

# Road Safety Assessment

Cass Avenue | Woonsocket, RI



SEPTEMBER 2018



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# 1

## Introduction

The Highway Safety Improvement Program (HSIP) was created under Section 1401 of SAFETEA-LU (the Federal transportation bill signed into law in 2005) with the purpose of reducing traffic fatalities and serious injuries on public roadways. Subsequent transportation bills - the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act – provided continuations of the HSIP, which is authorized under United States Code Title 23 Section 148 (23 U.S.C. 148). As part of the Rhode Island Department of Transportation (RIDOT) HSIP, several programs have been created that target specific safety improvements such as Roadway Departure, Intersection Safety, Safety Corridor, Interchange Improvements, RI\*STARS, Vulnerable Road User, Local Safety, and Safety Data Collection programs.

For Rhode Island to reach its goals set forth in the Strategic Highway Safety Plan 2017-2022 (SHSP) to halve fatalities and serious injuries by 2030, RIDOT developed the Safety Corridor Program to mitigate crash issues on state- and locally-maintained roadways as well as provide funding (when available) to implement crash mitigation measures.

The goal of the programs has been to target roadway segments with high frequencies of crashes for roadway safety assessments. Current Safety Corridor Program efforts have been focused on identifying four-lane road segments with the high speeds. However, the systemic Safety Corridor Program efforts have begun to review two-lane corridors with a likelihood for high severity (fatal and serious injury) crashes.

Cass Avenue was identified due to crash frequency and a concern for pedestrian safety along the corridor. With the recent fatal crash along Cass Avenue, RIDOT felt it was necessary to review the entire roadway within the City of Woonsocket. Based on a review of the historic crash data, this location falls under the purview of the Safety Corridor and Vulnerable Road User Programs.

For all locations investigated as part of the HSIP, RIDOT conducts a Road Safety Assessment (RSA) where RIDOT and an interdisciplinary team evaluate existing conditions and identify possible factors contributing to crash history and severity at these locations. The findings are then prioritized in order of perceived importance and associated with potential opportunities for targeted improvement/corrective mitigation. The potential improvements to be considered are either spot or systemic and are categorized as immediate-, near-, or long-term, representing the timeframe in which they should or could be implemented.

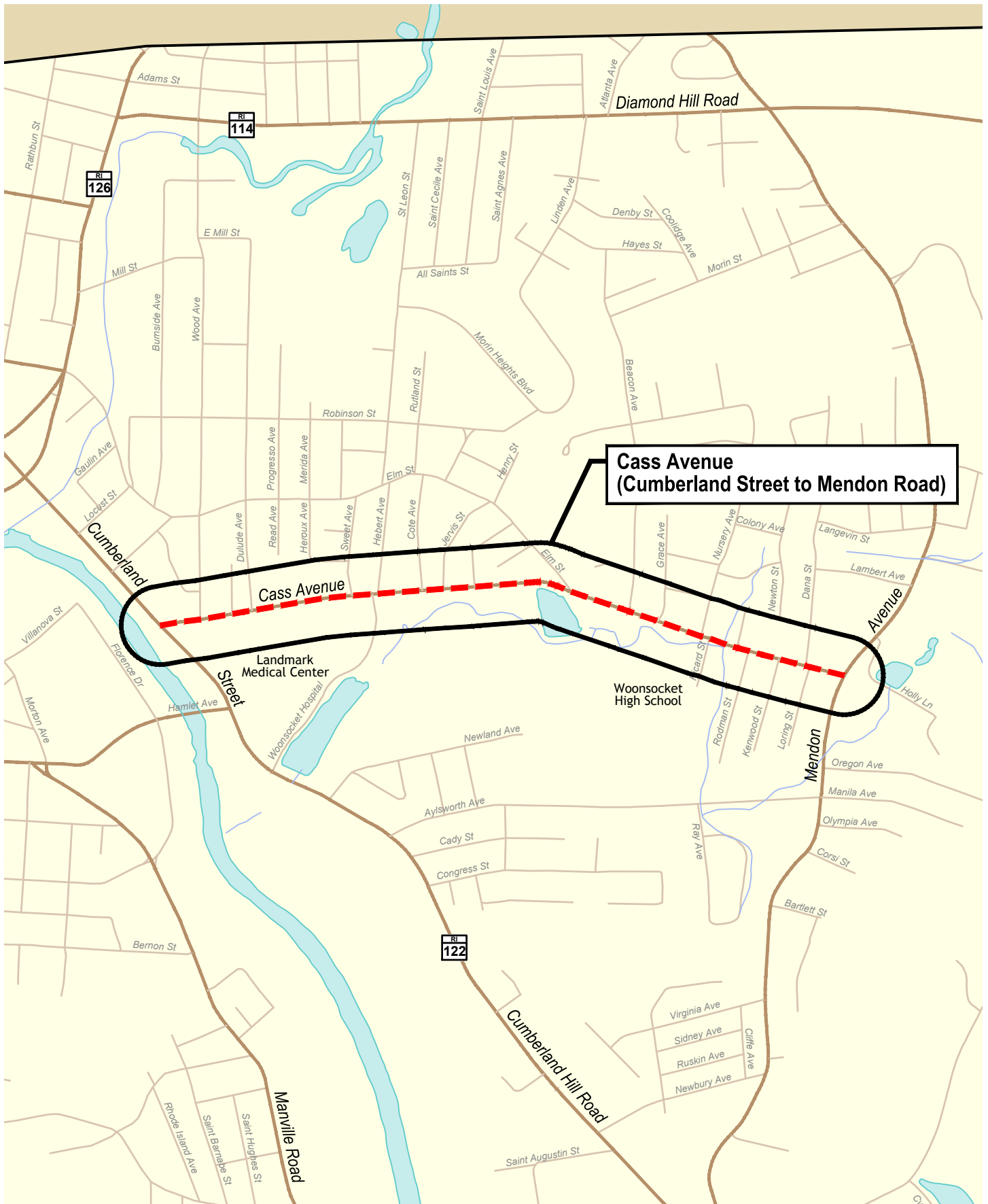
## 1.1 Study Area

RIDOT has identified Cass Avenue as exhibiting safety needs based on the crash history involving vulnerable roadway users, roadway departure crash trends, and observations. The focus of this report is Cass Avenue between Cumberland Street and Mendon Road in Woonsocket, Rhode Island.

Cass Avenue is a one-mile long corridor with a typical east-west orientation. The road consists of two travel lanes with parking permitted within the shoulder at spot locations throughout the corridor. Cass Avenue provides connections to Cumberland Street to the east and Mendon Road to the west. The road also provides connections from the adjacent neighborhoods to Woonsocket High School, Landmark Medical Center, as well as numerous parks and other small businesses.

There are two signalized intersections along Cass Avenue, at each terminus, located at the intersection with Cumberland Street and Mendon Road. There are a significant number of side streets controlled by at least a stop line, with some being marked by a stop sign as well along Cass Avenue.

**Figure 1-1** depicts the location of the study area.



**Cass Avenue  
(Cumberland Street to Mendon Road)**



0 1000 Feet



General Assessment Area  
Cass Avenue  
(Cumberland Street to Mendon Avenue)  
Woonsocket, Rhode Island

**Figure 1-1**



# 2

## Roadway Safety Assessment

### 2.1 Objective of Road Safety Assessment



The Federal Highway Administration (FHWA) defines a Roadway Safety Assessment (RSA) as a “formal safety performance evaluation of an existing or future road or intersection by an independent, multidisciplinary team.” RSAs are a valuable tool for transportation agencies to evaluate road safety issues contributing to injuries and deaths and to identify opportunities for improvement. The success of RSAs has led to the FHWA including the RSA process as one of its nine “proven safety countermeasures.”

RSAs examine safety conditions in detail by pulling together an interdisciplinary team that looks at the issues from different perspectives – perspectives that are often not a part of a traditional safety review. RSAs also consider safety from a human point of view, which aims to answer the following questions:

- › How and why are people reacting to the roadway conditions?
- › What do people sense and how do they react to those senses?
- › What are the associated risks with those elements?

### 2.2 Road Safety Assessment Interdisciplinary Team

An interdisciplinary team approach is a key factor in the success of Roadway Safety Assessments. Interactions between all road users (e.g., pedestrians and motor vehicles, commuter traffic and recreational vehicle traffic, bicycles and motor



vehicles, etc.) are investigated to determine potential risks and to identify programs and measures to help reduce those risks and create safer environments for all road users. By working with an interdisciplinary team of stakeholders the views of each of the unique users can be captured and integrated into solutions and countermeasures.

The Interdisciplinary RSA Team for the Cass Avenue assessment consisted of engineers and stakeholders from the City of Woonsocket and RIDOT. Representatives from project consultant Vanasse Hangen Brustlin (VHB) facilitated the RSA, which took place on July 31, 2018. The members of the RSA team are as follows:

- › Theodore Coleman – RIDOT Traffic Engineering
- › Jason Farias – RIDOT Office of Highway Safety
- › Ian McElwee – Woonsocket City Planner
- › Scott Sanford – Woonsocket Department of Public Works
- › Skye Levin – VHB
- › Kayla Cabral – VHB
- › Ryan Bloomer – VHB

## 2.3 Crash Analysis

Crash data for the assessment area was provided by RIDOT for a five-year period between January 1, 2013 and December 31, 2017. The crashes were reviewed by severity and crash type. Severity is measured using the KABCO method, which assigns a severity type to each crash. K-type crashes result in a fatality; A-type crashes result in an incapacitating injury; B-type crashes result in an evident injury; C-type crashes result in complaints of pain; and O-type crashes result in property damage only.

Along Cass Avenue, there were 131 crashes that occurred from 2013 through 2017. One of those crashes (<1%) was a K-type crash, one crash (<1%) was an A-type crash, five of the crashes (4%) were B-type crashes, twenty-seven of the crashes (21%) were C-type crashes, and the remaining 74 percent of crashes resulted in property damage only. The most common type of crash between two vehicles were rear-end type incidents, accounting for 40% of the total crashes. Angle crashes (side impacts) also occurred frequently, making up 33% of the total crashes.

Crashes with vulnerable users have a higher frequency of more severe outcomes. Both the fatal (K-type) crash and the incapacitating (A-type) crash were between vehicles and pedestrians using crosswalks along Cass Avenue. The fatal crash occurred in advance of Dulude Avenue with the motor vehicle traveling westbound at the Landmark Medical Center, which is situated on both sides of the road. The incapacitating crash occurred at the intersection of Elm Street and Cass Avenue, where students frequently cross to get to school. Vehicle-Pedestrian crashes account

for five out of the 131 total crashes (4%) however they also yield the most severe outcomes.

**Figure 2-1** provides a collision diagram detailing crashes along Cass Avenue between Cumberland Street and Mendon Road.





SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1a

MATCHLINE TO FIGURE 2b



MATCHLINE TO FIGURE 2a



MATCHLINE TO FIGURE 2c

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1b





MATCHLINE TO FIGURE 2b

MATCHLINE TO FIGURE 2d

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

**Figure 2-1c**



MATCHLINE TO FIGURE 2c



MATCHLINE TO FIGURE 2e

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1d





MATCHLINE TO FIGURE 2d

MATCHLINE TO FIGURE 2f

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS		TYPES OF COLLISION		SEVERITY	
	MOVING VEHICLE		REAR END	K	FATAL INJURY CRASH
	BACKING VEHICLE		HEAD ON	A	INCAPACITATING INJURY CRASH
	PEDESTRIAN		SIDE SWIPE	B	NON-INCAPACITATING INJURY CRASH
	BICYCLE		OUT OF CONTROL	C	COMPLAINT INJURY CRASH
	PARKED VEHICLE		LEFT TURN	O	NO INJURY/PROPERTY DAMAGE ONLY CRASH
	FIXED OBJECT		ANGLE		



Collision Diagram  
Cass Avenue  
Woonsocket, RI

**Figure 2-1e**



MATCHLINE TO FIGURE 2e

MATCHLINE TO FIGURE 2g



SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1f



MATCHLINE TO FIGURE 2f



SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH

Collision Diagram  
Cass Avenue  
Woonsocket, RI

**Figure 2-1g**



## 2.4 RSA Findings and Suggestions for Improvement


Based on a review of the 2013-2017 crash data and of the existing field conditions, the RSA participants identified several key safety-related findings within the assessment area. These findings were prioritized in order of perceived importance and associated with potential opportunities for targeted improvement/corrective mitigation. The potential improvements to be considered are either spot or systemic and are categorized as immediate-, near-, or long-term, representing the timeframe in which they should or could be implemented.


**Table 2-1** summarizes the findings and suggestions for each location included in this assessment.




**Table 2-1 Summary of RSA Findings and Suggestions for Cass Avenue**

OBSERVATION	IMMEDIATE TERM IMPROVEMENTS Under 6 months	NEAR TERM IMPROVEMENTS Under 2 years	LONGER TERM IMPROVEMENTS Over 2 years	COMMENTS
<p><b>Lack of Conspicuity at Pedestrian Crossings</b> – Existing signage and pavement markings at multiple pedestrian crossings along Cass Avenue were observed to be faded, obstructed by trees, vehicles or utility poles, and general wear.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.1</b> Remove existing signage and install new signs at the crosswalks and in advance of the crosswalks per the MUTCD.</p> <p><b>1.2</b> Restripe the crosswalks to be continental style pavement markings. Consider using a marking material with a long-lasting service life.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.3</b> Consider the installation of a rapid rectangular flashing beacon (RRFB) at the pedestrian crossings at Landmark Medical Center and Elm Street.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.4</b> Consider enhanced crosswalk treatment, such as High Intensity Activated Crosswalk.</p> <p><b>1.5</b> Consider installing pedestrian curb extensions / bumpouts at intersections to improve conspicuity and decrease pedestrian crossing distances.</p>	<p><b>Longer-term improvements are intended to address persistent safety issues if observed in the future.</b></p>
<p><b>Lack of signage and striping</b>– Guide/regulatory/warning signs are small, inconsistent, unclear, obstructed, or missing along Cass Avenue. Side streets along the corridor lack stop signs and/or stop bars. Striping was observed to be faded or missing due to recent utility work.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.6</b> Consider a comprehensive sign audit to verify sign height, placement, retro-reflectivity, current sign standards, consistency, redundancy, missing and unnecessary signs. Revise signs accordingly.</p> <p><b>1.7</b> Consider installing STOP signs and stop bars at all side streets, in appropriate locations, where an existing stop sign is missing.</p> <p><b>1.8</b> Install intersection warning signs for key intersections along the corridor.</p> <p><b>1.9</b> Re-paint/mark pavement striping where faded or missing. Consider using a marking material with a long-lasting service life.</p>			
<p><b>High vehicle speeds</b> – Vehicles are above posted speed limits on Cass Avenue. The posted speed limit is 25 mph. Near Ricard Street, 85<sup>th</sup> percentile speeds were about 50 percent higher than the posted speeds, and speeds was about 20 percent higher than posted near Elm Street and Landmark Medical Center. Higher speeds can result in crashes of a higher severity, less time for drivers to see and react to conditions on the road, and inadequate gaps for vehicles entering or crossing the mainline of traffic.</p>	<p><b>ENFORCEMENT:</b></p> <p><b>1.10</b> Consider a speeding enforcement campaign on Cass Avenue to discourage speeding.</p> <p><b>ENGINEERING:</b></p> <p><b>1.11</b> Remove existing speed limit signs and install new speed limit signs, spaced more appropriately.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.12</b> Restripe Cass Avenue to reduce existing lane widths to 11’ as a traffic calming measure.</p> <p><b>1.13</b> Install dynamic speed feedback signs to discourage speeding along Cass Avenue.</p>	<p><b>ENGINEERING:</b></p>	<p><b>Since the completion of the Roadway Safety Assessment, a speed study was completed, as described in Chapter 3.</b></p>

OBSERVATION	IMMEDIATE TERM IMPROVEMENTS Under 6 months	NEAR TERM IMPROVEMENTS Under 2 years	LONGER TERM IMPROVEMENTS Over 2 years	COMMENTS
<p><b>Inadequate Vulnerable Road User Facilities</b> – Cass Avenue runs alongside a medical center, a public park, and Woonsocket High School. The sidewalks and pedestrian crossings undergo constant use but currently lack the proper striping and advance sign placement. There were also several bicyclists observed on the corridor with no current marked facilities.</p> 	<p><b>EDUCATION:</b></p> <p><b>1.14</b> Consider a “Yield to Pedestrians” educational campaign to instruct drivers to yield to pedestrians in crosswalks.</p> <p><b>ENFORCEMENT:</b></p> <p><b>1.15</b> Consider enforcement at adjacent on-street parking, east of Elm street, to discourage parking within the pedestrian access routes.</p> <p><b>ENGINEERING:</b></p> <p><b>1.16</b> Upgrade or replace all pedestrian and playground warning signs to fluorescent yellow-green and retroreflective.</p> <p><b>1.17</b> Install retroreflective panels on pedestrian warning sign posts for enhanced visibility.</p> <p><b>1.18</b> Trim overgrown vegetation along Cass Avenue that is limiting sight lines of pedestrian warning signs.</p> <p><b>1.19</b> Install pedestrian warning signage on Cass Avenue approaches to marked crossings.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.20</b> Consider reducing existing lane widths through restriping to provide bicycle lanes in each direction.</p> <p><b>1.21</b> Review pedestrian signal equipment to determine deficiencies. Replace equipment accordingly.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.22</b> Install ADA compliant wheel chair ramps and stripe continental style crosswalks on appropriate intersection approaches.</p> <p><b>1.23</b> Consider installing pedestrian curb extensions / bumpouts at intersections.</p>	<p><b>Longer-term improvements are intended to address persistent safety issues if observed in the future.</b></p>

OBSERVATION	IMMEDIATE TERM IMPROVEMENTS <i>Under 6 months</i>	NEAR TERM IMPROVEMENTS <i>Under 2 years</i>	LONGER TERM IMPROVEMENTS <i>Over 2 years</i>	COMMENTS
<p><b>Inadequate Vehicle Sight Lines</b> – Inadequate vehicle sight lines occur at several intersections and segments along Cass Avenue due to the changes in elevation of the roadway, parked vehicles, and overgrown vegetation.</p> 	<p><b>ENGINEERING:</b></p> <ul style="list-style-type: none"> <li><b>1.24</b> Install hatched pavement markings at crosswalks, side streets, and fire hydrants to restrict parking per RI state law.</li> <li><b>1.25</b> Review parking restriction signage and revise accordingly.</li> <li><b>1.26</b> Consider conducting a parking study to determine use and need.</li> <li><b>1.27</b> Remove parking spaces directly next to side street and driveway intersections along Cass Avenue that may interfere with sight distance per RI state law.</li> <li><b>1.28</b> Trim overgrown vegetation along Cass Avenue that is limiting sight lines at side streets and driveways throughout the corridor.</li> <li><b>1.29</b> Consider enforcement at adjacent on-street parking, east of Elm Street, to discourage parking that inhibits vehicle sight distance.</li> </ul>			

OBSERVATION	IMMEDIATE TERM IMPROVEMENTS <i>Under 6 months</i>	NEAR TERM IMPROVEMENTS <i>Under 2 years</i>	LONGER TERM IMPROVEMENTS <i>Over 2 years</i>	COMMENTS
<p><b>Sub-standard roadside barrier</b> – Roadside objects and non-recoverable slopes were observed to be within the clear zone on Cass Avenue intermittently from south of Elm Street to Ricard Street.</p> 	<p><b>ENGINEERING:</b></p> <p><b>1.30</b> Evaluate the existing conditions along the corridor to determine if the current guardrail installation is appropriate.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.31</b> If the existing wood fencing system is not appropriate, install steel w-beam guardrail to shield objects within clear zone.</p> <p><b>1.32</b> Consider the installation of w-beam guardrail to shield trees and slopes within the clear zone in front of Woonsocket High School.</p>		
<p><b>Night-time crash history</b> – Multiple crashes along Cass Avenue occurred during the night-time. There may be insufficient existing lighting installed along the corridor.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.33</b> Conduct a street lighting study to determine deficiencies and potential improvements.</p>	<p><b>ENGINEERING:</b></p> <p><b>1.34</b> Review corridor-wide street lighting and implement any improvements necessary to ensure safety for vehicles and vulnerable road users.</p>		<p><b>Coordinate with National Grid for lighting improvements.</b></p>



# 3

## Countermeasure Implementation

All recommendations from this RSA have been reviewed and vetted by the assessment team. This chapter provides a high-level evaluation of the proposed mitigation measures for implementation feasibility and appropriateness.

### 3.1 Implementation Plan

**Table 3-1** presents the implementation plan for the RSA recommendations, including the timeframe in which each recommendation could reasonably be implemented. In addition, the table lists the “Safety Benefit - Costs” (where applicable) and the status of the recommendation.

The “Safety Benefit-Cost” column is a preliminary determination of the actual safety benefit expected as well as the cost to implement each recommendation made by the RSA team. Safety benefit estimates are subjective and may be based on the relative percent of crashes that may be reduced by the enhancement based on site specific crash data, statewide systemic crash trends, and known and documented crash reduction factors. Implementation costs are order-of-magnitude estimates based on recent contracts and other sources. The following exhibit illustrates the general guidance uses when making this determination.



<b>Safety Benefit</b>	<b>Implementation Costs</b>
<b>High</b> – Enhancement greatly reduces (>20%) crash types and severities experienced and/or addresses high risk facility types.	High – > \$100K
<b>Medium</b> – Enhancement reduces (<20%) crash types and severities experienced or addresses high risk facility types.	Medium – \$10K - \$100K
<b>Low</b> – Enhancement offers general safety benefits but not directly related to crash types and severities experienced or high-risk facility types.	Low – <\$10K

## 3.2 Funding

The implementation of recommendations is contingent on available funding. Per the Fixing America's Transportation (FAST) Act legislation, RIDOT is responsible for the reduction of fatalities and serious injuries on all public roadways, regardless of ownership. Therefore, RIDOT has the potential to provide partial or full funding for several of the improvements identified in this report as part of the Systemic Safety Corridor Program.

Any funding requested to implement the recommendations listed in the RSA should go through the HSIP Eligibility request process, which requires justification of the projected safety benefits for recommended improvements. RIDOT will then determine if it is eligible for HSIP funds and distribute the funds needed (dependent on availability) so that the design and/or construction of the improvements can be administered.

**Table 3-1 Implementation Matrix**

Mitigation Measures	Timeframe			Preliminary Costs	Status
	Immediate Term	Near Term	Long Term		
<b>1.0 Cass Avenue</b>					
<b>1.1</b> Remove existing signage and install new signs at the crosswalks and in advance of the crosswalks per the MUTCD.	X			High Benefit – Low Cost	
<b>1.2</b> Restripe the crosswalks to be continental style pavement markings.	X			High Benefit – Low Cost	In Design
<b>1.3</b> Consider the installation of a rapid rectangular flashing beacon (RRFB) at the pedestrian crossings at Landmark Medical Center and Elm Street.		X		High Benefit – Medium Cost	In Design
<b>1.4</b> Consider enhanced crosswalk treatment, such as High Intensity Activated Crosswalk.			X	High Benefit – High Cost	
<b>1.5</b> Consider a comprehensive sign audit to verify sign height, retro-reflectivity, current sign standards, consistency, redundancy, and unnecessary signs. Revise signs accordingly.	X			High Benefit – Low Cost	
<b>1.6</b> Install STOP signs and stop bars at all side streets, in appropriate locations, where an existing stop sign is missing.	X			Medium Benefit- Low Cost	
<b>1.7</b> Install intersection warning signs for key intersections along the corridor.	X			High Benefit – Low Cost	
<b>1.8</b> Consider a speeding enforcement campaign on Cass Avenue to discourage speeding.	X			N/A	
<b>1.9</b> Remove existing speed limit signs and install new speed limit signs, spaced more appropriately.	X			High Benefit – Low Cost	
<b>1.10</b> Conduct a speed study to determine operating speed.	X			N/A	Completed by VHB
<b>1.11</b> Restripe Cass Avenue to reduce existing lane widths to 11' as a traffic calming measure.		X		High Benefit – Low Cost	

Mitigation Measures	Timeframe			Preliminary Costs	Status
	Immediate Term	Near Term	Long Term		
<b>1.12</b> Install dynamic speed feedback signs to discourage speeding along Cass Avenue.		X		High Benefit – Medium Cost	
<b>1.13</b> Consider a “Yield to Pedestrians” educational campaign to instruct drivers to yield to pedestrians in crosswalks.	X			N/A	
<b>1.14</b> Consider enforcement at adjacent on-street parking, east of Elm street, to discourage parking within the pedestrian access routes.	X			N/A	
<b>1.15</b> Install retroreflective panels on pedestrian warning sign posts for enhanced visibility.	X			High Benefit – Low Cost	
<b>1.16</b> Trim overgrown vegetation along Cass Avenue that is limiting sight lines of pedestrian warning signs.	X			High Benefit – Low Cost	
<b>1.17</b> Install pedestrian warning signage on Cass Avenue approaches to marked crossings.	X			High Benefit – Low Cost	
<b>1.18</b> Consider reducing existing lane widths through restriping to provide bicycle lanes in each direction.		X		High Benefit – Low Cost	
<b>1.19</b> Review pedestrian signal equipment to determine deficiencies. Replace equipment accordingly.		X		N/A	
<b>1.20</b> Install ADA compliant wheel chair ramps and stripe continental style crosswalks on appropriate intersection approaches.			X	High Benefit – Medium Cost	
<b>1.21</b> Install hatched pavement markings at crosswalks, side streets, and fire hydrants to restrict parking per RI state law.	X			High Benefit – Low Cost	
<b>1.22</b> Review parking restriction signage and revise accordingly.	X			N/A	
<b>1.23</b> Consider conducting a parking study to determine use and need.	X			N/A	

Mitigation Measures	Timeframe			Preliminary Costs	Status
	Immediate Term	Near Term	Long Term		
<b>1.24</b> Remove parking spaces directly next to side street and driveway intersections along Cass Avenue that may interfere with sight distance per RI state law.	X			High Benefit – Low Cost	
<b>1.25</b> Trim overgrown vegetation along Cass Avenue that is limiting sight lines at side streets and driveways throughout the corridor.	X			High Benefit – Low Cost	
<b>1.26</b> Evaluate the existing conditions along the corridor to determine if the current guardrail installation is appropriate.	X			N/A	
<b>1.27</b> If the existing wood fencing system is not appropriate, install steel W-Beam guardrail to shield object within clear zone		X		High Benefit – Medium Cost	
<b>1.28</b> Conduct a lighting study to determine deficiencies and potential improvements.	X			N/A	
<b>1.29</b> Implement corridor-wide lighting installation to improve safety for vehicles and vulnerable road users.		X		High Benefit – Medium Cost	

### 3.3 Supporting Data

The following field work was completed to help inform the recommendations and suggestions.

#### 3.3.1 Speed Study

The posted speed limit along Cass Avenue is 25 miles per hour (mph). Speed measurements were collected by VHB in August 2018 along Cass Avenue near Ricard Street, Elm Street, and adjacent to Landmark Medical Center. The speed measurements were collected during off peak periods using a radar gun. The 85<sup>th</sup> percentile speeds were determined from this study. The 85<sup>th</sup> percentile speed is a speed at or below which 85 percent of the observed traffic on the roadway travel and is used as a typical measure of prevailing speed in the traffic engineering profession. **Table 3-2** shows the results of the speed study.

**Table 3-2 Speed Data Summary**

	Posted Speed Limit (mph)	85 <sup>th</sup> Percentile Speed (mph)	Average Speed (mph)
<b>Cass Avenue near Ricard Street</b>			
Westbound	25	38	33
Eastbound	25	37	34
<b>Cass Avenue near Elm Street</b>			
Westbound	25	31	27
Eastbound	25	31	27
<b>Cass Avenue near Landmark Medical Center</b>			
Westbound	25	30	27
Eastbound	25	29	26

As shown in **Table 3-2**, the 85<sup>th</sup> percentile speeds are higher than the posted speed limit by at least 5 mph at all locations observed. The speed data collected along the eastern segment of Cass Avenue were significantly higher than the western segment. The speeds along eastern segment near Ricard Street were found to be approximately 12 mph over the posted speed limit while the average speed limit is approximately 10 mph over the posted speed limit. The full results from the speed study can be found in **Appendix B**.

#### 3.3.2 Existing Guardrail and Roadside Evaluation

During the RSA, it was noted that the existing guardrail and roadside conditions along Cass Avenue from Beacon Avenue to Ricard Street would require a thorough evaluation. The guardrail and roadside evaluations were completed by VHB in September 2018. The field evaluations included documenting the slopes along the road, the presence of break lines and their distance from the edge of pavement, the presence of horizontal curves along the roadway, and the posted speed limit. As

mentioned above, speed studies were performed along the study area roadway to determine the 85<sup>th</sup> percentile speed in each direction.

Using the data collected during the field evaluation and the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide<sup>1</sup>, the clear zone along Cass Avenue was determined. The clear zone is defined as the “unobstructed, traversable area provided beyond the edge of the through travel way for the recovery of errant vehicles.” The clear zone requirements are based on the design speed, average daily traffic (ADT) volumes, and slopes adjacent to the traveled way.

As previously stated the 85<sup>th</sup> percentile speed along Cass Avenue is nearly 40 mph, which is 15 mph over the posted speed limit of 25 mph. Based on adjacent roadway volumes, it was assumed that the Average Daily Traffic (ADT) along Cass Avenue is greater than 6,000 vehicles per day (vpd). Based on Table 3-1 in the Roadside Design Guide, the clear zone was determined to be 18 feet from the traveled way.

During the field evaluation the slopes adjacent to the eastbound travel lane were documented. The first set of measurements were conducted across from Beacon Street. Adjacent to the eastbound shoulder there is an approximately 4-foot sidewalk. Behind the sidewalk, the slopes were 1V:16H for nearly two (2) feet. At approximately two (2) feet from the back of sidewalk, the slopes begin to steepen to nearly 1V:2H to the bottom of the slope which is nearly 20 feet.

The second set of measurements were conducted across from 764 Cass Avenue. Adjacent to the eastbound shoulder there is an approximately 4-foot sidewalk. Behind the sidewalk, the slopes were 1V:16H for nearly one and a half (1.5) feet. At approximately one and a half (1.5) feet from the back of sidewalk, the slopes begin to steepen to slightly greater than 1V:2H to the bottom of the slope which is approximately 25 feet.

The two additional sets of measurements were conducted in front of Woonsocket High School. Adjacent to the eastbound shoulder there is an approximately 4-foot sidewalk. Behind the sidewalk, the slopes were 1V:12H for just over two (2) feet. At approximately two (2) feet from the back of sidewalk, the slopes begin to steepen to slightly greater than 1V:2H to the bottom of the slope which is approximately 25 feet.

Objects within the clear zone and their location from the traveled way were also identified and documented. Trees were observed within the clear zone and within the area of the non-recoverable slopes.

Based on the field measurements taken on Cass Avenue near Woonsocket High School, the slopes along the roadway adjacent to the eastbound travel lane are considered recoverable within two feet from the traveled way as they do not exceed the threshold of 1V:4H. However, after the 2-foot area the slopes are considered non-recoverable as they greatly exceed the threshold of 1V:4H within the clear zone

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<sup>1</sup> Roadside Design Guide, 4<sup>th</sup> Edition. American Association of State Highway and Transportation Officials (AASHTO), 2011.

and a clear runout area past the non-recoverable slope is not provided due to the significant number of trees. Based on Figure 3-2 in Roadside Design Guide, if there is not a runout area provided past the non-recoverable slope then the non-recoverable slopes require shielding. Therefore, guardrail is warranted from Ricard Street to the east to the Woonsocket High School driveway.

During the RSA, it was also noted that there is a wood fence that is shielding roadside objects (pond, slopes, etc.). The wood fencing installed is not crash worthy and should be replaced with guardrail that meets the latest standards. **Appendix C** provides the field notes from the guardrail evaluation.

### **3.3.3 Sign and Pavement Marking Inventory**

Following the RSA, a sign and pavement marking inventory was completed at the intersection to identify existing signage, particularly concerning curve warning signage and speed limit signage. Key observations include the following:

- › Vegetation overgrowth: vegetation overgrowth along Cass Avenue obstructs the view of the existing signs and sight lines at some of the side streets.
- › Inadequate Signage: Advanced intersection warning signs are missing or not placed with enough warning of the approaching intersection. Speed limit signs were observed to be placed sporadically.
- › Insufficient Pedestrian Crossing: The advanced signage and signage at the crosswalks was observed to be lacking retro-reflectivity and not providing enough warning for vehicles. Crosswalk pavement marking appeared to be inconsistent along the corridor.
- › Lack of Pavement Markings: Pavement markings were observed to be faded along the corridor. The lane shift to allow on-street parking appears to be abrupt and not adequate based on the operating speed along Cass Avenue.
- › Pavement Condition: The existing pavement condition along Cass Avenue was observed to be in good condition with little cracking.

## **3.4 Findings**

### **3.4.1 Countermeasure Effectiveness**

#### **3.4.1.1 Rectangular Rapid Flashing Beacon (RRFB)**

Lack of pedestrian visibility was observed during the Cass Avenue RSA. Rectangular Rapid Flashing Beacons (RRFBs) at key pedestrian crossings within the study area are the recommended countermeasure.

RRFBs are user-activated LEDs that supplement MUTCD compliant warning signs at unsignalized intersections or mid-block crosswalks. The system can be activated manually by a push button or by a passive system that detects the presence of a person seeking to cross the street.

The Crash Modification Factors (CMF) Clearinghouse provides limited information on the impact RRFBs have on crashes. As a surrogate for reduction in crashes, studies have reviewed their impact to quantify benefits of the installation of RRFBs. Specifically, FHWA and the State of Florida studied the benefits of the installation.<sup>2</sup>

FHWA concluded that:

- › RRFBs are a low-cost alternative to traffic signals and HAWK signals that are proven to increase driver yielding behavior at crosswalks.
- › The stutter flash of the RRFB may have a greater response from drivers than traditional methods.
- › From the study completed in Florida, yielding behavior was increased from 18 percent to 81 percent from converting a no-beacon arrangement to a beacon system mounted on the supplementary warning sign on the right side of the crossing.

Given these findings, RRFBs are proposed at the existing crosswalk on Cass Avenue near Landmark Medical Center due to the history of vehicle/pedestrian crashes at this location.

#### **3.4.1.2 Lane Width Reduction**

The CMF Clearinghouse provides limited information concerning the impact on crashes that the reduction of lane widths has in urban areas. As a surrogate for reduction in crashes, studies have reviewed the direct benefits to speed reduction from reduced lane widths. Reductions in speed should translate into reductions in crash severity and ultimately a reduction in total crashes.

National Cooperative Highway Research Program (NCHRP) 613 “Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections” provides a summary of outcomes and best practices for several treatment options including reduced lane widths.

The report concluded that reducing lane widths:

- › Reduces mid-block speeds,
- › Reduces driver comfort, and
- › May decrease capacity due to reduced saturation flow rates.

As capacity was not an observed issue on Cass Avenue, the potential for decreased capacity should not prohibit reducing lane widths.

The National Association of City Transportation Officials (NACTO) Urban Street Design Guide also studied the relationship between the width of a travel lane and the speed of the roadway.

The guide concluded that:

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<sup>2</sup> “Rectangular Rapid Flash Beacon (RRFB)” Frederick, Michael and Rice, Ed, FHWA-SA-09-009. May 2009.



- › Narrower streets help promote slower driving speeds and also reduce crossing distances and shorten signal cycles.
- › Lanes greater than 11 feet should not be used in urban areas as they may cause unintended speeding and assume valuable right-of-way at the expense of other modes.

Reducing lane widths would have the additional advantage of being a low-cost application. Given the findings of this review, it is recommended that lane widths are reduced along Cass Avenue in order to encourage drivers to reduce speeds and provide width for future bicycle lanes.

#### **3.4.1.3 Replacement/Installation of Guardrail**

Guardrail is a roadside barrier used to deflect vehicles as they depart from the traveled way towards the roadside. The installation of guardrail is warranted by using the procedures discussed in the *AASHTO Roadside Design Guide*. Overall, guardrail is installed to shield objects such as non-recoverable slopes, roadside structures, or other objects that cannot be removed or relocated outside of the clear zone.

The CMF Clearinghouse does not provide information concerning the impact that the replace and/or installation of guardrail has on crashes. However, FHWA has studied the potential benefits through on-going analysis.

FHWA determined the following:

- › The total number of crashes may not be reduced; however, the severity of the crashes will be reduced by the installation of guardrail.
- › The guardrail when installed with reflectors has been shown to delineate the edge of the roadway and the horizontal curve.

The implementation of replacement/installation of guardrail may prevent vehicles from departing the roadway and striking any existing roadside features. The replacement and/or installation of guardrail is recommended based upon the field evaluation of the existing roadside conditions as shown in Section 3.3.3.

#### **3.4.1.4 Dynamic Speed Feedback Signs**

Research shows mixed outcomes concerning the use of dynamic speed display signs. These signs are electronic and are used to supplement a posted speed limit sign. The electronic face of the sign displays a driver's speed to the driver and may flash to alert drivers that are exceeding the speed limit.

The CMF Clearinghouse provides a modification factor for 'Installing a Changeable Speed Warning Sign'<sup>3</sup> of 0.54, meaning that 46 percent of crashes could be eliminated through the installation of a dynamic speed feedback sign. Beyond this

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<sup>3</sup> "Install changeable Speed Warning Sign" Crash Modification Factor Clearinghouse. US Department of Transportation, Federal Highway Administration. <http://www.cmfclearinghouse.org/detail.cfm?facid=78>. Accessed: August 25, 2016.

data, little information is available on the direct benefits in terms of crash reductions yielded by a dynamic speed feedback sign.

As a surrogate for reduction in crashes, many studies have reviewed the direct benefits to speed reduction that a dynamic speed feedback sign can provide. Reductions in speed should translate into reductions in crash severity and ultimately a reduction in total crashes.

One application for speed feedback signs that has been studied is use in suburban areas with posted speed limits of 25 mph and in the vicinity of a school. This is similar to Cass Avenue, as the posted speed limit is 25 mph and Woonsocket High School is located between Nursery Avenue and Beacon Avenue.

A September 2012 National Transportation Center Research report by Jeihani et. al.<sup>4</sup> summarizes the results of studies from research conducted by Morgan State University in Maryland. The study includes four (4) locations of various roadway classifications and posted speeds to review the impacts the dynamic speed feedback signs have on drivers and the reduction in operating speed. Overall, the study showed a reduction in operating speeds. However, after studies show that drivers would slow down for the feedback sign then increase their speed after passing it.

Key recommendations from this study applicable to Cass Avenue include:

- › Enforcement appears to contribute to speed reductions.
- › Signs should be considered a temporary solution because the effectiveness reduces with time.

Given the inconclusive impacts of permanent dynamic speed feedback sign installation, use of a temporary or portable dynamic speed feedback sign should be considered and paired with an enforcement program before permanent installation is considered near Woonsocket High School on Cass Avenue.

### **3.4.2 Implementation**

The following countermeasures should be considered for implementation through the Systemic Safety Corridor Program:

- › Install rapid rectangular flashing beacons (RRFB) at the crosswalk in front of the Landmark Medical Center;
- › Install guardrail to shield non-recoverable slopes within the clear zone where no run-out area is provided per the *Roadside Design Guide*;
- › Remove existing fencing and install new guardrail to meet current guardrail standards and extend guardrail near Cass Park across from Elm Street;
- › Install dynamic speed feedback signs approaching the high school in both directions;

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<sup>4</sup> Jeihani, et. al. "Evaluating the Effectiveness of Dynamic Speed Display Signs", National Transportation Center Research Report, US Department of Transportation, Washington D.C., September 2012.

- › Restripe Cass Avenue to reduce travel lane width and consider the installation of bicycle lanes in both directions; and
- › Revise regulatory and warning signs to provide consistency along the corridor.

Based on available funding through the RIDOT HSIP, RIDOT will implement the above countermeasures based on need. There is currently funding available to install the RRFB systems at the Landmark Medical Center because of the historic crashes at this crosswalk.

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## Appendix A – Crash Data

**Cass Avenue 1/1/2013 - 12/31/2017**

Case #	Date	Day of the Week	Time	At Street	Town	Direction	Location	Distance from Ref. Intersection (ft)	Lighting	Weather	Crash Type	Collision with	Severity	Emphasis Area
471471	9/22/2017	Friday	2:32 PM	Cumberland St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
470231	9/11/2017	Monday	2:01 PM	Cumberland St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
469101	9/5/2017	Tuesday	9:38 AM	Cumberland St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
298110	2/16/2014	Sunday	12:38 PM	Cumberland St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
427515	10/5/2016	Wednesday	5:40 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
435188	1/4/2017	Wednesday	1:19 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
446458	3/24/2017	Friday	10:10 PM	Cumberland St	Woonsocket	SB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
447913	4/7/2017	Friday	5:10 PM	Cumberland St	Woonsocket	SB	Intersection	50 F/N	Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
460846	4/14/2017	Friday	2:25 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
389578	2/2/2016	Tuesday	4:32 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
310908	6/16/2014	Monday	6:13 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
302545	4/3/2014	Thursday	5:01 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
402609	5/11/2016	Wednesday	6:51 PM	Cumberland St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
278188	9/26/2013	Thursday	5:47 PM	Cumberland St	Woonsocket	SB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	C	Intersection
371385	9/3/2015	Thursday	7:49 PM	287 Cumberland St	Woonsocket	SB	Intersection	50 F/N	Dark - Lighted	Clear	Sideswipe - Opposite Direction	Vehicle-Fixed Object	B	Roadway Departure
383910	1/12/2015	Monday	1:02 PM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Rain	Rear end	Vehicle-Vehicle	O	Intersection
342748	2/20/2015	Friday	1:10 PM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
271791	8/2/2013	Friday	6:01 PM	Cumberland St	Woonsocket	NB	Intersection	5 F/S	Daylight	Clear	Rear end	Vehicle-Vehicle	B	Intersection
271000	7/27/2013	Saturday	3:53 PM	Cumberland St	Woonsocket	WB	Intersection	100 F/E	Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
314928	6/16/2014	Monday	12:28 PM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
333530	12/16/2014	Tuesday	5:42 PM	Cumberland St	Woonsocket	SB	Intersection		Dark - Lighted	Clear	Angle	Vehicle-Vehicle	C	Intersection
442076	2/17/2017	Friday	7:44 AM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
411393	7/19/2016	Tuesday	2:27 PM	Cumberland St	Woonsocket	NB	Intersection	100 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	C	Intersection
263494	5/28/2013	Tuesday	3:41 PM	Cumberland St	Woonsocket	NB	Intersection	20 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
444962	3/16/2017	Thursday	5:31 PM	Cumberland St	Woonsocket	NB	Intersection	20 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
441156	1/23/2017	Monday	7:36 AM	Cumberland St	Woonsocket	SB	Intersection	100 F/S	Daylight	Snow	Angle	Vehicle-Vehicle	O	Intersection
289892	12/25/2013	Wednesday	9:55 AM	Cumberland St	Woonsocket	NB	Intersection	50 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
385225	9/15/2954	Sunday	8:54 AM	Cumberland St	Woonsocket	SB	Intersection	50 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	O	Older Drivers
328059	8/29/2014	Friday	7:09 AM	Cumberland St	Woonsocket	WB	Intersection	100 F/E	Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
270162	7/20/2013	Saturday	1:29 AM	Cumberland St	Woonsocket	NB	Intersection	20 F/S	Dark - Lighted	Clear	Collision with Roadside Object	Motorcycle-Fixed Object	C	Roadway Departure
455150	5/17/2017	Wednesday	3:28 PM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Older Drivers
320147	9/3/2014	Wednesday	1:53 PM	Cumberland St	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	C	Intersection
432945	12/16/2016	Friday	6:27 PM	Cumberland St	Woonsocket	WB	Intersection		Dark - Lighted	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
383642	12/23/2015	Wednesday	4:50 PM	Cumberland St	Woonsocket	EB	Intersection		Dark - Lighted	Rain	Angle	Vehicle-Vehicle	O	Intersection
334662	12/25/2014	Thursday	12:23 PM	Cumberland St	Woonsocket	WB	Intersection	100 F/E	Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
356206	5/29/2015	Friday	7:20 PM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
445381	1/30/2017	Monday	6:47 AM	Cumberland St	Woonsocket	SB	Intersection		Dawn	Clear	Angle	Vehicle-Vehicle	O	Intersection
472955	10/1/2017	Sunday	6:28 PM	Cumberland St	Woonsocket	NB	Intersection	100 F/S	Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	C	Intersection
310660	5/15/2014	Thursday	12:36 PM	Cumberland St	Woonsocket	SB	Intersection	100 F/S	Daylight	Cloudy	Collision with Vulnerable User	Vehicle-Bicycle	O	Vulnerable Road Users
302960	4/7/2014	Monday	10:39 PM	Cumberland St	Woonsocket	EB	Intersection		Dark - Unknown Lighting	Rain	Angle	Vehicle-Vehicle	O	Intersection
434840	1/2/2017	Monday	6:06 PM	Cumberland St	Woonsocket	EB	Intersection	250 F/E	Dark - Lighted	Clear	Angle	Vehicle-Vehicle	C	Intersection
353587	5/9/2015	Saturday	11:53 AM	Wood Ave	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Older Drivers
304896	4/26/2014	Saturday	3:37 PM	Wood Ave	Woonsocket	SB	Intersection		Daylight	Cloudy	Rear end	Vehicle-Vehicle	O	Intersection
254123	3/8/2013	Friday	6:50 AM	Wood Ave	Woonsocket	SB	Intersection		Daylight	Snow	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
467507	4/4/2017	Tuesday	5:25 PM	Wood Ave	Woonsocket	SB	Intersection		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
366520	8/14/2015	Friday	4:48 PM	Wood Ave	Woonsocket	WB	Intersection		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
327441	10/31/2014	Friday	10:28 PM	Wood Ave	Woonsocket	SB	Intersection	100 F/E	Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
435819	1/7/2017	Saturday	7:23 PM	Wood Ave	Woonsocket	WB	Intersection		Dark - Lighted	Snow	Angle	Vehicle-Vehicle	O	Intersection
283973	11/11/2013	Monday	2:26 PM	Wood Ave	Woonsocket	WB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
285861	11/5/2013	Tuesday	2:56 PM	Wood Ave	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	None
425939	10/6/2016	Thursday	12:49 PM	Wood Ave	Woonsocket	WB	Intersection		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
446659	3/28/2017	Tuesday	2:30 PM	Mailloux St	Woonsocket	WB	Intersection		Daylight	Rain	Rear end	Vehicle-Vehicle	O	Intersection
292263	1/14/2014	Tuesday	11:56 AM	Dulude Ave	Woonsocket	SB	Intersection	2 F/N	Daylight	Rain	Angle	Vehicle-Vehicle	O	Intersection
329199	11/14/2014	Friday	8:03 AM	Wood Ave	Woonsocket	EB	Intersection	50 F/E	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
332122	12/8/2014	Monday	5:40 PM	Wood Ave	Woonsocket	EB	Intersection		Dark - Lighted	Clear	Head on	Vehicle-Vehicle	O	Intersection
463740	7/17/2017	Monday	8:04 AM	Cumberland St	Woonsocket	NB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
398048	11/18/2014	Tuesday	6:41 PM	Dulude Ave	Woonsocket	WB	Intersection	156 F/E	Dark - Lighted	Clear	Collision with Vulnerable User	Vehicle-Pedestrian	K	Vulnerable Road Users
441093	1/31/2017	Tuesday	4:18 PM	Cumberland St	Woonsocket	WB	Intersection		Dusk	Snow	Rear end	Vehicle-Vehicle	O	Intersection
441048	2/7/2017	Tuesday	4:01 PM	Sweet Ave	Woonsocket	WB	Intersection	200 F/W	Dusk	Rain	Angle	Vehicle-Vehicle	O	Intersection
266255	6/18/2013	Tuesday	3:06 PM	Sweet Ave	Woonsocket	EB	Intersection	50 F/W	Daylight	Clear	Collision with Vulnerable User	Vehicle-Pedestrian	O	Vulnerable Road Users
444744	3/10/2017	Friday	3:59 PM	Sweet Ave	Woonsocket	EB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
448458	3/30/2017	Thursday	12:30 PM	160 Cass Ave	Woonsocket	EB	Segment		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Roadway Departure
394371	3/16/2016	Wednesday	11:57 AM	Hebert Ave	Woonsocket	WB	Intersection	50 F/W	Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
273570	8/19/2016	Friday	2:50 AM	Sweet Ave	Woonsocket	EB	Segment	300 F/E	Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure

Case #	Date	Day of the Week	Time	At Street	Town	Direction	Location	Distance from Ref. Intersection (ft)	Lighting	Weather	Crash Type	Collision with	Severity	Emphasis Area
469097	8/30/2017	Wednesday	2:41 PM	Sweet Ave	Woonsocket	SB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
312791	7/1/2014	Tuesday	8:54 PM	Sweet Ave	Woonsocket	WB	Intersection		Dark - Lighted	Clear	Angle	Vehicle-Vehicle	O	Intersection
289516	12/23/2013	Monday	10:32 AM	Sweet Ave	Woonsocket	WB	Intersection	2 F/N	Daylight	Rain	Angle	Vehicle-Vehicle	C	Intersection
483824	12/17/2017	Sunday	5:50 PM	Hebert Ave	Woonsocket	WB	Intersection		Dark - Lighted	Clear	Angle	Vehicle-Vehicle	O	Intersection
271978	8/4/2013	Sunday	9:50 AM	Hebert Ave	Woonsocket	WB	Segment		Daylight	Clear	Other (animal, etc.)	Vehicle-Fixed Object	O	None
272067	8/6/2013	Tuesday	1:47 AM	Hebert Ave	Woonsocket	EB	Intersection	100 F/S	Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	B	Intersection
374212	10/9/2015	Friday	5:24 PM	Cote Ave	Woonsocket	WB	Intersection		Daylight	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
445413	3/7/2017	Tuesday	2:27 PM	Cote Ave	Woonsocket	EB	Intersection	40 F/E	Daylight	Rain	Collision with Vulnerable User	Vehicle-Bicycle	C	Vulnerable Road Users
296630	2/14/2017	Tuesday	6:22 PM	Hebert Ave	Woonsocket	EB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
477312	10/20/2017	Friday	1:14 AM	Lebrun Ave	Woonsocket	WB	Segment		Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
365631	8/7/2015	Friday	5:22 PM	Jervis St	Woonsocket	WB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Roadway Departure
421150	9/29/2016	Thursday	9:07 AM	Elm St	Woonsocket	EB	Intersection		Daylight	Clear	Collision with Vulnerable User	Vehicle-Pedestrian	A	Vulnerable Road Users
472070	9/27/2017	Wednesday	7:44 AM	Elm St	Woonsocket	SB	Intersection	100 F/W	Dawn	Clear	Collision with Vulnerable User	Vehicle-Pedestrian	C	Vulnerable Road Users
294116	1/27/2014	Monday	2:08 PM	Elm St	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Older Drivers
277178	9/18/2013	Wednesday	8:12 AM	Elm St	Woonsocket	SB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Older Drivers
379496	11/23/2015	Monday	8:03 AM	Elm St	Woonsocket	WB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
429731	11/15/2016	Tuesday	11:04 PM	627 Cass Ave	Woonsocket	WB	Intersection		Dark - Lighted	Rain	Angle	Vehicle-Vehicle	O	Distracted Driving
426435	10/28/2016	Friday	11:17 AM	Elm St	Woonsocket	EB	Intersection		Daylight	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
256355	3/25/2013	Monday	4:25 PM	Elm St	Woonsocket	EB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Older Drivers
348722	3/27/2015	Friday	10:49 PM	Elm St	Woonsocket	EB	Intersection	50 F/E	Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	B	Roadway Departure
293152	1/21/2014	Tuesday	6:15 PM	Beacon Ave	Woonsocket	WB	Intersection		Dark - Lighted	Snow	Collision with Roadside Object	Vehicle-Motorcycle	O	Roadway Departure
257593	4/6/2013	Saturday	10:44 AM	Grace Ave	Woonsocket	WB	Intersection	5 F/E	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
354432	5/16/2015	Saturday	4:03 PM	Grace Ave	Woonsocket	WB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
352288	7/11/2864	Friday	10:34 AM	Ricard St	Woonsocket	EB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Older Drivers
426601	11/4/2016	Friday	5:48 PM	Nursery Ave	Woonsocket	EB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
265033	6/10/2013	Monday	1:30 AM	Beacon Ave	Woonsocket	EB	Intersection		Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
362691	7/20/2015	Monday	6:00 PM	Nursery Ave	Woonsocket	WB	Intersection		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Roadway Departure
343873	2/17/2015	Tuesday	5:46 PM	Nursery Ave	Woonsocket	EB	Segment	200 F/W	Dark - Lighted	Snow	Rear end	Vehicle-Vehicle	O	None
384181	1/16/2015	Friday	2:43 PM	Ricard St	Woonsocket	EB	Segment		Daylight	Clear	Rear end	Vehicle-Vehicle	O	None
446212	3/25/2017	Saturday	10:49 AM	Lexington St	Woonsocket	WB	Intersection		Daylight	Cloudy	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
405233	6/6/2016	Monday	7:49 AM	Ricard St	Woonsocket	EB	Intersection		Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
460902	6/27/2017	Tuesday	11:32 AM	Mendon Rd	Woonsocket	EB	Intersection	100 F/W	Daylight	Clear	Angle	Vehicle-Vehicle	O	Older Drivers
290006	12/20/2013	Friday	6:00 PM	Mendon Rd	Woonsocket	EB	Intersection		Dark - Lighted	Clear	Collision with Vulnerable User	Vehicle-Pedestrian	C	Vulnerable Road Users
381307	3/6/2015	Friday	5:50 PM	Loring St	Woonsocket	EB	Intersection		Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
311229	6/18/2014	Wednesday	4:43 PM	Mendon Rd	Woonsocket	WB	Intersection	50 F/W	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
248387	1/19/2013	Saturday	3:51 PM	Mendon Rd	Woonsocket	WB	Intersection	50 F/W	Dusk	Clear	Angle	Vehicle-Vehicle	O	Intersection
299434	3/5/2014	Wednesday	4:40 PM	Loring St	Woonsocket	EB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
393413	3/7/2016	Monday	3:07 PM	Loring St	Woonsocket	EB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
260282	5/2/2013	Thursday	7:58 AM	Mendon Rd	Woonsocket	EB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
336588	1/6/2015	Tuesday	8:32 PM	Mendon Rd	Woonsocket	EB	Intersection		Dark - Lighted	Snow	Rear end	Vehicle-Vehicle	O	Older Drivers
431120	11/8/2016	Tuesday	2:04 PM	Mendon Rd	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	C	Intersection
428980	11/15/2016	Tuesday	3:05 PM	1054 Cass Ave	Woonsocket	EB	Intersection		Dusk	Rain	Rear end	Vehicle-Vehicle	C	Intersection
429725	11/11/2016	Friday	5:21 PM	Mendon Rd	Woonsocket	SB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
431120	11/8/2016	Tuesday	2:04 PM	Mendon Rd	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
467471	8/23/2017	Wednesday	6:13 PM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
396018	3/30/2016	Wednesday	7:58 AM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
388139	1/26/2016	Tuesday	8:26 AM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
260168	1/23/2013	Wednesday	3:37 PM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Angle	Vehicle-Vehicle	O	Intersection
286688	12/2/2013	Monday	4:26 PM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Dark - Lighted	Cloudy	Angle	Vehicle-Vehicle	O	Intersection
425808	10/30/2016	Sunday	10:16 AM	Mendon Rd	Woonsocket	NB	Intersection	100 F/N	Daylight	Clear	Sideswipe - Same Direction	Vehicle-Vehicle	O	Intersection
301701	3/26/2014	Wednesday	3:37 PM	Mendon Rd	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
285262	11/21/2013	Thursday	7:51 AM	Mendon Rd	Woonsocket	SB	Intersection	300 F/N	Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
290003	12/13/2013	Friday	4:49 PM	Mendon Rd	Woonsocket	SB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
337153	1/16/2015	Friday	1:05 AM	Mendon Rd	Woonsocket	SB	Intersection		Dark - Lighted	Clear	Rear end	Vehicle-Vehicle	O	Intersection
384411	1/29/2015	Thursday	8:56 AM	Mendon Rd	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
441075	1/26/2017	Thursday	9:22 AM	Mendon Rd	Woonsocket	SB	Intersection	200 F/N	Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
455131	5/8/2017	Monday	2:10 PM	Mendon Rd	Woonsocket	SB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
294613	2/1/2014	Saturday	1:18 AM	Mendon Rd	Woonsocket	NB	Intersection		Dark - Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
308329	5/25/2014	Sunday	10:34 PM	Mendon Rd	Woonsocket	SB	Intersection		Dark - Not Lighted	Clear	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
429694	10/17/2016	Monday	4:28 PM	Mendon Rd	Woonsocket	NB	Intersection	100 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
460912	7/1/2017	Saturday	3:30 PM	Mendon Rd	Woonsocket	NB	Intersection	50 F/S	Daylight	Clear	Angle	Vehicle-Vehicle	C	Older Drivers
475376	10/3/2017	Tuesday	3:59 PM	Mendon Rd	Woonsocket	NB	Intersection		Daylight	Clear	Angle	Vehicle-Motorcycle	B	Vulnerable Road Users
445419	3/14/2017	Tuesday	11:58 AM	Mendon Rd	Woonsocket	EB	Intersection		Daylight	Snow	Collision with Roadside Object	Vehicle-Fixed Object	O	Roadway Departure
455077	4/15/2017	Saturday	9:46 AM	Mendon Rd	Woonsocket	NB	Intersection	50 F/S	Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
474973	10/17/2017	Tuesday	3:00 PM	Mendon Rd	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Older Drivers
479341	11/13/2017	Monday	7:07 AM	Mendon Rd	Woonsocket	NB	Intersection		Daylight	Clear	Rear end	Vehicle-Vehicle	O	Intersection
430816	11/28/2016	Monday	4:17 PM	1054 Cass Ave	Woonsocket	SB	Intersection		Dusk	Clear	Angle	Vehicle-Vehicle	O	Intersection

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## Appendix B – Speed Study



# Computations

Project: HSIP On-Call  
 Location: Cass Avenue at Ricard Street  
 Calculated by: RB  
 Checked by: KJC  
 Title: Speed Study

Project # 72700.03  
 Sheet 1 of 1  
 Date: 8/24/2018  
 Date: 9/14/2018

Posted Speed:

Direction	WB	EB
1	26	42
2	22	30
3	25	31
4	36	29
5	39	33
6	38	31
7	38	40
8	30	28
9	33	32
10	35	33
11	32	34
12	30	32
13	35	30
14	27	36
15	34	32
16	32	38
17	31	35
18	40	34
19	36	31
20	32	32
21	32	37
22	35	34
23	37	30
24	40	36
25	38	33
26	30	31
27	37	30
28	28	39
29	30	37
30	33	33
31	34	36
32	36	31
33	30	37
34	32	30
35	35	35
36	27	34
37	36	37
38	35	29
39	35	34
40	31	33
41	39	32
42	38	30
43	35	35
44	29	36
45	29	35
46	27	38
47	33	30
48	31	41
49	30	36
50	32	33
50th Percentile	33	34
85th Percentile	38	37

**Notes:**

Weather:

Unusual Behavior

Parking, etc:





# Computations

Project: HSIP On-Call  
 Location: Cass Avenue at East Side Produce  
 Calculated by: RB  
 Checked by: KJC  
 Title: Speed Study

Project # 72700.03  
 Sheet 1 of 1  
 Date: 8/24/2018  
 Date: 9/14/2018

Posted Speed:

Direction	WB	EB
1	23	28
2	19	27
3	28	20
4	21	30
5	22	28
6	26	31
7	25	29
8	27	34
9	25	29
10	24	31
11	35	26
12	23	25
13	25	28
14	33	24
15	31	35
16	25	28
17	30	36
18	28	30
19	31	25
20	21	28
21	26	26
22	37	22
23	29	26
24	24	18
25	26	21
26	19	25
27	24	26
28	26	31
29	31	31
30	28	28
31	25	24
32	27	31
33	37	29
34	21	25
35	27	27
36	27	28
37	23	26
38	21	20
39	36	27
40	41	28
41	21	24
42	20	26
43	28	23
44	27	29
45	28	21
46	24	21
47	22	28
48	25	31
49	29	24
50	21	29
50th Percentile	27	27
85th Percentile	31	31

**Notes:**

Weather:

Unusual Behavior

Parking, etc:



# Computations

Project: HSIP On-Call  
 Location: Cass Avenue at Landmark Medical Center  
 Calculated by: RB  
 Checked by: KJC  
 Title: Speed Study

Project # 72700.03  
 Sheet 1 of 1  
 Date: 8/24/2018  
 Date: 9/14/2018

Posted Speed:

Direction	WB	EB
1	30	27
2	24	26
3	27	25
4	26	28
5	21	33
6	22	25
7	21	20
8	25	26
9	27	26
10	28	33
11	26	27
12	27	25
13	32	21
14	29	27
15	28	28
16	25	24
17	33	28
18	26	27
19	24	25
20	21	22
21	22	29
22	32	20
23	29	21
24	23	25
25	24	20
26	22	16
27	24	25
28	22	29
29	21	24
30	24	26
31	25	27
32	27	26
33	24	30
34	27	28
35	29	24
36	26	28
37	36	16
38	26	31
39	29	26
40	22	20
41	33	28
42	26	26
43	29	28
44	27	23
45	24	22
46	35	27
47	32	26
48	22	29
49	26	26
50	24	33
50th Percentile	27	26
85th Percentile	30	29

**Notes:**

Weather:

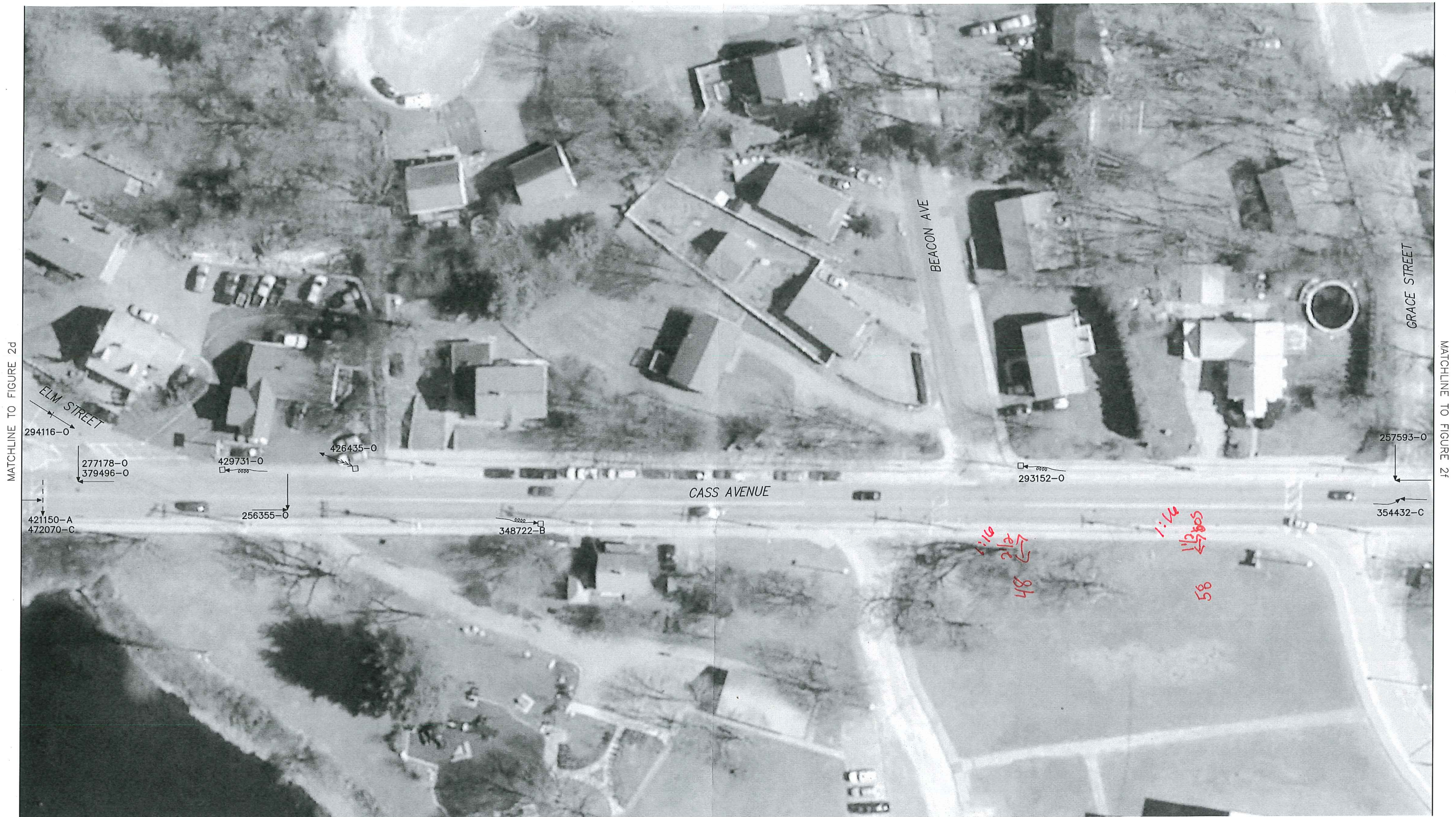
Unusual Behavior

Parking, etc:

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## Appendix C – Guardrail Evaluation





MATCHLINE TO FIGURE 2d

MATCHLINE TO FIGURE 2f

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1e



MATCHLINE TO FIGURE 2e



MATCHLINE TO FIGURE 2g

SOURCE:  
CRASH DATA PROVIDED BY RIDOT TRAFFIC  
RESEARCH UNIT. CRASH DATA PROVIDED DATES  
FROM 2013 THROUGH 2017.



0 25 50 Feet

SYMBOLS	
	MOVING VEHICLE
	BACKING VEHICLE
	PEDESTRIAN
	BICYCLE
	PARKED VEHICLE
	FIXED OBJECT

TYPES OF COLLISION	
	REAR END
	HEAD ON
	SIDE SWIPE
	OUT OF CONTROL
	LEFT TURN
	ANGLE

SEVERITY	
K	FATAL INJURY CRASH
A	INCAPACITATING INJURY CRASH
B	NON-INCAPACITATING INJURY CRASH
C	COMPLAINT INJURY CRASH
O	NO INJURY/PROPERTY DAMAGE ONLY CRASH



Collision Diagram  
Cass Avenue  
Woonsocket, RI

Figure 2-1f