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TECHNICAL MEMORANDUM

TO: Mr. Joshua Crabb, Highway Superintendent
Fairhaven Highway Department
5 Arsene Street
Fairhaven, Massachusetts 02719

DATE: September 26, 2025

FROM: Samuel W. Gregorio, PE, PTOE, RSP_1, Senior Project Manager
Gerson M. Ribeiro EIT, Project Engineer

PROJ NO.: T1680

RE: Main Street & Middle Street – Fairhaven, Massachusetts
One-Way Flow Assessment

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INTRODUCTION

TEC, Inc. (TEC) has been retained by the Town of Fairhaven (the "Town") to provide an evaluation of a potential corridor flow conversion from two-way flow (bidirectional traffic) to one-way flow along segments of Main Street and Middle Street between Washington Street and Ferry Street in Fairhaven, Massachusetts. The current two-way flow condition of the subject roadways between Washington Street and Ferry Street is made difficult by the narrow cross-sections of each of the subject roadways, the needed presence of on-street parking, and the presence of block-by-block conflict points with challenging sight lines in the dense urban setting. The location has been identified as a location of concern in the community.

TEC has evaluated traffic and safety characteristics of the study corridors under base year and future year conditions consistent with the *Transportation Impact Assessment (TIA) Guidelines* issued by the Massachusetts Department of Transportation (MassDOT)[1] and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports. Note that this study does not provide specific capacity and queue analysis of the subject intersections. The findings and recommendations for the change in flow conditions, if noted, are based on the detailed traffic analyses included in this report.

EXISTING CONDITIONS

A field inventory of the existing conditions along Main Street and Middle Street, and the internal intersection network, was conducted by TEC staff in April 2025 to obtain information related to intersection and roadway geometrics, operating characteristics, and safety

[1] *Transportation Impact Assessment (TIA) Guidelines*; Massachusetts Department of Transportation; March 13, 2014.

characteristics. A description of the existing roadway and intersection geometry is provided below. A graphical depiction of the study area is provided in Figure 1.

Key Corridors

Main Street

Main Street is a two-lane north-south roadway under the jurisdiction of the Town of Fairhaven south of Howland Road and under the jurisdiction of MassDOT north of Howland Road. The corridor is functionally classified as an urban minor arterial roadway north of Washington Street and an urban collector south of Washington Street. Main Street provides a regional connection between Acushnet Center to the north and Church Street to the south. This technical memorandum for evaluation of flow conditions focuses on only the section of Main Street between Washington Street and Ferry Street which represents the southerly end of the corridor. The following describes the corridor segment under evaluation.

Main Street is approximately 24-feet wide narrowing to 22-feet wide approaching Ferry Street and provides a single travel lane in each direction with directional flow unmarked. On-street parking is permitted along the westerly side of the corridor within the study area which significantly narrows useable roadway space for two-way traffic flow. It is not uncommon to see vehicles weave in and out behind on-street parked vehicles while also waiting for on-coming traffic to pass before proceeding along the corridor. Sidewalks are provided along both sides of Main Street with crosswalks present across Main Street and intersecting side streets at various intersections. No formal bicycle accommodation is provided along the corridor.

There is no MassDOT Special Speed Regulation along Main Street. The corridor is therefore subject to a 30 mile per hour (mph) statutory speed limit under Massachusetts General Law (MGL) Chapter 90, Section 17 (Ch90 §17) for thickly settled / business districts in absence of a Special Speed Regulation.

Middle Street

Middle Street is a two-lane north-south local roadway under the jurisdiction of the Town of Fairhaven. The roadway provides a local connection between US Route 6 to the north and Ferry Street to the south. This technical memorandum for evaluation of flow conditions focuses on only the section of Middle Street between Washington Street and Ferry Street which represents the southerly end of the corridor. The following describes the corridor segment under evaluation.

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Main Street & Middle Street - Fairhaven, MA
One-Way Flow Assessment

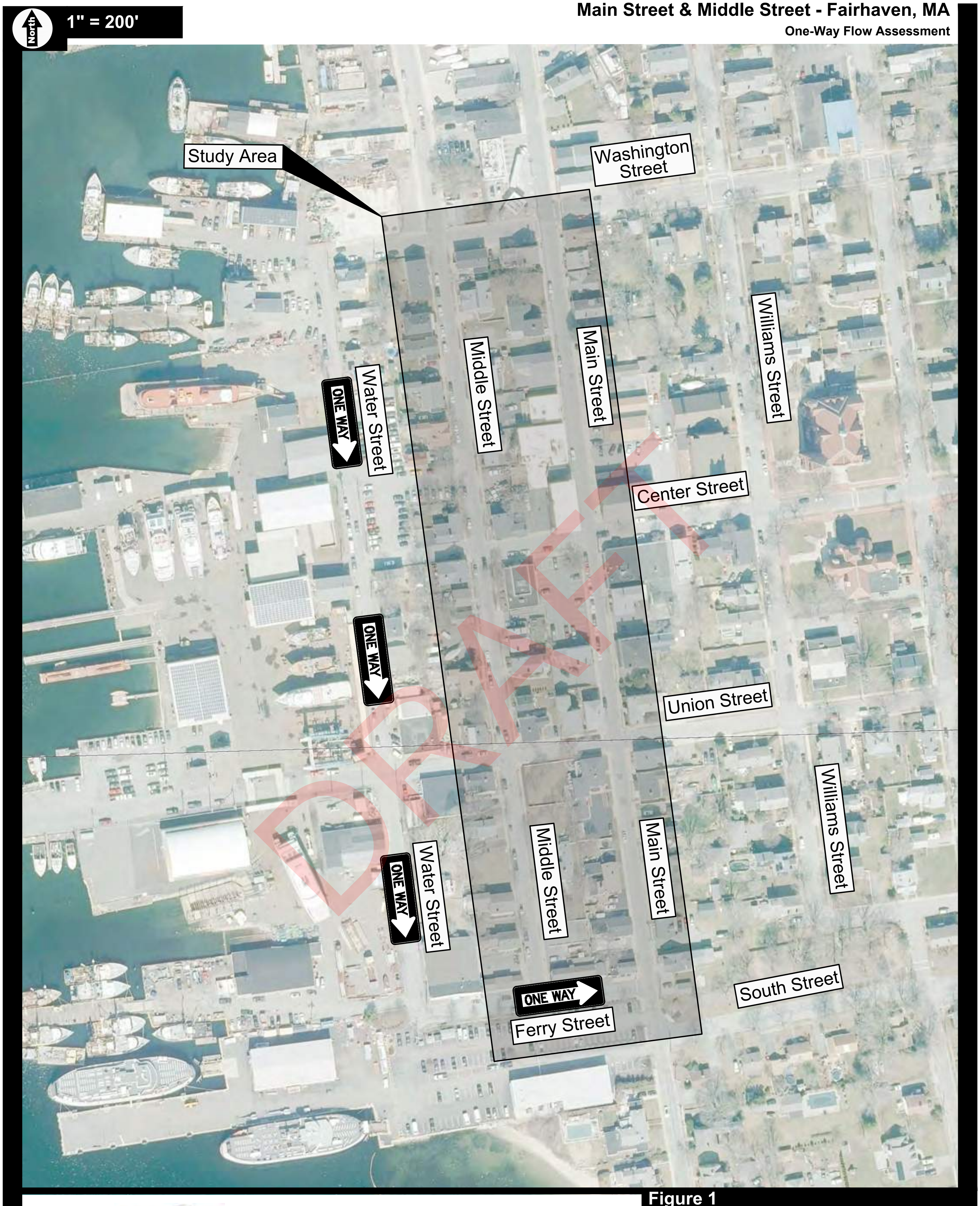

Figure 1

Study Location Map
Existing Conditions

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Middle Street ranged from approximately 24-feet to 26-feet wide and provides a single travel lane in each direction with directional flow unmarked. On-street parking is permitted along the westerly side of the corridor within the study area which significantly narrows useable roadway space for two-way traffic flow similar to Main Street. It is not uncommon to see vehicles weave in and out behind on-street parked vehicles while also waiting for on-coming traffic to pass before proceeding along the corridor. Grass buffered sidewalks are provided along both sides of Middle Street with crosswalks present across Middle Street and intersecting side streets at various intersections. No formal bicycle accommodation is provided along the corridor.

There is no MassDOT Special Speed Regulation along Middle Street. The corridor is therefore subject to a 30-mph statutory speed limit under MGL Ch90 §17 for thickly settled / business districts in absence of a Special Speed Regulation.

TRAFFIC VOLUMES

Traffic volume data for this report was obtained from Turning Movement Counts (TMCs) and supplemented with Automatic Traffic Recorder (ATR) counts conducted at the study area intersection. The details of the data collection effort for this project are described below.

Turning Movement Counts

To establish existing traffic volumes at the study area intersection, manual TMCs were conducted, during a typical weekday morning (7:00 AM to 9:00 AM) and weekday evening (4:00 PM to 6:00 PM) peak hours at the study intersections along each corridor on Wednesday, May 28, 2025. Local schools were in regular session during the time of the traffic counts. The weekday morning peak hour occurred between 8:00 AM and 9:00 AM and the weekday evening peak hour occurred between 4:00 PM to 5:00 PM. A detailed summary of the TMCs, partitioned into 15-minute intervals, is provided within Attachment A.

Automatic Traffic Recorder Counts

An ATR was conducted for a continuous 48-hour mid-week period on Main Street and Middle north of Center Street from Wednesday, May 28, 2025 through Thursday, May 29, 2025 concurrently with the TMCs. The ATRs were obtained to gather additional daily traffic volume data, vehicle speeds, and vehicle classification. A summary of the weekday ATR traffic data is presented in Table 1. A detailed summary of the ATR data, partitioned into 15-minute intervals, is provided within Attachment B.

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Table 1 – Existing Weekday Traffic Volume Summary

Location	Weekday Traffic Volume[a]	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Traffic Volume[b]	K Factor[c]	Directional Distribution[d]	Traffic Volume	K Factor	Directional Distribution
Main Street, north of Center Street	2,572	123	4.8%	57.7% SB	225	8.7%	57.3% NB
Middle Street, north of Center Street	1,516	88	5.8%	51.1% NB	134	8.8%	54.5% NB

[a] Daily traffic expressed in vehicles per day.
[b] Hourly traffic expressed in vehicles per hour.
[c] Percent of daily traffic volumes which occur during the peak hour.
[d] Percent of peak hour volume in the predominant direction of travel.

The Main Street corridor carries approximately 2,575 vehicles per day (vpd) on an average weekday. Directional distribution along the roadway is weighed in the southbound and northbound direction during the morning and evening peak hours, respectively. This is opposite from general commuter flows to/from the US Route 6 corridor approaching Interstate 195 (I-195). The peak hours along the Main Street corridor represent between 4.8% to 8.7% of the overall daily traffic. The average speed and the 85th percentile speed along Main Street northbound direction is 25 mph and 30 mph, respectively. The average speed and the 85th percentile speed along Main Street southbound direction is 23 mph and 28 mph, respectively. These speeds are generally below the statutory speed limit of the roadway but are consistent with the various friction elements present along the corridor.

The Middle Street corridor carries approximately 1,520 vpd on an average weekday. Directional distribution along the roadway is weighed in the northbound direction during the morning and evening peak hours. The peak hours along the Main Street corridor represent between 5.8% to 8.8% of the overall daily traffic. The average speed and the 85th percentile speed along Middle Street northbound direction is 24 mph and 24 mph, respectively. The average speed and the 85th percentile speed along Middle Street southbound direction is 22 mph and 28 mph, respectively. These speeds are generally below the statutory speed limit of the roadway but are consistent with the various friction elements present along the corridor.

Seasonal Adjustment

In accordance with MassDOT standards, traffic volumes are typically adjusted to average-month conditions. To account for seasonal adjustment, TEC utilized MassDOT's weekday seasonal and axle correction factors published in 2024 (the most recent year of the data). These factors provide a month-to-month overview of traffic volumes statewide by roadway functional classification and land (urban vs. rural) type. For urban minor arterial and local roadways, traffic volumes for the month of May were 9.0% higher (factor of 0.91) than the average-month conditions. Therefore, all traffic volumes within the study area were unadjusted to reflect a conservative condition. The compiled seasonal adjustment date is

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provided in Attachment C. The resulting 2025 Base Year Conditions weekday morning and weekday afternoon peak hour traffic volume network is illustrated in Figure 2.

Future Traffic Volumes

To determine traffic volumes under future year conditions, baseline traffic volumes in the area were projected to the year 2035 to provide a 10-year design horizon from the date of traffic counts. Traffic volumes on the roadway network at that time would include existing traffic and new traffic due to general background traffic growth, and traffic related to specific developments by others expected to be completed by 2035, if applicable. Consideration of these factors resulted in the development of the 2035 Future Year traffic volumes.

Background Growth

Traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an ambient growth rate for the area roadways and applies that percentage to all mainline and side street traffic volumes. The drawback to such a procedure is that some turning volumes may grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic. However, the drawback of this procedure is that the potential growth in population and development external to the project area would not be accounted for in the traffic projections.

To provide a conservative analysis framework, both procedures were used.

General Ambient Growth

To determine future traffic growth projections, TEC utilized MassDOT published year-by-year annual growth data between 2016 and 2019 to approximate annual growth in the area. The data indicates that for local roadways and urban minor arterial, traffic volumes grew 1.7% between 2016 and 2017, 0.3% between 2017 and 2018, and decreased by 0.4% between 2018 and 2019. This represents an approximate 0.53% increase in traffic per year on both local roadways and urban minor arterial. To provide a consistent analysis scenario, a 1.0% per year compounded annual background growth rate was used to account for potential future traffic growth external to the study area and any unforeseen development. The MassDOT annual growth data is provided in Attachment D.

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Not to Scale

Main Street & Middle Street - Fairhaven, MA

One-Way Flow Assessment

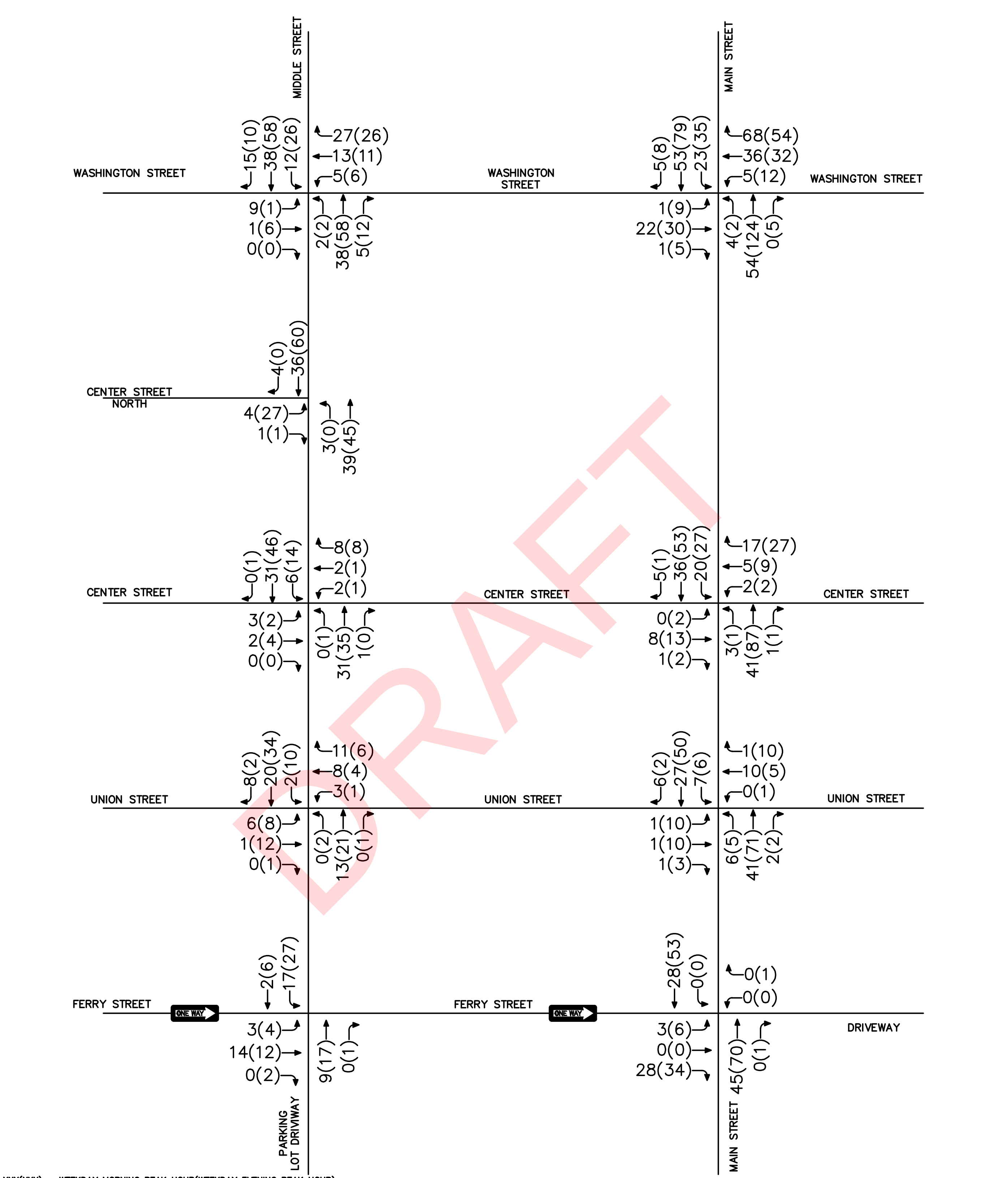

Figure 2

2025 Base Year Conditions
Weekday Morning and Weekday Evening
Peak Hour Traffic Volumes

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Specific Development by Others

TEC coordinated with the Town of Fairhaven Highway Superintendent to identify any nearby private and public development properties in the vicinity of the study area that are either in the planning process or were recently approved but not yet occupied. Based on these discussions, the town identified one (1) project that is in the vicinity of the study area in the planning process.

- *67 Middle Street Proposed Multi-Family Project* – The project falls within the 40R zones and is currently explored as a part 40R development which consist of three (3) three-story buildings with a total of 60 units. The project, located just north of the study area, is not expected to result in any substantial change in traffic volumes or traffic patterns at the study area intersections; however, it may be more impactful north of the study area approaching US Route 6. The majority of the site generated traffic by this development is expected to travel north from/to US Route 6 and I-195 and therefore any change in traffic traveling south though the study area is considered inclusive to the 1.0% per year background growth rate.

2035 Future Year Traffic Volumes – Existing Flow

The 2035 Future Year Condition traffic volumes were obtained by applying a 1.0% compounded annual growth rate to the 2025 Base Year Condition traffic volumes over the 10-year horizon period. The resulting 2035 Future Year Condition weekday morning and weekday evening peak hour traffic volume networks are illustrated in Figure 3.

Reassignment of Traffic Volumes – Proposed One-way Flow

The one-way flow condition along both Main Street and Middle Street between Washington Street and Ferry Street has been assessed based on the limited cross section allotted along each corridor while seeking to maintain on-street parking capabilities which is necessary to support the various commercial businesses and residential dwellings that line each corridor.

The proposed one-way flow traffic volumes consist of converting Main Street to one-way flow southbound between Washington Street and Union Street while converting Middle Street to one-way flow between Washington Street and Union Street. Although the assessment looks at these corridors an additional block south of Union Street (Ferry Street), two-way flow was maintained along Main Street and Middle Street for the single block between Union Street and Ferry Street to sufficiently provide an outlet for Ferry Street eastbound traffic. Note that Ferry Street is already a one-way eastbound roadway and this flow condition will be maintained. Traffic volumes were redistributed to study area corridors and side-street connections as necessary to support the flow conversion block-by-block;

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however, it is expected that drivers familiar with the area will correct themselves travelling to/from US Route 6 and to the north side of the town through various access roads.

2035 Future Year Traffic Volumes – One-way Flow

The 2035 Future Year Proposed Flow traffic volumes were obtained by adding the redistributed traffic volumes to the 2035 Future Year with Existing Flow traffic volumes. The resulting 2035 Future Year with Proposed Flow weekday morning and evening peak hour traffic volume networks are illustrated in Figure 4. An overall The Proposed One-way Flow graphical representation is depicted in Figure 5.

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Main Street & Middle Street - Fairhaven, MA

One-Way Flow Assessment

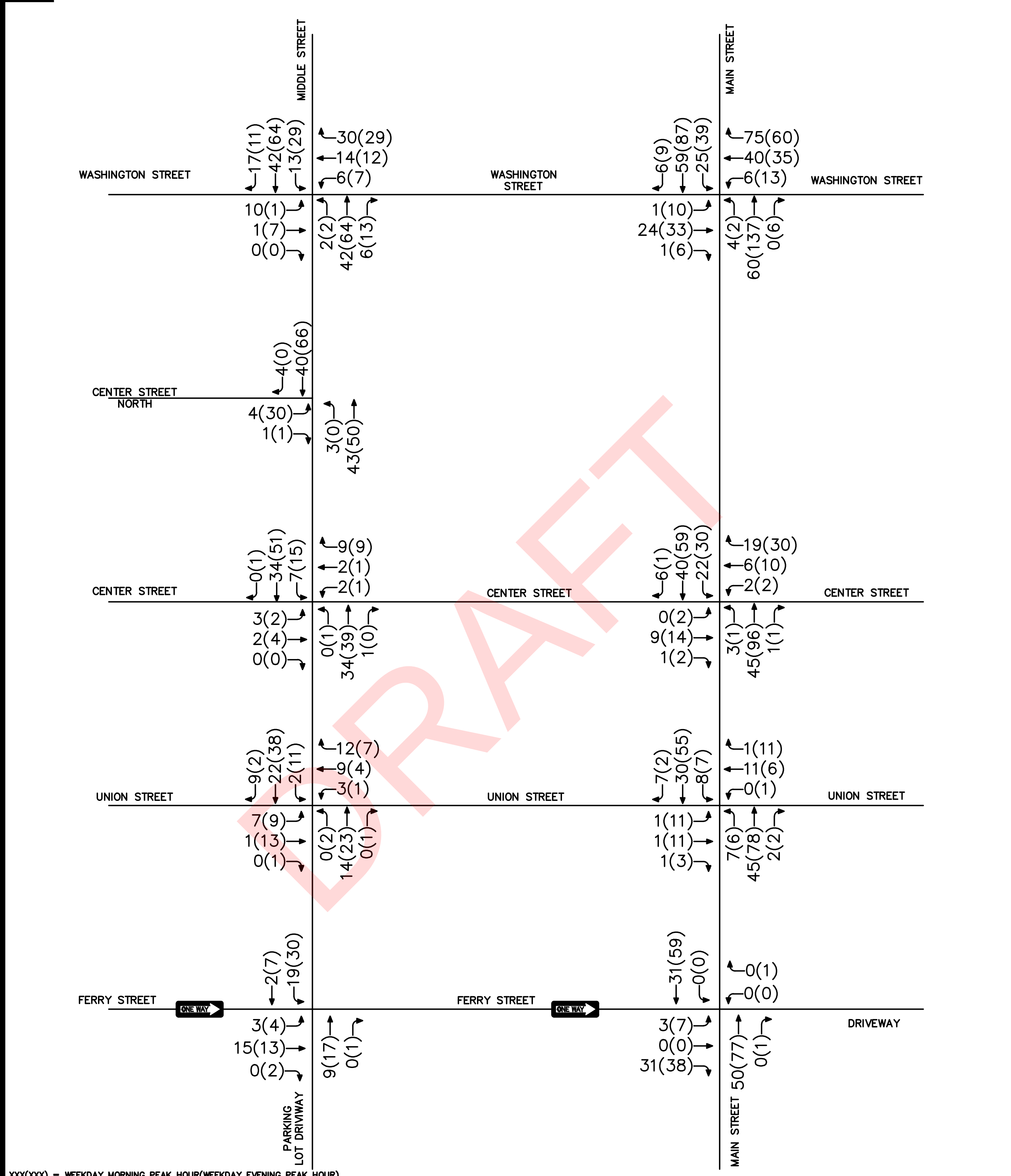

Figure 3

2035 Future Year Conditions
Weekday Morning and Weekday Evening Peak Hour Traffic Volumes

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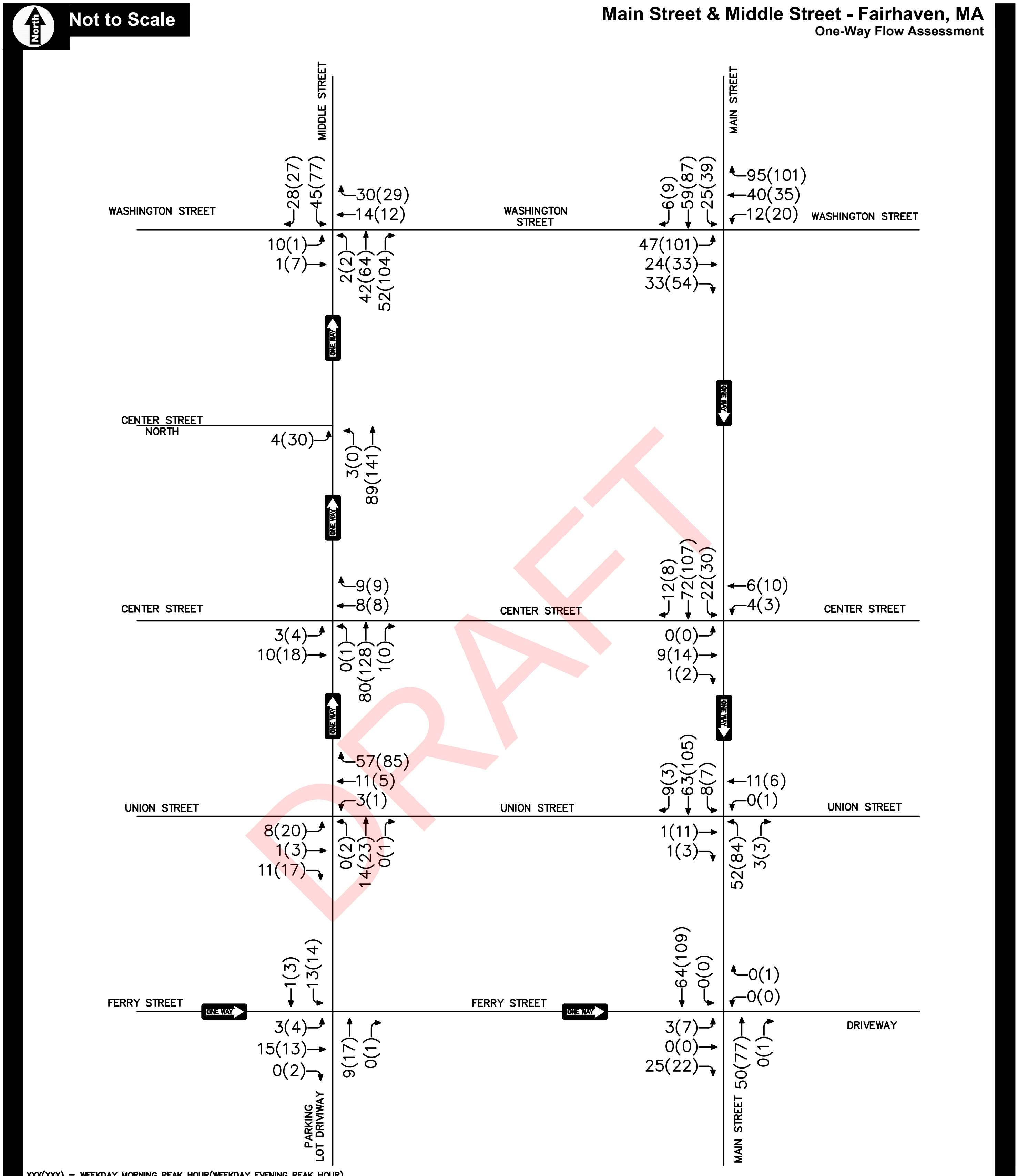

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Figure 4

2035 Future Year with Proposed One-Way Flow Conditions Weekday Morning and Weekday Evening Peak Hour Traffic Volumes

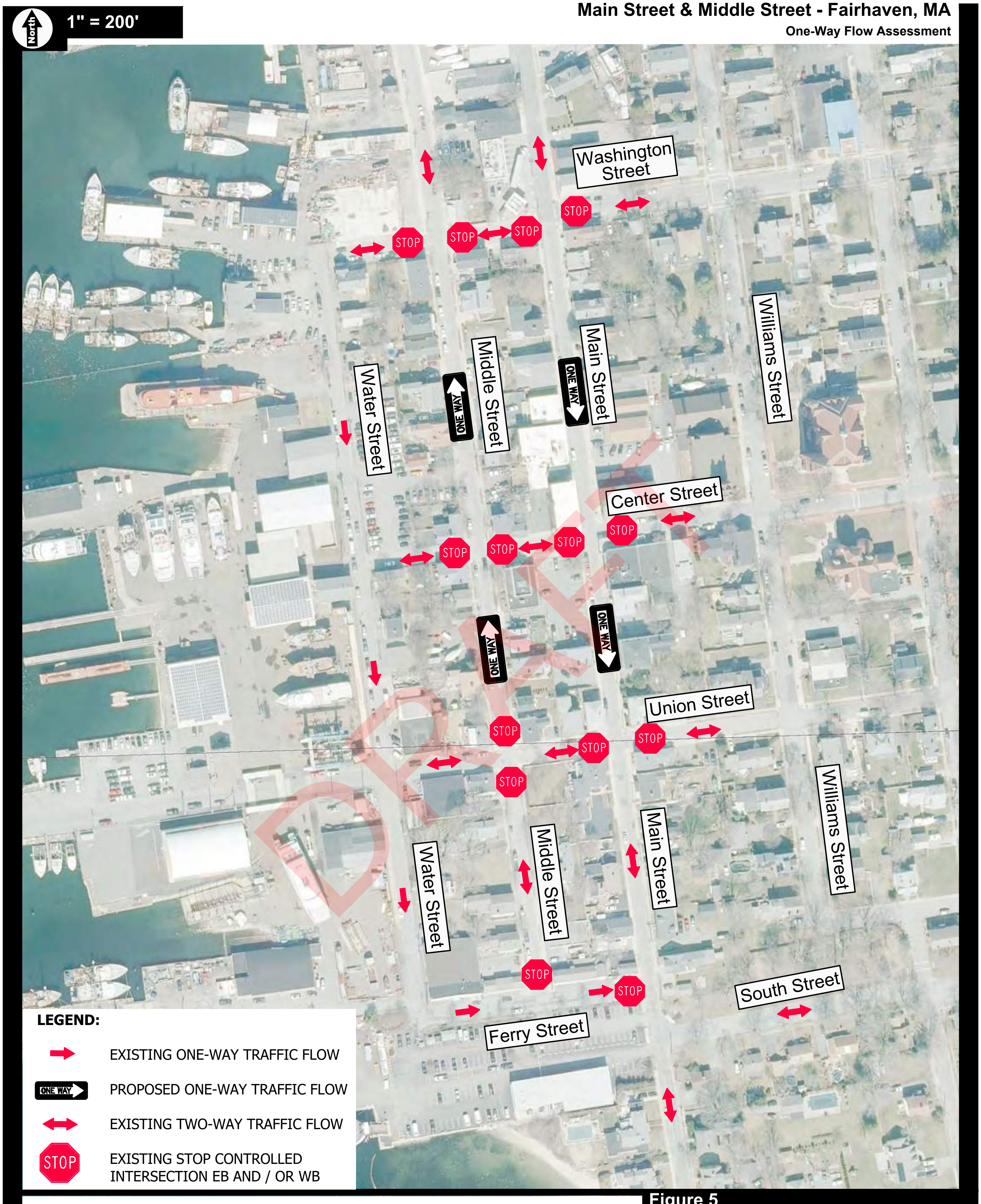

Figure 5

Proposed One-Way Traffic Flow Conditions

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SAFETY ANALYSIS

A comprehensive traffic safety analysis was conducted for the Main Street and Middle Street corridors and study area intersections. The traffic safety analysis included the compilation and examination of the crash data and a general safety review of sight distances along the corridor and at the study area intersections.

Crash Data

Crash data for the Main Street and Middle Street corridor and the study area intersections were compiled and analyzed for the most recent consecutive five-year period (2019-2023) on file from MassDOT on their Interactive Mapping Portal for Analysis (IMPACT) website. The motor vehicle crash data was reviewed to determine if any crash trends exist within the study area. Over the five-year period, a total of fifty-eight (58) total crashes were reported at the various study area intersections and along both the Main Street and Middle Street corridors. A summary of the vehicle crash data is provided in Table 2 (Main Street) and 3 (Middle Street). The compiled crash data are provided in Attachment E.

Segment Crash Evaluation

The crash data indicates that there was minimal crash history at the various study area intersections and along the Main Street and Middle Street corridors during the five-year study period. Each of the study area intersections experienced less than three (3) crashes per year which generally indicates no particular crash trend at any particular location; however, the crash data does provide safety considerations for the corridors as a whole.

A key aspect of the Main Street corridor is the overall number of sideswipe crashes that occurred. Forty percent (16 of 40 crashes) were sideswipe crashes which are consistent with the narrow cross-section and presence of on-street parking along the Main Street corridor. Of these sixteen (16) crashes, nine (9) involved an on-street parked vehicle. This also indicates a mix of conflicts with parked vehicles and conflicts vehicle-to-vehicle based on the narrowness of the corridor. Note that there were eleven (11) other crashes on the corridor / at the various intersections that involved a parked vehicle; of which five (5) was a backing vehicle attempting to park striking another parked vehicle. The peak commuter periods did not experience any significant number of crashes.

Middle Street experienced eighteen (18) crashes over the five-year study period. Over a quarter of the crashes (5 of 18 crashes) were sideswipe crashes of which two (2) involved a parked vehicle. Half (9 of 18 crashes) were angled type crashes over the various intersection locations which may indicate constricted sight lines from the side-street approaches. Contributing factors to these angled crashes were noted as failure to yield the right-of-way, inattention/distracted driving, and disregarding traffic controls.

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Table 2 – Crash History Summary – Main Street Intersections

Parameter		Main Street / Washington Street	Main Street / Center Street	Main Street / Union Street	Main Street / Ferry Street	Main Street Corridor
Crash Year	2019	2	3	1	0	0
	2020	2	1	3	0	2
	2021	1	3	2	0	3
	2022	1	5	5	0	1
	2023	0	2	0	0	3
	TOTAL	***6***	***14***	***11***	***0***	***9***
Average Annual		***1.2***	***2.8***	***1.8***	***0.0***	***1.8***
Manner of Collision	Angle	5	4	3	0	0
	Rear-end	0	5	0	0	1
	Sideswipe	1	3	5	0	7
	Single Vehicle	0	0	1	0	1
	Head-On	0	0	2	0	0
	Ped / Bike	0	0	0	0	0
	Not Reported	0	2	0	0	0
	TOTAL	***6***	***14***	***11***	***0***	***9***
Road Surface Conditions	Dry	4	11	10	0	9
	Wet	2	2	1	0	0
	Snow / Ice	0	0	0	0	0
	Other / Unknown	0	0	0	0	0
	TOTAL	***6***	***14***	***11***	***0***	***9***
Injury Status (Crash Severity)	Prop Damage	6	10	7	0	7
	Non-Fatal Injury	0	0	1	0	1
	Fatal Injury	0	0	0	0	0
	Not Reported	0	4	3	0	1
	TOTAL	***6***	***14***	***11***	***0***	***9***
Day of Week	Monday-Friday	3	10	8	0	5
	Saturday-Sunday	3	4	3	0	4
	TOTAL	***6***	***14***	***11***	***0***	***9***
Time of Day	6:00AM-9:00AM	1	0	2	0	1
	9:00AM-3:00PM	4	7	6	0	5
	3:00PM-6:00PM	0	3	1	0	2
	6:00PM-6:00AM	1	4	2	0	1
	TOTAL	***6***	***14***	***11***	***0***	***9***

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Table 3 – Crash History Summary – Middle Street Intersections

Parameter		Middle Street / Washington Street	Middle Street / Center Street	Middle Street / Union Street	Middle Street / Ferry Street	Middle Street Corridor
Crash Year	2019	1	1	0	0	0
	2020	4	1	3	0	1
	2021	0	0	0	0	1
	2022	0	0	0	1	0
	2023	1	0	1	0	3
	TOTAL	***6***	***2***	***4***	***1***	***5***
Average Annual		***1.2***	***0.4***	***0.8***	***0.2***	***1.0***
Manner of Collision	Angle	5	2	2	0	0
	Rear-end	0	0	1	1	1
	Sideswipe	1	0	1	0	3
	Single Vehicle	0	0	0	0	0
	Ped / Bike	0	0	0	0	0
	Not Reported	0	0	0	0	1
	TOTAL	***6***	***2***	***4***	***1***	***5***
Road Surface Conditions	Dry	3	2	4	1	3
	Wet	3	0	0	0	1
	Snow / Ice	0	0	0	0	0
	Other / Unknown	0	0	0	0	1
	TOTAL	***6***	***2***	***4***	***1***	***5***
Injury Status (Crash Severity)	Prop Damage	4	2	4	1	3
	Non-Fatal Injury	1	0	0	0	0
	Fatal Injury	0	0	0	0	0
	Not Reported	1	0	0	0	2
	TOTAL	***6***	***2***	***4***	***1***	***5***
Day of Week	Monday-Friday	5	2	4	1	4
	Saturday-Sunday	1	0	0	0	1
	TOTAL	***6***	***2***	***4***	***1***	***5***
Time of Day	6:00AM-9:00AM	3	0	0	0	0
	9:00AM-3:00PM	3	2	2	1	2
	3:00PM-6:00PM	0	0	1	0	1
	6:00PM-6:00AM	0	0	0	0	2
	TOTAL	***6***	***2***	***4***	***1***	***5***

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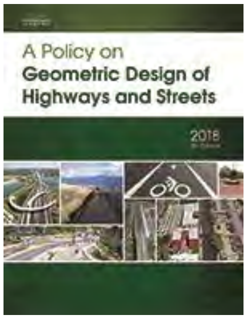
Sight Distances

During the March 2025 field inventory conducted by TEC staff, TEC measured the available sight distances at the side street intersections with Main Street and Middle Street. The available sight lines were compared to minimum requirements established by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance represents the length of roadway that is visible to a driver traveling within the roadway. Two types of sight distance are typically evaluated for driveways and intersections: stopping sight distance (SSD) and intersection sight distance (ISD). SSD is the minimum distance required for a driver traveling along a roadway to perceive an object in the roadway and stop safely in advance of the object when traveling on a wet pavement surface. SSD is measured from an eye height of 3.5 feet to an object height of 2 feet above the ground, which is equivalent to a driver viewing the taillight of a vehicle ahead. SSD is measured along the centerline of the travel lane approaching a driveway or intersection.



Current AASHTO 'Green Book' (2018)

ISD represents the length of the roadway visible to a driver waiting to exit a driveway or minor street. Minimum ISD requirements are based on the distance required for a driver to exit a minor street onto a major street without requiring an approaching vehicle to reduce its speed from the design speed to less than 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet and is measured from a distance 15 feet beyond the edge of the travel-way of the major roadway to represent a driver waiting to exit a driveway or minor roadway.

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SSD is typically considered the critical sight distance, as it represents the minimum distance required for safe stopping, while ISD represents an acceptable speed reduction for approaching vehicles. The ISD, however, must be at least equal to the minimum required SSD in order to prevent a driver from entering the roadway when an approaching vehicle is too close to safely stop. The guidance provided by AASHTO states:

> *"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."*

Sight distances as reported utilize the statutory speed (30-mph) as the measured 85th percentile speeds collected in May 2025 along the corridors was consistently at or less than the 30-mph statutory speed. Whereas drivers could legally operate at a higher speed than the measured speed, the higher of the two were utilized. In addition, the roadway grades entering the intersection from each approach were based on MassMapper web database (https://maps.massgis.digital.mass.gov/MassMapper/MassMapper.html). Table 4 provides a summary of the available ISD at the various intersections within the study area under the proposed one-way flow conditions, assuming no other improvements.

Table 4 – Existing Intersection Sight Distance Measurements

Approach / Direction	Statutory Speed [a]	AASHTO Desired Minimum	AASHTO Recommended Minimum	Measured Intersection Sight Distance [b]
Washington Street EB at Middle Street:				
Washington Street looking North [looking left]	30 MPH	335 FT	200 FT	180 FT [c]
Washington Street looking South [looking right]	30 MPH	335 FT	205 FT	50 FT [c]
Washington Street WB at Middle Street:				
Washington Street looking North [looking right]	30 MPH	335 FT	200 FT	85 FT [d]
Washington Street looking South [looking left]	30 MPH	335 FT	205 FT	100 FT [d]
Washington Street EB at Main Street:				
Washington Street looking North [looking left]	30 MPH	335 FT	195 FT	195 FT [c]
Washington Street WB at Main Street:				
Washington Street looking North [looking right]	30 MPH	335 FT	195 FT	105 FT [d]
Center Street EB at Middle Street:				
Center Street looking South [looking right]	30 MPH	335 FT	200 FT	50 FT [c]
Center Street WB at Middle Street:				
Center Street looking South [looking left]	30 MPH	335 FT	200 FT	240 FT
Center Street EB at Main Street:				
Center Street looking North [looking left]	30 MPH	335 FT	195 FT	120 FT [c]
Center Street WB at Main Street:				
Center Street looking North [looking right]	30 MPH	335 FT	195 FT	80 FT [d]
Middle Street NB at Union Street:				
Middle Street looking East [looking right]	30 MPH	335 FT	200 FT	65 FT [e]
Middle Street looking West [looking left]	30 MPH	335 FT	190 FT	120 FT [d]
Union Street EB at Main Street:				
Union Street looking North [looking left]	30 MPH	335 FT	200 FT	70 FT [c]
Union Street looking South [looking right]	30 MPH	335 FT	195 FT	40 FT [c]

[a] Operating speeds calculated as statutory speed.
[b] Assumes on-street parking lane is 7-feet wide where applicable with a minimum 20-feet from face of side-street curb absent of parking sign.
[c] Assumes vehicle is parked in on-street parking lane at first available stall.
[d] Visibility obstructed by building structure.
[e] Visibility obstructed by fence.
[f] Visibility obstructed by vegetation.

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Table 4 – Existing Intersection Sight Distance Measurements (Continued)

Approach / Direction	Statutory Speed [(a)]	AASHTO Desired Minimum	AASHTO Recommended Minimum	Measured Intersection Sight Distance
Union Street WB at Main Street:				
Union Street looking North [looking right]	30 MPH	335 FT	200 FT	120 FT [f]
Union Street looking South [looking left]	30 MPH	335 FT	195 FT	150 FT [f]
Middle Street SB at Ferry Street:				
Middle Street looking West [looking left]	30 MPH	335 FT	200 FT	60 FT [c]
Ferry Street EB at Main Street:				
Ferry Street looking North [looking left]	30 MPH	335 FT	205 FT	90 FT [c]
Ferry Street looking South [looking right]	30 MPH	335 FT	195 FT	230 FT

[a] Operating speeds calculated as statutory speed.
[b] Assumes on-street parking lane is 7-feet wide where applicable with a minimum 20-feet from face of side-street curb absent of parking sign.
[c] Assumes vehicle is parked in on-street parking lane at first available stall.
[d] Visibility obstructed by building structure.
[e] Visibility obstructed by fence.
[f] Visibility obstructed by vegetation.

Generally, the ISD at the several study area intersections do not exceed AASHTO minimum requirements for safe operations other than three (3) distinct locations. For many of the stop-controlled approaches, the visibility is restricted by the existing building structures / fences, on-street parked vehicles, and some street-side vegetation. Where restricted, the ISD could be extended or corrected with further implementation of all-way stop control (AWSC) at intersections, introduction of curb bump-outs, and other roadway pavement markings that establish the edge of travel way. If desired, on-street parking cold be limited in the vicinity of the intersections to further extend sight lines at key locations.

Under Section 2B.14 (Sight Distance) and Section 2B.18 (Other Factors) of the *Manual on Uniform Traffic Control Devices* (MUTCD), TEC generally recommends that the establishment of AWSC would generally be warranted to increase the safety characteristics of many locations where the sight distance is insufficient. Further discussion on the AWSC warranting characteristics is documented in the "Recommendation" section of this technical memorandum.

ONE-WAY FLOW ALTERNATIVES

Two (2) additional one-way flow alternatives were evaluated with minimal flow changes to the recommended proposed one-way alternative depicted in Figure 5. These alternatives are expected to have minimal to no impact on the traffic flow at study intersections and roadways compared to the recommended proposed one-way alternative.

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Alternative A

Alternative A consists of a slight modification to the proposed one-way traffic flow by extending the Middle Street one-way flow travel direction to Ferry Street and converting the Ferry Street section between Middle Street and Main Street to two-way flow. This would allow for Main Street northbound traffic south of Ferry Street to not be “trapped” and forced to utilize other streets such as South Street. The northbound traffic will have additional access to Middle Street via Ferry Street. Alternative A graphical representation is depicted in Figure 6.

Although not the recommended alternative, Alternative A has independent utility providing cross-sectional relief along each corridor for significant commercial stretches on Main Street in particular. The Alternative does result in additional impact to Ferry Street in particular as it requires one block of Ferry Street to become two-way flow to remove the potential “trap.” This block of Ferry Street is only 27 feet wide and would result in a narrow cross-section for two-way flow, albeit wider than Main Street or Middle Street. In addition, this change may invite accidental compliance issues along Ferry Street to the west and Water Street being one-way southbound under existing conditions may again result in vehicles becoming “trapped.”

Alternative B

With Alternative B, Main Street is converted from two-way to one-way in the northbound direction from Union Street to Washington Street while Middle Street is converted from two-way to one-way in the southbound direction from Washington Street to Ferry Street. The southbound traffic volumes at the Main Street / Washington Street intersection are expected to be redistributed to Middle Street and Water Street to the west and the various access parallel roadways, such as Green Street, to the east. The northbound Main Street traffic flow is not expected to change. The existing Middle Street northbound approach is expected to utilize Main Street as a primary route to access Middle Street and the north side of the Town. The Alternative B graphical representation is depicted in Figure 7.

Although not the recommended alternative, Alternative B has independent utility providing cross-sectional relief along each corridor for significant commercial stretches on Main Street in particular. The Alternative does result in additional impact and circulation on several cross streets, as both Water Street and Middle Street, which are adjacent parallel streets, would be one-way in the same southbound direction.

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1" = 200'

Main Street & Middle Street - Fairhaven, MA

One-Way Flow Assessment

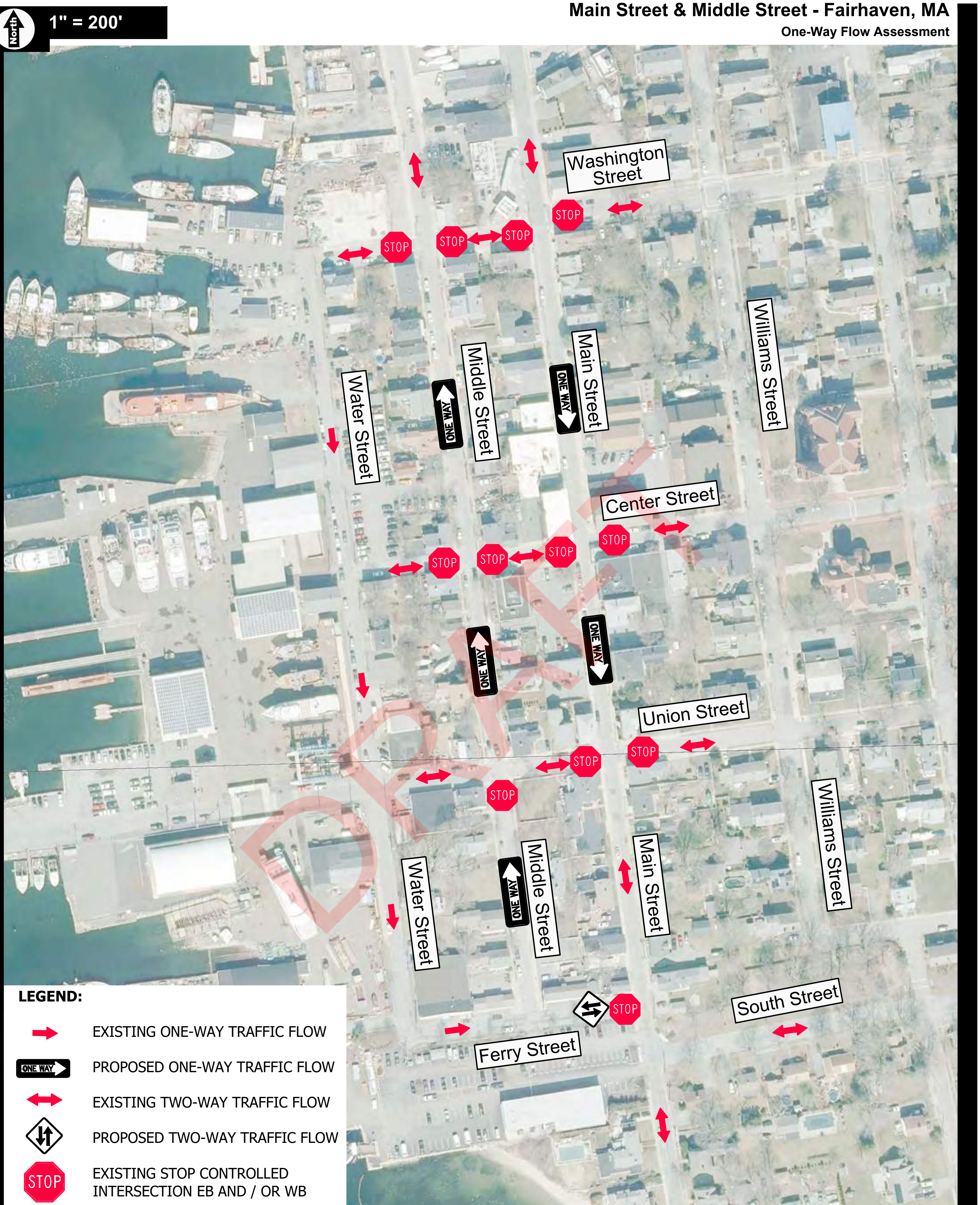

Figure 6

Alternative A

TEC
The Engineering Corp
TEC, Inc.
282 Merrimack Street, 2nd Floor
Lawrence, MA 01843
978-794-1792
www.TheEngineeringCorp.com

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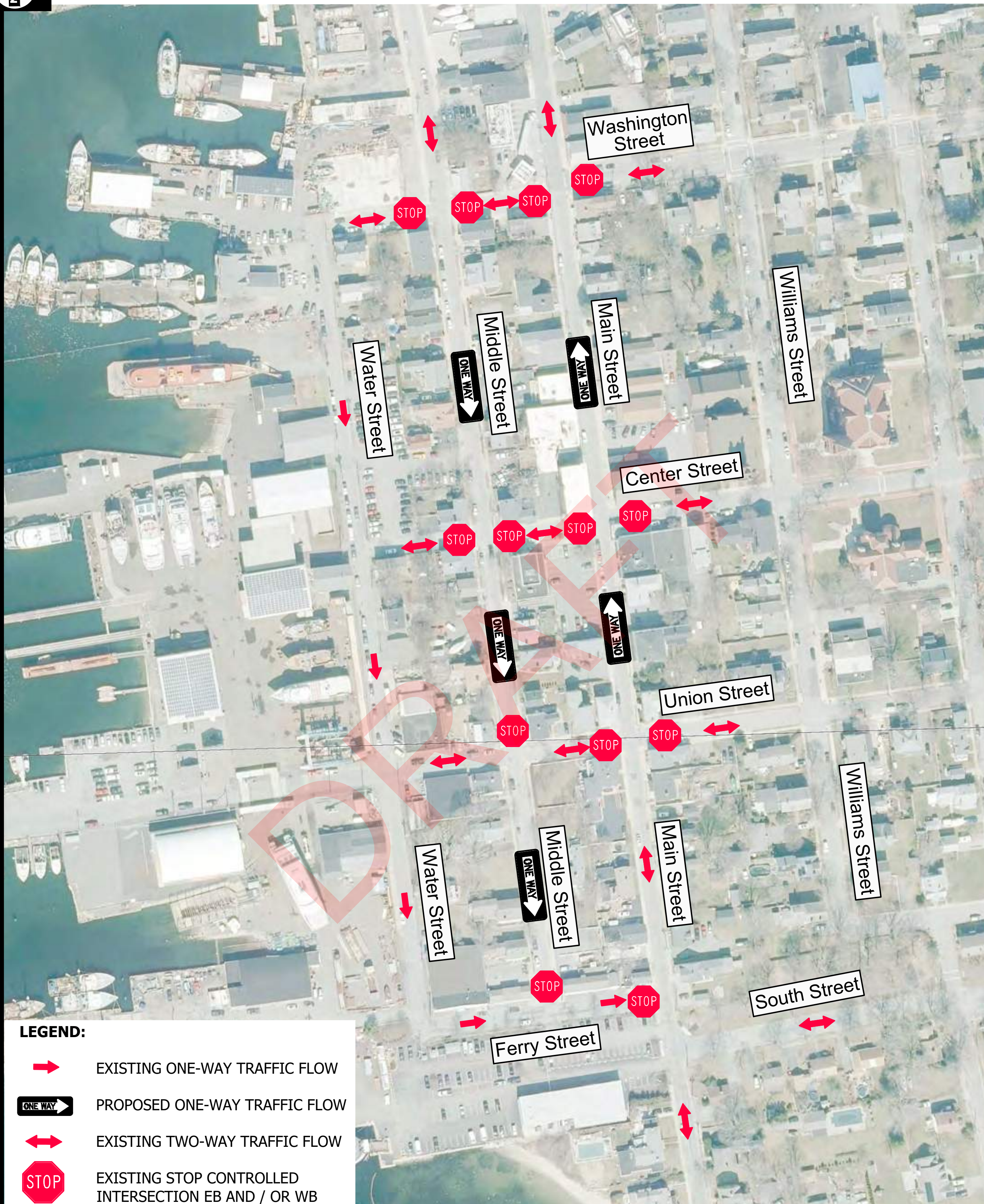
Main Street & Middle Street - Fairhaven, MA

One-Way Flow Assessment

North 1" = 200'



LEGEND:

- EXISTING ONE-WAY TRAFFIC FLOW
- ONE WAY — PROPOSED ONE-WAY TRAFFIC FLOW
- EXISTING TWO-WAY TRAFFIC FLOW
- STOP — EXISTING STOP CONTROLLED INTERSECTION EB AND / OR WB

Figure 7

Alternative B

TEC
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TRAFFIC IMPACT ANALYSIS

To assess the quality of future traffic flow with each alternative, roadway capacity and vehicle queue analyses were conducted under 2025 Base Year Conditions and 2035 Future Year Conditions for the existing and proposed one-way flow. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study. Synchro 12™ software was used to perform the analysis.

Levels of Service

A primary result of capacity analysis is the assignment of level-of-service to traffic facilities under various traffic-flow conditions.[2] The concept of level-of-service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level of service (LOS) A representing the best operating conditions and LOS F representing the worst. Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

Queue Length Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the *Synchro 12™* intersection capacity analysis software, which is also based upon the methodology and procedures presented in the *Highway Capacity Manual* (*HCM), 7th Edition*. Synchro reports the 95th percentile queues for unsignalized intersections and both the 50th (average) and 95th percentile vehicle queues for signalized intersections, which are based on the number of vehicles that experience a delay of six seconds or more at an intersection and is a function of the traffic signal timing; vehicle arrival patterns during the analysis period; and the saturation flow rate. The 50th percentile or average vehicle queue is the average number of vehicles that are projected to be delayed by six seconds or more at the intersection under study during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only five percent of the time, or approximately three minutes out of 60 minutes during the peak one hour of

[2] The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual 7th Edition*; Transportation Research Board; Washington, DC; 2022

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the day. During the remaining 57 minutes, the vehicle queue length will be less than the 95th percentile queue length.

Parameters for Traffic Impact Analysis

Unsignalized Intersections

The levels of service of two-way stop-controlled unsignalized intersections are determined by application of a procedure described in the *HCM 7th Edition*. Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and stop signs. Control delay includes the effects of initial deceleration delay approaching a stop sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the *HCM 7th Edition*. Table 5 summarizes the relationship between level of service and average control delay for unsignalized intersections.

Table 5 – Level of Service Criteria for Unsignalized Intersections [a]

Level of Service (v/c ≤ 1.0)	Level of Service (v/c > 1.0)	Average Control Delay (sec/veh)	Description
A	F	≤10.0	LOS A represents a condition with little or no control delay to minor street traffic.
B	F	10.1 to 15.0	LOS B represents a condition with short control delays to minor street traffic.
C	F	15.1 to 25.0	LOS C represents a condition with average control delays to minor street traffic.
D	F	25.1 to 35.0	LOS D represents a condition with long control delays to minor street traffic.
E	F	35.1 to 50.0	LOS E represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
F	F	>50.0	LOS F represents a condition where minor street demand volume exceeds capacity of an approach lane, with excessive control delays resulting.

[a] Source: *Highway Capacity Manual 7th Edition*; Transportation Research Board; Washington D.C.; 2022

Intersection Capacity and Queue Analysis Results

Overall, all the intersections under the 2025 Base Year Condition, 2035 Future Year Condition, and the 2035 Future Redistributed Condition (One-Way Flow) are expected to operate at levels of service (LOS B or better) with volume-to-capacity (v/c) ratios well below 1.00 indicating that adequate capacity exists at the intersection to accommodate the projected traffic volume conditions and under the one-way flow alternatives. The results of the intersection capacity and queue analysis are summarized in Table 6. The capacity analysis worksheets are provided in Attachment F.

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Table 6 – Intersection Capacity and Queue Analysis Summary

Intersection / Lane Group	2025 Base Year Condition				2035 Future Year with Existing Condition				2035 Future Redistributed Condition (One-Way Flow)			
	V/C[a]	Delay[b]	LOS[c]	Queue[d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Middle Street / Washington Street												
Weekday AM Peak Period												
Washington Street EB	0.03	10.0	B	<25	0.02	9.8	A	<25	0.02	7.8	A	<25
Washington Street WB	0.07	9.4	A	<25	0.06	9.3	A	<25	0.05	7.1	A	<25
Middle Street NBL	0.00	7.3	A	<25	0.00	7.3	A	<25	-	-	-	-
Middle Street NB	-	-	-	-	-	-	-	-	0.11	7.2	A	<25
Middle Street SBL	0.01	7.3	A	<25	0.01	7.3	A	<25	-	-	-	-
Middle Street SB	-	-	-	-	-	-	-	-	0.09	7.4	A	<25
Weekday PM Peak Period												
Washington Street EB	0.03	11.1	B	<25	0.01	10.6	B	<25	0.01	7.6	A	<25
Washington Street WB	0.07	10.1	B	<25	0.06	9.7	A	<25	0.05	7.3	A	<25
Middle Street NBL	0.00	7.4	A	<25	0.00	7.4	A	<25	-	-	-	-
Middle Street NB	-	-	-	-	-	-	-	-	0.19	7.7	A	<25
Middle Street SBL	0.02	7.7	A	<25	0.02	7.5	A	<25	-	-	-	-
Middle Street SB	-	-	-	-	-	-	-	-	0.14	8.0	A	<25
Middle Street / Center Street												
Weekday AM Peak Period												
Center Street EB	0.01	9.4	A	<25	0.01	9.3	A	<25	0.02	9.5	A	<25
Center Street WB	0.02	9.0	A	<25	0.02	8.9	A	<25	0.02	9.2	A	<25
Middle Street NBL	-	-	-	-	-	-	-	-	-	-	-	-
Middle Street SBL	0.01	7.3	A	<25	0.01	7.3	A	<25	-	-	-	-
Weekday PM Peak Period												
Center Street EB	0.02	10.2	B	<25	0.01	9.7	A	<25	0.03	9.9	A	<25
Center Street WB	0.02	9.1	A	<25	0.01	8.8	A	<25	0.02	9.5	A	<25
Middle Street NBL	0.00	7.3	A	<25	0.00	7.3	A	<25	0.0	7.2	A	<25
Middle Street SBL	0.01	7.4	A	<25	0.01	7.3	A	<25	-	-	-	-

[a] Volume-to-capacity ratio,
[b] Delay expressed in seconds per vehicle (average)
[c] Level of service
[d] 95th Percentile Queue

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Table 6 – Intersection Capacity and Queue Analysis Summary (Continued)

	2025 Base Year Condition				2035 Future Year with Existing Condition				2035 Future Redistributed Condition (One-Way Flow)			
Intersection / Lane Group	V/C[a]	Delay[b]	LOS[c]	Queue[d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Middle Street / Union Street												
Weekday AM Peak Period												
Union Street EBL	0.00	7.3	A	<25	0.01	7.3	A	<25	-	-	-	-
Union Street EB	-	-	-	-	-	-	-	-	0.02	6.8	A	<25
Union Street WBL	0.00	7.2	A	<25	0.00	7.2	A	<25	-	-	-	-
Union Street WB	-	-	-	-	-	-	-	-	0.07	6.8	A	<25
Middle Street NB	0.02	9.5	A	<25	0.02	9.5	A	<25	0.02	7.4	A	<25
Middle Street SB	0.05	9.3	A	<25	0.04	9.2	A	<25	-	-	-	-
Weekday PM Peak Period												
Union Street EBL	0.01	7.3	A	<25	0.01	7.2	A	<25	-	-	-	-
Union Street EB	-	-	-	-	-	-	-	-	0.05	7.1	A	<25
Union Street WBL	0.00	7.2	A	<25	0.00	7.2	A	<25	-	-	-	-
Union Street WB	-	-	-	-	-	-	-	-	0.09	6.80	A	<25
Middle Street NB	0.07	9.7	A	<25	0.03	9.4	A	<25	0.03	7.3	A	<25
Middle Street SB	0.07	9.6	A	<25	0.06	9.5	A	<25	-	-	-	-
Middle Street / Ferry Street												
Weekday AM Peak Period												
Ferry Street EBL	0.00	7.2	A	<25	0.00	7.2	A	<25	0.00	7.2	A	<25
Middle Street NB	0.01	9.3	A	<25	0.01	9.3	A	<25	0.01	9.3	A	<25
Middle Street SB	0.03	8.9	A	<25	0.02	8.9	A	<25	0.02	8.9	A	<25
Weekday PM Peak Period												
Ferry Street EBL	0.01	7.2	A	<25	0.00	7.2	A	<25	0.00	7.2	A	<25
Middle Street NB	0.05	9.5	A	<25	0.02	9.3	A	<25	0.02	9.3	A	<25
Middle Street SB	0.06	9.4	A	<25	0.04	9.1	A	<25	0.02	9.0	A	<25

[a] Volume-to-capacity ratio,
[b] Delay expressed in seconds per vehicle (average)
[c] Level of service
[d] 95th Percentile Queue

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Table 6 – Intersection Capacity and Queue Analysis Summary (Continued)

	2025 Existing Year Condition				2035 Future Year with Existing Condition				2035 Future Redistributed Condition (One-Way Flow)			
Intersection / Lane Group	V/C[a]	Delay[b]	LOS[c]	Queue[d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Main Street / Washington Street												
Weekday AM Peak Period												
Washington Street EB	0.04	10.5	B	<25	0.04	10.5	B	<25	0.13	7.8	A	<25
Washington Street WB	0.15	10.1	B	<25	0.16	10.1	B	<25	0.17	7.7	A	<25
Main Street NBL	0.00	7.3	A	<25	0.00	7.3	A	<25	-	-	-	-
Main Street SBL	0.02	7.4	A	<25	0.02	7.4	A	<25	-	-	-	-
Main Street SB	-	-	-	-	-	-	-	-	0.12	8.2	A	<25
Weekday PM Peak Period												
Washington Street EB	0.12	12.2	B	<25	0.10	12.0	B	<25	0.25	8.9	A	<25
Washington Street WB	0.18	11.4	B	<25	0.17	11.3	B	<25	0.20	8.4	A	<25
Main Street NBL	0.00	7.4	A	<25	0.00	7.4	A	<25	-	-	-	-
Main Street SBL	0.03	7.6	A	<25	0.03	7.6	A	<25	-	-	-	-
Main Street SB	-	-	-	-	-	-	-	-	0.20	9.0	A	<28
Main Street / Center Street												
Weekday AM Peak Period												
Center Street EB	0.02	9.9	A	<25	0.02	10.0	B	<25	0.01	9.9	A	<25
Center Street WB	0.04	9.2	A	<25	0.03	9.2	A	<25	0.02	10.0	B	<25
Main Street NBL	0.00	7.3	A	<25	0.00	7.3	A	<25	-	-	-	-
Main Street SBL	0.02	7.3	A	<25	0.02	7.3	A	<25	0.02	7.2	A	<25
Weekday PM Peak Period												
Center Street EB	0.03	10.4	B	<25	0.03	10.6	B	<25	0.03	10.3	B	<25
Center Street WB	0.06	9.6	A	<25	0.06	9.6	A	<25	0.02	10.4	B	<25
Main Street NBL	0.00	7.3	A	<25	0.00	7.3	A	<25	-	-	-	-
Main Street SBL	0.02	7.5	A	<25	0.02	7.5	A	<25	0.02	7.3	A	<25

[a] Volume-to-capacity ratio,
[b] Delay expressed in seconds per vehicle (average)
[c] Level of service
[d] 95th Percentile Queue

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Table 6 – Intersection Capacity and Queue Analysis Summary (Continued)

	2025 Existing Year Condition				2035 Future Year with Existing Condition				2035 Future Redistributed Condition (One-Way Flow)			
Intersection / Lane Group	V/C[a]	Delay[b]	LOS[c]	Queue[d]	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
Main Street / Union Street												
Weekday AM Peak Period												
Union Street EB	0.01	9.3	A	<25	0.00	9.2	A	<25	0.00	6.9	A	<25
Union Street WB	0.02	9.8	A	<25	0.02	9.7	A	<25	0.01	7.3	A	<25
Main Street NBL	0.00	7.3	A	<25	0.01	7.3	A	<25	-	-	-	-
Main Street NB	-	-	-	-	-	-	-	-	0.07	7.5	A	<25
Main Street SBL	0.01	7.3	A	<25	0.01	7.3	A	<25	-	-	-	-
Main Street SB	-	-	-	-	-	-	-	-	0.10	7.4	A	<25
Weekday PM Peak Period												
Union Street EB	0.05	10.2	B	<25	0.04	10.0	B	<25	0.02	7.3	A	<25
Union Street WB	0.03	9.5	A	<25	0.02	9.4	A	<25	0.01	7.5	A	<25
Main Street NBL	0.00	7.4	A	<25	0.00	7.3	A	<25	-	-	-	-
Main Street NB	-	-	-	-	-	-	-	-	0.11	7.8	A	<25
Main Street SBL	0.01	7.4	A	<25	0.01	7.4	A	<25	-	-	-	-
Main Street SB	-	-	-	-	-	-	-	-	0.14	7.7	A	<25
Main Street / Ferry Street												
Weekday AM Peak Period												
Ferry Street EB	0.05	8.7	A	<25	0.05	8.8	A	<25	0.04	6.9	A	<25
Private Driveway WB	-	-	-	-	-	-	-	-	-	-	-	-
Main Street NB	-	-	-	-	-	-	-	-	0.06	7.3	A	<25
Main Street SB	-	-	-	-	-	-	-	-	0.11	7.6	A	<25
Weekday PM Peak Period												
Ferry Street EB	0.05	9.0	A	<25	0.06	9.0	A	<25	0.04	7.2	A	<25
Private Driveway WB	0.00	8.7	A	<25	0.00	8.7	A	<25	0.00	6.9	A	<25
Main Street NB	-	-	-	-	-	-	-	-	0.10	7.6	A	<25
Main Street SB									0.17	7.9	A	<25

[a] Volume-to-capacity ratio,
[b] Delay expressed in seconds per vehicle (average)
[c] Level of service
[d] 95th Percentile Queue

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RECOMMENDATIONS

TEC recommends that the Town of Fairhaven implement one-way flow along Main Street and Middle Street between Washington Street to the north and Union Street to the south. Main Street would operate one-way in a southbound direction and Middle Street world would operate in a northbound direction. All other flow conditions within the study area would be retained. The basis of the change in flow conditions includes:

- Reduction in conflicts for the opposing traffic streams which limited cross-section while retaining much needed on-street parking. This would be expected to reduce the predicted occurrence of sideswipes, angle-type, and head-on crashes.
- Removal of the degraded sight line condition at stop-control side-streets in at least one direction of existing travel.
- Provides for increased cross-sectional width for vehicular flow with on-street parking needs while offering an improved experience for bicycle users. This could be further enhanced with the introduction of bicycle lanes.
- No significant detriment to traffic operations based on the minimal traffic volumes currently utilizing these roadways and cross-streets.

<u>**Traffic Control Considerations**</u>

In addition to changes in the flow conditions, TEC recommends the following considerations for traffic control changes along the Middle Street and Main Street corridors:

- TEC recommends consideration of AWSC at the following intersections which serve as an end point for the proposed change in flow conditions (one-way vs. two-way) which upon installation would result in opposing approaches with different flow conditions. This introduces a basis for this change in stop-control as noted in Section 2B.17(01)(A) of the MUTCD which denotes a need to control left-turn conflicts which may experience hesitation and confusion, leading to conflict, at the point of flow change. In addition, ISD at these intersections is significantly deficient and warrants AWSC under Section 2B.14 of the MUTCD:
    - Middle Street / Washington Street
    - Middle Street / Union Street
    - Main Street / Washington Street
    - Main Street / Union Street

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- TEC recommends consideration of AWSC at the intersection of Main Street / Ferry based on its limitations to ISD under Section 2B.14 of the MUTCD and its proximity to the terminus point of the Phoenix Bike Trail which introduces a separate conflict potential near the intersection.

The capacity and queue analysis provided in this technical memorandum depicts the AWSC condition at each of these intersection locations. As noted, the operations at these intersections are generally at acceptable levels of service. TEC anticipates that the change in flow condition, as well as any change in traffic control from two-way stop control (TWSC) to AWSC would have minimal impact on vehicular operations, as well as emergency vehicle operations along each corridor.

Note that the ISD conditions at each of the study area intersections would surpass the AWSC warrant under Section 2B.14 of the MUTCD. Prior to implementation at the above-mentioned intersections and the intersections at Center Street, the Town of Fairhaven should evaluate the opportunity to restrict on-street parking within the sight triangle area for those locations where on-street parking is the limiting factor.

Necessary Traffic Signs and Pavement Markings

Implementing one-way flow along Middle Street and Main Street will necessitate, at a minimum, new traffic signs at each intersection to reinforce the flow on each approach. This would be expected to include combinations of turn restriction signage (R3-1 & R3-2), "Do Not Enter" (R5-1) signs, and "One Way" (R6-1) signs. Prior to changes in traffic control, the Town should also seek to install and/or upgrade stop signs (R1-1) and stop lines at the designated locations where some existing infrastructure is faded, damaged, and/or missing. Where new traffic control is introduced, the Town should install additional stop signs (R1-1) and stop lines, as well as "All Way" plaques (R1-3p) where needed. A proposed one-way flow signage plan is depicted in Figure 8.

Other Considerations

In addition to base traffic signs and pavement markings to reinforce flow conditions and traffic control conditions, the Town should further explore upgrades to parking traffic signs and pavement markings to denote the specific location of on-street parking to maintain a consistent sight line condition from each stop-controlled approach. In addition, The Town should consider the introduction of bicycle lanes along Main Street and Middle Street within the one-way flow zones between Washington Street and Union Street where cross-sectional space is now allotted to support bicycle flow. Finally, the Town should consider modifications to the curb lines near intersections to support curb extensions in order to shorten pedestrian crossing distances, protect on-street parking, and extend sight lines, where possible.

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Main Street & Middle Street - Fairhaven, MA
One-Way Flow Assessment

1" = 200'

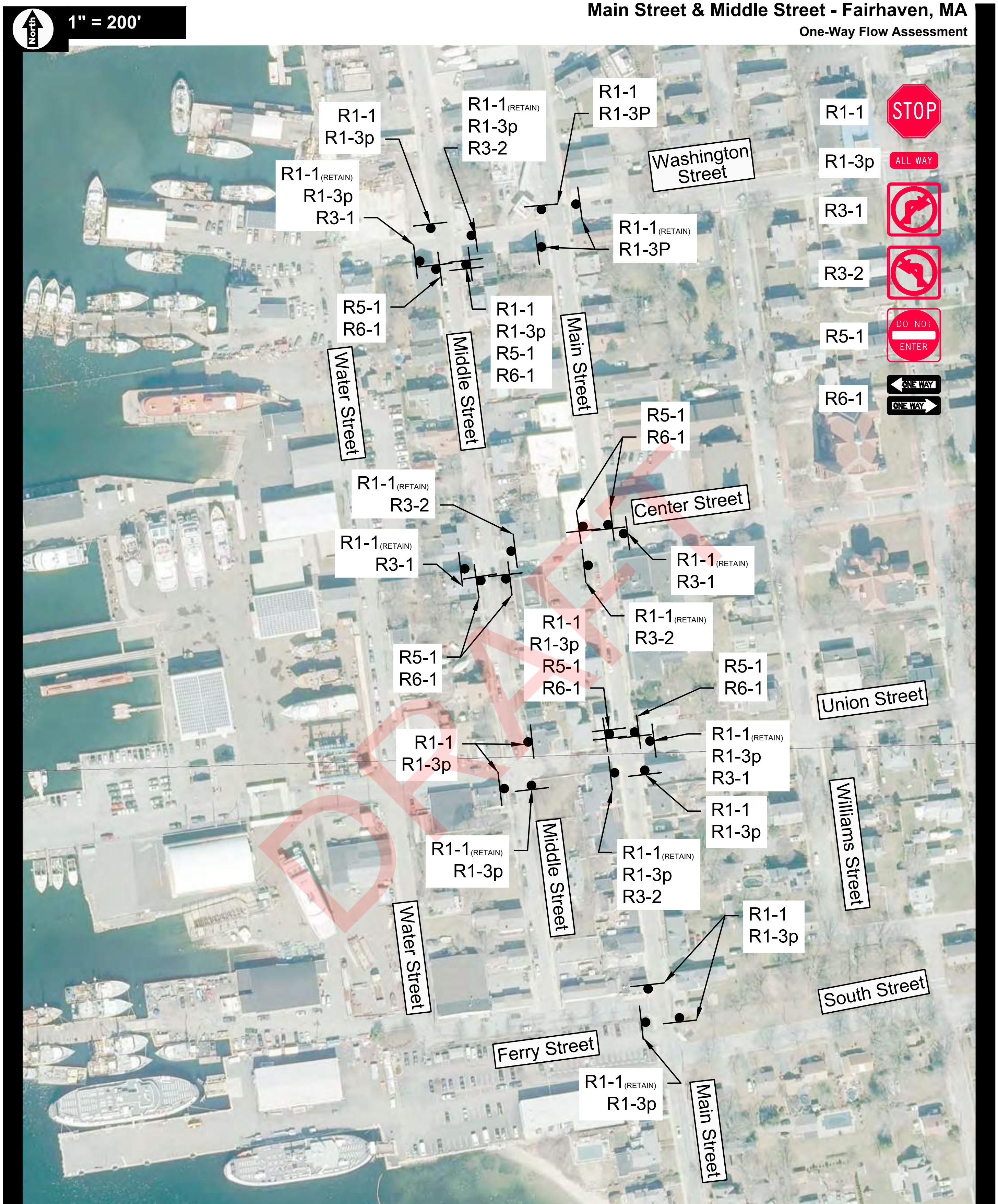

Figure 8

Proposed One-Way Traffic Flow & AWSC Traffic Signage Plan

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978-794-1792
www.TheEngineeringCorp.com

T:\T1680\Task 3 - One Way Flow studies\Study Area # 1\CAD\Highway\Graphics\T1680 - One Way Locus-Alt-signane plan.dwg 9/25/2025 2:26:14 PM