

Ref: 9090

October 24, 2022

Mr. Anthony J. Bucchere, Chair
Zoning Board of Appeals
Town of Scituate
600 Chief Justice Cushing Highway
Scituate, MA 02066

Attn: Ms. Janine M. Cicchese

Re: Response to Traffic Peer Review
The Cottages at Old Oaken Bucket - 279-281 Old Oaken Bucket Road
Scituate, Massachusetts

Dear Ms. Cicchese:

Vanasse & Associates, Inc. (VAI) is providing responses to the comments that were raised in the August 15, 2022 *Traffic Peer Review* letter prepared by Ron Müller & Associates (RMA) in reference to their review of the June 2022 *Transportation Impact Assessment* (the “June 2022 TIA”) prepared by VAI in support of The Cottages at Old Oaken Bucket to be located at 279-281 Old Oaken Bucket Road in Scituate, Massachusetts (hereafter referred to as the “Project”). In addition, revised trip-generation calculations and supporting analyses have been prepared in order to update the Build condition assessment that was presented in the June 2022 TIA to reflect refinements to the development program that have occurred since the preparation of that document. Specifically, the development program has been revised to include 24 single-family cottages vs. the mixed 32 unit single-family/duplex cottage development.

Listed below are the comments that were identified by RMA in the subject letter pertaining to the June 2022 TIA followed by our response on behalf of the Applicant.

General Comment

Comment 1: *There is a discrepancy between the various site plans submitted that requires clarification. There is site plan set dated February 7, 2022 that shows a different unit mix and access configuration than the June 6, 2022 Preliminary Plan on which the traffic study was based. The February 7, 2022 plan shows 26 duplex units in 13 buildings and 5 single family homes in addition to an existing house on the site. Most of the units are shown to be accessed via the same driveway as on the June 6, 2022 plan with the exception of one duplex building and the existing home that have direct access from Old Oaken Bucket Road. It is unclear which site plan is proposed, but for the purpose of this review, the June 6, 2022 site plan was assumed to be the correct one as it matches the description in the traffic study.*

Response: The development program for the Project has been revised and now includes 24 single-family detached cottages that will be accessed from a full-access driveway that will intersect the south side of Old Oaken Bucket Road at the approximate location of the

existing driveway that serves 279 Old Oaken Bucket Road. The revised Conceptual Plan is attached.

Existing Conditions

Comment 2: *The traffic study focused on the following intersections:*

- *Old Oaken Bucket Road at Maple Street & Winter Street*
- *Old Oaken Bucket Road at Route 123*

Based on the site location, expected use, and area roadway network, the study locations are appropriate for analysis.

Response: No response required.

Comment 3: *The study provided a description of the area roadway network. Manual traffic counts were performed in November 2021 during the weekday AM and PM peak periods at the study area intersections. Automatic Traffic Recorder counts were also conducted on Old Oaken Bucket Road in November 2021. RMA concurs with the selected time periods used for analysis.*

Response: No response required.

Comment 4: *Based on available 2019 MassDOT permanent count station data at Station 7318 located on Route 3 in Hingham, November volumes are approximately 2.9 percent lower than annual average-month conditions and therefore the existing volumes were upwardly adjusted by 2.9 percent. RMA concurs with these findings.*

Response: No response required.

Comment 5: *Given the current traffic conditions associated with the coronavirus pandemic, the study reviewed historic traffic data to determine if the traffic data needed to be adjusted to represent normal, pre-COVID traffic conditions. Permanent count station data at Station 6255 from November 2018 was adjusted to the year 2019 by applying the traffic growth procedure detailed in the April 2020 “Guidance on Traffic Counting Data” published by MassDOT in order to allow for a comparison between the projected November 2019 data to the November 2021 traffic volumes that were collected at the same location. Based on this comparison, the collected traffic volume data were found to be within the range of daily and seasonal traffic volume conditions that existed prior to the pandemic. As such no adjustment was made to the traffic volumes. RMA concurs with these findings.*

Response: No response required.

Comment 6: *Accident data were reviewed and summarized within the traffic study. The intersections of Old Oaken Bucket Road at Maple Street / Winter Street and Old Oaken Bucket Road at Route 123 experienced a crash rate higher than both the statewide and district wide averages indicating that safety issues may exist. Furthermore, the Scituate rotary has experienced 18 crashes over the five-year period averaging 3.6 crashes per year. A Road Safety Audit (RSA) was conducted at the rotary in December 2021. The RSA provided suggestions for improvements to enhance safety. The proponent has committed to*



performing RSAs at the intersections of Old Oaken Bucket Road at Maple Street/Winter Street and Old Oaken Bucket Road at Route 123 to determine short- and long-term improvements to improve safety. RMA suggests that the town include a condition of approval that these RSAs be completed and submitted to the town prior to issuance of a Certificate of Occupancy.

Response: Subsequent to the preparation of the June 2022 TIA, the Applicant retained Toole Design to conduct a Road Safety Audit (RSA) for the Old Oaken Bucket Road/Maple Street/Winter Street and Old Oaken Bucket Road/Route 123 intersections. After discussions with MassDOT and the Town, the Old Oaken Bucket Road/Route 123 intersection was removed from the RSA locations as this intersection was included in the RSA that was performed for the Scituate Rotary (Chief Justice Cushing Highway (Route 3A) at Route 123, New Driftway and County Road),¹ and it was MassDOT's opinion that the frequency of crashes occurring Old Oaken Bucket Road/Maple Street/Winter Street did not warrant conducting an RSA, and it was suggested to the Town by MassDOT that VAI provide suggested improvement measures that could be implemented at the intersection to improve safety. The Town concurred with this suggestion and, as such, VAI has reviewed existing conditions at the Old Oaken Bucket Road/Maple Street/Winter Street intersection and developed a list of potential improvement measures for the intersection that are intended to enhance safety. These measures are as follows and will be designed and constructed in conjunction with the Project subject to receipt of all necessary rights, permits and approvals.

1. Replace the STOP-signs, "All Way" plaques and marked STOP-lines on all approaches to include high visibility, thermoplastic pavement markings and the addition or red reflective tape to the sign posts;
2. Relocate the STOP-signs and marked STOP-lines on the Maple Street approaches so as to be located 5-feet from the edge of the traveled-way along Old Oaken Bucket Road to define the desired stopping point and improve sight lines to and from Old Oaken Bucket Road
3. Selectively trim/remove vegetation located within the sight triangle areas on the corners of the intersection; and
4. Install/replace the "Stop Sign Ahead" warning signs (graphic symbol) on all approaches and include supplemental street name and "All Way" plaques.

Future Conditions

Comment 7: *A 7-year design horizon was used for the No-Build and Build condition analyses consistent with MassDOT's Transportation Impact Assessment Guidelines. An annual growth rate of 1.0 percent per year was used to project the future No-Build volumes. The study used two permanent count stations (Station 7318 and Station 28) to estimate annual traffic growth. The data showed that, on average, traffic volumes have grown 0.7 percent per year between 2015 and 2019. To provide a conservative assessment, a 1.0 percent annual growth rate was used. RMA concurs with these findings.*

Response: No response required.

¹Road Safety Evaluation, Scituate Rotary, Town of Scituate; VHB, Inc.; December 2021.



Comment 8: *Based on discussions between the applicant and the Town of Scituate, there are three developments that should be included in the background growth rate assumptions. Traffic associated with the following developments was included:*

- *Greenbush Mixed Use Development on New Driftway*
- *Mixed Use-Development at 48-52 New Driftway*
- *Residential Development at 7 New Driftway*

Given the proximity of the site to Norwell, it is recommended that the applicant also contact that town to see if any developments there would have an impact on traffic volumes within the study area.

Response: The Director of Planning and Community Development for the Town of Norwell was contacted in order to determine if there were any planned future developments by others within the Town that would result in an increase in traffic volumes that would exceed the background traffic growth rate. Based on this discussion, no projects were identified for inclusion in the future condition traffic volumes.

Comment 9: *The applicant also reviewed if there were any roadway improvements proposed within the study area that would have an impact on traffic operations. Based on discussions with the town there are no proposed roadway improvements in the study area.*

Response: No response required.

Comment 10: *Based on the site plan there will be 32 residential units on site consisting of 11 attached duplexes (22 units) and 10 single family detached homes. The anticipated trip generation of the duplex units was appropriately estimated using the Institute of Transportation Engineers (ITE) Trip Generation Manual for Single Family Attached Housing (Land Use Code 215) and Single Family Detached Housing (Land Use Code 210).*

Response: As described previously, the development program for the Project has been revised and now includes the construction of 24 detached single-family cottages. In order to develop the traffic characteristics for the revised development program, ITE Land Use Code (LUC) 210, *Single-Family Detached Housing*, was used. Table 5R summarizes the traffic characteristics of the revised development program for the Project and compares the resulting traffic volumes to those of the development program that was assessed in the June 2022 TIA.



Table 5R
TRIP-GENERATION SUMMARY AND COMPARISON

Time Period/Direction	Revised Development Program	June 2022 TIA Development Program			(D = B+C) Total Trips	(E = A-D) Difference
	(A) Single-Family Detached Housing ^a	(B) Single-Family Detached Housing ^b	(C) Single-Family Attached Housing ^c			
<i>Average Weekday Daily:</i>						
Entering	136	61	59	120	+16	
<u>Exiting</u>	<u>136</u>	<u>61</u>	<u>59</u>	<u>120</u>	<u>+16</u>	
Total	272	122	118	240	+32	
<i>Weekday Morning Peak Hour:</i>						
Entering	5	2	2	4	+1	
<u>Exiting</u>	<u>15</u>	<u>7</u>	<u>4</u>	<u>11</u>	<u>+4</u>	
Total	20	9	6	15	+5	
<i>Weekday Evening Peak Hour:</i>						
Entering	16	7	5	12	+4	
<u>Exiting</u>	<u>10</u>	<u>4</u>	<u>4</u>	<u>8</u>	<u>+2</u>	
Total	26	11	9	20	+6	

^aBased on ITE LUC 210, *Single-Family Detached Housing (24 Dwellings)*.

^bBased on ITE LUC 210, *Single-Family Detached Housing (10 Dwellings)*.

^cBased on ITE LUC 215, *Single-Family Attached Housing (22 Dwellings)*.

As can be seen in Table 5, the revised development program (24 single-family detached cottages) is expected to generate 272 vehicle trips on an average weekday (two-way, 24-hour volume, or 136 vehicles entering and 136 exiting), with 20 vehicle trips (5 vehicles entering and 15 exiting) expected during the weekday morning peak-hour and 26 vehicle trips (16 vehicles entering and 10 exiting) expected during the weekday evening peak-hour.

In comparison to the development program that was assessed in the June 2022 TIA, the revised development program is expected to generate 32 *additional* trips on an average weekday, with 5 *additional* trips expected during the weekday morning peak-hour and 6 *additional* trips expected during the weekday evening peak-hour.

Figure 6R presents the revised Project-generated peak-hour trip assignment, with Figure 7R depicting the revised 2029 Build weekday morning and evening peak-hour traffic volumes.

Comment 11: *The traffic study describes that the trip distribution methodology was based on Journey-to-Work data obtained from the U.S. Census for persons residing in the Town of Scituate and then refined based on existing travel patterns in the study area. Based on these data, the study assumes 15 percent of the new site traffic will be to/from the west on Old Oaken*



Bucket Road, 16 percent will be to/from the northwest on Maple Street, 6 percent to/from the southwest on Winter Street, 27 percent to/from the southeast on Cornett Stetson Road and 36 percent to/from the northeast on Cornett Stetson Road. The distribution of new site trips appears reasonable.

Response: No response required.

Traffic Operation Analysis

Comment 12: *The unsignalized capacity analyses tables do not include the volume-to-capacity (v/c) ratio for each movement. It is recommended that these tables be updated to show the v/c ratio as this measure of effectiveness can be helpful in determining the project's impacts in particular with movements that are approaching capacity.*

Response: Table 8R has been expanded to include the requested information and to include the revised traffic operations analyses for the 2029 Building condition to reflect the revised development program for the Project. The detailed analysis results for the revised 2029 Build condition are attached.

A comparison of the results that were presented in Table 8 of the June 2022 TIA to those presented in Table 8R indicates that the minor increase in peak-hour trips that are associated with the revised development program (5 to 6 additional trips during the peak hours) did not result in a change in levels of service or in vehicle queuing for any movement at the study area intersections over No-Build conditions, consistent with the findings of the June 2022 TIA. In addition, all movements at the Project site driveway intersection with Old Oaken Bucket Road were shown to continue to operate at LOS A during both peak hours with negligible vehicle queuing.

Comment 13: *The intersection analyses were performed using the Highway Capacity Manual (HCM) 2010 methodology. Although there is a newer version available (HCM 6th methodology), it is unlikely to yield significantly different results or change the conclusions of the study.*

Response: No response required.

Sight Distance Evaluation

Comment 14: *Available sight distances from the proposed site driveway were measured and compared with minimum requirements as established by the American Association of State Highway and Transportation Officials (AASHTO) assuming a travel speed on Old Oaken Bucket Road of 40 mph. Based on the speed data, these minimum requirements should be based on an 85th percentile speed of 38 mph traveling eastbound and westbound, however use of a higher speed of 40 mph results in a more conservative assessment. Based on a speed of 40 mph, the minimum required sight distance would be 305 feet in both directions. Table 11 in the study shows that the minimum required distances can be exceeded assuming trimming or removal of trees and vegetation located within the sight triangle areas of the site driveway. The existing embankment to the east of the project site driveway should be regraded in order to provide the required line of sight. A field investigation of the proposed site driveway confirms this information and concurs that vegetation will need to be removed along the south side of Old Oaken Way within the sight triangles and the embankment east of the site driveway will need to be regraded. It is*



recommended that a sight line plan and profile be developed to specifically identify the areas of regrading and vegetation removal necessary to ensure that adequate sight distance will exist.

Response: The Project proponent is in the process of obtaining detailed ground survey for Old Oaken Bucket Road approaching the Project site driveway in to allow for the preparation of the requested sight distance plan. This plan will be provided under separate cover once the survey data is received.

Recommendations

Comment 15: *A number of onsite recommendations were made in the report pertaining to site access and circulation. It is recommended in the report that the driveway be 24 feet in width and operate under STOP control. All residential driveways should be a minimum of 21 feet long measured between the garage door and the edge of the sidewalk closest to the residential units, or 23 feet to the edge of the travel way at locations without a sidewalk. All crosswalks proposed on site should include ADA compliant wheelchair ramps and any signage and pavement markings be installed per MUTCD guidelines. It was further suggested that any signs or landscaping near the site driveway be placed outside of sight triangles and that any snow accumulation within these sight lines be removed. Existing trees and vegetation located along the south side of Old Oaken Bucket Road should also be removed or trimmed within the sight triangles. The existing embankment to the east of the project site driveway should be regraded in order to provide the required line of sight. RMA concurs with these recommendations.*

Response: No response required.

Comment 16. *Independent of the Project, the Old Oaken Bucket Road and Maple Street at Winter Street and Route 123at Old Oaken Bucket Road intersections were identified to have motor vehicle crash histories that warrant further review and advancement of specific improvements to enhance safety. As part of the project the proponent has committed to facilitate the completion of a Road Safety Audit (RSA) at these intersections which is intended to identify improvement strategies to increase safety. The proponent has also agreed to provide a financial contribution (fair-share contribution) to the town for the design and construction of the short-term improvements suggested as part of the RSA. As noted in Comment 5, it is recommended that the town include a condition of approval that these RSAs be completed and submitted to the town prior to issuance of a Certificate of Occupancy. It is further recommended that the town determine what a “fair-share” contribution for these improvements should be. One way to establish a fair share contribution is to calculate the percentage increase in volume-to-capacity ratio of the critical movements at the intersections and apply that percentage to the estimated cost of design and construction of the improvements.*

Response: See response to Comment 5.

Site Plan Review

Comment 17: *The site plan proposes one full access driveway to the site on the south side of Old Oaken Bucket Road. The site plan does not show any interior signing, striping, or dimensions. It is recommended that the applicant include a signing and striping plan of the interior of*



the site. A sidewalk is proposed along both sides of the driveway providing pedestrian connections to all buildings. It is recommended that a stop line and STOP sign (R1-1) be placed on the driveway exit to Old Oaken Bucket Road and that traffic control be established at the internal intersections.

Response: The Site Plans will be revised accordingly to include the requested signs and pavement markings, and will be submitted under separate cover.

Comment 18: *The fire department's largest vehicle should be able to traverse the site. It is recommended that the proponent coordinate with the Scituate Fire Department regarding adequate accessibility to all dwellings.*

Response: A vehicle turning analysis will be performed for a single-unit truck (SU-30) and the Scituate Fire Department design vehicle, and will be included with the revised Site Plans.

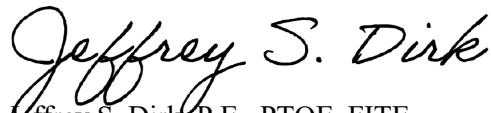
Comment 19: *The site plan should show the sight triangles at the proposed driveways to assure that any proposed landscaping or signs are outside these sight triangles and do not impede driver visibility. As discussed in Comment 13, a sight line plan and profile should be developed for the site driveway intersection with Old Oaken Bucket Road to specifically identify the areas of regrading and vegetation removal necessary to ensure that adequate sight distance will exist.*

Response: The sight triangle areas will be added to the Site Plans and a profile of the sight line for motorists exiting the Project site driveway will be developed to define the areas of vegetation removal and regrading. These plans will be included with the revised Site Plans.

We trust that this information is responsive to the comments that were raised in the August 15, 2022 *Traffic Peer Review* letter prepared by RMA pertaining to the June 2022 TIA. 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.



Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner

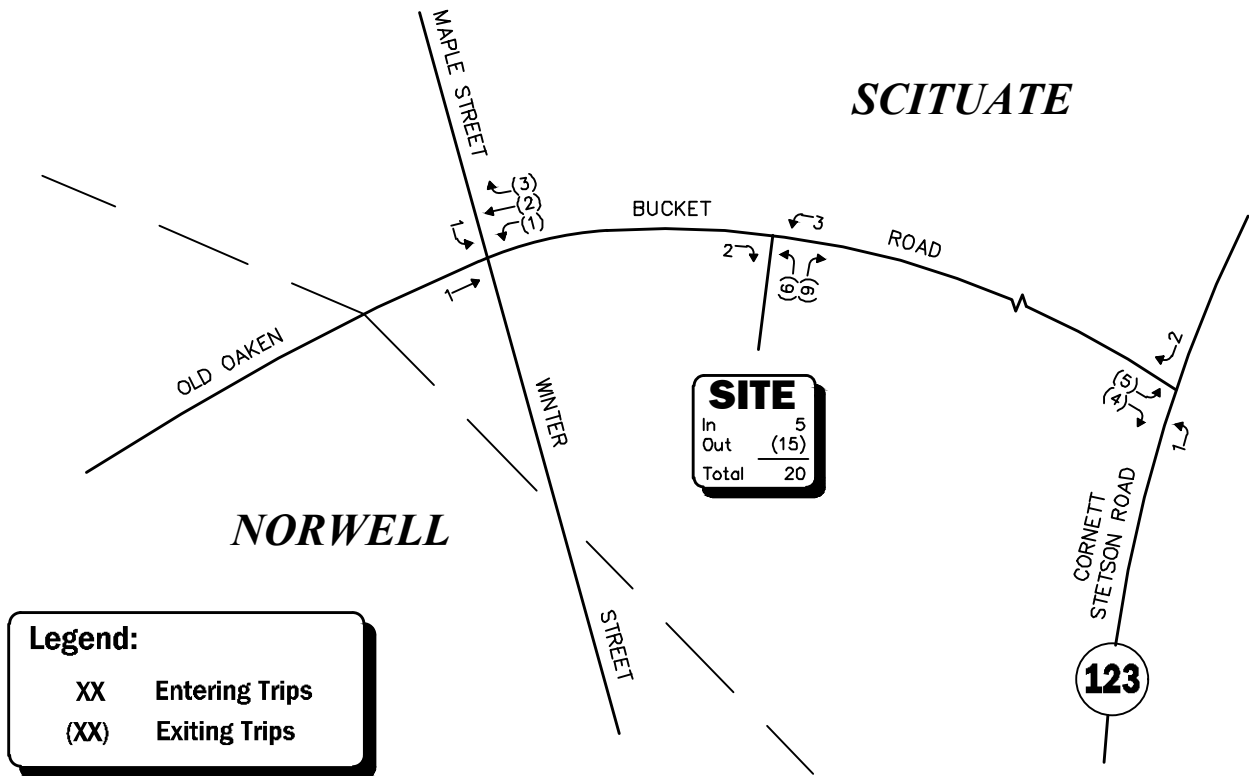
Professional Engineer in CT, MA, ME, NH, RI, and VA

JSD/dl

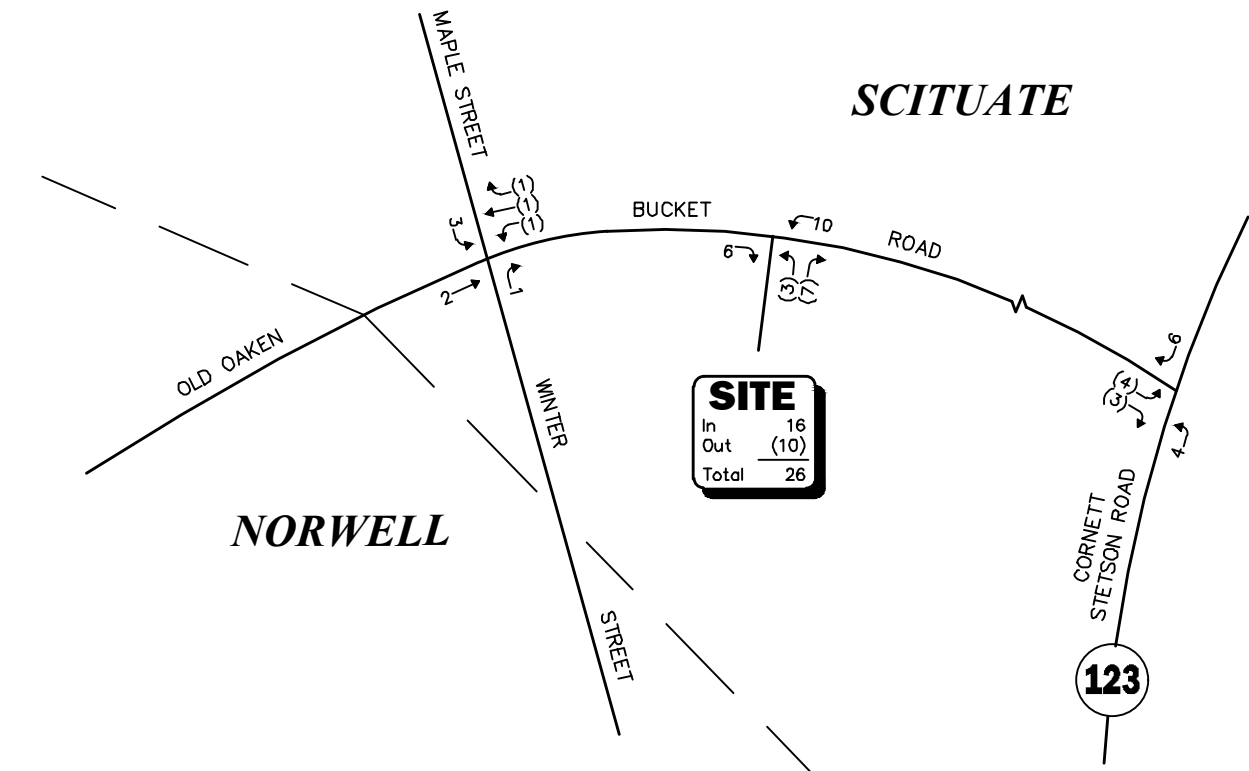
Attachments



WEEKDAY MORNING PEAK HOUR (8:00 - 9:00 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)



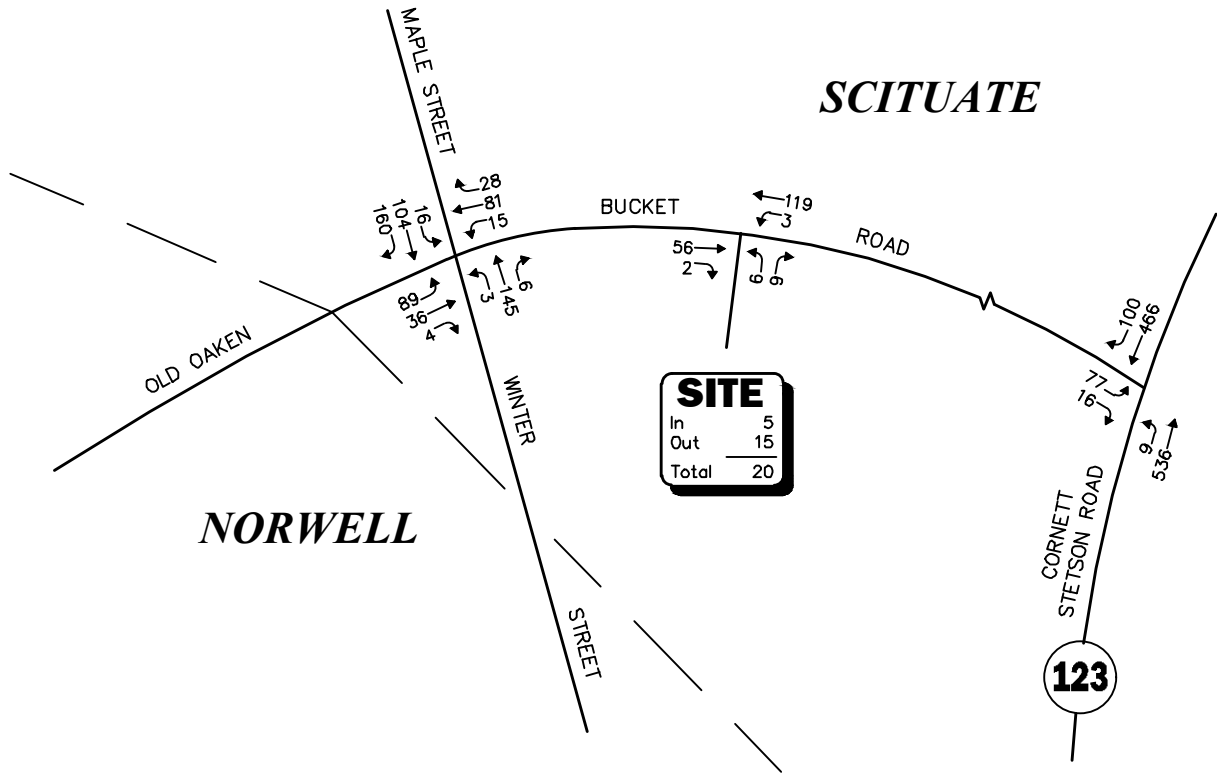
Not To Scale Figure 6R



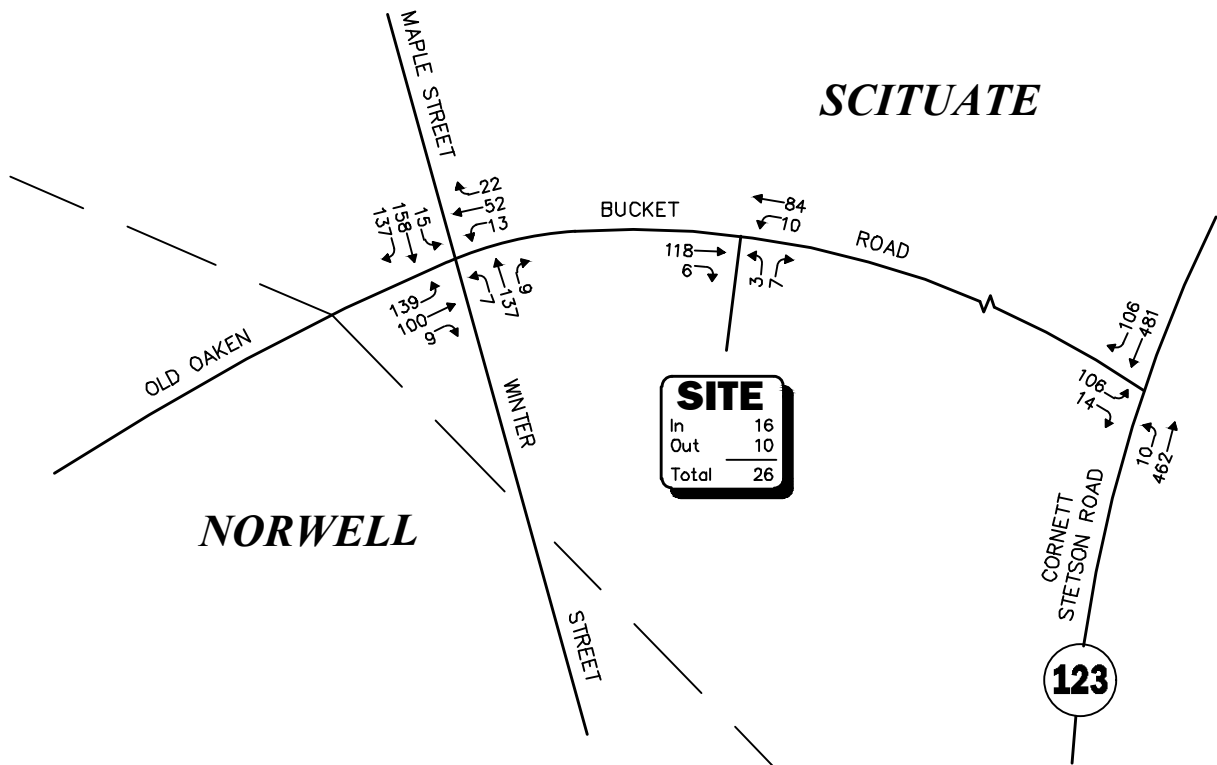
Project-Generated Peak-Hour Traffic Volumes

R:\9090\9090NT1.dwg, 10/24/2022 2:56:50 PM

WEEKDAY MORNING PEAK HOUR (8:00 - 9:00 AM)



WEEKDAY EVENING PEAK HOUR (4:00 - 5:00 PM)



Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.
 Not To Scale

Figure 7R



2029 Build
 Peak-Hour Traffic Volumes

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Table 8R
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak Hour/Movement	2021 Existing					2029 No-Build					2029 Build				
	Demand ^a	V/C ^b	Delay ^c	LOS ^d	Queue ^e 95 th	Demand	V/C	Delay	LOS	Queue ^e 95 th	Demand	V/C	Delay	LOS	Queue ^e 95 th
Old Oaken Bucket Road/Maple Street/Winter Street															
<i>Weekday Morning:</i>															
Old Oaken Bucket Road EB LT/TH/RT	117	0.18	9.5	A	1	128	0.21	10.0	A	1	129	0.21	10.0	A	1
Old Oaken Bucket Road WB LT/TH/RT	107	0.19	9.3	A	1	118	0.22	9.8	A	1	124	0.23	9.9	A	1
Winter Street NB LT/TH/RT	142	0.23	9.4	A	1	154	0.26	9.9	A	1	154	0.26	10.0	A	1
Maple Street SB LT/TH/RT	256	0.37	10.5	B	2	279	0.41	11.4	B	2	280	0.42	11.5	B	2
<i>Weekday Evening:</i>															
Old Oaken Bucket Road EB LT/TH/RT	227	0.40	12.2	B	2	246	0.45	13.3	B	3	248	0.46	13.4	B	3
Old Oaken Bucket Road WB LT/TH/RT	76	0.17	9.9	A	1	84	0.20	10.4	B	1	87	0.21	10.5	B	1
Winter Street NB LT/TH/RT	140	0.26	10.7	B	1	152	0.29	11.4	B	1	153	0.29	11.5	B	1
Maple Street SB LT/TH/RT	282	0.45	12.1	B	3	307	0.51	13.4	B	3	310	0.52	13.7	B	3
Route 123/Old Oaken Bucket Road															
<i>Weekday Morning:</i>															
Old Oaken Bucket Road EB LT/RT	74	0.37	26.6	D	2	84	0.51	36.9	E	3	93	0.55	39.3	E	3
Route 123 NB LT/TH	487	0.01	0.1	A	0	544	0.01	0.1	A	0	545	0.01	0.1	A	0
Route 123 SB TH/RT	502	0.00	0.0	A	0	564	0.00	0.0	A	0	566	0.00	0.0	A	0
<i>Weekday Evening:</i>															
Old Oaken Bucket Road EB LT/RT	102	0.46	30.5	D	2	113	0.60	43.9	E	4	120	0.64	48.3	E	4
Route 123 NB LT/TH	421	0.01	0.1	A	0	468	0.01	0.1	A	0	472	0.01	0.2	A	0
Route 123 SB TH/RT	525	0.00	0.0	A	0	581	0.00	0.0	A	0	587	0.00	0.0	A	0
Old Oaken Bucket Road/Project Driveway															
<i>Weekday Morning:</i>															
Old Oaken Bucket Road EB TH/RT	--	--	--	--	--	--	--	--	--	--	58	0.00	0.0	A	0
Old Oaken Bucket Road WB LT/TH	--	--	--	--	--	--	--	--	--	--	122	0.00	0.2	A	0
Project Driveway NB LT/RT	--	--	--	--	--	--	--	--	--	--	15	0.02	9.1	A	0
<i>Weekday Evening:</i>															
Old Oaken Bucket Road EB TH/RT	--	--	--	--	--	--	--	--	--	--	124	0.00	0.0	A	0
Old Oaken Bucket Road WB LT/TH	--	--	--	--	--	--	--	--	--	--	94	0.01	0.6	A	0
Project Driveway NB LT/RT	--	--	--	--	--	--	--	--	--	--	10	0.01	9.4	A	0

^aDemand in vehicles per hour.

^bVolume-to-capacity ratio.

^cAverage control delay per vehicle (in seconds).

^dLevel of service.

^eQueue length in vehicles.

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

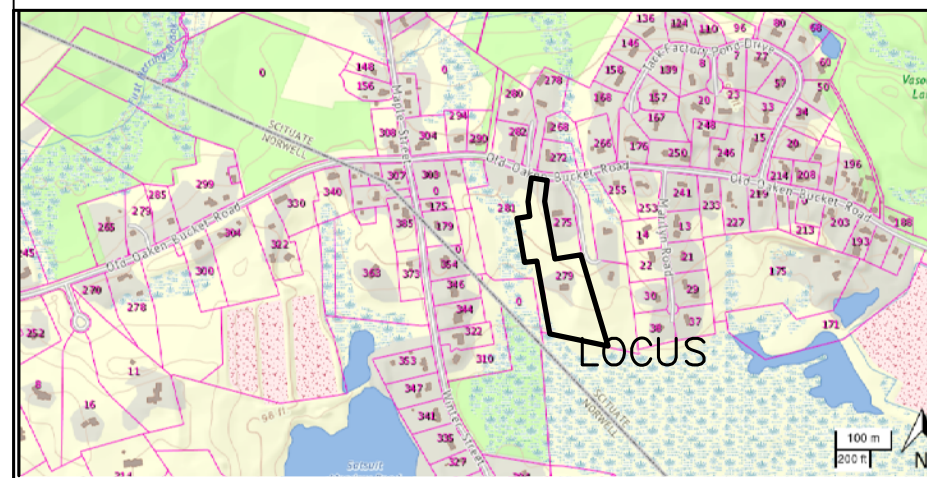
ATTACHMENTS

PROJECT SITE PLAN
TRIP-GENERATION CALCULATIONS
CAPACITY ANALYSIS WORKSHEETS

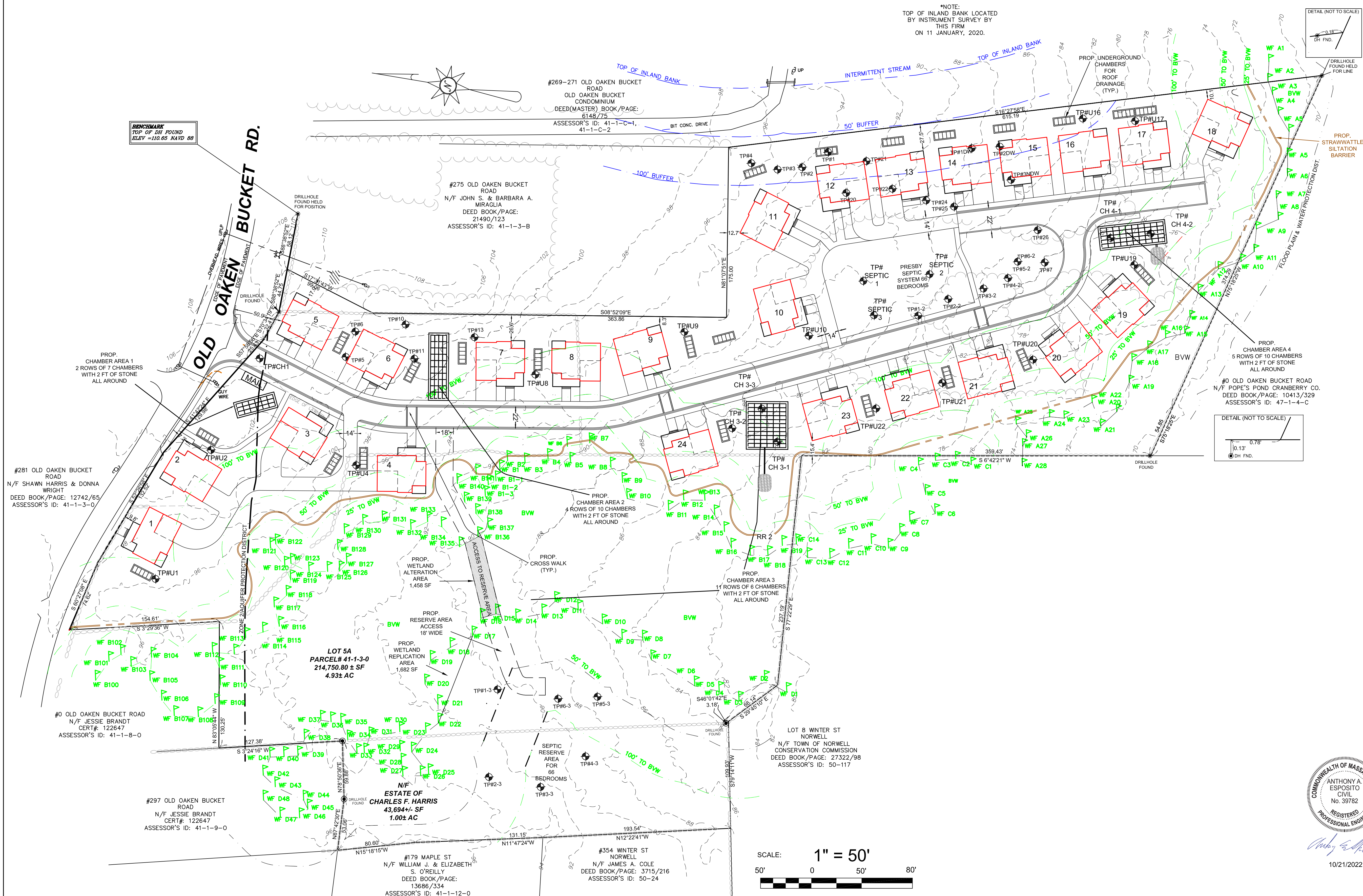


PROJECT SITE PLAN





LOCUS MAP
NOT TO SCALE



REVISIONS:

No.	DESCRIPTION	DATE

PROJECT TITLE:

**THE COTTAGES
AT
OLD OAKEN BUCKET
AT
#279-281 OLD OAKEN
BUCKET ROAD
SCITUATE, MA**

**LILY COTTAGE 2
CONCEPT
PLAN**

PARCEL 41-1-3-D
PARCEL 41-1-3-O

PREPARED BY:
**South
Shore
Survey
Consultants, Inc.**
REGISTERED LAND SURVEYORS
& CIVIL ENGINEERS
167 R SUMMER STREET
KINGSTON, MA 02364
781-582-2185
mark@ssscinc.net

PREPARED FOR:
THE LOVENDALE COMPANY, LLC
114 ONION HILL ROAD
DUXBURY, MA 02332

SCALE: **1" = 50'**
50' 0 50' 80'

DATE: OCTOBER 21, 2022
COMP./DESIGN: A. ESPOSITO
CHECK: M. D. CASEY
DRAWN: A. ESPOSITO
FIELD: LILIPS
APPROVED: M. D. CASEY
DWG.No. 1908 G&D
JOB No. 1908



10/21/2022

TRIP-GENERATION CALCULATIONS



Graph Look Up



ITETripGen Web-based App

Graph Look Up

How to Use ITETripGen

TGM Desk Reference

TGM Appendices

Support Documents

Add Users

Comments

Add-ons to do more

Try OTISS Pro

Query Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
210

LAND USE GROUP:
(200-299) Residential

LAND USE:
210 - Single-Family Detached Housing

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

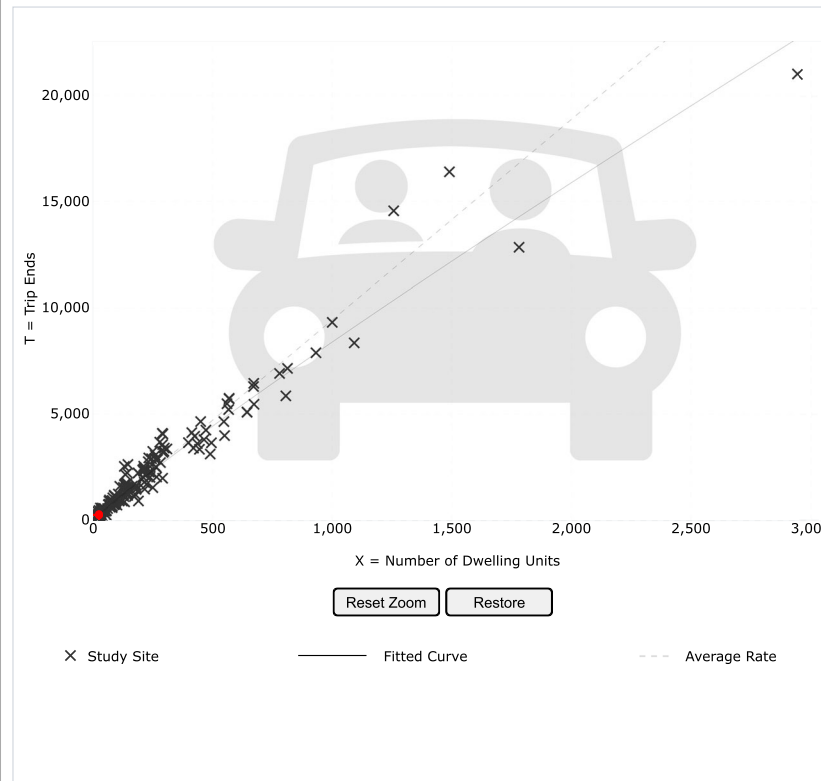
INDEPENDENT VARIABLE (IV):
Dwelling Units

TIME PERIOD:
Weekday

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
24 Calculate

Data Plot and Equation



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:	Single-Family Detached Housing (210) Click for Description and Data Plots
Independent Variable:	Dwelling Units
Time Period:	Weekday
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	174
Avg. Num. of Dwelling Units:	246
Average Rate:	9.43
Range of Rates:	4.45 - 22.61
Standard Deviation:	2.13
Fitted Curve Equation:	$\ln(T) = 0.92 \ln(X) + 2.68$
R²:	0.95
Directional Distribution:	50% entering, 50% exiting
Calculated Trip Ends:	Average Rate: 226 (Total), 113 (Entry), 113 (Exit) Fitted Curve: 271 (Total), 135 (Entry), 136 (Exit)

Graph Look Up



ITETripGen Web-based App

Graph Look Up

How to Use ITETripGen

TGM Desk Reference

TGM Appendices

Support Documents

Add Users

Comments

Add-ons to do more

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Query Filter

DATA SOURCE:

Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:

210

LAND USE GROUP:

(200-299) Residential

LAND USE :

210 - Single-Family Detached Housing

LAND USE SUBCATEGORY:

All Sites

SETTING/LOCATION:

General Urban/Suburban

INDEPENDENT VARIABLE (IV):

Dwelling Units

TIME PERIOD:

Weekday, Peak Hour of Adjacent Street Traffic

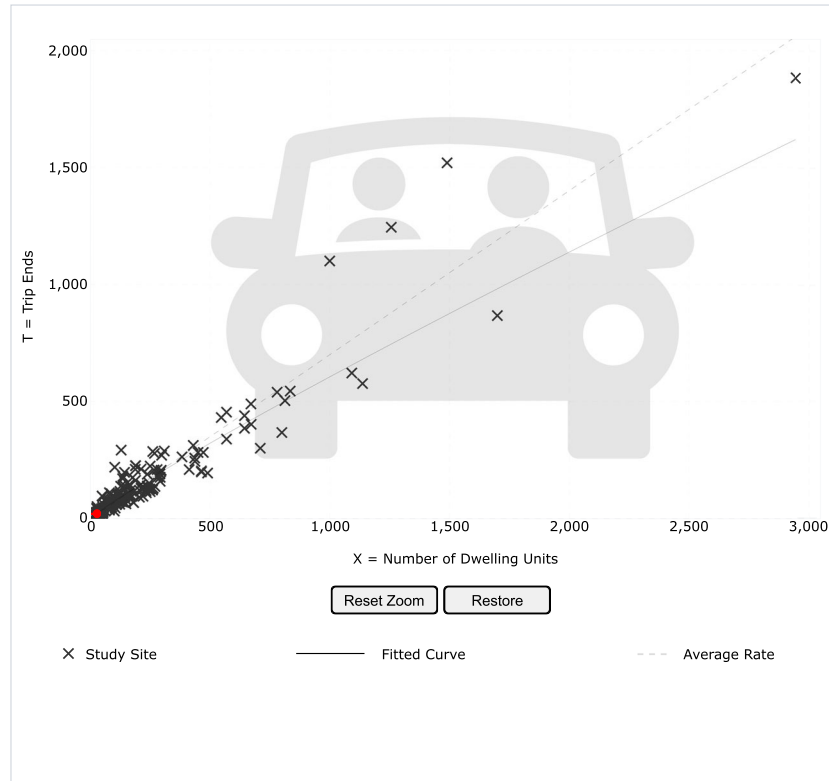
TRIP TYPE:

Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:

24 Calculate

Data Plot and Equation



DATA STATISTICS

Land Use:	Single-Family Detached Housing (210) Click for Description and Data Plots
Independent Variable:	Dwelling Units
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 7 and 9 a.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	192
Avg. Num. of Dwelling Units:	226
Average Rate:	0.70
Range of Rates:	0.27 - 2.27
Standard Deviation:	0.24
Fitted Curve Equation:	$\ln(T) = 0.91 \ln(X) + 0.12$
R²:	0.90
Directional Distribution:	26% entering, 74% exiting
Calculated Trip Ends:	Average Rate: 17 (Total), 4 (Entry), 13 (Exit) Fitted Curve: 20 (Total), 5 (Entry), 15 (Exit)

Graph Look Up



ITETripGen Web-based App

Graph Look Up

How to Use ITETripGen

TGM Desk Reference

TGM Appendices

Support Documents

Add Users

Comments

Add-ons to do more

Try OTISS Pro

Query Filter

DATA SOURCE:

Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:

210

LAND USE GROUP:

(200-299) Residential

LAND USE :

210 - Single-Family Detached Housing

LAND USE SUBCATEGORY:

All Sites

SETTING/LOCATION:

General Urban/Suburban

INDEPENDENT VARIABLE (IV):

Dwelling Units

TIME PERIOD:

Weekday, Peak Hour of Adjacent Street Traffic

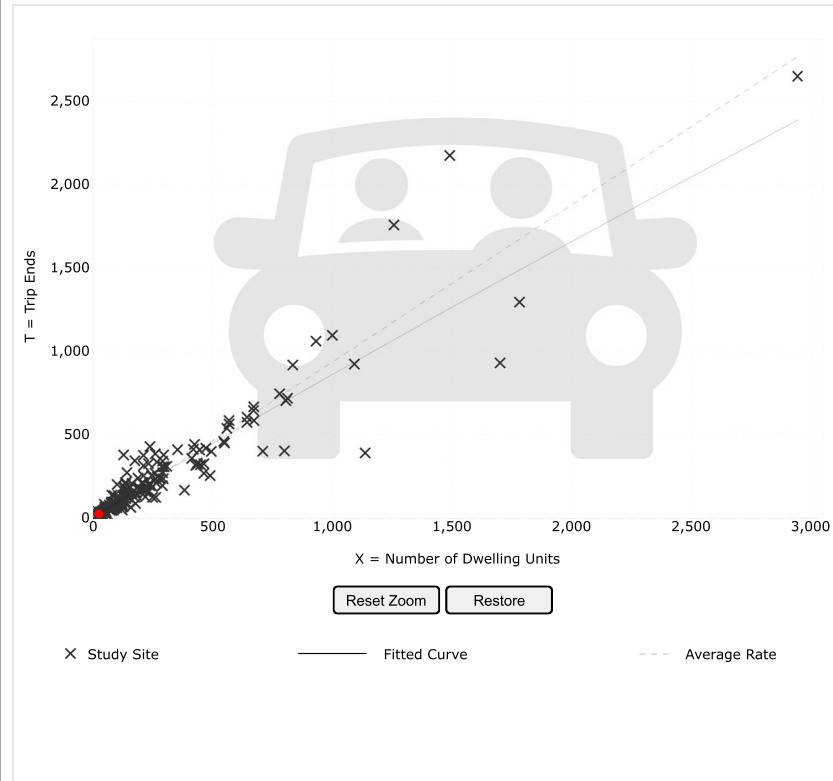
TRIP TYPE:

Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:

24 Calculate

Data Plot and Equation



DATA STATISTICS

Land Use:	Single-Family Detached Housing (210) Click for Description and Data Plots
Independent Variable:	Dwelling Units
Time Period:	Weekday Peak Hour of Adjacent Street Traffic One Hour Between 4 and 6 p.m.
Setting/Location:	General Urban/Suburban
Trip Type:	Vehicle
Number of Studies:	208
Avg. Num. of Dwelling Units:	248
Average Rate:	0.94
Range of Rates:	0.35 - 2.98
Standard Deviation:	0.31
Fitted Curve Equation:	$\ln(T) = 0.94 \ln(X) + 0.27$
R²:	0.92
Directional Distribution:	63% entering, 37% exiting
Calculated Trip Ends:	Average Rate: 23 (Total), 14 (Entry), 9 (Exit) Fitted Curve: 26 (Total), 16 (Entry), 10 (Exit)

CAPACITY ANALYSIS WORKSHEETS

Old Oaken Bucket Road at Maple Street and Winter Street
Route 123 at Old Oaken Bucket Road
Old Oaken Bucket Road at the Project Site Driveway



Old Oaken Bucket Road at Maple Street and Winter Street



2029 Build Weekday Morning
 1: Winter Street/Maple Street & Old Oaken Bucket Road

10/24/2022

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	89	36	4	15	81	28	3	145	6	16	104	160
Future Vol, veh/h	89	36	4	15	81	28	3	145	6	16	104	160
Peak Hour Factor	0.95	0.95	0.95	0.78	0.78	0.78	0.84	0.84	0.84	0.92	0.92	0.92
Heavy Vehicles, %	0	0	25	0	0	5	0	0	0	17	1	0
Mvmt Flow	94	38	4	19	104	36	4	173	7	17	113	174
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10	9.9	10	11.5
HCM LOS	A	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	69%	12%	6%
Vol Thru, %	94%	28%	65%	37%
Vol Right, %	4%	3%	23%	57%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	154	129	124	280
LT Vol	3	89	15	16
Through Vol	145	36	81	104
RT Vol	6	4	28	160
Lane Flow Rate	183	136	159	304
Geometry Grp	1	1	1	1
Degree of Util (X)	0.261	0.209	0.233	0.42
Departure Headway (Hd)	5.132	5.533	5.27	4.97
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	700	649	680	727
Service Time	3.163	3.568	3.304	2.97
HCM Lane V/C Ratio	0.261	0.21	0.234	0.418
HCM Control Delay	10	10	9.9	11.5
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	1	0.8	0.9	2.1

2029 Build Weekday Evening
 1: Winter Street/Maple Street & Old Oaken Bucket Road

10/24/2022

Intersection	
Intersection Delay, s/veh	12.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	139	100	9	13	52	22	7	137	9	15	158	137
Future Vol, veh/h	139	100	9	13	52	22	7	137	9	15	158	137
Peak Hour Factor	0.86	0.86	0.86	0.71	0.71	0.71	0.87	0.87	0.87	0.86	0.86	0.86
Heavy Vehicles, %	0	0	0	9	2	6	17	2	0	0	2	0
Mvmt Flow	162	116	10	18	73	31	8	157	10	17	184	159
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13.4	10.5	11.5	13.7
HCM LOS	B	B	B	B




Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	5%	56%	15%	5%
Vol Thru, %	90%	40%	60%	51%
Vol Right, %	6%	4%	25%	44%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	153	248	87	310
LT Vol	7	139	13	15
Through Vol	137	100	52	158
RT Vol	9	9	22	137
Lane Flow Rate	176	288	123	360
Geometry Grp	1	1	1	1
Degree of Util (X)	0.291	0.455	0.202	0.517
Departure Headway (Hd)	5.953	5.686	5.949	5.164
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	601	632	600	696
Service Time	4.016	3.74	4.017	3.216
HCM Lane V/C Ratio	0.293	0.456	0.205	0.517
HCM Control Delay	11.5	13.4	10.5	13.7
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.2	2.4	0.7	3

Route 123 at Old Oaken Bucket Road



2029 Build Weekday Morning
2: Route 123 & Old Oaken Bucket Road

10/24/2022

Intersection						
Int Delay, s/veh	3.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	77	16	9	536	466	100
Future Vol, veh/h	77	16	9	536	466	100
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	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	75	75	88	88	89	89
Heavy Vehicles, %	0	9	0	3	2	0
Mvmt Flow	103	21	10	609	524	112

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1209	580	636	0	-	0
Stage 1	580	-	-	-	-	-
Stage 2	629	-	-	-	-	-
Critical Hdwy	6.4	6.29	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.381	2.2	-	-	-
Pot Cap-1 Maneuver	204	501	957	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	535	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	201	501	957	-	-	-
Mov Cap-2 Maneuver	201	-	-	-	-	-
Stage 1	555	-	-	-	-	-
Stage 2	535	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	39.3	0.1	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	957	-	224	-	-
HCM Lane V/C Ratio	0.011	-	0.554	-	-
HCM Control Delay (s)	8.8	0	39.3	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	3	-	-

2029 Build Weekday Evening
2: Route 123 & Old Oaken Bucket Road

10/24/2022

Intersection						
Int Delay, s/veh	4.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		
Traffic Vol, veh/h	106	14	10	462	481	106
Future Vol, veh/h	106	14	10	462	481	106
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	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	88	95	95	76	76
Heavy Vehicles, %	1	0	0	0	1	0
Mvmt Flow	120	16	11	486	633	139

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1211	703	772	0	0
Stage 1	703	-	-	-	-
Stage 2	508	-	-	-	-
Critical Hdwy	6.41	6.2	4.1	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-
Follow-up Hdwy	3.509	3.3	2.2	-	-
Pot Cap-1 Maneuver	202	441	852	-	-
Stage 1	493	-	-	-	-
Stage 2	606	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	198	441	852	-	-
Mov Cap-2 Maneuver	198	-	-	-	-
Stage 1	484	-	-	-	-
Stage 2	606	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	48.3	0.2	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	852	-	212	-	-
HCM Lane V/C Ratio	0.012	-	0.643	-	-
HCM Control Delay (s)	9.3	0	48.3	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0	-	3.8	-	-

Old Oaken Bucket Road at the Project Site Driveway



2029 Build Weekday Morning
 3: Project Driveway & Old Oaken Bucket Road

10/24/2022

Intersection						
Int Delay, s/veh	0.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	56	2	3	119	6	9
Future Vol, veh/h	56	2	3	119	6	9
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	93	92	92	78	92	92
Heavy Vehicles, %	4	2	2	1	2	2
Mvmt Flow	60	2	3	153	7	10

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	62	0	220 61
Stage 1	-	-	-	-	61 -
Stage 2	-	-	-	-	159 -
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	-	-	1541	-	768 1004
Stage 1	-	-	-	-	962 -
Stage 2	-	-	-	-	870 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1541	-	766 1004
Mov Cap-2 Maneuver	-	-	-	-	766 -
Stage 1	-	-	-	-	962 -
Stage 2	-	-	-	-	868 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	893	-	-	1541	-
HCM Lane V/C Ratio	0.018	-	-	0.002	-
HCM Control Delay (s)	9.1	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

2029 Build Weekday Evening
 3: Project Driveway & Old Oaken Bucket Road

10/24/2022

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	118	6	10	84	3	7
Future Vol, veh/h	118	6	10	84	3	7
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	86	92	92	71	92	92
Heavy Vehicles, %	0	0	2	0	2	2
Mvmt Flow	137	7	11	118	3	8

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	144	0	281
Stage 1	-	-	-	-	141
Stage 2	-	-	-	-	140
Critical Hdwy	-	-	4.12	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	-	-	2.218	-	3.518
Pot Cap-1 Maneuver	-	-	1438	-	709
Stage 1	-	-	-	-	886
Stage 2	-	-	-	-	887
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1438	-	703
Mov Cap-2 Maneuver	-	-	-	-	703
Stage 1	-	-	-	-	886
Stage 2	-	-	-	-	880

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.4
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	834	-	-	1438	-
HCM Lane V/C Ratio	0.013	-	-	0.008	-
HCM Control Delay (s)	9.4	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-