Final Report

Safety Study of

Amostown Road, Pease Avenue and Morgan Road

September 2006

Prepared for:
Town of West Springfield

Pioneer Valley
Planning Commission

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Prepared in cooperation with the Executive Office of Transportation, the Massachusetts Highway Department and the U.S. Department of Transportation - Federal Highway Administration and the Federal Transit Administration.

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I. INTRODUCTION

The Town of West Springfield requested the Pioneer Valley Planning Commission (PVPC) to perform a study of existing transportation conditions at the intersection of Amostown Road with Dewey Street and key intersections along Morgan Road as part of the Unified Planning Work Program (UPWP). This study identifies the existing transportation and safety conditions for this area and provides recommendations to improve existing traffic conditions.

A. STUDY AREA

Morgan Road is utilized as an alternative route to Westfield Street (Route 20) for commuting traffic from Westfield, Holyoke, Russell, and other neighboring towns to access Riverdale Road (Route 5). Many motorists also access this route to utilize Interstate 91 and the Massachusetts Turnpike. Dewey Street from Amostown Road is also commonly used as a cut-through route to avoid Westfield Road (Route 20). A list of the study area intersections is presented in Table I-1. Figure I-1 presents a map of the study area.

Table I-1 Study Area Intersections

Intersection
Amostown Road with Dewey Street
Morgan Road with Pease Avenue
Morgan Road with Birnie Avenue
Morgan Road with Piper Avenue
Morgan Road with Piper Cross Road

Amostown Road primarily serves residential land uses at its intersection with Dewey Street and provides one travel lane in each direction. Dewey Street serves as the minor approach to this intersection and operates under "STOP" sign control. One travel lane is provided for all approaches with a posted speed limit of 30 miles per hour on Amostown Road and 25 miles per hour on Dewey Street. Sidewalks are present on Dewey Street and were noted to be in good condition. At the time of the field inventory, lane markings and pavement conditions were noted to be in excellent condition on Amostown Road. Alternately, pavement conditions and lane markings on Dewey Street were observed to be very faded.

In the vicinity of its intersection with Pease Avenue, Morgan Road serves residential land uses and provides one travel lane at each approach. The eastbound approach of Morgan Road serves as the minor approach and operates under "STOP" sign control with a posted speed limit of 30 miles per hour. Pease Avenue serves residential land uses and has a posted speed limit of 30 miles per hour. At the time of the field inventory, the pavement markings along Morgan Road and Pease Avenue were noted to be in good condition. Alternately, the eastbound approach did not have pavement markings and sidewalks are provided, however they were noted to be in poor condition.

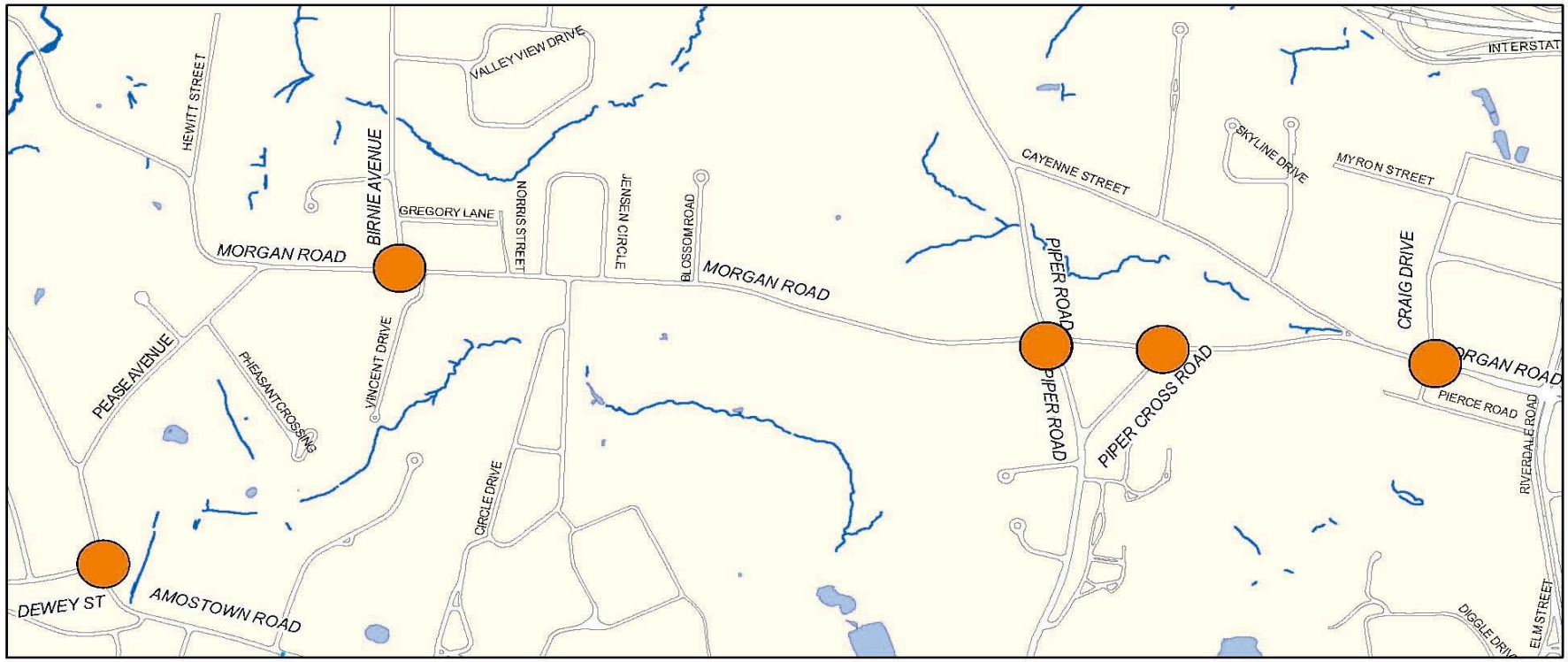
Birnie Avenue serves as the minor approach at its intersection with Morgan Road to form a three-way intersection. Both roads provide a one lane approach and the posted speed limit on Morgan Road is 30 miles per hour. Birnie Avenue operates under "STOP" sign

control and provides a one lane approach with a posted speed limit of 25 miles per hour. At the time of the field inventory, the sidewalks and pavement markings were noted to be in poor condition. No curbing was present on Birnie Avenue at the time of the field inventory.

The intersection of Morgan Road with Piper Road is a four-way intersection operating under traffic signal control with push button activated pedestrian signals. Morgan Road and Piper Road primarily serve residential land uses and have posted speed limits of 30 miles per hour. Sidewalks and pedestrian crosswalks are provided on the northwesterly side of Piper Road as well as along the westbound approach of Morgan Road. The crosswalks and pavement markings were noted to be in very good condition. Flashing "SIGNAL AHEAD" signs are located in advance of the intersection on both approaches of Morgan Road. Standard "SIGNAL AHEAD" signs are located in advance of the intersection on both approaches of Piper Road. Right turns on red are prohibited at this intersection.

Morgan Road intersects with Piper Cross Road to form a three-way unsignalized intersection. Morgan Road provides one lane of traffic in the vicinity of the intersection with sidewalks provided on the southwesterly side of the intersection. The posted speed limit is 30 miles per hour. Piper Cross Road provides one travel lane and operates under "STOP" sign control. Sidewalks and a crosswalk are provided and the posted speed limit is 25 miles per hour. At the time of the field inventory, it was observed that Piper Cross Road intersects with Morgan Road at a very acute angle. This creates sight distance restrictions for vehicles attempting to make a left or right turn from Piper Cross Road. It was also observed that the stop line on Piper Cross Road was painted very far back from the intersection.

The intersection of Morgan Road with Craig Drive and Showcase Drive operates under traffic signal control. Morgan Road primarily serves residential and commercial land uses and provides one lane of traffic at the eastbound approach and an exclusive left lane and through and right lane at the westbound approach. The posted speed limit is 30 miles per hour. Sidewalks are provided on the south side of Morgan Road. Craig Drive provides one travel lane in the vicinity of the intersection and serves residential land uses with a posted speed limit of 25 miles per hour. Showcase Drive serves as an entrance/exit from the Showcase Cinemas and provides a pedestrian crosswalk and stop line that was observed to be in good condition. At the time of the field inventory, no other lane markings were provided for this approach. The West Springfield Fire Department is located on the northeast corner of the intersection. A pre-emption signal for the station is located immediately to the east of the intersection. A "STOP HERE ON FLASHING RED" sign is located next to the mast arm of the emergency signal for westbound traffic on Morgan Road. Right turns on red are prohibited at this intersection.



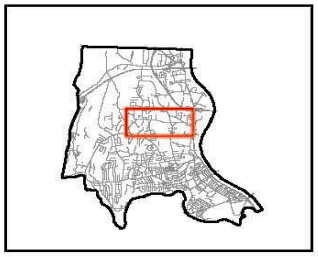


Figure I-1

Study Area Map

West Springfield, MA

0 500 1,000 2,000 Feet

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II. EXISTING TRANSPORTATION CONDITIONS

This section provides a technical evaluation of the transportation components throughout the study area. It includes a presentation of the data collected, crash experience and operations analyses to the overall performance and safety of these intersections.

A. 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.

1. Hourly Vehicle Volume

Manual Turning Movement Counts (TMC's) were conducted at the six intersections within the study area. The TMC's were conducted during the peak commuter periods. The peak 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. At each location the TMC's were conducted to identify the highest 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 some of the analyses conducted in this study.

As traffic volumes tend to fluctuate over the course of the year, the Massachusetts Highway Department (MassHighway) develops traffic volume adjustment factors to reflect monthly variations. These factors were examined to determine how traffic conditions in the study area compare to average month conditions in accordance with the month that each intersection was studied.

Based on the MassHighway data, traffic volumes during the month of March are estimated to be slightly lower than the annual average. Therefore, the traffic count data was adjusted to reflect average month conditions. Turning movement count data for the morning and afternoon peak hours are summarized on Figures II-2 and II-3.

B. CRASH EXPERIENCE

Crash information was gathered for all six intersections based on the information provided by the West Springfield Police Department to identify any existing safety problems. A crash rate analysis was performed to compare each intersection to the state average. Table II-1 summarizes the number of crashes by location and type for a period of four years (2002-2005) to identify any common conditions and possible causes.

The crash rate per million entering vehicles was calculated for each intersection. In theory, crash rates can increase as the traffic volume along the roadway increases or as the potential for conflict is increased. The crash rate per million entering vehicles takes into consideration the number of crashes at an intersection and the number of vehicles that

enter the intersection over the course of an average day. Based on MassHighway data, the average crash rate for an unsignalized intersection in the MassHighway District 2 region is 0.85 and the average crash rate for a signalized intersection is 0.94.

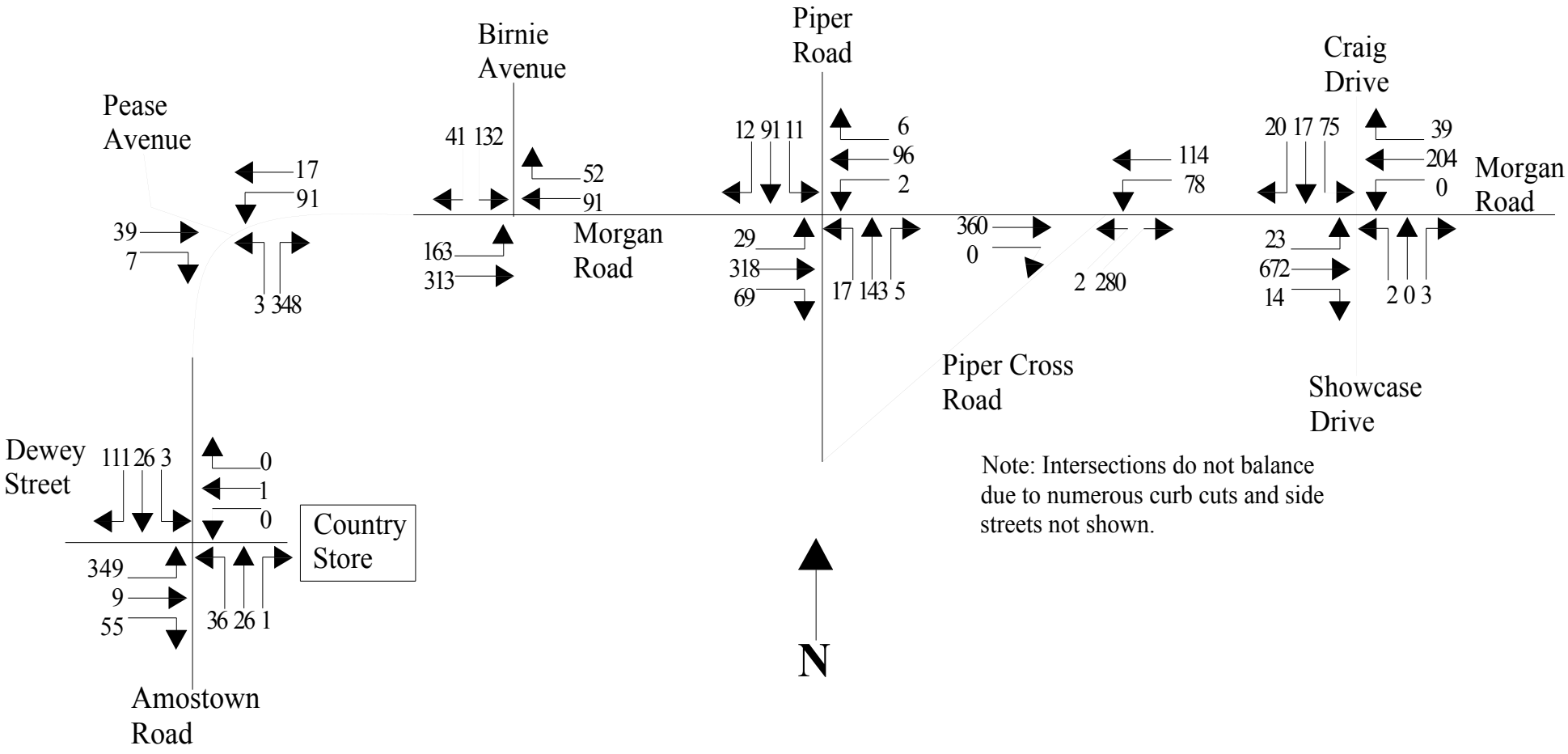
Table II-1 Crash History Summary

Intersection	Year	# of Crashes	Fatality		Crash Type		Weather		Crash Rate
Amostown Road									
with Dewey Street	2002	7	Property	13	Angle	4	Clear	9	0.96
	2003	3	Injury	3	Side Swipe	2	Rain	3	
	2004	4			Rear-End	4	Snow	1	
	2005	2			Object	4	Fog	0	
		16			Head On	2	Overcast	3	
Morgan Road with									
Pease Avenue	2002	2	Property	1	Angle	1	Clear	3	0.53
	2003	0	Injury	6	Side Swipe	0	Rain	2	
	2004	2			Rear-End	1	Snow	1	
	2005	3			Object	2	Fog	1	
		7			Head On	3	Overcast		
Morgan Road with									
Birnie Avenue	2002	0	Property	3	Angle	1	Clear	2	0.23
	2003	1	Injury	1	Side Swipe	0	Rain		
	2004	2			Rear-End	2	Snow	2	
	2005	1			Object	1	Fog		
		4			Head On	0	Overcast		
Morgan Road with									
Piper Road	2002	1	Property	18	Angle	9	Clear	12	0.97
	2003	11	Injury	4	Side Swipe	3	Rain	3	
	2004	7			Rear-End	9	Snow	3	
	2005	3			Object	0	Fog	0	
		22			Head On	1	Overcast	4	
Morgan Road with									
Piper Cross Road	2002	9	Property	21	Angle	3	Clear	26	1.51
	2003	6	Injury	9	Side Swipe	0	Rain	2	
	2004	9			Rear-End	24	Snow		
	2005	6			Object	1	Fog		
		30			Head On	2	Overcast	2	
Morgan Road with									
Craig Drive	2002	8	Property	25	Angle	13	Clear	22	1.09
	2003	12	Injury	4	Side Swipe	3	Rain	4	
	2004	5			Rear-End	12	Snow	2	
	2005	4			Object	1	Fog		
		29			Head On	0	Overcast	1	

Source: West Springfield Police Department, 2002-2005

As can be seen from Table II-1, the intersections of Morgan Road with Craig Drive and Morgan Road with Piper Cross Road experienced the most crashes over the four-year period. The majority of the crashes at the intersection of Morgan Road with Piper Cross Road were rear end-type crashes that occurred during off-peak hours. A mixture of rear end-type as well as angle-type crashes have occurred at the intersection of Morgan Road with Craig Drive. The intersections of Morgan Road with Craig Drive and Morgan Road with Piper Cross Road also have high calculated crash rates of 1.50 and 1.09 respectively.

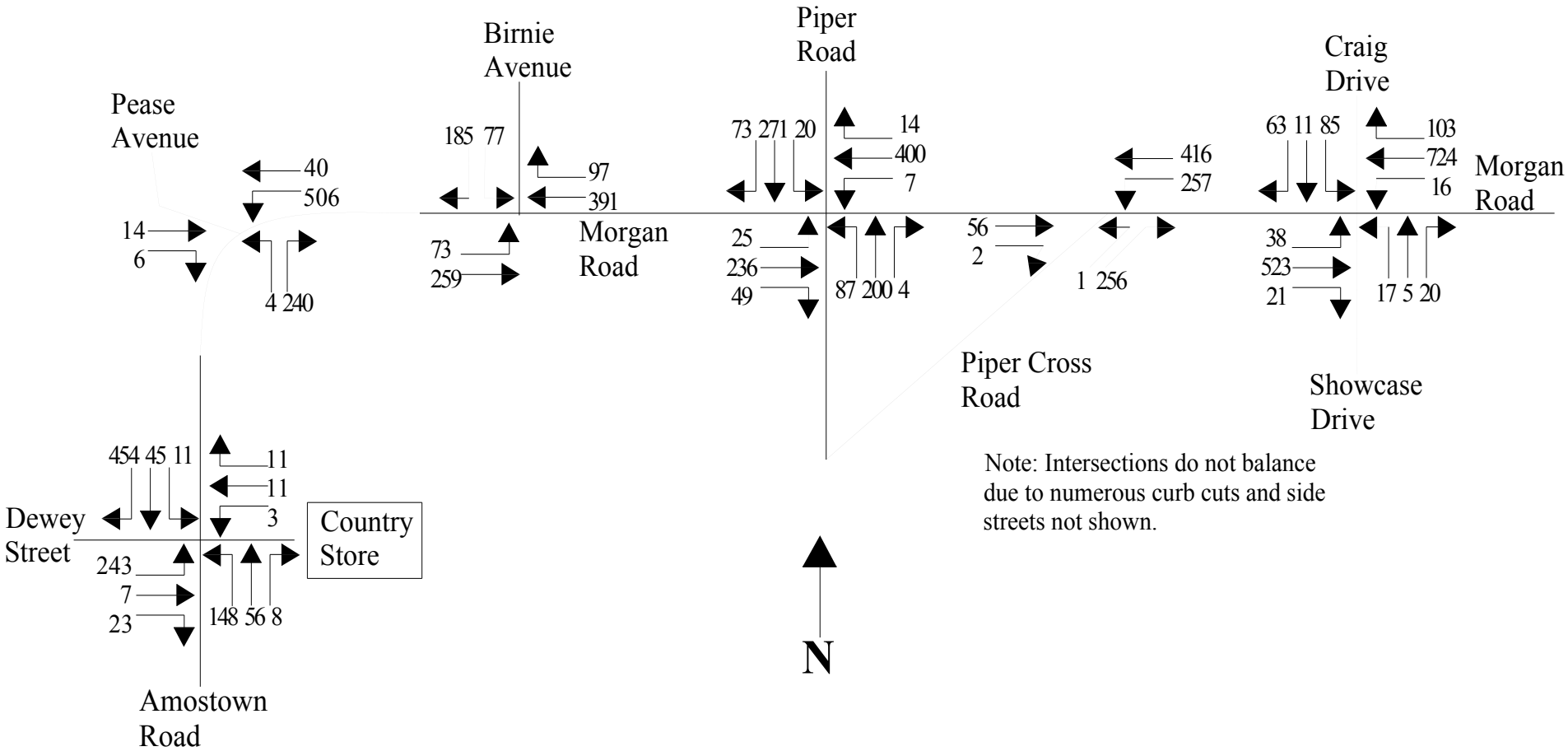
Figure II-1 - Morning Peak Hour Turning Movement Counts



West Springfield, MA

Not to scale

Figure II-2 - Afternoon Peak Hour Turning Movement Counts



Note: Intersections do not balance due to numerous curb cuts and side streets not shown.

West Springfield, MA

Not to scale

The intersection of Amostown Road with Dewey Street also had a high number of crashes with a reported total of 16, an average of four crashes per year. The majority of crashes (75%) resulted in rear end-type, angle-type and vehicles hitting an object at this intersection. The intersection of Morgan Road with Pease Avenue experienced a relatively low number of crashes, however nearly 50% were reported to be head-on crashes. While the crash data did not specify if the head-on crashes involved another vehicle or a fixed object, this is a potentially serious problem which should be monitored by the Town of West Springfield. No fatalities were reported at any of the intersections within the study area from 2002 to 2005.

A number of factors can contribute to the crashes that have occurred in the study area. At the intersection of Morgan Road with Piper Cross Road, exiting traffic from Piper Cross Road can experience difficulties in viewing on-coming eastbound traffic due to the difficulties due to its acute angle, causing northbound traffic to make a sudden stop. The trees to the west of the intersection may also obstruct motorist's view from Piper Cross Road. This may contribute to the number of rear-end type crashes at this intersection. Additionally, it was noted that sight distance is difficult for exiting traffic from Piper Cross Road due to the grade to the east of the intersection. This would cause the on-coming motorists to be seen at last minute and may also contribute to rear-end type crashes. The geometry and lack of sufficient signing at the intersection of Morgan Road with Pease Avenue may contribute to the number of head-on crashes that occurred. Also, during the field inventory, the guard rail in the northwesterly corner of the intersection had been a result of vehicles hitting the guard rail. The guard rail was also quickly replaced. This could be an indication that the head-on crashes may have resulted in hitting the guard rail.

PVPC staff observed a number of vehicles to "run" the red light at the intersection of Morgan Road with Craig Drive, particularly from the westbound approach. This could be a result of peak hour congestion; however, it is a serious safety problem that could result in an increase in personal injuries and crashes at this location.

C. ANALYSIS PROCEDURES

1. Capacity Analysis

The study area was examined with regard to capacity and delay characteristics to determine the existing Level of Service (LOS). LOS is an indicator of the operating conditions which occur on a roadway under different volumes of traffic and is defined in the 2003 Highway Capacity Manual by six levels, "A" through "F". A number of operational factors can influence the LOS including geometry, travel speeds, and delay. Table II-2 presents a summary of the LOS at a signalized intersection.

Depending on the time of day and year, a roadway may operate at varying levels. Level of Service "A" represents the best operating conditions and is an indicator of ideal travel conditions with vehicles operating at or above posted speed limits with little or no delays. Conversely, LOS "F", or failure, generally indicates forced flow conditions illustrated by long delays and vehicle queues. Level of Service "C" indicates a condition of stable flow and is generally considered satisfactory in rural areas. Under LOS "D" conditions, delays are considerably longer than under LOS "C", but are considered acceptable in urban areas.

At LOS "E" the roadway begins to operate at unstable flow conditions as the facility is operating at or near its capacity. A summary of the LOS at an unsignalized intersection is shown in Table II-3.

Table II-2 Level of Service (LOS) Designations - Signalized Intersections

Category	**Description**	**Delay** (in seconds)
LOS A	Describes a condition of free flow, with low volumes and relatively high speeds. There is little or no reduction in maneuverability due to the presence of other vehicles and drivers can maintain their desired speeds. Little or no delays result for side street motorists.	< 10.0
LOS B	Describes a condition of stable flow, with desired operating speeds relatively unaffected, but with a slight deterioration of maneuverability within the traffic stream. Side street motorists experience short delays.	>10.0 to 20.0
LOS C	Describes a condition still representing stable flow, but speeds and maneuverability begin to be restricted. Motorists entering from side streets experience average delays.	>20.0 to 35.0
LOS D	Describes a high-density traffic condition approaching unstable flow. Speeds and maneuverability become more restricted. Side street motorists may experience longer delays.	>35.0 to 55.0
LOS E	Represents conditions at or near the capacity of the facility. Flow is usually unstable, and freedom to maneuver within the traffic stream becomes extremely difficult. Very long delays may result for side street motorists.	>55.0 to 80.0
LOS F	Describes forced flow or breakdown conditions with significant queuing along critical approaches. Operating conditions are highly unstable as characterized by erratic vehicle movements along each approach.	> 80.0

Table II-3 Level of Service Designations - Unsignalized Intersections

Average Control Delay (s/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

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 II-4 presents a summary of the Level of Service for the signalized intersections in this study area. Table II-5 presents a summary of the Level of Service for the unsignalized intersections.

Table II-4- Level of Service of Signalized Intersections

Intersection	AM Peak		PM Peak	
	Delay**	LOS*	Delay**	LOS*
Morgan Road with Piper Road				
Morgan Road, EB All Movements	24.0	C	18.4	B
Morgan Road, WB All Movements	12.0	B	20.3	C
Piper Road, NB All Movements	11.3	B	13.7	B
Piper Road, SB All Movements	10.6	B	12.9	B
Overall	14.5	B	16.3	B
Morgan Road with Craig Drive				
Morgan Road, EB All Movements	14.1	B	115	F
Morgan Road, WB Left and Through Movement	5.5	A	20	C
Craig Drive, SB All Movements	8.2	A	12	A
Driveway, NB All Movements	13.1	B	18	B
Overall	10.2	B	41.3	D

* = Level of Service
** = In Seconds

Table II-5 Level of Service of Unsignalized Intersections

Intersection	AM Peak		PM Peak	
	Delay**	LOS*	Delay**	LOS*
Amostown Road with Dewey Street				
Amostown Road, NB All Movements	4.4	A	7.4	A
Amostown Road, SB All Movements	0.2	A	0.3	A
Dewey Street, EB All Movements	19.7	C	205.7	F
Country Store, WB All Movements	9.9	A	20.1	C
Overall	8.6	A	51.2	F
Morgan Road with Pease Avenue				
Pease Avenue, NB All Movements	0.1	A	0.2	A
Morgan Road, EB All Movements	11.2	B	16.1	C
Morgan Road, WB All Movements	0	A	0	A
Overall	3.8	A	5.4	A
Morgan Road with Birnie Avenue				
Morgan Road, EB All Movements	3.5	A	2.6	A
Morgan Road, WB All Movements	0	A	0	A
Birnie Avenue, SB All Directions	25.9	D	27	D
Overall	9.8	B	9.9	B
Morgan Road with Piper Cross Road				
Morgan Road, WB All Movements	4	A	0	A
Morgan Road, EB All Movements	0	A	5.1	A
Piper Cross Road, NB All Movements	15.7	C	13.1	B
Overall	6.6	A	6.1	A

* = Level of Service
** = In Seconds

Based on the results of the analysis, there is significantly more delay in the study area in the afternoon peak hour. The longest delays occur at the intersection of Morgan Road with Craig Drive. The eastbound approach of Morgan Road operates at LOS"F" during the afternoon peak hour due to lack of enough green time. At the intersection of Amostown Road with Dewey Street, vehicles attempting to exit from Dewey Street were calculated to operate at Level of Service (LOS) "F" during the afternoon peak hour.

Although vehicles exiting the Country Store did not experience significant delay, it was observed at the time of the field inventory that some of these vehicles attempting to turn at this intersection do not use their turn signal. This may cause confusion and traffic problems at this intersection. It was also noted that vehicles exiting from Dewey Street stop past the stop line, close to the middle of the intersection. The existing location of the stop line may have sight distance problems associated with the trees to the north of the intersection.

2. Traffic Signal Warrant Analysis

The four unsignalized intersections 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. Satisfaction of a warrant is not the sole determinate if a signal is required. The installation of a traffic signal must also improve the safety and operation of the location under study. Table II-6 presents the results of the signal warrant analysis for each of the four study area intersections.

Table II-6 Signal Warrant Analysis Results

Warrant	Description	Amostown Road with Dewey Street, Version 1	Amostown Road with Dewey Street, Version 2	Morgan Road with Pease Avenue	Morgan Road with Birnie Avenue
1	Eight Hour Vehicular Volume	Not Satisfied	Satisfied	Not Satisfied	80% Satisfied
2	Four Hour Vehicular Volume	Satisfied	Satisfied	70% Satisfied	Not Satisfied
3	Peak Hour Volume	Satisfied	Satisfied	Not Satisfied	Satisfied
4	Pedestrian Volume	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5	School Crossings	Not Applicable	Not Applicable	Not Applicable	Not Applicable
6	Coordinated Signal System	Not Applicable	Not Applicable	Not Applicable	Not Applicable
7	Crash Experience	Not Satisfied	Not Satisfied	Not Satisfied	Not Satisfied
8	Roadway Network	Not Applicable	Not Applicable	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.

Based on the results of the analysis in Table II-6, one out of the four intersections meets the minimum volume requirements of Warrant #1. The intersection of Morgan Road with Piper Cross Road had a high number of crashes, however rear-end type crashes are not typically alleviated by the installation of a traffic signal and therefore did not satisfy Warrant #7. The intersection of Amostown Road with Dewey Street meets the minimum volume requirements for Warrant #2 and Warrant #3, therefore the installation of a traffic signal may be feasible. Dewey Street operates as the minor approach at this intersection; however, due to the cut-through route utilized by commuters, Dewey Street experiences

more volumes than the northbound approach of Amostown Street during morning and afternoon peak hours. PVPC conducted an additional analysis where the volumes from the southbound approach of Amostown Road and Dewey Street were defined as the two major approaches. This analysis concluded that Warrant #1 is fully satisfied under this scenario.

The intersection of Morgan Road with Birnie Avenue only satisfies 80% of the minimum volume requirements and due to the low number of crashes that have occurred at this intersection, the installation of a traffic signal is not recommended at this time. The intersection of Morgan Road with Pease Avenue did not satisfy the minimum volume requirements and the crash rate was very low and therefore does not require the installation of a traffic signal.

3. Multi-Way Stop Applications

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 four unsignalized intersections along the study area were identified as possible candidates to operate under multi-way stop control due to their existing safety problems and congestion. 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.

All four intersections currently meet the volume requirements for the installation of multi-way stop signs. 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 moving traffic on the major street approach which is not currently required to stop. An additional engineering study must indicate that the installation of all-way stop

control does not impede traffic flow. At the intersection of Amostown Road with Dewey Street, the installation of multi-way "STOP" signs may decrease some overall delay for Dewey Street. Alternatively, such an installation may increase delay at the southbound approach of Amostown Road. Therefore, an additional study performed by a licensed professional is recommended to assure that multi-way "STOP" signs will not disrupt the flow of traffic.

Table II-7 Level of Service under Multi-Way Stop Control

	AM Peak		PM Peak	
Intersection	**Delay****	**LOS***	**Delay****	**LOS***
Amostown Road with Dewey Street				
Amostown Road, NB All Movements	9.25	A	14.2	B
Amostown Road, SB All Movements	9.08	A	45.6	E
Dewey Street, EB All Movements	15.37	C	17.6	C
Country Store, WB All Movements	8.04	A	10.7	B
Overall	10.4	B	22.0	C
Morgan Road with Pease Avenue				
Pease Avenue, NB All Movements	9.7	A	11.6	B
Morgan Road, EB All Movements	8.2	A	8.7	A
Morgan Road, WB All Movements	8.7	A	28.4	D
Overall	8.9	A	16.2	C
Morgan Road with Birnie Avenue				
Morgan Road, EB All Movements	17.7	C	16.7	C
Morgan Road, WB All Movements	9.49	A	23.3	C
Birnie Avenue, SB All Directions	10.9	B	14.1	B
Overall	12.7	B	18.0	C
Morgan Road with Piper Cross Avenue				
Morgan Road, WB All Movements	11.9	B	93.8	F
Morgan Road, EB All Movements	15.5	C	15	B
Piper Cross Avenue, NB All Movements	11.7	B	13.5	B
Overall	13.0	B	40.8	E

* = Level of Service
** = In Seconds

As can be seen from Table II-7, the intersections in the study area suffer much less delay during the morning peak hours and significantly more delay during the afternoon peak hours. The intersection of Amostown Road with Dewey Street suffers less delay under a multi-way "STOP" control than existing conditions which could improve safety among this intersection. The multi-way "STOP" application does not significantly improve operations at the intersections of Morgan Road with Pease Avenue, Morgan Road with Birnie Avenue and Morgan Road with Piper Cross Road. Therefore, such installation is not recommended at this time.

At the intersection of Morgan Road with Piper Cross Road, an all-way stop application would increase delay due to the high volume of through traffic at this intersection. In addition, the acute angle at which Piper Cross Road intersects with Morgan Road contributes to sight distance restrictions. The lack of proper sight distance would not make this intersection a good candidate for a multi-way stop installation as it is important for motorists to determine which vehicle arrived at the intersection first in order to establish right of way.

4. Traffic Signal Control

Three of the four study area intersections found to potentially satisfy the requirements for the installation of a traffic signal were analyzed to determine the effects the installation of a traffic signal on current vehicular operation. The intersection of Morgan Road with Pease Avenue was not analyzed as it does not currently meet one of the MUTCD warrants. Table II-9 presents the results from this analysis using existing volumes.

Table II-8 – Level of Service under Traffic Signal Control

	AM Peak		PM Peak	
Intersection	**Delay****	**LOS***	**Delay****	**LOS***
Amostown Road with Dewey Street				
Amostown Road, NB All Movements	10.9	B	26.3	C
Amostown Road, SB All Movements	5.6	A	4.1	A
Dewey Street, EB All Movements	14.5	B	19.1	B
Country Store, WB All Movements	3.5	A	5.9	A
Overall	8.6	A	13.9	B
Morgan Road with Birnie Avenue				
Morgan Road, EB All Movements	15.1	B	13.6	B
Morgan Road, WB All Movements	4.3	A	9.8	A
Birnie Avenue, SB All Directions	9.9	A	6.6	A
Overall	9.8	A	10.0	B
Morgan Road with Piper Cross Avenue				
Morgan Road, WB All Movements	8.4	A	30.1	C
Morgan Road, EB All Movements	8.5	A	4.9	A
Piper Cross Avenue, NB All Movements	4.4	A	6.3	A
Overall	7.1	A	13.8	B

* = Level of Service
** = In Seconds

As can be seen from Table II-9, all of the intersections are expected to operate with much lower delays under traffic signal control. The intersection of Morgan Road with Birnie Avenue and does not currently suffer long delays or experienced a high number of crashes, therefore a traffic signal is not recommended at this time. Traffic operations at the intersection of Amostown Road with Dewey Street would improve under traffic signal control. While the intersection does not meet the minimum requirements of Warrant #1, it did satisfy two other warrants. The Town of West Springfield may wish to consider the installation of a multi-way "STOP" as a short term improvement strategy for this intersection.

III. TRANSPORTATION RECOMMENDATIONS

Based on the results of the transportation study, a series of recommendations were developed to address existing traffic deficiencies and improve safety in the study area. The Town of West Springfield has maintenance authority over the study area intersections. The private site access and egress driveways fall under the jurisdiction of the respective property owners.

1. Amostown Road with Dewey Street

- At the time of the field inventory, the lane markings on Dewey Street were slightly faded at this intersection. Re-painting these lines can direct traffic more efficiently and safely.
- This intersection satisfies the warrant for the installation of multi-way "STOP" control. However, an additional engineering study must indicate that this will not disrupt the flow of traffic. It is also recommended that multi-way "STOP" signs be installed on a trial basis to determine if they are having a positive impact on traffic operations.
- The Town of West Springfield should consider the installation of a channelized right turn at the southbound approach. This could alleviate traffic flow for through and left -turning vehicles at the southbound approach. In addition, the delay of motorists attempting a left turn from Dewey Street could be alleviated. This would require permission and cooperation by current property owners. This option should not be combined with multi-way "STOP" control.
- It has been observed at the time of the field inventory that some trucks may attempt the right turn movement via driving over the northwesterly corner of this intersection from the southbound approach. The installation of granite curbing would serve to clearly define the entrance and exit. This could be a lower-cost alternative to the installation of a channelized right turn and may require the permission and cooperation of property owners in this area.
- At the time of the field inventory, it was noted that the presence of the trees obstruct the motorist's view, therefore causing motorists to stop past the stop line. Moving the stop line a couple of feet east would allow motorists to see past the trees and safely enter and exit this intersection.
- This intersection satisfies the warrant for the installation of a traffic signal. Overall delay would significantly decrease and provide more protection to the minor approach under signalized control. It is recommended that all remedies be tried and have failed before a traffic signal is proposed.

2. Morgan Road with Pease Avenue

- At the time of the field inventory, pavement markings at the eastbound approach of Morgan Road were not present. It is recommended that new pavement markings be installed to assist in traffic control in this area.
- It was observed that motorists making a right turn from Pease Avenue and a left turn from Morgan Road onto Pease Avenue can travel this sharp curb at a high speed. "CURVE AHEAD" signs were present at each approach and were very small and hard

to read. It is recommended that larger signs replace the current signage to alert motorists and potentially reduce speed.
- The sidewalks at this intersection were noted to be weathered and small. Consider reconstructing the sidewalk to allocate more space and safety for pedestrians.
- This intersection currently meets the volume requirements for the installation of multi-way "STOP" control. This may increase safety and reduce the number of head-on type crashes. However, an additional engineering study must indicate that such an installation will not disrupt the flow of traffic.

3. *Morgan Road with Birnie Avenue*

- This intersection meets the current volume requirements to operate under multi-way "STOP" control. However, the current Level of Service and the low number of crashes at this intersection indicate that any improvements are not recommended at this time.

4. *Morgan Road with Piper Road*

- This intersection operates at LOS "B" during the morning and afternoon peak hour and there has been a low occurrence of crashes in the most recent period. Therefore, there are currently no recommendations to improve this intersection.

5. *Morgan Road with Piper Cross Road*

- The Town of West Springfield should consider obtaining the services of a licensed professional engineer to determine if the existing geometry can be modified to improve sight distance and safety at this intersection. The existing alignment is likely the main contribution to the high number of rear end-type crashes at this intersection.
- While the intersection satisfies the minimum criteria for the installation of a traffic signal and to operate under multi-way "STOP" control, the intersection currently operates under a good Level of Service and it is not recommended at this time.
- At the time of the field inventory, it was noted that the sight distance at the minor approach was limited due to the grade at the westbound approach. Consider installing an "INTERSECTION AHEAD" sign to alert motorists ahead of time. This can

6. *Morgan Road with Craig Drive and Showcase Drive*

- The intersection of Morgan Road with Craig Drive currently operates at LOS "F" during the afternoon peak hour due to the amount of delay at the eastbound approach. PVPC staff was unable to obtain the traffic signal timing plans from the Town of West Springfield; therefore the timing in this analysis was based on observations at the time of the field inventory. There is a sign located on the northbound and southbound approaches that informs traffic of the maximum wait time of 25 seconds for a green light. If there are no volumes at the minor approaches, the traffic signals for Morgan Road would not turn red. Due to the consistent amount of traffic approaching the intersection at the two minor approaches, the eastbound approach needs more green time improve traffic flow. PVPC conducted an additional analysis to determine the

Level of Service with changes made to the signal timing plan, which is presented in Table III-1.

Figure III-1 - Level Of Service with Changes to the Signal Timing Plan

Morgan Road with Craig Drive	AM Peak		PM Peak	
	Delay **	LOS*	Delay**	LOS*
Morgan Road, EB All Movements	9.2	A	9.7	A
Morgan Road, WB All Movements	4.4	A	13.2	B
Craig Drive, SB All Movements	13	B	18.7	B
Driveway, NB All Movements	20.6	C	29.5	C
Overall	**11.8**	**B**	**17.8**	**B**

As can be seen from the Table, the flow of traffic is significantly improved at this intersection. The eastbound and westbound approaches were given 15 additional seconds to the signal timing plan. The timing for the remaining two approaches stayed the same.

- At the time of the field inventory, it was observed that the pavement markings on Craig Drive and Showcase Drive were faded. It is recommended that the pavement markings be re-painted to direct motorists and increase safety at this intersection.