

November 5, 2023

Mr. Travis Ahern
Town Solicitor
Town of Holliston, MA
703 Washington Street
Holliston, MA 01746

**Re: Professional Traffic Engineering Services
Norfolk Street and Franklin Street Traffic Engineering Study
Holliston, Massachusetts
Pare Project No.: 23150.00**

Dear Mr. Ahern:

Pare Corporation (Pare) has completed a traffic calming study for the implementation of future traffic calming and safety improvements within the study area of Norfolk Street, Franklin Street, and Central Street. The roadway segments chosen for the study were determined in cooperation with staff from the town of Holliston in August 2023. This study area was chosen as it is an area with potential for significant growth in use by pedestrians and bicyclists, as Norfolk Street and Franklin Street have been designated as scenic roadways and the study area is less than one mile away from the Town's downtown area, the Upper Charles Rail Trail, and three schools, including Placentino Elementary School, Miller Elementary School, and Adams Middle School. In addition, the study intersection of Central Street at Norfolk Street was identified as a high crash location by the Massachusetts Department of Transportation (MassDOT). A locus map showing the study area and the study intersections is shown in **Figure 1**.

As part of the traffic calming study, an existing conditions assessment was conducted within the study area. The purpose of this existing conditions traffic assessment is to review existing traffic conditions within the study area. The following information provided within outlines the results of field observations, traffic counts conducted during morning and afternoon commuter peaks, and a 12-hour Manual-Turning-Movement-Count (MTMC) and describes the existing conditions within the area.

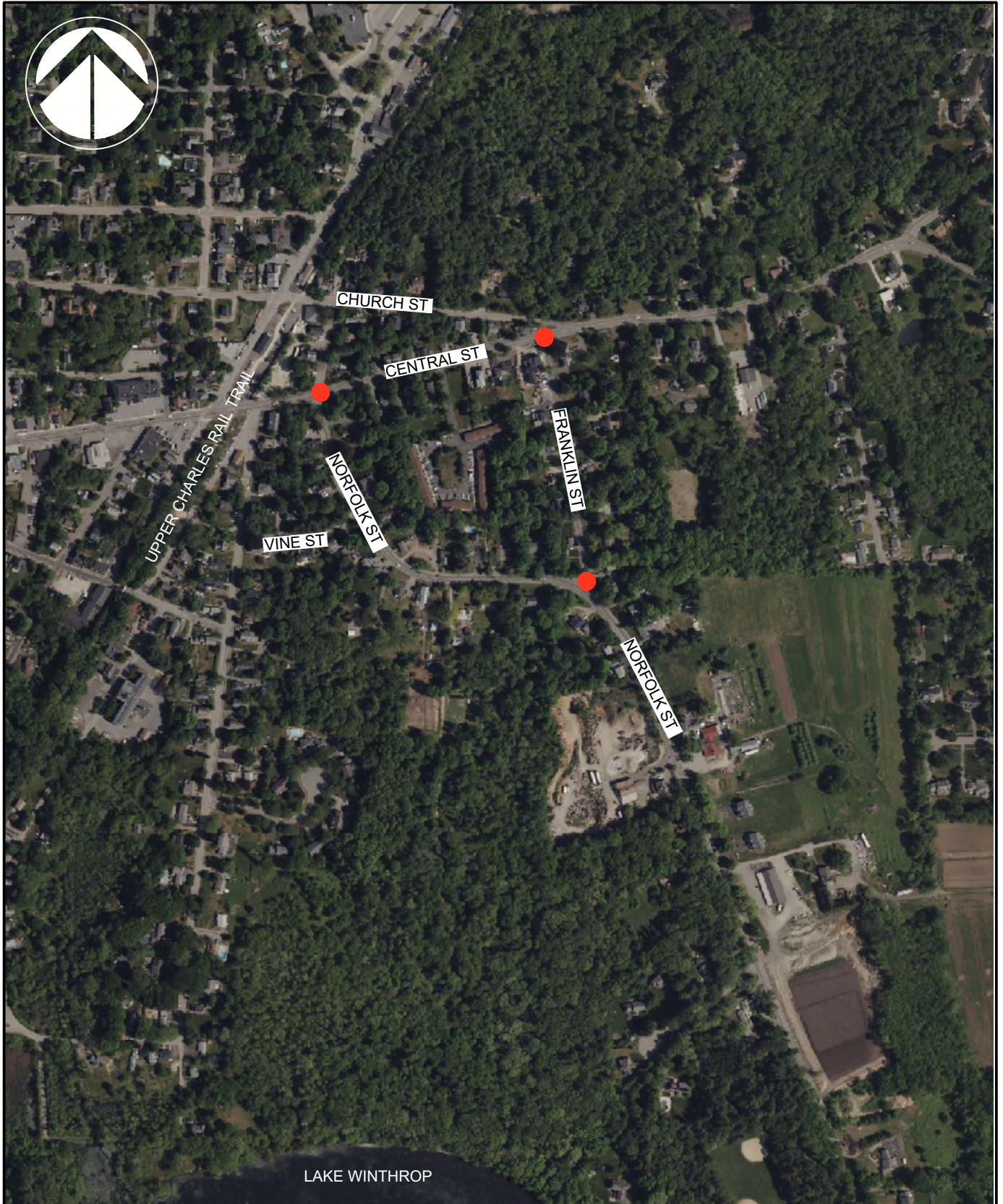
EXISTING CONDITIONS

Listed below are the roadways and intersections included in the study area.

Study Area Roadways:

Central Street

Central Street is a two-way street, classified as a minor arterial under local jurisdiction. This roadway runs in the general east/west direction within the study area. It consists of 11-foot-wide travel lanes, with paved shoulders that vary in width from 18 inches to approximately three feet. Bituminous concrete sidewalks separated from the roadway by planted buffer strips are present on both sides of the roadway.



● = STUDY INTERSECTIONS



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FIGURE 1
LOCUS MAP

HOLLISTON TRAFFIC CALMING STUDY
HOLLISTON, MASSACHUSETTS

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Sidewalk conditions along the southern side of the roadway are deteriorating with tree roots seen uplifting and damaging the sidewalk, while vegetation creeps over the sidewalk, reducing the passable space. Street lighting is provided within the study area.

A speed limit of 35 miles per hour is posted for most of the study area along Central Street. However, just east of Norfolk Street the speed limit changes to 25 miles per hour from that point west toward the rail trail and downtown. Within the study area, the land use surrounding this roadway is predominantly residential.

The Town of Holliston has identified the section of Central Street beginning at Franklin Street and extending to Dalton Street as a section of roadway for the addition of a sidewalk and PROWAG-compliant curb ramps in its Complete Street Project Prioritization List. This project is ranked at number 37.

Franklin Street

Franklin Street is a two-way street, classified as a minor arterial under local jurisdiction. This roadway runs in the general north/south direction within the study area. Franklin Street ranges approximately 21 to 23-feet-wide with no pavement markings. A bituminous concrete sidewalk is also present only along the western side of the roadway which varies in width between 3.5-5 feet wide.

The speed limit for Franklin Street is 25 miles per hour. Within the study area, there are post-mounted signs stating “NO THRU TRUCKING 6AM-7PM” at both ends of the street. Flexible delineators have been installed on Franklin Street as it intersects Norfolk Street to slow down drivers entering the roadway. Land uses surrounding this roadway are residential only.

Norfolk Street

Norfolk Street is a two-way street, classified as a major collector between Central Street and Franklin Street and is under local jurisdiction. This roadway generally runs in a north/south direction but curves east/west between Vine Street and Franklin Street. Norfolk Street is approximately 27 feet wide, including a 12-foot-wide travel lane with a one-and-a-half-foot wide shoulder along each direction. A bituminous concrete sidewalk lines the eastern side of the roadway ranging from four-feet-wide to six-and-a-half-feet-wide. The western side of the roadway contains a six-foot-wide sidewalk that is only present north of Vine Street.

A speed limit of 25 miles per hour is posted on this roadway within the study area. Accompanying signs along the west side of the roadway include “LEFT CURVE ARROW” and “SLOW CHILDREN.” Land uses surrounding this roadway are residential only.

The section of Norfolk Street included in this review is included in the Town of Holliston’s Complete Street Project Prioritization Plan. The proposed improvements in the plan include widening the current sidewalk along Norfolk Street by three feet to make the sidewalk a shared-use path. This project is ranked number 12 on the Town’s priority list.

Study Area Intersections:

Central Street at Norfolk Street



Photo 1. Intersection of Central Street at Norfolk Street

The intersection of Central Street and Norfolk Street forms a four-legged unsignalized intersection. This intersection is two-way-stop-controlled from the northern and southern legs, with an overhead flashing beacon present. Norfolk Street makes up the northern and southern legs, while Central Street makes up the eastern and western legs. All legs of this intersection contain one travel lane allowing all movements and one receiving lane. Standard-style crosswalks are located across the Norfolk Street legs of the intersection. Additionally, there are sidewalks present along the perimeter of the intersection.

Project number 18 on the Town of Holliston’s Complete Streets Project Prioritization Plan includes Pedestrian and PROWAG improvements to this intersection, including adding a crosswalk across Central Street with rectangular rapid flashing beacons (RRFBs) and PROWAG-compliant curb ramps. In addition, project number 34 includes utility relocation at the intersection to enhance accessibility.

Central Street at Franklin Street

The intersection of Central Street and Franklin Street forms a three-legged unsignalized intersection. Franklin Street makes up the southern leg, while Central Street makes up the eastern and western legs. The Franklin Street approach is stop-controlled while the Central Street approaches are free-flowing. All legs of the intersection consist of one approach lane allowing all available movements and one receiving lane. Additionally, there are sidewalks present along both sides of the western leg as well as the western side of the southern leg. There are no sidewalks along Central Street east of Franklin Street. A bituminous concrete curb ramp is present at the southwest corner of the intersection, but it does not appear to meet current design standards.



Photo 2. Intersection of Central Street at Franklin Street

Project number 41 on the Town of Holliston’s Complete Streets Project Prioritization Plan includes installation of PROWAG-compliant curb ramps at this intersection.

Norfolk Street at Franklin Street

Photo 3. Intersection of Norfolk Street at Franklin Street

The intersection of Norfolk Street and Franklin Street forms an unsignalized intersection. This intersection is two-way-stop-controlled. Franklin Street makes up the northern leg, which splits into two legs just north of the intersection, including one leg for turns to/from the west on Norfolk Street and the other for turns to/from the south on Norfolk Street. Norfolk Street makes up the western and southern legs of the intersection. All approaches to the intersection consists of one approach lane that allows all available movements and one receiving lane.

At the time of field observations, flexible delineators were present along Franklin Street as it intersects with the southern leg of Norfolk Street. Delineators take up a maximum width of six-and-a-half feet of the road to slow down northbound vehicles entering Franklin Street. There are no crosswalks present along the perimeter of the intersection. Additionally, there are sidewalks lining the corner of the north and west leg, as well as on the east side of the south leg.

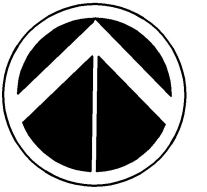
Project number 45 on the Town of Holliston's Complete Streets Project Prioritization Plan includes installation of PROWAG-compliant curb ramps at this intersection.



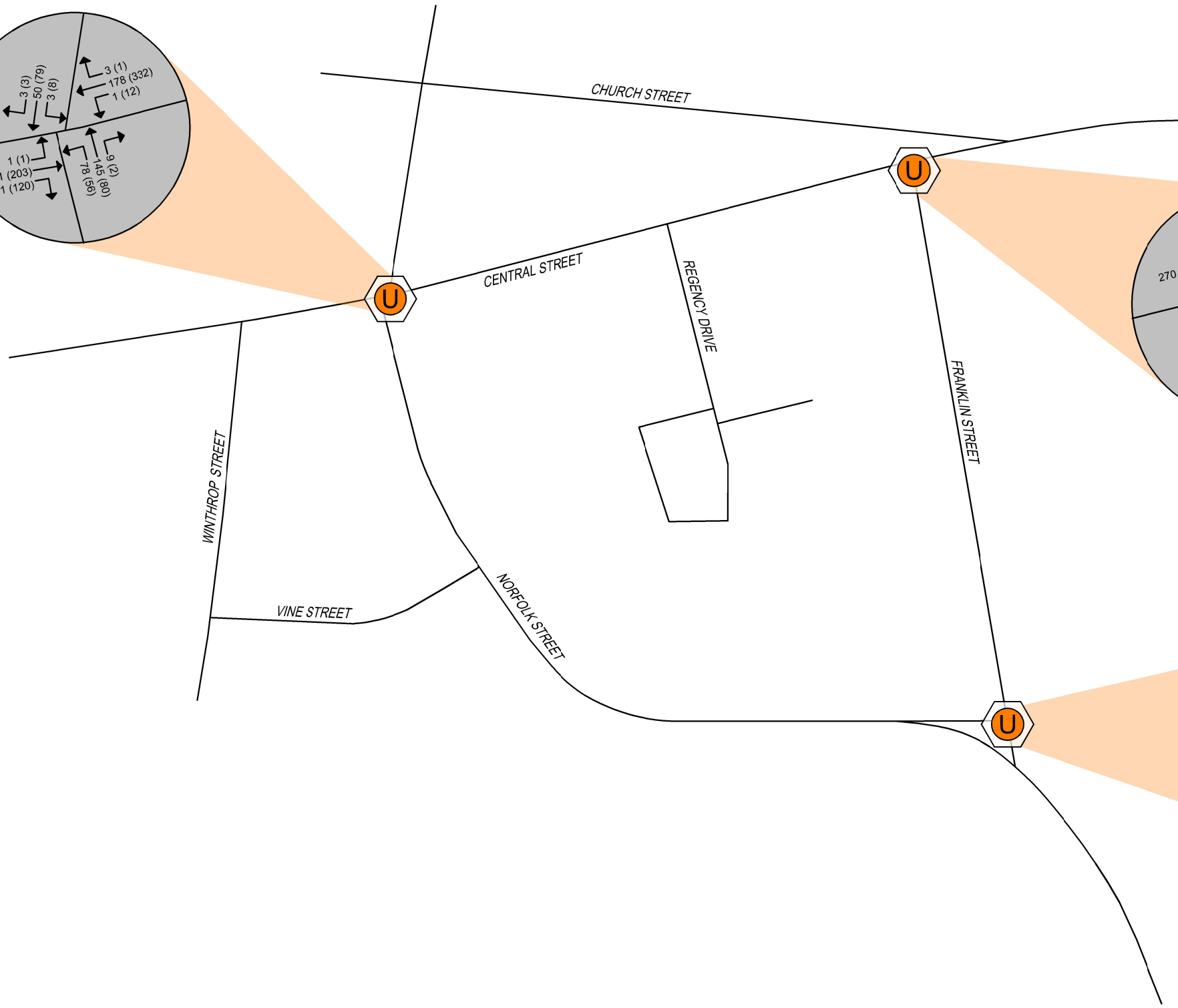
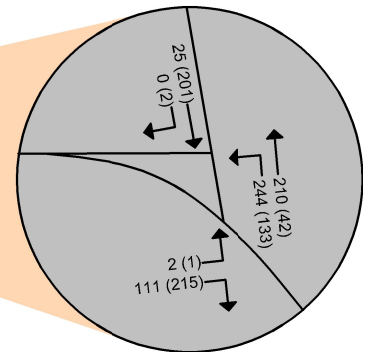
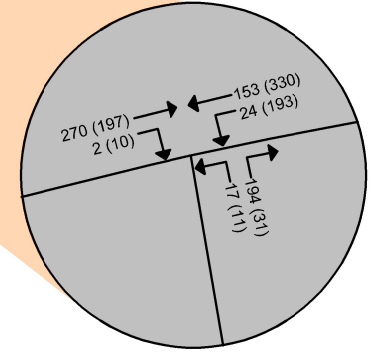
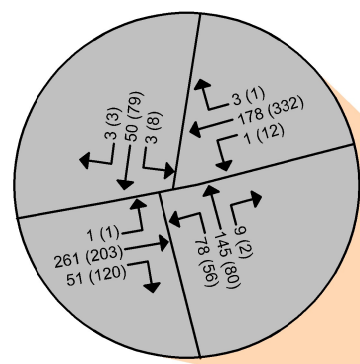
Photo 4. Tapered delineator along Franklin Street to slow vehicles down

DATA COLLECTION

For the purposes of assessing the study intersections, manual-turning-movement-counts (MTMC's) were conducted on September 14, 2023 at the study intersections: Central Street at Norfolk Street, Central Street at Franklin Street, and Norfolk Street at Franklin Street. The manual traffic counts captured vehicular volumes and classifications. Peak commuter counts were conducted from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. at the intersections of Central Street at Franklin Street and Norfolk Street at Franklin Street. A 12-hour manual turning movement count was performed from the hours of 7:00 a.m. to 7:00 p.m. at the intersection of Central Street and Norfolk Street. The results of these traffic counts are shown in **Figure 2** on the following page.



S Signalized
U Unsignalized



AM COMMUTER VOLUMES (PM COMMUTER VOLUMES)



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FIGURE 2
EXISTING (2023) TRAFFIC VOLUMES
HOLLISTON NORFOLK-FRANKLIN STUDY

HOLLISTON, MASSACHUSETTS

SAFETY ANALYSIS

Sight Distance

On September 19, 2023, spot speed studies were conducted on Central Street, Norfolk Street, and Franklin Street between the study intersections. A speed limit of 35 miles per hour is posted for most of the Central Street study area. Norfolk Street has a speed limit of 25 miles per hour posted. A de facto speed limit of 25 miles per hour is assumed for Franklin Street. A summary of the speed data results is shown in **Tables 1 through 3** below. The most notable metric presented in the table is the 85th percentile speed, which was utilized for the sight distance analysis. Based on the speeds observed, the sight distance analysis was conducted using a design speed of 40 miles per hour for Central Street, and 30 miles per hour for Norfolk Street and Franklin Street.

Table 1: Central Street Speed Study Summary

	Posted Speed	Average Speed	True Median (50 th Percentile)	85 th Percentile	10 MPH Pace	% over Posted
Eastbound	35	34	34	38	29-38	36
Westbound	35	33	33	36	28-37	22

Table 2: Norfolk Street Speed Study Summary

	Posted Speed	Average Speed	True Median (50 th Percentile)	85 th Percentile	10 MPH Pace	% over Posted
Northbound	25	28	28	31	23-32	77
Southbound	25	26	26	29	21-30	61

Table 3: Franklin Street Speed Study Summary

	Posted Speed	Average Speed	True Median (50 th Percentile)	85 th Percentile	10 MPH Pace	% over Posted
Northbound	25	25	24	30	18-27	45
Southbound	25	24	24	26	17-26	24

In conjunction with the spot speed study conducted, the available sight distance at the existing intersections were measured. Photos of the sight lines are shown in **Photos 5 through 14** below.

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Photo 5. Sight distance looking left (west) from Norfolk Street (northbound)



Photo 6. Sight distance looking right (east) from Norfolk Street (northbound)



Photo 7. Sight distance looking left (east) from Norfolk Street (southbound)



Photo 8. Sight distance looking right (west) from Norfolk Street (southbound)

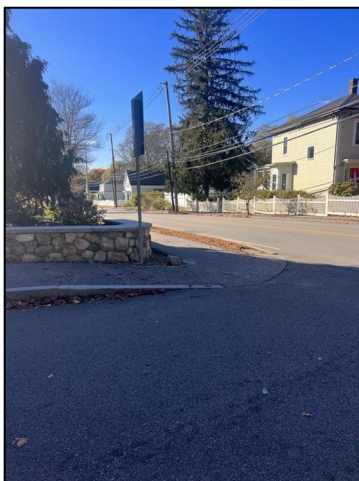


Photo 9. Sight distance looking left (west) from Franklin Street



Photo 10. Sight distance looking right (east) from Franklin Street (southbound)



Photo 11. Sight distance looking left (south) from Franklin Street (southbound)



Photo 12. Sight distance looking right (west) from Franklin Street (southbound)



Photo 13. Sight distance looking left (south) from Franklin Street (westbound)



Photo 14. Sight distance looking right (west) from Franklin Street (westbound)

According to the latest editions of the American Association of State Highway and Transportation Officials (AASHTO) publication *A Policy on the Geometric Design of Highways and Streets*, the minimum safe stopping sight distance for speeds of 40 miles per hour and 30 miles per hour is 305 feet and 200 feet, respectively. In addition, AASHTO gives guidance for a more desirable sight distance for this speed, which will not only avoid collisions, but maintain vehicular flow of at least 70 percent of the original operating speed. Meeting the desirable criteria for sight distance is more applicable to heavily traveled arterials, where maintaining steady traffic flow along the major road is important. A summary of the required and measured sight distances for all three intersections can be found in **Table 4** below.

Table 4: Sight Distance Summary

		Required ISD (ft)	Desirable ISD (ft)	Measured ISD (ft)
Central Street at Norfolk Street (northbound)	Looking West (Left)	305	385	>500
	Looking East (right)	305	445	>500
Central Street at Norfolk Street (southbound)	Looking East (Left)	305	385	330
	Looking West (right)	305	445	350
Central Street at Franklin Street	Looking West(left)	200	290	190
	Looking East (right)	200	335	275
Norfolk Street at Franklin Street (southbound)	Looking South (Left)	200	290	415
	Looking West (Right)	200	335	>500
Norfolk Street at Franklin Street (westbound)	Looking South (Left)	200	290	400
	Looking West (Right)	200	335	>500

ISD = Intersection Sight Distance

As shown in the table above, sight lines for each intersection exceed the required minimum sight distance. Most of the limitations to sight distance in the project area involve vegetation that is located on adjacent private property.

Crash Data

Crash data was obtained through the Massachusetts Department of Transportation (MassDOT) crash portal for the most recent five-year period, from November 1, 2018, through October 31, 2023. The crash data obtained included the study intersections of Central Street at Norfolk Street, Central Street at Franklin Street, and Norfolk Street at Franklin Street to be analyzed, as well as the roadway segments outside of the immediate vicinity of study intersections. **Table 5** below provides a breakdown of the crashes based on type and severity.

Table 5: Crash Data Summary

Roadway/ Intersection	Total Crashes	Crash Severity		Crash Type						
		Non-Fatal Injuries	Fatalities	Rear-End	Angle	Sideswipe	Head-On	Single Vehicle	Pedestrian/Bicyclist	Other/Unknown
Central Street between Norfolk Street and Franklin Street	1	1	0	0	0	0	0	0	1	0
Norfolk Street between Central Street and Franklin Street	6	2	0	0	0	0	0	5	0	1
Franklin Street Between Central Street and Norfolk Street	0	0	0	0	0	0	0	0	0	0
Central Street at Norfolk Street	21	9	0	1	17	0	1	2	0	0
Central Street at Franklin Street	3	0	0	0	1	2	0	0	0	0
Norfolk Street at Franklin Street	2	0	0	1	0	0	0	1	0	0
Total	33	12	0	2	18	2	1	8	1	1

As shown, a total of 33 crashes occurred within the study area, or roughly 6.6 crashes per year. Of these crashes, 12 (36%) resulted in non-fatal injuries and no reported fatalities.

Angle crashes were the most common with 18 occurring, or roughly 55%. These crashes are quite prevalent at the intersection of Central Street at Norfolk Street, with one occurring at the intersection of Central Street and Franklin Street. Angle crashes are commonly observed at intersections and are typically the result of violation of traffic controls, aggressive driving, or limited sight distance. It should be noted that the Town recently performed some vegetation trimming near this intersection, which improved sight distance. Prior to this work being done, some of the sight lines at this intersection were limited, which may have been a contributing factor in some of these crashes.

Singe Vehicle crashes occurred eight times, or roughly 24% of all the crashes reported. These crashes are typically due to the lack of driver attentiveness or high speeds resulting in crashes with a stationary objects, or the result of a collision with an animal in the roadway.

There was on crash involving a bicyclist on Central Street approximately 200 feet east of Norfolk Street. The bicyclist was suspected of having a minor injury but was not transported to the hospital.

All other crash types contributed less than 6% of the overall crashes that occurred. Rear-end, head-on and sideswipe crashes were reported at the study intersections, while an unknown type of crash was reported along Norfolk Street.

The overall crash rate and specific crash pattern at the Central Street and Norfolk Street intersection warrants further study to identify and address the frequency of angle collisions at this intersection.

PRELIMINARY ASSESSMENT

A preliminary assessment was done to examine the different traffic calming alternatives that can improve safety at the study intersections. Based on the safety analyses above, the study intersections of Norfolk Street at Franklin Street and Central Street at Franklin Street experienced few crashes within the most recent five-year period. Central Street at Norfolk Street did, however, experience a significant number of angle crashes. Examination of the benefits of supplementing the overhead flashing beacon were analyzed based on operation in this location. With the existing overhead flashing beacon, the right-of-way at the four-legged, two-way stop-controlled intersection is supplemented and is intended to reinforce drivers' awareness of existing stop signs and entering vehicles. However, it is believed that due to the operating speed on Central Street and the reduced sight distance for through or crossing traffic, there is less awareness/reaction time for drivers resulting in angle crashes.

The roadway segment of Norfolk Street between Franklin Street and Central Street experienced over one crash per year, with most of these crashes being single-vehicle collisions, indicating that vehicles are likely leaving the roadway, most likely along the curves.

To increase driver awareness and reduce the number of crashes in the study area, the following options are deemed potentially beneficial:

Speed cushions

Speed cushions will encourage motorists to slow down through vertical deflection. The speed cushions will force motor vehicles to slow down without coming to a complete stop allowing flow of traffic to be minimally impacted. However, the geometry of the cushions allow larger emergency vehicles to pass uninterrupted; there are firehouses located 1,100-feet east and 1,500-feet west of the intersection along Central Street. This treatment could be beneficial on both Central Street and on Norfolk Street.

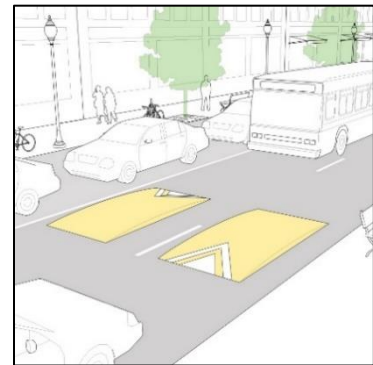


Figure 3. Speed Cushions

Lane Narrowing



Figure 4. Lane Narrowing

A reduction in the width of travel lanes has been proven to slightly reduce driver speed and improve driver awareness. In addition, reducing travel lane width can in some instances allocate space for bicycle lanes or other amenities. As the Upper Charles Rail Trail is located approximately 300 feet west of Norfolk Street, making Central Street and Norfolk Street more bicycle-friendly would be beneficial.

Supplemental Signage



Figure 5. Speed Display Feedback Unit

Speed display feedback signs mounted directly under the posted speed limit of 25 miles per hour along Central Street and Norfolk Street will alert drivers of the speed change and to slow to the legal limit. These signs are cost-effective, low maintenance, and provide immediate feedback. Additionally, potential signage options that could be incorporated include a “CROSS TRAFFIC AHEAD DOES NOT STOP” for the Norfolk Street approaches to Central Street which should be post-mounted directly under the stop signs for the most effectiveness. Complimentary “STOP AHEAD” pavement markings may also be beneficial for Norfolk Street. A review of the curvature signage along Norfolk Street should be undertaken to reinforce awareness of the curves along Norfolk Street, regardless of any implementation of traffic calming measures.

All study intersections can be improved and made safer with the pruning and routine maintenance of vegetation to maximize sight distances.

Traffic volumes were reviewed to see if they were high enough to warrant possible signalization as an intersection mitigation measure. Based on the volumes counted, it does not appear that traffic volumes at any of the study intersections are high enough to warrant signalization.

CONCLUSIONS AND RECOMMENDATIONS

Pare Corporation conducted an assessment of the study area, including Franklin Street and sections of Central Street and Norfolk Street, including a documentation of existing conditions, a safety review and identification of safety improvement options. The existing roadway segments of Central Street, Norfolk Street, and Franklin Street all consist of one travel lane in each direction, with posted speed limits of 35 miles per hour on Central Street, and 25 miles per hour for Norfolk/Franklin Street. Central Street at Franklin Street and Norfolk Street at Franklin Street are both unsignalized, stop-controlled intersections, with the intersection of Central Street at Norfolk Street also being unsignalized, stop-controlled complimented by an overhead flashing beacon.

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The existing roadways and intersections were reviewed for safety with respect to adequate stopping sight distance as well as crash history. A review of the crash data showed a predominance of angle collisions at the intersection of Central Street and Norfolk Street and single-vehicle crashes along Norfolk Street. To directly address the angle crashes, it is recommended that vegetations in the vicinity of all three intersections be trimmed to enhance sight distances, but this is particularly important at the intersection of Central Street at Norfolk Street, as sight distances here do not meet the minimum sight distance guidelines. Improvements to the curvature warning signage along Norfolk Street can help reduce the number of single-vehicle crashes along this corridor.

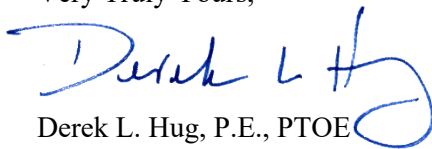
In addition, vehicular speeds are a contributing factor in not only the occurrence of crashes, but especially the severity of those crashes. Nine of the 21 crashes at the intersection of Central Street at Norfolk Street resulted in personal injuries. The following options should be considered to reduce speeds, particularly along Central Street and Norfolk Street:

- Extension of the 25 MPH speed zone on Central Street further to the east.
- Addition of speed cushions along Central Street and Norfolk Street within the study area.
- Narrowing of travel lanes along Central Street and Norfolk Street.
- Supplemental signage along Central Street and Norfolk Street.
- Making the temporary extension at the intersection of Norfolk Street and Franklin Street permanent.

Finally, a preliminary review of the traffic volumes in the area indicates that none of the intersections in the study area have high enough traffic volumes to warrant the installation of a traffic signal.

If you have any questions, please feel free to give me a call.

Very Truly Yours,

A handwritten signature in blue ink that reads 'Derek L. Hug'.

Derek L. Hug, P.E., PTOE
Managing Engineer

AB/DH