Framingham, MA

Grant Street
Safety Evaluation

December 2021

CRASH ANALYSIS

315 Norwood Park South
2nd Floor
Norwood, Massachusetts 02062
781.255.1982
www.BETA-Inc.com

Grant Street
Safety Evaluation
Framingham, MA

CRASH ANALYSIS

Prepared by: BETA GROUP, INC.
Prepared for: City of Framingham, Massachusetts

December 2021

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

At the request of the City of Framingham, BETA Group, Inc. (BETA) has been retained to perform a safety evaluation and crash analysis along the Grant Street corridor. The primary purpose of the evaluation was to assess recent crash history and review potential safety improvements, with a focus on the following:

- Review existing conditions along the corridor, including but not limited to travel speeds, traffic volumes, and crash records.
- Observe and monitor actual field conditions with representatives from the City to review current operations.
- Identify potential improvements and countermeasures to mitigate crashes.

The project study area, shown in **Figure 1**, is the entire length of Grant Street, which generally runs in a north-south direction between Howard Street to the south and Hartford Street to the north.

2.0 EXISTING CONDITIONS

Grant Street is an approximate 0.94-mile-long City owned collector roadway that provides one travel lane in each direction, separated by a double yellow centerline. Between Howard Street and Clinton Street there are varying width 2-foot to 5-foot shoulders on both sides and no parking is allowed on either side. Between Clinton Street and Clark Street parking is allowed on the west side of the roadway, but not on the east side. North of Clark Street, parking is allowed on both sides of Grant Street to the end of the corridor.

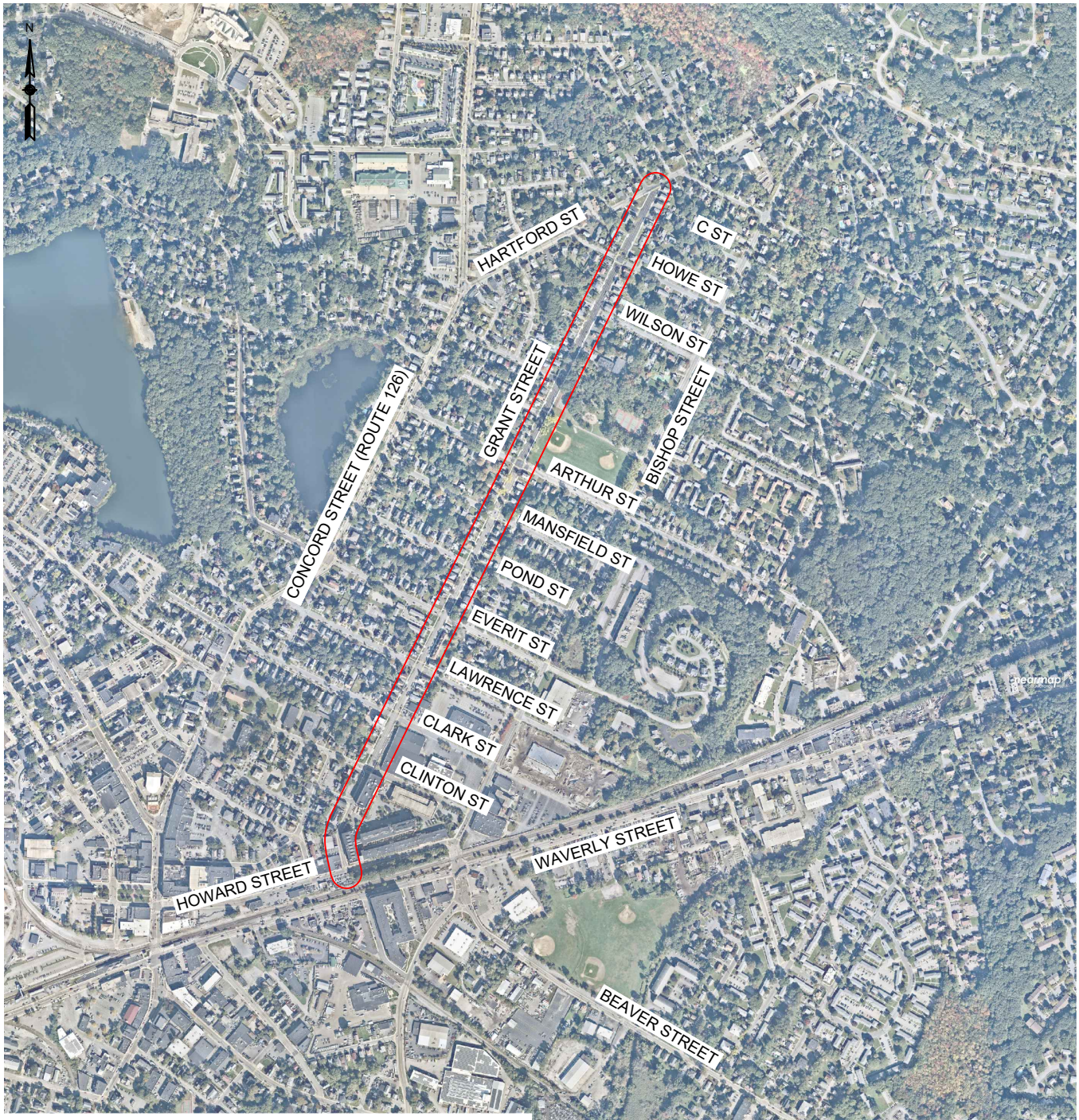
There are fifteen (15) intersections along the corridor, and the following is a breakdown of the traffic control at each:

- 1 location under Traffic Signal Control – Arthur Street,
- 2 locations under All-Way Stop Control – Clark Street and Everit Avenue (Overhead Flashing Beacon), and
- 12 locations under Two-Way Stop Control

Each intersecting roadway is two lanes with one lane in each direction, with the exception of the west leg of Clinton Street, which is a single lane, one-way street, eastbound towards Grant Street.

Land use surrounding the roadway is a mix of commercial and residential on the southern end between Howard Street and Clark Street and transitions to all residential through the rest of the corridor. The only exception to this is Butterworth Park, which is on the northeast corner of the Arthur Street intersection.

The posted speed limit on Grant Street is 25 MPH both northbound and southbound between Howard Street and Clinton Street, and 35 MPH both northbound and southbound from Clinton Street to Hartford Street.



LEGEND

STUDY AREA

1000 0 1000 2000

SCALE IN FEET: 1"=1000'

BETA

www.BETA-Inc.com

Grant Street
Accident Evaluation

Framingham, Massachusetts

Figure 1

Location Map

2.1 Recent Construction

In 2020, modifications were implemented throughout the Grant Street corridor that consisted primarily of traffic calming and enhanced pedestrian/complete streets facilities. Specific improvements include the following:

- Curb extensions at intersections
- New sidewalks and wheelchair ramps
- Additional crosswalks, across both intersecting streets as well as Grant Street
- New paving, signage, and pavement markings

An example of these proposed improvements is shown in **Figure 2**, and the complete Existing Conditions layout of the entire corridor is included in the Appendix.

Figure 2 – Proposed Improvements

2.2 TRAVEL SPEEDS

As part of the evaluation, speed data provided by the City was reviewed and analyzed. The data was collected at various locations along the corridor between 2019 and 2020. The summarized data is presented in **Table 1**.

Table 1 – Travel Speeds

Location	Year	Direction	Posted Speed	Average Speed	85% Speed	Direction	Posted Speed	Average Speed	85% Speed
Across from #62	2021	SB	25	25	30	NB	25	20	29
Everit Avenue	2019	SB	35	18	29	NB	35	18	29
#161	2020	SB	35	29	33	NB	35	29	33
#161	2020	SB	35	25	30	NB	35	26	30
Across from #260	2021	SB	35	28	34	NB	35	26	33

Note: All speeds in miles per hour (mph)

The locations shown in the table, with the exception of Everit Avenue, represent addresses on Grant Street, with 62 Grant just north of Clinton Street, 161 Grant just south of Pond Street, and 260 Grant near Burdette Avenue. As shown, the average speeds collected are at or below the posted speed limit at all locations for both directions of travel. For the 85th percentile speed, which is defined as the speed at or below which 85 percent of all vehicles are observed to travel, only the number 62 Grant location revealed rates above the posted speed limit of 25 mph. The 85th percentile speed is often used as a guide to establish the signed or regulatory speed limit, but the average speed can also be utilized depending on the characteristics of the roadway. For both directions at number 62 Grant, the 85th percentile speeds are within 5 mph of the posted speed limit, and the rates are considered appropriate and safe for this section of Grant Street.

2.3 TRAFFIC VOLUMES

To assess and understand traffic conditions within the study area, traffic volume data was collected on October 20, 2021, and October 21, 2021. The data collected consisted of Automatic Traffic Recorders (ATRs) to evaluate daily volumes, as well as Turning Movement Counts (TMCs) to determine peak hourly demand at the following locations:

1. Clinton Street
2. Everit Avenue
3. Mansfield Street

One ATR was placed between Pond Street and Mansfield Street and the other just north of Essex Street. The locations for the TMCs were selected based on preliminary crash data provided by the City, which identified these locations as the ones with the highest crash history along the entire corridor. The TMCs were conducted from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM. Passenger cars, heavy vehicles, pedestrians, and bicycles were all counted. A summary of the daily traffic volumes is shown in **Table 2**, and the peak hour vehicle turning movements for the selected intersections are shown in **Figures 3, 4, and 5**. Full traffic volume summaries are included in the Appendix.

Table 2 – Daily Traffic Volumes

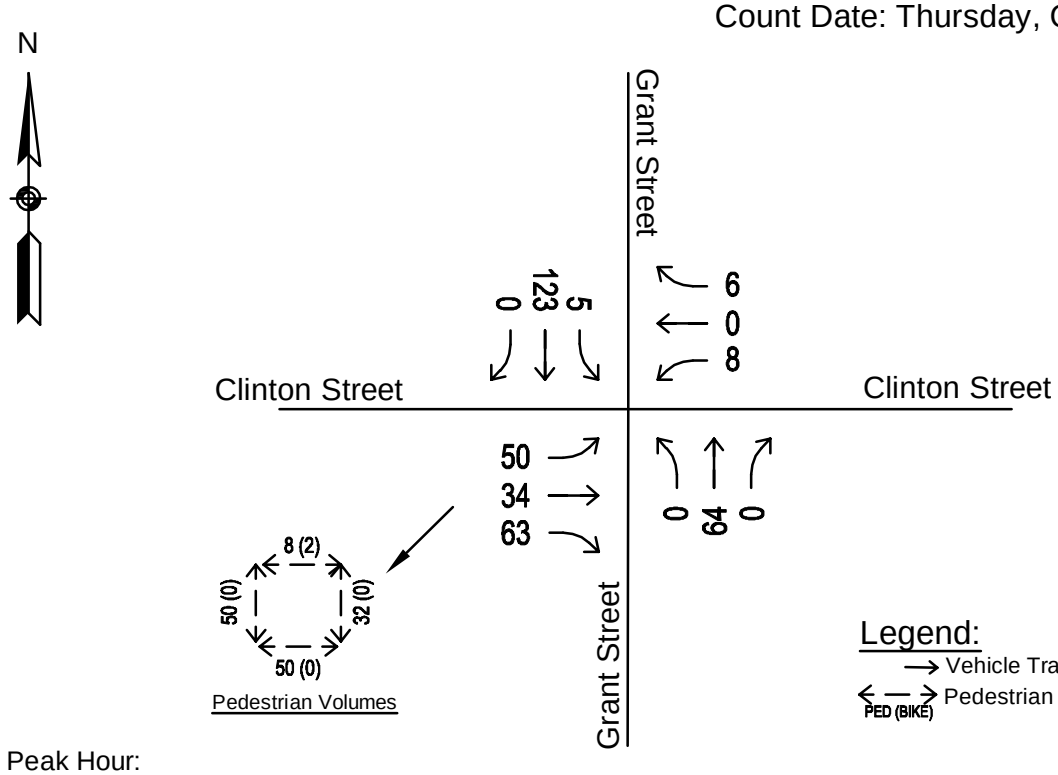
Location	Weekday	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
	ADT*	Volume	K Factor**	Dir. Dist.	Volume	K Factor**	Dir. Dist.
Grant Street between Pond Street and Mansfield Street	3,810	266	7.0%	NB 62%	431	11.3%	SB 60%
Grant Street north of Essex Street	3,160	238	7.5%	NB 68%	372	11.8%	SB 60%

* Average Daily Traffic, vehicles per day

** Percentage of the ADT that occurs during the peak hour

A review of the data shown in **Table 2** reveals Average Daily Traffic (ADT) volumes of 3,810 vehicles per day (vpd) just south of Mansfield Street and 3,160 vpd north of Essex Street. At both locations, a higher percentage of traffic is traveling northbound during the morning peak hour, and southbound during the evening peak hour. The K factor, which is the percentage of the ADT that occurs during the peak hour, was found to be higher at both locations during the evening peak hour. This illustrates that the evening peak hour volume is greater than that of the morning peak hour. Additionally, the higher ADT at the location between Pond Street and Mansfield Street, reveals that there is more traffic entering and exiting the corridor from the interesting roadways, south of Butterworth Park.

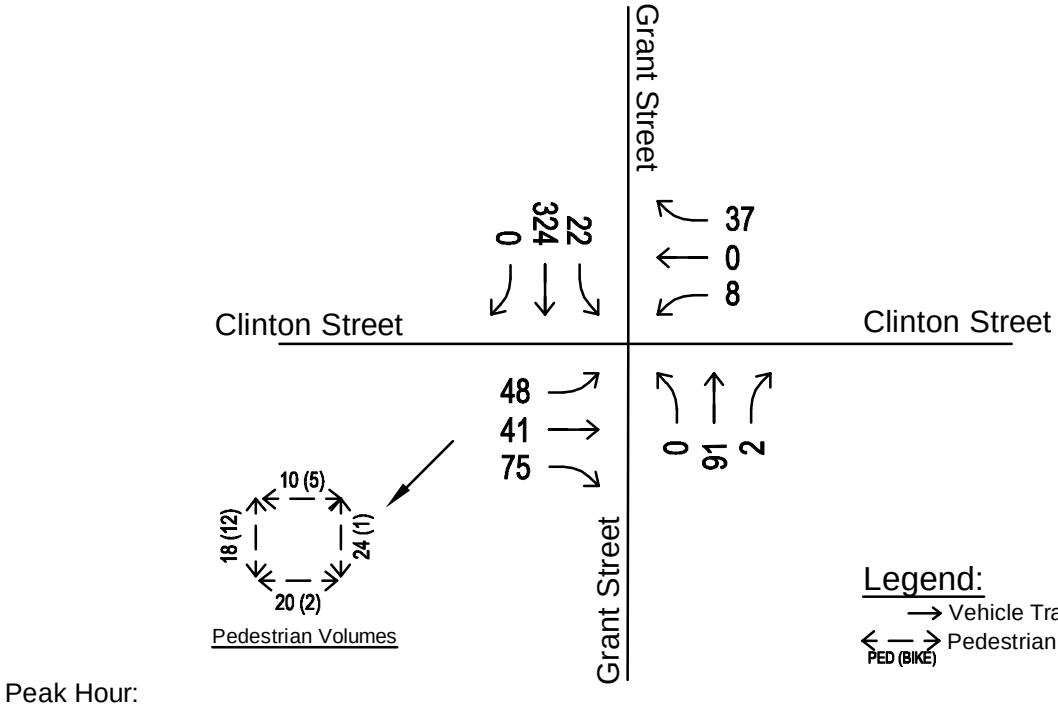
Count Date: Thursday, October 21, 2021



AM Peak Hour:
7:45-8:45 AM

Not To Scale

Count Date: Thursday, October 21, 2021



PM Peak Hour:
5:00-6:00 PM

Not To Scale

BETA
www.BETA-Inc.com

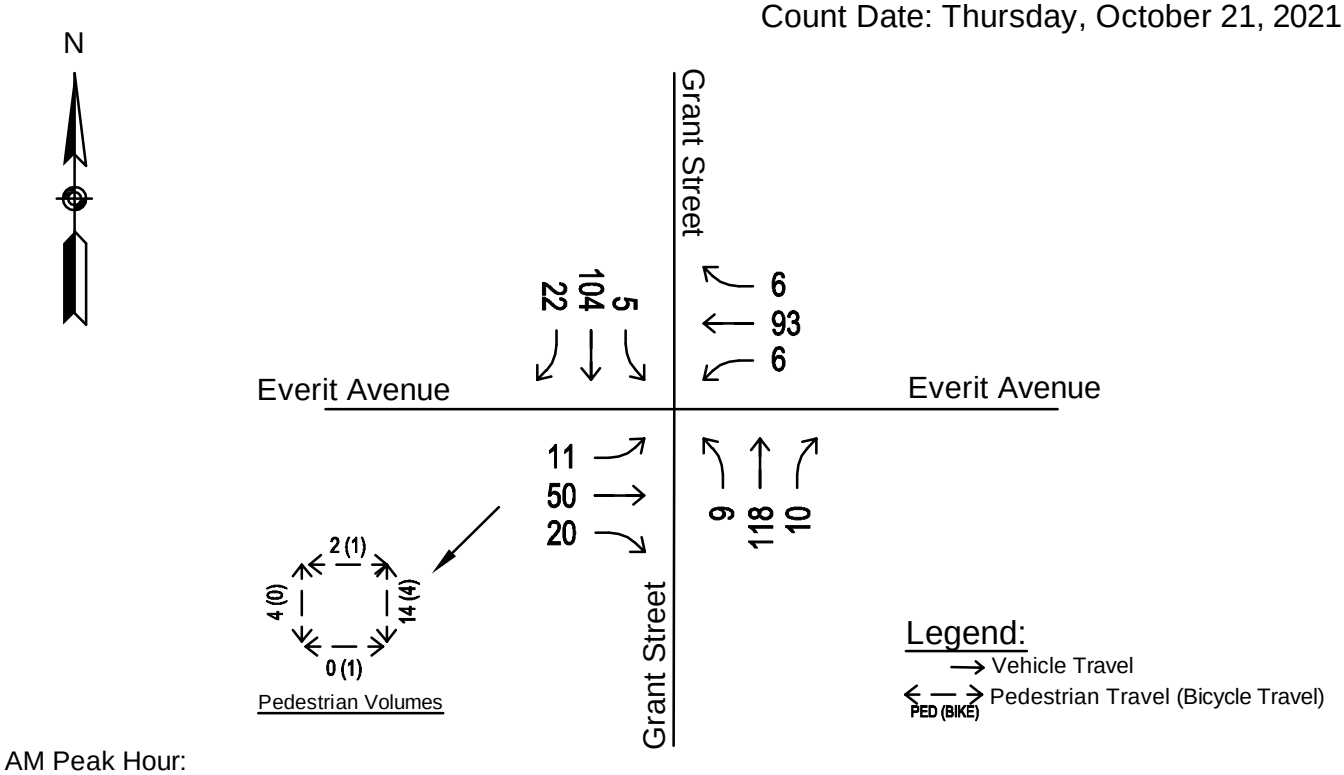
Grant Street Accident Evaluation

Framingham, MA

Figure 3

2021 Peak Hour
Turning Movement Volumes

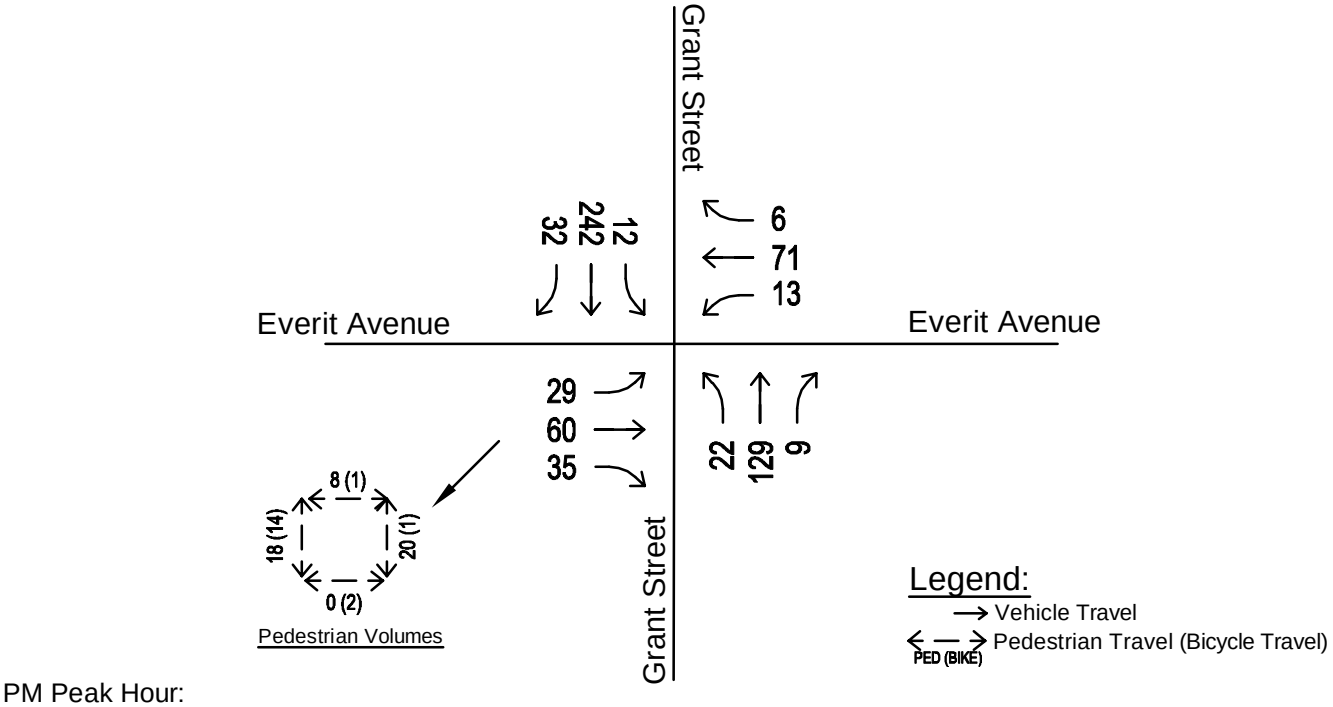
Count Date: Thursday, October 21, 2021



AM Peak Hour:
7:30-8:30 AM

Not To Scale

Count Date: Thursday, October 21, 2021



PM Peak Hour:
5:00-6:00 PM

Not To Scale

BETA
www.BETA-Inc.com

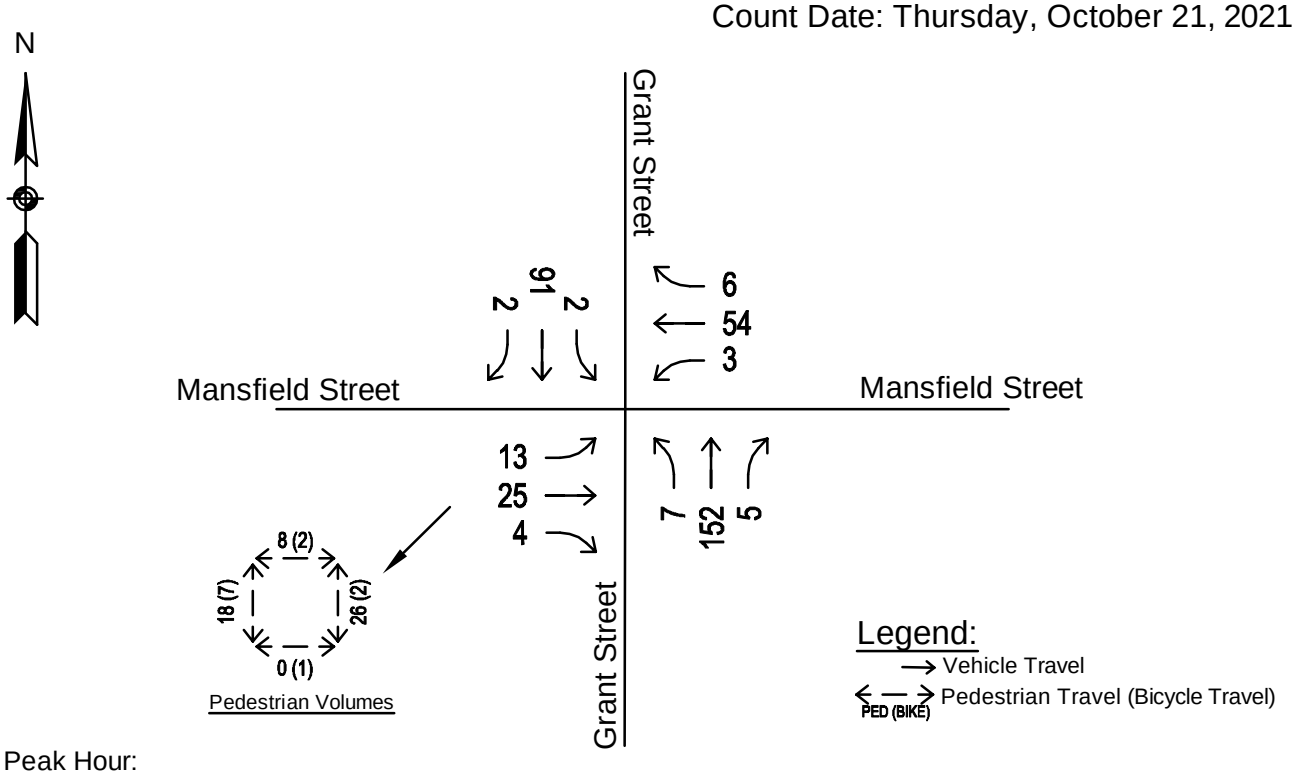
Grant Street Accident Evaluation

Framingham, MA

Figure 4

2021 Peak Hour
Turning Movement Volumes

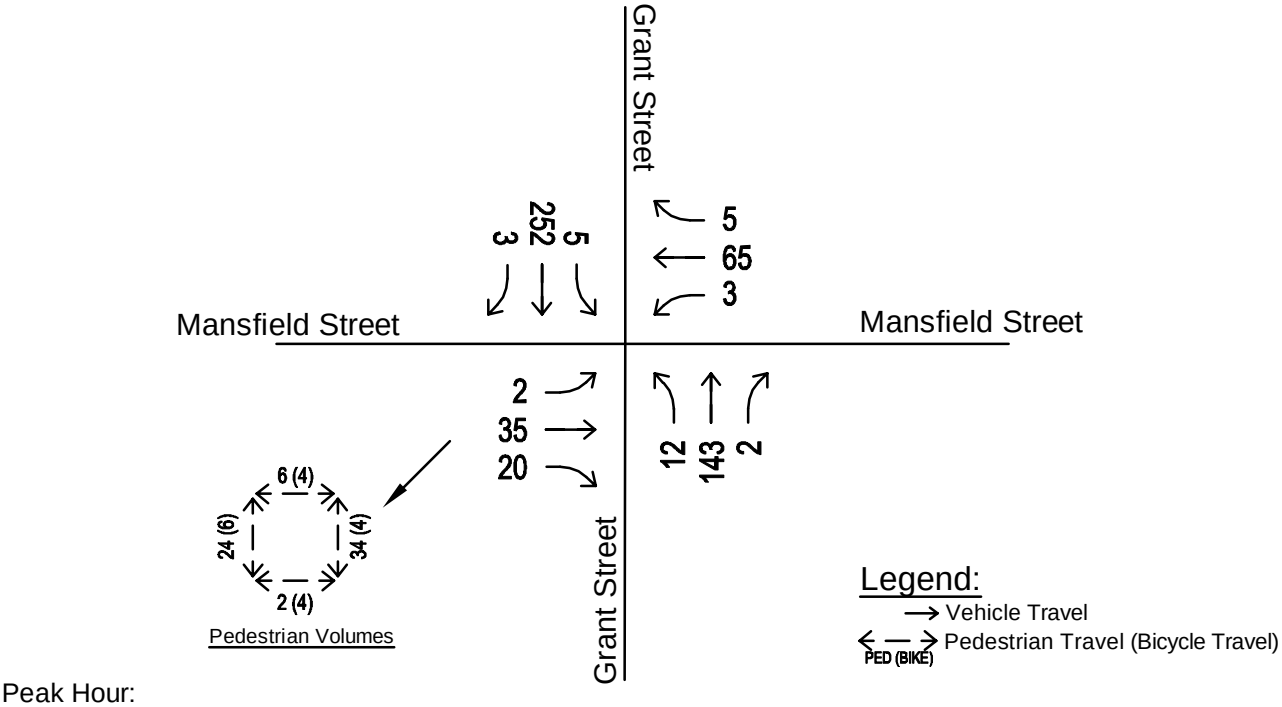
Count Date: Thursday, October 21, 2021



AM Peak Hour:
7:00-8:00 AM

Not To Scale

Count Date: Thursday, October 21, 2021



PM Peak Hour:
5:00-6:00 PM

Not To Scale

BETA
www.BETA-Inc.com

Grant Street Accident Evaluation

Framingham, MA

Figure 5

2021 Peak Hour
Turning Movement Volumes

2.4 CRASH HISTORY

Crash reports for the entire corridor were obtained from the Framingham Police Department for the period of January 2018 through August 2021. The complete crash data, as well as collisions diagrams, and crash rate worksheets at the critical locations of Clinton Street, Everit Avenue, and Mansfield Street are included in the Appendix. A review of the data revealed the following summary information:

- 78 reported crashes occurred along the entire corridor
- All but 4 crashes took place at an intersection
- The three critical intersections experienced the highest number with 49% of all crashes occurring at these locations;
    - Mansfield Street – 18 crashes
    - Everit Avenue – 10 crashes
    - Clinton Street – 10 crashes
- 67% were angle type collisions
- 40% resulted in an injury

Crash rates were also calculated for each of the critical intersections, and are as follows:

Intersection	Crash Rate*
Mansfield Street	2.80
Everit Avenue	1.31
Clinton Street	1.29

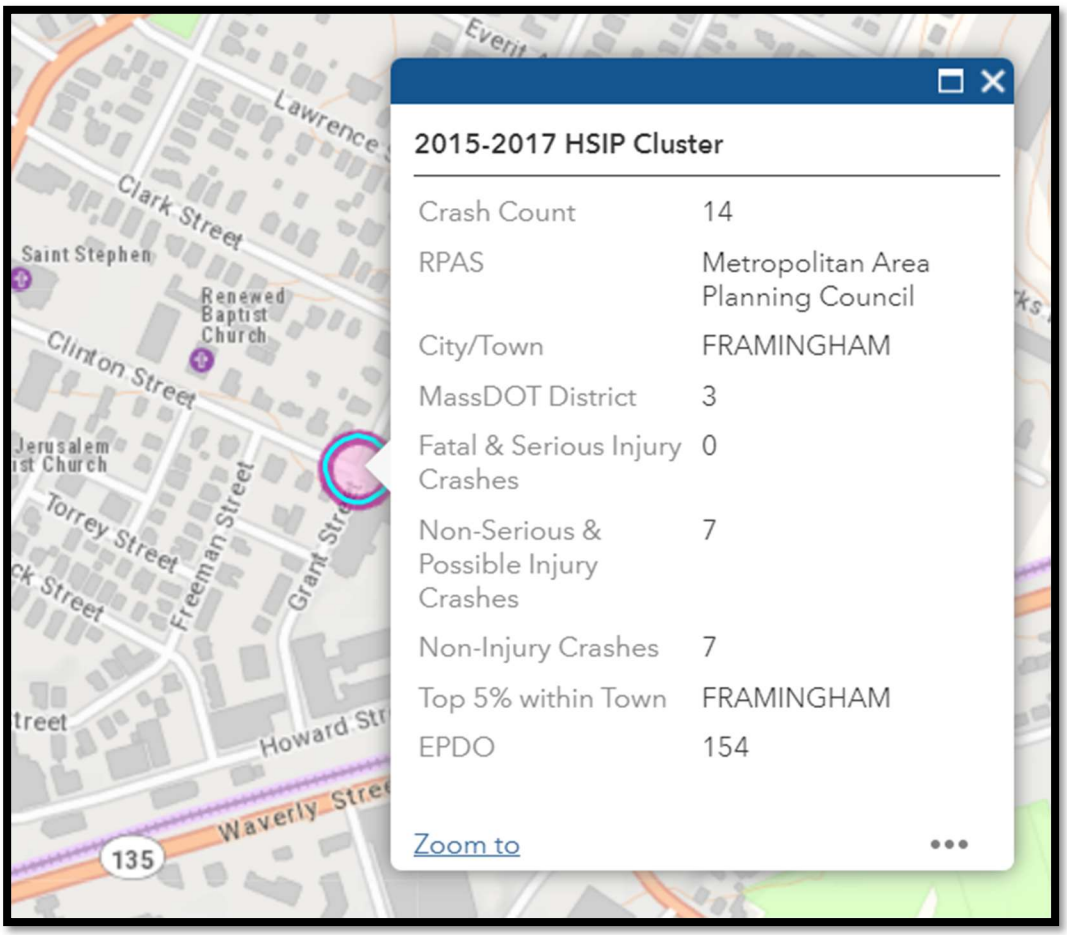
* Number of crashes per Million Entering Vehicles (MEV)

Crash rates are calculated as the number of crashes per million vehicles entering the intersection and are used to compare crash history to other similar intersections. Crash rates can be compared to statewide averages as well as MassDOT District averages. Framingham is within MassDOT District 3. The crash rates at all three locations are higher than both the statewide and District 3 averages for unsignalized intersections of 0.57 and 0.61 MEV, respectively. This illustrates that these locations experience anywhere from two to four times as many crashes as similar facilities throughout the region and state.

A closer review of the crash reports revealed that a significant number of crashes involved motorists who are not local, or do not have a high degree of familiarity with the study area roadways or traffic control. Some drivers even indicated that they were following the directions provided to them by their on-board navigation devices.

A review of MassDOT's Top Crash Locations portal revealed that the Clinton Street intersection was identified as a Highway Safety Improvement Program (HSIP) cluster for the 2015 to 2017 timeframe. This means that it ranked within the top 5% of all locations within the region with regards to crashes. The ranking is based on factors beyond just number of crashes, and puts significant emphasis on crash severity, such as injuries and/or fatalities. **Figure 6** provides an illustration of the information included in the online portal, which shows that the Clinton Street intersection experienced 14 crashes between 2015 and 2017, with 7 of them resulting in injuries.

Figure 6 – Clinton Street HSIP Cluster



3.0 Findings and Recommendations

3.1 Traffic Signal Warrants

The feasibility and appropriateness of installing a traffic signal to provide controlled stop-and-go operation was analyzed at the critical intersections. To justify the installation of a traffic control signal, one or more of the signal warrants in the Manual on Uniform Traffic Control Devices (MUTCD) must be satisfied. The warrants outlined in the MUTCD are as follows:

Warrant 1, Eight Hour Vehicular Volume

Warrant 2, Four Hour Vehicular Volume

Warrant 3, Peak Hour

Warrant 4, Pedestrian Volume

Warrant 5, School Crossing

Warrant 6, Coordinated Signal System

Warrant 7 Crash Experience

Warrant 8, Roadway Network

Warrant 9, Intersection Near a Grade Crossing

Based on the traffic count data that was collected, none of the traffic volume warrants (Warrants 1 – 4) were met. The analysis of Warrant 7 revealed that although each critical location experienced a significant number of crashes that could be corrected by a traffic control signal, the traffic volume demand is still too low at each location to satisfy this warrant.

Warrants 5, 6, 8, and 9 were determined to not be applicable and were therefore not evaluated.

The results of this analysis revealed that the installation of a traffic control signal is not supported at any of the intersections.

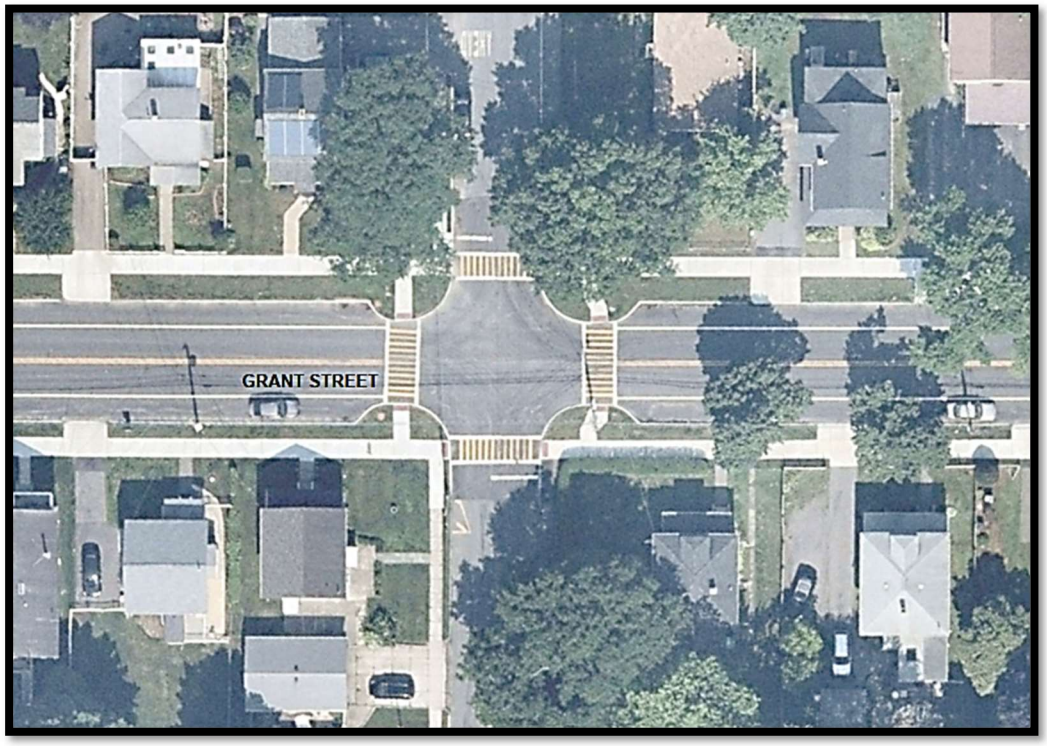
3.2 Field Observations

Observations were made along the Grant Street corridor with representatives from the City to obtain additional information regarding current conditions and operations. There were two main takeaways from these observations:

- Recently installed crosswalks across Grant Street may be creating confusion.
- Intersection sight distance does not appear to be a factor at most locations, however, motorists may not understand how and where to stop prior to proceeding.

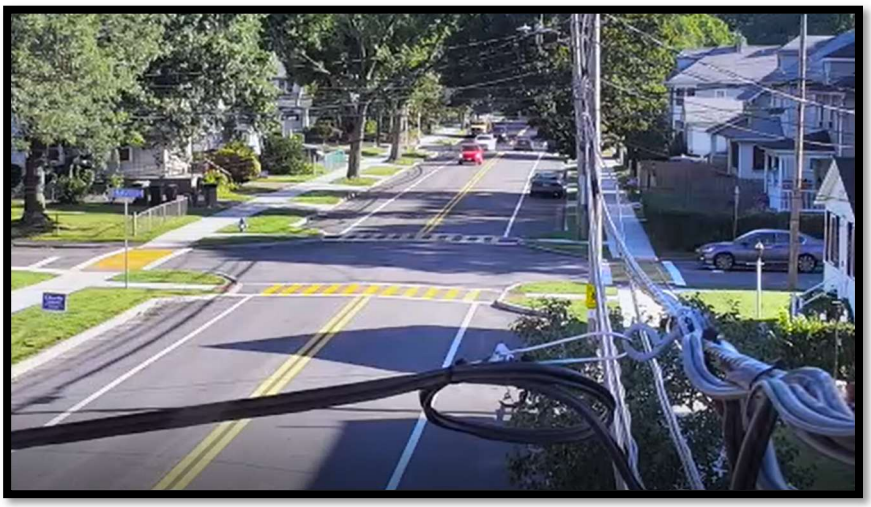
Regarding the crosswalks installed across Grant Street throughout the corridor, **Figure 7** illustrates these changes at the Mansfield Street intersection. The concern is that although the implementation of the crosswalks is an enhancement for pedestrians, they may be creating the appearance of an All-Way stop controlled intersection to motorists. Particularly, to those that are not familiar with area, as mentioned above.

Figure 7 – Example of New Crosswalks Across Grant Street

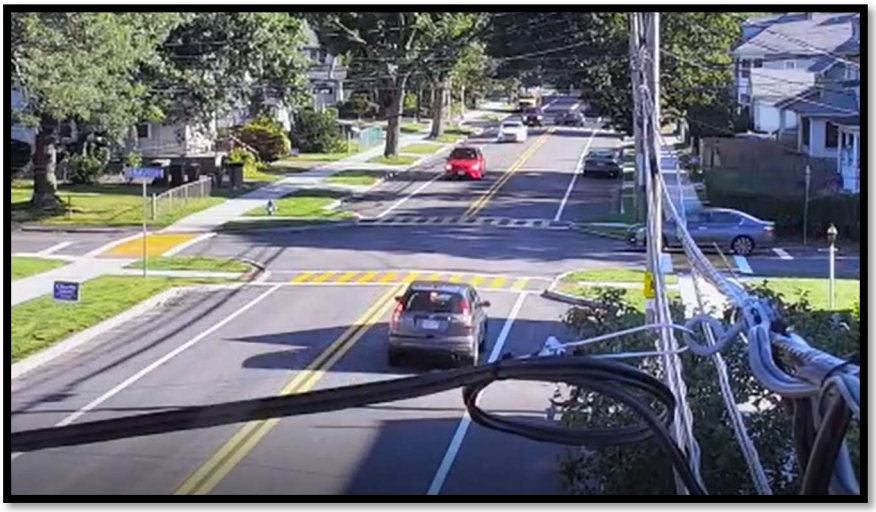


This issue was also identified through video monitoring of the Mansfield Street intersection that was conducted by the City. **Figure 8** is a series of three still shots from the video footage that demonstrates the misunderstanding that some motorists experience when approaching and traveling through the intersection.

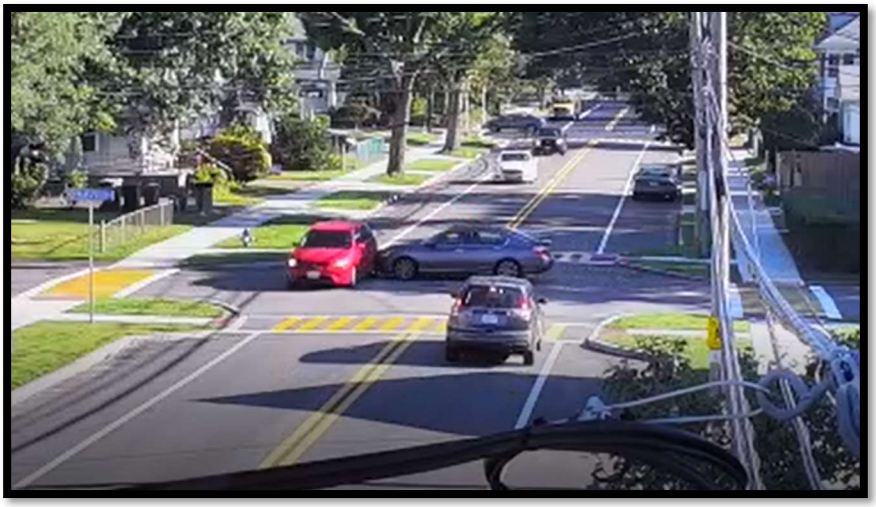
Figure 8 – Video Monitoring of Mansfield Street Intersection



Vehicle approaches Grant Street along the Mansfield Street westbound approach.



Mansfield Street vehicle begins to enter intersection as vehicles approach the intersection from both directions of Grant Street. Northbound vehicle appears to slow down in advance of recently installed crosswalk.



Northbound Grant Street vehicle comes to a stop, Mansfield Street vehicle fully enters the intersection, striking the Grant Street southbound vehicle that did not stop.

These images from the video footage reveal that the motorists on Mansfield Street was likely confused when the northbound Grant Street vehicle slowed down in advance of the intersection, possibly misinterpreting this decision as an indication that vehicles on Grant Street must stop at the intersection, or that it is under All-Way Stop control. This misunderstanding ultimately led to the collision.

Regarding sight distance at the intersections, only two locations appeared to have conditions that were potentially creating obstructions. At Clinton Street intersection, there is a small parking lot on the southwest corner of the intersection that allows vehicles to be parked right along the back edge of the sidewalk. As shown in **Figure 9**, vehicles parked in this lot can hinder the sight distance of eastbound motorists stopped at the intersection.

Figure 9 – Sight Distance, Clinton Street Intersection

The other location is at Mansfield Street, where vehicles traveling westbound approaching Grant Street could potentially have their sight distance impacted by a row of shrubs on the northeast corner, which is along the back edge of the sidewalk. However, it is not clear whether this has created any problems, since vehicles can safely travel closer to the intersection to see around the shrubs, due to the parking lane along Grant Street, which has been enhanced by the recently installed curb extensions. Related to this, observations revealed that motorists approaching from the various intersecting roadways appear to be uncertain as to how close they can get to Grant Street prior to proceeding into the intersection itself. Part of this uncertainty may be due to the distance that the stop lines are from the actual travel way on Grant Street.

Figure 10 shows the location of the stop lines for both approaches to Grant Street at the Lawrence Street intersection, which is consistent at each intersection throughout the corridor. Per design standards established by the American Association of State Highway and Transportation Officials (AASHTO), MassDOT and the MUTCD, the stop lines must be located in advance of the crosswalks, so they are required to be installed as shown. However, throughout the corridor this puts the stop lines on the side streets approximately 20-feet to 25-feet from the travel lane on Grant Street, which approximates a whole vehicle length.

Figure 10 – Location of Stop Lines Relative to the Intersection

3.3 RECOMMENDED IMPROVEMENTS

Based on a review of the existing conditions along Grant Street, as well as the relevant data, including crash records, traffic volumes, and travel speeds, improvements are recommended to address the identified safety issues. The following proposed improvements were developed to enhance the safety and operations throughout the corridor.

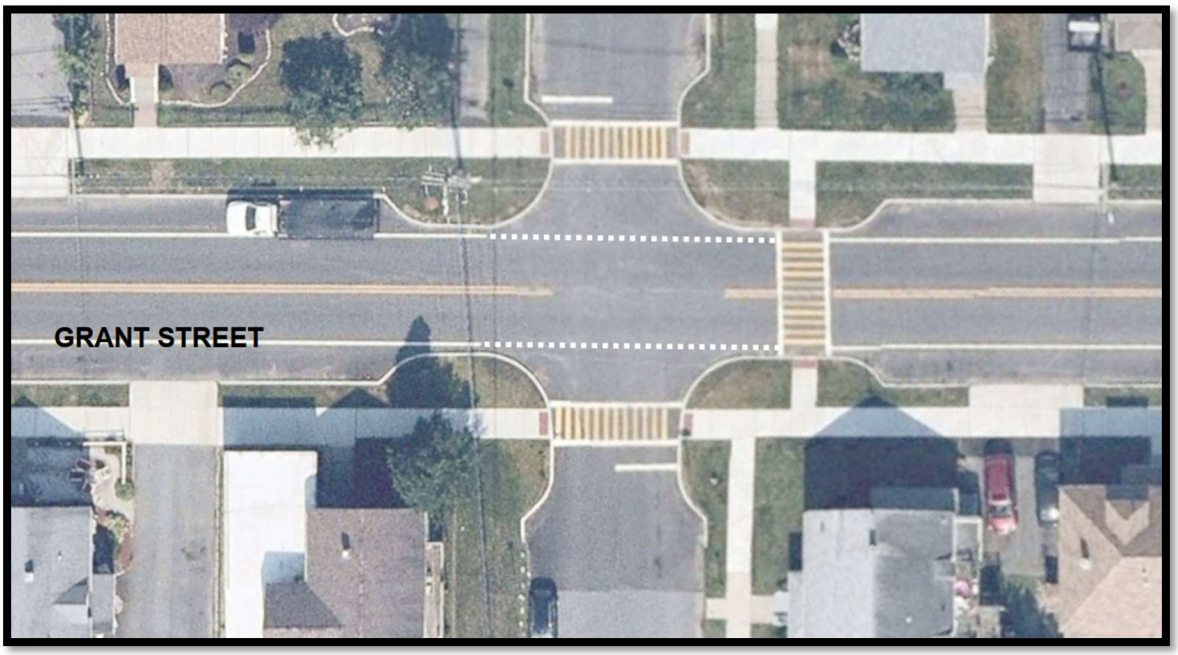
- Change the traffic control operations at the Mansfield Street intersection to an All-Way stop. Per the MUTCD, a multi-way stop should be considered at a location that has experienced five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. The Mansfield Street intersection has experienced 18 crashes over the last 3.5 years, and all but one was a right-angle collision. Angle collisions are considered to be correctible by an All-Way stop.
- Install Pedestrian Warning signs at all uncontrolled Grant Street crosswalks. Not only will these signs enhance the awareness of motorists that there is a crosswalk, but will also help reinforce that these locations are not all-way stop controlled. These signs should also be supplemented with the downward arrow plaque to provide motorists additional information.

- Install Guide or Extension Lines for the white edge lines across all intersection streets along the corridor. This is recommended primarily to provide a visual marker of the edge of the Grant Street travel way for motorists approaching from one of the side streets, which will provide a better understanding where vehicles can yield prior to entering an intersection.

Figure 11 provides an example of both a Stop sign and All-Way plaque assembly, as well as a Pedestrian Warning sign with a downward arrow. **Figure 12** illustrates the layout of extending the white edge lines through an intersection.

Figure 11 – Proposed Signage Examples

Figure 12 – Guide/Extension Lines



Other modifications, such as supplemental and enhanced signage and pavement markings can also be considered for future implementation if necessary.

The recommendations provided in this report are based on an evaluation of crash data, traffic operations and geometric conditions along the Grant Street corridor. Implementation of these recommendations is expected to increase driver awareness and enhance safety. It is recommended that the crash history along the corridor be evaluated twelve (12) to eighteen (18) months after implementation of the recommended improvements to assess the success of the improvements.