


MEMORANDUM

DATE: December 1, 2021

TO: Mr. Jamie Ponte
Commissioner
Department of Public Infrastructure
1105 Shawmut Avenue
New Bedford, Massachusetts 02746

FROM: Daniel J. Mills, P.E., PTOE – Principal 
Daniel A. Dumais, P.E. – Senior Project Manager

RE: **Response to Comments - Peer Review of Traffic Memorandum**
Proposed Marijuana Dispensary
366 Hathaway Road, New Bedford, MA

MDM Transportation Consultants, Inc. (MDM) has prepared the following responses to transportation-related comments as issued in a letter to you by CDM Smith dated November 10, 2021. To facilitate review, specific comments are paraphrased with corresponding responses. MDM notes that this project does not meet or exceed the transportation related thresholds (e.g., trip generation, parking, etc.) for Massachusetts Environmental Policy Act (MEPA) review; therefore, comments regarding MassDOT TIA guidelines and required analysis under the MEPA review process are not warranted as indicated in the responses below. In addition, the traffic impact assessment (TIA) prepared as part of the project application was scoped in accordance by the City staff as not requiring a formal traffic study.

Overview

Comment 1: "The project proponent should add a study location i.d. to the Hathaway Road at Self Storage Driveway intersection on Figure 1 - Site Location."

Response: **Figure 1** has been updated to add the Hathaway Road at Self-Storage Driveway and is provided in the **Attachments** for reference.

Comment 2: "The project proponent should clarify that mainline traffic along Hathaway Road will continue to operate as LOS A during the peak hours at the unsignalized intersections."

Response: MDM concurs that the mainline traffic along Hathaway Road will continue to operate with minimal delay (LOS A) during the peak hours at the unsignalized study intersections. No further response required.

Project Description

Comment 3: *"The project proponent should show proposed bike parking, dimensions, and roadway geometry on Figure 2 - Preliminary Site Plan."*

Response: The Figure 2 – Preliminary Site Plan as included in the traffic report is for contextual purposes only. The Project's official site plans are provided by the site engineer, Hayes Engineering, and should be referred to for details regarding bike parking, dimensions and site geometry.

Comment 4: *"The project proponent should include AutoTURN drawings to show the routing for the design, delivery, emergency response, and trash removal vehicles."*

Response: AutoTURN analysis has been completed for the proposed site layout using the City's Engine 7 Pump Truck, a delivery van, and refuse truck. The site layout provide maneuvering area for these design vehicles. Supporting AutoTURN® analysis and exhibits are provided to confirm this finding (refer to the **Attachments**).

Comment 5: *"The project proponent should provide the distance between the existing self-storage driveway and the proposed access drive."*

Response: Modifications are proposed at the existing site driveway in order to provide improved alignment with the Route 140 southbound off-ramp, reduced curb cut width and improved definition and separation to the adjacent commercial driveway to the east of the site. The distance between the proposed access driveway opposite the Route 140 southbound ramps and the existing self-storage driveway is approximately 130 feet center to center.

Comment 6: *"The project proponent should describe where delivery vehicles will park, and what their impact will be on traffic flow."*

Response: Deliveries will be made via van-type vehicles which are expected to use one of the employee designated parking spaces. As such, there is not impact expected to site traffic flow.

Comment 7: *"The project proponent describes the facility as "medical and/or adult use retail sales". The project proponent should confirm whether this facility is governed by ADA 208.2.1, which would require that 10% of parking spaces be accessible; the current design provides accessible parking at 4.3% of spaces."*

Response: The proposed use is not considered a Hospital Outpatient Facility and therefore requirements under ADA 208.2.1 do not apply.

Baseline Traffic & Safety Characteristics

Comment 8: *"The project proponent should include transit information (MassDOT TIA Guidelines, 3.II.I)."*

Response: As stated in the latest MassDOT TIA Guidelines dated 3-13-2014:

"The primary purpose of the TIA Guidelines is to provide the planning and the preliminary level of engineering analysis to ensure consistency, adequacy, and comprehensiveness in the basic information included in the transportation analysis sections of environmental documents submitted to Commonwealth agencies for review. These guidelines generally apply to all projects subject to MEPA that trigger transportation thresholds. Specific and unique requirements may be noted in the Certificate of the Secretary of the Executive Office of Energy and Environmental Affairs (EOEEA) on an Environmental Notification Form (ENF), Expanded ENF for a project, or a Notice of Project Change (NPC)."

Given that the project does not meet any MEPA thresholds and the project is not taking any credit for public transit use this recommendation is not warranted for this project. Nevertheless, the Southeastern Regional Transit Authority (SRTA) provides transit service to New Bedford and area communities. Bus 8, the closest bus route, travels along Mount Pleasant Street and is located approximately 0.75 mile from the site.

Comment 9: *"The project proponent should also conduct a multi-modal network and pedestrian and bicycle facilities review (MassDOT TIA Guidelines 5.I.B)."*

Response: See Response 8, this recommendation is not warranted for this project. That said, ADA accessible sidewalk is limited in the immediate area to a 0.25 mile stretch to the west of the site along the southerly side of Hathaway Road. A substandard sidewalk in poor condition is located to the east of the site along the southerly side of Hathaway Road. Per New Bedford's "A Guide to the City's Bike Paths" there are no bicycle paths provided within 1-mile of the site.

Comment 10: *"The project proponent should show crashes involving non-motorized modes (pedestrians and bicycles) in Table 1 – Intersection Crash Summary. "*

Response: The intersection crash summary has been updated to include pedestrian and bicycle type crashes (see **Table R1**).

TABLE R1
INTERSECTION CRASH SUMMARY
2016 THROUGH 2020¹

Data Category	INTERSECTION			
	Hathaway Rd at Rockdale Ave	Hathaway Rd at Rt 140 SB Ramps	Hathaway Rd at Rt 140 NB Ramps	Hathaway Rd at Shawmut Ave
Traffic Control	Unsignalized	Unsignalized	Unsignalized	Signalized
Crash Rate ²	0.48	0.56	0.54	1.17
District Avg. ³	0.57	0.57	0.57	0.75
<i>Year:</i>				
2016	3	1	6	12
2017	8	6	11	12
2018	2	11	2	11
2019	4	8	1	12
<u>2020</u>	<u>4</u>	<u>2</u>	<u>5</u>	<u>9</u>
Total	21	28	25	56
<i>Type:</i>				
Angle	11	18	14	20
Rear-End	5	8	7	20
Head-On	0	0	0	2
Sideswipe	2	1	2	9
Single Vehicle	2	1	2	3
Other/Unknown	1	0	0	0
Pedestrian	0	0	0	2
Bicycle	0	0	0	0
<i>Severity:</i>				
P. Damage Only	10	20	12	37
Personal Injury	11	8	13	19
Fatality	0	0	0	0
<i>Conditions:</i>				
Dry	14	24	21	46
Wet	7	4	4	9
Snow	0	0	0	1
Other/Unknown	0	0	0	0
<i>Time:</i>				
7:00 to 9:00 AM	0	2	1	2
4:00 to 6:00 PM	2	10	5	13
Rest of Day	19	16	19	41

¹ Source: MassDOT Crash Database

² Crashes per million entering vehicles

³ District 5 average = 0.75 for signalized intersections and 0.57 for unsignalized intersections

As summarized in **Table R1**, there were two pedestrian related crashes at the marked crosswalks at the intersection of Hathaway Road at Shawmut Avenue. One of the crashes involved a single vehicle traveling in the westbound direction along Hathaway Road resulting in a collision under dark conditions with a pedestrian resulting in a non-fatal injury. The second crash involved an angle type collision with a vehicle making an eastbound right turn from Hathaway Road onto Shawmut Avenue with a pedestrian under dark conditions resulting in a non-fatal injury. There were no other pedestrian or bicycle related crashes reported at any of the other study intersections during the study period.

Comment 11: “The project proponent should provide collision diagrams and narratives for all study area intersections with more than 3 crashes per year. (MassDOT TIA Guidelines 3.III.F). As example, the intersection of Hathaway Road at Shawmut Avenue has a crash rate that is 56% higher than the district average. It is unclear if these collisions are all occurring immediately at the intersection or occur as a result of existing driveway access within the vicinity of the intersection. ”

Response: See **Response 8**, this recommendation is not warranted for this project. MDM notes that even without a reduction for alternative transportation modes and pass-by credit, the project will have less than a 2% increase in traffic at the study intersections away from the Hathaway Road at the Route 140 ramps during the peak hours, indicating that these locations don’t merit further analysis as part of this project. The project will have less than a 5% increase in traffic at the Hathaway Road intersections with the Route 140 ramps and the intersections experienced crash rates at or below the MassDOT District 5 average and are not listed at high crash locations (HSIP) no further analysis is warranted at the ramps as part of this project. Trip increase calculation are provided in the **Attachments**.

Comment 12: “The project proponent should confirm that the crash data queried for intersections extended as far back as the calculated 95th percentile queues for each approach. ”

Response: The crash data was queried for the study intersections to areas within the influence areas of the intersections which would generally accommodate the 95th percentile queues for each approach.

Comment 13: “Angle crashes account for a majority of the crashes at the unsignalized intersections (52% at Rockdale, 64% at SB ramps, and 56% at NB ramps). The project proponent should identify how the development will not exacerbate these conditions.”

Response: It is not uncommon for the majority of crashes at an unsignalized intersection to be angle type collisions. The project will result in a moderate trip increase near the Site which is anticipated to dissipate and disperse through the various travel routes in the area. As outlined in the traffic study, incremental traffic increases at the study intersections due to the proposed development generally result in inconsequential changes in intersection operations compared to No-Build conditions. The unsignalized intersections were observed to have crash rates at or

below the District average rates indicating no immediate safety countermeasures are warranted. As outlined in the traffic report, while no roadway improvements are warranted to accommodate the project, the Proponent will work with MassDOT to implement pavement markings improvements at the Route 140 southbound ramp intersection with Hathaway Road to better define the travel way (see **Exhibit 5** as described below in Comment #25).

Projected Future Traffic Conditions

Comment 14: “The ITE Trip Generation Manual provides a warning regarding sample sizes of less than 10. This applies to pages 540-543, 545, and 546 of the ITE TGM11, as included in the attachments of the study. The project proponent should collect peak hour turning movement counts at similar sites within the State of Massachusetts to confirm that ITE LUC 882 accurately represents Recreational Marijuana Dispensary activity for the proposed site in New Bedford. The site generated traffic volume should be updated as needed.”

Response: Supplemental trip generation data was collected at three (3) recreational marijuana dispensaries within the Commonwealth of Massachusetts on Thursday, November 18, 2021 and Saturday, November 20, 2021. The empirical data is summarized below in **Table R2**.

TABLE R2
TRIP-GENERATION COMPARISON

Period/Direction	Traffic Study (ITE Based)¹	Framingham, MA Trip Rate²	Millbury, MA Trip Rate³	Hudson, MA Trip Rate⁴
<i>Weekday Morning Peak Hour:</i>				
Entering	23	6	10	3
Exiting	<u>22</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	45	6	10	3
<i>Weekday Evening Peak Hour:</i>				
Entering	41	43	44	19
Exiting	<u>40</u>	<u>40</u>	<u>40</u>	<u>19</u>
Total	81	83	84	38
<i>Saturday Midday Peak Hour:</i>				
Entering	62	36	49	16
Exiting	<u>62</u>	<u>33</u>	<u>47</u>	<u>14</u>
Total	124	69	96	30

¹ Based on ITE LUC 882 (Marijuana Dispensary) trip rates applied to 4,292 sf.

² Based on driveway counts at Nova Farms (3,090 sf) located at 1137 Worcester Road in Framingham, MA in November 2021 prorated to 4,290 sf. This facility is located along Route 9.

³ Based on driveway counts at Nature's Remedy (4,470 sf) located at 266 North Main Street in Millbury, MA in November 2021 prorated to 4,290 sf. This facility is located near I-90 and Route 146.

⁴ Based on driveway counts at Temescal Wellness (3,705 sf) located at 252 Coolidge Street in Hudson, MA in November 2021 prorated to 4,290 sf. This facility is located near I-495.

As shown in **Table R2**:

- *Weekday Morning Peak Hour.* Consistent with the proposed operations of the Site the facilities in Framingham, Millbury, and Hudson all opened after the typical weekday morning commuter period (7:00 am to 9:00 am). It is likely that the weekday morning peak hour trips at these facilities are associated with employees. The TIAS reflects the more conservative ITE based trip rates and represents conditions should the proposed dispensary elect to establish operating hours during the weekday morning peak hour.
- *Weekday Evening Peak Hour.* Observed operations at the dispensary facilities in Framingham, Millbury, and Hudson indicate that the ITE based trip rates are appropriate.
- *Saturday Midday Peak Hour.* Observed operations at the dispensary facilities in Framingham, Millbury, and Hudson indicate that the ITE based trip rates are conservative.

In summary, the ITE based trip rates used in the TIA are appropriate for planning purposes and have been shown to be highly consistent during the critical weekday evening peak hour and conservative during both the weekday morning peak hour and Saturday midday peak hour. The conclusions and transportation mitigation as outlined in the TIA remain valid and no further analysis is required.

Comment 15: "The project proponent should include an assessment of the mode split assumptions for this development and identify potential for pedestrian, bicycle, and transit improvements. (MassDOT TIA Guidelines 3.IV.C.1)"

Response: See **Response 8**, this recommendation is not warranted for this project. Due to the lack of pedestrian, bicycle and transit opportunities within the study area, the traffic study assumed no reduction for alternative transportation use; therefore, the mode split assumption was 100 percent vehicle use.

Comment 16: "The project proponent describes and illustrates the volumes as distributed through the network. Distribution percentages are assumed for the six (6) origin/ destination points within the network. The percentages assumed do not seem to correspond with the peak hour volumes in the existing conditions scenario. The project proponent should provide calculations or methodology showing how these percentages were developed or a narrative detailing the assumptions."

Response: The calculation sheets for the trip distribution are provided in the **Attachments**.

Comment 17: *“The project proponent should consider encouraging exiting vehicles bound for Hathaway Road westbound to use the shared driveway by adding signage on the property and restricting left turns out of the proposed driveway.”*

Response: The Applicant will work with MassDOT during the Highway Access Permit process to enhance the pavement markings along Hathaway Road at the Route 140 southbound ramp to formalized left turn lanes on Hathaway Road and to provide bicycle accommodations if warranted and feasible within the existing roadway width. Furthermore, the Applicant will add signage to the property to guide movements to the adjacent shared driveway and will restrict egress movements from the proposed site driveway to right turn only movements with signage and pavement marking to the driveway approach to Hathaway Road.

Comment 18: *“The project proponent should consider modifying Figure 9 – Trip Distribution to illustrate the percentages of trips arriving and departing from the two site driveways.”*

Response: The TIA Figure 9 – Trip Distribution has been updated to add the turn percentages at the site driveways.

Comment 19: *“The applicant should consider restricting the proposed driveway to right turns only for exiting traffic. This will simplify the movements at this new intersection requiring vehicles bound for Route 140 southbound to exit via the shared driveway and then take a left onto the on-ramp.”*

Response: See **Response 17**.

Traffic Operations Analysis

Comment 20: *“The project proponent should include queue results and available storage capacity for all analyzed intersections in existing, no-build, and build conditions. (MassDOT TIA Guidelines, 5.I.B.7)”*

Response: See **Response 8**, this recommendation is not warranted for this project. MDM also notes that the queue results were provided in the TIA Attachments. For reference purposes, the TIA the average and 95th percentile queues are summarized by intersection in **Table R3** through **Table R7**.

TABLE R3
VEHICLE QUEUE ANALYSIS SUMMARY
HATHAWAY ROAD AT ROCKDALE AVENUE

Approach	Storage Length (feet)	2028 No-Build		2028 Build	
		Average Queue Length	95 th Percentile Queue Length	Average Queue Length	95 th Percentile Queue Length
<i>Weekday Morning Peak Hour</i>					
Eastbound L/T/R	>1000	-	<25	-	<25
Westbound L/T/R	>1000	-	43	-	43
Northbound L/T/R ²	>1000	-	93	-	93
Southbound L/T/R ²	60±	-	<25	-	<25
<i>Weekday Evening Peak Hour</i>					
Eastbound L/T/R	>1000	-	<25	-	<25
Westbound L/T/R	>1000	-	33	-	35
Northbound L/T/R ²	>1000	-	78	-	83
Southbound L/T/R ²	60±	-	<25	-	<25
<i>Saturday Midday Peak Hour</i>					
Eastbound L/T/R	>1000	-	<25	-	<25
Westbound L/T/R	>1000	-	<25	-	<25
Northbound L/T/R ²	>1000	-	53	-	55
Southbound L/T/R ²	60±	-	<25	-	<25

¹ Average and 95th percentile queue lengths are reported in feet per lane.

TABLE R4
VEHICLE QUEUE ANALYSIS SUMMARY
HATHAWAY ROAD AT ROUTE 140 SB RAMPS/SITE DRIVEWAY

Approach	Storage Length (feet)	2028 No-Build		2028 Build	
		Average Queue Length	95 th Percentile Queue Length	Average Queue Length	95 th Percentile Queue Length
<i>Weekday Morning Peak Hour</i>					
Eastbound L/T/R	>1000	-	28	-	28
Westbound L/T/R	>1000	-	<25	-	<25
Northbound L/T/R ³	100±	-	n/a	-	<25
Southbound L/T ³	>1000	-	30	-	38
<i>Weekday Evening Peak Hour</i>					
Eastbound L/T/R	>1000	-	<25	-	<25
Westbound L/T/R	>1000	-	<25	-	<25
Northbound L/T/R ³	100±	-	n/a	-	<25
Southbound L/T ³	>1000	-	65	-	93
<i>Saturday Midday Peak Hour</i>					
Eastbound L/T/R	>1000	-	<25	-	<25
Westbound L/T/R	>1000	-	<25	-	<25
Northbound L/T/R ³	100±	-	n/a	-	<25
Southbound L/T ³	>1000	-	28	-	40

¹ Average and 95th percentile queue lengths are reported in feet per lane.

² n/a: Not Applicable.

TABLE R5
VEHICLE QUEUE ANALYSIS SUMMARY
HATHAWAY ROAD AT ROUTE 140 NORTHBOUND RAMPS

Approach	Storage Length (feet)	2028 No-Build		2028 Build	
		Average Queue Length	95 th Percentile Queue Length	Average Queue Length	95 th Percentile Queue Length
<i>Weekday Morning Peak Hour</i>					
Eastbound L/T/R	>1000	-	45	-	48
Westbound L/T/R	>1000	-	<25	-	<25
Southbound L ²	>1000	-	215	-	223
Southbound R ²	180±	-	25	-	28
<i>Weekday Evening Peak Hour</i>					
Eastbound L/T/R	>1000	-	45	-	48
Westbound L/T/R	>1000	-	<25	-	<25
Southbound L ²	>1000	-	343	-	363
Southbound R ²	180±	-	50	-	53
<i>Saturday Midday Peak Hour</i>					
Eastbound L/T/R	>1000	-	28	-	28
Westbound L/T/R	>1000	-	<25	-	<25
Southbound L ²	>1000	-	170	-	185
Southbound R ²	180±	-	25	-	28

¹ Average and 95th percentile queue lengths are reported in feet per lane.

TABLE R6
VEHICLE QUEUE ANALYSIS SUMMARY
HATHAWAY ROAD AT SELF-STORAGE DRIVEWAY

Approach	Storage Length (feet)	2028 No-Build		2028 Build	
		Average Queue Length	95 th Percentile Queue Length	Average Queue Length	95 th Percentile Queue Length
<i>Weekday Morning Peak Hour</i>					
Eastbound T/R	>1000	-	<25	-	<25
Westbound L/T	>1000	-	<25	-	<25
Northbound L/R ²	150±	-	<25	-	<25
<i>Weekday Evening Peak Hour</i>					
Eastbound T/R	>1000	-	<25	-	<25
Westbound L/T	>1000	-	<25	-	<25
Northbound L/R ²	150±	-	<25	-	<25
<i>Saturday Midday Peak Hour</i>					
Eastbound T/R	>1000	-	<25	-	<25
Westbound L/T	>1000	-	<25	-	<25
Northbound L/R ²	150±	-	<25	-	<25

¹ Average and 95th percentile queue lengths are reported in feet per lane.

TABLE R7
VEHICLE QUEUE ANALYSIS SUMMARY
HATHAWAY ROAD AT SHAWMUT AVENUE – SIGNALIZED INTERSECTION

Approach	Storage Length (feet)	2028 No-Build		2028 Build	
		Average Queue Length	95 th Percentile Queue Length	Average Queue Length	95 th Percentile Queue Length
<i>Weekday Morning Peak Hour</i>					
Eastbound L	>300	25	57	25	57
Eastbound T/R	>1000	181	373	183	378
Westbound L	>300	59	150	59	152
Westbound T/R	>1000	126	228	127	230
Northbound L	>300	133	279	134	283
Northbound T/R	>1000	47	118	47	118
Southbound L/T	>1000	44	89	44	89
Southbound R	>300	<25	<25	<25	<25
<i>Weekday Evening Peak Hour</i>					
Eastbound L	>300	30	64	30	64
Eastbound T/R	>1000	363	642	395	656
Westbound L	>300	82	221	82	221
Westbound T/R	>1000	194	320	196	323
Northbound L	>300	122	204	124	211
Northbound T/R	>1000	<25	83	<25	83
Southbound L/T	>1000	64	118	64	118
Southbound R	>300	<25	53	<25	53
<i>Saturday Midday Peak Hour</i>					
Eastbound L	>300	25	49	25	49
Eastbound T/R	>1000	279	479	286	492
Westbound L	>300	55	110	52	105
Westbound T/R	>1000	222	340	225	344
Northbound L	>300	107	175	109	178
Northbound T/R	>1000	<25	80	<25	80
Southbound L/T	>1000	38	80	38	80
Southbound R	>300	<25	<25	<25	<25

¹ Average and 95th percentile queue lengths are reported in feet per lane.

Comment 21: *"It is recommended that the peak hour factor (PHF) be revised to 0.92 for future year traffic volumes in an urban environment."*

Response: Given that the traffic volumes were counted during the peak hours in 15-minute increments, the peak hour factors (PHF's) used in the TIA remain valid. MDM disagrees with the blanket use of a 0.92 peak hour factor (PHF) unless the count data is limited which in this case does not apply.

Conclusions and Recommendations

Comment 22: *"The project proponent should measure and graphically illustrate the available sight distance at the proposed driveways. Document the available intersection sight distance at proposed site driveway(s). Sight distance measurements must be in conformance with the latest edition of the AASHTO manual, A Policy on Geometric Design of Highways and Streets." (MassDOT TIA Guidelines, 5.I.G)"*

Response: A review of data available along Hathaway Road collected by MassDOT indicated an 85th percentile travel speeds of 43 mile per hour (mph) in both travel directions in the area which is higher than the regulatory speed limit of 30 mph. The speed data collected by MassDOT is provided in the **Attachments**. The speed data sets the basis for the sight line evaluation as presented below.

An evaluation of sight lines was conducted to ensure that minimum recommended sight lines are available to safely exit onto Hathaway Road. The evaluation documents existing sight lines for vehicles as they relate to Hathaway Road with comparison to recommended guidelines for the regulatory speed limit and 85th percentile speeds.

The American Association of State Highway and Transportation Officials' (AASHTO) standards¹ reference two types of sight distance which are relevant at the site driveway intersections on Hathaway Street: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements were compared to minimum SSD and ISD criteria for the regulatory speed limit and observed travel speeds in the Site vicinity.

¹ A policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), 2018.

Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near a regulatory speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle entering or exiting the site driveways onto Hathaway Road. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet level pavement. Adjustment factors are applied to account for roadway grades where applicable.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the eastbound and westbound Hathaway Road approaches to the intersections. **Table R8** and graphically shown in **Exhibit 1**, and **Exhibit 2** presents a summary of the available SSD for the Hathaway Road segment approaches to the site driveways and AASHTO's recommended SSD for the regulatory speed limit and 85th percentile travel speeds.

TABLE R8
STOPPING SIGHT DISTANCE SUMMARY
HATHAWAY ROAD APPROACHES TO SITE DRIVEWAYS

Approach/ Travel Direction	Available SSD	AASHTO Recommended SSD ¹	
		Regulatory Speed ²	85 th Percentile Travel Speed ³
<i>Eastern Driveway</i>			
<i>Eastbound</i>	>500 Feet	200 Feet	340 Feet
<i>Westbound</i>	>500 Feet	200 Feet	340 Feet
<i>Shared Driveway</i>			
<i>Eastbound</i>	>500 Feet	200 Feet	340 Feet
<i>Westbound</i>	>500 Feet	200 Feet	340 Feet

¹Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet with adjustments for grade.

²Hathaway Road Regulatory speed = 30 mph

³85th Percentile travel speed: 43 mph EB, 43 mph WB

As summarized in **Table R8** and shown graphically in **Exhibit 1** and **Exhibit 2**, the available sight lines exceed AASHTO's recommended SSD criteria for the proposed site driveways based on the regulatory and 85th percentile travel speeds along Hathaway Street.



Site Plan Source: Hayes Engineering

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Proposed Marijuana Dispensary

New Bedford, Massachusetts

Scale: As Noted
DWG No. 1166 Sight Distance West Driveway (2021-12-1).dwg

Date: December 2021
Project No. 1166

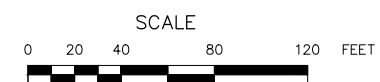


Exhibit 1

Stopping Sight Distance Analysis

West Driveway



Site Plan Source: Hayes Engineering

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Proposed Marijuana Dispensary
New Bedford, Massachusetts

Scale: As Noted
DWG No. 1166 Sight Distance East Driveway (2021-12-1).dwg

Date: December 2021
Project No. 1166

SCALE
0 20 40 80 120 FEET

Exhibit 2
Stopping Sight Distance Analysis
East Driveway

Intersection Sight Distance

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO's Intersection Sight Distance (ISD) considerations, "...If the available sight distance for an entering ...vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions...To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road." AASHTO's ISD criteria are defined into several "cases". For the unsignalized site driveway approaches, which are under STOP sign control, the ISD in question relates to the ability to turn right, turn left or travel straight through at the site driveway intersection with Hathaway Road.

Available ISD was estimated in the field using AASHTO standards for driver's eye (3.5 feet), object height (3.5 feet) and decision point (between 8 and 14.5 feet from the edge of the travel way) for the eastbound and westbound direction along Hathaway Road. **Table R9** and graphically shown in **Exhibit 3** and **Exhibit 4** presents a summary of the available ISD for the departure from the site driveways and AASHTO's minimum and ideal ISD recommendations.

TABLE R9
INTERSECTION SIGHT DISTANCE SUMMARY
SITE DRIVEWAY DEPARTURES TO HATHAWAY ROAD

View Direction	Available ISD	AASHTO Minimum ¹	AASHTO Ideal ¹
		85 th Percentile Travel Speed ³	Regulatory Speed ²
Eastern Driveway			
Looking East	>500 Feet	340 Feet	335 Feet
Looking West	>500 Feet	340 Feet	290 Feet
Shared Driveway			
Looking East	>500 Feet	340 Feet	335 Feet
Looking West	450± Feet	340 Feet	290 Feet

¹ Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet and an object height of 3.5 feet and adjustments for roadway grade if required. Minimum value as noted represents SSD per AASHTO guidance.

²Hathaway Road Regulatory speed = 30 mph

³85th Percentile travel speed: 43 mph EB, 43 mph WB

The results of the ISD analysis presented in **Table R9** and shown graphically in **Exhibit 3** and **Exhibit 4** indicate that the available sight lines looking east and west from the site driveways onto Hathaway Road will exceed the recommended minimum and ideal sight line criteria from AASHTO. MDM recommends that any new plantings (shrubs, bushes) or physical landscape features to be located within driveway sight lines should also be maintained at a height of 2 feet or less above the adjacent existing roadway grade to ensure unobstructed lines of sight.



Site Plan Source: Hayes Engineering

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Proposed Marijuana Dispensary New Bedford, Massachusetts

Scale: As Noted
DWG No. 1166 Sight Distance West Driveway (2021-12-1).dwg

Date: December 2021
Project No. 1166

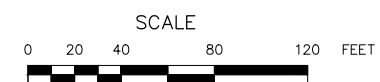


Exhibit 3 *Intersection Sight Distance Analysis* *West Driveway*



Site Plan Source: Hayes Engineering

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Proposed Marijuana Dispensary
New Bedford, Massachusetts

Scale: As Noted
DWG No. 1166 Sight Distance East Driveway (2021-12-1).dwg

Date: December 2021
Project No. 1166

SCALE
0 20 40 80 120 FEET

Exhibit 4
Intersection Sight Distance Analysis
East Driveway

Comment 23: *"The project proponent should consider conducting a MUTCD Warrant Analysis. These intersections may meet Warrant 3, Peak Hour, and Warrant 7, Crash Experience."*

Response: A traffic signal warrant analysis has been conducted for the Route 140 southbound ramps/Hathaway Road/site driveway intersection based on Traffic Signal Warrant 1 (8-hour) with an 85th percentile speed along Hathaway Road of 43 mph in both travel directions. Traffic volumes were collected at the intersection over a 12-hour period (7:00 am to 7:00 pm) on September 30, 2021. The warrant analysis did not consider right-turn movements from the Route 140 southbound off-ramp as this movement is channelized and operates under yield control. The analysis indicates that a traffic signal is warranted based on MUTCD Condition 1B at this location under existing conditions independent of the proposed development project. Detailed traffic signal warrant calculations are provided in the **Attachments**.

While the above analysis indicates that traffic signal control may be warranted at the Route 140/Hathaway Road intersection, the intersection is under the jurisdiction of MassDOT and any modification would need their review and approval.

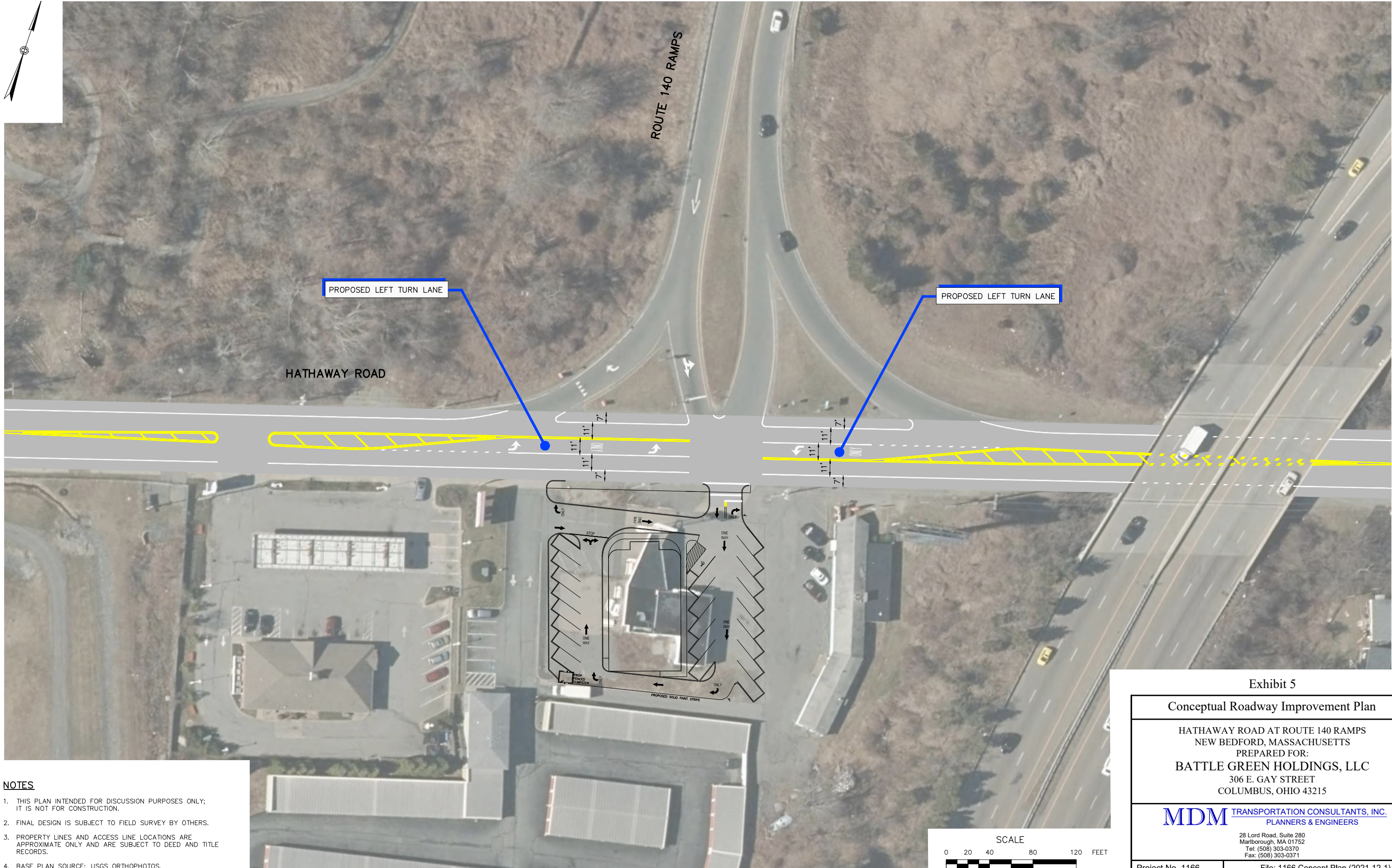
Comment 24: *"Project proponent should elaborate on the proposed bicycle accommodations. Were bicycle counts conducted? What impacts would these proposed improvements have on the roadway geometry?"*

Response: Given the lack of bicycle accommodations in the area, **Exhibit 5** described below in Comment #25 includes a usable area for bicyclists which will be discussed with MassDOT during their Highway Access Permit process.

Bicycle and pedestrian counts were conducted at the intersections and are included in the **Attachments**. The project will include a secure bike parking area near the building entrance for employees and patrons. Refer to the Site Layout Plan submitted separately by Hayes Engineering.

Comment 25: *"Project proponent should provide a concept plan to illustrate the proposed geometry with left turn bays as described."*

Response: The off-site improvement is conceptually shown in **Exhibit 5**. The improvement will require MassDOT review and approval.



- NOTES**
1. THIS PLAN INTENDED FOR DISCUSSION PURPOSES ONLY; IT IS NOT FOR CONSTRUCTION.
 2. FINAL DESIGN IS SUBJECT TO FIELD SURVEY BY OTHERS.
 3. PROPERTY LINES AND ACCESS LINE LOCATIONS ARE APPROXIMATE ONLY AND ARE SUBJECT TO DEED AND TITLE RECORDS.
 4. BASE PLAN SOURCE: USGS ORTHOPHOTOS.

Exhibit 5

Conceptual Roadway Improvement Plan

HATHAWAY ROAD AT ROUTE 140 RAMPs
NEW BEDFORD, MASSACHUSETTS
PREPARED FOR:
BATTLE GREEN HOLDINGS, LLC
306 E. GAY STREET
COLUMBUS, OHIO 43215

MDM TRANSPORTATION CONSULTANTS, INC.
PLANNERS & ENGINEERS
28 Lord Road, Suite 280
Marlborough, MA 01752
Tel: (508) 303-0370
Fax: (508) 303-0371

Project No. 1166	File: 1166 Concept Plan (2021-12-1).dwg	
Date: Dec. 1, 2021	Scale: As Noted	Sheet 1 of 1

Comment 26: *"Project proponent should provide a concept plan to illustrate the alignment of the interchange ramps in relationship to the driveways of the development."*

Response: See **Response 25**. As shown in **Exhibit 5**, the site driveway is located opposite the Route 140 southbound ramp.

Comment 27: *"Project proponent should elaborate on customer processing time and address the following questions:*

- a. What is the typical time to service a customer at this facility?*
- b. How many employee vehicles will be parking in the parking lot?*
- c. Do the number of proposed parking spaces satisfy this need?"*

Response:

- a. The dispensary will offer an online and mobile platform for patrons to order and purchase products prior to arriving at the facility. These "express" customers are generally processed within 5 minutes or less and expect to represent approximately 50% of sales. Customers that do not pre-order are generally processed within 15 minutes or less.
- b. Approximately six (6) employees will park in the parking lot.
- c. The proposed 23 parking spaces satisfy the 22 space Zoning requirement and is expected to meet the parking demand generated by the proposed use.

Comment 28: *"It is recommended that the project proponent be responsible for providing police officers to control traffic as needed during the opening of this new facility, and subsequently as required by the Department of Public Infrastructure (DPI)."*

Response: As part of the grand opening of the facility, the Applicant will review Traffic Management Plans with the City to including Police Details as required.

Attachments

Comment 29: *"The following maps should be included in the Attachments as recommended by MassDOT TIA Guidelines, Section 5.I.A.*

- a. Site plotted centrally on the USGS map*
- b. Site plotted in accordance with the MassDOT Road Inventory Maps*
- c. Zoning map"*

Response: See **Response 8**, this recommendation is not warranted for this project.

Comment 30: *"The following additional information should be included in the Attachments as recommended by MassDOT TIA Guidelines, Section 5.II.*

- a. Bicycle Counts*
- b. Transit Service Existing Conditions Data*
- c. Plotted intersection sight distance analyses*
- d. Collision Diagrams (See Item #16 above)*
- e. Speed Data"*

Response: See **Response 8**, this recommendation is not warranted for this project; however, with the exception of *Collision Diagrams*, additional information has been provided for the above items.

Comment 31: *"The project proponent should confirm whether pedestrian counts were taken. The backup sheets from MDM Transportation Consultants, Inc. show pedestrian counts of 0 for all time periods."*

Response: Pedestrian counts were conducted simultaneously with the vehicle turning movement counts (TMC's) and are include in the **Attachments** for reference. The data indicates a nominal amount of pedestrian activity within the study area.

Comment 32: *"Vehicle extension at the intersection of Shawmut Avenue at Hathaway Road should be set to 2 seconds for all phases, it is currently shown as 3 seconds for Phase 1 and Phase 7."*

Response: The vehicle extension has been updated to 2 seconds for all phases. The updated capacity analysis worksheets are provided in the **Attachments**. The updated capacity worksheets indicate no material change in reported operations; therefore, no further analysis is required.

Comment 33: *"Existing and No-Build Synchro operational analysis has been conducted for the scenario as described in the 'Off-Site Improvements – Update Pavement Markings' section, including left turn bays for Hathaway Road. The project proponent should document in the study that this reflects existing operational conditions."*

Response: The Baseline and No-Build Synchro operations has been conducted based on the observed use of the intersections by vehicles given the expansive travel lane widths. The Applicant proposes to formalize the turn lanes at the Hathaway Road intersection with the Route 140 southbound ramps if approved by MassDOT.

ATTACHMENTS

- Revised Figures
- AutoTURN® Analysis
- Public Transportation Information
- Local Bicycle Facilities Information
- Trip Increase Calculations
- Trip Distribution Calculations
- MassDOT Speed Data
- Signal Warrant Analysis
- Pedestrian and Bicycle Count Sheets
- Updated Capacity Analysis
- Peer Review Comment Letter - CDM Smith

□ Revised Figures



Figure 1

Site Location

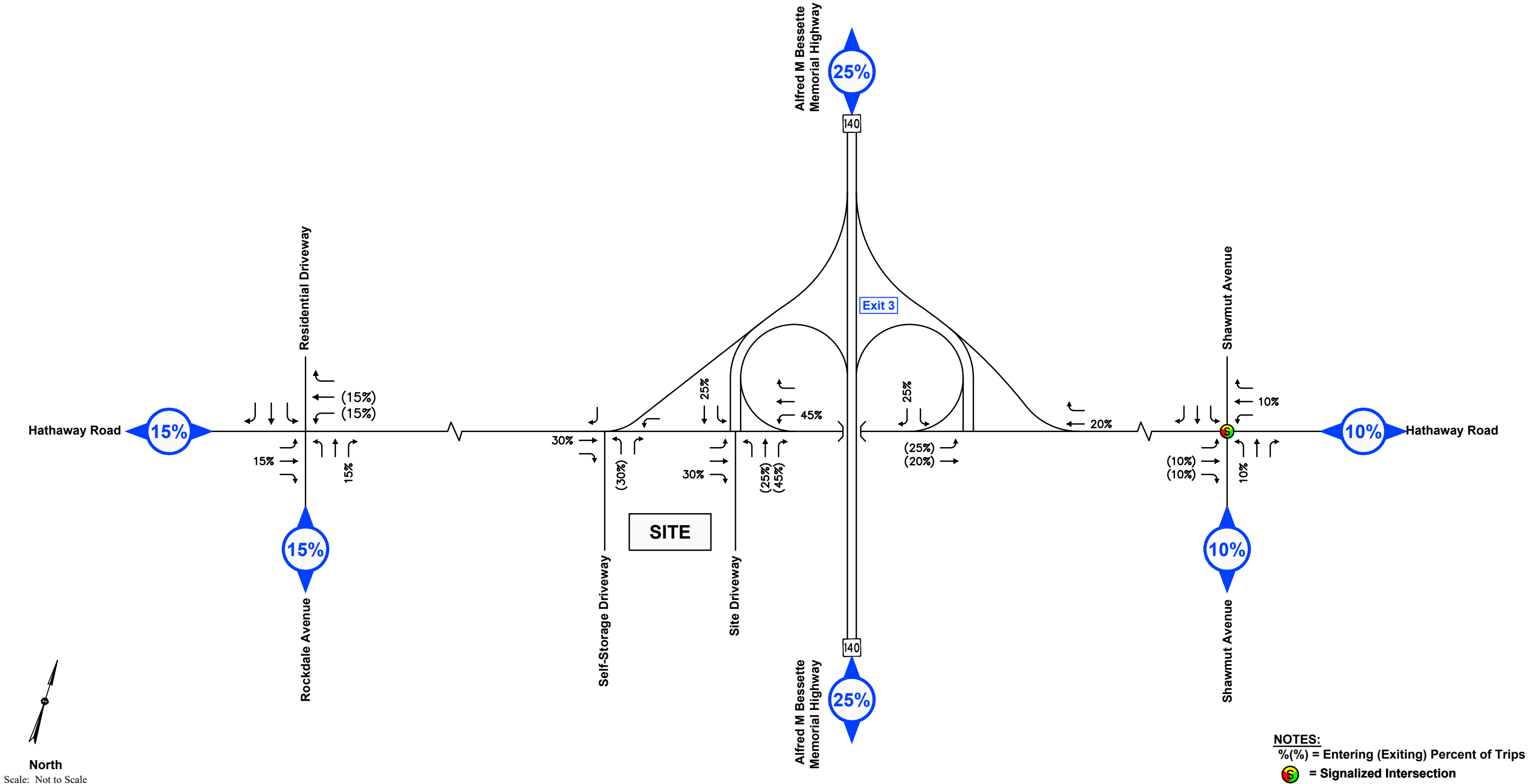


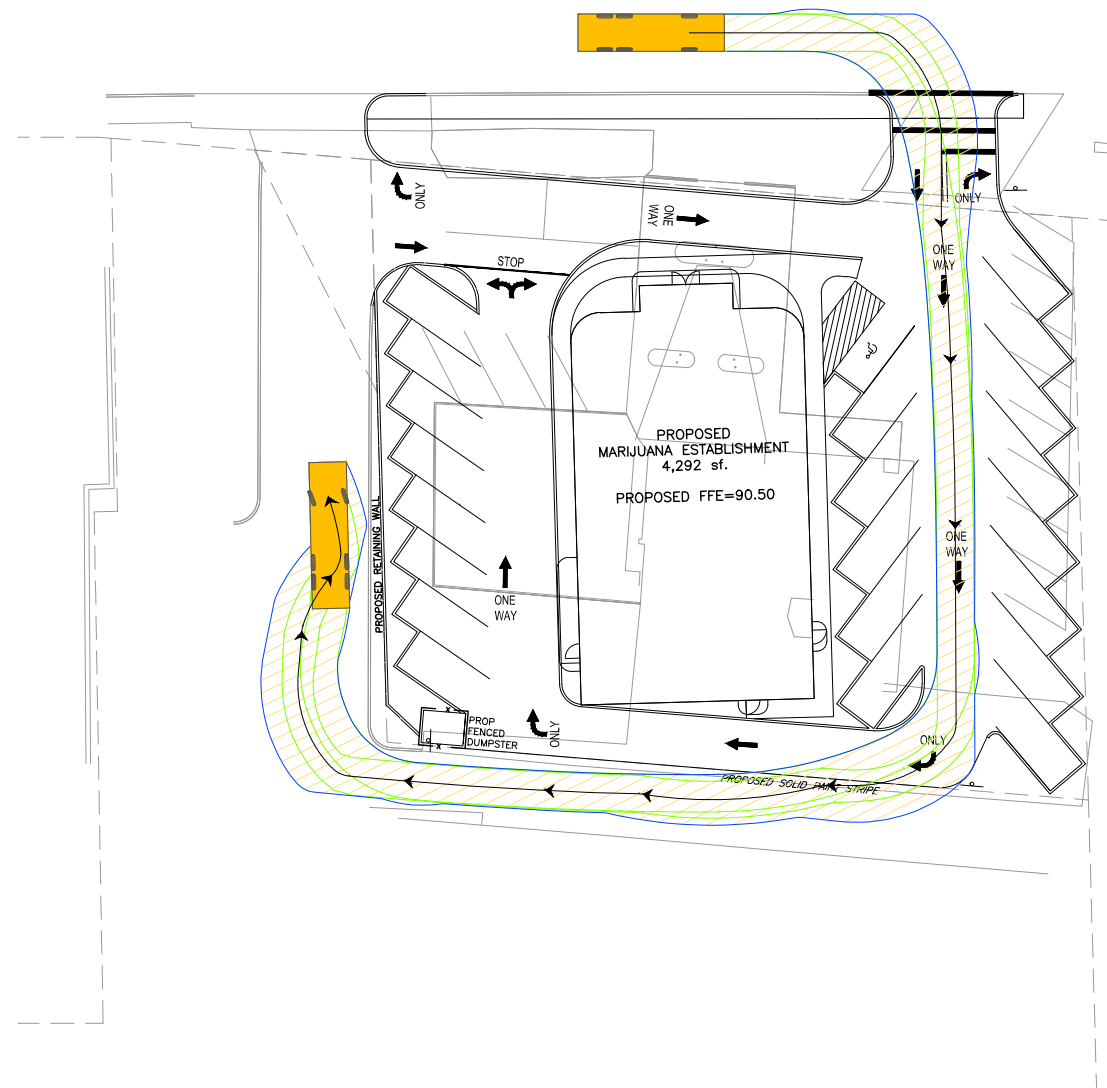
Figure 9 (Revised)

Trip Distribution

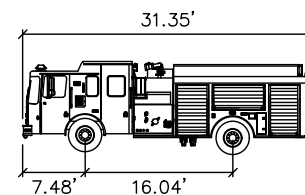
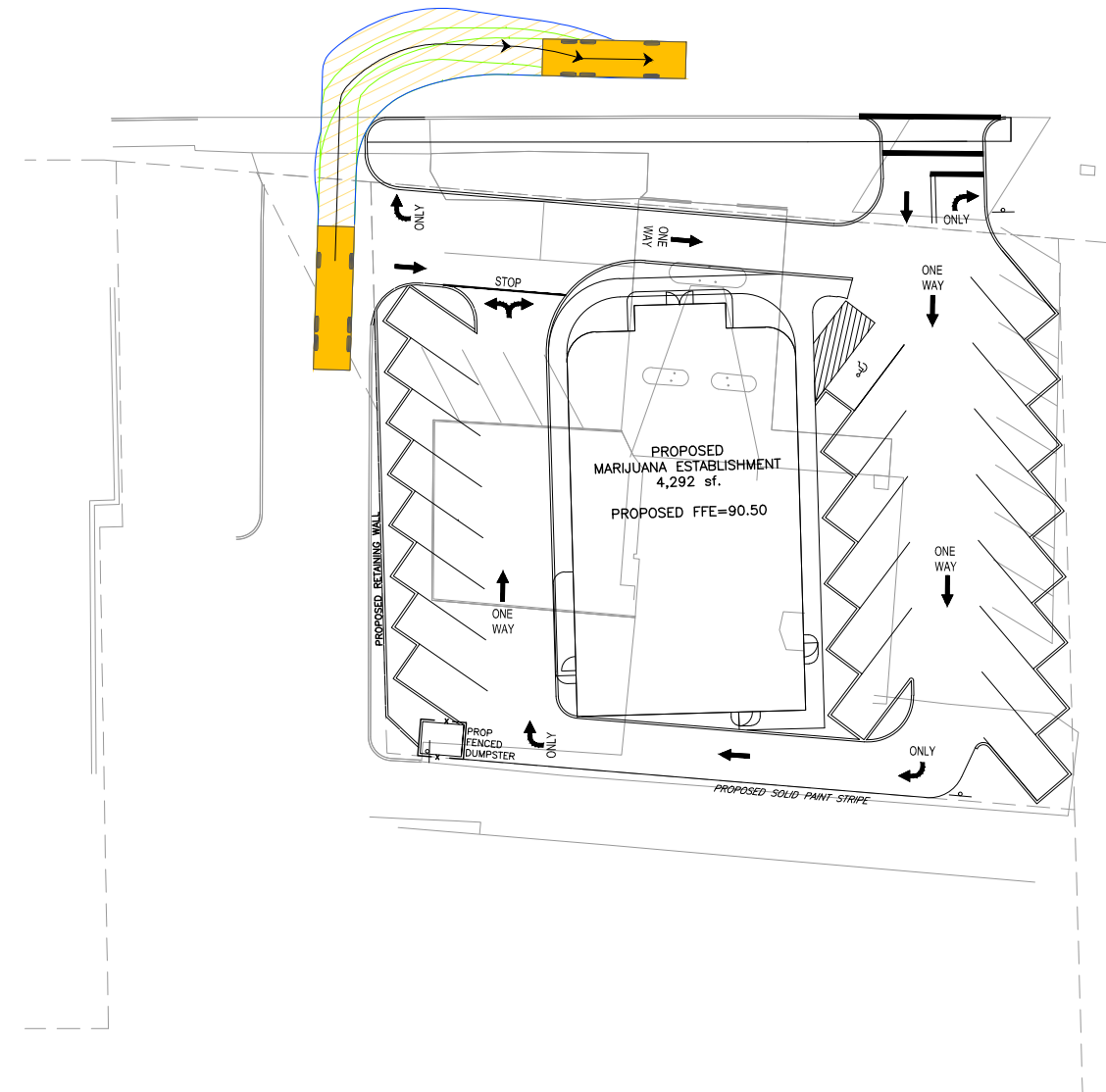
□ AutoTURN® Analysis



HATHAWAY ROAD



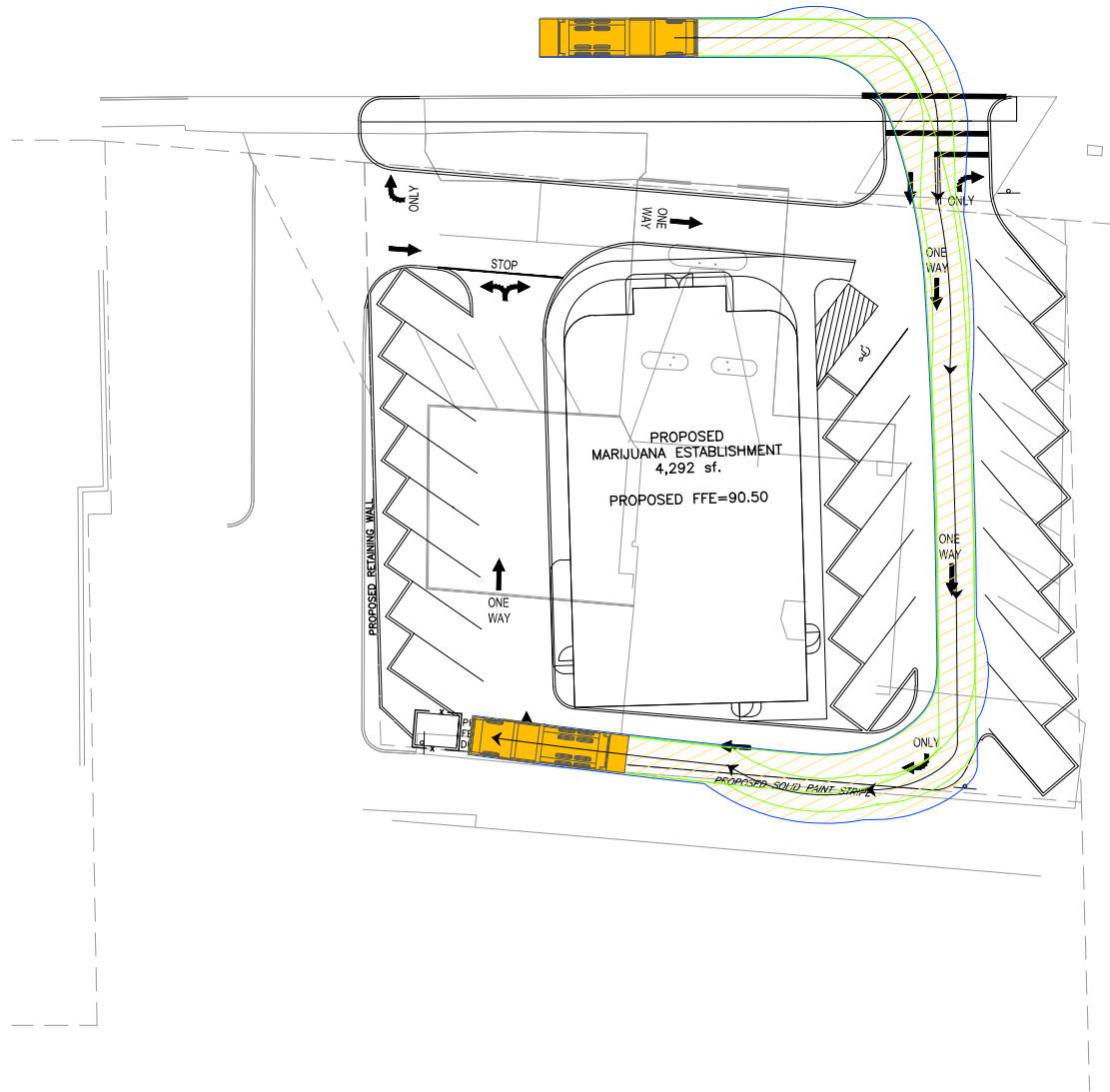
HATHAWAY ROAD



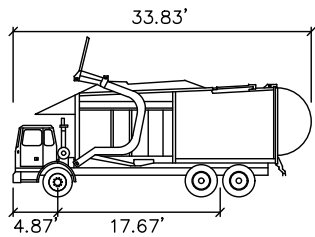
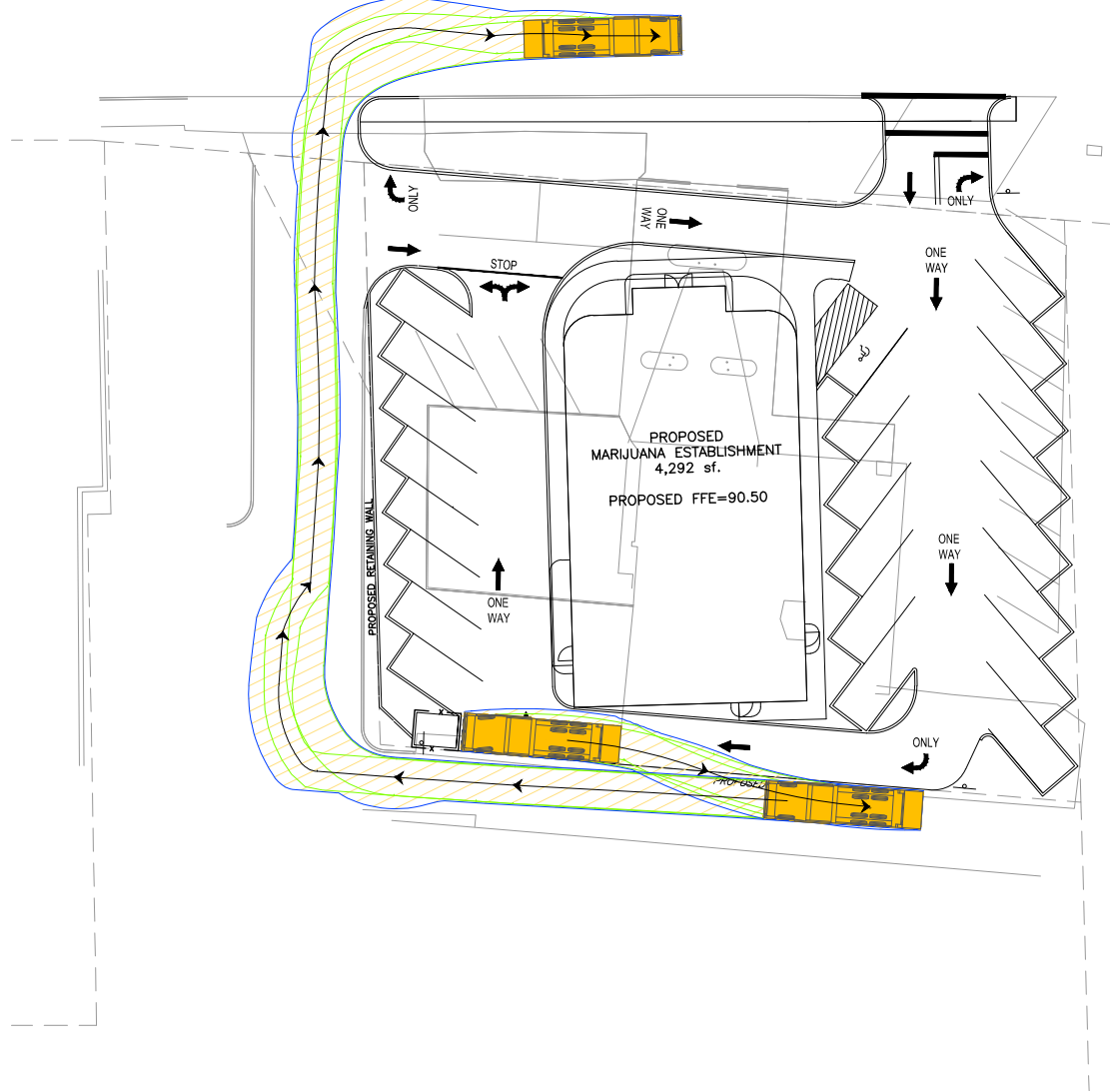
New Bedford Engine 7 – Pierce Arrow XT
Width : 8.00 FT.
Track : 8.00 FT.
Lock to Lock Time : 6.0 SEC.
Steering Angle : 37.6°



HATHAWAY ROAD



HATHAWAY ROAD



Refuse Truck

Width : 8.46 FT.
Track : 8.00 FT.
Lock to Lock Time : 6.0 SEC.
Steering Angle : 45.0°

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Marlborough, MA 01752

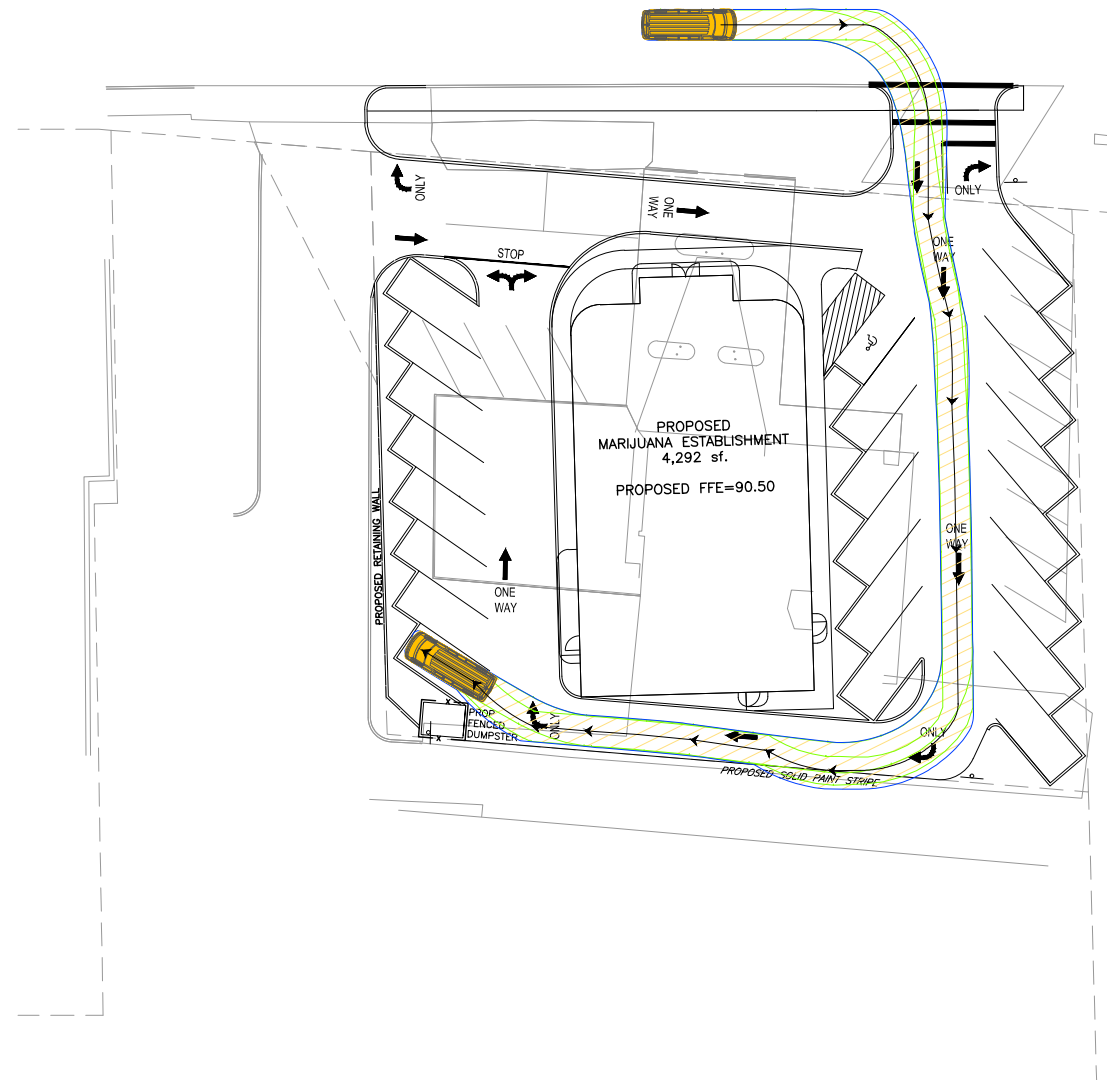
Proposed Marijuana Dispensary
New Bedford, Massachusetts



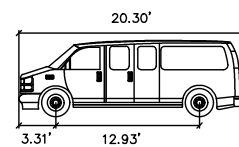
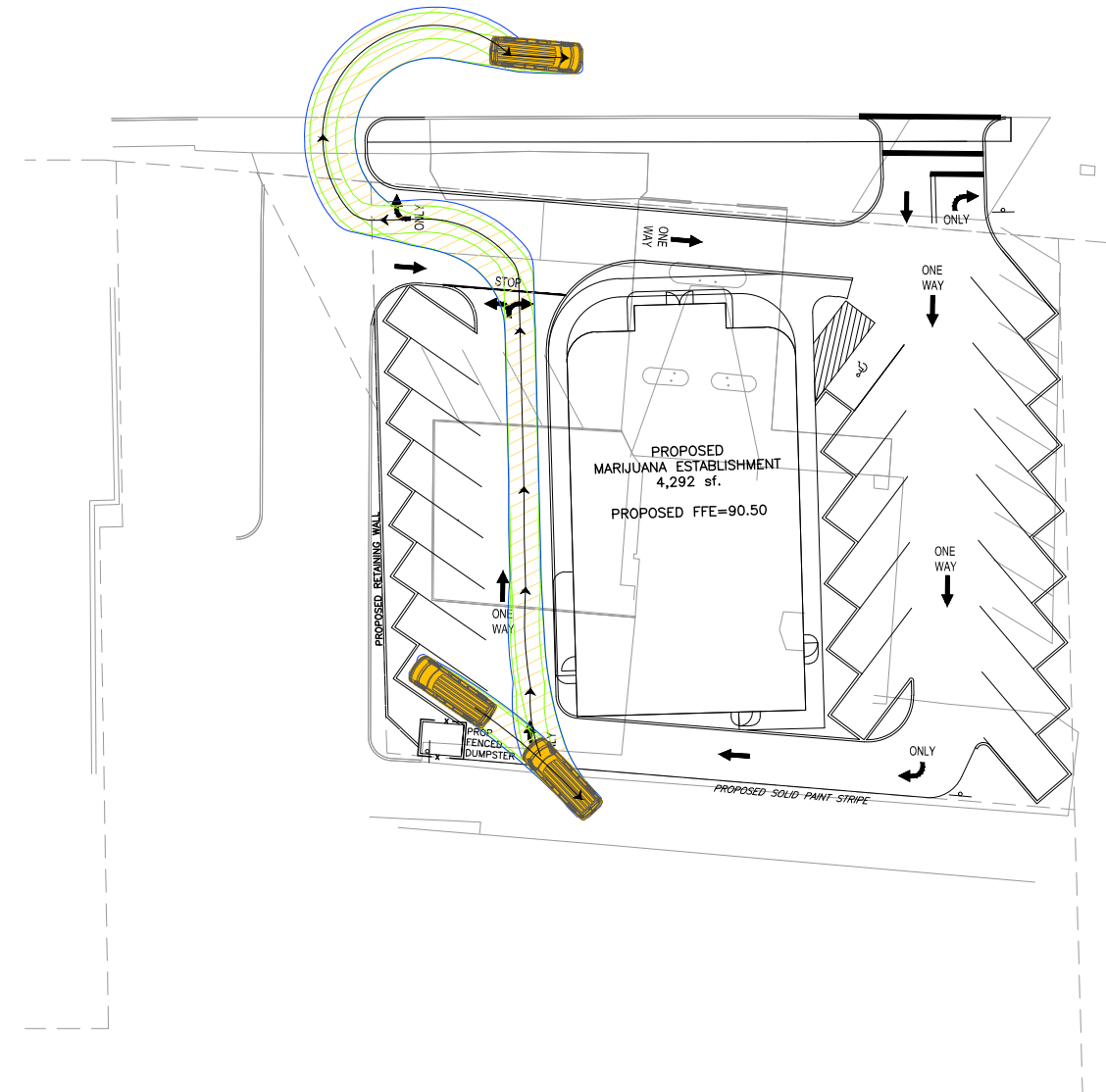
Attachment 2
Autoturn Analysis
Refuse Truck



HATHAWAY ROAD



HATHAWAY ROAD



Chevrolet Express 3500 (2016)

Width : 6.60 FT.
Track : 6.48 FT.
Lock to Lock Time : 6.0SEC.
Steering Angle : 31.9°

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Proposed Marijuana Dispensary
New Bedford, Massachusetts

SCALE
0 10 20 40 60 FEET

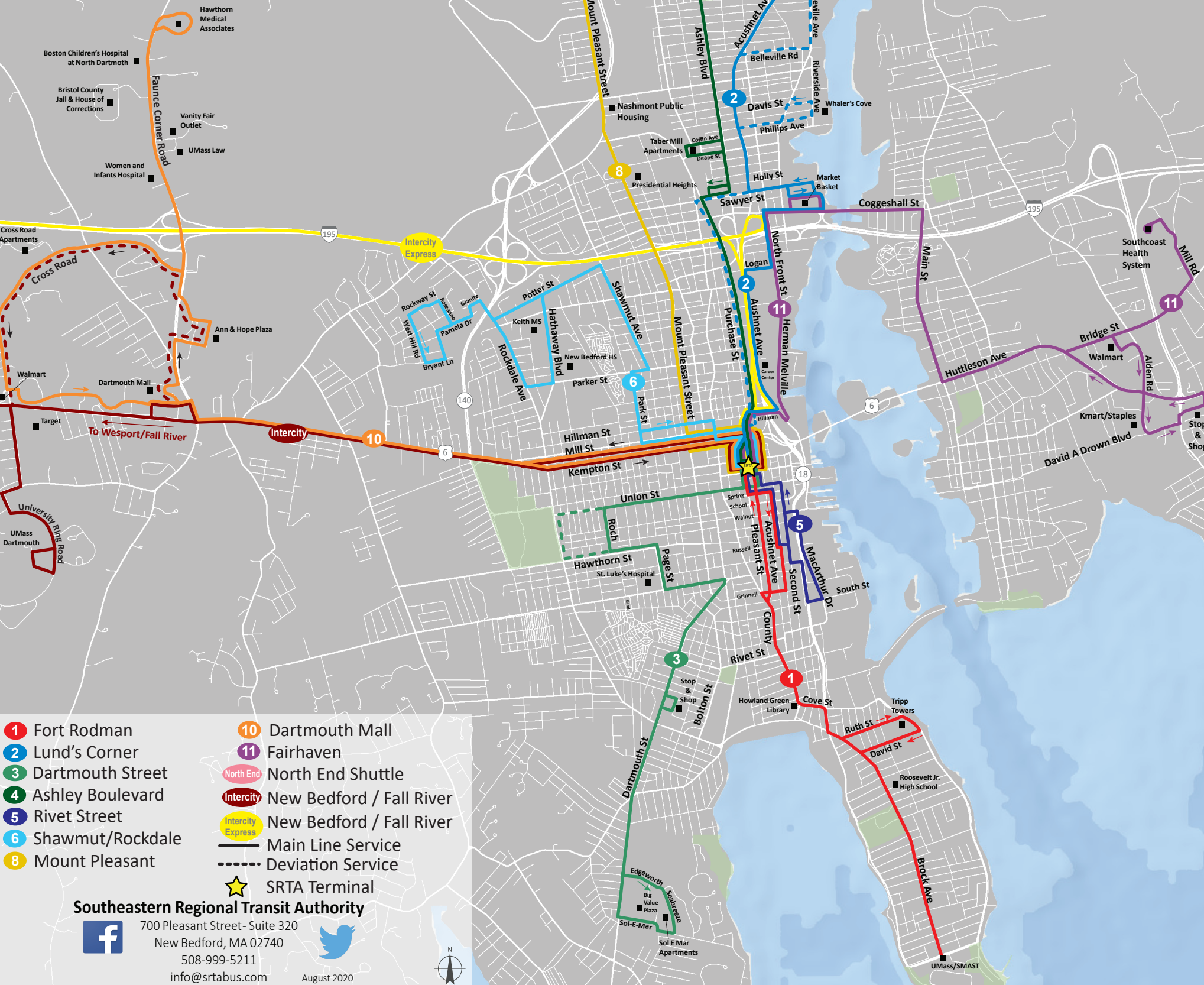
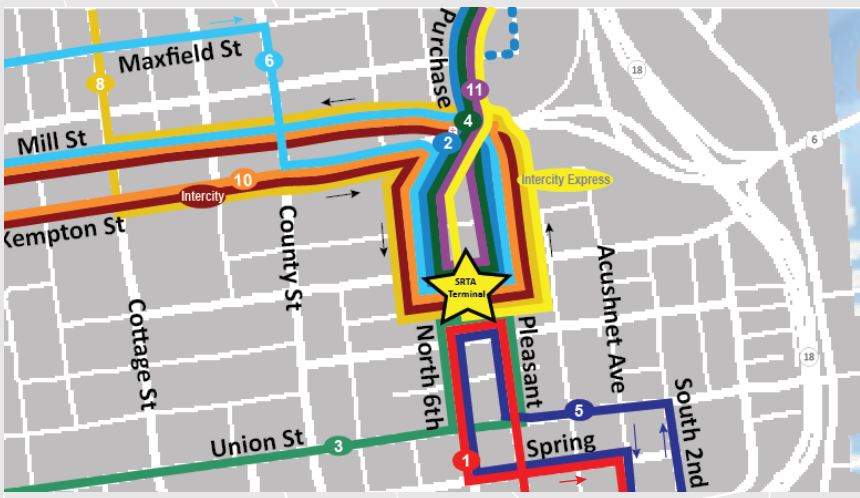
Attachment 3
Autoturn Analysis
Passenger Van

□ Public Transportation Information

SRTA

NEW BEDFORD SYSTEM MAP

Downtown New Bedford



□ Local Bicycle Facilities Information

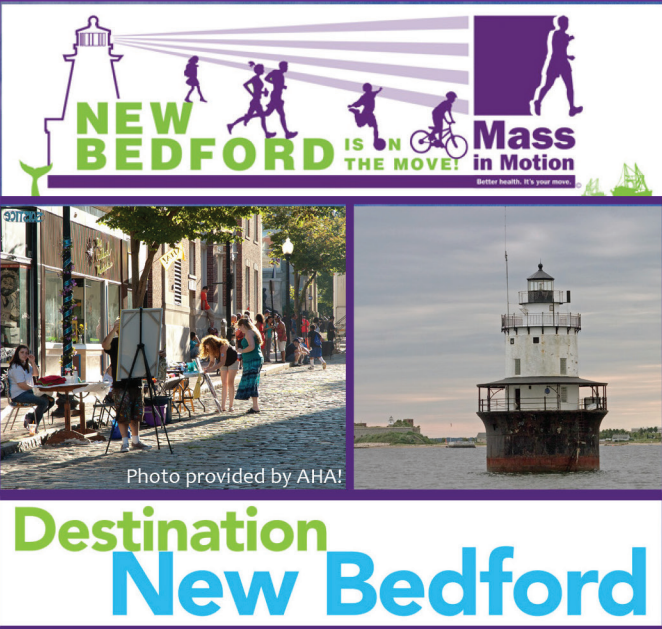
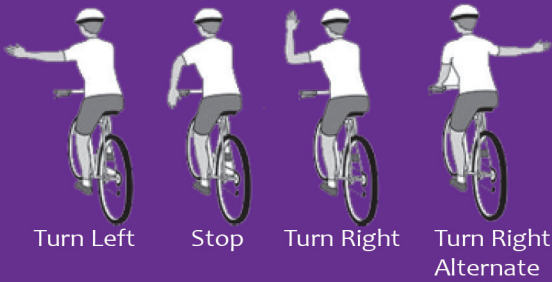
Welcome to New Bedford, a city filled with stories of the whaling days, the Underground Railroad and the legendary white whale, which inspired Herman Melville’s Moby Dick.

Discover vibrant arts, charming boutique shops, wineries and restaurants offering mouth watering options including a variety of seafood and international cuisine choices from the #1 fishing port in America.

STAY SAFE

Please Follow These Rules when Riding:

- * Always wear a helmet
- * Ride on the right with traffic
- * Obey traffic signs, lights, and road markings
- * Give right of way to pedestrians
- * Use lights when riding at night
- * Use hand signals when turning



Visit www.DestinationNewBedford.org for a complete list of events and attractions. 1-800-508-5353

To learn more about the city’s healthy initiatives visit www.massinmotion-newbedford.org

Questions about cycling in New Bedford? Visit www.nbbike.org



BIKE NEW BEDFORD



A Guide To The City’s Bike Paths

Bike to the Beach



Soak up the sun and feel the sand between your toes at the beach.

New Bedford Whaling National Historical Park



Travel back in time to the 19th century when New Bedford was the world’s foremost whaling port. Check out the Seamen’s Bethel, a famous landmark from Herman Melville’s story “Moby Dick.” Have a whale of a time at the Whaling Museum!

Main Attractions

Downtown
The classic cobblestone-lined streets of Downtown lead to the New Bedford Whaling National Park and the historic heart of the city, laced with art galleries, shops and authentic restaurants. Park your bicycle and explore the area by foot.

Seaport Cultural District
Located along the working waterfront in downtown New Bedford, the Seaport Cultural District emanates a historic charm, inspiration and dynamic creativity inside and out. All within short walking distance, the vibrant community and cultural institutions are bound to awaken your imagination.

South End
Surrounded by 3 miles of accessible shoreline, The South End boasts fabulous sandy beaches and is famous for the Fort Taber Park and the Military Museum. If that isn’t enough, check out the antiques stores and the seafood restaurants!

West End
With tree-lined streets and beautiful architecture showcasing spectacular Victorian, Queen Anne, Colonial and Greek revival style homes, the West End eludes nostalgic charm for the whaling days. Ride Hawthorn Street to Buttonwood Park, one of the biggest parks in the city and home of the Buttonwood Park Zoo.

North End
Home to the Madeira Museum, the North End features some of the most exciting festivals during the summer months as well as the International Marketplace filled with retail shops, cafes, bakeries, and restaurants year round.



There is designated bike parking throughout New Bedford. Please see the map for bike rack locations.

Let’s Bike New Bedford!
Use the new bike paths to explore all the wonderful attractions the city has to offer. Remember to ride with caution and have fun!

Port of New Bedford



Park your bike at the docks and experience the beauty that the fishing port has to offer. Take a tour of the harbor! Visit the Schooner Ernestina - a National Historic Landmark!

Get Cultured



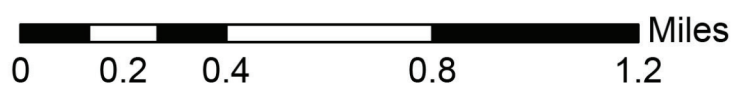
At the New Bedford Seaport Cultural District, you can find the city’s best food, entertainment and fun. Take a stroll to the New Bedford Art Museum/ArtWorks!



New Bedford

-  Cycle Aid Stations
-  Bike Racks
-  The Beach
-  New Bedford Regional Airport
-  Park
-  New Bedford Seaport Cultural District
-  New Bedford Whaling National Historical Park
-  Bike Paths
-  Shared Use Bike Path
-  Hurricane Barrier Bike Path

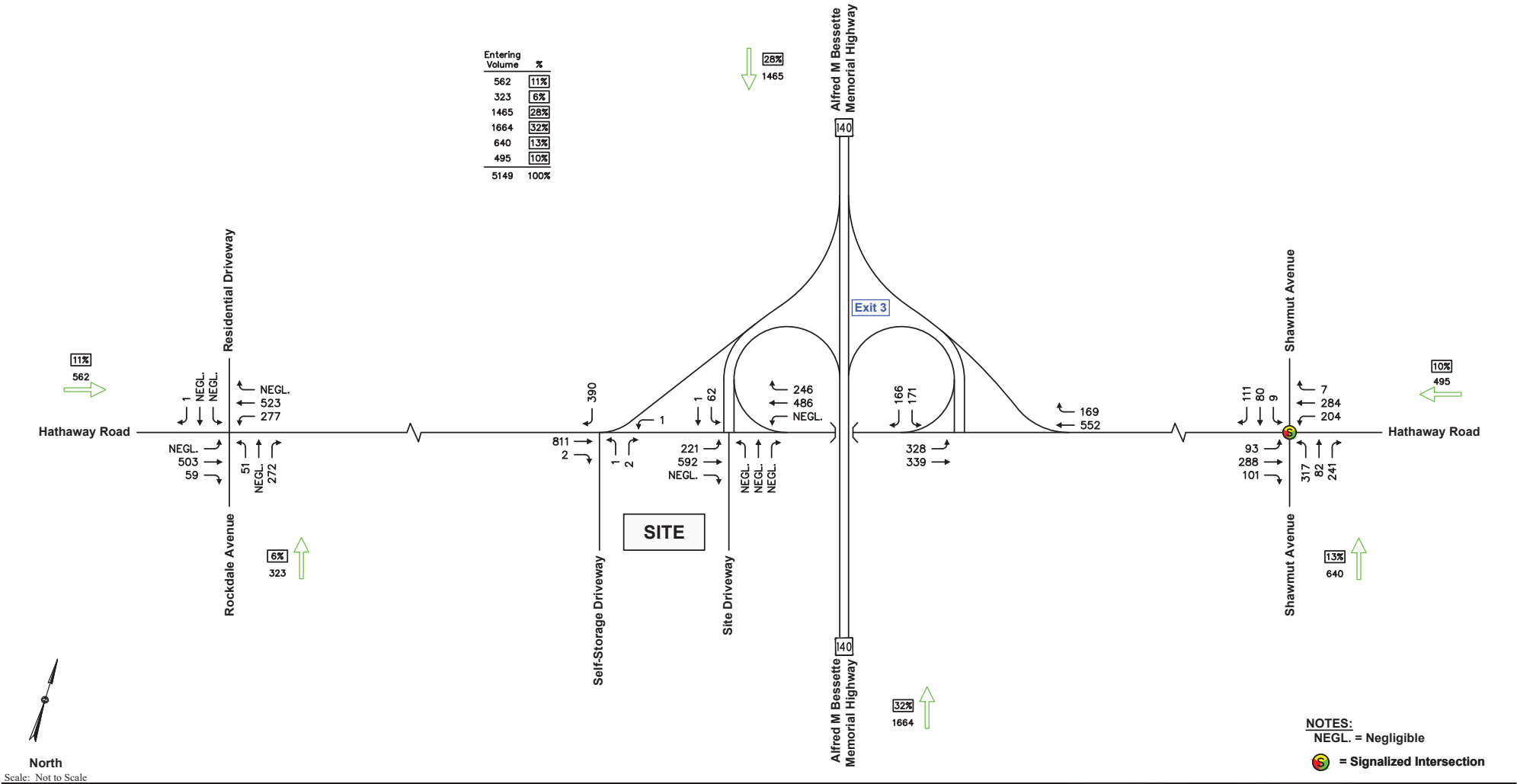
- 1** Museum of Madeiran Heritage
- 2** International Marketplace
- 3** New Bedford Museum of Glass
- 4** Historic Downtown
- 5** The Whaling Museum
- 6** Working Waterfront
- 7** Rotch-Jones-Duff House
- 8** Buttonwood Park Zoo
- 9** Fort Taber/Military Museum



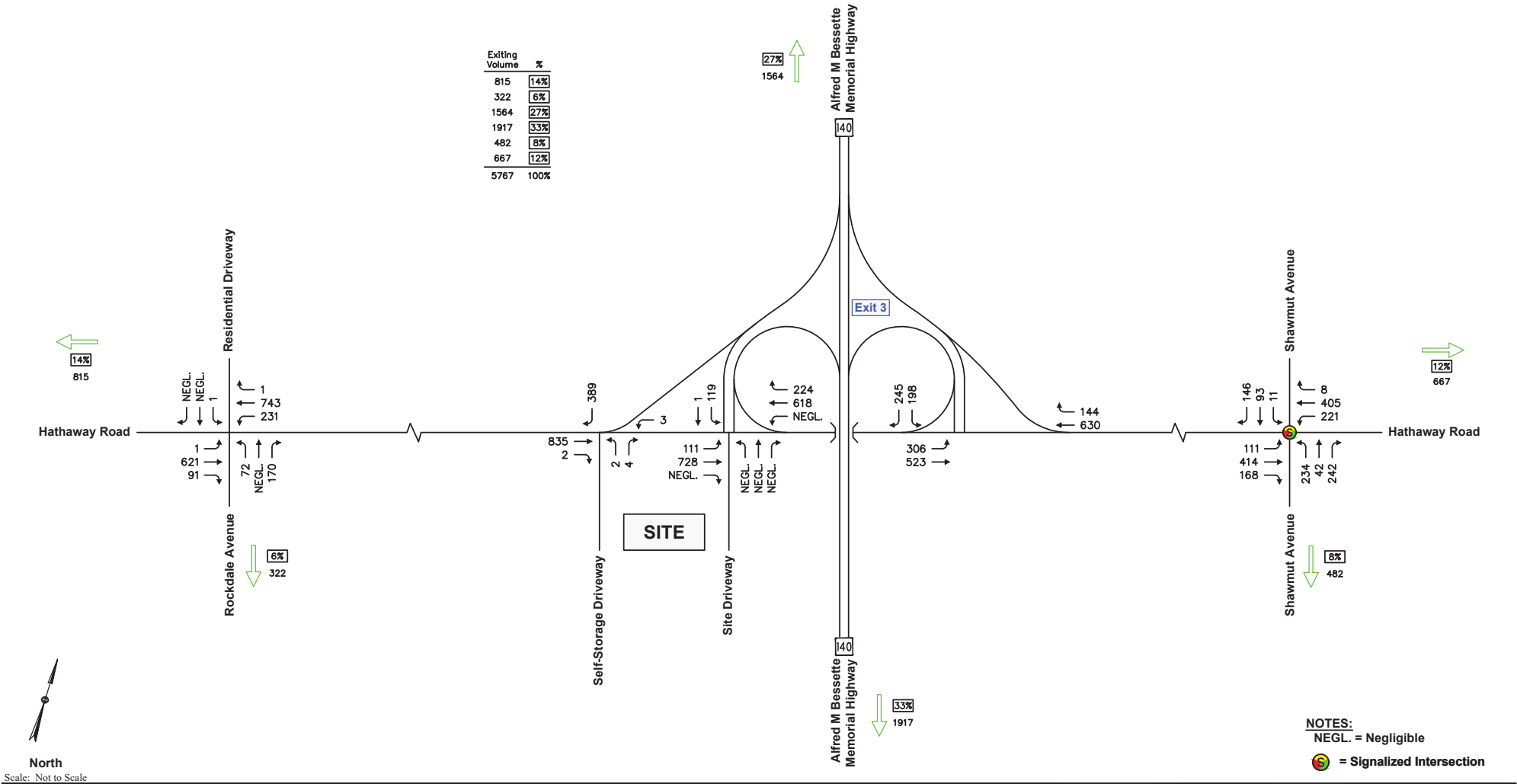
□ Trip Increase Calculations

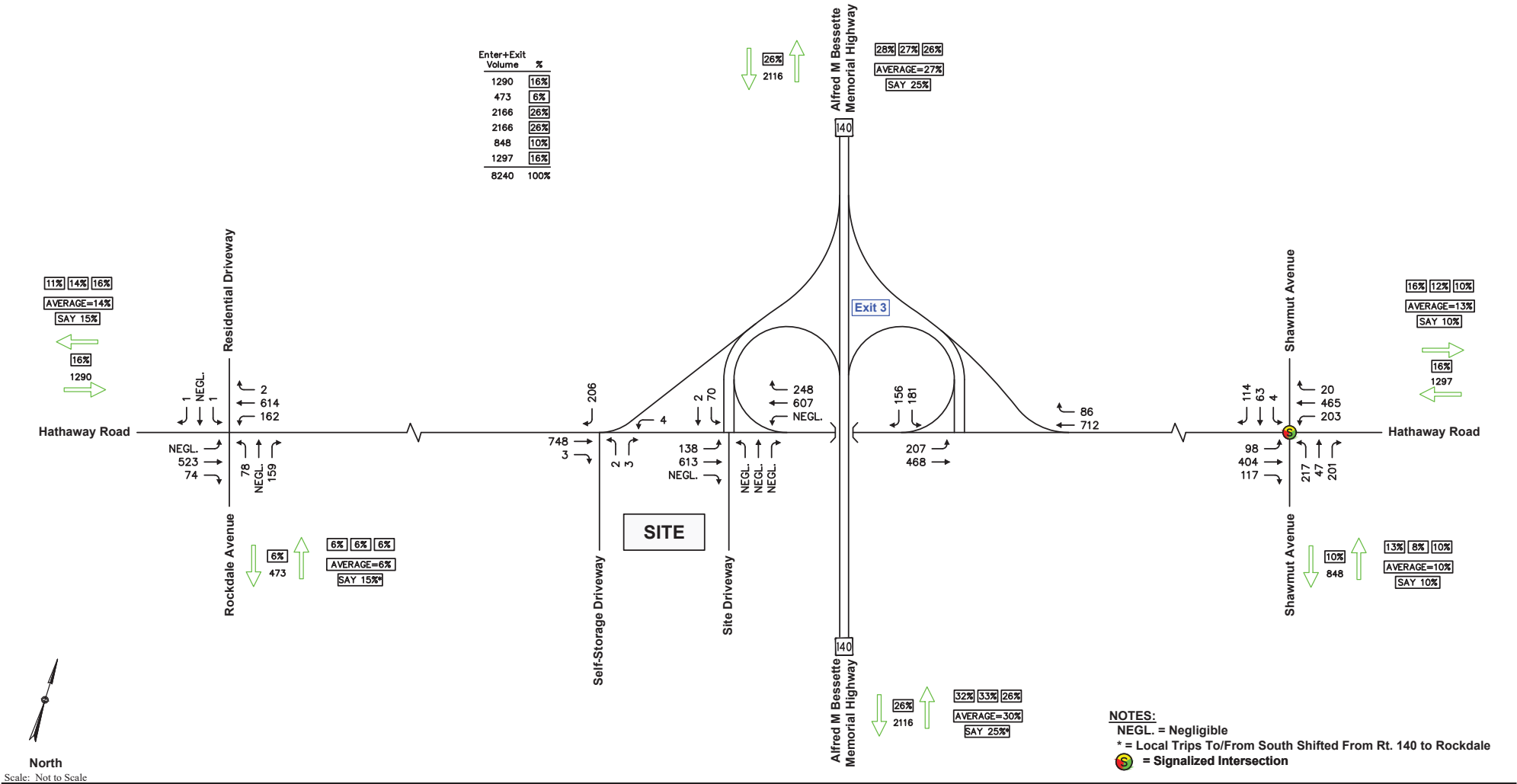
	Weekday Morning Peak Hour			Weekday Evening Peak Hour			Saturday Midday Peak Hour		
	Baseline Total Entering Volume	Trip Increase	% Trip Increase	Baseline Total Entering Volume	Trip Increase	% Trip Increase	Baseline Total Entering Volume	Trip Increase	% Trip Increase
Hathaway Road at Rockdale Avenue	1686	13	0.8%	1931	25	1.3%	1614	28	1.7%
Hathaway Road at 140 SB Ramps	1998	45	2.3%	2190	81	3.7%	1884	92	4.9%
Hathaway Road at 140 NB Ramps	1725	20	1.2%	2046	36	1.8%	1810	42	2.3%
Hathaway Road at Shawmut Avenue	1817	8	0.4%	2095	16	0.8%	1953	20	1.0%

□ Trip Distribution Calculations



North
Scale: Not to Scale





□ MassDOT Speed Data

2018	16,740 ³	1,590	10	59	16,230 (97%)	510 (3%)	Grown from 2017
2017	16,690	1,590	10	59	15,301 (92%)	1,388 (8%)	
2016	20,134 ³		10	57	19,026 (94%)	1,108 (6%)	Grown from 2015

|<<|<|>|>>| 1-5 of 30

Travel Demand Model										
Model Year	Model AADT	AM PHV	AM PPV	MD PHV	MD PPV	PM PHV	PM PPV	NT PHV	NT PPV	

VOLUME COUNT			
	Date	Int	Total
	Sun 10/4/2020	15	14,427
	Sat 10/3/2020	15	14,823
	Fri 10/2/2020	15	17,508
	Thu 10/1/2020	15	17,230
	Wed 9/30/2020	15	16,615
	Tue 9/29/2020	15	15,909
	Wed 6/19/2019	15	17,645
	Tue 6/18/2019	15	17,773
	Mon 6/17/2019	15	18,143
	Wed 8/9/2017	15	16,033
<< < > >> 1-10 of 21 mm / dd / yyyy To Date			

VOLUME TREND	
Year	Annual Growth
2020	-1%
2019	-7%
2018	0%
2017	-17%
2016	6%
2015	15%
2014	3%
2013	-5%
2012	3%
2011	9%

|<<|<|>|>>| 1-10 of 29

SPEED					
	Date	Int	Pace	85th	Total
	Sun 10/4/2020	15	35 - 45	43	14,427
	Sat 10/3/2020	15	35 - 45	43	14,823
	Fri 10/2/2020	15	35 - 45	43	17,508
	Thu 10/1/2020	15	35 - 45	43	17,230
	Wed 9/30/2020	15	35 - 45	43	16,615
	Tue 9/29/2020	15	35 - 45	43	15,909
	Wed 6/19/2019	15	35 - 45	42	17,645
	Tue 6/18/2019	15	35 - 45	42	17,773
	Mon 6/17/2019	15	35 - 45	42	18,143
	Wed 8/9/2017	15	35 - 45	43	16,033
<< < > >> 1-10 of 19 mm / dd / yyyy To Date					

CLASSIFICATION			
	Date	Int	Total
	Sun 10/4/2020	15	14,427
	Sat 10/3/2020	15	14,823
	Fri 10/2/2020	15	17,508
	Thu 10/1/2020	15	17,230
	Wed 9/30/2020	15	16,615
	Tue 9/29/2020	15	15,909
	Wed 6/19/2019	15	17,645
	Tue 6/18/2019	15	17,773
	Mon 6/17/2019	15	18,143
	Wed 8/9/2017	15	16,033
<< < > >> 1-10 of 19 mm / dd / yyyy To Date			

WEIGH-IN-MOTION				
	Date	Axles	Avg GVW	Total
No Data				

PER VEHICLE				
	Date	Axles	85th	Total
No Data				

GAP			
	Date	Int	Total
	Wed 8/17/2011	15	18,123
	Tue 8/16/2011	15	17,476

PARTIAL COUNT

Date Int 24-Hr Total

NOTES/FILES			
	Note	Date	

□ Signal Warrant Analysis

MUTCD TRAFFIC SIGNAL WARRANT ANALYSIS

INTERSECTION : Hathaway Road at Route 140 SB Ramps

Project Name	1166 - New Bedford (Battle Green)
Scenario	2021 Unadjusted Existing Volumes
Comments	No Pandemic Adjustment

	Street Name	Direction	No. of Lanes
Major Street 1	Hathaway Road	EB	1
Major Street 2	Hathaway Road	WB	1
Minor Street 1	Route 140 SB Ramps	SB	1
Minor Street 2	Site Driveway	NB	1

Left Turns Only

Operating Speed on Major Roadway >40 MPH

Distance to nearest traffic signal (ft) >300

Time Period	Hathaway Road EB Approach Volume	Hathaway Road WB Approach Volume	Total Major St. Volume	Route 140 SB Ramps SB Approach Volume	Site Driveway NB Approach Volume	Higher Minor St. Volume	Warrant 1			
							CONDITION A Minimum Volume Threshold Met Maj. 350 / Min. 105	CONDITION B Minimum Volume Threshold Met Maj. 525 / Min. 53	56% CONDITION A Minimum Volume Threshold Met Maj. 280 / Min. 84	56% CONDITION B Minimum Volume Threshold Met Maj. 420 / Min. 42
6:00-7:00 AM	744	445	0	57		0	NO	NO	NO	NO
7:00-8:00 AM	607	430	1189	69		57	NO	YES	NO	YES
8:00-9:00 AM	426	381	1037	54		69	NO	YES	NO	YES
9:00-10:00 AM	464	380	844	48		54	NO	YES	NO	YES
10:00-11:00 AM	525	396	921	37		48	NO	NO	NO	YES
11:00 AM-12:00 PM	553	434	987	62		37	NO	NO	NO	NO
12:00-1:00 PM	615	433	1048	59		62	NO	YES	NO	YES
1:00 PM - 2:00 PM	814	496	1310	82		59	NO	YES	NO	YES
2:00 PM - 3:00 PM	782	554	1336	108		82	NO	YES	NO	YES
3:00 PM - 4:00 PM	811	597	1408	116		108	YES	YES	YES	YES
4:00 PM - 5:00 PM	745	555	1300	92		116	YES	YES	YES	YES
5:00 PM - 6:00 PM	614	416	1030	68		92	NO	YES	YES	YES
6:00 PM - 7:00 PM	0	0	0	0		68	NO	YES	NO	YES
7:00 PM - 8:00 PM	0	0	0	0		0	NO	NO	NO	NO
8:00 PM - 9:00 PM	0	0	0	0		0	NO	NO	NO	NO
9:00 PM - 10:00 PM	0	0	0	0		0	NO	NO	NO	NO
						Hours Met	2	10	3	11
						Warrant Met	NO	YES	NO	YES

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% ^a	80% ^b	70% ^c	56% ^d	100% ^a	80% ^b	70% ^c	56% ^d
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

^a Basic minimum hourly volume

Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% ^a	80% ^b	70% ^c	56% ^d	100% ^a	80% ^b	70% ^c	56% ^d
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

^a Basic minimum hourly volume

MUTCD Traffic Signal Warrant #2 Analysis

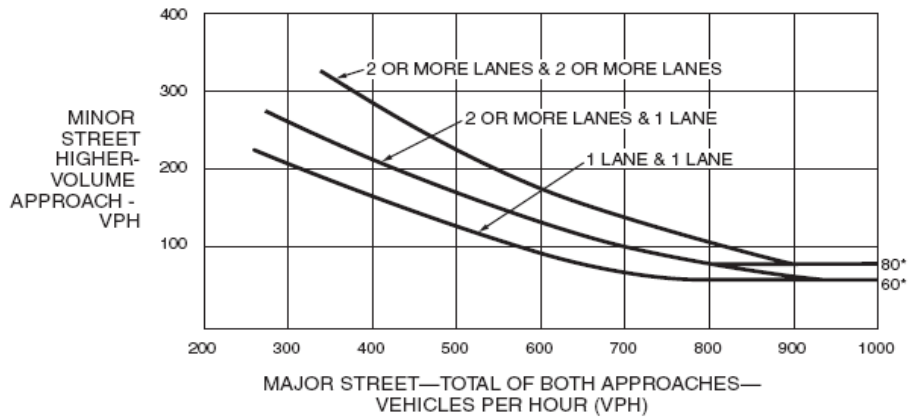
Project Name 1166 - New Bedford (Battle Green)
 Date 2021 Unadjusted Existing Volumes
 0% Rights Turns Included for SB Approach

	Street Name	Direction
Major 1	Hathaway Road	EB
Major 2	Hathaway Road	WB
Minor 1	Route 140 SB Ramps	SB
Minor 2	Site Driveway	NB

Node	Time Period	Major St. 1 Approach Volume	Major St. 2 Approach Volume	Total Major St. Volume	Minor St. 1 Approach Volume	Minor St. 2 Approach Volume	Higher Minor St. Volume	Warrant 2 Threshold Met
1	6:00-7:00 AM	0	0	0	0	0	0	NO
2	7:00-8:00 AM	744	445	1189	57	0	57	NO
3	8:00-9:00 AM	607	430	1037	69	0	69	YES
4	9:00-10:00 AM	426	381	807	54	0	54	NO
5	10:00-11:00 AM	464	380	844	48	0	48	NO
6	11:00 AM-12:00 PM	525	396	921	37	0	37	NO
7	12:00-1:00 PM	553	434	987	62	0	62	YES
8	1:00 PM - 2:00 PM	615	433	1048	59	0	59	NO
9	2:00 PM - 3:00 PM	814	496	1310	82	0	82	YES
10	3:00 PM - 4:00 PM	782	554	1336	108	0	108	YES
11	4:00 PM - 5:00 PM	811	597	1408	116	0	116	YES
12	5:00 PM - 6:00 PM	745	555	1300	92	0	92	YES
13	6:00 PM - 7:00 PM	614	416	1030	68	0	68	YES
14	7:00 PM - 8:00 PM	0	0	0	0	0	0	NO
15	8:00 PM - 9:00 PM	0	0	0	0	0	0	NO
16	9:00 PM - 10:00 PM	0	0	0	0	0	0	NO
Hours Met								7

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

- Pedestrian and Bicycle Count Sheets

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Rt 140 NB Ramps
E/W: Hathaway Road
New Bedford, MA

File Name : 1166_Hathaway_at_140_NB_Ramps_881463_09-30-2021
Site Code : 1166
Start Date : 9/30/2021
Page No : 1

Groups Printed- Bicycles on Road - Pedestrians

[illegible]

28 Lord Road, Suite 280
Marlborough, MA, 01752

File Name : 1166_Hathaway_at_140_SB_Ramps_881461_09-30-2021
Site Code : 1166
Start Date : 9/30/2021
Page No : 1

[illegible]

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Hathaway Road
NB: Rockdale Avenue
New Bedford, MA

File Name : 1166_Hathaway_at_Rockdale_881456_09-30-2021
Site Code : 1166
Start Date : 9/30/2021
Page No : 1

Groups Printed- Bicycles on Road - Pedestrians

	Southbound Approach From North					Hathaway Road From East					Rockdale Avenue From South					Hathaway Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
Total	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	3
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	1	0	0	1	0	0	0	3	3	0	0	0	0	0	4
Grand Total	0	0	0	1	1	0	1	0	0	1	0	0	0	4	4	1	0	0	0	1	7
Apprch %	0	0	0	100		0	100	0	0		0	0	0	100		100	0	0	0		
Total %	0	0	0	14.3	14.3	0	14.3	0	0	14.3	0	0	0	57.1	57.1	14.3	0	0	0	14.3	
Bicycles on Road	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2
% Bicycles on Road	0	0	0	0	0	0	100	0	0	100	0	0	0	0	0	100	0	0	0	100	28.6
Pedestrians	0	0	0	1	1	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	5
% Pedestrians	0	0	0	100	100	0	0	0	0	0	0	0	0	100	100	0	0	0	0	0	71.4

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Shawmut Avenue
E/W: Hathaway Road
New Bedford, MA

File Name : 1166_Hathaway_at_Shawmut_881460_09-30-2021
Site Code : 1166
Start Date : 9/30/2021
Page No : 1

Groups Printed- Bicycles on Road - Pedestrians

	Shawmut Avenue From North					Hathaway Road From East					Shawmut Avenue From South					Hathaway Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	2
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	3
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	4
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	1	1	0	0	1	1	2	1	1	0	0	2	0	0	1	1	2	7
Apprch %	0	0	0	100		0	0	50	50		50	50	0	0		0	0	50	50		
Total %	0	0	0	14.3	14.3	0	0	14.3	14.3	28.6	14.3	14.3	0	0	28.6	0	0	14.3	14.3	28.6	
Bicycles on Road	0	0	0	0	0	0	0	1	0	1	1	1	0	0	2	0	0	1	0	1	4
% Bicycles on Road	0	0	0	0	0	0	0	100	0	50	100	100	0	0	100	0	0	100	0	50	57.1
Pedestrians	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	3
% Pedestrians	0	0	0	100	100	0	0	0	100	50	0	0	0	0	0	0	0	0	100	50	42.9

28 Lord Road, Suite 280
Marlborough, MA, 01752

File Name : 1166_Hathaway_at_140_NB_Ramps_Sat_10-2-2021
Site Code : 1166
Start Date : 10/2/2021
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[illegible]

28 Lord Road, Suite 280
Marlborough, MA, 01752

File Name : 1166_Hathaway_at_140_SB_Ramps_Sat_10-2-2021
Site Code : 1166
Start Date : 10/2/2021
Page No : 1

[illegible]

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Hathaway Road
NB: Rockdale Avenue
New Bedford, MA

File Name : 1166_Hathaway_at_Rockdale_Sat_10-2-2021
Site Code : 1166
Start Date : 10/2/2021
Page No : 1

Groups Printed- Bicycles on Road - Pedestrians

[illegible]

MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Shawmut Avenue
E/W: Hathaway Road
New Bedford, MA

File Name : 1166_Hathaway_at_Shawmut_Sat_10-2-2021
Site Code : 1166
Start Date : 10/2/2021
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Groups Printed- Bicycles on Road - Pedestrians





















	Shawmut Avenue From North					Hathaway Road From East					Shawmut Avenue From South					Hathaway Road From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
11:00 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3
11:15 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	2
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	2	2	5
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	2
Grand Total	0	0	0	1	1	0	0	0	2	2	0	1	0	1	2	0	0	0	2	2	7
Apprch %	0	0	0	100		0	0	0	100		0	50	0	50		0	0	0	100		
Total %	0	0	0	14.3	14.3	0	0	0	28.6	28.6	0	14.3	0	14.3	28.6	0	0	0	28.6	28.6	
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	100	0	0	50	0	0	0	0	0	14.3
Pedestrians	0	0	0	1	1	0	0	0	2	2	0	0	0	1	1	0	0	0	2	2	6
% Pedestrians	0	0	0	100	100	0	0	0	100	100	0	0	0	100	50	0	0	0	100	100	85.7

□ Updated Capacity Analysis

Lanes, Volumes, Timings













9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	93	288	101	204	284	7	317	82	241	9	80	111
Future Volume (vph)	93	288	101	204	284	7	317	82	241	9	80	111
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.961			0.996			0.888				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1612	1748	0	1719	1709	0	1687	1572	0	0	1502	1262
Flt Permitted	0.543			0.267			0.403				0.912	
Satd. Flow (perm)	921	1748	0	483	1709	0	716	1572	0	0	1376	1262
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			2			225				202
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	12%	5%	3%	5%	11%	0%	7%	20%	3%	25%	26%	28%
Adj. Flow (vph)	100	310	109	219	305	8	341	88	259	10	86	119
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	419	0	219	313	0	341	347	0	0	96	119
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	27.5		13.6	28.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	15.6%	34.1%		16.9%	35.4%		19.6%	49.0%		29.4%	29.4%	29.4%
Maximum Green (s)	7.0	21.0		8.0	22.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	26.7	19.0		30.6	24.5		22.9	22.7			11.2	11.2
Actuated g/C Ratio	0.39	0.28		0.45	0.36		0.33	0.33			0.16	0.16
v/c Ratio	0.23	0.84		0.61	0.51		0.88	0.52			0.43	0.32
Control Delay	12.8	40.2		20.9	24.3		46.4	9.6			35.0	2.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	12.8	40.2		20.9	24.3		46.4	9.6			35.0	2.8
LOS	B	D		C	C		D	A			D	A
Approach Delay		34.9			22.9			27.8			17.2	
Approach LOS		C			C			C			B	
90th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	29.4		13.9	13.9	13.9
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	26.5		11.0	11.0	11.0
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	6.9	21.0		8.0	22.9		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.0	19.8		8.0	22.6		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Min	Gap		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	12.7		7.5	26.6		10.2	10.0		0.0	0.0	0.0
10th %ile Term Code	Skip	Gap		Gap	Hold		Hold	Min		Skip	Skip	Skip
Queue Length 50th (ft)	23	165		54	116		122	38			41	0
Queue Length 95th (ft)	53	#334		#110	209		#257	102			85	6
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	438	565		364	614		386	903			372	488
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.23	0.74		0.60	0.51		0.88	0.38			0.26	0.24

Intersection Summary

Area Type: Other

Cycle Length: 80.6

Actuated Cycle Length: 68.5

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Morning Peak Hour Conditions

Natural Cycle: 75

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 27.2

Intersection LOS: C

Intersection Capacity Utilization 71.9%

ICU Level of Service C

Analysis Period (min) 15

90th %ile Actuated Cycle: 76.5

70th %ile Actuated Cycle: 73.6

50th %ile Actuated Cycle: 72.6








30th %ile Actuated Cycle: 71.4

10th %ile Actuated Cycle: 48.3

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.





















Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	28.5 s	39.5 s
 Ø5	 Ø6	 Ø7
13.6 s	27.5 s	15.8 s
		 Ø8
		23.7 s

Lanes, Volumes, Timings













9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	111	414	168	221	405	8	234	42	242	11	93	146
Future Volume (vph)	111	414	168	221	405	8	234	42	242	11	93	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.957			0.997			0.872				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1530	1760	0	1770	1866	0	1770	1589	0	0	1840	1495
Flt Permitted	0.413			0.114			0.447				0.927	
Satd. Flow (perm)	665	1760	0	212	1866	0	833	1589	0	0	1714	1495
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			1			257				170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	18%	3%	4%	2%	1%	25%	2%	17%	2%	9%	2%	8%
Adj. Flow (vph)	118	440	179	235	431	9	249	45	257	12	99	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	118	619	0	235	440	0	249	302	0	0	111	155
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	39.6	32.0		49.1	37.6		26.9	26.7			11.2	11.2
Actuated g/C Ratio	0.45	0.36		0.56	0.43		0.30	0.30			0.13	0.13
v/c Ratio	0.32	0.95		0.74	0.55		0.69	0.46			0.51	0.46
Control Delay	12.7	53.2		31.0	22.7		36.5	7.5			45.0	9.5
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	12.7	53.2		31.0	22.7		36.5	7.5			45.0	9.5
LOS	B	D		C	C		D	A			D	A
Approach Delay		46.7			25.6			20.6			24.3	
Approach LOS		D			C			C			C	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	30.0		14.5	14.5	14.5
90th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	27.2		11.7	11.7	11.7
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.6	32.0		12.0	38.2		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	6.0	32.0		9.3	36.1		10.0	25.5		10.0	10.0	10.0
10th %ile Term Code	Min	Max		Gap	Hold		Max	Hold		Min	Min	Min
Queue Length 50th (ft)	28	315		67	175		113	18			59	0
Queue Length 95th (ft)	59	#576		#184	289		182	80			111	45
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	369	652		330	801		360	762			349	440
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.32	0.95		0.71	0.55		0.69	0.40			0.32	0.35

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 88.3

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Weekday Evening Peak Hour Conditions

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.95

Intersection Signal Delay: 31.2

Intersection LOS: C

Intersection Capacity Utilization 79.0%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 92.1

70th %ile Actuated Cycle: 89.3

50th %ile Actuated Cycle: 87.6








30th %ile Actuated Cycle: 87.6

10th %ile Actuated Cycle: 84.9

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.





















Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	43.5 s	39.5 s
 Ø5	 Ø6	 Ø7
17.6 s	38.5 s	15.8 s
		 Ø8
		23.7 s

Lanes, Volumes, Timings













9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	98	404	117	203	465	20	217	47	201	4	63	114
Future Volume (vph)	98	404	117	203	465	20	217	47	201	4	63	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.966			0.994			0.878				0.850
Flt Protected	0.950			0.950			0.950				0.997	
Satd. Flow (prot)	1719	1786	0	1787	1889	0	1805	1635	0	0	1859	1553
Flt Permitted	0.381			0.192			0.397				0.959	
Satd. Flow (perm)	689	1786	0	361	1889	0	754	1635	0	0	1788	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			3			205				170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	5%	3%	2%	1%	0%	0%	0%	2%	2%	0%	2%	4%
Adj. Flow (vph)	100	412	119	207	474	20	221	48	205	4	64	116
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	531	0	207	494	0	221	253	0	0	68	116
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	35.0	27.4		43.7	35.4		22.2	22.0			10.5	10.5
Actuated g/C Ratio	0.45	0.35		0.56	0.45		0.28	0.28			0.13	0.13
v/c Ratio	0.25	0.84		0.53	0.58		0.63	0.42			0.29	0.33
Control Delay	11.1	37.5		14.3	21.7		32.8	8.5			38.4	4.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	11.1	37.5		14.3	21.7		32.8	8.5			38.4	4.6
LOS	B	D		B	C		C	A			D	A
Approach Delay		33.3			19.5			19.9			17.1	
Approach LOS		C			B			B			B	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	26.3		10.8	10.8	10.8
90th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.5		10.0	10.0	10.0
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
50th %ile Green (s)	6.7	30.2		11.1	35.4		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Gap	Gap		Gap	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.0	25.1		9.4	29.3		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Min	Gap		Gap	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	18.4		7.7	32.5		10.2	10.0		0.0	0.0	0.0
10th %ile Term Code	Skip	Gap		Gap	Hold		Hold	Min		Skip	Skip	Skip
Queue Length 50th (ft)	23	247		51	201		93	18			34	0
Queue Length 95th (ft)	46	#426		87	309		162	77			76	18
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	406	761		428	940		352	834			423	497
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.25	0.70		0.48	0.53		0.63	0.30			0.16	0.23

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 78.6

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2021 Baseline Conditions
Saturday Midday Peak Hour Conditions

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 23.8

Intersection LOS: C

Intersection Capacity Utilization 73.4%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 88.4

70th %ile Actuated Cycle: 87.6

50th %ile Actuated Cycle: 84.9








30th %ile Actuated Cycle: 78.1

10th %ile Actuated Cycle: 54.2

95th percentile volume exceeds capacity, queue may be longer.





















Queue shown is maximum after two cycles.

Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	43.5 s	39.5 s
 Ø5	 Ø6	 Ø7
17.6 s	38.5 s	15.8 s
		 Ø8
		23.7 s













Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	309	108	219	304	8	340	88	258	10	86	119
Future Volume (vph)	100	309	108	219	304	8	340	88	258	10	86	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.961			0.996			0.888				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1612	1748	0	1719	1709	0	1687	1572	0	0	1502	1262
Flt Permitted	0.480			0.231			0.451				0.922	
Satd. Flow (perm)	814	1748	0	418	1709	0	801	1572	0	0	1391	1262
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			2			223				202
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	12%	5%	3%	5%	11%	0%	7%	20%	3%	25%	26%	28%
Adj. Flow (vph)	108	332	116	235	327	9	366	95	277	11	92	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	108	448	0	235	336	0	366	372	0	0	103	128
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	27.5		13.6	28.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	15.6%	34.1%		16.9%	35.4%		19.6%	49.0%		29.4%	29.4%	29.4%
Maximum Green (s)	7.0	21.0		8.0	22.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	28.0	20.5		31.5	25.1		26.9	26.7			11.2	11.2
Actuated g/C Ratio	0.38	0.28		0.43	0.34		0.37	0.36			0.15	0.15
v/c Ratio	0.28	0.89		0.73	0.57		0.88	0.52			0.49	0.35
Control Delay	13.5	46.8		28.9	26.0		45.5	10.1			37.0	3.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	13.5	46.8		28.9	26.0		45.5	10.1			37.0	3.7
LOS	B	D		C	C		D	B			D	A
Approach Delay		40.4			27.2			27.7			18.6	
Approach LOS		D			C			C			B	
90th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	30.0		14.5	14.5	14.5
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	27.0		11.5	11.5	11.5
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.2	21.0		8.0	23.6		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	18.6		8.0	33.0		10.0	25.5		10.0	10.0	10.0
10th %ile Term Code	Skip	Gap		Max	Hold		Max	Hold		Min	Min	Min
Queue Length 50th (ft)	25	181		59	126		133	47			44	0
Queue Length 95th (ft)	57	#373		#150	228		#279	118			89	11
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	391	516		321	586		414	839			341	462
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.28	0.87		0.73	0.57		0.88	0.44			0.30	0.28

Intersection Summary

Area Type: Other

Cycle Length: 80.6

Actuated Cycle Length: 73.3

Lanes, Volumes, Timings 9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Weekday Morning Peak Hour Conditions

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 29.9

Intersection LOS: C

Intersection Capacity Utilization 75.6%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 77.1

70th %ile Actuated Cycle: 74.1

50th %ile Actuated Cycle: 72.6








30th %ile Actuated Cycle: 72.6

10th %ile Actuated Cycle: 70.2

95th percentile volume exceeds capacity, queue may be longer.





















Queue shown is maximum after two cycles.

Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	28.5 s	39.5 s
 Ø5	 Ø6	 Ø7
13.6 s	27.5 s	15.8 s
		 Ø8
		23.7 s

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road













2028 No-Build Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	119	444	180	237	434	9	251	45	259	12	100	157
Future Volume (vph)	119	444	180	237	434	9	251	45	259	12	100	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.957			0.997			0.872				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1530	1760	0	1770	1866	0	1770	1590	0	0	1840	1495
Flt Permitted	0.377			0.106			0.448				0.923	
Satd. Flow (perm)	607	1760	0	197	1866	0	835	1590	0	0	1707	1495
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			1			276				170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	18%	3%	4%	2%	1%	25%	2%	17%	2%	9%	2%	8%
Adj. Flow (vph)	127	472	191	252	462	10	267	48	276	13	106	167
Shared Lane Traffic (%)												
Lane Group Flow (vph)	127	663	0	252	472	0	267	324	0	0	119	167
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	39.7	32.0		49.6	37.8		27.3	27.1			11.5	11.5
Actuated g/C Ratio	0.45	0.36		0.56	0.43		0.31	0.30			0.13	0.13
v/c Ratio	0.37	1.02		0.79	0.60		0.74	0.48			0.54	0.49
Control Delay	13.7	70.7		38.1	23.9		39.5	7.6			45.7	10.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	13.7	70.7		38.1	23.9		39.5	7.6			45.7	10.8
LOS	B	E		D	C		D	A			D	B
Approach Delay		61.5			28.8			22.0			25.3	
Approach LOS		E			C			C			C	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	30.7		15.2	15.2	15.2
90th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	27.8		12.3	12.3	12.3
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.9		10.4	10.4	10.4
50th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
30th %ile Green (s)	6.8	32.0		12.0	38.0		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	6.0	32.0		10.5	37.3		10.0	25.5		10.0	10.0	10.0
10th %ile Term Code	Min	Max		Gap	Hold		Max	Hold		Min	Min	Min
Queue Length 50th (ft)	30	~363		82	194		122	19			64	0
Queue Length 95th (ft)	64	#642		#221	320		#204	83			118	53
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	345	648		323	795		361	771			345	438
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.37	1.02		0.78	0.59		0.74	0.42			0.34	0.38

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 88.9

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Weekday Evening Peak Hour Conditions

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.02

Intersection Signal Delay: 37.5

Intersection Capacity Utilization 83.1%

Analysis Period (min) 15

90th %ile Actuated Cycle: 92.8

70th %ile Actuated Cycle: 89.9

50th %ile Actuated Cycle: 88

30th %ile Actuated Cycle: 87.6

10th %ile Actuated Cycle: 86.1

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.








95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Intersection LOS: D





















ICU Level of Service E

Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	43.5 s	39.5 s
 Ø5	 Ø6	 Ø7
17.6 s	38.5 s	15.8 s
		 Ø8
		23.7 s













Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	433	125	218	498	21	233	50	215	4	68	122
Future Volume (vph)	105	433	125	218	498	21	233	50	215	4	68	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.966			0.994			0.878				0.850
Flt Protected	0.950			0.950			0.950				0.997	
Satd. Flow (prot)	1719	1786	0	1787	1889	0	1805	1635	0	0	1859	1553
Flt Permitted	0.339			0.157			0.449				0.968	
Satd. Flow (perm)	613	1786	0	295	1889	0	853	1635	0	0	1805	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			3			219				170
Link Speed (mph)		30			30			30				30
Link Distance (ft)		950			500			500				500
Travel Time (s)		21.6			11.4			11.4				11.4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	5%	3%	2%	1%	0%	0%	0%	2%	2%	0%	2%	4%
Adj. Flow (vph)	107	442	128	222	508	21	238	51	219	4	69	124
Shared Lane Traffic (%)												
Lane Group Flow (vph)	107	570	0	222	529	0	238	270	0	0	73	124
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	37.3	29.8		46.8	37.7		25.8	25.6			10.2	10.2
Actuated g/C Ratio	0.44	0.35		0.55	0.45		0.30	0.30			0.12	0.12
v/c Ratio	0.30	0.89		0.62	0.63		0.64	0.42			0.33	0.37
Control Delay	11.7	43.6		18.8	23.1		33.8	8.2			40.2	5.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	11.7	43.6		18.8	23.1		33.8	8.2			40.2	5.7
LOS	B	D		B	C		C	A			D	A
Approach Delay		38.6			21.8			20.2			18.5	
Approach LOS		D			C			C			B	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	26.6		11.1	11.1	11.1
90th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.5		10.0	10.0	10.0
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
50th %ile Green (s)	6.9	32.0		12.0	37.9		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.1	30.6		10.5	35.8		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Gap		Gap	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	23.1		8.8	38.3		9.0	24.5		10.0	10.0	10.0
10th %ile Term Code	Skip	Gap		Gap	Hold		Gap	Hold		Min	Min	Min
Queue Length 50th (ft)	25	279		55	222		107	21			38	0
Queue Length 95th (ft)	49	#479		110	340		175	80			80	24
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	365	688		376	851		372	781			385	465
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.29	0.83		0.59	0.62		0.64	0.35			0.19	0.27

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 84.6

Lanes, Volumes, Timings 9: Shawmut Avenue & Hathaway Road

2028 No-Build Conditions
Saturday Midday Peak Hour Conditions

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 26.4

Intersection LOS: C

Intersection Capacity Utilization 77.1%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 88.7

70th %ile Actuated Cycle: 87.6

50th %ile Actuated Cycle: 87.6

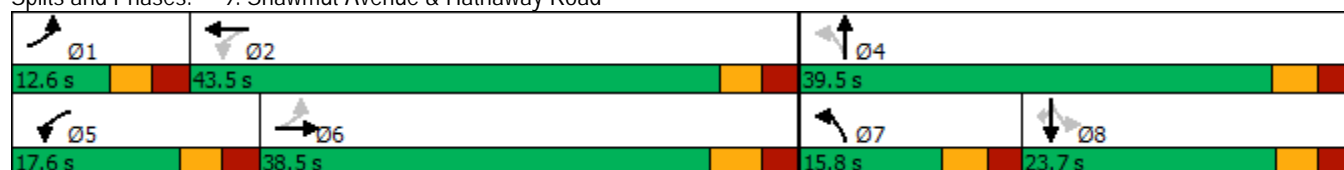
30th %ile Actuated Cycle: 84.7

10th %ile Actuated Cycle: 74.5

95th percentile volume exceeds capacity, queue may be longer.





















Queue shown is maximum after two cycles.

Splits and Phases: 9: Shawmut Avenue & Hathaway Road



Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road













2028 Build Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	311	110	219	306	8	342	88	258	10	86	119
Future Volume (vph)	100	311	110	219	306	8	342	88	258	10	86	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.961			0.996			0.888				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1612	1748	0	1719	1709	0	1687	1572	0	0	1502	1262
Flt Permitted	0.478			0.228			0.451				0.921	
Satd. Flow (perm)	811	1748	0	413	1709	0	801	1572	0	0	1390	1262
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			2			223				202
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	12%	5%	3%	5%	11%	0%	7%	20%	3%	25%	26%	28%
Adj. Flow (vph)	108	334	118	235	329	9	368	95	277	11	92	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	108	452	0	235	338	0	368	372	0	0	103	128
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Weekday Morning Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	27.5		13.6	28.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	15.6%	34.1%		16.9%	35.4%		19.6%	49.0%		29.4%	29.4%	29.4%
Maximum Green (s)	7.0	21.0		8.0	22.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	28.3	20.7		31.7	25.3		26.9	26.7			11.2	11.2
Actuated g/C Ratio	0.39	0.28		0.43	0.34		0.37	0.36			0.15	0.15
v/c Ratio	0.28	0.89		0.73	0.57		0.89	0.52			0.49	0.35
Control Delay	13.5	47.1		29.2	26.0		46.6	10.1			37.1	3.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	13.5	47.1		29.2	26.0		46.6	10.1			37.1	3.7
LOS	B	D		C	C		D	B			D	A
Approach Delay		40.6			27.3			28.3			18.6	
Approach LOS		D			C			C			B	
90th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	30.0		14.5	14.5	14.5
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	27.0		11.5	11.5	11.5
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	7.0	21.0		8.0	22.8		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.2	21.0		8.0	23.6		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	19.6		8.0	34.0		10.0	25.5		10.0	10.0	10.0
10th %ile Term Code	Skip	Gap		Max	Hold		Max	Hold		Min	Min	Min
Queue Length 50th (ft)	25	183		59	127		134	47			44	0
Queue Length 95th (ft)	57	#378		#152	230		#283	118			89	11
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	392	514		320	589		413	838			340	461
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.28	0.88		0.73	0.57		0.89	0.44			0.30	0.28

Intersection Summary

Area Type: Other

Cycle Length: 80.6

Actuated Cycle Length: 73.5

Lanes, Volumes, Timings 9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Weekday Morning Peak Hour Conditions

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 30.2

Intersection LOS: C

Intersection Capacity Utilization 75.9%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 77.1

70th %ile Actuated Cycle: 74.1

50th %ile Actuated Cycle: 72.6








30th %ile Actuated Cycle: 72.6

10th %ile Actuated Cycle: 71.2

95th percentile volume exceeds capacity, queue may be longer.





















Queue shown is maximum after two cycles.

Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	28.5 s	39.5 s
 Ø5	 Ø6	 Ø7
13.6 s	27.5 s	15.8 s
		 Ø8
		23.7 s













Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	119	448	184	237	438	9	255	45	259	12	100	157
Future Volume (vph)	119	448	184	237	438	9	255	45	259	12	100	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.956			0.997			0.872				0.850
Flt Protected	0.950			0.950			0.950				0.995	
Satd. Flow (prot)	1530	1759	0	1770	1866	0	1770	1590	0	0	1840	1495
Flt Permitted	0.372			0.106			0.448				0.923	
Satd. Flow (perm)	599	1759	0	197	1866	0	835	1590	0	0	1707	1495
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			1			276				170
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		950			500			500			500	
Travel Time (s)		21.6			11.4			11.4			11.4	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	18%	3%	4%	2%	1%	25%	2%	17%	2%	9%	2%	8%
Adj. Flow (vph)	127	477	196	252	466	10	271	48	276	13	106	167
Shared Lane Traffic (%)												
Lane Group Flow (vph)	127	673	0	252	476	0	271	324	0	0	119	167
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Weekday Evening Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	39.7	32.0		49.6	37.8		27.3	27.1			11.5	11.5
Actuated g/C Ratio	0.45	0.36		0.56	0.43		0.31	0.30			0.13	0.13
v/c Ratio	0.38	1.04		0.79	0.60		0.75	0.48			0.54	0.49
Control Delay	13.8	75.0		38.1	24.0		40.3	7.6			45.7	10.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	13.8	75.0		38.1	24.0		40.3	7.6			45.7	10.8
LOS	B	E		D	C		D	A			D	B
Approach Delay		65.3			28.9			22.5			25.3	
Approach LOS		E			C			C			C	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	30.7		15.2	15.2	15.2
90th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	27.8		12.3	12.3	12.3
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
50th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.9		10.4	10.4	10.4
50th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Gap	Gap	Gap
30th %ile Green (s)	6.8	32.0		12.0	38.0		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	6.0	32.0		10.5	37.3		10.0	25.5		10.0	10.0	10.0
10th %ile Term Code	Min	Max		Gap	Hold		Max	Hold		Min	Min	Min
Queue Length 50th (ft)	30	~395		82	196		124	19			64	0
Queue Length 95th (ft)	64	#656		#221	323		#211	83			118	53
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	342	648		323	795		361	771			345	438
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.37	1.04		0.78	0.60		0.75	0.42			0.34	0.38

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 88.9

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Weekday Evening Peak Hour Conditions

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 1.04

Intersection Signal Delay: 39.0

Intersection Capacity Utilization 83.8%

Analysis Period (min) 15

90th %ile Actuated Cycle: 92.8

70th %ile Actuated Cycle: 89.9

50th %ile Actuated Cycle: 88

30th %ile Actuated Cycle: 87.6

10th %ile Actuated Cycle: 86.1

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

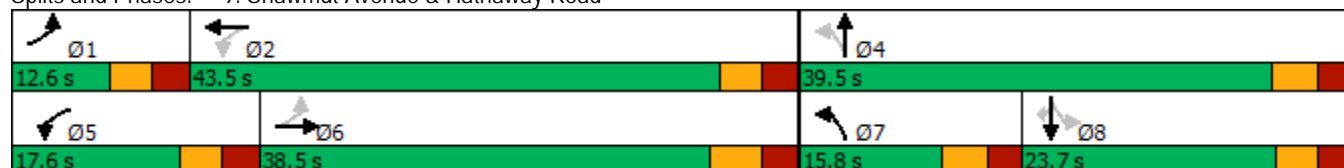
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Intersection LOS: D

ICU Level of Service E





















Splits and Phases: 9: Shawmut Avenue & Hathaway Road



Lanes, Volumes, Timings













9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	438	130	208	503	21	238	50	215	4	68	122
Future Volume (vph)	105	438	130	208	503	21	238	50	215	4	68	122
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	80		0	0		50
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.966			0.994			0.878				0.850
Flt Protected	0.950			0.950			0.950				0.997	
Satd. Flow (prot)	1719	1786	0	1787	1889	0	1805	1635	0	0	1859	1553
Flt Permitted	0.333			0.153			0.447				0.968	
Satd. Flow (perm)	603	1786	0	288	1889	0	849	1635	0	0	1805	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			3			219				170
Link Speed (mph)		30			30			30				30
Link Distance (ft)		950			500			500				500
Travel Time (s)		21.6			11.4			11.4				11.4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	5%	3%	2%	1%	0%	0%	0%	2%	2%	0%	2%	4%
Adj. Flow (vph)	107	447	133	212	513	21	243	51	219	4	69	124
Shared Lane Traffic (%)												
Lane Group Flow (vph)	107	580	0	212	534	0	243	270	0	0	73	124
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100		20	100	20
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	1	6		5	2		7	4			8	

Lanes, Volumes, Timings
9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Saturday Midday Peak Hour Conditions

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6			2			4			8		8
Detector Phase	1	6		5	2		7	4		8	8	8
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0		6.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.6	16.5		11.6	15.7		11.8	16.0		15.7	15.7	15.7
Total Split (s)	12.6	38.5		17.6	43.5		15.8	39.5		23.7	23.7	23.7
Total Split (%)	13.2%	40.3%		18.4%	45.5%		16.5%	41.3%		24.8%	24.8%	24.8%
Maximum Green (s)	7.0	32.0		12.0	37.8		10.0	33.5		18.0	18.0	18.0
Yellow Time (s)	3.0	3.8		3.0	3.0		3.3	3.3		3.0	3.0	3.0
All-Red Time (s)	2.6	2.7		2.6	2.7		2.5	2.7		2.7	2.7	2.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	5.6	6.5		5.6	5.7		5.8	6.0			5.7	5.7
Lead/Lag	Lead	Lag		Lead	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Recall Mode	None	Min		None	Min		None	None		None	None	None
Act Effect Green (s)	37.9	30.4		47.2	38.1		25.8	25.6			10.2	10.2
Actuated g/C Ratio	0.45	0.36		0.55	0.45		0.30	0.30			0.12	0.12
v/c Ratio	0.30	0.89		0.60	0.63		0.66	0.42			0.34	0.37
Control Delay	11.7	43.7		18.2	23.1		34.7	8.2			40.3	5.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	11.7	43.7		18.2	23.1		34.7	8.2			40.3	5.7
LOS	B	D		B	C		C	A			D	A
Approach Delay		38.7			21.7			20.8			18.5	
Approach LOS		D			C			C			B	
90th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	26.6		11.1	11.1	11.1
90th %ile Term Code	Max	Max		Max	Max		Max	Hold		Gap	Gap	Gap
70th %ile Green (s)	7.0	32.0		12.0	37.8		10.0	25.5		10.0	10.0	10.0
70th %ile Term Code	Max	Max		Max	Hold		Max	Hold		Min	Min	Min
50th %ile Green (s)	6.9	32.0		12.0	37.9		10.0	25.5		10.0	10.0	10.0
50th %ile Term Code	Gap	Max		Max	Hold		Max	Hold		Min	Min	Min
30th %ile Green (s)	6.1	32.0		10.1	36.8		10.0	25.5		10.0	10.0	10.0
30th %ile Term Code	Gap	Max		Gap	Hold		Max	Hold		Min	Min	Min
10th %ile Green (s)	0.0	24.5		8.5	39.4		9.3	24.8		10.0	10.0	10.0
10th %ile Term Code	Skip	Gap		Gap	Hold		Gap	Hold		Min	Min	Min
Queue Length 50th (ft)	25	286		52	225		109	21			38	0
Queue Length 95th (ft)	49	#492		105	344		#178	80			80	24
Internal Link Dist (ft)		870			420			420			420	
Turn Bay Length (ft)	100			100			80					50
Base Capacity (vph)	363	684		372	851		370	778			383	463
Starvation Cap Reductn	0	0		0	0		0	0			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.29	0.85		0.57	0.63		0.66	0.35			0.19	0.27

Intersection Summary

Area Type: Other

Cycle Length: 95.6

Actuated Cycle Length: 85.1

Lanes, Volumes, Timings

9: Shawmut Avenue & Hathaway Road

2028 Build Conditions
Saturday Midday Peak Hour Conditions

Natural Cycle: 80

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 26.6

Intersection LOS: C

Intersection Capacity Utilization 77.4%

ICU Level of Service D

Analysis Period (min) 15

90th %ile Actuated Cycle: 88.7

70th %ile Actuated Cycle: 87.6

50th %ile Actuated Cycle: 87.6








30th %ile Actuated Cycle: 85.7

10th %ile Actuated Cycle: 75.9

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 9: Shawmut Avenue & Hathaway Road

 Ø1	 Ø2	 Ø4
12.6 s	43.5 s	39.5 s
 Ø5	 Ø6	 Ø7
17.6 s	38.5 s	15.8 s
		 Ø8
		23.7 s

□ Peer Review Comment Letter – CDM Smith



260 West Exchange Street, Suite 300
Providence, Rhode Island
tel: 401 751-5360

November 10, 2021

Mr. Jamie Ponte
Commissioner
Department of Public Infrastructure
1105 Shawmut Avenue
New Bedford, Massachusetts 02746

Subject: Peer Review of Traffic Memorandum
Proposed Marijuana Dispensary
366 Hathaway Road
New Bedford, MA

Dear Mr. Ponte:

In accordance with your request, we have undertaken a peer review of the traffic analysis materials prepared for the proposed Marijuana Dispensary to be located at 366 Hathaway Rd, New Bedford, MA 02740. The current proposal includes the reconstruction of an existing building to a 4,292 square-foot marijuana dispensary (medical and/or adult use retail sales). Access will be provided via a driveway opposite to the Route 140 Southbound ramps, where 23 parking spaces will be provided.

We have received a copy of the following documents from your office pertaining to our peer review:

- Traffic Memorandum (hereafter referred to as the Study) – Memorandum Regarding the Proposed Marijuana Dispensary, 366 Hathaway Road, New Bedford, MA, prepared by MDM Transportation Consultants, Inc. dated October 20, 2021.

Traffic Impact Study Methodology

The analysis and documentation submitted by the project proponent were generally prepared in accordance with accepted industry procedures and standards including the 2014 MassDOT Transportation Impact Assessment (TIA) Guidelines. We offer the following comments:

Overview

The project proponent gives an overview of the Study and summarizes the findings.

1. The project proponent should add a study location i.d. to the Hathaway Road at Self-storage Driveway intersection on Figure 1 - Site Location.



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Mr. Jamie Ponte

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2. The project proponent should clarify that mainline traffic along Hathaway Road will continue to operate as LOS A during the peak hours at the unsignalized intersections.

Project Description

The project proponent describes existing and proposed land use.

3. The project proponent should show proposed bike parking, dimensions, and roadway geometry on Figure 2 - Preliminary Site Plan.
4. The project proponent should include AutoTURN drawings to show the routing for the design, delivery, emergency response, and trash removal vehicles.
5. The project proponent should provide the distance between the existing self-storage driveway and the proposed access drive.
6. The project proponent should describe where delivery vehicles will park, and what their impact will be on traffic flow.
7. The project proponent describes the facility as “medical and/or adult use retail sales”. The project proponent should confirm whether this facility is governed by ADA 208.2.1, which would require that 10% of parking spaces be accessible; the current design provides accessible parking at 4.3% of spaces.

Baseline Traffic & Safety Characteristics

8. The project proponent should include transit information (MassDOT TIA Guidelines, 3.II.I).
9. The project proponent should also conduct a multi-modal network and pedestrian and bicycle facilities review (MassDOT TIA Guidelines 5.I.B).

Baseline Traffic Data

The project proponent describes studied intersections, data collection, COVID-19 adjustments, and seasonal adjustment factors. Backup is included in the attachments.

Intersection Crash History

10. The project proponent should show crashes involving non-motorized modes (pedestrians and bicycles) in Table 1 – Intersection Crash Summary.
11. The project proponent should provide collision diagrams and narratives for all study area intersections with more than 3 crashes per year. (MassDOT TIA Guidelines 3.III.F). As example, the intersection of Hathaway Road at Shawmut Avenue has a crash rate that is

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56% higher than the district average. It is unclear if these collisions are all occurring immediately at the intersection or occur as a result of existing driveway access within the vicinity of the intersection.

12. The project proponent should confirm that the crash data queried for intersections extended as far back as the calculated 95th percentile queues for each approach.
13. Angle crashes account for a majority of the crashes at the unsignalized intersections (52% at Rockdale, 64% at SB ramps, and 56% at NB ramps). The project proponent should identify how the development will not exacerbate these conditions.

Projected Future Traffic Conditions

Background Growth

The project proponent describes their growth process of 1% per year compounded over 7 years and includes referenced continuous count station data in the attachments. No exception is taken with this section.

2028 No-Build Traffic Volumes

Volume figures are provided. No exception is taken with this section.

Trip Generation

14. The ITE Trip Generation Manual provides a warning regarding sample sizes of less than 10. This applies to pages 540-543, 545, and 546 of the ITE TGM11, as included in the attachments of the study. The project proponent should collect peak hour turning movement counts at similar sites within the State of Massachusetts to confirm that ITE LUC 882 accurately represents Recreational Marijuana Dispensary activity for the proposed site in New Bedford. The site generated traffic volume should be updated as needed.
15. The project proponent should include an assessment of the mode split assumptions for this development and identify potential for pedestrian, bicycle, and transit improvements. (MassDOT TIA Guidelines 3.IV.C.1)

Trip Distribution

16. The project proponent describes and illustrates the volumes as distributed through the network. Distribution percentages are assumed for the six (6) origin/ destination points within the network. The percentages assumed do not seem to correspond with the peak hour volumes in the existing conditions scenario. The project proponent should provide calculations or methodology showing how these percentages were developed or a narrative detailing the assumptions.

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17. The project proponent should consider encouraging exiting vehicles bound for Hathaway Road westbound to use the shared driveway by adding signage on the property and restricting left turns out of the proposed driveway.
18. The project proponent should consider modifying Figure 9 – Trip Distribution to illustrate the percentages of trips arriving and departing from the two site driveways.
19. The applicant should consider restricting the proposed driveway to right turns only for exiting traffic. This will simplify the movements at this new intersection requiring vehicles bound for Route 140 southbound to exit via the shared driveway and then take a left onto the on-ramp.

2028 Build Condition Traffic Volumes

Build volume figures are included. No exception is taken with this section.

Traffic Operations Analysis

Analysis Methodology

Methodology is described. No exception is taken with this section.

Model Calibration

Methodology is described, and backup calculations are included. No exception is taken with this section.

Analysis Results

20. The project proponent should include queue results and available storage capacity for all analyzed intersections in existing, no-build, and build conditions. (MassDOT TIA Guidelines, 5.I.B.7)
21. It is recommended that the peak hour factor (PHF) be revised to 0.92 for future year traffic volumes in an urban environment.

Conclusions and Recommendations

Access/Site Improvements

22. The project proponent should measure and graphically illustrate the available sight distance at the proposed driveways. “Document the available intersection sight distance at proposed site driveway(s). Sight distance measurements must be in conformance with the latest edition of the AASHTO manual, A Policy on Geometric Design of Highways and Streets.” (MassDOT TIA Guidelines, 5.I.G)

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Mr. Jamie Ponte

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23. The project proponent should consider conducting a MUTCD Warrant Analysis. These intersections may meet Warrant 3, Peak Hour, and Warrant 7, Crash Experience.

Pedestrian and Bicycle Accommodations

No exception is taken with this section.

Off-Site Improvements

24. Project proponent should elaborate on the proposed bicycle accommodations. Were bicycle counts conducted? What impacts would these proposed improvements have on the roadway geometry?
25. Project proponent should provide a concept plan to illustrate the proposed geometry with left turn bays as described.
26. Project proponent should provide a concept plan to illustrate the alignment of the interchange ramps in relationship to the driveways of the development.

Grand Opening

27. Project proponent should elaborate on customer processing time and address the following questions:
 - a. What is the typical time to service a customer at this facility?
 - b. How many employee vehicles will be parking in the parking lot?
 - c. Do the number of proposed parking spaces satisfy this need?
28. It is recommended that the project proponent be responsible for providing police officers to control traffic as needed during the opening of this new facility, and subsequently as required by the Department of Public Infrastructure (DPI).

Attachments

29. The following maps should be included in the Attachments as recommended by MassDOT TIA Guidelines, Section 5.I.A.
 - a. Site plotted centrally on the USGS map
 - b. Site plotted in accordance with the MassDOT Road Inventory Maps
 - c. Zoning map

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30. The following additional information should be included in the Attachments as recommended by MassDOT TIA Guidelines, Section 5.II.

- a. Bicycle Counts
- b. Transit Service Existing Conditions Data
- c. Plotted intersection sight distance analyses
- d. Collision Diagrams (See Item #16 above)
- e. Speed Data

Traffic Volume Data

31. The project proponent should confirm whether pedestrian counts were taken. The backup sheets from MDM Transportation Consultants, Inc. show pedestrian counts of 0 for all time periods.

Seasonal/Yearly Growth Data

No exception is taken with this section.

Pandemic Adjustment Data

No exception is taken with this section.

Crash Data

See section above regarding Crashes.

Delay Study Results

No exception is taken with this section.

Capacity Analysis

- 32. Vehicle extension at the intersection of Shawmut Avenue at Hathaway Road should be set to 2 seconds for all phases, it is currently shown as 3 seconds for Phase 1 and Phase 7.
- 33. Existing and No-Build Synchro operational analysis has been conducted for the scenario as described in the 'Off-Site Improvements – Update Pavement Markings' section, including left turn bays for Hathaway Road. The project proponent should document in the study that this reflects existing operational conditions.



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Summary

Based on our review of the Proposed Marijuana Dispensary Traffic Memorandum, we find that the study has generally been prepared in accordance with accepted industry standards and procedures. We do however recommend the proponent address the concerns listed above.

We appreciate the opportunity to provide the City of New Bedford with these peer review services. We anticipate providing review of the project proponent's responses to these comments in accordance with our task order contract. Please do not hesitate to call if you have any questions relative to our review of the traffic-related issues associated with the proposed redevelopment.

Sincerely,

A handwritten signature in blue ink that reads "Lisa Sherman". The signature is fluid and cursive, with the first and last names clearly distinguishable.

Lisa Sherman, PE, PTOE, PMP
Project Manager
CDM Smith Inc.

