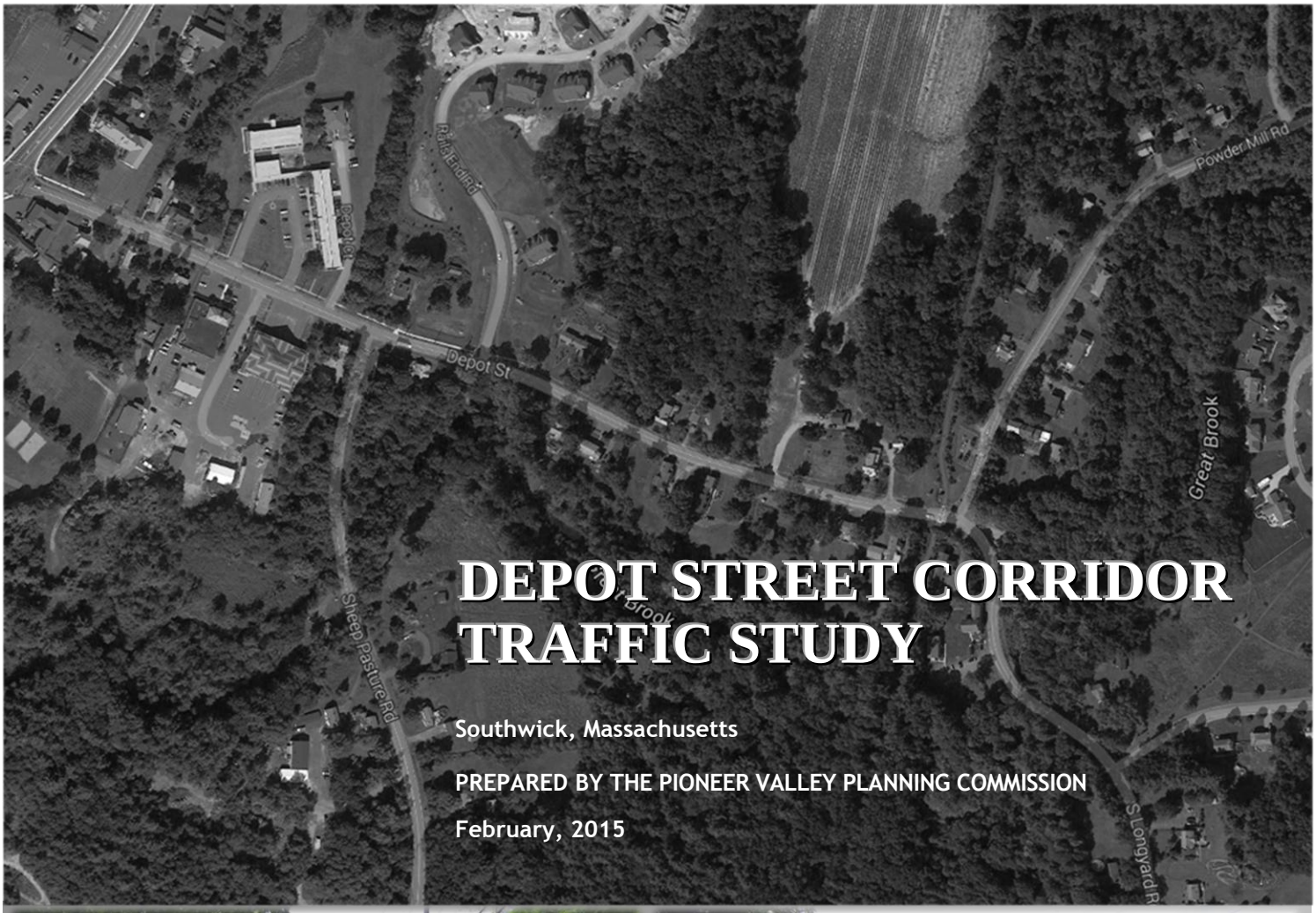

DEPOT STREET CORRIDOR TRAFFIC STUDY

Southwick, Massachusetts

PREPARED BY THE PIONEER VALLEY PLANNING COMMISSION

February, 2015

Catalyst for Regional Progress

PVPC

This document was prepared under contract with the Massachusetts Department of Transportation. This report was funded in part through grant(s) from the Federal Highway Administration (and Federal Transit Administration), U.S. Department of Transportation. The views and opinions of the authors (or agency) expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation.

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I. INTRODUCTION

The Town of Southwick requested the Pioneer Valley Planning Commission (PVPC) to conduct an assessment of vehicle, pedestrian and bicycle safety in the Depot Street/Sheep Pasture Road/Powder Mill Road area as part of the Unified Planning Work Program. This study identifies the existing transportation and safety issues and provides recommendations to improve existing traffic conditions.

A. STUDY AREA

The study area for the traffic study is the Depot Street corridor, specifically the intersection of S. Longyard Road/Depot Street and Powder Mill Road and the intersection of Depot Street and Sheep Pasture Road.

B. EXISTING CONDITIONS

1. Depot Street and Sheep Pasture Road:

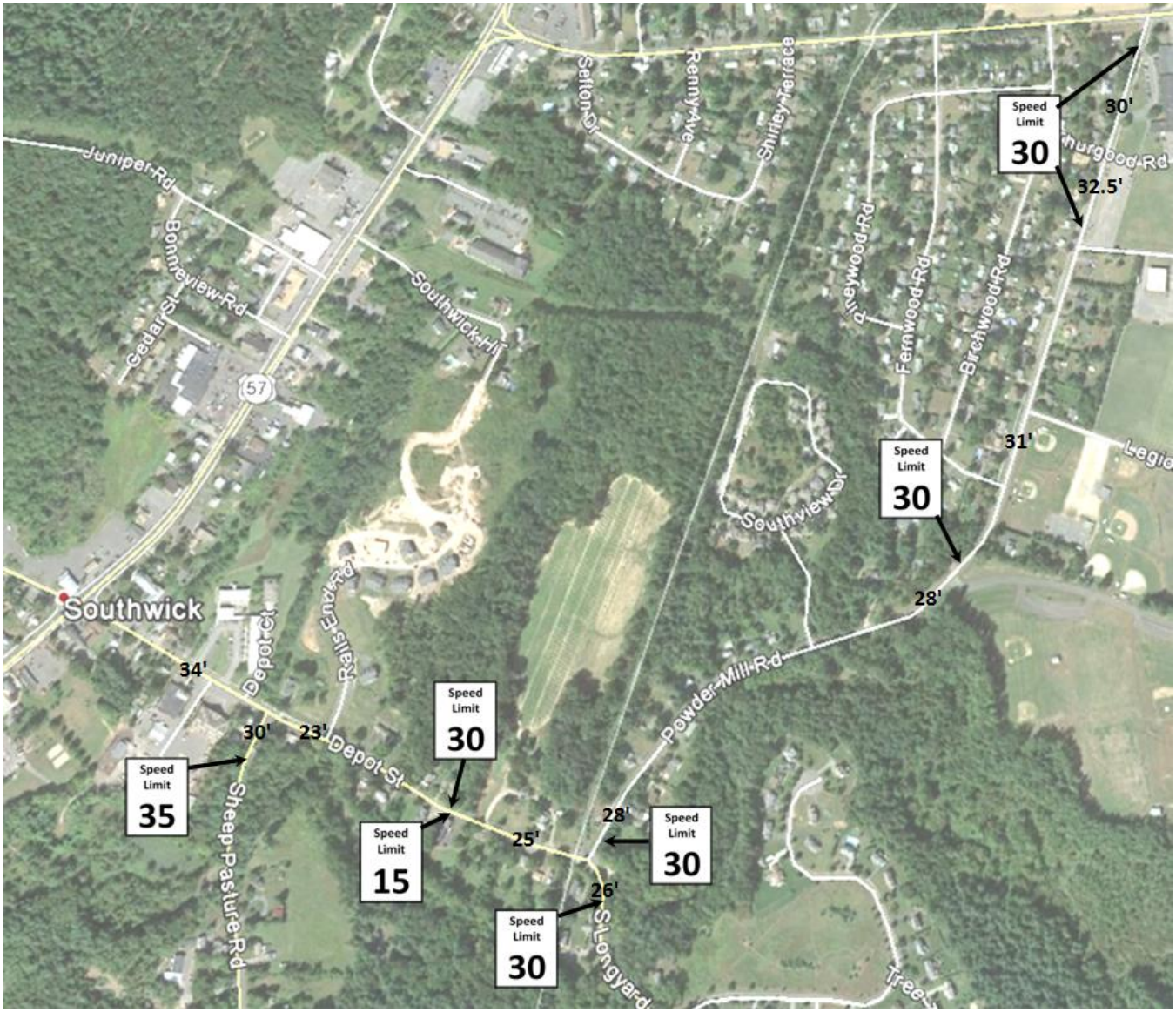
Depot Street intersects with Sheep Pasture Road to the east of College Highway to form a 3-way unsignalized intersection. Sheep Pasture Road operates under "STOP" sign control and provides one lane of travel in each direction with an average pavement cross section width of 30 feet. Sheep Pasture Road provides a connection between Depot Street and Congamond Road (Route 168). There are no sidewalks on Sheep Pasture Road in the vicinity of Depot Street. The average width of Depot Street at this location is 24 feet with one lane of travel in each direction. It is important to note that the pavement width varies

and is as narrow as 21 feet at the Great Brook just behind the guardrail on the southern side of Depot Street with a significant vertical drop. The posted speed limit on Depot Street is 30 mph. There is a 4 foot sidewalk on the north side of Depot Street. The concrete portion of the sidewalk is in good condition but the bituminous section of the sidewalk is old and in very bad condition (See Figure 6). Pavement conditions were observed to be in fair condition. Sun glare is an issue in the mornings at this intersection for vehicles coming out of Sheep Pasture Road and looking easterly and in the afternoons for vehicles driving Westerly on the Depot Street. These concerns were expressed by the town's workers.

2. Depot Street and Powder Mill Road/South Longyard Road:

Depot Street intersects with South Longyard Road and Powder Mill Road to form a "Y" intersection operating under a 3-way "STOP" sign control. All roadways at this intersection provide one lane of traffic in each direction with pavement markings which are in a fair to poor condition. The average pavement width of Depot Street is 25 feet while the average roadway width of Powder Mill Road and South Longyard Road is 28 and 26 feet, respectively. The posted speed limit on Depot Street is 15 mph with Powder Mill Road and South Longyard Road having a posted speed limit of 30 mph and 35 mph respectively. Pavement conditions were observed to be in fair condition.

Figure 1: Speed Limit Regulations and Road Widths



II. DATA COLLECTION

Comprehensive data collection was conducted for this study to identify existing deficiencies. This activity consisted of obtaining traffic volumes, crash experience, and observations of traffic patterns throughout the study area.

A. DAILY VEHICLE VOLUME

Vehicle volume data was collected for use in the transportation analysis in order to measure the travel demands on an average weekday. Average Daily Traffic (ADT) volumes were compiled for typical weekday 48-hour periods at various mid-block locations within the study area using Automatic Traffic Recorders (ATRs). All ADT volumes were factored using adjustment factors provided by the Massachusetts Department of Transportation (MassDOT) to represent Average Annual Daily Traffic (AADT) levels. The daily traffic counts conducted as part of this study were performed in April-May of 2014. A total of sixteen daily traffic counts were conducted in the study area. Table 1 and Figure 2 present a summary of the study area weekday AADT volumes.

Table 1: Average Daily Traffic

Street	Location	NB/EB	SB/WB	Total
Depot Street	East of College Highway	3352	3886	7238
S. Longyard Road	South of Depot Street	1247	1245	2492
Sheep Pasture Road	South of Depot Street	2791	2771	5562
Depot Street	Between Powder Mill Road and Sheep Pasture Road	2448	2526	4974
Powder Mill Road	North of Depot Street	1848	1909	3757
Powder Mill Road	South of Feeding Hills Road	1956	1927	3883

Figure 2: Average Daily Counts

B. HOURLY VEHICLE VOLUME

Manual Turning Movement Counts (TMC) were conducted at several intersections within the study area. The TMCs were conducted during the peak commuter periods. The typical weekday commuter period occurs during the morning hours of 7:00 AM to 9:00 AM and the afternoon hours of 4:00 PM to 6:00 PM. Due to the three schools being a part of the study area, the peak hour counts were done from 6:00 AM to 9:00 AM in the morning, and from 2:00 PM and 6:00 PM in the evening. At each location TMCs were conducted to identify the peak four consecutive 15-minute periods of traffic through the intersection. These consecutive peak 15-minute periods constitute a location's "Peak Hour Volume". The peak hour of traffic volume represents the most critical period for operations and will be the focus for the intersection analysis.

The TMC data also identifies the peak hour factor and vehicle classifications. The peak hour factor (PHF) accounts for variations in travel demand during the peak hour. The PHF is defined as the ratio of the volume occurring during the peak hour to the maximum rate of flow during the highest interval within the peak hour.[1] The information is used to determine how uniform the arrival of traffic was over the course of the peak hour and is used to determine the operational characteristics of the intersection. All vehicles, pedestrians, and bicyclists are manually classified during the turning movement counts to determine their level of use at the intersection. The percentage of heavy vehicles (trucks) that utilize the intersection is important as large vehicles have different operating characteristics than normal passenger vehicles. Pedestrians and bicyclists are also counted as to understand to assess how well each intersection accommodates non-vehicular traffic.

All turning movement counts were adjusted by factors provided by MassDOT to reflect average month conditions. Turning movement count data for the AM and PM Peak Hours is summarized in Figures 2-2 and 2-3 respectively.

Figure 3: AM Turning Movement Counts

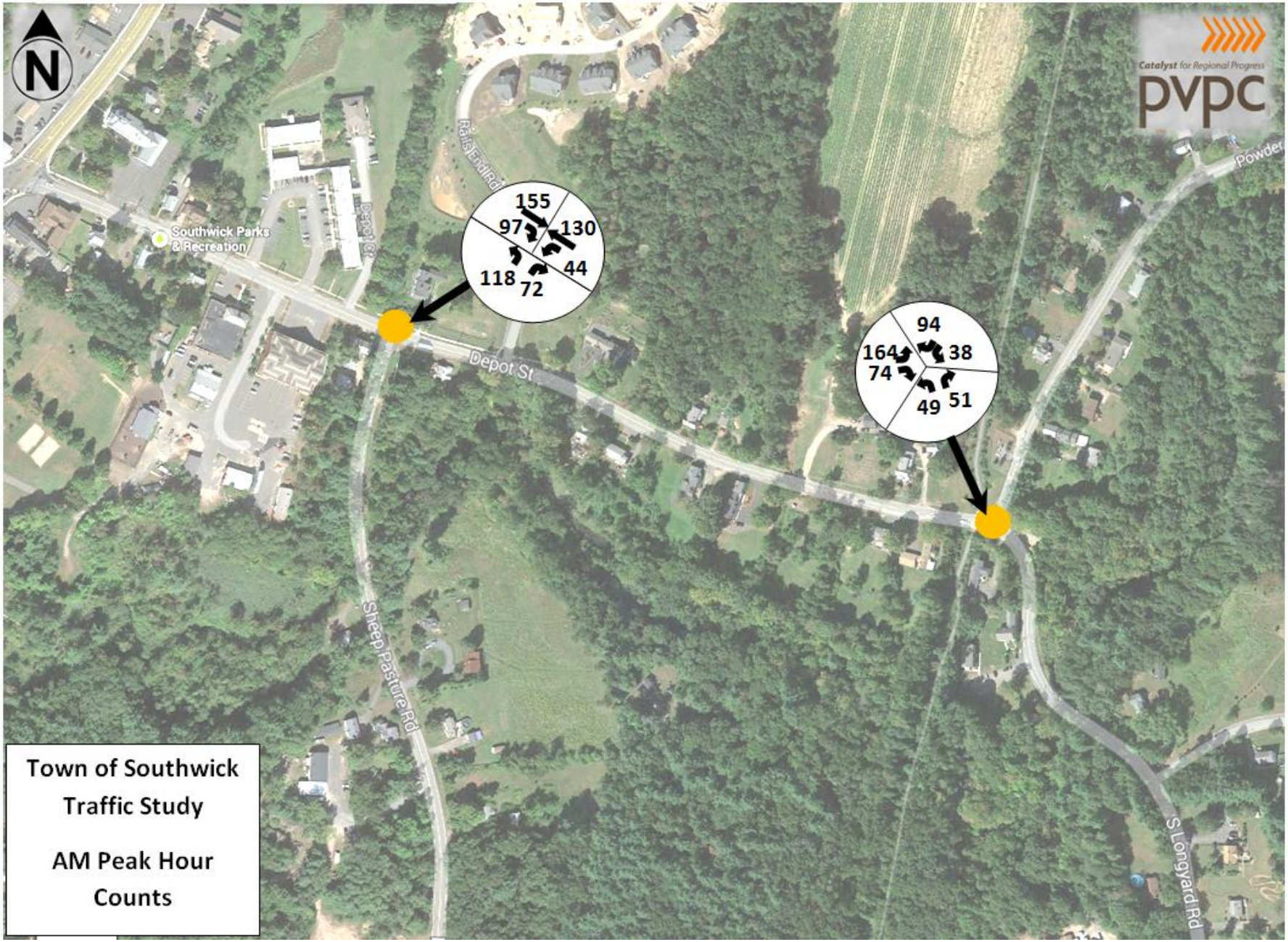
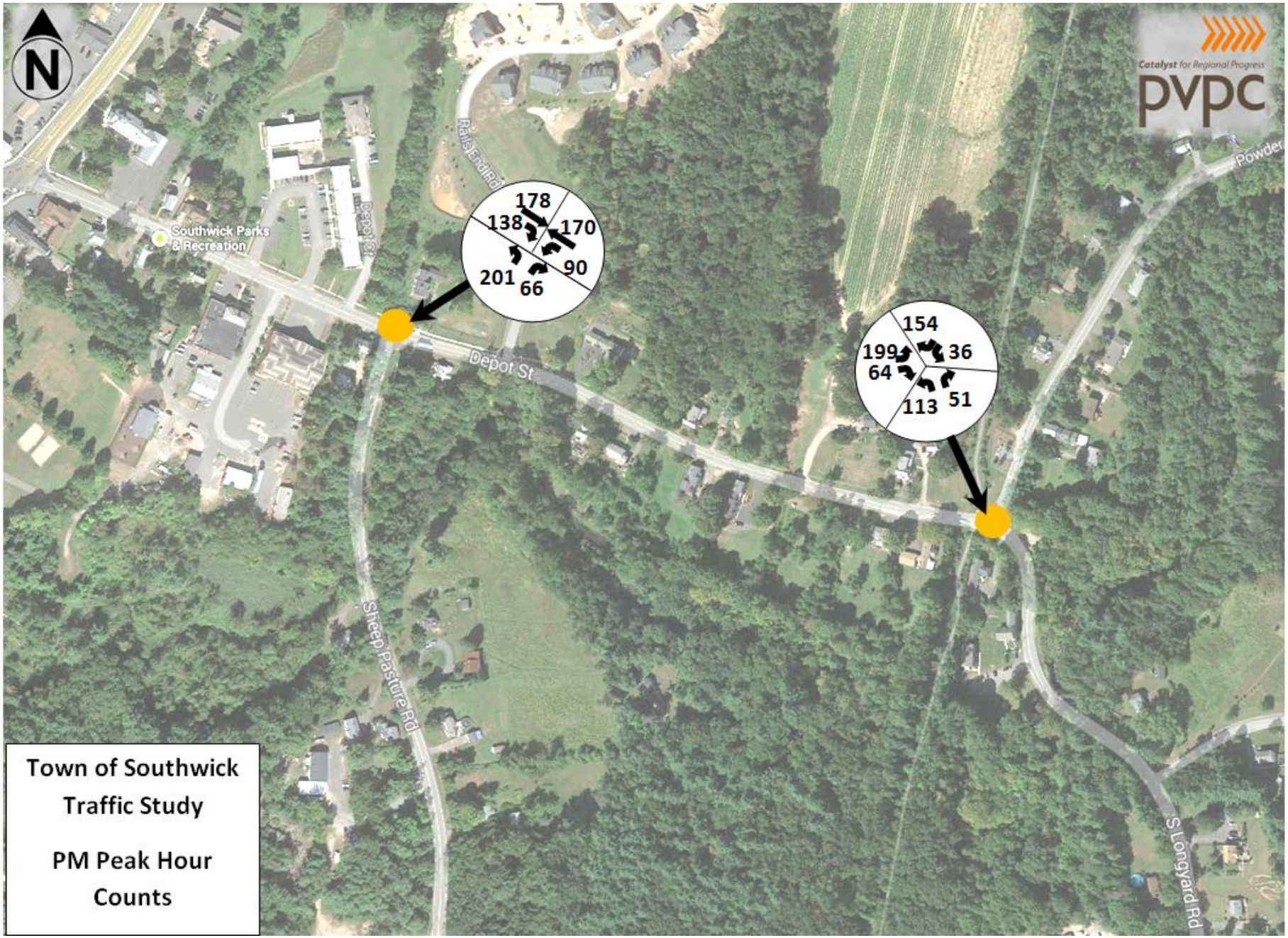


Figure 4: PM Turning Movement Counts



C. PEDESTRIAN VOLUMES DURING THE PEAK HOUR

Due to close proximity of intersections in our study area to the library, schools and the rail trail, pedestrian and bicyclist activity was recorded at peak times. Table 2-2 summarizes the pedestrian and bicycle data collected at each of the study area intersections during the morning and afternoon peak hours.

Table 2: Pedestrian Volumes During the Peak Hour

		AM Peak		PM Peak	
Street	**Cross Street**	**Pedestrians**	**Bicyclists**	**Pedestrians**	**Bicyclists**
Powder Mill Road	Depot/S.Longyard	17	17	4	7
Depot Street	Sheep Pasture Road	0	6	0	0

D. RAIL TRAIL PEDESTRIAN COUNT

Pedestrian counter was placed just north of Depot Street. Table 3 shows data collected on selected days in July and August.

Hour	Sat 7/26	Sun 7/27	Fri 8/15	Sat 8/16	Sun 8/17	Mon 8/18
5		3			1	
6		4		5	1	
7		14		13	4	
8	38	27	20	44	33	10
9	80	22	34	23	53	11
10	81	10	39	61	61	29
11	90	13	50	75	67	30
12	77	2	28	84	51	35
1	71	7	12	55	62	22
2	68	29	19	68	93	36
3	52	31	24	73	78	59
4	57	33	18	41	62	27
5	37	26	16	34	34	41
6	30	16	22	25	27	38
7	20		28	15	15	26
8	3		2	1		1
9	1		1			
10			1			
11	1			1		
Total	**706**	**237**	**314**	**618**	**642**	**365**

E. VEHICLE CLASSIFICATION

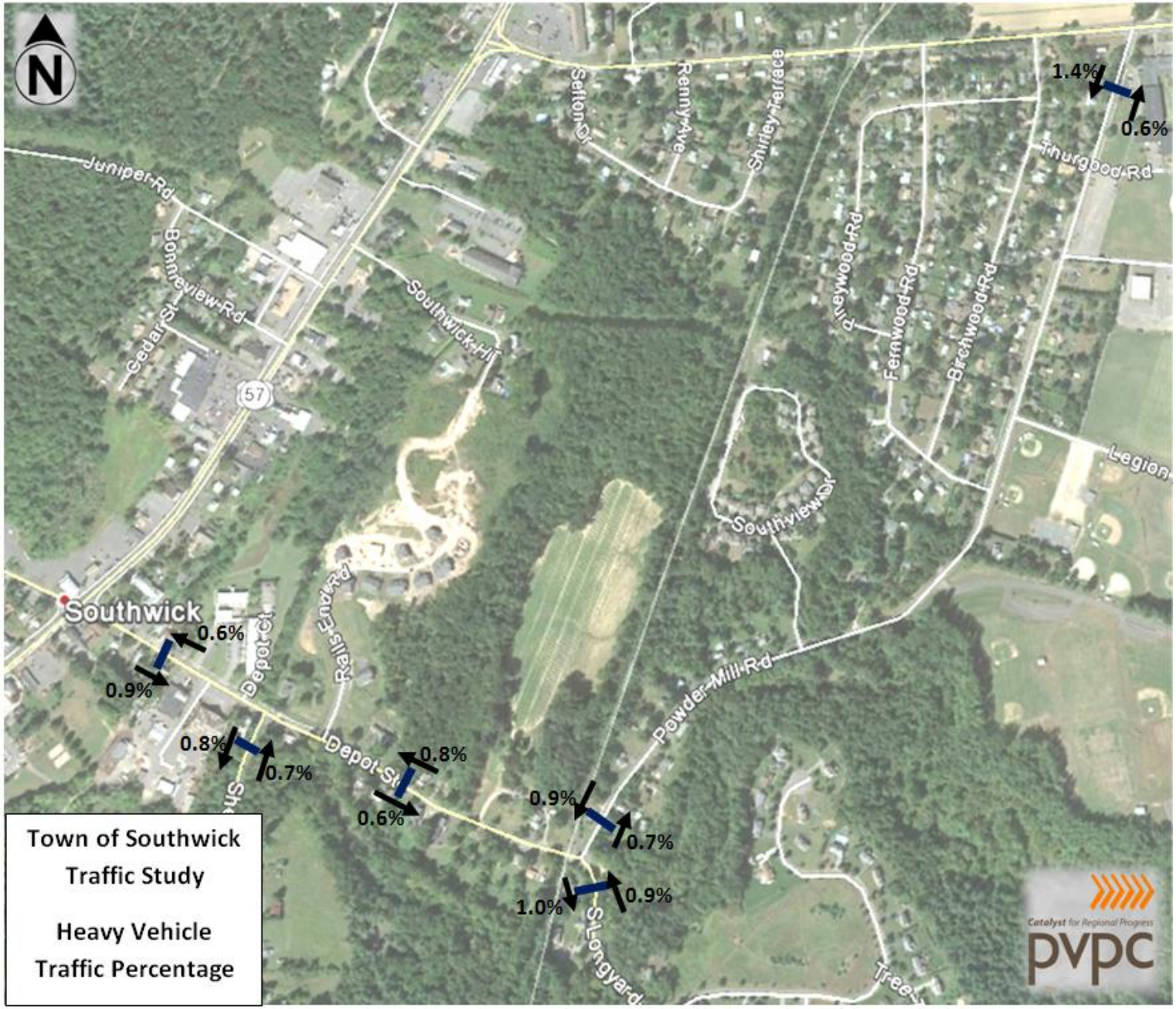
Vehicle classification data is used to identify the percentage of heavy vehicles and passenger cars on the roadway. Heavy vehicles include trucks, recreational vehicles and buses. The percent of heavy vehicles in the traffic flow is an important component in calculating the serviceability of a corridor or intersection. Trucks impact traffic flow because they occupy more roadway space than passenger cars and have poorer operating capabilities with respect to acceleration, deceleration and maneuverability. The percentage of heavy vehicle traffic is also an important factor in the pavement design of a roadway.

Figure 5 displays heavy vehicle percentages in the study area on a map. As can be seen in the Figure there is no significant heavy vehicle traffic in the study area.

Table 3: Vehicle Classification

ID	Street	Location	Direction	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	> 3 Axle	Heavy Vehicles	Total	% Heavy
2261	S. Longyard Road	South of Depot Street	SB	32	1642	628	17	138	12	13	25	2482	1.0%
			NB	39	2008	371	11	42	6	16	22	2493	0.9%
2242	Depot Street	East of College Highway	EB	98	5162	1129	55	199	34	29	63	6706	0.9%
			WB	103	6771	758	22	73	27	18	45	7772	0.6%
9297	Sheep Pasture Road	South of Depot Street	NB	70	4221	1048	42	166	23	14	37	5584	0.7%
			SB	59	4218	1033	40	153	23	20	43	5546	0.8%
9337	Depot Street	Between Powder Mill Road and Sheep Pasture Road	WB	44	3772	829	87	176	29	11	40	4898	0.8%
			EB	53	3975	803	94	98	18	10	28	5051	0.6%
9338	Powder Mill Road	North of Depot Street	SB	28	2881	529	90	138	20	12	32	3698	0.9%
			NB	24	3094	512	82	80	21	6	27	3819	0.7%
9556	Powder Mill Road	South of Feeding Hills Road	SB	34	2385	1034	74	405	24	30	54	3986	1.4%
			NB	17	3171	551	57	110	13	10	23	3929	0.6%

Figure 5: Heavy Vehicle Traffic Percentage



F. TRAVEL SPEEDS

Travel Speed data was collected to establish the ranges in which vehicles were measured to be traveling. This data was used to establish "bins" of data to summarize the ranges in which vehicles were measured to be traveling. Speed data is summarized in Table 4.

Table 4: Speed Data

ID	Street	Location	Direction	Limit	0-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	>50
2261	S. Longyard Road	South of Depot Street	SB	30	2.3%	2.1%	34.6%	53.5%	7.4%	0.2%	0.0%	0.0%	0.0%
			NB	30	6.6%	20.4%	62.3%	10.5%	0.2%	0.0%	0.0%	0.0%	0.0%
2242	Depot Street	East of College Highway	EB	30	9.1%	0.7%	4.8%	29.2%	42.3%	12.6%	1.1%	0.1%	0.0%
			WB		43.9%	1.5%	11.1%	30.7%	11.7%	0.9%	0.1%	0.0%	0.0%
9297	Sheep Pasture Road	South of Depot Street	NB	35	1.8%	0.4%	1.2%	9.5%	40.9%	38.3%	7.1%	0.8%	0.1%
			SB		1.4%	0.1%	0.6%	12.5%	56.1%	26.6%	2.4%	0.3%	0.1%
9337	Depot Street	Between Powder Mill Road and Sheep Pasture Road	WB	30	2.2%	0.3%	1.5%	12.9%	45.5%	31.3%	5.6%	0.5%	0.1%
			EB	30	2.2%	0.5%	2.2%	18.7%	52.3%	21.3%	2.7%	0.2%	0.1%
9338	Powder Mill Road	North of Depot Street	SB	30	2.1%	1.5%	14.2%	52.5%	27.7%	1.9%	0.1%	0.0%	0.0%
			NB	30	2.2%	0.7%	17.3%	63.3%	15.8%	0.6%	0.1%	0.0%	0.0%
9556	Powder Mill Road	South of Feeding Hills Road	SB	30	5.3%	2.3%	24.0%	50.7%	16.6%	1.0%	0.1%	0.0%	0.0%
			NB	30	20.6%	13.3%	39.8%	25.0%	1.2%	0.1%	0.0%	0.0%	0.0%

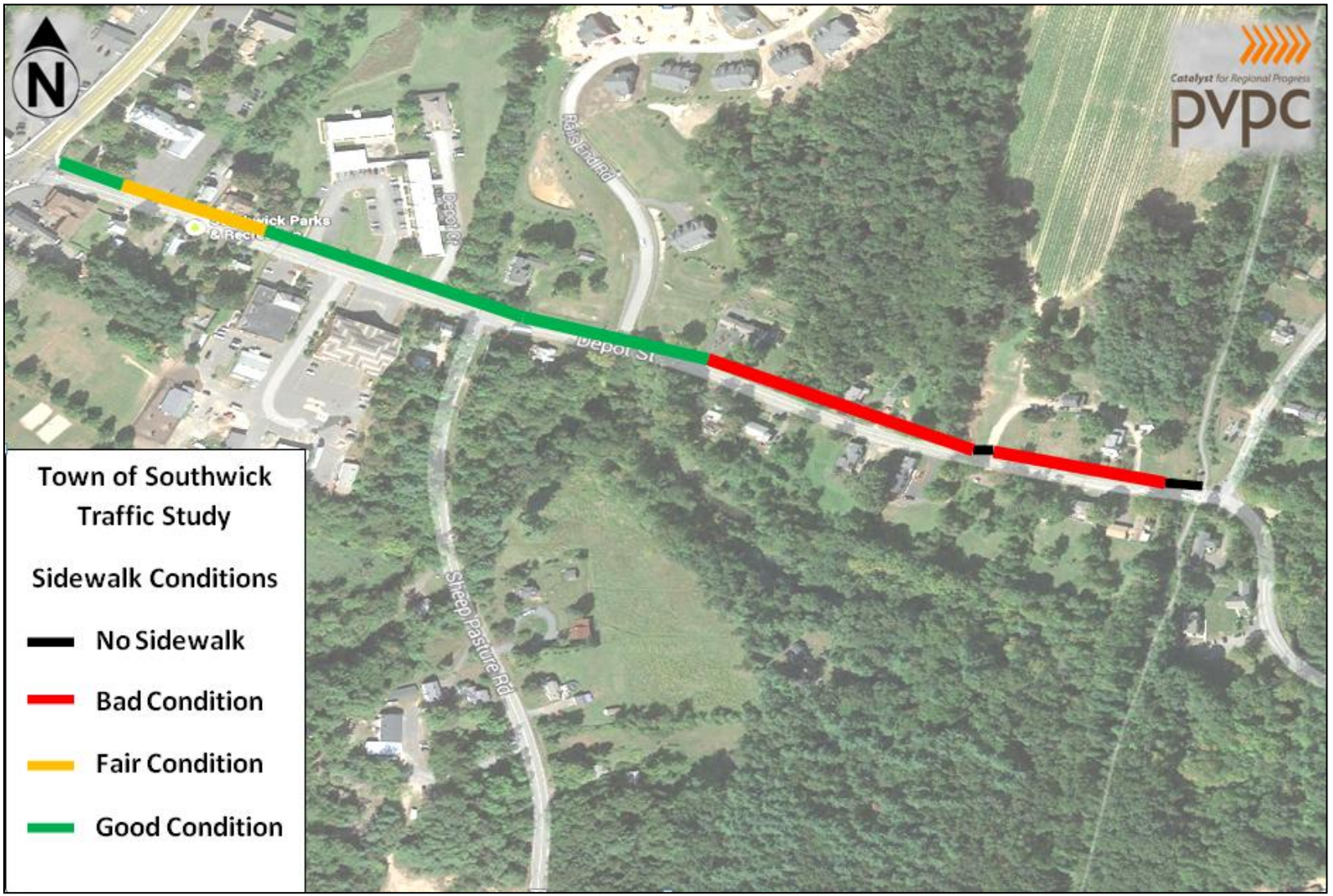
G. INFRASTRUCTURE

1. A walking heritage and an important recreational activity

Since 1730's when Southwick was settled, residents relied on walking as their principal mode of transportation. Walking determined how streets and the village center were laid out. Areas for socialization and interaction were so important for both community and trade that development patterns in were concentrated around a 3 mile walking distance. These walking paths eventually evolved into roads for horses, carriages and finally automobiles. With the automobile the need for walking greatly diminished.

Today, many residents of Southwick feel the need for exercise and for access to open spaces. Walking is recognized as an easy and inexpensive form of regular physical activity that lowers the risks of cancer, heart disease, diabetes, stroke, arthritis, and osteoporosis, as well as keeps weight in check and ward off depression. Walking is most effective if each person gets a minimum of 30 minutes of daily activity, according to the U.S. Centers for Disease Control. In response the Town has actively pursued ways to create safer walking opportunities including significant investments in sidewalks. In coordination with Public Works and Parks and Recreation the Town maintains a network of sidewalks and paths with access to parks, trails, and conservation areas. Within the Depot Road Study area sidewalks are included along sections of many of adjoining streets. Figure 6 shows the current condition of all sidewalks in the study area.

Figure 6: Sidewalk Condition



H. School Pedestrian Circulation and Access

The Southwick-Tolland-Granville Regional School District had an enrollment of 1,636 students during the 2014-15 academic year (including 100 enrolled through the School Choice and METCO). Three of the regional system's schools (Southwick-Tolland Regional High School, Powder Mill Middle School, and Woodland Elementary School) are located in proximity to the study area. The Southwick-Tolland-Granville District is currently into the second year of a two-and-a -half-year construction project. This extensive work totals $64 million. As part of the project the Woodland Elementary School and Powder Mill Middle School are being renovated and the high school has been expanded to accommodate grades 7 through 12. When the construction is completed, students will go to an early education center pre-kindergarten through second grade, then an intermediate school through 6th grade then the high school through senior year. Within the framework of these significant changes it was difficult to identify specific needs/opportunities for pedestrians. As a regional school system in a more rural setting the potential for students to walk to school is limited to those in close proximity to the schools. School principals generally reported a modest number of walkers. A 20 mile per hour school zone has been established on both Powder Mill Road and Feeding Hills Road. The Superintendent is John D. Barry.

110-acre parcel of land that includes the Southwick-Tolland, Regional High School, Powder Mill Middle School, Woodland, Elementary School, and Southwick Public Library

In 2014 the Southwick-Tolland Regional High School (grades 9-12) had an enrollment of 539 students. The school is located at 93 Feeding Hills Road behind the Southwick Public Library. Students start the day at 7:30 am and are dismissed at 2:10 pm. Busses drop of students in the new driveway in front of the building near the cafeteria where students follow a path to the new main entrance. Parents also drop off in front of the building in the new driveway and students enter the building at the new main entrance. Students must use the sidewalks and cross walks. Parents are encouraged not to block the bus lane. A crosswalk from the parking and bus drop off areas to the cafeteria entrance area is proposed. Beginning January of 2015 the school will transition to include 7th and 8th grades. The Principal is Pamela Hunter.

Woodland Elementary School (enrollment 526) at 80 Powder Mill Rd is one of two elementary schools in the Southwick-Tolland-Granville Regional School District. School hours for Woodland Elementary School (PK-4) are from 9:00 AM – 3:20 PM. Teachers are on duty at 8:50 and students are expected to be in their classes at 9:00. Bus drop off is directly in front of the school entrance. Parents that drive students to school use the drop off point at the adjacent Southwick REC Center. There are signs that direct drop off pedestrian traffic around the building to the crossing guard. Students being dismissed to parents meet in the gym at 3:20. Crossing guards are provided to assist pedestrians and help with traffic flow during arrival and dismissal. The Woodland Elementary School Principal is Kimberley Saso.

Powder Mill Middle School adjacent to Woodland Elementary School at 94 Powder Mill Rd (previously grades 5-8/ 450 students) has a class start time of 8:15 with dismissal at 2:41pm (students participating in the breakfast program arrive at 7:45am). The 2014-15 academic year is a transitional year for Powder Mill Middle School . Beginning January 5th, 2015 7th and 8th grade students will move to the Southwick-Tolland Regional High School location. Parents are asked to use the large parking lot on the south side of the school for pickup and drop off. The circular drive is reserved for busses and is not open to traffic from 8:00-8:30am and from 2:15-3:00 pm. Parents are instructed not to drop students off near the auditorium entrance or other non-designated locations. Crossing guards are positioned at crosswalks within the established school zones on Powder Mill Road and Feeding Hills Road. The Principal is Ronald Peloquin.

1. Massachusetts Safe Routes to School Program

Safe Routes to School is a national movement to create safe, convenient, and fun opportunities for children to bicycle and walk to and from schools. The program's goal is to reverse the decline in children walking or biking to school where (nationally only 15 percent of school children walk). The Massachusetts Safe Routes to School Program is a central source of Safe Routes

services to all interested schools in the state and currently provides services to 43% of public K-8 schools. The program provides safety trainings, classroom visits, presentations to parents and community members, special events, encouragement programs, free promotional items, infrastructure improvements and summer programs.

To participate in the SRTS program, a school or community first completes the Massachusetts Safe Routes to Partnership Enrollment Form (see appendix for a copy of this form). Schools that identify interest in collaborating on Safe Routes to School initiatives can contact MassRIDES via email or phone. MassRIDES coordinators will meet with the school staff and brief stakeholders on the Safe Routes to School program. The coordinator will work with schools and communities to implement education and encouragement activities and assist in identifying potentially eligible infrastructure projects targeted to enhancing safe access to the school. Interested Southwick school staff or community organizations taking the lead should contact Jana Linhart and complete the Partnership Enrollment Form (Attached in the Appendix) and send it to:

Jana Linhart

Western Massachusetts School Outreach Coordinator

Massachusetts Safe Routes to School

c/o MassRIDES / MassDOT`

10 Park Plaza, Suite 2180

Boston, MA 02116

t: 857.268.8639

f: 857.368.0656

www.commute.com

www.facebook.com/SafeRoutes.MA

www.twitter.com/SafeRoutes_MA

I. COMPARISON

Table 5: ADT Comparison

Street	Location	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Depot Street	East of College Highway	8532		9098	8027	8933	8593	7845		7305		7176	7238
S. Longyard Road	South of Depot Street		2797		2968		3079		2248		2422		2492
Sheep Pasture Road	South of Depot Street				6617		6347	5872					5562
Depot Street	Between Powder Mill Road and Sheep Pasture Road				5753		5707	3821					4974
Powder Mill Road	North of Depot Street				4403								3757

III. ANALYSIS PROCEDURES

A. INTERSECTION ANALYSIS

Traffic operations were examined at two unsignalized intersections throughout the study area.

At an unsignalized intersection, LOS is determined by the average total delay which is defined as the total elapsed time from when a vehicle stops at the end of a queue to when the same vehicle departs from the stop line. The basic assumption at an unsignalized intersection is that through moving traffic on the major street is not hindered by other movements. In reality, as minor street delays increase, vehicles are more likely to accept smaller gaps in the traffic stream causing through moving vehicles to reduce speed and suffer some delay. The left turn movement off the minor street approach is the most heavily opposed movement and typically suffers the greatest delay. Therefore this movement is used as a gauge to determine the overall operations at an unsignalized intersection. Table 2-13 lists the level of service criteria for unsignalized intersections.

Table 6: Level Of Service (LOS) Designations - Unsignalized Intersections

Average Control Delay (sec/veh)	LOS	Expected Delay To Minor Street
0.0 to 10.0	A	Little or no delay
>10.0 to 15.0	B	Short traffic delays
>15.0 to 25.0	C	Average traffic delays
>25.0 to 35.0	D	Long traffic delays
>35.0 to 50.0	E	Very long delays
>50.0	F	Extreme delays

B. CAPACITY ANALYSIS SUMMARY

Intersection capacity analyses were conducted for all intersections in the study area. The analysis presents information identifying the operational condition of intersections, both signalized and unsignalized. Acceptable conditions are those measured with Level Of Service (LOS) assignments of A through D, while unacceptable conditions are assigned E or F. The LOS for individual intersection approaches was calculated as well as for overall intersection operation. Table 2-15 summarizes the level of service at the two unsignalized intersections analyzed in the study area during the weekday AM and PM peak hours.

Table 7: Unsignalized Intersection LOS

Unsignalized Intersections	AM Peak		PM Peak	
	Delay (s)	LOS	Delay (s)	LOS
Depot Street/S. Longyard Road and Powder Mill Road				
Depot Street Eastbound All Movements	11.5	B	11.3	B
S. Longyard Road Westbound All Movements	8.5	A	9.2	A
Powder Mill Road Southbound All Movements	9.4	A	9.6	A
Overall	10.3	B	10.2	B
Sheep Pasture Road and Depot Street				
Depot Street Eastbound All Movements	0.0	A	0.0	A
Depot Street Westbound All Movements	8.1	A	8.3	A
Sheep Pasture Road Northbound All Movements	16.5	C	30.9	D
Overall	5.3	A	10.9	B

C. SIGNAL WARRANT ANALYSIS

The intersections in the study area were examined to determine if the minimum warrants for the installation of a traffic signal are met. The 2003 edition of the Manual on Uniform Traffic Control Devices (MUTCD) sets forth the criteria for eight warrants of which one or more should be fully satisfied before a signal is installed. In addition, the installation of a traffic signal must improve the safety and operation of the location under study. The study area is classified as an urban area by the Federal Government following the 2010 Census. Tables 8 and 9 present the results of the signal warrant analysis for each of the study area intersections.

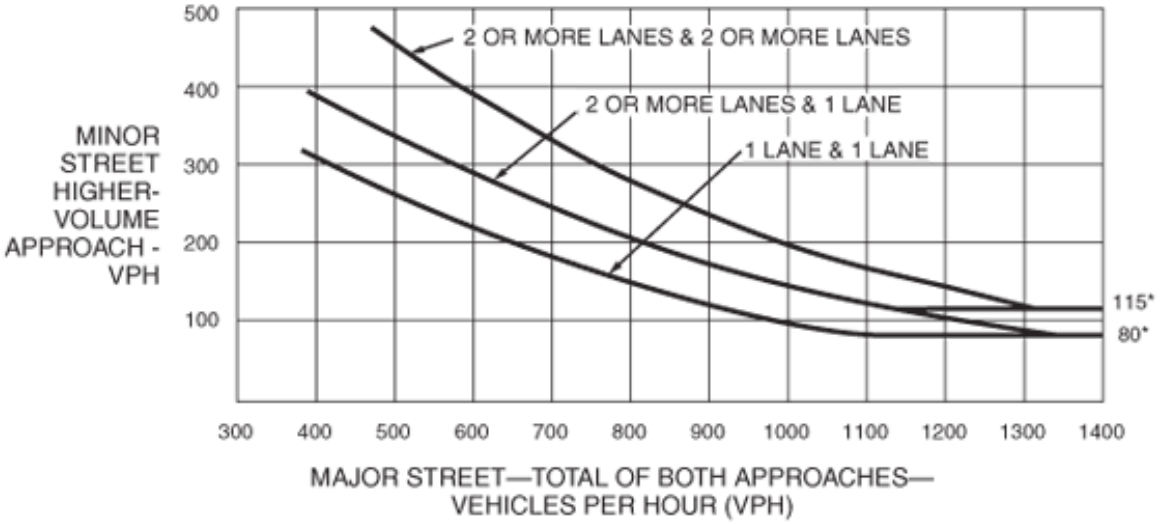
Table 8: Signal Warrant Analysis

Warrant	Description	Depot Street with Sheep Pasture Road	Depot Street and Powder Mill Road with South Longyard Road
1	Eight Hour Vehicular Volume	Not Satisfied	Not Satisfied
2	Four Hour Vehicular Volume	Satisfied	Not Satisfied
3	Peak Hour Volume	Not Applicable	Not Applicable
4	Pedestrian Volume	Not Applicable	Not Applicable
5	School Crossings	Not Applicable	Not Applicable
6	Coordinated Signal System	Not Applicable	Not Applicable
7	Crash Experience	Not Satisfied	Not Satisfied
8	Roadway Network	Not Applicable	Not Applicable

Of the eight total warrants for the installation of a traffic signal, Warrant #1 – Eight Hour Vehicular Volume is generally considered the most important as it requires minimum volumes to be met on both the major and minor streets for at least eight hours. Warrant #2 – Four Hour Vehicular Volume and Warrant #3 – Peak Hour Volume also require minimum volumes to be met but over shorter timeframes. Warrant #7 – Crash Experience requires 80% of the volume requirements of Warrant #1 to be satisfied and at least 5 crashes of a type correctable through traffic signalization to have occurred over the last year. This warrant also requires that less restrictive remedies such as improved signing and pavement markings be tried and have failed to reduce crashes before a signal can be installed.

The intersection of Depot Street with Sheep Pasture Road meets the minimum requirement of Warrant 2 while the intersection of Depot Street and Powder Mill Road with South Longyard Road does not meet any of the warrants. MUTCD warrant #2 states that the need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes.

Figure 7: MUTCD Warrant 2



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

D. MULTI-WAY STOP APPLICATIONS

The intersection of Sheep Pasture and Depot Street was identified as a possible candidate to operate under multi-way stop control due to its existing safety concerns.

A multi-way "STOP" requires all vehicles to come to a complete stop prior to advancing through the intersection. The first vehicle to arrive at the intersection is granted the right of way. Multi-way stop signs can increase safety in the long term by defining the right of way at the intersection, however it is not uncommon for crashes to increase in the short term as traffic adjusts to the new flow procedure. "STOP" signs are not intended to act as a speed control device.

The Manual on Uniform Traffic Control Devices defines the criteria to install multi-way stop control as follows:

1. In the event that a traffic signal is warranted, a multi-way stop can be installed for a brief period of time until the traffic signal is constructed.
2. A crash problem, as indicated by 5 or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right and left turn collisions as well as right-angle collisions.
3. Minimum volumes for an intersection:

    - The volume of vehicles entering the intersection from the major street approaches (the total of approaches coming from both directions) is at or exceeds 300 vehicles per hour for any 8 hours of a 24 hour period.
    - The combination of vehicular, pedestrian and cyclists traffic entering the intersection from both of the approaches on the minor street is or exceeds 200 units per hour for the same 8 hours used for the volume of the major street for both approaches or have a delay of at least 30 seconds per vehicle during the highest hour, but
    - If 85 percent of the approach speed for the major street traffic is higher than 40 miles per hour, the minimum vehicular volume warrants are 70 percent of the above values.

Multi-way stop signs would create gaps for left and right turning vehicles and potentially reduce delay for these movements; however, they would also create delay for through traffic on the major street approach which is not currently required to stop. At the intersection of Depot Street with Sheep Pasture Road, multi-way stop signs could reduce delay for the left-turning vehicles out of Sheep Pasture Road. The multi-way stop warrant is satisfied for this intersection because it meets the warrants for a traffic signal and the volume requirements of criteria #3.

E. SAFETY/CRASH ANALYSIS

Information on the crash history at fifteen intersections in the study area was researched through Southwick Police Department records. Table 9 summarizes the number of crashes by location and type for the 2011-2013 calendar years to identify any common conditions and possible causes. Figures 8 through 11 show the crash locations. The safety analysis of the study area does not demonstrate any significant safety issues.

Table 9 Crash History

	DATE	TIME	DAY	SEV.	LIGHT	SURFACE	LOCATION	PATTERN
2	1/25/2011	02:52PM	TUE	PD	1	2	DEPOT/COLLLEGE HWY	8
6	4/23/2011	06:57PM	SAT	I	1	2	DEPOT/SHEEP PASTURE RD	8
5	5/7/2011	1:11PM	SAT	PD	1	1	DEPOT/SHEEP PASTURE RD	8
7	6/19/2011	05:27PM	SUN	PD	1	1	DEPOT/COLLLEGE HWY	8
8	8/12/2011	10:38AM	FRI	I	1	1	DEPOT/SHEEP PASTURE RD	0,15
11	3/5/2012	12:35AM	MON	I	4	1	DEPOT/SHEEP PASTURE RD	1
13	5/17/2012	03:56PM	THU	I	1	1	DEPOT/SHEEP PASTURE RD	8
14	8/5/2012	12:26AM	SUN	PD	4	1	DEPOT/SHEEP PASTURE RD	5
16	9/16/2012	07:46PM	SUN	I	3	1	DEPOT/COLLLEGE HWY	5
17	9/21/2012	05:35PM	FRI	I	1	1	DEPOT/SHEEP PASTURE RD	5
1	10/5/2012	10:20AM	FRI	PD	1	1	DEPOT/SHEEP PASTURE RD	5
19	10/29/2012	03:06PM	MON	I	1	2	POWDER MILL/SOUTH VIEW	11
21	5/11/2013	10:50AM	SAT	PD	1	1	DEPOT/COLLLEGE HWY	8
23	7/18/2013	04:38PM	THU	I	1	1	DEPOT/SHEEP PASTURE RD	8
24	8/28/2013	2:38PM	WED	I	1	1	DEPOT/COLLEGE HWY	0
22	5/16/2013	08:12AM	THU	PD	1	1	POWDERMILL RD	8
9	1/18/2012	11:06AM	WED	I	1	1	POWDER MILL RD	7
4	4/19/2011	07:08PM	TUE	PD	1	2	POWDER MILL/SOUTH VIEW	1, 15
20	11/9/2012	07:58AM	FRI	I	1	1	POWDER HILL/FEEDING HILLS	8
15	8/31/2012	02:27PM	FRI	PD	1	1	POWDER HILL/DEPOT	5
3	2/11/2011	07:52AM	FRI	PD	1	1	POWDER MILL/FEEDING HILLS	5
25	9/30/2013	02:33PM	MON	PD	1	1	POWDER MILL RD	5
26	1/11/2014	4:14PM	SAT	PD	1	2	POWDER MILL/FEEDING HILLS	8

Figure 8: Powder Mill Road Crash Diagram

Figure 9: Depot St and College Highway Crash Diagrams

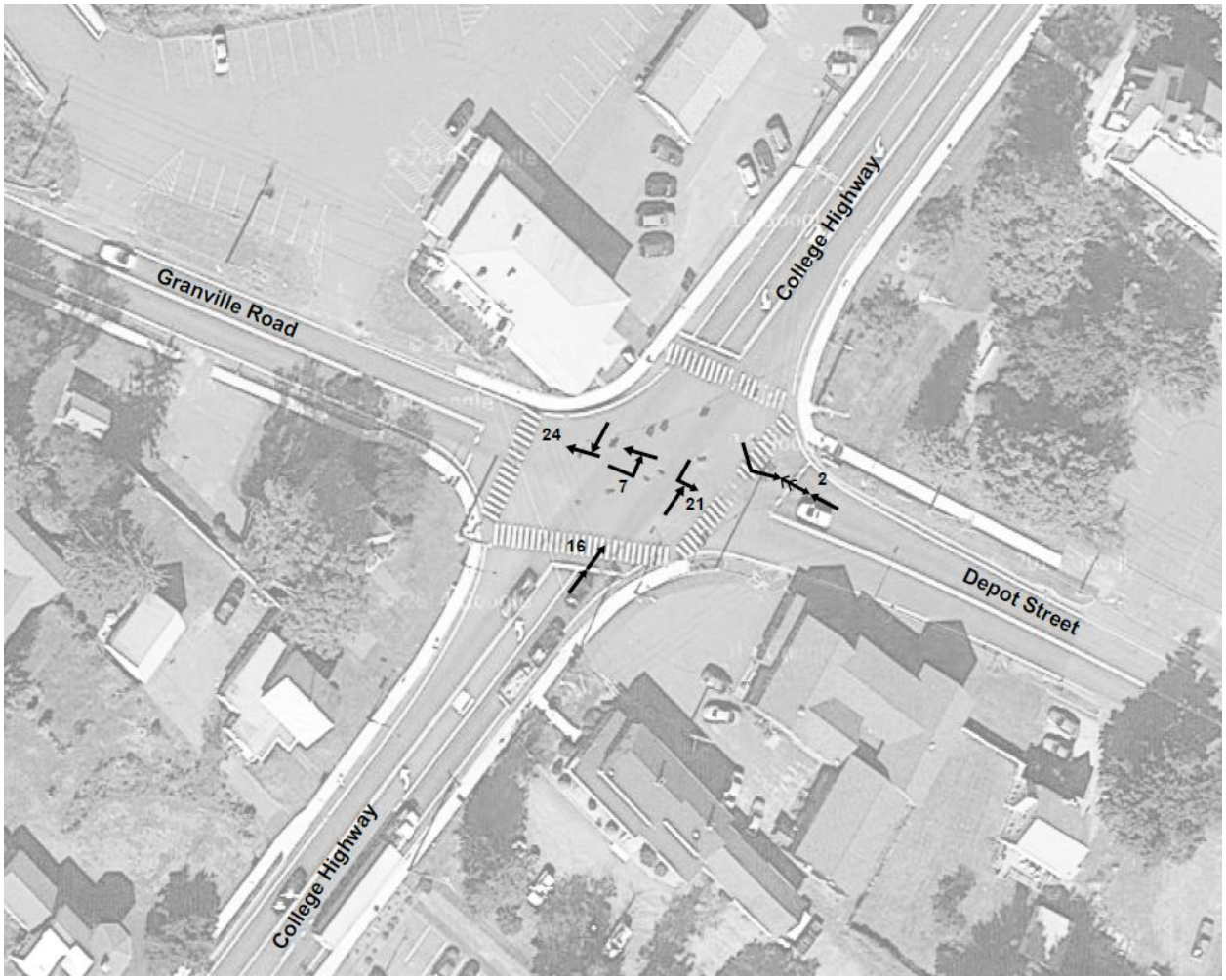


Figure 10: Depot St and Sheep Pasture Road Crash Diagrams

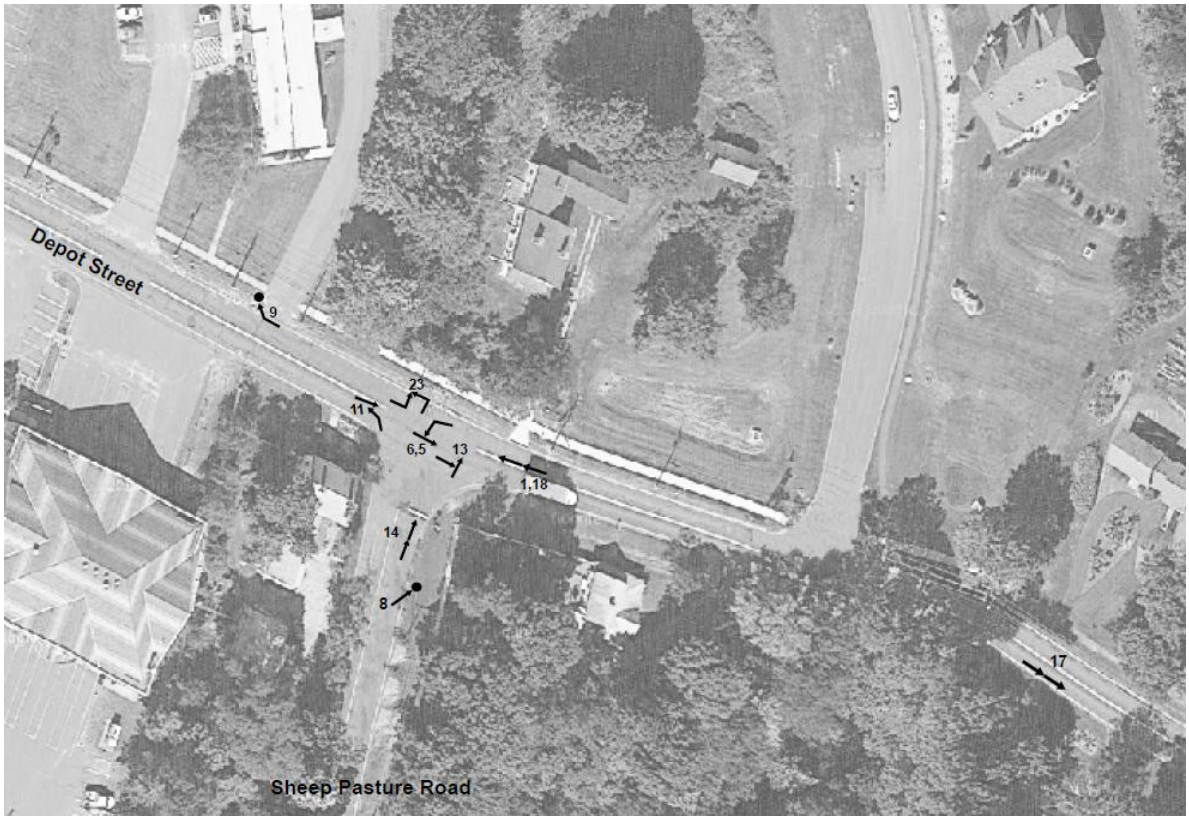
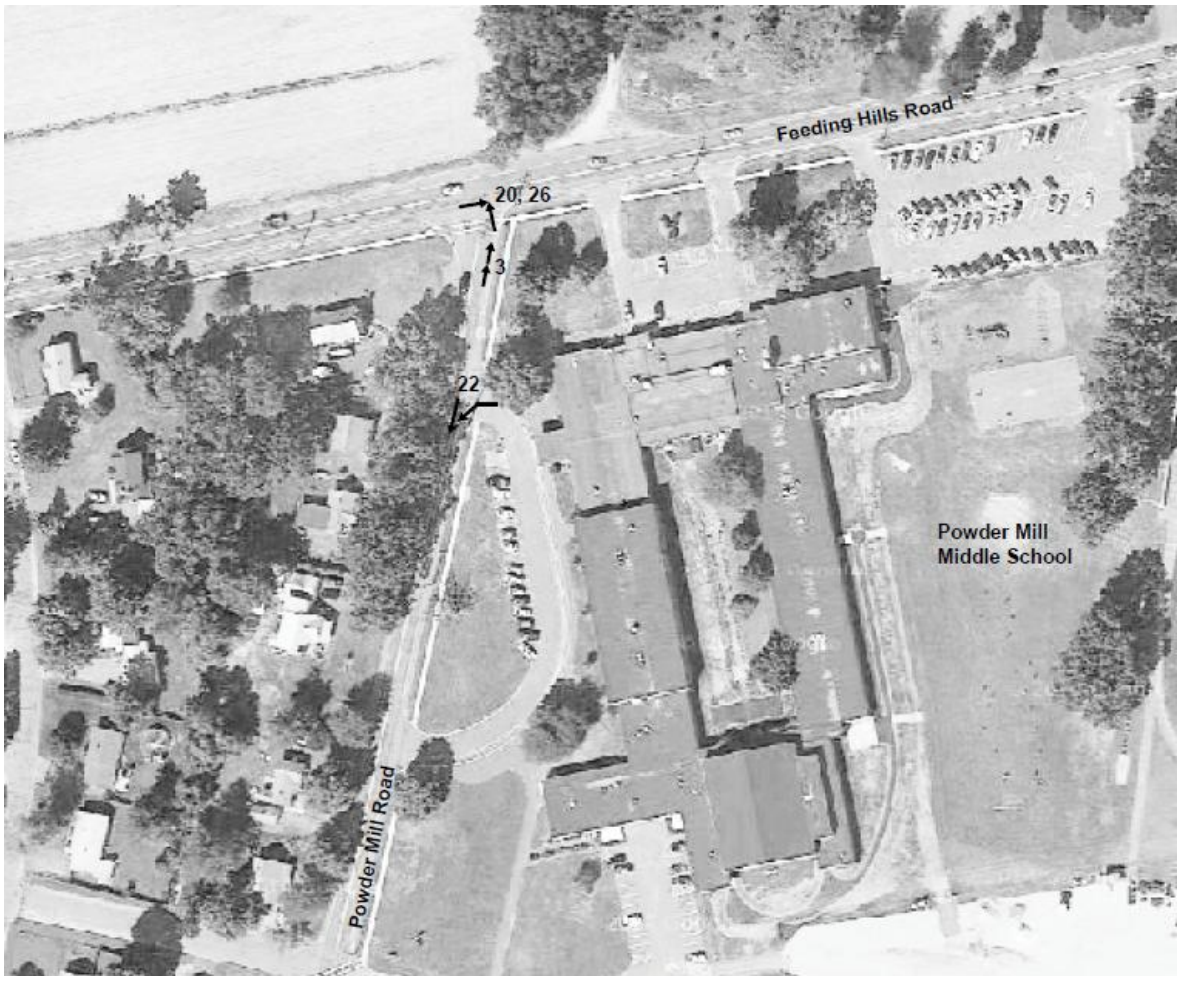


Figure 11: Powder Mill Road and Feeding Hills Road Crash Diagrams



F. BICYCLE CONNECTIVITY AND STRESS ASSESSMENT

The Southwick Rail Trail is a continuous 6.3 mile paved off road multi-use trail extending from the Massachusetts–Connecticut state line (where it continues south as the Farmington Canal Heritage Trail) north to the Westfield town line where it connects to the Columbia Greenway Rail Trail. The rail trail passes on the west side of the Congamond Lakes and follows the path of the New Haven and Northampton Railroad (and portions of the Hampshire and Hampden Canal). This popular trail is a key link in the pedestrian and bicycle network for the Depot Street Corridor, providing access to neighborhoods, schools, municipal buildings, the town library and village center.

The rail trail's separation from traffic establishes a high level of expectation for a low stress environment for users. Many residents including children and families are drawn to the safety and security of the trail environment where motor vehicles and conflicts with traffic are limited to a few intersections. With these expectations in mind PVPC staff used the Bicycle Stress Index to evaluate conditions for cycling on Depot Street and Powder Mill Road. The Bicycle Stress Index takes into consideration the general public's tolerance for traffic stress and classifies environments into four levels of traffic stress (LTS) based on traffic volume, travel speeds and width of the curb lane (including shoulder) with LTS-1 being the lowest level of stress and LTS - 4 being the highest level of stress.

Table 10: Levels of Traffic Stress (LTS)

LTS 1	Presenting little traffic stress and demanding little attention from cyclists, and attractive for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On road sections, cyclists are either physically separated from traffic or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane per direction, or are in mixed traffic with a low speed differential and demanding only occasional interaction with motor vehicles. Next to a parking lane, cyclists have ample operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross.
LTS 2	Presenting little traffic stress but demanding more attention than might be expected from children. On road sections, cyclists are either physically separated from traffic or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles with a low speed differential. Where a bike lane lies between a through lane and a right-turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the right-turn lane comparable to bicycling speeds. Crossings are not difficult for most adults.
LTS 3	Offering cyclists a mostly exclusive cycling zone (e.g., bike lane) requiring little negotiation with motor traffic, but in close proximity to moderately high speed traffic; or mixed traffic requiring regular negotiation with traffic with a low speed differential. Crossings may be stressful, but are still considered acceptably safe to most adult pedestrians.
LTS 4	Requiring riding in close proximity to high speed traffic, or regularly negotiating with moderately high speed traffic, or making dangerous crossings.

Depot Road and Powder Mill road are classified as "mixed traffic" locations because there is not dedicated bike lane for cyclists. The criteria for "mixed traffic" location are given above. Shared streets (streets without a marked centerline) are considered less stressful than shared lanes, because a marked centerline gives the appearance of reserving space for motor traffic in which bikes are intruders and blockers; by contrast, the lack of a centerline guides motorists to keep to the center (effectively reserving the margins for bikes) and emphasizes that road space is meant to be shared. Current practice suggests that traffic volume on streets without a centerline should be between 2,000 and 4,000 vehicles per day, otherwise traffic tends to divide into two lanes, making road-sharing more stressful.

Table 11: Level of Traffic Stress in Mixed Traffic

	Through Lanes per Direction			
Speed Limit	no marked centerline	1	2	3+
Up to 25 mph	1	2	3	4
30 mph	2	3	4	4
35+ mph	4	4	4	4

The roadway geometry (Figure 12) and posted vehicle speed limits (Figure 1) on Depot Street and Powder Mill Road shown Bicycle Traffic Stress (LTS) of Level 3. Level 3 roads include those where bicyclist ride adjacent to mixed traffic with a relatively low speed differential in an environment requiring regular negotiation with traffic. While these conditions are more than acceptable to experienced cyclist they offer less comfort to young riders or those less experienced riders that are drawn in large numbers to the adjacent Southwick Rail. To attract trail users off the trail destination into Town or the Southwick Recreation Center (including Whalley Park) it is important to achieved an equally acceptable level of comfort (LTS1) on Depot Street and Powder. To create a similar low stress environment would require a protected bike lane or separated cycle track. An alternative would be to add, repair, or widen sidewalks to Depot Street and Powder Mill Road. Wide sidewalks could be used to maintain convenient comfort access for children and to important local destinations. Detailed illustration of a proposed sidewalk network is shown in Figures 13 and 14.

IV. RECOMENDATIONS

A. DEPOT STREET AND SHEEP PASTURE ROAD

- It is recommended that multi-way "STOP" signs be installed at the intersection Depot Street with Sheep Pasture Road on a trial basis. Based on the PVPC turning movement counts, multi-way "STOP" signs may operate more efficiently at this intersection as the volume of traffic on all three approaches meets the minimum vehicular volume.
- It is recommended that the "STOP" sign and line be moved further toward Depot Street. Currently, motorists have to move a full automobile's length forward to improve their sight distance and have a better visibility for the eastbound traffic on Depot Street. To prohibit drivers turning left from Depot Street onto Sheep Pasture Road from cutting the corner, a turning line with in-pavement reflectors should be installed. Also, a rumble strip installed in the center line for 20 feet approaching the turn would also help drivers turn at the proper radius.
- Approximately 200 feet from the intersection, there is a faded "STOP" warning sign on Sheep Pasture Road. It is recommended that this sign be replaced.
- The Town of Southwick should install an "Intersection Ahead" sign on Depot Street in the westbound direction to alert motorists of the sight distance concerns and enhance safety.
- Work with the owner of 17 Depot Street to have the shrubs and vegetation moved or trimmed so that it does not block the sight for vehicles coming out of Sheep Pasture Road.
- Work with the owner of 21 Depot Street to keep the corner of the front yard clear of snow in order to provide good sight line for drivers coming out of Sheep Pasture road.
- Install a "sun glare" warning sign on Sheep Pasture Road in the northbound direction to alert the drivers about the sun glare in the mornings.

B. DEPOT STREET AND POWDER MILL ROAD/SOUTH LONGYARD ROAD

- At the time of the field inventory, pavement markings including "STOP" lines in the vicinity of the intersection were noted to be faded in many areas. It is recommended that new pavement markings be installed and curbing be improved to assist in traffic control in this area.
- Reconfigure the intersection to make it a "T-Intersection". This will make it less confusing and improve safety for both the motorist and users of the rail trail. Figure 12 shows the current intersection geometry and Figure 13 shows the proposed intersection geometry. Relocation of the sewer pump that is currently located next to the intersection will also provide more right-of-way options.
- Install a sidewalk on the east side of Powder Mill road to provide a connection from Depot Street to recreational centers and the schools (Preferred width of 6 feet). This sidewalk would also provide access from Depot Street and the rail trail to the Whalley Park that is being constructed. Whalley park is going to be an 80+ acre park with soccer, baseball and softball fields as well as a large playscape, pavilion and rest facilities. Figure 14 provides a map with the proposed sidewalk.
- A left-turn lane should be installed at the Whalley Park's entrance to help vehicles coming into the park since the entrance is a blind curve. "Park Entrance" warning signs installed north and south of the entrance to the park would be very helpful to alert drivers using the Powder Mill road.

- At the time of the field inventory, it was noticed that many motorists were not coming to a complete stop before proceeding through the intersection. This happened at all approaches. The Town of Southwick should monitor this intersection periodically to help deter non-compliance with the "STOP" sign.
- An existing residential driveway currently feeds into the intersection. The Town of Southwick should work closely with the owner of the property to help reconfigure the intersection layout and increase safety.
- Improve the crosswalk characteristics. The current crosswalk pavement markings going across Depot St are in a very bad condition. PVPC recommends repainting the lines and maintain them in good condition to prevent unsafe conditions. Furthermore PVPC would like to propose installing flashing signs that can be activated by the pedestrian to provide additional warning.

Figure 12: Existing Intersection of Depot Street and Powder Mill Road

Figure 13: Proposed Recommendation for the Intersection of Depot Street and Powder Mill Road

Figure 14: Recommendation to Install a sidewalk on the East Side of Powder Mill Road