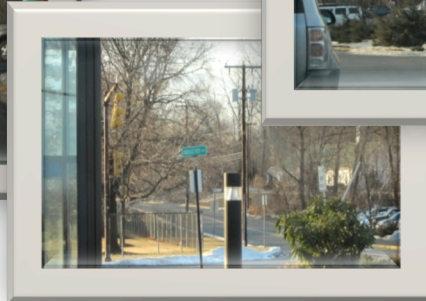
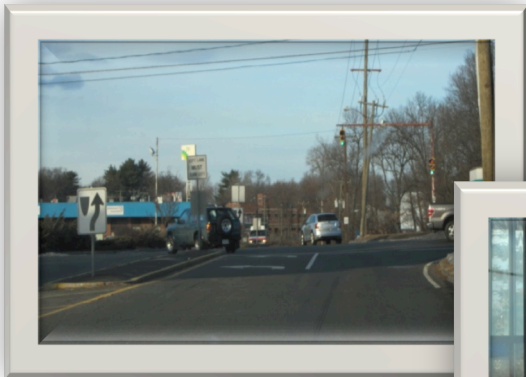


# TRANSPORTATION SAFETY STUDY

## SPRINGFIELD

**Intersection of Cottage Street, Robbins Road, and  
Industry Avenue**



MAY 2012

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**Prepared in cooperation with the City of Springfield, Massachusetts Department of Transportation and the U.S. Department of Transportation - Federal Highway Administration and the Federal Transit Administration.**

**The views and opinions of the Pioneer Valley Planning Commission expressed herein do not necessarily state or reflect those of the U.S. Department of Transportation.**

## ABBREVIATIONS

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1	a.m.	Afore Meridian
2	AADT	Average Annual Daily Traffic
3	ADT	Average Daily Traffic
4	ATR	Automatic Traffic Recorders
5	Ave.	Avenue
6	FY	For Year
7	LOS	Level of Service
8	MassDOT	Massachusetts Department of Transportation
9	MPH	Miles per Hour
10	MUTCD	Manual on Uniform Traffic Control Devices
11	p.m.	Post Meridian
12	PVPC	Pioneer Valley Planning Commission
13	Rd.	Road
14	St.	Street
15	TMC	Turning Movement Counts
16	TRB	Transportation Research Board
17	VPH	Vehicles per Hour

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## I. INTRODUCTION

The Pioneer Valley Planning Commission (PVPC) conducted a transportation and safety study at the intersection of Cottage Street, Robbins Road, and Industry Avenue at the request of the City of Springfield as part of the FY 2011 Unified Planning Work Program. The existing high volume of traffic and long peak hour delays contribute to congestion in this area. PVPC studied the existing traffic and transportation conditions and analyzed potential problems that reduce the efficiency of traffic operations at this location. A series of short-term recommendations were developed to enhance efficiency the traffic operations at the intersection.

### A. STUDY AREA

The intersection of Cottage Street, Robbins Road, and Industry Avenue is a four way intersection located in the northern part of the City of Springfield. It is a signalized intersection characterized by high percentage of truck traffic because of its location in an industrialized area and its proximity to Interstate 291.

Land use in the immediate vicinity of the intersection is a mix of commercial and light industrial. *Cottage Street Liquors* is located on the northeast corner of the intersection. An office building and ATM occupy the south east corner. A warehouse is located on the southwest corner and another office/retail use building is located on the northwest corner.

The pavement and the pavement markings at the intersection were found to be in good condition at the time of field inventory. Granit curbing is provided on all approaches, however there are no sidewalks in the vicinity of the intersection. PVTA bus stop is located along Robbins Road in the north of the intersection. Temporary on street parking is permitted along Robbins Road approach in the vicinity of the intersection. At the time of field visit, signal pole for post mounted signal located in the northeast corner of the intersection for Industry Avenue approach was found to be damaged and tilted possibly due to heavy impact in past.

Raised medians separate entering and exiting traffic on all four approaches to the intersection. Exclusive left turn lanes are provided for all but the westbound approach of Cottage Street which provides one left turn/ through lane and one exclusive right turn lane.

Cottage Street is classified as urban major collector (U5) which links Berkshire Avenue to I-291 via the study area intersection and runs parallel to Route 20 (Page Boulevard). Robbins Road and Industry Avenue are both local roads.

Figures 1 and 2 depict the study area and the Ariel image of the intersection of Cottage Street, Robbins Road, and Industry Avenue.

Figure 1: Study Area

Intersection of Cottage Street and Robbins Road and Industry Avenue

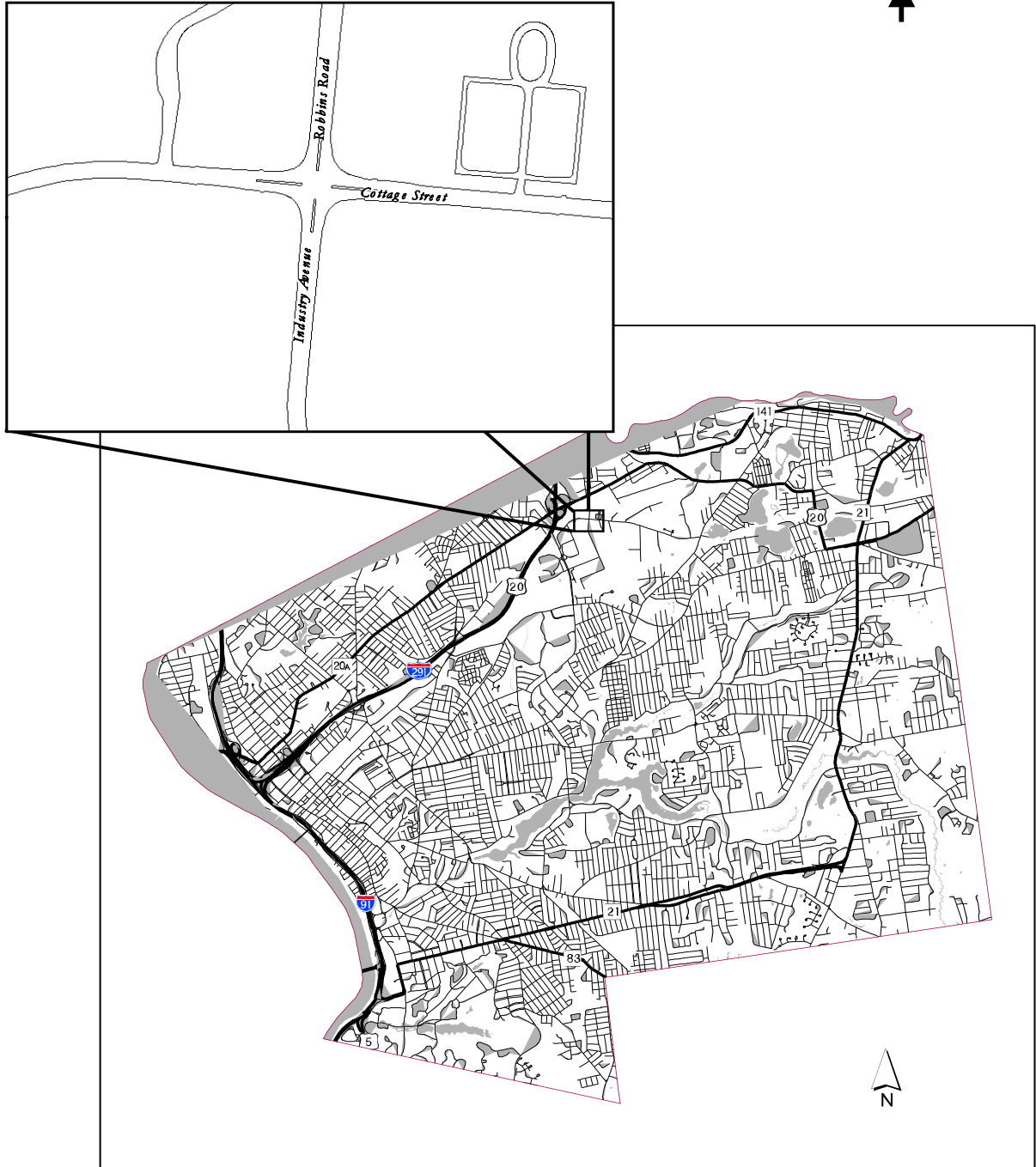




Figure 2: Aerial Image of the Intersection





## II. EXISTING TRANSPORTATION CONDITIONS

This section provides a technical evaluation of the transportation conditions at the intersection. It includes a presentation of the collected data, analysis of traffic operations, and a series of observations and conclusions derived from the analysis.

### A. PEAK HOUR VOLUME AND TURNING MOVEMENT COUNTS

Turning Movement Counts (TMC's) were conducted for the intersection during the peak commuter periods. The weekday peak 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. The afternoon peak hour counts were conducted between 3:00 PM to 6:00 PM at this location because of the higher commercial and industrial traffic in this area. The TMC's 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 some of the analysis conducted in this study.

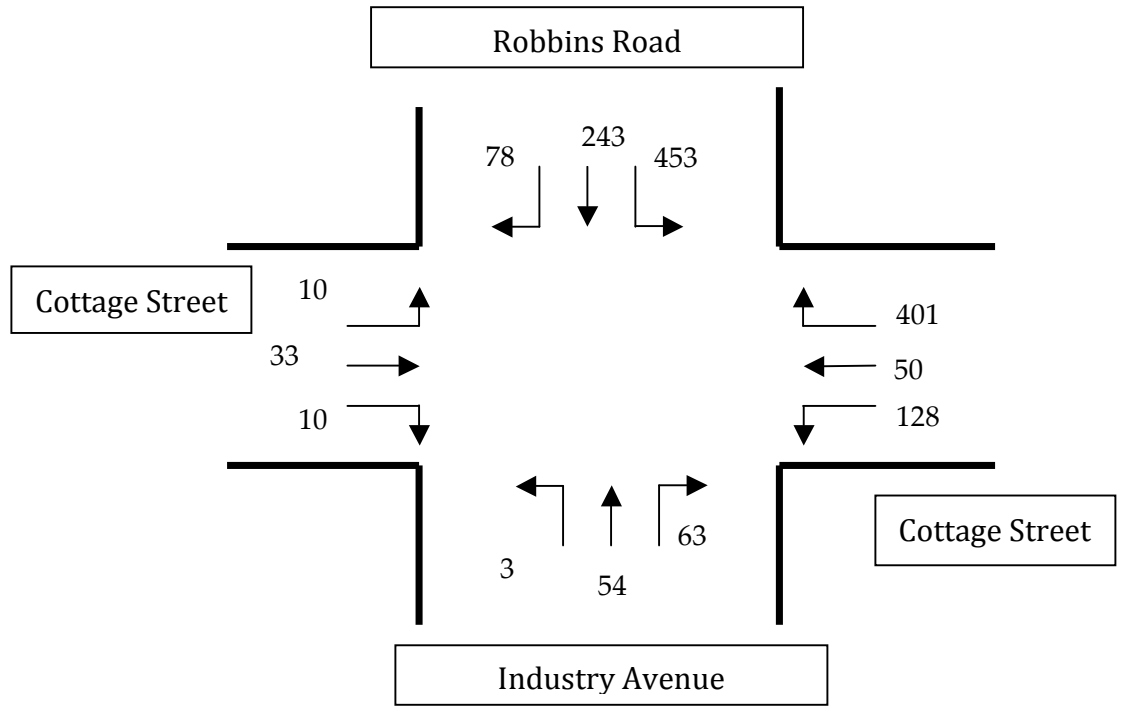
The TMC data also identifies the number of heavy vehicles and pedestrians on the roadway. Heavy vehicles include trucks, recreational vehicles and buses. The percentage of heavy vehicles in the traffic flow is an important component in calculating the serviceability of a corridor or intersection. Trucks 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 TMC data was obtained during weekday peak periods. As traffic volumes tend to fluctuate over the course of the year, the Massachusetts Department of Transportation (MassDOT) develops traffic volume adjustment factors to reflect monthly variations. These factors were examined to determine the traffic conditions at the intersection of Cottage Street, Robbins Road, and Industry Avenue. Figure 3 depicts the turning movement counts during the morning and afternoon peak hours at the intersection.

A majority of the vehicles at this intersection commute along Cottage Street to access I-291 via Robbins Road. As a result, the Cottage Street westbound and Robbins Road approaches have higher traffic volume compared to the remaining two approaches. During the morning peak hour a substantial number of vehicles commute southbound from Robbins Road travelling straight across the intersection to access Industry Avenue. This pattern is reversed during the afternoon peak hour.

**Figure 3: Turning Movement Counts**

Morning Peak Hour (7:30 am - 8:30 am)



Afternoon Peak Hour (4:15 pm - 5:15 pm)

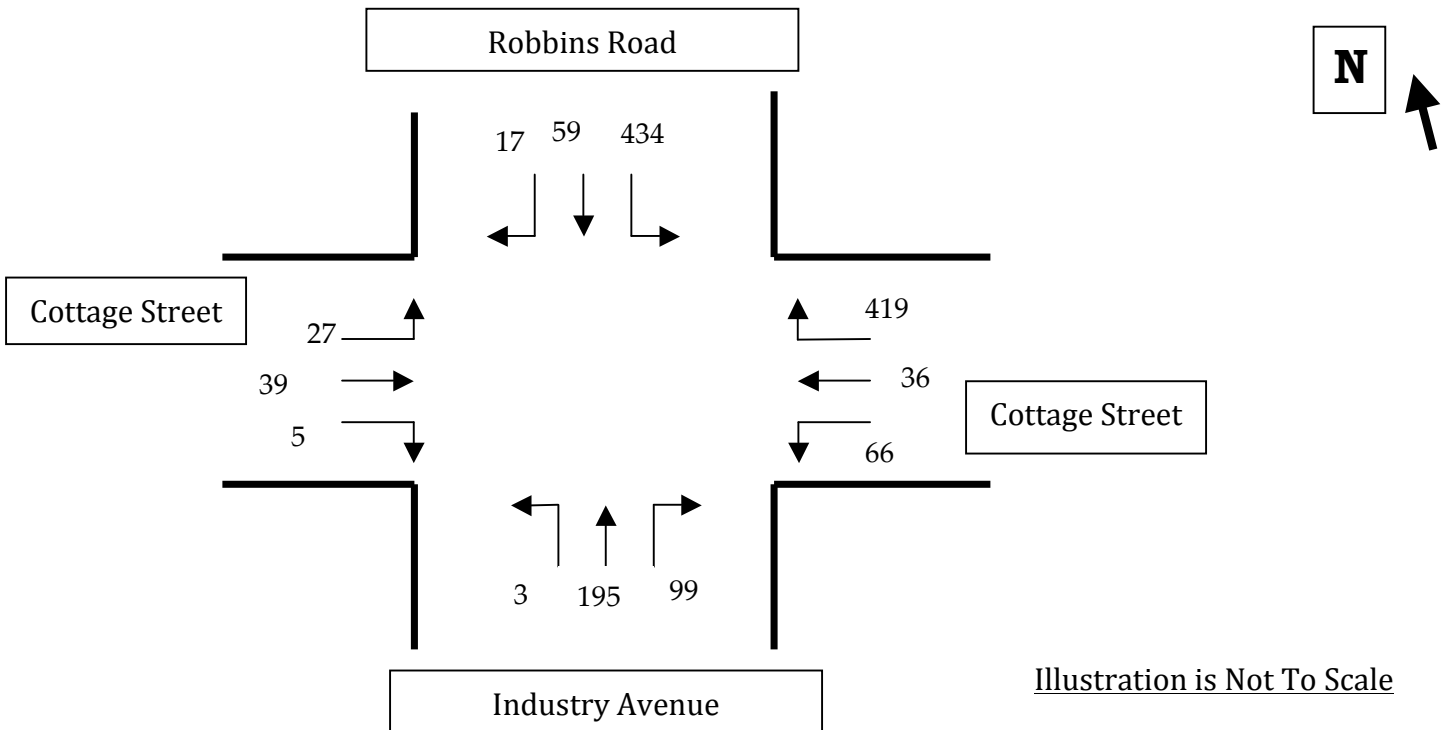


Illustration is Not To Scale

The volume of heavy vehicles at the intersection was approximately 6% of the total traffic volume during morning peak hour and 3% during the afternoon peak hour. The majority of heavy vehicles were observed on the Cottage Street and Robbins Road approaches.

## B. SAFETY

To study safety, PVPC obtained the crash history of the intersection from the MassDOT and the Springfield Police Department. Actual crash reports were studied and analyzed to form a collision diagram of the intersection and identify patterns that could potentially contribute to the crashes in this area.

### 1. Crash Rate Analysis

A crash rate analysis was performed to compare the value at the intersection to the average value for MassDOT District 2 intersections. The crash rate per million entering vehicles was calculated. 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 MassDOT data, the average crash rate for signalized intersections in District 2 is 0.94.

As shown in Table 1, there were no reported crashes at this intersection during calendar years of 2006, 2007 and 2010. The crash rate at the intersection of Cottage Street, Robbins Road, and Industry Avenue is 0.48 which is lower than the average value for other signalized intersections in MassDOT District 2.

**Table 1: Crash History**

Year	Total	Type	Severity	Weather Condition	Road Condition	Crash Rate
2008	3	Angle	2 Property Damage	1 Clear	2 Dry	2
		Head On	1 Non Fatal Injury	2 Cloudy	0 Wet	1
				Rain	1 Unknown	0
2009	3	Angle	1 Property Damage	3 Clear	2 Dry	2
		Rear End	1 Non Fatal Injury	0 Cloudy	1 Wet	1
		Sideswipe	1	Rain	0 Unknown	0
Total	6					<b>0.48</b>

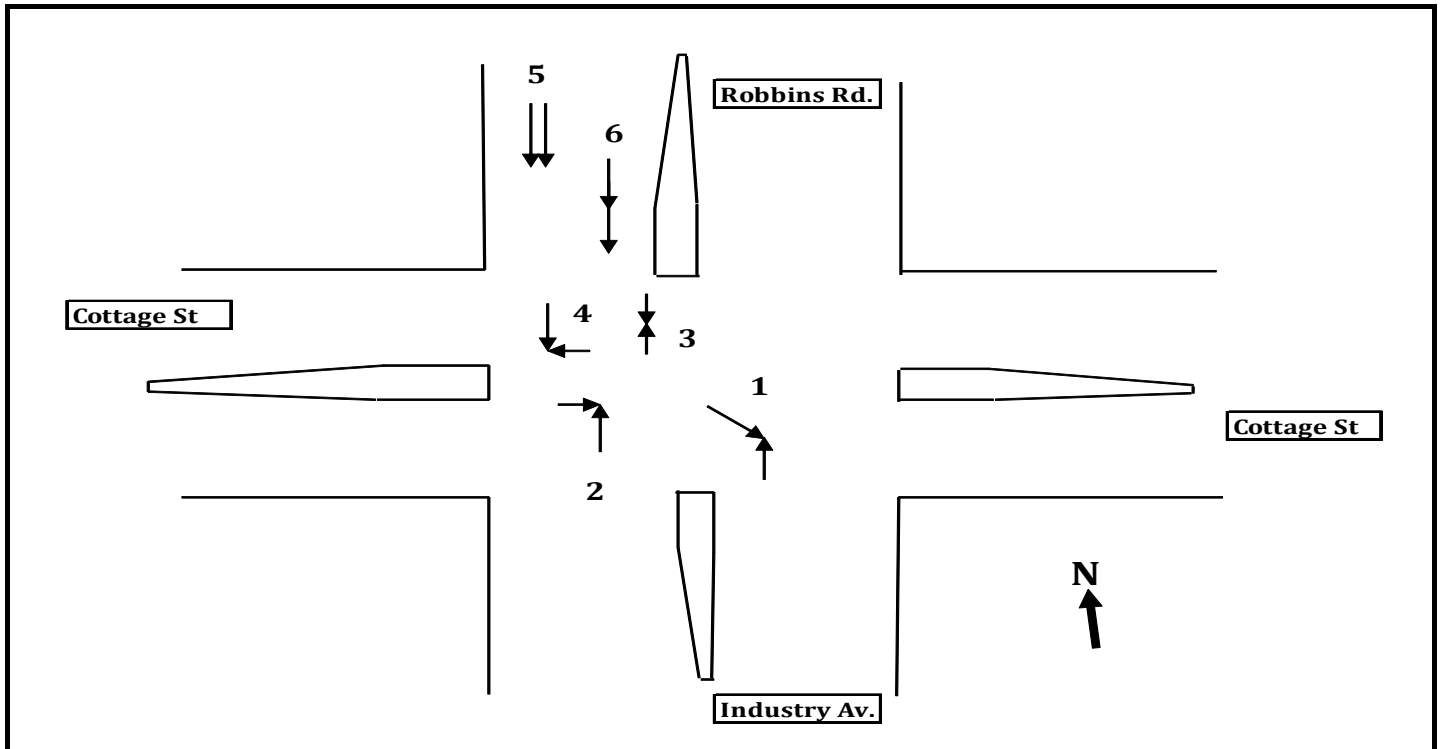
Source: MassDOT, Springfield Police Department

A total of 6 crashes were recorded during the 2008 and 2009 calendar years. The crashes did not follow a notable trend or pattern.

## 2. Collision Diagram

Based upon the data in the crash reports, each crash has been depicted graphically in the collision diagram and crash patterns have been identified. Figure 4 shows the collision diagram for the intersection. The details of the crashes shown in the figure are summarized in Table 2.

Figure 4: Collision Diagram



### LEGEND

Parked Car	→ □	Traffic Flow	••••▶
Angle	→ ↘	Pedestrian	→ ○
Rear End	→ →→	Side Swipe	→ →
Backing	→ ←←	Lane Change	→ ↗
Head-on	→ ↔		
Bicycle	↓ ↻		

**Table 2: Crashes included in Collision Diagram**

No.	Date	Time	Day	Sev.	L	R	P
1	06/12/08	11:06 AM	Thurs	I	1	1	8
2	08/04/08	2:42 PM	Mon	I	1	1	8
3	09/27/08	3:00 AM	Sat	PD	3	2	2
4	05/04/09	9:22 AM	Mon	PD	1	1	13
5	11/09/09	8:00 AM	Mon	PD	1	1	6
6	11/20/09	9:08 AM	Fri	PD	1	2	5

Source: Springfield Police Department

**LEGEND**

Fatality	F
Personal Injury	I
Property Damage	PD

Light Condition (L)

- 1. Daylight
- 2. Dawn/Dusk
- 3. Darkness
- 4. Unknown

Pattern (P)

- 0. Not Known
- 1. Speed too fast
- 2. Failure to Yield
- 3. Ran Stop Sign
- 4. Ran Traffic Signal
- 5. Rear End
- 6. Improper Passing
- 7. Wrong side of road
- 8. Improper turning
- 9. Improper backing
- 10. Sideswipe
- 11. Pedestrian violation
- 12. Human Error
- 13. Angle

Road Condition (R)

- 1. Dry
- 2. Wet
- 3. Snow/Ice
- 4. Not Known

**C. LEVEL OF SERVICE ANALYSIS**

The intersection 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 2010 Highway Capacity Manual by six levels, ‘A’ through ‘F’. A number of operational factors can influence the LOS including geometry, travel speeds, delay, and the number of pedestrians. Table 3 presents the LOS designations for a signalized intersection.

**Table 3: Level of Service (LOS) Designations for 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

Source: Highway Capacity Manual

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. Table 4 depicts the existing level of services at all the four approaches during the AM and PM peak hours.

Currently the traffic signal at this intersection operates as a two phase actuated signal with a 20 second advance for the Robbins Road approach. Both phases have a maximum green extension of 50 seconds. Right turns are allowed on a red light from all of the approaches.

**Table 4: Existing Level of Service**

Approach	Movement	AM Peak Hour		PM Peak Hour	
		Delay *	LOS **	Delay *	LOS **
Robbins Road Southbound	Left	24.7	C	33.2	C
	Through/Right	10.7	B	8.0	A
Industry Avenue Northbound	Left	17.9	B	18.4	B
	Through/Right	20.5	C	27.2	C
Cottage Street Eastbound	Left	20.0	B	19.4	B
	Through/Right	12.5	B	15.8	B
Cottage Street Westbound	Left/Through	17.1	B	17.5	B
	Right	8.8	A	10.9	B

Source: PVPC

\* Delay in seconds \*\* Level of Service

At the time of the field visit, it was observed during the afternoon peak hour that the queue at the Robbins Road approach was very long approximately between 5:00 pm to 5:15 pm. During this short time period, the through moving traffic from the Industry Avenue approach increased and as a result the left turning vehicles from Robbins Road did not have enough of a gap to turn. In addition, the high volume of heavy vehicles on Robbins Road also contributed to the longer queues by restricting access to the exclusive left turn lane. This was complicated by vehicles parked both legally and illegally along Robbins Road that restricted the flow of traffic. This phenomenon is not reflected in the LOS analysis because it is a very short-time issue which is not observed throughout the peak hour.



### III. RECOMMENDATIONS

The intersection of Cottage Street, Robbins Road, and Industry Avenue experiences long vehicle queue and heavy congestion for a short time period during the afternoon peak hour. Queue length can extend beyond the intersection of Robbins Road with Route 20, and contribute to congestion at that location. The following short and long term recommendations have been made to improve transportation conditions at the intersection.

#### A. INCREASING LENGTH OF THE LEFT TURN LANE

The existing left turn lane on the Robbins Road approach is 60 feet long. According to Massachusetts Department of Transportation's (MassDOT) Project Development and Design guidelines, the required length of an exclusive left turn lane for approaches with a 30 mph speed limit is 220 feet with 100 feet of taper. The short length of the existing lane does not allow adequate storage for the high volume of left turning vehicles. This results in vehicles queuing back into the through traffic lane and block their access to the intersection. The City of Springfield should consider increasing the storage length of the left turn lane as a short term measure to reduce congestion.

#### B. RESTRICTING PARKING ALONG ROBBINS ROAD

It was observed during the field visits that parked vehicles along Robbins Road reduce the available pavement width and restrict vehicles from travelling around the left turn queue. It is recommended that the City of Springfield talk to the business owners in this location and consider restricting the on street parking during the afternoon peak hour. Ample of parking is available across the street from this location.

#### C. INCREASING ADVANCE TIME FOR LEFT TURNS ON ROBBINS ROAD

It is recommended that the City of Springfield consider a different signal timing plan for the afternoon peak hour which provides longer advance green (30 seconds) to the Robbins Road approach and a maximum 35 seconds green extension for other approaches. The LOS analyzed by utilizing this timing plan during the afternoon peak hour is shown in Table 5.

**Table 5: LOS after Increasing Robbins Road Approach Advance**

Approach	Movement	PM Peak Hour	
		Delay *	LOS **
Robbins Road Southbound	Left	19.9	B
	Through/Right	7.4	A
Industry Avenue Northbound	Left	18.6	B
	Through/Right	28.0	C
Cottage Street Eastbound	Left	20.5	C
	Through/Right	16.5	B
Cottage Street Westbound	Left/Through	18.4	B
	Right	10.6	B

Source: PVPC

\* Delay in seconds \*\* Level of Service

**D. DUAL LEFT TURN LANE FOR ROBBINS ROAD APPROACH**

The City of Springfield should consider an engineering study to examine the need and feasibility of providing an additional left turn lane for the Robbins Road approach as a long term improvement measure at this intersection. This would necessitate an additional receiving lane of appropriate width and length for Cottage Street in the westbound direction. Such a measure could require the acquisition of additional right of way along the southeast corner of the intersection.

The City should also examine the effect and feasibility of converting the through/right movement lane for the Robbins Road approach into a left/through/right movement lane similar to the one at the intersection of Robbins Road with Page Boulevard (Route 20). This improvement measure would also require an additional receiving lane for Cottage Street, a different signal phasing plan, and possibly an upgraded signal equipment.

**E. SIGNAL EQUIPMENT**

The existing signal equipment lacks back plates and visors for the signal heads. The pole of the post-mounted signal for the Industry Avenue approach was found to be damaged and tilted during the field visit. It is recommended that the City of Springfield update the signal equipment at this intersection to conform with the Manual of Uniform Traffic Control Devices (MUTCD) standards.