

Ref: 8058

September 21, 2021

Mr. Robert Hummel
Senior Planner
Town of Belmont
19 Moore Street
Belmont, MA 02478

Re: Response to Traffic Peer Review
McLean Zone 3 Residential Development
Belmont, Massachusetts

Dear Mr. Hummel:

Vanasse & Associates, Inc. (VAI) has provided responses to the comments that were raised in the August 6, 2021 Traffic Peer Review prepared by BSC Group, Inc. (BSC) on behalf of the Town in reference to their review of the April 2021 *Transportation Impact Assessment* (the “April 2021 TIA”) prepared by VAI.

Listed below are the comments that were identified by BSC in their review letter followed by our responses.

Study Methodology:

Comment 1: *The study methodology is consistent with the requirements of the Town of Belmont and the Massachusetts Department of Transportation (MassDOT) guidelines for traffic impact assessment.*

Response: Comment noted, no response required.

Comment 2: *The primary impacts of the Project will occur along Pleasant Street. The selected study area is consistent with expected Project impacts.*

Response: Comment noted, no response required.

Existing Traffic Volumes

Comment 3: *The data was collected during November 2020 during typical weekday commuter peak periods. Due to the reduction of typical commuter traffic during 2020, the Applicant applied adjustment factors into the baseline traffic conditions. The peak hour volumes were adjusted upward by 40 percent based on the traffic volume comparison. BSC agrees with the methodology to increase the 2020 traffic volumes upward. However, the traffic volumes oriented to/from Olmsted Drive may require a different adjustment factor, since it serves residential uses only. **BSC requests that the Applicant develop existing traffic volumes for Olmsted Drive based on the current residential development at Waverley Woods and The Woodlands and compare to the traffic volumes that were used in the TIA.** The Applicant should discuss if there are any significant differences between the trip generation estimates and the existing traffic volumes used in the TIA and what the impacts of any differences would be on any conclusions or analyses.*

Response: The requested trip generation updates is presented in Table 1.

Table 1
WAVERLY WOODS TRIP GENERATION SUMMARY

Time Period/ Directional Distribution	LUC 220 Vehicle Trips ^a	April 2021 TIA
Weekday Daily	262	--
<i>Weekday Morning Peak Hour:</i>		
Entering	5	1
<u>Exiting</u>	<u>15</u>	<u>9</u>
Total	20	10
<i>Weekday Evening Peak Hour:</i>		
Entering	16	6
<u>Exiting</u>	<u>10</u>	<u>5</u>
Total	26	11

^aBased on ITE LUC 220, Multifamily Housing (Mid-Rise); 40 units.

With addition of ITE trip generation associated with the Waverly Woods, minor increases in delay occurred for individual movements, but the overall operations at both study area intersections were shown to continue to operate at Level of Service (LOS) D or better and minor vehicle queuing increases during peak periods. Overall, no significant changes were identified that changes the April 2021 analyses results. The detailed results are presented in the appendix. Please note that the Woodlands community does not utilize Olmsted Drive for access/egress.

Safety Evaluation:

Comment 4: *The sight distance along Olmsted Drive is sufficient and should be properly maintained at all times, including during snow events. The Applicant should commit to the continued maintenance of any vegetation that may impact sight lines at all internal driveways and at the intersection of Pleasant Street at Olmsted Drive.*

Response: Comment noted, no response required.

Comment 5: *BSC recommends that the Applicant provide updated crash data between 2017 – present for the intersection of Trapelo Road at Pleasant Street. A traffic signal was recently installed at this intersection and the more recent data may indicate how the signal installation impacted crash patterns at the intersection.*

Response: Updated crash data are presented in Table 3R for the most recent 7-year review period (2014-2020). The updated crash data shows that the intersection of Pleasant Street with Trapelo Road experienced a total of 65 accidents averaging 9.29 accidents per year. The motor vehicle crash rate for this location will not exceed MasDOT's average crash rate for a signalized intersection.



No-Build Traffic Volumes

Comment 6: *The 2027 No-Build traffic volumes were developed in accordance with standard traffic engineering practice.*

Response: Comment noted, no response required.

Build Traffic Volumes

Trip Generation:

Comment 7: *The ITE LUCs that were used are appropriate for the proposed land uses. BSC agrees with the trip generation methodology used in the TIAS and the application of the transit usage reduction.*

Response: Comment noted, no response required.

Comment 8: *Based on the trip generation comparison, the estimates for the proposed project are within the limits established for Zone 3 in the TMMA. The actual trip generation will be monitored as part of post-construction counts. In the event that the actual trip generation estimates exceed the limits, the Applicant will be required to comply with the measures described in the TMMA.*

Response: Comment noted, no response required.

Trip Assignment:

Comment 9: *BSC agrees with the usage of journey-to-work data and existing traffic patterns to develop trip distribution patterns for the Project.*

Response: Comment noted, no response required.

Traffic Operations Analysis:

Comment 10: *The traffic operations analysis was conducted in accordance with traffic engineering standards. The Project is not expected to significantly contribute to the queues or delays at the study intersections during normal operations.*

Response: Comment noted, no response required.

Traffic Signal Warrant Analysis:

Comment 11: *BSC reviewed the TSWA analysis and verified that the traffic volumes that form the basis of the evaluation are accurate and based on standard industry methodology and that a signal is not expected to be warranted with the buildout of Zone 3 and Zone 4. Comment #3 of this review letter requested the Applicant to reevaluate traffic volumes along Olmsted Drive based on trip generation estimates. Any updates to traffic volumes on Olmsted Road should be reflected in the TSWA.*

Response: Based on the BSC comment, the Traffic Signal Warrant Analysis was updated and is attached. Even



with the additional vehicle trips associated with Waverly Woods, a traffic signal is not warranted

Comment 12: *The November 22, 1999 TMMA indicates that McLean agreed to fund the design and construction of signalizing and adding a left turn lane at the intersection of Pleasant Street at McLean Driveway (now named Olmsted Drive) prior to the occupancy of an research and development building (Zone 4) or the senior housing (Zone 3). Based on a review of the intersection, the left-turn lane is already installed and the installation of a traffic signal is not currently warranted based on the expected traffic volumes. Please also refer to Comment #3 to provide updates to the TSWA.*

Response: VAI concurs.

Comment 13: *The Applicant is required to conduct post-construction traffic monitoring counts as directed by the TMMA. In the event that the counts exceed the trip generation thresholds allowed in the TMMA, the Applicant should review how this impacts the TSWA and revisit the need for a traffic signal in the future, with the inclusion of the Zone 4 traffic volumes.*

Response: VAI concurs. Should the traffic monitoring counts exceed the TMMA limits then a signal warrant analysis will be completed.

Proposed Recommendations and Conclusions:

Comment 14: *BSC recommends that the Applicant provide additional measures in the TDM plan to further promote non-vehicular modes of travel. The Project is located in proximity to Waverly Square, which provides access to the MBTA commuter rail and bus lines and should serve the residents of the proposed project. The Applicant should commit to providing residents with transit subsidies such as discounted commuter rail and bus passes to promote travel via public transit. The Applicant should also provide on-site bicycle storage for visitors through the installation of bicycle racks throughout the site and for residents through secure, weather-proof storage areas.*

Response: Bicycle racks will be provided throughout the site for residents and visitors. The applicant will provide a 1-month MBTA pass as part of the “Welcome” package.

Comment 15: *BSC also reviewed the conceptual site plan as part of the transportation review. The review indicates that there existing pedestrian access route from Zone 3 to the public roadway network runs partially along Olmsted Drive and is diverted through an existing McLean Hospital property at the corner of Trapelo Road and Pleasant Street. Based on our site visit, pedestrian access from Pleasant Street is not well defined and should be upgraded to provide specific wayfinding information. The circuitous nature of the on-site roadways may be difficult to navigate for visitors and deliveries. To provide better wayfinding information, the Applicant should develop a comprehensive on-site wayfinding signage to direct both motorists and pedestrians to destinations points such as Pleasant Street, Trapelo Road, and Waverley Square.*

Response: Wayfinding signage will be added to the site plan.

Comment 16: *The Applicant should construct new on-site and upgrade existing pedestrian facilities to be ADA-compliant. This includes the installation of detectible warning panels at all curb ramps and the installation of high-visibility crosswalks at intersections. It is expected that there will be pedestrian*



activity between the Project site and Waverley Square. The Applicant should also review and upgrade as necessary the terminus of the pedestrian route through the McLean Hospital property at the intersection of Trapelo Road at Pleasant Street. Currently, pedestrians must walk through an existing driveway and parking lot to access the path that connects with Olmsted Drive.

Response: All new on-site pedestrian crossings will be ADA compliant. It is true that pedestrians must walk through a driveway and parking lot to access Pleasant Street. This is an existing condition that was approved by the Town as part of a distinct and separate design and site plan approval process for Olmsted Drive

Comment 17: *The internal roadways and site driveways should be designed to accommodate emergency vehicles. Signage and pavement markings should be compliant with standards in the Manual on Uniform Traffic Control Devices (MUTCD). Adequate sight distance should be maintained at each driveway. BSC requests that the Applicant provide vehicle turning maneuvers on a site plan to show that the site can accommodate the City's fire and emergency vehicles. **BSC recommends that the northerly portion of Olmsted Drive be maintained to accommodate a secondary point of access/egress for emergency vehicles.***

Response: VAI concurs.

Comment 18: *BSC requests that the Applicant describe or show on the site plans how the delivery and loading for each of the buildings will operate. The site should be able to accommodate the largest single-unit box truck (SU-40) for moving operations.*

Response: The applicant has provided a truck delivery plan.

We trust that this information is responsive to the comments that were raised in the August 6, 2021 traffic peer Review letter prepared by BSC. If you should have any questions or would like to discuss our responses in more detail, please feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.



F. Giles Ham, P.E.
Senior Advisor

Attachments

cc: File



APPENDIX

MOTOR VEHICLE CRASH DATA

TRAFFIC SIGNAL WARRANT ANALYSIS (TSWA)

UPDATED LEVEL OF SERVICE TABLES AND CAPACITY ANALYSIS

MOTOR VEHICLE CRASH DATA

Table 3R
MOTOR VEHICLE CRASH DATA SUMMARY^a

Scenario	Trapelo Road at Pleasant Street (Signalized)	Pleasant Street at Olmsted Drive (Unsignalized)
<i>Year:</i>		
2014	13	0
2015	14	0
2016	8	0
2017	7	1
2018	13	0
2019	5	0
<u>2020</u>	<u>5</u>	<u>0</u>
Total	65	1
Average ^b	9.29	0.14
Crash Rate ^c	0.67	0.03
Significant	No	No
<i>Manner of Collision:</i>		
Angle	20	1
Rear-End	28	0
Head-On	3	0
Sideswipe	11	0
Single Vehicle Crash	3	0
<u>Unknown/Other</u>	<u>0</u>	<u>0</u>
Total	65	1
<i>Time of Day:</i>		
Weekday (Monday through Friday)	59	1
Saturday	4	0
<u>Sunday</u>	<u>2</u>	<u>0</u>
Total	65	1
<i>Lighting Conditions:</i>		
Daylight	52	0
Dawn/Dusk	2	1
Dark (lit)	10	0
Dark (unlit)	0	0
<u>Unknown</u>	<u>1</u>	<u>0</u>
Total	65	1
<i>Pavement Conditions</i>		
Dry	48	1
Wet	11	0
Snow	1	0
Ice	1	0
<u>Unknown (Other)</u>	<u>4</u>	<u>0</u>
Total	49	1
<i>Severity:</i>		
Property Only	48	0
Injury Accident	12	1
Fatal Accident	0	0
<u>Other</u>	<u>5</u>	<u>0</u>
Total	65	1

^aSource: MassDOT, 2014 through 2021. The crash data from 2019 are subject to change.

^bAverage crashes over seven-year period.

^cCrash rate per million entering vehicles.

Unsignalized intersections are significant if rate >0.57 crashes per million vehicles (District 4) or if rate >0.57 crashes per million vehicles (Statewide).

Signalized intersections are significant if rate >0.73 crashes per million vehicles (District 4) or if rate >0.78 crashes per million vehicles (Statewide).



Crash Data

2014-2020

Crash Number	Crash Severity	Crash Status	Crash Year	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions	Weather Conditions	Latitude	Longitude
Trapelo Road at Pleasant Street															
3731020	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Followed too closely) / D2: (No improper driving)	Dusk	Rear-end	Wet	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: W / V2: W	Rain/Cloudy	42.38875	-71.19265
3731027	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Failed to yield right of way) / D2: (No improper driving)	Dark - lighted roadway	Sideswipe, same direction	Wet	0	V1: Changing lanes / V2: Travelling straight ahead	V1: E / V2: E	Rain	42.38875	-71.19265
3733273	Property damage only (none injured)	Closed	2014	No injury	1	D1: (Unknown)	Daylight	Single vehicle crash	Slush	0	V1: Entering traffic lane	V1: W	Snow/Blowing sand, snow	42.38875	-71.19265
3784412	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Unknown) / D2: (Unknown)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: S / V2: W	Cloudy	42.38875	-71.19265
3799403	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Glare),(Inattention) / D2: (No improper driving)	Dusk	Rear-end	Dry	0	V1: Entering traffic lane / V2: Slowing or stopped in traffic	V1: W / V2: W	Clear	42.38875	-71.19265
3799409	Non-fatal injury	Closed	2014	Non-fatal injury - Possible	2	D1: (Failed to yield right of way) / D2: (No improper driving)	Daylight	Head-on	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: W	Clear	42.38875	-71.19265
3869503	Property damage only (none injured)	Closed	2014	No injury	2	D1: (No improper driving),(No improper driving) / D2: (Failed to yield right of way),(Failed to yield right of way)	Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: W	Clear/Clear	42.38875	-71.19265
3910702	Property damage only (none injured)	Closed	2014	No injury	2	D1: (No improper driving) / D2: (No improper driving)	Daylight	Rear-end	Wet	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Cloudy/Rain	42.38871	-71.19256
3911039	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Unknown) / D2: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Turning right / V2: Travelling straight ahead	V1: W / V2: W	Clear	42.38875	-71.19265
3950575	Property damage only (none injured)	Closed	2014	No injury	2	D1: (No improper driving)	Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Backing	V1: S / V2: N	Clear	42.38875	-71.19265
3988936	Property damage only (none injured)	Closed	2014	No injury	2	D1: (Failed to yield right of way),(Glare) / D2: (No improper driving)	Daylight	Sideswipe, same direction	Dry	0	V1: Entering traffic lane / V2: Travelling straight ahead	V1: E / V2: E	Clear	42.38875	-71.19265
3988944	Property damage only (none injured)	Closed	2014	No injury	2	D1: (No improper driving),(No improper driving) / D2: (Disregarded traffic signs, signals, road markings),(Failure to keep in proper lane or running off road)	Daylight	Sideswipe, same direction	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: E / V2: E	Clear/Clear	42.38875	-71.19265
3990023	Not Reported	Closed	2014	Not Applicable	2	D1: (Unknown) / D2: (No improper driving),(No improper driving)	Daylight	Sideswipe, same direction	Dry	0	V1: Other / V2: Travelling straight ahead	V1: E / V2: Not Reported	Clear	42.38875	-71.19265
4060665	Property damage only (none injured)	Closed	2015	No injury	2	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end	Wet	0	V1: Entering traffic lane / V2: Entering traffic lane	V1: W / V2: W	Clear	42.38875	-71.19265
4060679	Not Reported	Closed	2015	Not reported	3		Dark - lighted roadway	Rear-end	Snow	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic / V3: Entering traffic lane	V1: W / V2: W / V3: Not Reported	Snow	42.38875	-71.19265
4060683	Property damage only (none injured)	Closed	2015	No injury	2	D1: (No improper driving) / D2: (Inattention)	Daylight	Sideswipe, same direction	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: E / V2: E	Clear	42.38875	-71.19265
4060695	Property damage only (none injured)	Closed	2015	No injury	2	D1: (Followed too closely) / D2: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: W / V2: W	Clear	42.38875	-71.19265
4060702	Property damage only (none injured)	Closed	2015	No injury	1	D1: (No improper driving)	Unknown	Rear-end	Unknown	0	V1: Slowing or stopped in traffic	V1: E	Unknown	42.38875	-71.19265
4060747	Not Reported	Closed	2015	Not reported	1		Daylight	Sideswipe, same direction	Dry	0	V1: Turning right	V1: W	Clear	42.38875	-71.19265

Crash Data

2014-2020

Crash Number	Crash Severity	Crash Status	Crash Year	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions	Weather Conditions	Latitude	Longitude
4060783	Not Reported	Closed	2015	Not reported	2		Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: W	Clear	42.38875	-71.19265
4062484	Non-fatal injury	Closed	2015	Non-fatal injury - Non-incapacitating	2	D1: (No improper driving) / D2: (Inattention)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Clear	42.38875	-71.19265
4076411	Property damage only (none injured)	Closed	2015	No injury	3	D1: (Inattention) / D2: (No improper driving) / D3: (No improper driving)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead / V3: Slowing or stopped in traffic	V1: E / V2: W / V3: S	Clear	42.38875	-71.19265
4076418	Non-fatal injury	Closed	2015	Non-fatal injury - Possible	2	D1: (Followed too closely) / D2: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	42.38875	-71.19265
4177563	Property damage only (none injured)	Closed	2015	No injury	2		Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Entering traffic lane	V1: E / V2: E	Clear	42.38875	-71.19265
4177603	Property damage only (none injured)	Closed	2015	No injury	1	D1: (Fatigued/asleep)	Dark - lighted roadway	Single vehicle crash	Dry	0	V1: Travelling straight ahead	V1: E	Clear	42.38875	-71.19265
4178511	Property damage only (none injured)	Closed	2015	No injury	3	D1: (Unknown) / D3: (Unknown)	Daylight	Sideswipe, opposite direction	Dry	0	V1: Turning right / V2: Turning right / V3: Travelling straight ahead	V1: N / V2: N / V3: W	Clear	42.38875	-71.19265
4178931	Property damage only (none injured)	Closed	2015	No injury	2	D1: (No improper driving) / D2: (Failed to yield right of way)	Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: W	Clear	42.38875	-71.19265
4190363	Property damage only (none injured)	Closed	2016	No injury	2	D1: (Failure to keep in proper lane or running off road),(Failed to yield right of way) / D2: (No improper driving),(No improper driving)	Daylight	Angle	Dry	0	V1: Changing lanes / V2: Travelling straight ahead	V2: W	Clear/Clear	42.38875	-71.19265
4190365	Non-fatal injury	Closed	2016	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Failed to yield right of way),(Inattention)	Daylight	Head-on	Wet	0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	Rain/Cloudy	42.38875	-71.19265
4190407	Non-fatal injury	Closed	2016	Non-fatal injury - Non-incapacitating	3	D1: (Unknown) / D2: (Unknown) / D3: (No improper driving)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead / V3: Travelling straight ahead	V1: E / V2: W / V3: S	Clear	42.38875	-71.19265
4190408	Property damage only (none injured)	Closed	2016	No injury	2	D1: (Unknown) / D2: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: N / V2: E	Cloudy	42.38875	-71.19265
4190409	Non-fatal injury	Closed	2016	Non-fatal injury - Non-incapacitating	2	D1: (No improper driving)	Daylight	Head-on	Dry	0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	Clear	42.38875	-71.19265
4302300	Property damage only (none injured)	Closed	2016	No injury	2	D1: (Failed to yield right of way) / D2: (No improper driving)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: W	Clear	42.38875	-71.19265
4302314	Property damage only (none injured)	Closed	2016	No injury	2	D1: (No improper driving) / D2: (Inattention)	Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: E / V2: E	Clear	42.38875	-71.19265
4302347	Property damage only (none injured)	Closed	2016	No injury	3	D1: (No improper driving) / D2: (No improper driving) / D3: (Followed too closely)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1: W / V2: W / V3: W	Clear	42.38875	-71.19265
4380481	Non-fatal injury	Closed	2017	Non-fatal injury - Possible	2		Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: E / V2: E	Clear	42.38901	-71.19319
4380495	Property damage only (none injured)	Closed	2017	No injury	2	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	Wet	0	V1: Turning right / V2: Travelling straight ahead	V1: N / V2: W	Rain	42.38901	-71.19319
4380622	Property damage only (none injured)	Closed	2017	No injury	2	D1: (Other improper action),(Unknown) / D2: (Other improper action),(Unknown)	Daylight	Angle	Dry	0	V1: Slowing or stopped in traffic / V2: Backing	V1: E / V2: N	Clear/Clear	42.38901	-71.19319
4380633	Property damage only (none injured)	Closed	2017	No injury	2	D1: (Unknown) / D2: (Failed to yield right of way)	Daylight	Angle	Dry	0	V1: Travelling straight ahead / V2: Entering traffic lane	V1: W / V2: S	Clear/Clear	42.38901	-71.19319

Crash Data

2014-2020

Crash Number	Crash Severity	Crash Status	Crash Year	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions	Weather Conditions	Latitude	Longitude
4381828	Property damage only (none injured)	Closed	2017	No injury	2		Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: E / V2: E	Clear/Clear	42.3891	-71.19352
4399849	Property damage only (none injured)	Closed	2017	No injury	2	D1: (Failed to yield right of way),(Unknown) / D2: (Unknown),(Unknown)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: N / V2: W	Clear/Clear	42.38901	-71.19319
4415759	Property damage only (none injured)	Closed	2017	No injury	2		Daylight	Sideswipe, same direction	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Clear	42.38901	-71.19319
4493775	Property damage only (none injured)	Closed	2018	No injury	1	D1: (Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc),(Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc)	Daylight	Single vehicle crash	Dry	0	V1: Travelling straight ahead	V1: E	Clear/Clear	42.38875	-71.19264
4512520	Property damage only (none injured)	Closed	2018	No injury	2		Dark - lighted roadway	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: E / V2: E	Clear/Clear	42.38875	-71.19264
4512521	Non-fatal injury	Closed	2018	Non-fatal injury - Incapacitating	3	D1: (Unknown),(Unknown) / D2: (No improper driving),(No improper driving) / D3: (No improper driving),(No improper driving)	Dark - lighted roadway	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic	V1: E / V2: E / V3: E	Clear/Clear	42.38875	-71.19264
4516426	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving),(No improper driving) / D2: (Failed to yield right of way),(Failed to yield right of way)	Daylight	Angle	Wet	0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	Cloudy/Cloudy	42.38875	-71.19264
4516437	Non-fatal injury	Closed	2018	Non-fatal injury - Non-incapacitating	4	D1: (No improper driving) / D2: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic / V4: Travelling straight ahead	V1: E / V2: E / V3: E / V4: E	Clear	42.38875	-71.19264
4533143	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving) / D2: (No improper driving),(Inattention)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Clear	42.38875	-71.19264
4554581	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving),(No improper driving) / D2: (Followed too closely),(Unknown)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Clear/Other	42.38875	-71.19264
4561048	Non-fatal injury	Closed	2018	Non-fatal injury - Non-incapacitating	2	D1: (Other improper action) / D2: (No improper driving)	Daylight	Sideswipe, same direction	Dry	0	V1: Changing lanes / V2: Travelling straight ahead	V1: W / V2: W	Clear	42.38875	-71.19264
4593556	Non-fatal injury	Closed	2018	Non-fatal injury - Non-incapacitating	2	D1: (No improper driving),(Unknown) / D2: (Followed too closely),(Unknown)	Daylight	Rear-end	Dry	0	V1: Turning right / V2: Travelling straight ahead	V1: W / V2: W	Clear/Unknown	42.389	-71.1932
4601347	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: E / V2: E	Cloudy/Sleet, hail (freezing rain or drizzle)	42.38884	-71.19283
4601450	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving),(No improper driving) / D2: (No improper driving),(No improper driving)	Dark - lighted roadway	Angle	Dry	0	V1: Turning right / V2: Travelling straight ahead	V1: N / V2: S	Clear/Clear	42.389	-71.1932
4613931	Non-fatal injury	Closed	2018	Non-fatal injury - Non-incapacitating	3	D1: (Inattention),(Inattention) / D2: (No improper driving),(No improper driving) / D3: (No improper driving),(No improper driving)	Daylight	Rear-end	Dry	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic	V1: W / V2: W / V3: W	Clear/Clear	42.389	-71.1932
4613937	Property damage only (none injured)	Closed	2018	No injury	2	D1: (No improper driving),(Unknown)	Dark - lighted roadway	Angle	Wet	0	V1: Travelling straight ahead / V2: Turning left	V1: N / V2: E	Rain/Rain	42.389	-71.1932

Crash Data

2014-2020

Crash Number	Crash Severity	Crash Status	Crash Year	Max Injury Severity Reported	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions	Weather Conditions	Latitude	Longitude
4651305	Not Reported	Open	2019	No injury	2		Daylight	Sideswipe, same direction	Unknown	0	V1: Travelling straight ahead / V2: Overtaking/passing	V1: E / V2: E	Cloudy/Cloudy	42.389	-71.1932
4729101	Property damage only (none injured)	Open	2019	No Apparent Injury (O)	2	D1: (Inattention) / D2: (No improper driving)	Daylight	Rear-end		0	V1: Changing lanes / V2: Slowing or stopped in traffic	V1: W / V2: W	Clear	42.38868	-71.1925
4729102	Property damage only (none injured)	Open	2019	No Apparent Injury (O)	2		Daylight	Angle		0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	Rain/Rain	42.38875	-71.19264
4763058	Property damage only (none injured)	Open	2019	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Failed to yield right of way)	Daylight	Angle	Wet	0	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	Rain	42.38875	-71.19264
4763059	Property damage only (none injured)	Open	2019	No Apparent Injury (O)	3	D1: (No improper driving),(No improper driving)	Dark - lighted roadway	Rear-end	Dry	0	V1: Slowing or stopped in traffic / V2: Changing lanes / V3: Slowing or stopped in traffic	V1: E / V2: E / V3: E	Clear/Unknown	42.38875	-71.19264
4806045	Property damage only (none injured)	Open	2020	No Apparent Injury (O)	2	D1: (Failed to yield right of way)	Dark - lighted roadway	Sideswipe, opposite direction	Wet	0	V1: Turning left / V2: Turning left	V1: E / V2: S	Rain	42.38875	-71.19264
4812325	Property damage only (none injured)	Open	2020	No Apparent Injury (O)	2	D1: (Failed to yield right of way) / D2: (Driving too fast for conditions)	Dark - lighted roadway	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: W	Cloudy	42.38875	-71.19264
4890579	Property damage only (none injured)	Open	2020	No Apparent Injury (O)	2	D1: (Failed to yield right of way),(Failed to yield right of way) / D2: (No improper driving),(No improper driving)	Daylight	Angle	Dry	0	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: W	Clear/Clear	42.38875	-71.19264
4894253	Property damage only (none injured)	Open	2020	No Apparent Injury (O)	2	D1: (No improper driving) / D2: (Unknown)	Daylight	Rear-end	Wet	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: E / V2: E	Snow	42.38875	-71.19264
4918664	Property damage only (none injured)	Open	2020	No Apparent Injury (O)	1	D1: (No improper driving)	Daylight	Rear-end	Dry	0	V1: Turning left	V1: E	Clear	42.38875	-71.19264
Pleasant Street at Olmsted Drive															
4380932	Non-fatal injury	Closed	2017	Non-fatal	1	D1: (Glare)	Dusk	Angle	Dry	0	V1: Turning left	V1: W	Clear	42.38903	-71.19046

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Belmont COUNT DATE : 2021

DISTRICT : 4 UNSIGNALIZED : ☐ SIGNALIZED : ☒

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Trapello Road

MINOR STREET(S) : Pleasant St

ST #

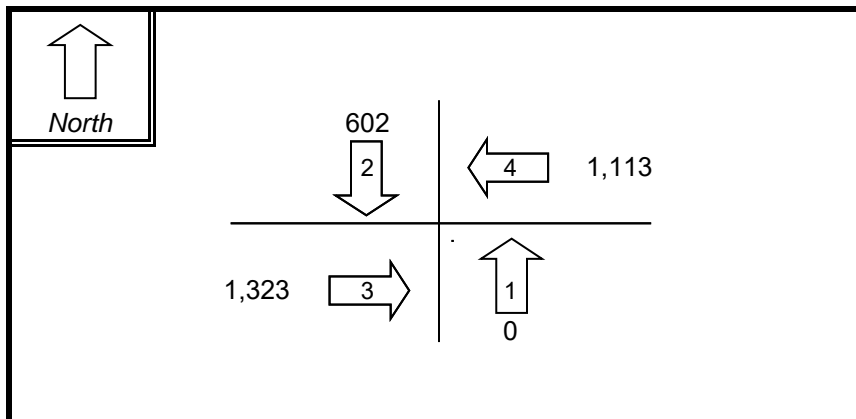
ST #

ST #

ST #

ST #

**INTERSECTION
DIAGRAM
(Label Approaches)**



INTERSECTION

REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	0	602	1,323	1,113		3,038

" K " FACTOR : **0.080** APPROACH ADT : **37,975** ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : **65** # OF YEARS : **7** AVERAGE # OF ACCIDENTS (A) : **9.29**

CRASH RATE CALCULATION : **0.67** RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 6 signalized intersections = 0.73

Accident Rate for District 6 unsignalized intersections = 0.57

Statewide Accident Rate for Signalized Inteserction = 0.78 and Unsignalized/Inteserction = 0.57

S:\Jobs\8058\RTC\1-Crash\Crash Rates Worksheet

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Belmont COUNT DATE : 2021

DISTRICT : 4 UNSIGNALIZED : ☒ SIGNALIZED : ☐

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Pleasant Street

ST #

MINOR STREET(S) : Olmsted Drive

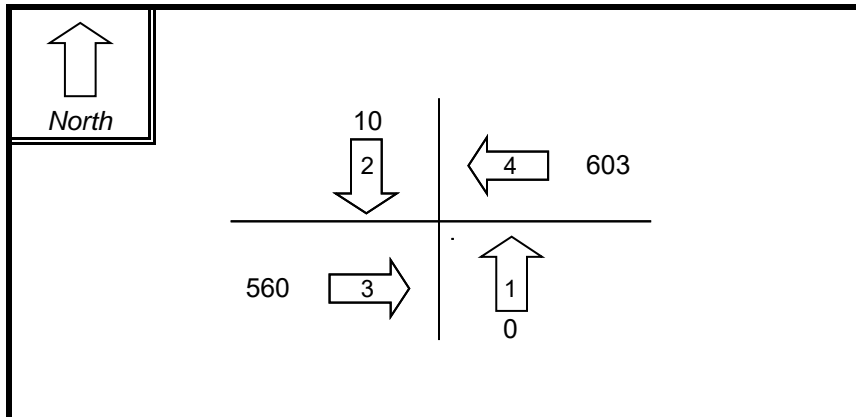
ST #

ST #

ST #

ST #

**INTERSECTION
DIAGRAM**
(Label Approaches)



INTERSECTION

REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	0	10	560	603		1,173

" K " FACTOR : **0.080** APPROACH ADT : **14,663** ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : **1** # OF YEARS : **7** AVERAGE # OF ACCIDENTS (A) : **0.14**

CRASH RATE CALCULATION : **0.03** RATE = $\frac{(A * 1,000,000)}{(ADT * 365)}$

Comments : Accident Rate for District 6 signalized intersections = 0.73

Accident Rate for District 6 unsignalized intersections = 0.57

Statewide Accident Rate for Signalized Inteserction = 0.78 and Unsignalized/Inteserction = 0.57

S:\Jobs\8058\RTC\1-Crash\Crash Rates Worksheet

TRAFFIC SIGNAL WARRANT ANALYSIS (TSWA)

Institute of Transportation Engineers (ITE)
Trip Generation, 10th Edition
Land Use Code (LUC) 220 - Multifamily Housing (Low-Rise)

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 40

AVERAGE WEEKDAY DAILY

$$T = 7.56 * (X) - 40.86$$

$$T = 7.56 * 40 - (40.86)$$

$$T = 261.54$$

$$T = 262 \text{ vehicle trips}$$

with 50% (131 vpd) entering and 50% (131 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$\ln T = 0.95 * \ln(X) - 0.51$$

$$\ln T = 0.95 * \ln 40 - (0.51)$$

$$\ln T = 2.99$$

$$T = 19.97$$

$$T = 20 \text{ vehicle trips}$$

with 23% (5 vph) entering and 77% (15 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$\ln T = 0.89 * \ln(X) - 0.02$$

$$\ln T = 0.89 * \ln 40 - (0.02)$$

$$\ln T = 3.26$$

$$T = 26.13$$

$$T = 26 \text{ vehicle trips}$$

with 63% (16 vph) entering and 37% (10 vph) exiting.

Hourly Distribution of Entering and Exiting Vehicle

Trips by Land Use

Source: ITE *Trip Generation Manual* , 10th Edition

Land Use Code 220
 Land Use Multifamily Housing (Low-Rise)
 Setting General Urban/Suburban
 Time Period Weekday
 Trip Type Vehicle
 # Data Sites 9
 % of 24-Hour Traffic

Time	Entering	Exiting
	131	131
12-1 AM	0.7	0.3
1-2 AM	0.4	0.1
2-3 AM	0.3	0.3
3-4 AM	0.3	0.4
4-5 AM	0.4	1.0
5-6 AM	0.1	2.6
6-7 AM	1.1	5.8
7-8 AM	2.6	12.9
8-9 AM	4.0	9.1
9-10 AM	3.9	7.2
10-11 AM	3.9	4.7
11-12 PM	4.9	5.5
12-1 PM	5.6	5.4
1-2 PM	4.8	4.9
2-3 PM	5.9	6.0
3-4 PM	8.3	5.2
4-5 PM	10.0	5.1
5-6 PM	11.4	6.7
6-7 PM	9.5	6.3
7-8 PM	7.1	4.3
8-9 PM	5.7	3.5
9-10 PM	4.7	1.4
10-11 PM	2.9	1.0
11-12 AM	1.5	0.4

Start Date: 6/13/2019
 Start Time: 12:00:00 AM
 Site Code: 82890001
 Location : Boston Post Road
 Location : West of Village Drive

2020 Raw

	Olmsted Dr From North		Pleasant St From East		Pleasant St From West	
	0.6	0.4		0.4		0.6
Start Time	Left	Right	Thru	Right	Left	Thru
7-8 AM	10	7	307	1	2	283
8-9 AM	7	5	344	2	3	272
9-10 AM	6	4	293	2	3	229
10-11 AM	4	2	252	2	3	241
11-12 PM	4	3	244	3	4	252
12-1 PM	4	3	291	3	4	256
1-2 PM	4	3	260	3	4	309
2-3 PM	5	3	355	3	5	294
3-4 PM	4	3	357	4	7	354
4-5 PM	4	3	391	5	8	387
5-6 PM	5	4	358	6	9	339
6-7 PM	5	3	243	5	7	232

Covid Adj - 2020 Baseline Condition

COVID adj 1.4						
1% above no seasonal adjustment						
	Olmsted Dr From North		Pleasant St From East		Pleasant St From West	
Time	Left	Right	Thru	Right	Left	Thru
7-8 AM	10	7	430	1	3	396
8-9 AM	7	5	482	3	4	381
9-10 AM	6	4	410	3	4	321
10-11 AM	4	2	353	3	4	337
11-12 PM	4	3	342	4	6	353
12-1 PM	4	3	407	4	6	358
1-2 PM	4	3	364	4	6	433
2-3 PM	5	3	497	4	7	412
3-4 PM	4	3	500	6	10	496
4-5 PM	4	3	547	7	11	542
5-6 PM	5	4	501	8	13	475
6-7 PM	5	3	340	7	10	325

2021 Adjustment

1 year 1.01						
1 percent per year compounded annual background						
	Olmsted Dr From North		Pleasant St From East		Pleasant St From West	
Time	Left	Right	Thru	Right	Left	Thru
7-8 AM	10	7	434	1	3	400
8-9 AM	7	5	487	3	4	385
9-10 AM	6	4	414	3	4	324
10-11 AM	4	2	357	3	4	340
11-12 PM	4	3	345	4	6	357
12-1 PM	4	3	411	4	6	362
1-2 PM	4	3	368	4	6	437
2-3 PM	5	3	502	4	7	416
3-4 PM	4	3	505	6	10	501
4-5 PM	4	3	552	7	11	547
5-6 PM	5	4	506	8	13	480
6-7 PM	5	3	343	7	10	328

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use

Source: ITE Trip Generation Manual, 10th Edition

Land Use Code	882					
Land Use	Marijuana Dispensary					
Setting	General Urban/Suburban					
Time Period	Weekday					
Trip Type	Vehicle	Daily			Daily	
# Data Sites	4	303	303	303	303	303
	% of 24-Hour Traffic	Entering	Exiting	Entering	Exiting	Exiting
Time	Entering	Exiting				
12-1 AM	0	0	0.0	0.0	0	0
1-2 AM	0	0	0.0	0.0	0	0
2-3 AM	0	0	0.0	0.0	0	0
3-4 AM	0	0	0.0	0.0	0	0
4-5 AM	0	0	0.0	0.0	0	0
5-6 AM	0.1	0.1	0.3	0.3	0	0
6-7 AM	0.4	0.1	1.2	0.3	1	0
7-8 AM	1.4	0.2	4.2	0.6	4	1
8-9 AM	4.1	3.6	12.4	10.9	12	11
9-10 AM	5.3	4.3	16.1	13.0	16	13
10-11 AM	8.2	7.5	24.8	22.7	25	23
11-12 PM	8.1	7.9	24.5	23.9	25	24
12-1 PM	9.1	8.9	27.6	27.0	28	27
1-2 PM	8.3	8.0	25.1	24.2	25	24
2-3 PM	8.4	9.3	25.5	28.2	26	28
3-4 PM	9.9	9.6	30.0	29.1	30	29
4-5 PM	11.3	11.4	34.2	34.5	34	34
5-6 PM	12.4	12.4	37.6	37.6	38	38
6-7 PM	12.5	14.7	37.9	44.5	38	45
7-8 PM	0.2	1.6	0.6	4.8	1	5
8-9 PM	0.1	0.2	0.3	0.6	0	1
9-10 PM	0	0.1	0.0	0.3	0	0
10-11 PM	0	0	0.0	0.0	0	0
11-12 PM	0	0	0.0	0.0	0	0
					303	303

Data obtained from the ITE General Urban/Suburban - Trips by time of day

Background Development							
				out			
				From North	From East	From West	
Start Time	Left	Right	Thru	Right	Left	Thru	
%	0	0	0.65	0	0	0.65	
7-8 AM	0	0	1	0	0	3	
8-9 AM	0	0	7	0	0	8	
9-10 AM	0	0	8	0	0	10	
10-11 AM	0	0	15	0	0	16	
11-12 PM	0	0	16	0	0	16	
12-1 PM	0	0	18	0	0	18	
1-2 PM	0	0	16	0	0	16	
2-3 PM	0	0	18	0	0	17	
3-4 PM	0	0	19	0	0	20	
4-5 PM	0	0	22	0	0	22	
5-6 PM	0	0	25	0	0	25	
6-7 PM	0	0	29	0	0	25	

2028 No- Build							
				7 year			
				1 percent per year compounded annual			
				background			
				Olmsted Dr	Pleasant St	Pleasant St	
				From North	From East	From West	
Start Time	Left	Right	Thru	Right	Left	Thru	
7-8 AM	10	7	466	1	2	432	
8-9 AM	7	5	529	2	3	421	
9-10 AM	6	4	452	2	3	357	
10-11 AM	4	2	398	2	3	381	
11-12 PM	4	3	386	3	4	399	
12-1 PM	4	3	459	3	4	406	
1-2 PM	4	3	411	3	4	485	
2-3 PM	5	3	556	3	5	463	
3-4 PM	4	3	560	4	7	557	
4-5 PM	4	3	614	5	8	608	
5-6 PM	5	4	568	6	9	540	
6-7 PM	5	3	397	5	7	377	

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use

Source: ITE Trip Generation Manual , 10th Edition

nd Use Code		221		Land Use Code		252					
Setting		Multifamily Housing (Mid-Rise)		Land Use: Housing - Attached							
Time Period		General Urban/Suburban		Setting Urban/Suburban							
Trip Type		Weekday		332		Time Period/Weekday		288		610	
# Data Sites		Vehicle				Trip Type Vehicle				305 305	
		8		Daily		# Data Sites		1 Daily		Total	
		% of 24-Hour Traffic		166 166		% of 24-Hour Traffic		144 144		144 144	
Time		Entering Exiting		Entering Exiting		Time		Entering Exiting		Entering Exiting	
12-1 AM	0.7	0.3	1.2	0.5	1	0	12-1 AM	0.3	0.4	0.4	0.6
1-2 AM	0.3	0.2	0.5	0.3	0	0	1-2 AM	0.2	0.5	0.3	0.7
2-3 AM	0.2	0.2	0.3	0.3	0	0	2-3 AM	0	0.1	0.0	0.1
3-4 AM	0.4	0.3	0.7	0.5	1	0	3-4 AM	0.1	0.2	0.1	0.3
4-5 AM	0.3	0.8	0.5	1.3	0	1	4-5 AM	0.2	0.5	0.3	0.7
5-6 AM	0.6	2.7	1.0	4.5	1	4	5-6 AM	0.9	2.2	1.3	3.2
6-7 AM	1.5	6.5	2.5	10.8	2	11	6-7 AM	1.3	3.0	1.9	4.3
7-8 AM	2.8	12.1	4.6	20.1	5	20	7-8 AM	2.1	5.1	3.0	7.3
8-9 AM	3.5	8.8	5.8	14.6	6	15	8-9 AM	3.9	6.3	5.6	9.1
9-10 AM	2.9	5.7	4.8	9.5	5	10	9-10 AM	4.7	6.7	6.8	9.6
10-11 AM	2.7	4.7	4.5	7.8	5	8	10-11 AM	6.4	7.5	9.2	10.8
11-12 PM	4.5	4.5	7.5	7.5	7	8	11-12 PM	6.8	6.5	9.8	9.4
12-1 PM	4.8	4.6	8.0	7.6	8	8	12-1 PM	8.5	9.0	12.2	13.0
1-2 PM	4.1	4.8	6.8	8.0	7	8	1-2 PM	7.7	8.0	11.1	11.5
2-3 PM	5.8	5.0	9.6	8.3	10	8	2-3 PM	9.1	6.7	13.1	9.6
3-4 PM	6.7	4.9	11.1	8.1	11	8	3-4 PM	8.7	5.7	12.5	8.2
4-5 PM	10.6	6.2	17.6	10.3	18	10	4-5 PM	8.3	6.3	12.0	9.1
5-6 PM	12.6	7.7	20.9	12.8	21	13	5-6 PM	7.3	5.7	10.5	8.2
6-7 PM	9.3	6.6	15.4	11.0	15	11	6-7 PM	6.3	5.2	9.1	7.5
7-8 PM	7.8	4.8	12.9	8.0	13	8	7-8 PM	5.8	5.2	8.4	7.5
8-9 PM	7.0	3.3	11.6	5.5	12	6	8-9 PM	4.8	4.1	6.9	5.9
9-10 PM	5.5	2.2	9.1	3.7	9	4	9-10 PM	3.1	2.2	4.5	3.2
10-11 PM	3.6	1.9	6.0	3.2	6	3	10-11 PM	2.5	1.8	3.6	2.6
11-12 AM	2.0	1.1	3.3	1.8	3	2	11-12 AM	0.8	1.1	1.2	1.6
					166	166					

Data obtained from the ITE General Urban/Suburban - Trips by time of day

Trip Generation						
Time	out		in		in	
	From North	From East	From West	From North	From East	From West
Left	Right	Thru	Right	Left	Thru	
%	0.4	0.6	0	0.4	0.6	0
7-8 AM	11	16	0	3	5	0
8-9 AM	10	14	0	5	7	0
9-10 AM	8	12	0	5	7	0
10-11 AM	8	11	0	6	8	0
11-12 PM	7	10	0	7	10	0
12-1 PM	8	12	0	8	12	0
1-2 PM	8	12	0	7	11	0
2-3 PM	7	11	0	9	14	0
3-4 PM	6	10	0	10	14	0
4-5 PM	8	11	0	12	18	0
5-6 PM	8	13	0	13	19	0
6-7 PM	7	11	0	10	14	0

2028 Build Zone 3						
Start Time	Olmsted Dr From North		Pleasant St From East		Pleasant St From West	
	Left	Right	Thru	Right	Left	Thru
7-8 AM	21	23	466	4	7	432
8-9 AM	17	19	529	7	10	421
9-10 AM	14	16	452	7	10	357
10-11 AM	12	13	398	8	11	381
11-12 PM	11	13	386	10	14	399
12-1 PM	12	15	459	11	16	406
1-2 PM	12	15	411	10	15	485
2-3 PM	12	14	556	12	19	463
3-4 PM	10	13	560	14	21	557
4-5 PM	12	14	614	17	26	608
5-6 PM	13	17	568	19	28	540
6-7 PM	12	14	397	15	21	377

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use

Source: ITE Trip Generation Manual, 10th Edition

Land Use Code 710
Land Use General Office Building
Setting General Urban/Suburban
Time Period Weekday
Daile number obtaneid from TMA

Trip Type # Data Sites	Vehicle 16		Daily 892 892		Daily 892 892	
	% of 24-Hour Traffic				Entering	Exiting
Time	Entering	Exiting	Entering	Exiting	Entering	Exiting
12-1 AM	0.2	0.1	1.8	0.9	2	1
1-2 AM	0	0.1	0.0	0.9	0	1
2-3 AM	0	0	0.0	0.0	0	0
3-4 AM	0	0.1	0.0	0.9	0	1
4-5 AM	0.1	0.2	0.9	1.8	1	2
5-6 AM	0.4	0.1	3.6	0.9	4	1
6-7 AM	4.6	0.5	41.0	4.5	41	4
7-8 AM	13.1	1.9	116.9	16.9	117	17
8-9 AM	14.4	3.5	128.4	31.2	129	31
9-10 AM	6.4	4.3	57.1	38.4	57	38
10-11 AM	5.4	5.9	48.2	52.6	48	52
11-12 PM	6.2	10.3	55.3	91.9	55	92
12-1 PM	10.2	10.4	91.0	92.8	91	93
1-2 PM	9.0	6.7	80.3	59.8	81	60
2-3 PM	8.2	6.5	73.1	58.0	73	58
3-4 PM	7.4	8.5	66.0	75.8	66	76
4-5 PM	5.5	15.2	49.1	135.6	49	135
5-6 PM	4.2	15.6	37.5	139.2	38	139
6-7 PM	1.7	2.9	15.2	25.9	15	26
7-8 PM	0.9	2.2	8.0	19.6	8	20
8-9 PM	0.7	1.3	6.2	11.6	6	12
9-10 PM	0.5	1.5	4.5	13.4	4	13
10-11 PM	0.3	2.0	2.7	17.8	3	18
11-12 AM	0.4	0.2	3.6	1.8	4	2
					892	892

Data obtained from the ITE General Urban/Suburban - Trips by time of day

Trip Generation						
Time	out		in		in	
	From North	From East	From West	From North	From East	From West
Time	Left	Right	Thru	Right	Left	Thru
%	0.4	0.6	0	0.4	0.6	0
7-8 AM	7	10	0	47	70	0
8-9 AM	12	19	0	52	77	0
9-10 AM	15	23	0	23	34	0
10-11 AM	21	31	0	19	29	0
11-12 PM	37	55	0	22	33	0
12-1 PM	37	56	0	36	55	0
1-2 PM	24	36	0	32	49	0
2-3 PM	23	35	0	29	44	0
3-4 PM	30	46	0	26	40	0
4-5 PM	54	81	0	20	29	0
5-6 PM	56	83	0	15	23	0
6-7 PM	10	16	0	6	9	0

Note: Same distribution of the zone 3 was assumed for zone 4 Developments

2028 Build - w/ Zone 3 and 4						
	Olmsted Dr From North		Pleasant St From East		Pleasant St From West	
	Left	Right	Thru	Right	Left	Thru
Start Time						
7-8 AM	28	33	466	51	77	432
8-9 AM	29	38	529	59	87	421
9-10 AM	29	39	452	30	44	357
10-11 AM	33	44	398	27	40	381
11-12 PM	48	68	386	32	47	399
12-1 PM	49	71	459	47	71	406
1-2 PM	36	51	411	42	64	485
2-3 PM	35	49	556	41	63	463
3-4 PM	40	59	560	40	61	557
4-5 PM	66	95	614	37	55	608
5-6 PM	69	100	568	34	51	540
6-7 PM	22	30	397	21	30	377

HCS7 Signal Warrants

Signal Warrants Analysis

File Name: 1 - 2028 Build Zone 3.xsw
 Analyst: RE
 Agency: VAI
 Date Performed: 08/23/2021
 Time Analyzed: 2028 No-Build Condition
 Jurisdiction: McLean Hospital Residential Development - Belmont MA
 Analysis Year: 2028 Build Revised
 Project Description: Pleasant Street at Olmsted Drive
 Units: U.S. Customary

General

Major Street Direction: East-West
 Starting Time Interval: 7
 Median Type: Undivided
 Major Street Speed (mi/h): 25
 Nearest Signal (ft): 360
 Population <10,000: No
 Coordinated Signal System: No
 Crashes Per Year: 0
 Adequate Trials of Crash Experience Alternatives: No

School Crossing and Roadway Network

Number of Students in Highest Hour: 0
 Number of Adequate Gaps in Period: 0
 Number of Minutes in Period: 0
 Two or More Major Routes: Yes
 Weekend Count: No
 5-year Growth Factor (%): 0

Railroad Crossing

Grade Crossing Approach: None
 Highest Volume Hour with Trains: Unknown
 Distance to Stop Line (ft):
 Rail Traffic (trains/day): 0
 High Occupancy Buses (%): 0
 Tractor-Trailer Trucks (%): 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	1	0	0	0	0	0	0	0
Lane Usage	L	T			TR						LR	

Traffic Volumes (veh/h)

Hour	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
07 - 08	7	432	0	0	466	4	0	0	0	21	0	23
08 - 09	10	421	0	0	529	7	0	0	0	17	0	19
09 - 10	10	357	0	0	452	7	0	0	0	14	0	16
10 - 11	11	381	0	0	398	8	0	0	0	12	0	13
11 - 12	14	399	0	0	386	10	0	0	0	11	0	13
12 - 13	16	406	0	0	459	11	0	0	0	12	0	15
13 - 14	15	485	0	0	411	10	0	0	0	12	0	15
14 - 15	19	463	0	0	556	12	0	0	0	12	0	14
15 - 16	21	557	0	0	560	14	0	0	0	10	0	13
16 - 17	26	608	0	0	614	17	0	0	0	12	0	14
17 - 18	28	540	0	0	568	19	0	0	0	13	0	17
18 - 19	21	377	0	0	397	15	0	0	0	12	0	14

Pedestrian Volumes and Gaps (Per Hour)

Hour	Eastbound		Westbound		Northbound		Southbound	
	Gaps	Volume	Gaps	Volume	Gaps	Volume	Gaps	Volume
07 - 08	0	0	0	0	0	0	0	0
08 - 09	0	0	0	0	0	0	0	0
09 - 10	0	0	0	0	0	0	0	0
10 - 11	0	0	0	0	0	0	0	0
11 - 12	0	0	0	0	0	0	0	0
12 - 13	0	0	0	0	0	0	0	0
13 - 14	0	0	0	0	0	0	0	0
14 - 15	0	0	0	0	0	0	0	0
15 - 16	0	0	0	0	0	0	0	0
16 - 17	0	0	0	0	0	0	0	0
17 - 18	0	0	0	0	0	0	0	0
18 - 19	0	0	0	0	0	0	0	0

Delay

Hour	Eastbound		Westbound		Northbound		Southbound	
	secs/veh	veh-hrs	secs/veh	veh-hrs	secs/veh	veh-hrs	secs/veh	veh-hrs
07 - 08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08 - 09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 - 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 - 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 - 13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 - 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 - 15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 - 16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16 - 17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17 - 18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18 - 19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary

Hour	Major Volume	Minor Volume	Total Volume	1A 100%	1A 80%	1B 100%	1B 80%	2 100%	3A 100%	3B 100%	4A 100%	4B 100%
07 - 08	909	44	953	No	No	No	No	No	No	No	No	No
08 - 09	967	36	1003	No	No	No	No	No	No	No	No	No
09 - 10	826	30	856	No	No	No	No	No	No	No	No	No
10 - 11	798	25	823	No	No	No	No	No	No	No	No	No
11 - 12	809	24	833	No	No	No	No	No	No	No	No	No
12 - 13	892	27	919	No	No	No	No	No	No	No	No	No
13 - 14	921	27	948	No	No	No	No	No	No	No	No	No
14 - 15	1050	26	1076	No	No	No	No	No	No	No	No	No
15 - 16	1152	23	1175	No	No	No	No	No	No	No	No	No
16 - 17	1265	26	1291	No	No	No	No	No	No	No	No	No
17 - 18	1155	30	1185	No	No	No	No	No	No	No	No	No
18 - 19	810	26	836	No	No	No	No	No	No	No	No	No
Total	11554	344	11898	0	0	0	0	0	0	0	0	0

Results

Warrant 1: Eight-Hour Vehicular Volume	[]
A. Minimum Vehicular Volumes	[]
B. Interruption of Continuous Traffic	[]
80% Vehicular --and-- Interruption Volumes	[]
Warrant 2: Four-Hour Vehicular Volume	[]
Four-Hour Vehicular Volumes	[]
Warrant 3: Peak Hour	[]
A. Peak-Hour Conditions	[]
B. Peak-Hour Vehicular Volume Hours Met	[]
Warrant 4: Pedestrian Volume	[]
A. Four Hour Volumes	[]
B. One-Hour Volumes	[]
Warrant 5: School Crossing	[]
Gaps Same Period	[]
Student Volumes	[]
Nearest Traffic Control Signal	[X]
Warrant 6: Coordinated Signal System	[]
Degree of Platooning	[]
Warrant 7: Crash Experience	[]
A. Adequate Trials of Alternatives	[]
B. Reported Crashes	[]
C. 80% Volumes for Warrants 1A, 1B --or-- 4	[]
Warrant 8: Roadway Network	[]
A. Weekday Volume	[]
B. Weekend Volume	[]

Warrant 9: Grade Crossing

[]

A. Grade Crossing within 140 ft --and--

[]

B. Peak-Hour Vehicular Volumes

[]

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HCS7 Signal Warrants

Signal Warrants Analysis

File Name: 4 - 2028 Build Zone 3 and Zone 4.xsw
 Analyst: JC
 Agency: VAI
 Date Performed: 1/4/2021
 Time Analyzed: 2028 Build Condition Revised
 Jurisdiction: McLean Hospital Residential Development - Belmont MA
 Analysis Year: 2028 Zone 3 and Zone 4
 Project Description: Pleasant Street at Olmsted Drive
 Units: U.S. Customary

General

Major Street Direction: East-West
 Starting Time Interval: 7
 Median Type: Undivided
 Major Street Speed (mi/h): 25
 Nearest Signal (ft): 360
 Population <10,000: No
 Coordinated Signal System: No
 Crashes Per Year: 0
 Adequate Trials of Crash Experience Alternatives: No

School Crossing and Roadway Network

Number of Students in Highest Hour: 0
 Number of Adequate Gaps in Period: 0
 Number of Minutes in Period: 0
 Two or More Major Routes: Yes
 Weekend Count: No
 5-year Growth Factor (%): 0

Railroad Crossing

Grade Crossing Approach: None
 Highest Volume Hour with Trains: Unknown
 Distance to Stop Line (ft):
 Rail Traffic (trains/day): 0
 High Occupancy Buses (%): 0
 Tractor-Trailer Trucks (%): 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	0	1	0	0	0	0	0	0	0
Lane Usage	L	T			TR						LR	

Traffic Volumes (veh/h)

Hour	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
07 - 08	77	432	0	0	466	51	0	0	0	28	0	33
08 - 09	87	421	0	0	529	59	0	0	0	29	0	38
09 - 10	44	357	0	0	452	29	0	0	0	29	0	39
10 - 11	40	381	0	0	398	27	0	0	0	33	0	44
11 - 12	47	399	0	0	386	32	0	0	0	48	0	68
12 - 13	71	406	0	0	459	47	0	0	0	49	0	71
13 - 14	64	485	0	0	411	42	0	0	0	36	0	51
14 - 15	63	463	0	0	556	41	0	0	0	35	0	49
15 - 16	61	557	0	0	560	40	0	0	0	40	0	59
16 - 17	55	608	0	0	614	37	0	0	0	66	0	95
17 - 18	51	540	0	0	568	34	0	0	0	69	0	100
18 - 19	30	377	0	0	397	21	0	0	0	22	0	30

Pedestrian Volumes and Gaps (Per Hour)

Hour	Eastbound			Westbound			Northbound			Southbound		
	Gaps	Volume		Gaps	Volume		Gaps	Volume		Gaps	Volume	
07 - 08	0	0		0	0		0	0		0	0	
08 - 09	0	0		0	0		0	0		0	0	
09 - 10	0	0		0	0		0	0		0	0	
10 - 11	0	0		0	0		0	0		0	0	
11 - 12	0	0		0	0		0	0		0	0	
12 - 13	0	0		0	0		0	0		0	0	
13 - 14	0	0		0	0		0	0		0	0	
14 - 15	0	0		0	0		0	0		0	0	
15 - 16	0	0		0	0		0	0		0	0	
16 - 17	0	0		0	0		0	0		0	0	
17 - 18	0	0		0	0		0	0		0	0	
18 - 19	0	0		0	0		0	0		0	0	

Delay

Hour	Eastbound		Westbound		Northbound		Southbound	
	secs/veh	veh-hrs	secs/veh	veh-hrs	secs/veh	veh-hrs	secs/veh	veh-hrs
07 - 08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08 - 09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 - 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 - 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 - 13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 - 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 - 15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 - 16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16 - 17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17 - 18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18 - 19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Summary

Hour	Major Volume	Minor Volume	Total Volume	1A 100%	1A 80%	1B 100%	1B 80%	2 100%	3A 100%	3B 100%	4A 100%	4B 100%
07 - 08	1026	61	1087	No	No	No	Yes	No	No	No	No	No
08 - 09	1096	67	1163	No	No	No	Yes	No	No	No	No	No
09 - 10	882	68	950	No	No	No	Yes	No	No	No	No	No
10 - 11	846	77	923	No	No	No	Yes	No	No	No	No	No
11 - 12	864	116	980	No	No	No	Yes	No	No	No	No	No
12 - 13	983	120	1103	No	Yes	Yes	Yes	No	No	No	No	No
13 - 14	1002	87	1089	No	No	Yes	Yes	No	No	No	No	No
14 - 15	1123	84	1207	No	No	Yes	Yes	No	No	No	No	No
15 - 16	1218	99	1317	No	No	Yes	Yes	Yes	No	No	No	No
16 - 17	1314	161	1475	Yes	Yes	Yes	Yes	Yes	No	No	No	No
17 - 18	1193	169	1362	Yes	Yes	Yes	Yes	Yes	No	No	No	No
18 - 19	825	52	877	No	No	No	No	No	No	No	No	No
Total	12372	1161	13533	2	3	6	11	3	0	0	0	0

Results

Warrant 1: Eight-Hour Vehicular Volume	[]
A. Minimum Vehicular Volumes	[]
B. Interruption of Continuous Traffic	[]
80% Vehicular --and-- Interruption Volumes	[]
Warrant 2: Four-Hour Vehicular Volume	[]
Four-Hour Vehicular Volumes	[]
Warrant 3: Peak Hour	[]
A. Peak-Hour Conditions	[]
B. Peak-Hour Vehicular Volume Hours Met	[]
Warrant 4: Pedestrian Volume	[]
A. Four Hour Volumes	[]
B. One-Hour Volumes	[]
Warrant 5: School Crossing	[]
Gaps Same Period	[]
Student Volumes	[]
Nearest Traffic Control Signal	[X]
Warrant 6: Coordinated Signal System	[]
Degree of Platooning	[]
Warrant 7: Crash Experience	[]
A. Adequate Trials of Alternatives	[]
B. Reported Crashes	[]
C. 80% Volumes for Warrants 1A, 1B --or-- 4	[X]
Warrant 8: Roadway Network	[]
A. Weekday Volume	[]
B. Weekend Volume	[]

Warrant 9: Grade Crossing

[]

A. Grade Crossing within 140 ft --and--

[]

B. Peak-Hour Vehicular Volumes

[]

This text report was created in HCS™ Signal Warrants Version 7.8.5 on 9/20/2021 2:08:17 PM

UPDATED LEVEL OF SERVICE TABLES AND CAPACITY ANALYSIS

Pleasant Street at Trapelo Road
Pleasant Street at Olmsted Drive
Olmsted Drive at Site Drive

Table 11R
SIGNALIZED INTERSECTION LEVEL-OF-SERVICE SUMMARY

Signalized Intersection/ Peak Hour/Movement	2021 Baseline Condition				2028 No-Build				2028 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th	V/C	Delay	LOS	Queue Avg/95 th
Trapelo Road at Pleasant Street:												
<i>Weekday Morning:</i>												
Trapelo Road EB LT	0.71	23.2	C	80/164	0.84	40.7	D	121/270	0.85	41.8	D	122/270
Trapelo Road EB TH	0.79	16.9	B	357/558	0.90	28.9	C	454/855	0.92	31.0	C	472/855
Trapelo Road WB TH/RT	0.72	24.2	C	265/368	0.88	35.6	D	328/525	0.90	37.8	D	339/528
Pleasant Street WB LT	0.79	51.1	D	136/242	0.72	40.7	D	148/217	0.73	40.2	D	153/227
Pleasant Street WB RT	0.39	14.5	B	80/129	0.37	7.1	A	47/85	0.37	7.0	A	46/88
Overall	--	23.1	C	--	--	31.5	C	--	--	33.1	C	--
<i>Weekday Evening:</i>												
Trapelo Road EB LT	0.82	36.6	D	144/324	0.94	55.8	E	186/372	0.95	56.7	E	190/379
Trapelo Road EB TH	0.87	23.5	C	409/849	0.93	29.0	C	514/873	0.93	28.4	C	514/873
Trapelo Road WB TH/RT	0.93	41.7	D	371/552	0.98	47.7	D	387/546	0.99	50.1	D	403/555
Pleasant Street WB LT	0.69	42.1	D	123/182	0.78	49.9	D	140/251	0.82	53.6	D	146/263
Pleasant Street WB RT	0.47	9.9	A	80/136	0.58	18.2	B	160/253	0.71	12.6	B	32/134
Overall	--	31.4	C	--	--	39.2	D	--	--	39.6	D	--

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in feet.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.



Table 12R
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2021 Baseline Condition				2028 No-Build				2028 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue 95 th Percentile	Demand	Delay	LOS	Queue 95 th Percentile	Demand	Delay	LOS	Queue 95 th Percentile
<i>Olmsted Drive at Pleasant Street:</i>												
<i>Weekday Morning:</i>												
Olmsted Drive SB LT RT	15	16.5	C	0.4	15	18.3	C	0.4	40	23.2	C	1.5
<i>Weekday Evening:</i>												
Olmsted Drive SB LT RT	10	20.3	C	0.4	10	23.9	C	0.5	30	35.1	E	2.0

^aVolume-to-capacity ratio.

^bControl (signal) delay per vehicle in seconds.

^cLevel-of-Service.

^dQueue length in vehicle.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movement





















Pleasant Street at Trapelo Road

Lanes, Volumes, Timings

2021 Existing Condition - Weekday Morning - Revised

3: Private Driveway/Pleasant Street & Trapelo Road

09/01/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					 			 				
Traffic Volume (vph)	267	892	0	0	810	187	0	0	0	241	0	264
Future Volume (vph)	267	892	0	0	810	187	0	0	0	241	0	264
Satd. Flow (prot)	1711	1801	0	0	3319	0	0	2153	0	1947	0	1599
Flt Permitted	0.129									0.757		
Satd. Flow (perm)	232	1801	0	0	3319	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					36							51
Lane Group Flow (vph)	287	959	0	0	1095	0	0	0	0	259	0	284
Turn Type	pm+pt	NA			NA					Perm		custom
Protected Phases	5	2			6			8				4
Permitted Phases	2						8			4		5
Detector Phase	5	2			6		8	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		25.0	25.0		25.0		25.0
Total Split (s)	24.0	64.0			40.0		26.0	26.0		26.0		26.0
Total Split (%)	26.7%	71.1%			44.4%		28.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		3.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		Min	Min		Min		Min
Act Effct Green (s)	60.9	60.9			40.7					19.1		39.3
Actuated g/C Ratio	0.68	0.68			0.45					0.21		0.44
v/c Ratio	0.71	0.79			0.72					0.79		0.39
Control Delay	23.2	16.9			24.2					51.1		14.5
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	23.2	16.9			24.2					51.1		14.5
LOS	C	B			C					D		B
Approach Delay		18.3			24.2						31.9	
Approach LOS		B			C						C	
Queue Length 50th (ft)	80	357			265					136		80
Queue Length 95th (ft)	164	558			368					#242		129
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	469	1217			1521					361		718
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.61	0.79			0.72					0.72		0.40
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 23.1

Intersection LOS: C

Intersection Capacity Utilization 68.2%

ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road






















Lanes, Volumes, Timings

2021 Existing Condition - Weekday Evening - Revised

3: Private Driveway/Pleasant Street & Trapelo Road

09/01/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	351	972	0	0	904	209	0	0	0	218	0	385
Future Volume (vph)	351	972	0	0	904	209	0	0	0	218	0	385
Satd. Flow (prot)	1711	1801	0	0	3319	0	0	2153	0	1947	0	1599
Flt Permitted	0.100									0.757		
Satd. Flow (perm)	180	1801	0	0	3319	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					33							151
Lane Group Flow (vph)	377	1045	0	0	1223	0	0	0	0	234	0	414
Turn Type	pm+pt	NA			NA					Perm		custom
Protected Phases	5	2			6		3	8				4
Permitted Phases	2						8			4		5
Detector Phase	5	2			6		3	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		1.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		6.0	25.0		25.0		25.0
Total Split (s)	22.0	56.0			34.0		8.0	26.0		26.0		26.0
Total Split (%)	24.4%	62.2%			37.8%		8.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		1.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		None	Min		Min		Min
Act Effct Green (s)	60.2	60.2			35.1					19.8		44.9
Actuated g/C Ratio	0.67	0.67			0.39					0.22		0.50
v/c Ratio	0.82	0.87			0.93					0.69		0.47
Control Delay	36.6	23.5			41.7					42.1		9.9
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	36.6	23.5			41.7					42.1		9.9
LOS	D	C			D					D		A
Approach Delay		26.9			41.7						21.5	
Approach LOS		C			D						C	
Queue Length 50th (ft)	144	409			~371					123		80
Queue Length 95th (ft)	#324	#849			#552					182		136
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	470	1204			1315					388		858
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.80	0.87			0.93					0.60		0.48
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 85												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 31.4

Intersection LOS: C

Intersection Capacity Utilization 74.8%

ICU Level of Service D

Analysis Period (min) 15

~ 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.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road





















Lanes, Volumes, Timings

2028 No Build - Weekday Morning - Revised

3: Private Driveway/Pleasant Street & Trapelo Road

09/01/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	296	956	0	0	868	208	0	0	0	266	0	292
Future Volume (vph)	296	956	0	0	868	208	0	0	0	266	0	292
Satd. Flow (prot)	1711	1801	0	0	3316	0	0	2153	0	1947	0	1599
Flt Permitted	0.097									0.757		
Satd. Flow (perm)	175	1801	0	0	3316	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					34							153
Lane Group Flow (vph)	318	1028	0	0	1183	0	0	0	0	286	0	314
Turn Type	pm+pt	NA			NA					Perm		custom
Protected Phases	5	2			6		3	8				4
Permitted Phases	2						8			4		5
Detector Phase	5	2			6		3	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		1.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		6.0	25.0		25.0		25.0
Total Split (s)	22.0	56.0			34.0		8.0	26.0		26.0		26.0
Total Split (%)	24.4%	62.2%			37.8%		8.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		1.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		None	Min		Min		Min
Act Effct Green (s)	57.0	57.0			36.2					23.0		43.8
Actuated g/C Ratio	0.63	0.63			0.40					0.26		0.49
v/c Ratio	0.84	0.90			0.88					0.72		0.37
Control Delay	40.7	28.9			35.6					40.7		7.1
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	40.7	28.9			35.6					40.7		7.1
LOS	D	C			D					D		A
Approach Delay		31.7			35.6						23.1	
Approach LOS		C			D						C	
Queue Length 50th (ft)	121	454			328					148		47
Queue Length 95th (ft)	#270	#855			#525					217		85
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	412	1139			1352					417		843
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.77	0.90			0.88					0.69		0.37
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 85												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 31.5

Intersection LOS: C

Intersection Capacity Utilization 73.4%

ICU Level of Service D

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road























Lanes, Volumes, Timings

2028 No Build - Weekday Evening - Revised

3: Private Driveway/Pleasant Street & Trapelo Road

09/01/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	390	1042	0	0	969	236	0	0	0	246	0	429
Future Volume (vph)	390	1042	0	0	969	236	0	0	0	246	0	429
Satd. Flow (prot)	1711	1801	0	0	3316	0	0	2153	0	1947	0	1599
Flt Permitted	0.098									0.757		
Satd. Flow (perm)	176	1801	0	0	3316	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					39							36
Lane Group Flow (vph)	419	1120	0	0	1324	0	0	0	0	265	0	461
Turn Type	pm+pt	NA			NA					Perm		custom
Protected Phases	5	2			6			8				4
Permitted Phases	2						8			4		5
Detector Phase	5	2			6		8	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		25.0	25.0		25.0		25.0
Total Split (s)	24.0	64.0			40.0		26.0	26.0		26.0		26.0
Total Split (%)	26.7%	71.1%			44.4%		28.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		3.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		Min	Min		Min		Min
Act Effct Green (s)	60.2	60.2			36.0					19.8		44.0
Actuated g/C Ratio	0.67	0.67			0.40					0.22		0.49
v/c Ratio	0.94	0.93			0.98					0.78		0.58
Control Delay	55.8	29.0			47.7					49.9		18.2
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	55.8	29.0			47.7					49.9		18.2
LOS	E	C			D					D		B
Approach Delay		36.3			47.7						29.8	
Approach LOS		D			D						C	
Queue Length 50th (ft)	186	514			~387					140		160
Queue Length 95th (ft)	#372	#873			#546					#251		253
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	446	1204			1350					361		786
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.94	0.93			0.98					0.73		0.59
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.98

Intersection Signal Delay: 39.2

Intersection LOS: D

Intersection Capacity Utilization 81.2%

ICU Level of Service D

Analysis Period (min) 15

~ 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.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	298	956	0	0	868	213	0	0	0	277	0	296
Future Volume (vph)	298	956	0	0	868	213	0	0	0	277	0	296
Satd. Flow (prot)	1711	1801	0	0	3312	0	0	2153	0	1947	0	1599
Flt Permitted	0.099									0.757		
Satd. Flow (perm)	178	1801	0	0	3312	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					35							153
Lane Group Flow (vph)	320	1028	0	0	1188	0	0	0	0	298	0	318
Turn Type	pm+pt	NA			NA					Perm		custom
Protected Phases	5	2			6		3	8				4
Permitted Phases	2						8			4		5
Detector Phase	5	2			6		3	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		1.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		6.0	25.0		25.0		25.0
Total Split (s)	22.0	56.0			34.0		8.0	26.0		26.0		26.0
Total Split (%)	24.4%	62.2%			37.8%		8.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		1.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		None	Min		Min		Min
Act Effct Green (s)	56.1	56.1			35.4					23.9		44.6
Actuated g/C Ratio	0.62	0.62			0.39					0.27		0.50
v/c Ratio	0.85	0.92			0.90					0.73		0.37
Control Delay	41.8	31.0			37.8					40.2		7.0
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	41.8	31.0			37.8					40.2		7.0
LOS	D	C			D					D		A
Approach Delay		33.5			37.8						23.1	
Approach LOS		C			D						C	
Queue Length 50th (ft)	122	472			339					153		46
Queue Length 95th (ft)	#270	#855			#528					227		88
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	409	1123			1324					425		866
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.78	0.92			0.90					0.70		0.37
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 85												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.92

Intersection Signal Delay: 33.1

Intersection LOS: C

Intersection Capacity Utilization 74.3%

ICU Level of Service D

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road






















Lanes, Volumes, Timings

2028 Build - Weekday Evening - Revised

3: Private Driveway/Pleasant Street & Trapelo Road

09/01/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	394	1042	0	0	969	249	0	0	0	255	0	432
Future Volume (vph)	394	1042	0	0	969	249	0	0	0	255	0	432
Satd. Flow (prot)	1711	1801	0	0	3309	0	0	2153	0	1947	0	1599
Flt Permitted	0.097									0.757		
Satd. Flow (perm)	175	1801	0	0	3309	0	0	2153	0	1551	0	1599
Satd. Flow (RTOR)					42							395
Lane Group Flow (vph)	424	1120	0	0	1339	0	0	0	0	274	0	465
Turn Type	pm+pt	NA			NA					Perm		Perm
Protected Phases	5	2			6			8				
Permitted Phases	2						8			4		4
Detector Phase	5	2			6		8	8		4		4
Switch Phase												
Minimum Initial (s)	5.0	5.0			5.0		5.0	5.0		5.0		5.0
Minimum Split (s)	25.0	25.0			25.0		25.0	25.0		25.0		25.0
Total Split (s)	24.0	64.0			40.0		26.0	26.0		26.0		26.0
Total Split (%)	26.7%	71.1%			44.4%		28.9%	28.9%		28.9%		28.9%
Yellow Time (s)	4.0	4.0			4.0		3.0	3.0		3.0		3.0
All-Red Time (s)	2.0	2.0			2.0		3.0	3.0		3.0		3.0
Lost Time Adjust (s)	-1.0	-1.0			-1.0			0.0		-1.0		-1.0
Total Lost Time (s)	5.0	5.0			5.0			6.0		5.0		5.0
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min	C-Min			C-Max		Min	Min		Min		Min
Act Effct Green (s)	60.5	60.5			36.1					19.5		19.5
Actuated g/C Ratio	0.67	0.67			0.40					0.22		0.22
v/c Ratio	0.95	0.93			0.99					0.82		0.71
Control Delay	56.7	28.4			50.1					53.6		12.6
Queue Delay	0.0	0.0			0.0					0.0		0.0
Total Delay	56.7	28.4			50.1					53.6		12.6
LOS	E	C			D					D		B
Approach Delay		36.2			50.1						27.8	
Approach LOS		D			D						C	
Queue Length 50th (ft)	190	514			~403					146		32
Queue Length 95th (ft)	#379	#873			#555					#263		134
Internal Link Dist (ft)		354			319			95			460	
Turn Bay Length (ft)										300		
Base Capacity (vph)	448	1210			1351					361		675
Starvation Cap Reductn	0	0			0					0		0
Spillback Cap Reductn	0	0			0					0		0
Storage Cap Reductn	0	0			0					0		0
Reduced v/c Ratio	0.95	0.93			0.99					0.76		0.69
Intersection Summary												
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												

Maximum v/c Ratio: 0.99

Intersection Signal Delay: 39.6

Intersection LOS: D

Intersection Capacity Utilization 82.4%

ICU Level of Service E

Analysis Period (min) 15

~ 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.

Splits and Phases: 3: Private Driveway/Pleasant Street & Trapelo Road













Pleasant Street at Olmsted Drive

HCM 6th TWSC
5: Pleasant Street & Olmsted Drive

2021 Existing Condition - Weekday Morning - Revised

09/01/2021





Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	9	3	451	496	2
Future Vol, veh/h	6	9	3	451	496	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	38	38	86	83	89	89
Heavy Vehicles, %	0	0	0	4	3	0
Mvmt Flow	16	24	3	543	557	2
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1107	558	559	0	-	0
Stage 1	558	-	-	-	-	-
Stage 2	549	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	235	533	1022	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	583	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	234	533	1022	-	-	-
Mov Cap-2 Maneuver	234	-	-	-	-	-
Stage 1	575	-	-	-	-	-
Stage 2	583	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	16.5	0.1		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1022	-	353	-	-	
HCM Lane V/C Ratio	0.003	-	0.112	-	-	
HCM Control Delay (s)	8.5	-	16.5	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0	-	0.4	-	-	





Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	6	10	550	597	6
Future Vol, veh/h	4	6	10	550	597	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	33	33	91	91	84	84
Heavy Vehicles, %	0	0	0	1	1	0
Mvmt Flow	12	18	11	604	711	7
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1341	715	718	0	-	0
Stage 1	715	-	-	-	-	-
Stage 2	626	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	170	434	892	-	-	-
Stage 1	488	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	168	434	892	-	-	-
Mov Cap-2 Maneuver	168	-	-	-	-	-
Stage 1	482	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	20.3	0.2		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	892	-	266	-	-	
HCM Lane V/C Ratio	0.012	-	0.114	-	-	
HCM Control Delay (s)	9.1	-	20.3	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0	-	0.4	-	-	

HCM 6th TWSC
5: Pleasant Street & Olmsted Drive

2028 No Build - Weekday Evening - Revised

09/01/2021






Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	9	3	501	549	2
Future Vol, veh/h	6	9	3	501	549	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	38	38	86	83	89	89
Heavy Vehicles, %	0	0	0	4	3	0
Mvmt Flow	16	24	3	604	617	2
Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1228	618	619	0	-	0
Stage 1	618	-	-	-	-	-
Stage 2	610	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	199	493	971	-	-	-
Stage 1	542	-	-	-	-	-
Stage 2	546	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	198	493	971	-	-	-
Mov Cap-2 Maneuver	198	-	-	-	-	-
Stage 1	540	-	-	-	-	-
Stage 2	546	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s	18.3		0.1		0	
HCM LOS	C					
Minor Lane/Major Mvmt	NBL		NBT	EBLn1	SBT	SBR
Capacity (veh/h)	971		-	309	-	-
HCM Lane V/C Ratio	0.004		-	0.128	-	-
HCM Control Delay (s)	8.7		-	18.3	-	-
HCM Lane LOS	A		-	C	-	-
HCM 95th %tile Q(veh)	0		-	0.4	-	-

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	6	10	616	669	6
Future Vol, veh/h	4	6	10	616	669	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	33	33	91	91	84	84
Heavy Vehicles, %	0	0	0	1	1	0
Mvmt Flow	12	18	11	677	796	7
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1499	800	803	0	-	0
Stage 1	800	-	-	-	-	-
Stage 2	699	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	136	388	830	-	-	-
Stage 1	446	-	-	-	-	-
Stage 2	497	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	134	388	830	-	-	-
Mov Cap-2 Maneuver	134	-	-	-	-	-
Stage 1	440	-	-	-	-	-
Stage 2	497	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	23.9	0.2		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	830	-	221	-	-	
HCM Lane V/C Ratio	0.013	-	0.137	-	-	
HCM Control Delay (s)	9.4	-	23.9	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0	-	0.5	-	-	

HCM 6th TWSC
5: Pleasant Street & Olmsted Drive

2028 - Build Condition - Weekday Morning - Revised






09/01/2021

Intersection						
Int Delay, s/veh	1.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	24	10	501	549	6
Future Vol, veh/h	16	24	10	501	549	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	38	38	86	83	89	89
Heavy Vehicles, %	0	0	0	4	3	0
Mvmt Flow	42	63	12	604	617	7
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1249	621	624	0	-	0
Stage 1	621	-	-	-	-	-
Stage 2	628	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	193	491	967	-	-	-
Stage 1	540	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	191	491	967	-	-	-
Mov Cap-2 Maneuver	191	-	-	-	-	-
Stage 1	534	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	23.2	0.2		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	967	-	302	-	-	
HCM Lane V/C Ratio	0.012	-	0.349	-	-	
HCM Control Delay (s)	8.8	-	23.2	-	-	
HCM Lane LOS	A	-	C	-	-	
HCM 95th %tile Q(veh)	0	-	1.5	-	-	

HCM 6th TWSC
5: Pleasant Street & Olmsted Drive

2028 Build - Weekday Evening - Revised




09/01/2021

Intersection						
Int Delay, s/veh	2.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	12	18	27	616	669	16
Future Vol, veh/h	12	18	27	616	669	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	33	33	91	91	84	84
Heavy Vehicles, %	0	0	0	1	1	0
Mvmt Flow	36	55	30	677	796	19
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1543	806	815	0	-	0
Stage 1	806	-	-	-	-	-
Stage 2	737	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	128	385	821	-	-	-
Stage 1	443	-	-	-	-	-
Stage 2	477	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	123	385	821	-	-	-
Mov Cap-2 Maneuver	123	-	-	-	-	-
Stage 1	427	-	-	-	-	-
Stage 2	477	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	35.1	0.4		0		
HCM LOS	E					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	821	-	208	-	-	
HCM Lane V/C Ratio	0.036	-	0.437	-	-	
HCM Control Delay (s)	9.5	-	35.1	-	-	
HCM Lane LOS	A	-	E	-	-	
HCM 95th %tile Q(veh)	0.1	-	2	-	-	

Olmsted Drive at Site Drive

Intersection




Int Delay, s/veh 2.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	16	7	3	9	0
Future Vol, veh/h	0	16	7	3	9	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	17	8	3	10	0

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	11	0	0 27 10
Stage 1	-	-	- 10 -
Stage 2	-	-	- 17 -
Critical Hdwy	4.12	-	- 6.42 6.22
Critical Hdwy Stg 1	-	-	- 5.42 -
Critical Hdwy Stg 2	-	-	- 5.42 -
Follow-up Hdwy	2.218	-	- 3.518 3.318
Pot Cap-1 Maneuver	1608	-	- 988 1071
Stage 1	-	-	- 1013 -
Stage 2	-	-	- 1006 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1608	-	- 988 1071
Mov Cap-2 Maneuver	-	-	- 988 -
Stage 1	-	-	- 1013 -
Stage 2	-	-	- 1006 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1608	-	-	-	988
HCM Lane V/C Ratio	-	-	-	-	0.01
HCM Control Delay (s)	0	-	-	-	8.7
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	13	17	10	7	0
Future Vol, veh/h	0	13	17	10	7	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	14	18	11	8	0
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	29	0	-	0	38	24
Stage 1	-	-	-	-	24	-
Stage 2	-	-	-	-	14	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1584	-	-	-	974	1052
Stage 1	-	-	-	-	999	-
Stage 2	-	-	-	-	1009	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1584	-	-	-	974	1052
Mov Cap-2 Maneuver	-	-	-	-	974	-
Stage 1	-	-	-	-	999	-
Stage 2	-	-	-	-	1009	-
Approach	EB	WB		SB		
HCM Control Delay, s	0	0		8.7		
HCM LOS				A		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1584	-	-	-	974	
HCM Lane V/C Ratio	-	-	-	-	0.008	
HCM Control Delay (s)	0	-	-	-	8.7	
HCM Lane LOS	A	-	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	0	