2

2023 Existing Conditions

Evaluation of the transportation impacts associated with the proposed project requires an understanding of the existing transportation system in the project study area. The 2023 existing conditions evaluation consisted of an inventory of intersection traffic control, roadway geometry, traffic volumes, and recent vehicle crash history in the study area. Each of these elements is described in detail below.

2.1 Study Area

2.1.1 Intersections

The description of the intersections includes the physical characteristics, geometric conditions, and current operating conditions.

The selected signalized intersection and the surrounding area are shown in Figure 1 and listed below:

1. Boston Post Road (Route 1) at Willetts Avenue (signalized); and,
2. Phase 1 site driveway at Willetts Avenue (unsignalized)

Boston Post Road (Route 1) at Willetts Avenue and Private Driveway (signalized)

Boston Post Road (Route 1) is intersected by Willetts Avenue from the south and a private driveway from the north to form a four-leg signalized intersection. The traffic signal operates in coordination with other signals along Route 1 as part of a time-based CTDOT system. The

northbound Willetts Avenue approach provides single multi-purpose lane. The southbound driveway provides a left-turn lane and a shared through/right/turn lane. The westbound Route 1 approach contains two shared through/turn lanes. The eastbound Route 1 approach provides a shared through/left-turn lane and an exclusive right-turn lane. Sidewalks are provided on the north side of Route 1 and on the south side of Route 1 to the west of Willetts Avenue. A crosswalk is provided across the western leg of Route 1. Push buttons are provided to call an exclusive pedestrian phase for crossing this crosswalk.

The traffic control signal equipment was replaced by the Connecticut Department of Transportation (CTDOT) in 2022 with brand new traffic signal span poles, signal heads, pedestrian signals and timings and phasings. The signal is in a closed loop traffic signal system with several adjacent traffic signals along US Route 1. CTDOT replaced the equipment under a programmed project upgrade. A copy of the traffic control signal plan is in the Appendix.

Waterford Woods Site Driveway at Willetts Avenue

Willetts Avenue intersects with the recently constructed Waterford Woods site driveway. Willetts Avenue has one lane approaches with shoulders and Waterford Woods has a two-lane stop sign controlled approach.

The intersection has ample sight distances to the east and west from the northbound approach The site driveway was approved by the Town and OSTA as part of the prior Waterford Woods approvals.

There are no changes planned for the site driveway intersection under the Waterford Central project.

2.1.2 Roadways

Boston Post Road (US Route 1)

Boston Post Road (US Route 1) is a four-lane roadway (two lanes in each direction) west of Willetts Avenue and a two-lane roadway (one lane in each direction) east of Willetts Avenue. Boston Post Road (US Route 1) is under state jurisdiction and is classified principal arterial roadway. The posted speed limit on Boston Post Road (US Route 1) is 30 miles per hour within the project area. CTDOT collected speed data on Route 1 to the east of Willetts Avenue in March 2020. According to this data, the 85th percentile speed on Route 1 is approximately 41 miles per hour.

Willetts Avenue

Willetts Avenue is a two-lane roadway (one lane in each direction) with a northwest-southeast orientation in the vicinity of the project site that runs between Boston Post Road (Route 1) and

Ocean Avenue (Route 213). Willetts Avenue is classified an urban collector and is under local jurisdiction. The posted speed limit on Willetts Avenue is 30 miles per hour within the project area. VHB collected speed data on Willetts Avenue west of Myrock Avenue in October 2022. According to this data, the 85th percentile speed along Willetts Avenue is approximately 37 miles per hour in the eastbound direction and 38 in the westbound direction.

2.2 Crash History and Analysis

To identify potential vehicle crash trends and/or roadway deficiencies near the project site, VHB conducted a review of the UConn Connecticut Crash Data Repository to document the number of geolocated vehicular collisions that have taken place over the most recent three years (2020-2022).

The review revealed 12 reported crashes occurred at the Route 1 at Willetts Avenue intersection, with no crashes reported along the site frontage. It should be noted that the results of the Crash Database review were dependent on the accuracy of crash reporting and geolocating.

Table 1 presents the number of crashes and crash characteristics for the study intersections of Route 1 at Willetts Avenue during the three-year study period. No crashes resulted in a fatality.

Nearly 92% of all the crashes in the study area resulted in property damage only, while the remaining one crash involved possible injury. Approximately 67% of the crashes were rear-end crashes, with 8% each of the crashes being angle and sideswipe type collisions and the remaining nearly 17% of crashes being unknown collisions (curb, utility pole, etc.). The crashes occurred at varying times and under primarily dry pavement and daylight conditions.

The crash data suggests a downward trend of crashes at the intersection and with replacement of the traffic control signal equipment in 2022 with updated timings and phasings, the crash trend is expected to continue.

Table 1 Crash Analysis Summary

	US Route 1 at Willetts Avenue
Year	
2020	7
2021	3
2022	2
Total	12
Collision Type	
Angle	1
Rear-end	8
Head-on	0
Sideswipe, same direction	1
Unknown	2
Total	12
Severity	
Fatal Injury	0
Injury – Non-Fatal	1
Property Damage Only	11
Not Reported/Unknown	0
Total	12
Time of day	
Weekday, 7:00 AM - 9:00 AM	2
Weekday, 4:00 – 6:00 PM	1
Saturday, 11:00 AM – 1:00 PM	1
Weekday, other time	5
Weekend, other time	3
Total	12
Season	
Dec – Feb	3
Mar – May	4
June – Aug	3
Sept – Nov	2
Total	12
Pavement Conditions	
Dry	10
Wet	2
Snow	0
Ice	0
Total	12
Light Conditions	
Daylight	8
Dawn/Dusk	1
Dark, Not Lighted	1
Dark, Lighted	2
Unknown	0
Total	12
Non-Motorist (Bike, Pedestrian)	**0**

Source: UConn Connecticut Crash Data Repository

2.3 Traffic Count Data

For Waterford Central, VHB conducted manual turning movement and classification (TMC) counts at the study area intersections of US Route 1 at Willetts Avenue during the typical weekday morning peak hours (7:00 – 9:00 AM) and extended weekday afternoon peak hours (3:00 – 6:00 PM). Included in these counts are passenger vehicles, heavy vehicles, buses, and pedestrians. These counts were conducted under previous traffic studies for Waterford Woods and again on October 12th of 2022 for Waterford Central. Within these periods, the peak hours of the intersections generally occurred from 7:30 AM to 8:30 AM during a typical weekday morning, and 3:00 PM to 4:00 PM during a typical weekday afternoon.

The midafternoon peak hour suggests a combination of school peak hour traffic and 1st shift workers from Electric Boat may be causing the peak hour to run earlier than the typical 4-6pm peak hours for commuters.

Additionally, these volumes were grown by a conservative 1% over one year to bring the 2022 volumes into a base year of 2023 and account for ambient traffic growth.

The 2023 Existing conditions weekday morning and weekday afternoon peak hour traffic volume networks are summarized in Figure 2.

3

2024 Future Conditions

Based upon the project development schedule provided by the project team, the proposed project is expected to begin operations in 2024. Therefore, the year 2024 was used for future traffic estimations, first modelled without the project in place, and then modelled with the project in place. The traffic volumes projected to be realized in the 2024 no-build and 2024 build conditions, as described in the following sections, provide a basis of comparison to evaluate the transportation impacts of the project.

3.1 2024 No-Build Conditions

The future no-build scenario includes the 2023 existing conditions traffic volumes, anticipated background traffic growth, and other known development projects affecting the study area network.

Traffic growth in the study area is a function of expected land development, economic activity, and changes in local and regional demographics. A frequently used procedure by the transportation engineering industry is to estimate the historical annual percentage increase in traffic volumes and apply that increase to the study-area traffic volumes. Another procedure involves the estimation of traffic generated by specific planned major developments that would be expected to affect traffic volumes on the study area roadways. Both methods were assessed.

3.1.1 Background Traffic Growth

Based on previous conversations with CTDOT and for the purpose of this study, a 1.0% growth rate per year was recommended. The 2023 existing conditions traffic volumes were increased by 1.0% over one year to account for ambient traffic growth in the study area by 2024.

3.2 2024 Build Conditions

The 2024 build conditions represent future conditions with the opening of the proposed project. The 2024 build conditions traffic volumes include the no-build conditions volumes plus the vehicle trips anticipated to be generated by the project.

3.2.1 Site Access and Parking

As shown on the site plan, the Waterford Central development will utilize the existing full access Waterford Woods driveway on Willetts Avenue. An internal driveway will connect the Wateford Central site to the Wateford Woods site; no access to Waterford Central will be provided via Myrock Avenue. The Waterford Woods Site Driveway is unsignalized, with two lanes exiting, a left turn lane and a right turn lane.

Parking will be available for residents and guests in the proposed surface lots. Lots designated for each building will be provided and interconnected for site circulation. In total, the proposed on-site parking for the total development is 305 spaces.

A reduced-size copy of the proposed site plan is included in the Appendix.

3.2.2 Site-Generated Traffic

To estimate the vehicle trip generation for the proposed project, traffic projections can be derived from trip generation rates published by the Institute of Transportation Engineers (ITE) in their Trip Generation Manual, 11th Edition1. ITE is the industry standard methodology used to project trips generated by this type of development, which is based on a number of observations at other, similar land uses throughout the United States. In addition, this is an Office of the State Traffic Administration (OSTA) approved methodology. It was determined that the following land use codes were utilized to estimate the Waterford Central site generated traffic:

- LUC 220 "Multi-Family Housing (Low-Rise)" was utilized to estimate trip generation associated with the residential development's 216 units.

The anticipated new trip generation for the proposed Waterford Central of the development is summarized in Table 2.

As shown in Table 2, the Waterford Central development is expected to generate approximately 85 (20 entering, 65 exiting) new vehicle trips during the weekday morning peak hour, and approximately 107 (67 entering, 40 exiting) new vehicle trips during the

weekday afternoon peak hour. This represents net new vehicles on the adjacent roadway network and in addition to the prior approved and under construction Waterford Woods project traffic already using the site driveway and Willetts Avenue.

It should be noted that the traffic volumes projected to be generated are conservatively estimated, with an average of 100 trips generated in the peak hours. OSTA considers intersections for study when 100 or more trips are generated by a project. This project will have less than 100 trips generated at adjacent intersections.

Table 2 Trip Generation Summary

Time Period	Waterford Central Residential (216 Units) [1]
Weekday Morning Peak Hour [2]	
Enter	22
Exit	68
Total	90
Weekday Afternoon Peak Hour [2]	
Enter	71
Exit	42
Total	113

1. Based on ITE Land Use Code 220 Multi-Family Housing (Low-Rise) based on 216 units
2. Vehicles per hour

3.2.3 Trip Distribution and Assignment

The site-generated trips presented in Table 2 were distributed along the study area roadways and assigned to specific intersection turning movements to determine where exactly project-related traffic impacts may occur.

The anticipated distribution of the site generated traffic was determined by examining the existing traffic patterns, the major routes in Waterford in relation to the site location, anticipating commuter traffic patterns in the area, prior studies for Waterford Woods and ease of access to the site. VHB has investigated the most recent census for the surrounding towns to determine the Journey to Work data to forecast appropriate connections to employment draws in the surrounding area.

It was assumed that site-generated traffic would be allocated across the major routes in the area based on the traffic percentages that are summarized in Table 3. A figure depicting the distribution patterns shown in Table 3 can be seen in the Appendix.

Table 3 Regional Trip Distribution

Traffic Entering/Leaving via	Portion of Project-Generated Traffic
US Route 1 to/from the east	10%
US Route 1 to/from the west	40%
Willetts Avenue to/from the southeast	50%
Total	100%

Source: VHB, Inc.

The resulting site-generated trips are depicted on Figure 4. These site-generated trips were then added to the 2024 no-build conditions traffic volumes to develop the 2024 build conditions traffic volumes, presented in Figure 5.

3.2.4 Intersection Improvements

The signalized intersection of Willetts Avenue at Boston Post Road (US Route 1) exhibits long queues on the northbound approach during the afternoon peak hours only. These queues will increase and potentially extend the site driveway intersection with the additional traffic proposed as part of the Waterford Central project. VHB conducted alternative analysis of retiming and geometric changes to CT DOT for input as the signalized intersection is owned by CTDOT and operates as part of a corridor time-based system.

The analysis in the following chapter is based on the conversations held with CTDOT and explores widening the Willetts Avenue approach to include a northbound left-turn lane, and a shared left-turn/through/right-turn lane.

A figure depicting the conceptualized geometry is provided in the Appendix.

4

Traffic Operations Analysis

To assess the quality of traffic operations within the study area, intersection capacity analyses were conducted for the 2022 Existing conditions, the 2024 No-Build conditions, and the 2024 Build conditions. Capacity analyses provide an indication of the adequacy of the roadway facilities to serve the anticipated traffic demands.

4.1 Method

The capacity analyses were conducted using industry standard Synchro software (Version 11). Signalized intersections were analyzed based on the evaluation criteria from the *Highway Capacity Manual (HCM) 2000*[1]. The HCM 2000 methodology was used instead of HCM 2010 or HCM 6th Edition due to limitations in these newer HCM methodologies that would preclude analysis of some signalized study intersections. For instance, the HCM 2010 and HCM 6th Edition methodologies do not support analysis of intersections with non-NEMA phasing, more than four approaches, or clustered intersections. To analyze unsignalized intersections, the HCM 6th Edition was used due to limitations analyzing all-way stop-controlled intersections in the previous versions.

Capacity analyses results are reported using a variety of performance measures, including "Level of Service" (LOS), Volume-to-Capacity (v/c) ratio, and queue length. These performance measures are described below.

[1] *Highway Capacity Manual,* Transportation Research Board, Washington, DC (2000).

Level-of-Service (LOS)

The level of service designation at intersections is based on the average control delay experienced by a vehicle traveling through the intersection. Similar to a report card, LOS designations are letter based, ranging from A to F, with LOS A representing the best operating condition (lowest vehicle delays) and LOS F representing the worst operating condition (highest vehicle delays). It is important to note that intersections during peak traffic conditions are not necessarily expected to operate at LOS A; an intersection operating at LOS A during typical peak conditions may suggest that the roadway is over-designed with too much capacity. Additionally, an intersection operating at LOS F during the peak periods does not necessarily indicate a failing intersection. In some cases, LOS F conditions may be deemed tolerable, provided that the lengthy delays do not lead to other, more serious conditions, such as increases in crash frequency.

LOS is assigned differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection, and the LOS can be reported for individual turning movements, approaches, or for the intersection as a whole. For unsignalized intersections with stop-control on the side street approaches, the analysis assumes that through and right-turning movements on the main street are unimpeded by side street traffic. As such, LOS is reported only for left-turns from the main street and for all movements from the side street; the overall intersection LOS is not reported. Additionally, the delay values for each range are slightly longer for signalized intersections than unsignalized intersections. This is based on the presumption that the public will be more patient at signalized intersections where they are guaranteed entry into the intersection in a reasonable amount of time.

Volume-to-Capacity (v/c)

Volume-to-Capacity (v/c) can be reported for individual lane groups or for the intersection as a whole. Volume-to-Capacity is a ratio comparing the volume of vehicles proceeding through an intersection (or lane group) with the capacity of the intersection (or lane group) to accommodate that volume. A v/c ratio of 1.0 indicates an intersection operating at its capacity.

Queue Length

Vehicle queues are the expected length of vehicles waiting at an intersection. This report documents the 50th percentile and 95th percentile vehicle queue lengths in feet. The 50th percentile queue represents the maximum vehicle queue length that is expected to occur during a signal cycle under typical (median) traffic flow rates during the peak period analyzed. The 95th percentile queue represents the maximum vehicle queue length that is expected to be exceeded only during the 5-percent of signal cycles (two or three times per hour) in the peak hour with the heaviest traffic flow. The 95th percentile queue is generally considered the maximum vehicle queue for design purposes.

4.2 Signalized Intersection Capacity Analysis

Table 4 presents a summary of the capacity analyses for the signalized intersection. The Synchro analysis reports are included in the Appendix.

The results indicate that the intersection of Willetts Avenue at Boston Post Road (US Route 1) maintains acceptable LOS through 2024 build conditions for the weekday morning and afternoon peak hours. The intersection is expected to improve from 2023 Existing and 2024 No-Build conditions under the 2024 Build condition considering the additional left-turn lane on the northbound approach.

Willetts Avenue at Boston Post Road (Route 1): Overall LOS B is maintained through 2024 Build conditions in the weekday morning peak hours. The weekday afternoon peak hours exhibits LOS C during the 2023 Existing and 2024 No-Build conditions. The addition of the exclusive left-turn lane in the northbound direction improves the intersection function overall to LOS B and maintains the northbound approach at LOS C and improves the eastbound approach from LOS E to LOS C during the weekday afternoon peak hours. Queues on the northbound approach are reduced from a maximum of 497 feet during the No-Build condition to 209 feet under the proposed Build condition. A queue length of 209 feet is approximately 11 vehicles in length.

Widening of the Willetts Avenue approach is necessary only in the afternoon peak hour to mitigate the peak hour traffic flow from New London area and the development traffic.

Table 4 Signalized Intersection Capacity Analysis Summary

Location	Peak Hour	Movement	2023 Existing Conditions					2024 No-Build Conditions					2024 Build Conditions				
			v/c[1]	Del[2]	LOS[3]	Q50[4]	Q95[5]	v/c	Del	LOS	Q50	Q95	v/c	Del	LOS	Q50	Q95
Boston Post Road (Route 1) at Willetts Avenue/Private Driveway	AM	EB L/T	0.41	14.3	B	93	218	0.45	16.3	B	103	220	0.38	11.4	B	78	220
		EB R	0.27	2.3	A	0	11	0.27	2.3	A	0	12	0.28	2.4	A	0	12
		WB L/T/R	0.21	11.8	B	42	81	0.23	13.3	B	46	82	0.20	9.4	A	35	82
		NB L*	-	-	-	-	-	-	-	-	-	-	0.58	28.7	C	105	143
		NB L/T/R	0.74	30.7	C	163	227	0.75	29.3	A	178	260	0.58	28.9	C	106	144
		SB L	0.29	41.4	D	3	7	0.29	41.4	D	3	7	0.29	41.4	D	3	7
		SB T/R	0.00	38.8	D	0	0	0.00	38.8	D	0	0	0.00	38.8	D	0	0
		Overall	**0.53**	**14.6**	**B**	**-**	**-**	**0.56**	**15.4**	**B**	**-**	**-**	**0.44**	**13.6**	**B**	**-**	**-**
	PM	EB L/T	1.03	71.3	E	271	#469	1.03	72.6	E	274	#475	0.71	21.5	C	189	#474
		EB R	0.26	2.6	A	0	12	0.28	2.7	A	0	12	0.30	2.7	A	0	13
		WB L/T/R	0.72	28.4	C	138	178	0.79	31.5	C	146	188	0.46	14.8	B	96	177
		NB L*	-	-	-	-	-	-	-	-	-	-	0.66	28.2	C	138	209
		NB L/T/R	0.75	22.6	C	207	#455	0.79	24.8	C	225	#497	0.64	27.6	C	134	204
		SB L	0.06	37.9	D	1	8	0.06	37.9	D	1	8	0.06	37.9	D	1	8
		SB T/R	0.10	38.1	D	2	19	0.10	38.1	D	2	19	0.10	38.1	D	2	19
		Overall	**0.84**	**33.3**	**C**	**-**	**-**	**0.87**	**34.5**	**C**	**-**	**-**	**0.67**	**17.6**	**B**	**-**	**-**

Source: VHB, Inc. using Synchro 11 software.
1 volume-to-capacity ratio
2 delay, in seconds
3 level of service
4 50th percentile queue length, in feet
5 95th percentile queue length, in feet
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound; R = right; T = through, L= left
# 95th% volume exceeds capacity, queue may be longer
~ Volume exceeds capacity, queue is theoretically infinite
m Volume for 95th percentile queue is metered by upstream signal
*Proposed left-turn lane under 2024 Build Conditions per discussion with CT DOT

4.3 Unsignalized Intersection Capacity Analysis

Table 5 presents a summary of the capacity analyses for the unsignalized study intersection. The Synchro analysis reports are included in the Appendix.

The results indicate that both signalized intersections will maintain acceptable LOS through 2024 build conditions.

Site Drive at Willetts Avenue: Under No-Build conditions, this intersection functions with LOS B or better during the weekday morning peak hour and LOS C or better during the afternoon peak hour. Under the Build conditions the weekday morning peak hour is expected to degrade slightly to operate at LOS C or better. Queue lengths are expected to be approximately two vehicles in length under Build conditions.

There is ample capacity at the site driveway for additional traffic.

Table 5 Unsignalized Intersection Capacity Analysis Summary

Location	Peak Hour	Movement	2024 No-Build Conditions					2024 Build Conditions				
			Dem.	v/c	Del	LOS	Q95	Dem.	v/c	Del	LOS	Q95
Site Drive at Willetts Avenue	AM	EB T/R	409	0.26	0.0	-	0	419	0.27	0.0	-	0
		WB L/T	338	0.01	0.4	A	1	348	0.02	0.7	A	2
		NB L/R	73	0.18	14.9	B	16	138	0.35	18.0	C	39
	PM	EB T/R	442	0.28	0.0	-	0	476	0.30	0.0	-	0
		WB L/T	546	0.04	1.1	A	3	579	0.08	2.0	A	6
		NB L/R	48	0.16	18.0	C	14	88	0.33	23.4	C	35

Source: VHB, Inc. using Synchro 11 software and HCM 6th Edition methodology.
1 demand, in vehicles per hour
2 volume-to-capacity ratio for the critical movement
3 delay of critical approach only, in seconds
4 level of service
5 95th percentile queue length, in feet
EB = Eastbound; WB = Westbound; NB = Northbound; SB = Southbound; R = right; T = through, L= left

5

Conclusion

This traffic impact and access study has outlined the anticipated transportation impacts of the proposed Waterford Central residential development on Willetts Avenue in Waterford, Connecticut.

The proposed project is a proposed residential complex adjacent to the Waterford Woods apartment complex which has six residential buildings containing a total of 204 units with a variety of one-bedroom and two-bedroom units and 313 parking spaces.

Waterford Central is proposed to include 216 units with a variety of one- and two-bedroom units available. Additionally, parking is expected to be approximately 305 spaces. Waterford Central will utilize the same previously approved and recently constructed site driveway access as Waterford Woods, connected via an internal driveway. The site driveway has ample intersection sight distances.

The Waterford Central development is expected to generate approximately 85 (20 entering, 65 exiting) new vehicle trips during the weekday morning peak hour, and approximately 107 (67 entering, 40 exiting) new vehicle trips during the weekday afternoon peak hour.

The intersection of Willetts Avenue at Boston Post Road (US Route 1) maintains acceptable LOS through 2024 build conditions for the weekday morning peak hour. The intersection is expected to improve from 2023 Existing and 2024 No-Build conditions under the 2024 Build condition with the inclusion of an additional left-turn lane on the northbound approach. The queuing on the Willetts Avenue approach to US Route 1 will be vastly improved in operation and shortened with the improvements under this project. The unsignalized intersections in the study area operate with LOS C or better under all conditions.

It is therefore the conclusion of this Traffic Impact and Access Study that the study area roadways and intersections can accommodate the additional traffic generated by the Waterford Central development with the proposed improvements at the signalized study area intersection of US Route 1 at Willetts Avenue.

Materials supporting the findings within this document are included in the attached Appendix.

\\vhb\gbl\proj\Wethersfield\42676.01\Graphics\FIGURES\SITE LOCATION FIG.dwg

0 200 400 Feet

Site and Study Intersection Location
Proposed Apartment Complex
Waterford Central
384 & 394 Willetts Avenue, Waterford, CT

Figure 1