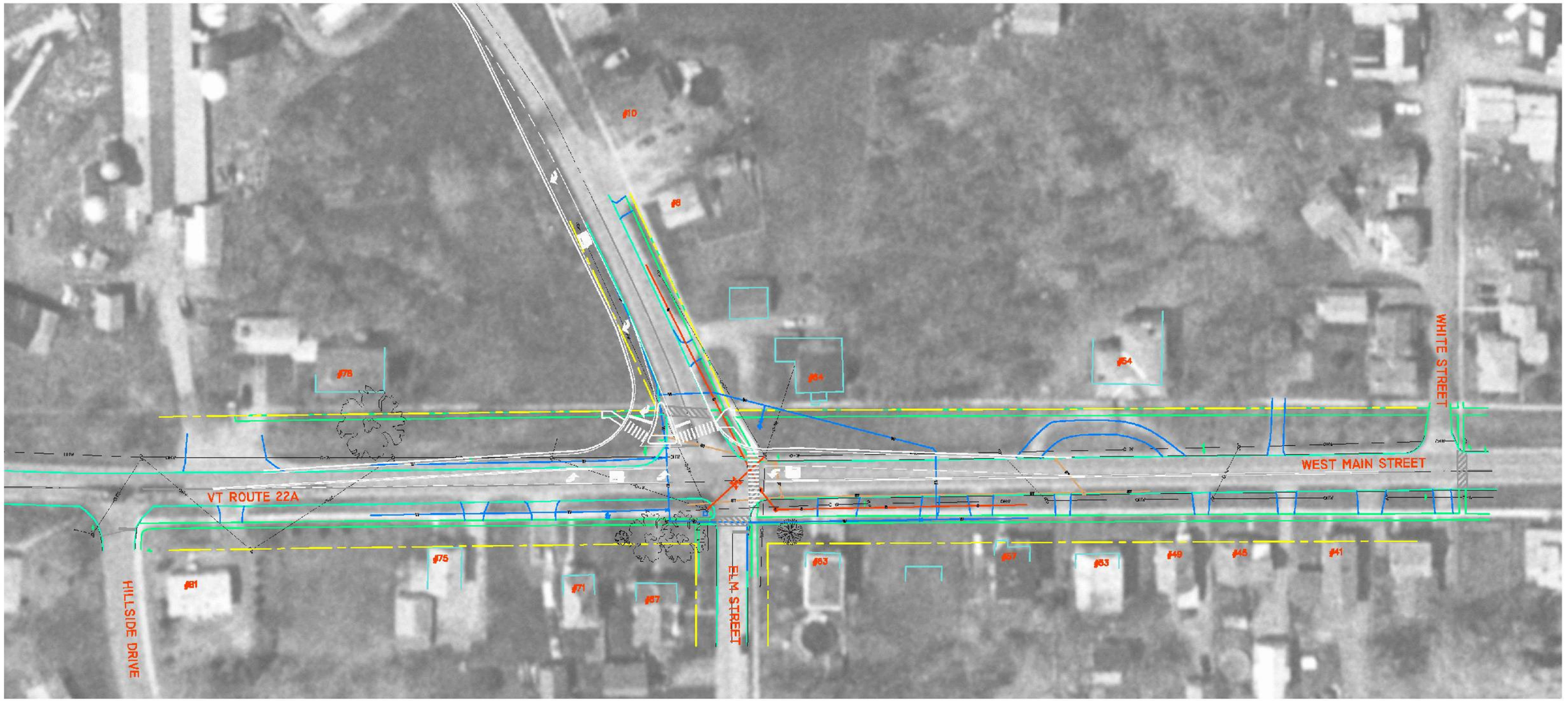


Figure 12 Alternative D - Signalization

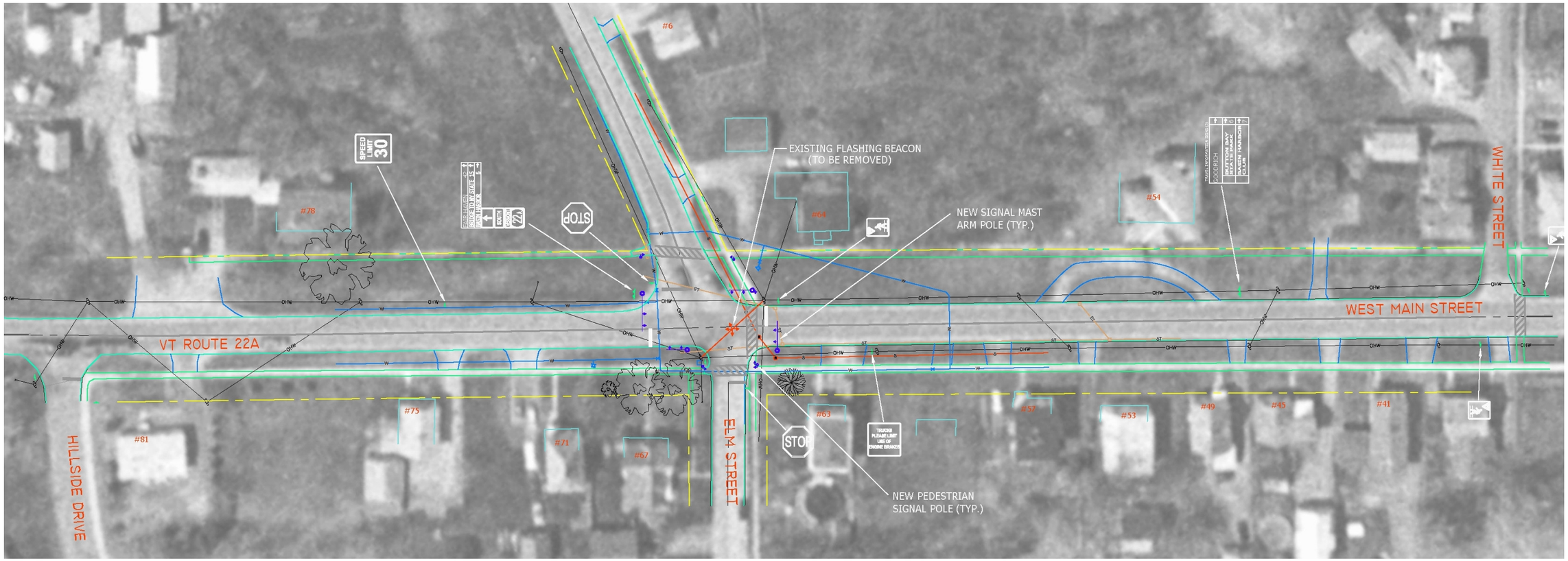


Figure 13 Alternative E - Roundabout