

December 15, 2020

Mr. Alex Vigliotti  
Vigliotti Construction Company  
140 North Branford Road  
Branford, CT 06405

**RE: Traffic Study  
Proposed Multifamily (Age-Restricted) Development  
343 Clintonville Road  
North Haven, Connecticut  
MMI #2709-13-07**

Dear Mr. Vigliotti:

Milone & MacBroom, Inc. (MMI)/SLR has prepared the traffic study for the proposed 120-unit age-restricted residential development with 161 parking spaces to be located at 343 Clintonville Road (State Route 22) in North Haven, Connecticut. The proposed development will have two 60-unit buildings with an adjacent clubhouse for resident use. The site will provide vehicular access via a new driveway along Clintonville Road approximately 500 feet east of the intersection at Bassett Road/Mill Road. The site is currently occupied by a former garden and nursery center, which will be demolished. The study entailed field reconnaissance, an inventory of present roadway conditions, traffic data collection, estimation of site-generated traffic associated with the proposed development, and analysis of future intersection traffic operations at and near the site.

### **Site Environs**

The study area for this analysis was comprised of the following intersections:

- Clintonville Road at Bassett Road/Mill Road (signalized)
- Clintonville Road at the proposed site driveway (unsignalized)

Clintonville Road (Route 22) runs east/west with one travel lane in each direction with approximately 7- to 9-foot shoulders. The wide shoulder can be used to turn right into driveways or bypass left-turning traffic; at the Bassett Road/Mill Road intersection, the shoulder on the westbound approach can be used as a right-turn lane. The posted speed limit on Clintonville Road is 40 miles per hour (mph). Speed data were collected along Clintonville Road east of the site location on Thursday, September 5, 2019, and indicate the 85<sup>th</sup> percentile speeds were 43.7 mph and 42.5 mph for westbound and eastbound vehicles, respectively.

An at-grade railroad crossing exists about 700 feet east of the site. There are presently no sidewalks along the site frontage; however, a sidewalk segment runs for about 450 feet along the north side of Clintonville Road from the railroad tracks to a point just east of the site. The sidewalks primarily serve the Tuscan Villa Apartments and Fieldstone Court.

Bassett Road/Mill Road runs north/south with one lane in each direction. The posted speed limit is 30 mph. North of the site, Bassett Road crosses over I-91 and eventually becomes Bradley Street; south of the site, Mill Road continues through North Haven and ends at Spring Road.

The land uses near the site area include residential and commercial uses. There are also several schools within a half-mile radius of the site. Figure 1 shows the site location and surrounding area.

**Crash History**

Traffic crash data near the site were obtained via the Connecticut Crash Data Repository for the most recent 3-year period of September 1, 2017, through August 31, 2020. The data are summarized in Table 1 by location, crash severity, and collision type.

In total, 14 crashes were reported during this period in the vicinity of the site; approximately 80 percent of the crashes occurred at the signalized intersection of Clintonville Road at Bassett Road/Mill Road. Approximately 80 percent of crashes resulted in property damage only. The most frequent collision type was the rear-end collision, which comprised approximately 50 percent of crashes, followed by angle collisions at 20 percent.

**TABLE 1**  
**Crash Data Summary**

LOCATION	CRASH SEVERITY				TYPE OF COLLISION						
	SUSPECTED MINOR INJURY	POSSIBLE INJURY	PROPERTY DAMAGE ONLY	TOTAL	ANGLE	FIXED OBJECT	REAR END	ANIMAL	SIDESWIPE, OPPOSITE DIRECTION	SIDESWIPE, SAME DIRECTION	TOTAL
Clintonville Road at Bassett Road/Mill Road	1		10	<b>11</b>	3		6	1		1	<b>11</b>
Along Clintonville Road at Railroad Crossing	1	1		<b>2</b>		1	1				<b>2</b>
Along Clintonville Road at Site Frontage			1	<b>1</b>					1		<b>1</b>
<b>TOTAL</b>	<b>2</b>	<b>1</b>	<b>11</b>	<b>14</b>	<b>3</b>	<b>1</b>	<b>7</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>14</b>

Source: University of Connecticut Crash Data Repository from September 1, 2017, to August 31, 2020

**Baseline Traffic Volumes**

Manual turning movement counts were conducted on Thursday, September 5, 2019, during the morning peak period (7:00 a.m. to 9:00 a.m.) and afternoon peak period (4:00 p.m. to 6:00 p.m.) at the intersection

of Clintonville Road at Bassett Road/Mill Road and at two existing age-restricted housing developments along Clintonville Road: Tuscan Villa Apartments and Fieldstone Court. The peak hours were found to be 7:30 a.m. to 8:30 a.m. for the weekday morning and 4:45 p.m. to 5:45 p.m. for the weekday afternoon. Figure 2 shows the baseline weekday morning and afternoon peak-hour traffic volumes.

Traffic monitoring data were obtained from the Connecticut Department of Transportation (CTDOT) for Clintonville Road at a location east of Pond Hill Road, east of the proposed site. The most recent average daily traffic (ADT) volume collected in 2015 was approximately 10,200 vehicles. Along Bassett Road and Mill Road, traffic counts collected in 2018 show the ADT was approximately 3,500 vehicles.

### **Future Traffic Volumes**

Future traffic growth is attributed to new development and broader regional transportation trends. Future traffic volumes at the study intersections were estimated for two scenarios:

- No-build scenario: future traffic volumes without the traffic generated by the proposed development. This traffic scenario is reflective of future conditions before the proposed development is built.
- Build scenario: future traffic volumes with the traffic generated by the proposed development. This traffic scenario is reflective of future conditions after the proposed development is open.

The future no-build and build scenarios are then compared to determine traffic impacts due to the proposed development.

The year 2022 is when the proposed development intends to open and was used as the projection year for future traffic growth. CTDOT advised using a 0.6 percent annual growth rate to apply to the baseline traffic volumes to account for general background traffic growth. CTDOT and the Town of North Haven indicated there are no other major developments anticipated nearby that would add notable traffic through the study intersections. The 2022 no-build traffic volumes are therefore the baseline traffic volumes grown by 0.6 percent for 3 years. Figure 3 shows the 2022 no-build traffic volumes for the morning and afternoon peak hours.

### **Site-Generated Traffic and Distribution**

Typically, morning and afternoon peak-hour traffic generated by the proposed development is estimated based on statistical data contained in the Institute of Transportation Engineers' (ITE) *Trip Generation*<sup>1</sup> manual. Land use code (LUC) 252 (Senior Adult Housing – attached) was used to calculate the entering and exiting site traffic trips, shown in Table 2. These trips were compared to the traffic counts collected at the nearby Tuscan Villa Apartments and Fieldstone Court in terms of trips per dwelling unit. It was determined that Fieldstone Court generated trips at a higher rate compared to ITE. Therefore, the proposed site-generated traffic was calculated based on the more conservative Fieldstone Court counts for the purposes of this study. These trips are presented in bold text in Table 2 and compared to the trips that would be generated with ITE and the Tuscan Villa Apartments counts.

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<sup>1</sup> *Trip Generation, 10th Edition*. Institute of Transportation Engineers, 2017

**TABLE 2**  
**Site-Generated Traffic**

TRIPS BASED ON 120 UNITS AND:	NUMBER OF VEHICLE TRIPS					
	WEEKDAY MORNING PEAK HOUR			WEEKDAY AFTERNOON PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
ITE LUC 252 (Senior Adult Housing – Attached)	8	16	24	17	14	31
September 2019 count data, Tuscan Villa Apartments	5	9	14	13	11	24
<b>September 2019 count data, Fieldstone Court</b>	<b>12</b>	<b>23</b>	<b>35</b>	<b>30</b>	<b>24</b>	<b>54</b>

The geographic distribution of the site-generated traffic, shown in bold in Table 2, through the study intersections was estimated based on evaluation of journey-to-work census data for North Haven residents as well as the counts at the two nearby residential driveways. The census data show most trips are to and from the towns and cities along I-91, accessed from west of the site, and the driveway counts corroborate this distribution, approximately 80 percent. The distribution was applied to the anticipated travel patterns to and from the proposed development, illustrated in Figure 4. The previously calculated site traffic was then applied to the distribution to determine site traffic turning movements at the study intersections. These anticipated site-generated traffic volumes are depicted in Figure 5.

The 2022 build traffic volumes were determined by adding the new site-generated traffic volumes to the no-build traffic volumes. The resulting 2022 build traffic volumes are shown in Figure 6.

It is also noted that several years ago the site operated as a garden and nursery center that generated its own traffic. Former garden and nursery center traffic that was previously on the area roadways is being replaced to some extent by traffic from the proposed development, albeit years later. In this sense, one can expect that the *net* increase in traffic to/from the site will be less than that shown in Table 2 above.

**Site Access and Sight Lines**

Vehicular access to and from the site will be provided with one 24-foot-wide driveway along Clintonville Road. Parking spaces (161 total) will be provided such that residents of the western building will likely park on the western side of the site, and residents of the eastern building will likely park on the eastern side of the site.

A new sidewalk will be installed along the site frontage on the north side of Clintonville Road to connect the existing sidewalk east of the site toward the Bassett Road/Mill Road intersection to the west.

Sight lines were measured and evaluated from the location of the proposed driveway. Based on the CTDOT *Highway Design Manual* for the 85<sup>th</sup> percentile speeds observed along Clintonville Road, the following required sight distances were found to be met:

- 485 feet for a driver exiting the site looking east (to the left). It is recommended that overgrown brush be cut back to maintain the sight line.
- 470 feet for a driver exiting the site looking west (to the right). Sight line is clear.

**Traffic Capacity Analyses**

Capacity analyses were conducted for the signalized intersection of Clintonville Road at Bassett Road/Mill Road and Clintonville Road at the proposed site driveway using *Synchro*, a very commonly used traffic analysis software. Potential traffic impacts caused by the proposed project and the quality of operations at the study intersections were evaluated by comparing the no-build and build traffic volume conditions. The quality of traffic operations is expressed as a level of service (LOS), a qualitative indicator directly related to delay and inconvenience to motorists, ranging from designation A through F. LOS A through LOS D during peak hours are often deemed acceptable in many communities. A more detailed explanation of LOS and the analysis worksheets are provided in the Appendix.

Table 3 summarizes the LOS results with the proposed development in place (build scenario) and without the proposed development in place (no-build scenario). The comparison indicates the impact of the proposed development on traffic operations. The *Synchro* output sheets are attached in the Appendix.

As shown in Table 3, it is expected the signalized study intersection will not experience a change in LOS as a result of the proposed development. The intersection maintains overall LOS C during both peak hours, and the individual movements maintain LOS D or better. The proposed site driveway approach is anticipated to operate at LOS C or better. Note that overall intersection LOS is not calculated for unsignalized intersections.

**TABLE 3  
 Level of Service Summary**

MOVEMENTS	WEEKDAY MORNING PEAK HOUR		WEEKDAY AFTERNOON PEAK HOUR	
	NO-BUILD	BUILD	NO-BUILD	BUILD
<b>Clintonville Road at Bassett Road/Mill Road</b> (signalized)	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>
Eastbound Left/Thru/Right	C	C	D	D
Westbound Left/Thru/Right	B	B	B	B
Northbound Left/Thru/Right	C	C	C	C
Southbound Left/Thru/Right	D	D	D	D
<b>Clintonville Road at Site Driveway</b> (unsignalized)	-	-	-	-
Eastbound Left/Thru	-	A	-	A
Southbound Left/Right	-	C	-	C

**Summary and Conclusion**

This study was conducted to assess the traffic aspects of the proposed 120-unit age-restricted residential development to be located at 343 Clintonville Road in North Haven, Connecticut. To determine a profile of baseline conditions, field reconnaissance and data assembly efforts were undertaken. Traffic generated by the proposed development was estimated based on industry statistical data, and intersection capacity analyses were performed comparing future conditions in the site study area. The analyses showed that

the surrounding roadway system will be able to accommodate the traffic that would be generated by the proposed development with no perceptible impacts. It is recommended that any vegetation within the state's right-of-way along the north side of Clintonville Road east of the proposed site driveway be trimmed back and regularly maintained to allow sufficient visibility for motorists looking in both directions from the site egress onto the roadway.

We hope this report is useful to you and the Town of North Haven in assessing the traffic impacts of the proposed development. If you have any questions or need anything further, please do not hesitate to contact either of the undersigned.

Very truly yours,

MILONE & MACBROOM, INC.



David G. Sullivan, PE  
Manager of Traffic & Transportation Planning



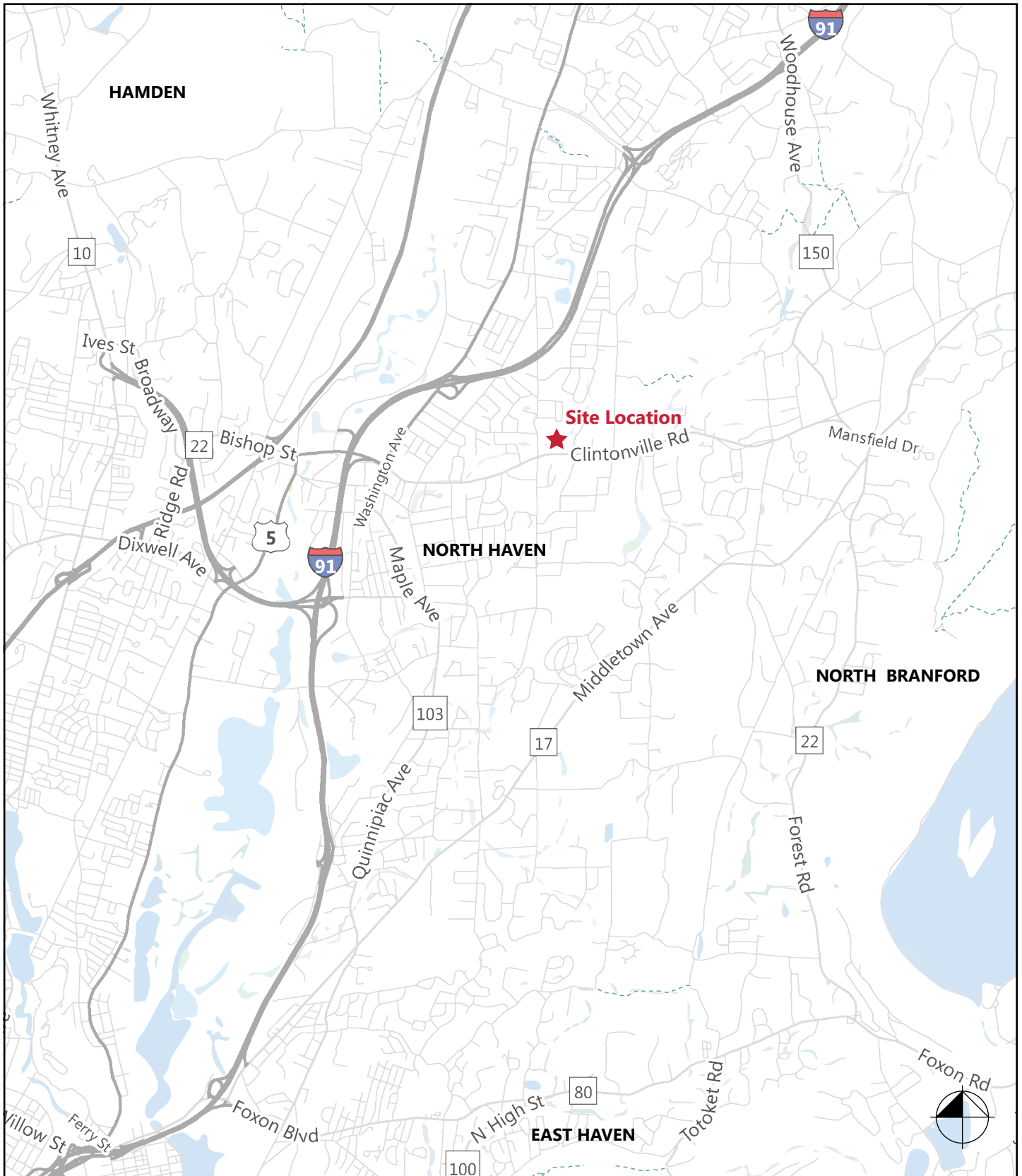
Neil C. Olinski, MS, PTP  
Lead Transportation Planner

Enclosures

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RESIDENTIAL DEVELOPMENT  
343 CLINTONVILLE ROAD  
NORTH HAVEN, CT

SITE LOCATION MAP





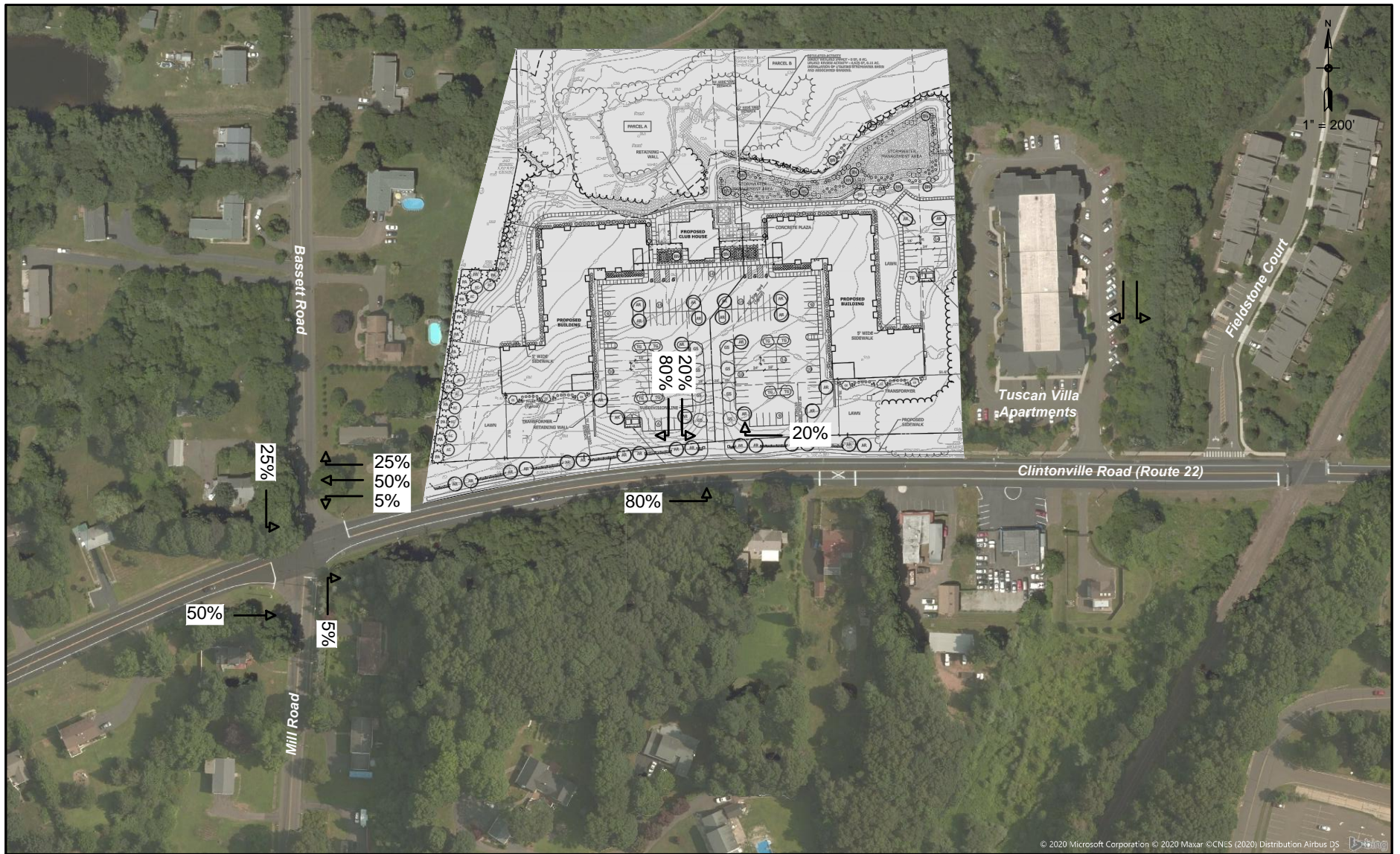




**2022 NO-BUILD CONDITIONS TRAFFIC VOLUMES**  
**343 Clintonville Road**  
**North Haven, Connecticut**

**LEGEND**  
 neg = negligible  
 ## [##] = AM Peak Hour  
 [PM Peak Hour]

**FIGURE 3**



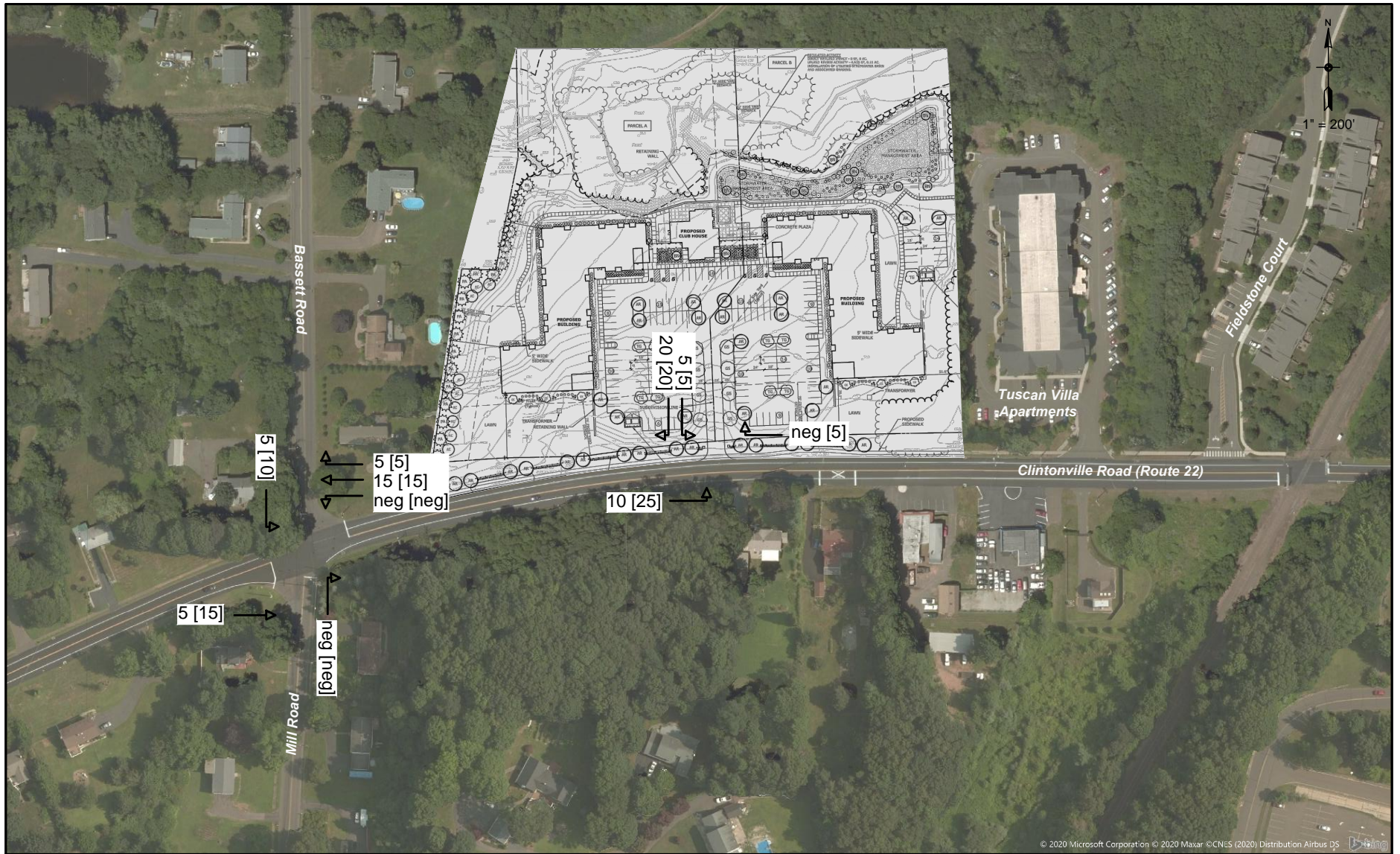
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**SITE-GENERATED TRAFFIC DISTRIBUTION**  
**343 Clintonville Road**  
**North Haven, Connecticut**

**LEGEND**  
 neg = negligible  
 ## [##] = AM Peak Hour  
 [PM Peak Hour]

**FIGURE 4**

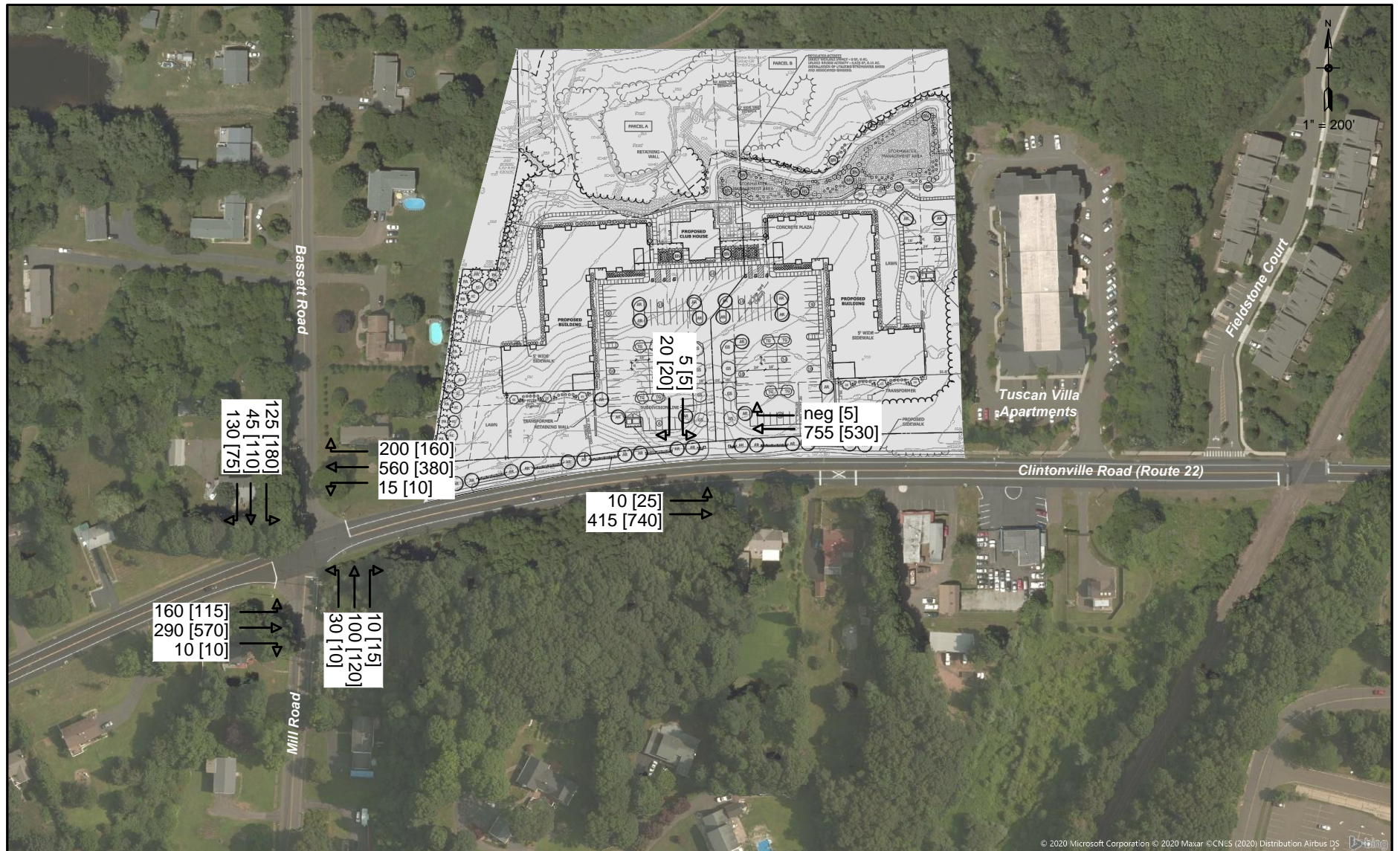


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**SITE-GENERATED TRAFFIC**  
**343 Clintonville Road**  
**North Haven, Connecticut**

**LEGEND**  
 neg = negligible  
 ## [##] = AM Peak Hour  
 [PM Peak Hour]

**FIGURE 5**



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## 2022 BUILD CONDITIONS TRAFFIC VOLUMES

343 Clintonville Road  
 North Haven, Connecticut

**LEGEND**  
 neg = negligible  
 ## [##] = AM Peak Hour  
 [PM Peak Hour]

**FIGURE 6**

# **APPENDIX**

# LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (MOTORIZED VEHICLE MODE)

Level of service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions: in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-min analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group. The criteria are given below.

<b>LEVEL-OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS MOTORIZED VEHICLE MODE</b>		
<b>LOS By Volume-to-Capacity Ratio<sup>1</sup></b>		<b>CONTROL DELAY (s/veh)</b>
<b>v/c ≤ 1.0</b>	<b>v/c &gt; 1.0</b>	
<b>A</b>	<b>F</b>	<b>≤ 10</b>
<b>B</b>	<b>F</b>	<b>&gt; 10 AND ≤ 20</b>
<b>C</b>	<b>F</b>	<b>&gt; 20 AND ≤ 35</b>
<b>D</b>	<b>F</b>	<b>&gt; 35 AND ≤ 55</b>
<b>E</b>	<b>F</b>	<b>&gt; 55 AND ≤ 80</b>
<b>F</b>	<b>F</b>	<b>&gt; 80</b>

<sup>1</sup> For approach-based and intersection-wide assessments, LOS is defined solely by control delay.

Specific descriptions of each LOS for signalized intersections are provided below:

**Level of Service A** describes operations with a control delay of 10 s/veh and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If LOS A is the result of favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

**Level of Service B** describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

**Level of Service C** describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

**Level of Service D** describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

**Level of Service E** describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

**Level of Service F** describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

Reference: Highway Capacity Manual 6, Transportation Research Board, 2016.

# LEVEL OF SERVICE

## FOR TWO-WAY

### STOP SIGN CONTROLLED INTERSECTIONS

The level of service for a TWSC (two-way stop controlled) intersection is determined by the computed or measured control delay and is defined for each minor movement. Level of service is not defined for the intersection as a whole. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. LOS criteria are given in the Table. LOS criteria are given below:

<b>LEVEL-OF SERVICE CRITERIA FOR AWSC INTERSECTIONS</b>	
<b>LOS<sup>1</sup></b>	<b>CONTROL DELAY (s/veh)</b>
<b>A</b>	<b><math>\leq 10</math></b>
<b>B</b>	<b><math>&gt; 10 \text{ AND } \leq 15</math></b>
<b>C</b>	<b><math>&gt; 15 \text{ AND } \leq 25</math></b>
<b>D</b>	<b><math>&gt; 25 \text{ AND } \leq 35</math></b>
<b>E</b>	<b><math>&gt; 35 \text{ AND } \leq 50</math></b>
<b>F</b>	<b><math>&gt; 50</math></b>

Note: LOS criteria apply to each lane on a given approach and to each approach on the minor street.  
 LOS is not calculated for major-street approaches or for the intersection as a whole.  
 LOS F is assigned to a movement if the volume-to-capacity ratio exceeds 1.0, regardless of the control delay

Reference: Highway Capacity Manual Version 6.0, Transportation Research Board, 2016.



Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	160	285	10	15	545	195	30	100	10	120	45	130
Future Volume (vph)	160	285	10	15	545	195	30	100	10	120	45	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	10	15	15	15	15	15	15
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		100	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1765	0	0	1736	0	0	2006	0	0	1890	0
Flt Permitted		0.552			0.988			0.880			0.783	
Satd. Flow (perm)	0	991	0	0	1717	0	0	1785	0	0	1510	0
Right Turn on Red			No			Yes			Yes			Yes
Satd. Flow (RTOR)					35			5			51	
Link Speed (mph)		45			45			30			25	
Link Distance (ft)		513			623			559			453	
Travel Time (s)		7.8			9.4			12.7			12.4	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	495	0	0	820	0	0	153	0	0	320	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	21.4	21.4		21.4	21.4		24.2	24.2		24.2	24.2	
Total Split (s)	51.4	51.4		51.4	51.4		29.2	29.2		29.2	29.2	
Total Split (%)	63.8%	63.8%		63.8%	63.8%		36.2%	36.2%		36.2%	36.2%	
Yellow Time (s)	4.4	4.4		4.4	4.4		3.2	3.2		3.2	3.2	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.4			6.4			4.2			4.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)		43.0			43.0			17.4			17.4	
Actuated g/C Ratio		0.60			0.60			0.24			0.24	
v/c Ratio		0.83			0.78			0.35			0.79	
Control Delay		27.9			18.4			23.9			35.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		27.9			18.4			23.9			35.6	

Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS		C			B			C			D	
Approach Delay		27.9			18.4			23.9			35.6	
Approach LOS		C			B			C			D	
Stops (vph)		318			503			101			221	
Fuel Used(gal)		8			12			2			4	
CO Emissions (g/hr)		563			848			130			288	
NOx Emissions (g/hr)		110			165			25			56	
VOC Emissions (g/hr)		131			197			30			67	
Dilemma Vehicles (#)		28			49			0			0	
Queue Length 50th (ft)		154			231			56			115	
Queue Length 95th (ft)		#415			#562			103			203	
Internal Link Dist (ft)		433			543			479			373	
Turn Bay Length (ft)												
Base Capacity (vph)		638			1119			642			573	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.78			0.73			0.24			0.56	

Intersection Summary

Area Type: Other  
 Cycle Length: 80.6  
 Actuated Cycle Length: 71.2  
 Natural Cycle: 75  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.83  
 Intersection Signal Delay: 24.6  
 Intersection LOS: C  
 Intersection Capacity Utilization 103.6%  
 ICU Level of Service G  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Mill Road/Bassett Road & Clintonville Road



Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	160	290	10	15	560	200	30	100	10	125	45	130
Future Volume (vph)	160	290	10	15	560	200	30	100	10	125	45	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	10	15	15	15	15	15	15
Storage Length (ft)	0		0	0		100	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1765	0	0	1736	0	0	2006	0	0	1892	0
Flt Permitted		0.543			0.988			0.879			0.776	
Satd. Flow (perm)	0	975	0	0	1717	0	0	1783	0	0	1498	0
Right Turn on Red			No			Yes			Yes			Yes
Satd. Flow (RTOR)					35			5				49
Link Speed (mph)		45			45			30				25
Link Distance (ft)		513			623			559				453
Travel Time (s)		7.8			9.4			12.7				12.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	500	0	0	842	0	0	153	0	0	326	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4		4
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		7.0	7.0		7.0		7.0
Minimum Split (s)	21.4	21.4		21.4	21.4		24.2	24.2		24.2		24.2
Total Split (s)	51.4	51.4		51.4	51.4		29.2	29.2		29.2		29.2
Total Split (%)	63.8%	63.8%		63.8%	63.8%		36.2%	36.2%		36.2%		36.2%
Yellow Time (s)	4.4	4.4		4.4	4.4		3.2	3.2		3.2		3.2
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0			0.0				0.0
Total Lost Time (s)		6.4			6.4			4.2				4.2
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None		None
Act Effct Green (s)		44.6			44.6			18.2				18.2
Actuated g/C Ratio		0.61			0.61			0.25				0.25
v/c Ratio		0.85			0.80			0.34				0.80
Control Delay		30.2			19.6			23.7				37.1
Queue Delay		0.0			0.0			0.0				0.0
Total Delay		30.2			19.6			23.7				37.1
LOS		C			B			C				D
Approach Delay		30.2			19.6			23.7				37.1
Approach LOS		C			B			C				D
Stops (vph)		320			527			102				230
Fuel Used(gal)		8			13			2				4
CO Emissions (g/hr)		583			894			130				301
NOx Emissions (g/hr)		113			174			25				59
VOC Emissions (g/hr)		135			207			30				70

Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Dilemma Vehicles (#)		28			49			0			0	
Queue Length 50th (ft)		171			261			56			120	
Queue Length 95th (ft)		#425			#587			103			210	
Internal Link Dist (ft)		433			543			479			373	
Turn Bay Length (ft)												
Base Capacity (vph)		602			1074			615			546	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.83			0.78			0.25			0.60	

Intersection Summary

Area Type: Other  
 Cycle Length: 80.6  
 Actuated Cycle Length: 73.5  
 Natural Cycle: 80  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.85  
 Intersection Signal Delay: 26.0  
 Intersection LOS: C  
 Intersection Capacity Utilization 105.3%  
 ICU Level of Service G  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: Mill Road/Bassett Road & Clintonville Road



Lanes, Volumes, Timings  
 2: Clintonville Road & Site Driveway

11/16/2020



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	10	415	755	1	5	20
Future Volume (vph)	10	415	755	1	5	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	12
Satd. Flow (prot)	0	1799	1801	0	1643	0
Flt Permitted		0.999			0.991	
Satd. Flow (perm)	0	1799	1801	0	1643	0
Link Speed (mph)		30	45		30	
Link Distance (ft)		623	296		216	
Travel Time (s)		14.2	4.5		4.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	462	822	0	27	0
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	49.8%
ICU Level of Service	A
Analysis Period (min)	15

HCM 6th TWSC  
 2: Clintonville Road & Site Driveway

11/16/2020

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	10	415	755	1	5	20
Future Vol, veh/h	10	415	755	1	5	20
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	11	451	821	1	5	22

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	822	0	-	0	1295 822
Stage 1	-	-	-	-	822 -
Stage 2	-	-	-	-	473 -
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	807	-	-	-	179 374
Stage 1	-	-	-	-	432 -
Stage 2	-	-	-	-	627 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	807	-	-	-	176 374
Mov Cap-2 Maneuver	-	-	-	-	176 -
Stage 1	-	-	-	-	424 -
Stage 2	-	-	-	-	627 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	18
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	807	-	-	-	305
HCM Lane V/C Ratio	0.013	-	-	-	0.089
HCM Control Delay (s)	9.5	0	-	-	18
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	115	555	10	10	365	155	10	120	15	170	110	75
Future Volume (vph)	115	555	10	10	365	155	10	120	15	170	110	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	10	15	15	15	15	15	15
Storage Length (ft)	0		0	0		100	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1783	0	0	1729	0	0	2014	0	0	1944	0
Flt Permitted		0.807			0.985			0.969			0.746	
Satd. Flow (perm)	0	1450	0	0	1704	0	0	1958	0	0	1484	0
Right Turn on Red			No			Yes			Yes			Yes
Satd. Flow (RTOR)					33			7				17
Link Speed (mph)		45			45			30				25
Link Distance (ft)		513			623			559				453
Travel Time (s)		7.8			9.4			12.7				12.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	739	0	0	576	0	0	157	0	0	387	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	21.4	21.4		21.4	21.4		24.2	24.2		24.2	24.2	
Total Split (s)	51.4	51.4		51.4	51.4		39.2	39.2		39.2	39.2	
Total Split (%)	56.7%	56.7%		56.7%	56.7%		43.3%	43.3%		43.3%	43.3%	
Yellow Time (s)	4.4	4.4		4.4	4.4		3.2	3.2		3.2	3.2	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.4			6.4			4.2			4.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)		45.4			45.4			24.6			24.6	
Actuated g/C Ratio		0.56			0.56			0.30			0.30	
v/c Ratio		0.91			0.59			0.26			0.83	
Control Delay		35.6			15.6			20.4			40.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		35.6			15.6			20.4			40.8	
LOS		D			B			C			D	
Approach Delay		35.6			15.6			20.4			40.8	
Approach LOS		D			B			C			D	
Stops (vph)		492			327			93			302	
Fuel Used(gal)		13			8			2			5	
CO Emissions (g/hr)		930			552			122			384	
NOx Emissions (g/hr)		181			107			24			75	
VOC Emissions (g/hr)		216			128			28			89	

# Lanes, Volumes, Timings

## 1: Mill Road/Bassett Road & Clintonville Road

11/16/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Dilemma Vehicles (#)		38			32			0			0	
Queue Length 50th (ft)		311			167			56			172	
Queue Length 95th (ft)		#673			344			99			276	
Internal Link Dist (ft)		433			543			479			373	
Turn Bay Length (ft)												
Base Capacity (vph)		815			972			860			659	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.91			0.59			0.18			0.59	

### Intersection Summary

Area Type: Other

Cycle Length: 90.6

Actuated Cycle Length: 80.7

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 29.2

Intersection LOS: C

Intersection Capacity Utilization 110.6%

ICU Level of Service H

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

### Splits and Phases: 1: Mill Road/Bassett Road & Clintonville Road





Lanes, Volumes, Timings

1: Mill Road/Bassett Road & Clintonville Road

12/10/2020

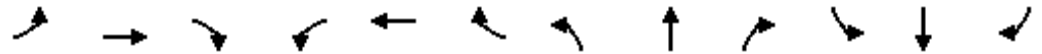


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	115	570	10	10	380	160	10	120	15	180	110	75
Future Volume (vph)	115	570	10	10	380	160	10	120	15	180	110	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	11	10	15	15	15	15	15	15
Storage Length (ft)	0		0	0		100	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1783	0	0	1729	0	0	2014	0	0	1944	0
Flt Permitted		0.800			0.985			0.968			0.742	
Satd. Flow (perm)	0	1438	0	0	1704	0	0	1956	0	0	1478	0
Right Turn on Red			No			Yes			Yes			Yes
Satd. Flow (RTOR)					32			7				17
Link Speed (mph)		45			45			30				25
Link Distance (ft)		513			623			559				453
Travel Time (s)		7.8			9.4			12.7				12.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	756	0	0	598	0	0	157	0	0	398	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Detector Phase	2	2		2	2		4	4		4	4	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	21.4	21.4		21.4	21.4		24.2	24.2		24.2	24.2	
Total Split (s)	51.4	51.4		51.4	51.4		39.2	39.2		39.2	39.2	
Total Split (%)	56.7%	56.7%		56.7%	56.7%		43.3%	43.3%		43.3%	43.3%	
Yellow Time (s)	4.4	4.4		4.4	4.4		3.2	3.2		3.2	3.2	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.4			6.4			4.2			4.2	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min		Min	Min		None	None		None	None	
Act Effct Green (s)		45.3			45.3			25.3			25.3	
Actuated g/C Ratio		0.56			0.56			0.31			0.31	
v/c Ratio		0.94			0.62			0.26			0.85	
Control Delay		41.6			16.6			20.2			41.7	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		41.6			16.6			20.2			41.7	
LOS		D			B			C			D	
Approach Delay		41.6			16.6			20.2			41.7	
Approach LOS		D			B			C			D	
Stops (vph)		509			352			93			312	
Fuel Used(gal)		15			8			2			6	
CO Emissions (g/hr)		1017			592			121			400	
NOx Emissions (g/hr)		198			115			24			78	
VOC Emissions (g/hr)		236			137			28			93	

# Lanes, Volumes, Timings

## 1: Mill Road/Bassett Road & Clintonville Road

12/10/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Dilemma Vehicles (#)		38			33			0			0	
Queue Length 50th (ft)		339			184			56			179	
Queue Length 95th (ft)		#698			366			99			287	
Internal Link Dist (ft)		433			543			479			373	
Turn Bay Length (ft)												
Base Capacity (vph)		802			964			852			650	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.94			0.62			0.18			0.61	

### Intersection Summary

Area Type: Other

Cycle Length: 90.6

Actuated Cycle Length: 81.3

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 32.1

Intersection LOS: C

Intersection Capacity Utilization 113.0%

ICU Level of Service H

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

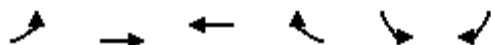
### Splits and Phases: 1: Mill Road/Bassett Road & Clintonville Road



## Lanes, Volumes, Timings

### 2: Clintonville Road & Site Driveway

12/10/2020



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	25	740	530	5	5	20
Future Volume (vph)	25	740	530	5	5	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	11	12	12
Satd. Flow (prot)	0	1797	1799	0	1643	0
Flt Permitted		0.998			0.991	
Satd. Flow (perm)	0	1797	1799	0	1643	0
Link Speed (mph)		30	45		30	
Link Distance (ft)		623	296		216	
Travel Time (s)		14.2	4.5		4.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	831	581	0	27	0
Sign Control		Free	Free		Stop	

#### Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	69.1%
ICU Level of Service	C
Analysis Period (min)	15

HCM 6th TWSC  
 2: Clintonville Road & Site Driveway

12/10/2020

Intersection						
Int Delay, s/veh	0.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	25	740	530	5	5	20
Future Vol, veh/h	25	740	530	5	5	20
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	27	804	576	5	5	22

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	581	0	-	0	1437 579
Stage 1	-	-	-	-	579 -
Stage 2	-	-	-	-	858 -
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	993	-	-	-	147 515
Stage 1	-	-	-	-	560 -
Stage 2	-	-	-	-	415 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	993	-	-	-	140 515
Mov Cap-2 Maneuver	-	-	-	-	140 -
Stage 1	-	-	-	-	533 -
Stage 2	-	-	-	-	415 -

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	993	-	-	-	335
HCM Lane V/C Ratio	0.027	-	-	-	0.081
HCM Control Delay (s)	8.7	0	-	-	16.7
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3