Vanasse & Associates inc
Transportation Engineers & Planners

35 New England Business Center Drive
Suite 140
Andover, MA 01810

Ref: 8688

November 22, 2021

Ms. Marzie Galazka, Director
Community and Economic Development Department
Town of Swampscott
27 Monument Avenue
Swampscott, MA 01907

Re: Response to Peer Review of Traffic Impact Assessment and Supplementary Materials
Proposed Residential Development – Elm Place
Swampscott, Massachusetts

Dear Ms. Galazka:

Vanasse & Associates, Inc. (VAI) is providing responses to the comments that were raised in the October 25, 2021 *Peer Review of Traffic Impact Assessment and Supplementary Materials* letter prepared by WorldTech Engineering (WTE) on behalf of the Town in reference to their review of the January 2021 *Transportation Impact Assessment* (the "January 2021 TIA") and the September 28, 2021 *Parking Demand Study* prepared by VAI in support of the proposed multifamily residential development to be located at 21 Elm Place in Swampscott, Massachusetts (hereafter referred to as the Project). Listed below are each of the comments identified in the subject letter followed by our response on behalf of the Applicant.

TRANSPORTATION IMPACT ACCESS STUDY REVIEW

Comment No. 1: *The TIA for the proposed development consists of the construction of 128 multi-family residential units with off-street parking for 109 vehicles or a parking ratio of 0.85 spaces per unit, which is below the parking requirements required under current zoning. Parking will be provided on-site in a surface lot and access to the Project site will be provided by way of a new driveway that will intersect the west side of Elm Place approximately 190 feet south of Essex Street. According to the parking plan provided with the TIA, 109 new parking spaces will be provided in a new surface lot and an additional 17 spaces are designated for use by the existing tumbling academy. The parking for the new residential development and the existing tumbling academy are proposed to be accessed via a single driveway off of Elm Place. It is not clear how parking for the new residential complex will be managed in relation to the parking provided for tumbling academy. The proponent has proposed a revised parking plan which will increase the parking supply from 109 spaces to 124 for residences with additional parking for visitors and employees.*

Response: A parking management plan is being developed that will differentiate the parking allocated to the Project and to the Tumbling Academy. The initial thought is that the spaces allocated to the Tumbling Academy will be defined by signs, with the parking area for the Project defined by signs at the entry points ("Parking for Elm Place Residents Only") and monitored by the issuance of stickers to Elm Place residents.

Comment No. 2: *The project is reported to generate 578 net new vehicle trips on an average weekday, 36 net new automobile trips during the morning peak hour and 36 net new automobile trips in the afternoon peak hour. Estimates for transit and bicycle/pedestrian trips are provided as well. The proponent has proposed a reduction in the number of residential units from 128 to 120. This reduction in the size of the project will result in approximately 4 peak hour trips in the morning and 5 in the afternoon on an average weekday. The traffic operations analyses contained in the TIA used the higher traffic volumes to produce a slightly conservative analysis. A reduction in single occupancy vehicle (SOV) use is assumed based on data derived obtained from the 2013-2017 American Community Survey in the TIA. The 5% peak hour transit reduction value seems reasonable given the proximity to the commuter rail service and the project's commitment to provide a pedestrian connection to the Swampscott Commuter Rail Station.*

Response: No response required.

EXISTING CONDITIONS

Study Area

Comment No. 3: *The study area in the TIA includes the following intersections:*

1. Essex Street at Burrill Street (Signalized)
2. Essex Street at Pitman Road (Stop Control)
3. Essex Street at Elm Place (2 locations-Stop Control)
4. Essex Street at Burpee Road (Signalized)

The study area used in the Elm Place Residential Development TIA should be expanded to discuss the impacts at the intersection of Essex Street at Hillcrest Circle and Essex Street at Essex Terrace.

Response: The intersections of Essex Street at Hillcrest Circle and Essex Street at Essex Terrace were added to the study area as requested and manual turning movement counts were conducted at the subject intersections on Tuesday and Wednesday, November 2nd and 3rd, 2021. The November traffic count data was seasonally adjusted to average-month conditions and incorporated into the 2020 Existing, 2028 No-Build, and 2028 Build traffic-volume conditions as depicted on Figures 3R, 4R, and 7R.

In order to assess the potential impact of the Project at the expanded study area intersections, a traffic operations analysis (motorist delays, vehicle queuing and level-of-service(LOS)) was performed under 2020 Existing, 2028 No-Build, and 2028 Build traffic-volume conditions. Table 1 summarizes the results of the traffic operations analyses for the expanded study area intersections, a description of which follows, with the detailed analysis results attached:

- *Essex Street/Hillcrest Circle* – The critical movements (all movements from Hillcrest Circle) were shown to operate at LOS B during the weekday morning peak-hour and at LOS C during the weekday evening peak-hour under all analysis conditions, with no changes in level-of-service or vehicle queuing (negligible) shown to occur as a result of the Project.

- *Essex Street/Essex Terrace* – The critical movements (all movements from Essex Terrace) were shown to operate at LOS C during the weekday morning peak-hour and at LOS A during the weekday evening peak-hour under all analysis conditions, also with no changes in level-of-service or vehicle queuing (negligible) shown to occur as a result of the Project.

The above being said, actual operating conditions and motorist delays for Hillcrest Circle and Essex Terrace are related to vehicle queuing along the Essex Street resulting from the operation of the traffic signal systems at the Essex Street/ Burrill Street and Essex Street/Burpee Lane intersections. These roadways are situated between these two signalized intersections and vehicle queues along Essex Street can extend to or beyond these roadways during specific periods of the day. The Project proponent has committed to design and implement an optimal traffic signal timing and phasing plan for the Essex Street/Burrill Street and Essex Street/Burpee Lane intersections subject to receipt of all necessary rights permits and approvals, which will serve to reduce motorist delays and vehicle queuing. To the extent so desired by the Town, the Project proponent will install "Do Not Block" signs and accompanying pavement markings on Essex Street at both intersections.

A review of motor vehicle crash data at the expanded study area intersections obtained from the Massachusetts Department of Transportation (MassDOT) for the 5-year period 2014 through 2018, inclusive, indicated that one (1) crash was reported at the Essex Street/Hillcrest Circle intersection that was classified as a rear-end type crash that resulted in property damage only, with no (0) crashes reported at the Essex Street/Essex Terrace intersection.

Trip Distribution

Comment No. 4: *The trip distribution pattern developed for the site predicts approximately 2/3 of the trips are expected to access the site from the west and the remainder to the east along Essex Street.* ***This trip distribution pattern was developed primarily on Journey to Work census data, reviewed in the TIA and found acceptable****.*

Response: No response required.

Traffic Volumes, Data Collection, and Seasonal Adjustment

Comment No. 5: *Traffic volume data was collected at the study area intersections by means of manual turning movement counts in December 2020. The study reviewed December versus average monthly volume at a nearby permanent count location (# 8087) and adjusted the study traffic counts up by 3% to represent average annual traffic in further evaluations. Based on the pre and post- COVID-19 traffic conditions, the traffic count data was increased by an additional 18.4% to account for reduced traffic volumes in 2020 due to the pandemic.*

We are in general agreement that the use of the seasonal adjustment and growth factors for the project provides a reasonable basis from which to assess the potential impacts of the Project.

Response: No response required.

Crash Data

Comment No. 6: *Motor vehicle crash data was obtained for the study area intersections from MassDOT for the 5- year period of 2013-2017. The safety analysis at the study area intersections showed an average of 1 or fewer crashes per year and crash rates well below the MassDOT Statewide and District average for similar type intersections.*

The motor vehicle crash analysis was completed in accordance with MassDOT standards, and we agree with the findings of the analysis.

Response: No response required.

FUTURE TRAFFIC CONDITIONS

General Background Growth

Comment No. 7: *A background growth rate of 1.25% per year was assumed based on a review of historic counts in the area and reported discussions with the Town of Swampscott, Community and Economic Development Department.*

The use of the 1.25% compounded growth rate is found to be reasonable for a background traffic growth rate.

Response: No response required.

Specific Development by Others

Comment No. 8: *Two other minor development projects were identified in the TIA and trips associated with the project were estimated based on proposed land uses and additional traffic applied to the No Build study area traffic volumes.*

Response: No response required.

Project-Generated Traffic

Comment No. 9: *The assumptions used to estimate weekday daily and peak hour traffic volumes were based on a combination of standard ITE[1] trip generation factors, Institute of Transportation Engineers Land Use Code (LUC) 221, Multifamily Housing (Mid-Rise), and adjustments for transit ridership based on pre-COVID census data. The estimates for transit ridership were based on information provided in the 2019 American Community Survey (ACS) for the Town of Swampscott. The data utilized in the trip generation adjustments were assumed to be more conservative than published census data to account for the unknowns in travel behavior during the current pandemic. It has been acknowledged that these trip generation rates used in the TIA are based on [128] units of residential development. The reduction in the size of the project, after the completion of the TIA, would result in a minor reduction in the number of new trips assigned to the study area intersections.*

[1]Trip Generation, 10th Edition; Institute of Transportation Engineers; Washington, DC; 2017.

The TIA utilizes a reasonable approach to establishing trip generation rate for the proposed project.

Response: No response required.

Trip Distribution and Assignment

Comment No. 10: *Traffic volumes associated with the project were assigned to the study area roadways based on a review of the Journey-to-Work data.*

We find the Trip Distribution reasonable based on our familiarity with the local roadway network.

Response: No response required.

Sight Distance

Comment No. 11: *Table 11 from the TIA presents the sight distance information for the intersection of Essex Street at Elm Place and the Project Site Driveway at Elm Place. Stopping Sight Distance (SSD) calculations were provided for a vehicle traveling on Essex Place to see a vehicle exiting the site driveway, to perceive a problem and react accordingly. Intersection sight distance (ISD) calculations were also provided which represents drivers looking for available gaps to safely exit the intersection or driveway.*

The TIA concludes that if the measured ISD is at least equal to the required SSD values, then the intersection can operate in a safe manner. However, this may require a vehicle traveling on Essex Street to slow or stop to accommodate the vehicle pulling out of Elm Place. The site drive is shown to meet SSD and ISD for vehicles turning left onto Elm Place. The location of the parked cars and the snow storage areas just north of the site drive have the potential to block the sight distance for drivers exiting the site to turn left onto Elm Place.

Recommendations should be provided to improve the sight distance for drivers on Elm Place to enter Essex Street to meet ISD requirements or provide additional warning measures to warn drivers on Essex Street. At the Site Drive intersection with Elm Place, review the parking layout along Elm Place to make sure that ISD sight triangles can be maintained, and snow storage and landscaping will not impede sight distances for exiting vehicles.

Response: The sight distance measurements presented in Table 11 of the January 2021 TIA demonstrate that the available sight lines at the Essex Street/Elm Place (south) and Elm Place/Project site driveway intersections meet the recommended minimum sight distances for safe operation (SSD). The sight line looking to the north from Elm Place along Essex Street was found to be partially obscured by a large tree that is located along the east side of Essex Street just north of Elm Place. Further review of the sight line measurements indicates that the subject tree does not present a continuous obstruction that would impede a motorists view of a moving vehicle along Elm Street, and that the available sight line would exceed the desirable intersection sight distance of 335 feet. The photo below illustrates the available sight line looking to the north from Elm Place.

Looking North from Elm Place Toward Burpee Road

To the extent so desired by the Town, an "Intersection Ahead" warning sign can be installed along Essex Street to advise motorists of the approaching intersection and the potential for vehicles to be entering the traveled-way.

The parking layout along Elm Place will be revised as necessary to remove potential sight line obstructions within the sight triangle area. In addition, snow accumulations located within the snow storage area will be maintained at a height of no more than 3 feet or will otherwise be removed where such accumulations would impede sight lines.

Parking

Comment No. 12: *According to the TIA, there are 109 parking spaces proposed, for 128 multifamily housing units, which is calculated to be 0.85 parking spaces per unit. A strict interpretation of the zoning requirements would require 192 spaces based on current zoning requirements. The parking layout provided with the TIA did not show handicapped spaces, visitor spaces or car sharing spaces. The size of the proposed parking spaces was shown to be 9 feet by 18 feet with drive aisles of 24 feet in order to facilitate parking maneuvers. The parking spaces proposed along Elm Place requires drivers to either back into or out of the parking spaces fronting Elm Place. This is common to the interior of parking lots, but not expected on a public street. It also requires a setback variance from the zoning regulations and prevents a sidewalk being extended from Essex Street toward the site.*

In order to provide additional information on the parking demand, a supplementary parking study was performed by VAI based on data obtained for three site that were deemed to have similar travel characteristics to the residential development proposed in Swampscott. The following results were reported from that study "On Average, the three sites were observed to have a peak-parking demand ratio of 1.11 spaces per dwelling unit on a weekday and 1.08 spaces per dwelling unit on a Saturday."

Several new publications indicate that a smaller number of parking spaces, below 1.5 spaces/residential unit is desirable. ITE recently published data[2] on parking that recommended 1.19 parking space per multifamily housing units or 0.61 parking spaces

[2]ITE, Parking Generation, 5th Edition, 2019

per bedroom, if within ½ mile of transit service. The 2019 MAPC parking study[3] surveyed sites with a parking ratio of 0.25 to 2.0 spaces per unit with an average of 1.0 space per unit. A recent update to the 2019 MAPC study was performed in four Northshore communities including in close proximity to Swampscott. A 0.95 parking demand ratio was surveyed, and the average parking supply was found to be 1.25 spaces per unit.

The trend toward providing less parking than traditional zoning requirements is well documented, but not widely adopted by local communities. Most of the recent research has been done under pre COVID-19 conditions. The VAI report did give some insight on the state of parking at residential developments under current travel conditions and corresponds fairly well to data in the new Parking Generation Manual published by ITE.

Recent presentations made to the Town of Swampscott in June and July of this year indicate a willingness of the Projects' proponents to downsize the project slightly from (128 to 120 units). At the same time the number of parking spaces would be increased from 109 to 124 spaces. While the number of parking spaces and the ratio would be increased (1.03 spaces/unit), it would still fall short of recommendations from ITE, zoning requirements, and local data surveyed this summer.

We recommend a final review of the parking layout be provided, including how the management of the spaces will be performed. The parking management plan should include a description of the shared parking provided on the site with the tumbling academy.

Because of the residential neighborhood abutting the proposed development, if sufficient parking cannot be demonstrated on-site, residents and/or visitors will park on residential streets near the site. Recommendations for on-street parking regulations should be included as well. Other parking recommendations to be considered are the addition of reserved car share spaces and electric charging stations. Designate areas for both short and long term bicycle parking, as well as handicapped spaces.

Response: The parking layout for the Project currently achieves a reasonably balanced parking supply that is consistent with the nature of the use and its location in relation to public transportation services. The location of short and long-term bicycle parking and handicapped parking spaces are shown on the Site Plan. Any revised parking layouts prepared by Hancock Associates will include considerations for where electric vehicle charging and car-sharing services would be.

A parking management plan will continue to be developed as this project moves into its final form. That plan will differentiate the parking allocated to the Project and to the Tumbling Academy. The initial thought is that the spaces allocated to the Tumbling Academy will be defined by signs, with the parking area for the Project defined by signs at the entry points ("Parking for Elm Place Residents Only") and monitored by Project staff, by the issuance of stickers to Elm Place residents.

[3]MAPC, Metro Boston, Perfect Fit Parking Initiative, July 2019

Site Access

In reviewing the site plan from a transportation and circulation perspective, WTE offers the following comments:

The applicant provided a Fire Department Access Plan, dated 1/11/21. The plan did not include fire truck vehicle tracking information.

Comment No. 13: ***A revised plan should be prepared which includes swept path analysis on the site plans to ensure municipal fire vehicles can adequately maneuver the site. The applicant should coordinate with the Town's Fire Department and present their confirmation that the access needs for the site from a fire apparatus standpoint can effectively handle a response to the facility from a turning radius and building access perspective.***

Response: Hancock had prepared a swept path analysis for the Swampscott Fire Department which was included in the supplemental application materials, and has since prepared an updated analysis. The applicant also met with the Fire Department multiple times to review all the plans before obtaining their approval.

Comment No. 14: ***The applicant should provide information on how and where refuse/garbage pickup for the apartments units will take place. A vehicle turning radius assessment for refuse/garage trucks should be identified on the plan.***

Response: Trash and recycling will be collected and stored in an enclosed room within the proposed building. On collection day, the bins/totes will be moved outside of the building and picked-up outside of the parking garage and then returned to the storage room. A vehicle turning analysis will be prepared for the trash/recycling vehicle by Hancock Associates and submitted under separate cover.

Comment No. 15: ***The requirements for STOP-sign control at the driveway locations and for other signs and pavement markings to be installed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) should be added to the site plans.***

Response: The requisite signs and pavement markings internal to the Project site will be added to the final Site Plans.

Traffic Operations Analysis

Utilizing the observed roadway geometry, traffic volumes-both existing and projected-and the appropriate traffic control at each location; the TIA analyzed the impacts of the project at each of the study area intersections. The TIA utilizes the most appropriate version of the highway capacity software and presents an accurate description of the Level of Service terms.

In reviewing the analysis, we agree with the statement that the project related impacts have minor impacts to the study are intersections and all intersections are operating in an acceptable manner from a traffic operations and safety perspective. After reviewing the capacity analyses reports, Build conditions did not change any of the timings used in the analysis. Also, the queues formed on Essex Street in the southbound

direction at Burpee Road and northbound at Burrill Street will continue to block two of the minor side streets in close proximity to the traffic signals.

Comment No. 16: ***We request additional signage and pavement markings be installed at the Essex Street/Hillcrest Circle and Essex Street /Essex Terrace intersections to prevent queues from blocking those intersections***

Response: To the extent so desired by the Town and subject to receipt of all necessary rights, permits and approvals, the Project proponent will install "Do Not Block" signs and accompanying pavement markings on Essex Street at both intersections.

Comment No. 17: ***Please evaluate if signal timing changes at the two signalized intersections should be proposed under build conditions? This would include green times, vehicle clearance intervals and pedestrian crossing times****.*

Response: The existing traffic signal timing at the Essex Street/Burrill Street and Essex Street/ Burpee Road has been reviewed and the Project proponent has committed to design and implement an optimal traffic signal timing and phasing plan for both intersections subject to receipt of all necessary rights permits and approvals, to include a review of vehicle clearance intervals and pedestrian crossing times. Table 2 summarizes the results of the capacity analysis with the recommended traffic signal timing adjustments. As identified in Table 2, there will be a slight increase in overall and individual approach movement delays due to an increase in the pedestrian crossing time for the exclusive pedestrian phase; however, all the movements at the intersections will continue to operate at LOS D or better under 2028 Build conditions.

RECOMMENDATIONS & CONCLUSIONS

Comment No. 18: *WTE has reviewed the TIA's conclusions and generally agree with the conclusion statement contained in the TIA. The conclusion states "that The Project will not result in a significant impact (Increase) on motorist delay or vehicle queuing over existing or anticipated future conditions without the project."*

Response: No response required.

Comment No. 19: ***We have requested optimized timings for the two signalized intersections.***

Response: See response to Comment No. 17.

The TIA also makes a number of recommendations with respect to Project access and Transportation Demand Management (TDM) measures. In addition to those recommendations provided in TIA, we would add the following additions or clarifications.

Comment No. 20: *At the site driveway onto Elm Place confirm that adequate sight distance can be provided, in consideration of the parking and snow storage issues described in this memo and adequate access can be provided for emergency vehicles and trash pickup.*

Response: The parking layout along Elm Place will be revised as necessary to remove potential sight line obstructions within the sight triangle area. Snow accumulations located within the snow storage area will be maintained at a height of no more than 3 feet or will otherwise be removed where such accumulations would impede sight lines. The

driveway is designed to provide adequate sight distances and the necessary geometry to accommodate access to the Project site, conditions which will be demonstrated by the vehicle turning analyses that are being prepared by Hancock Associates and will be submitted under separate cover.

Comment No. 21: *Provide a parking management plan that describes how shared parking with the tumbling academy will work and additional information on the location and number of handicapped spaces, ride sharing spaces, bicycle parking, electric charging stations and handicapped parking.*

Response: The location of handicapped parking spaces and bicycle parking are shown on the Site Plans prepared by Hancock Associates. The Project proponent will evaluate including electric vehicle charging accommodations for residents of the Project as well as ride-sharing spaces, and will include these spaces on a subsequent revision of the Site Plan to the extent deemed feasible. A parking management plan will continue to be developed as this project moves into its final form. That plan will differentiate the parking allocated to the Project and to the Tumbling Academy. The initial thought is that the spaces allocated to the Tumbling Academy will be defined by signs, with the parking area for the Project defined by signs at the entry points ("Parking for Elm Place Residents Only") and monitored by Project staff, by the issuance of stickers to Elm Place residents.

Comment No. 22: *Provide ADA-compliant wheelchair ramps at all pedestrian crossings internal to the project and for crossing the project site driveway.*

Response: ADA compliant wheelchair ramps will be provided at all pedestrian crossings internal to the project and for crossing the project site driveway.

Comment No. 23: *Provide a fire truck and trash truck access plan including vehicle tracking information.*

Response: The requested vehicle turning analyses are being prepared by Hancock Associates and will be submitted under separate cover.

Comment No. 24: *Provide a revised site access plan which shows proposed signs and pavement markings as well as the revised parking layout.*

Response: The requested information will be added to the final Site Plans.

Comment No. 25: *Recommendations should be provided to improve the sight distance for drivers on Elm Place to enter Essex Street to meet ISD requirements or provide additional warning measures to warn drivers on Essex Street.*

Response: See response to Comment No. 11.

Comment No. 26: *Provide additional signage and pavement markings at the Essex Street/Hillcrest Circle and Essex Street at Essex Terrace intersections to prevent queues from the adjacent traffic signals from blocking traffic trying to gain access to/from Essex Street.*

Response: See response to Comment No. 16.

We trust that this information is responsive to the comments that were raised in the October 25, 2021 letter prepared by WTE. 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

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

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

JSD/atg

Attachments

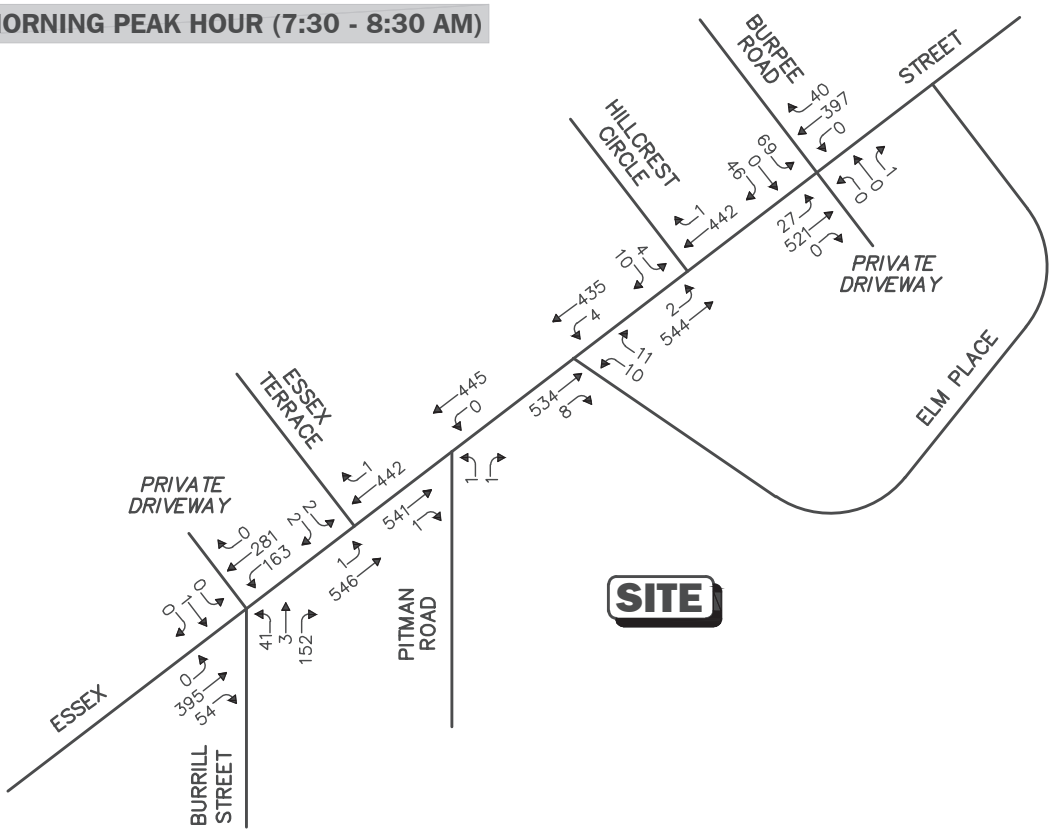
cc: R. Emery, P.E. – WorldTech Engineering (via email)
M. Currin, A. Gile – WinnDevelopment (via email)

ATTACHMENTS

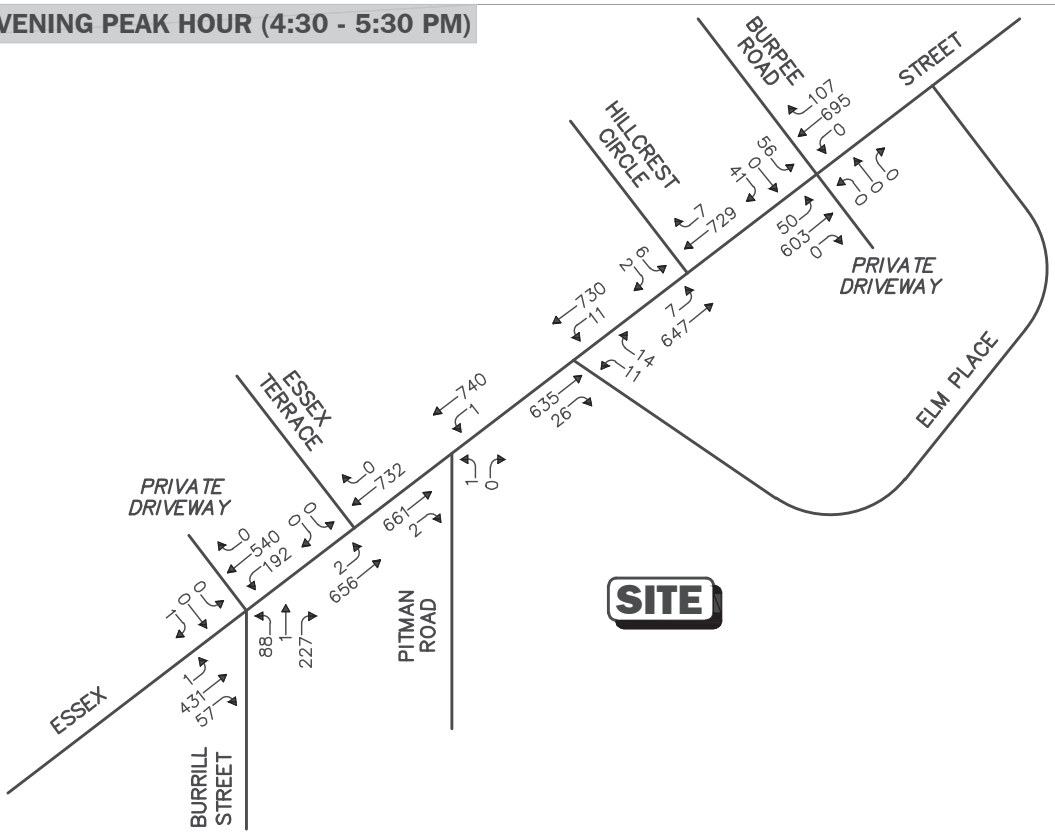
REVISED TRAFFIC-VOLUME NETWORKS
LEVEL-OF-SERVICE SUMMARY TABLES
MANUAL TURNING MOVEMENT COUNTS
CAPACITY ANALYSIS WORKSHEETS

REVISED TRAFFIC-VOLUME NETWORKS

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)



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

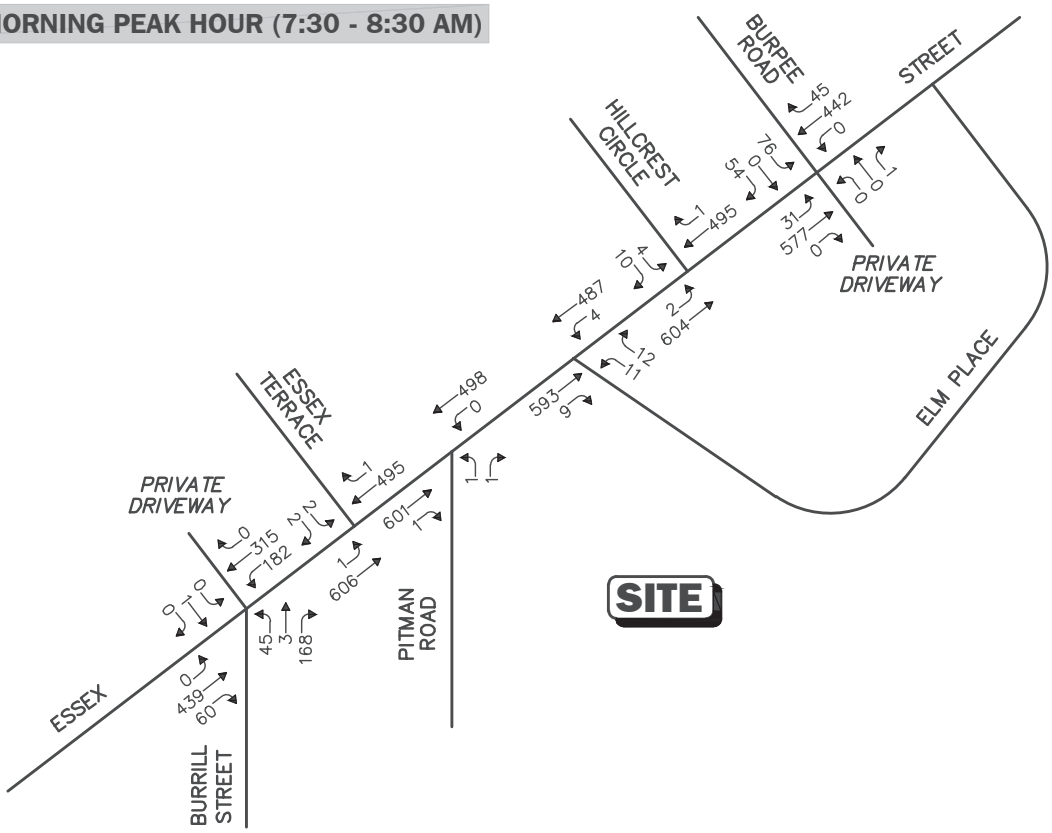
Not To Scale

Figure 3R

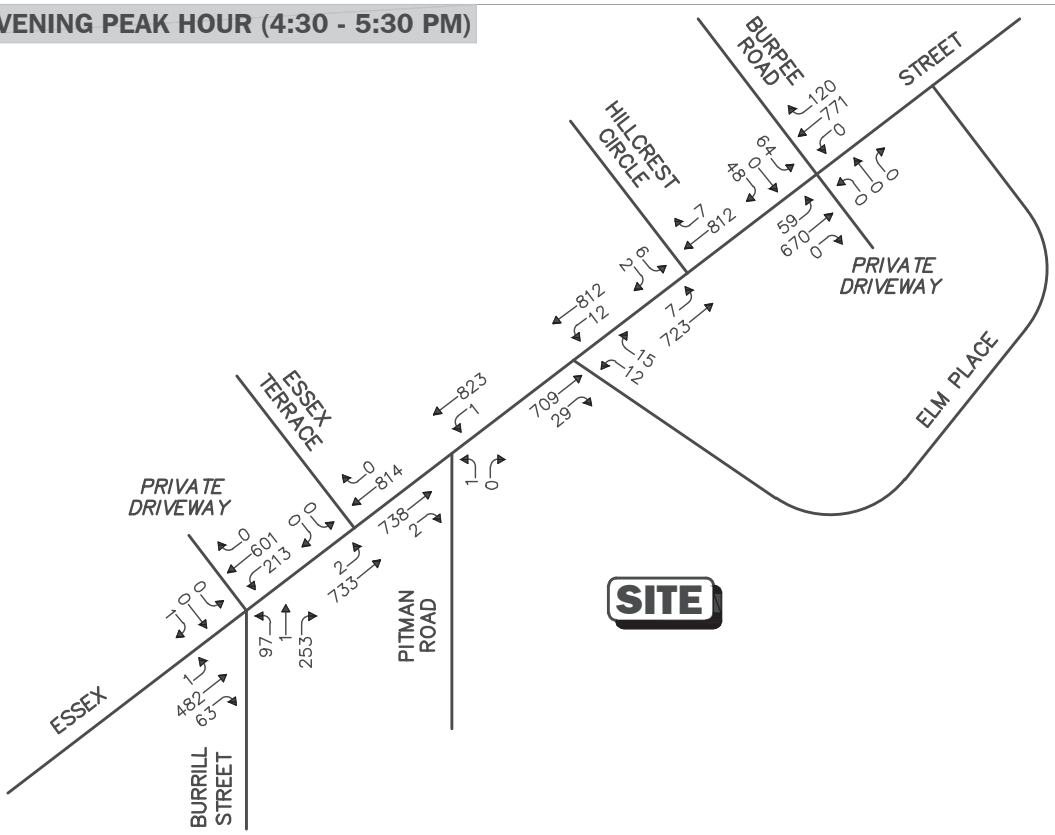
2020 Existing
Peak-Hour Traffic Volumes

Vanasse & Associates inc

WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)



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

Not To Scale

Figure 4R

2028 No-Build
Peak-Hour Traffic Volumes

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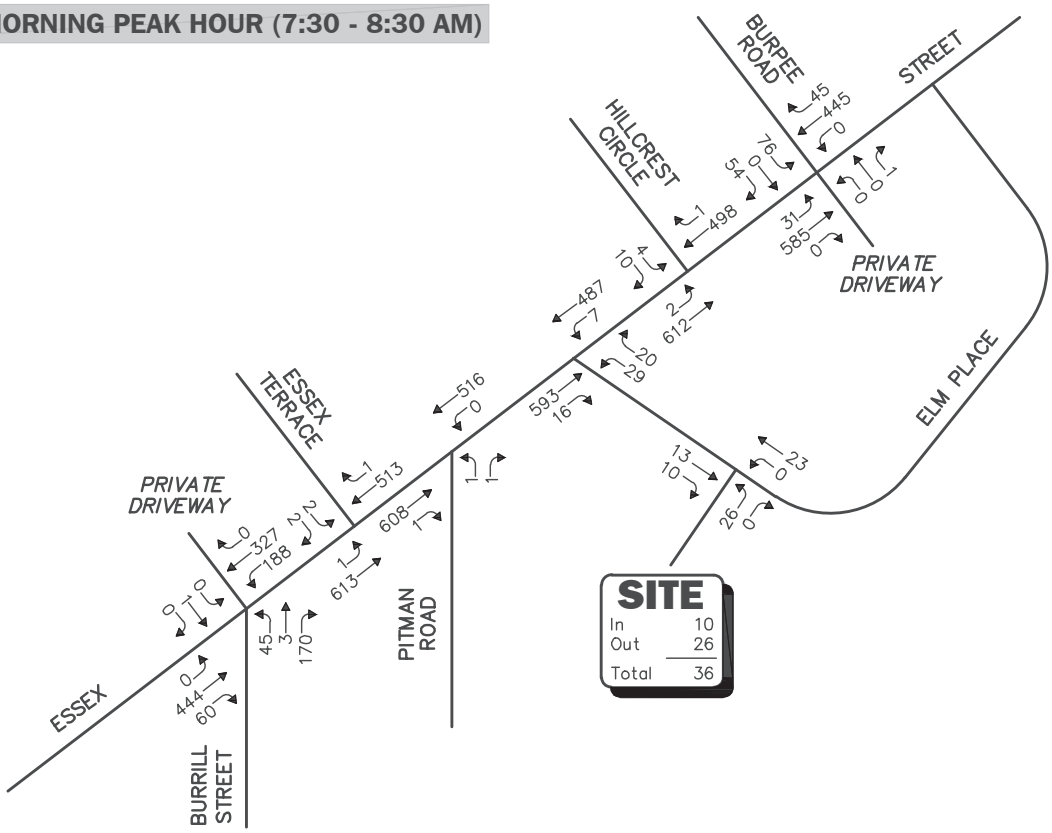
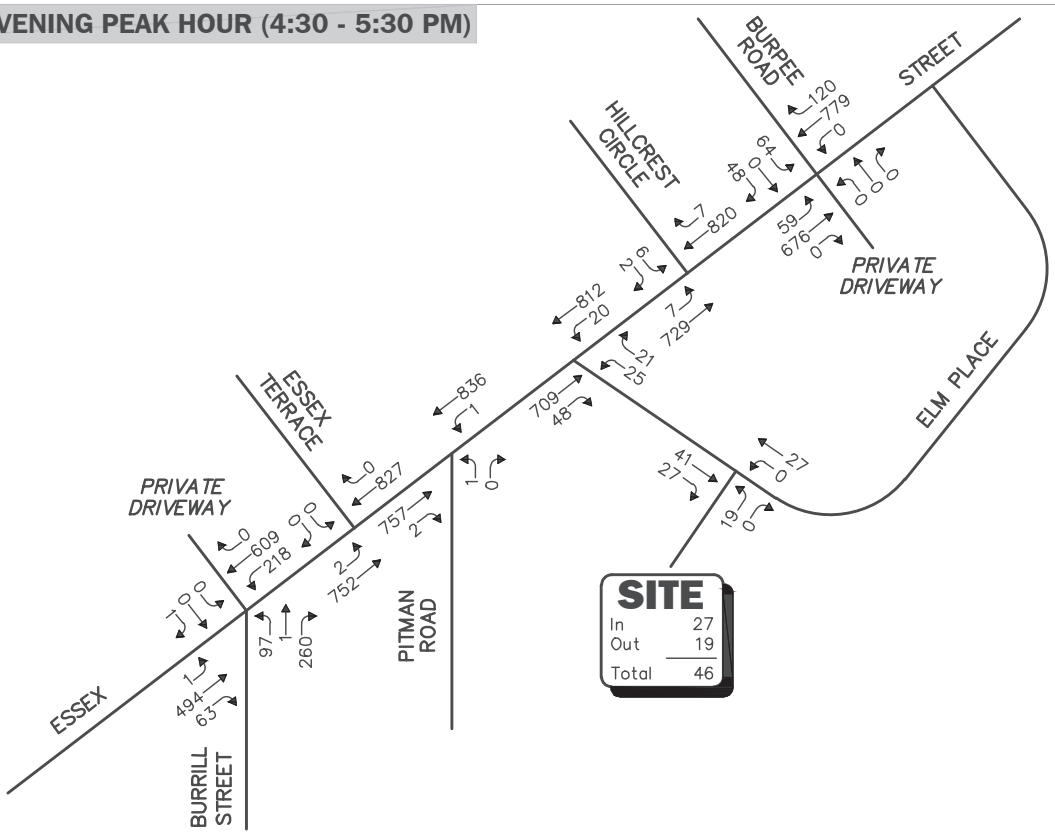
WEEKDAY MORNING PEAK HOUR (7:30 - 8:30 AM)



WEEKDAY EVENING PEAK HOUR (4:30 - 5:30 PM)



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

Not To Scale

Figure 7R

2028 Build
Peak-Hour Traffic Volumes

Vanasse & Associates inc

LEVEL-OF-SERVICE SUMMARY TABLES

Table 1
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/ Peak Hour/Movement	2020 Existing				2028 No-Build				2028 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Essex Street at Hillcrest Circle												
Weekday Morning:												
Essex Street NEB LT/TH	546	0.1	A	0	606	0.1	A	0	614	0.1	A	0
Essex Street SWB TH/RT	443	0.0	A	0	496	0.0	A	0	499	0.0	A	0
Hillcrest Circle SB LT/RT	14	12.2	B	0	14	13.0	B	0	14	13.1	B	0
Weekday Evening:												
Essex Street NEB LT/TH	654	0.3	A	0	730	0.3	A	0	736	0.3	A	0
Essex Street SWB TH/RT	736	0.0	A	0	819	0.0	A	0	827	0.0	A	0
Hillcrest Circle SB LT/RT	8	19.1	C	0	8	22.1	C	0	8	22.5	C	0
Essex Street at Essex Terrace												
Weekday Morning:												
Essex Street NEB LT/TH	547	0.0	A	0	607	0.0	A	0	614	0.0	A	0
Essex Street SWB TH/RT	444	0.0	A	0	496	0.0	A	0	514	0.0	A	0
Essex Terrace SB LT/RT	4	17.7	C	0	4	20.9	C	0	4	21.8	C	0
Weekday Evening:												
Essex Street NEB LT/TH	658	0.1	A	0	735	0.1	A	0	754	0.1	A	0
Essex Street SWB TH/RT	732	0.0	A	0	814	0.0	A	0	827	0.0	A	0
Essex Terrace SB LT/RT	0	0.0	A	0	0	0.0	A	0	0	0.0	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level of service.
[d]Queue length in vehicle.
NB = northbound; SB = southbound; NEB = northeastbound; SWB = southwestbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 2
MITIGATED SIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

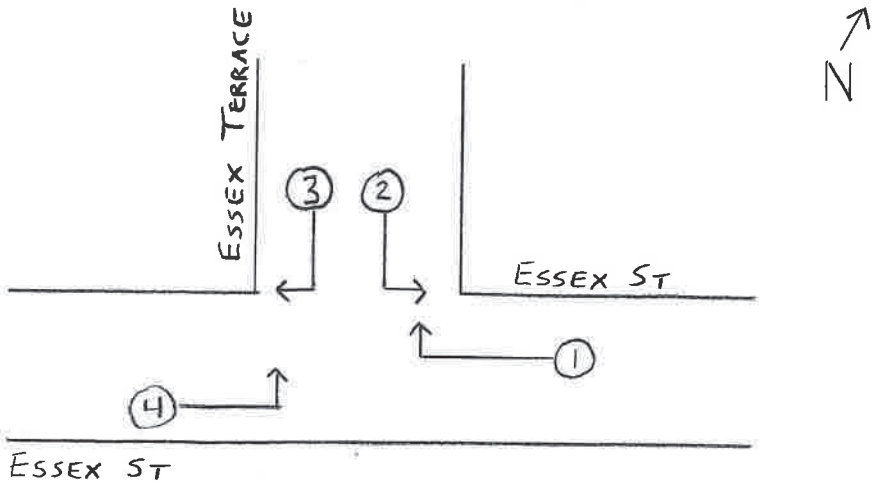
Signalized Intersection/ Peak Hour/Movement	2020 Existing				2028 No-Build				2028 Build with Timing Changes			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] 50th/95th	V/C	Delay	LOS	Queue 50th/95th	V/C	Delay	LOS	Queue 50th/95th
Essex Street at Burrill Street												
Weekday Morning:												
Essex Street NEB LT/TH/RT	0.76	25.3	C	6/22	0.77	25.9	C	6/23	0.73	23.6	C	6/23
Essex Street SWB LT	0.56	13.1	B	1/8	0.57	13.4	B	1/8	0.67	17.6	B	1/8
Essex Street SWB TH/RT	0.36	8.3	A	2/10	0.37	8.4	A	2/10	0.39	9.6	A	2/10
Burrill Street NB LT/TH/RT	0.52	29.5	C	2/6	0.52	29.7	C	2/6	0.49	30.0	C	2/5
Driveway SB LT/TH/RT	0.21	40.4	D	0/0	0.21	40.6	D	0/0	0.06	34.6	C	0/0
Overall	**--**	**19.7**	**B**	**--**	**--**	**19.9**	**B**	**--**	**--**	**21.1**	**C**	**--**
Weekday Evening:												
Essex Street NEB LT/TH/RT	0.83	34.0	C	9/25	0.84	34.0	C	9/25	0.87	35.3	D	8/26
Essex Street SWB LT	0.65	19.4	B	2/8	0.66	19.7	B	2/8	0.78	28.1	C	2/10
Essex Street SWB TH/RT	0.67	16.7	B	6/21	0.67	16.7	B	7/22	0.72	18.1	B	6/24
Burrill Street NB Lt/TH/RT	0.80	40.0	D	6/16	0.83	43.1	D	6/16	0.87	46.3	D	5/14
Driveway SB LT/TH/RT	0.00	41.6	D	0/0	0.00	42.1	D	0/0	0.00	36.0	D	0/0
Overall	**--**	**27.7**	**C**	**--**	**--**	**28.5**	**C**	**--**	**--**	**31.1**	**C**	**--**
Essex Street at Burpee Road												
Weekday Morning:												
Essex Street NEB LT	0.14	7.5	A	0/2	0.14	7.5	A	0/2	0.16	8.8	A	0/1
Essex Street NEB TH/RT	0.76	14.8	B	3/22	0.76	14.8	B	3/22	0.81	18.5	B	4/19
Essex Street SWB LT/TH/RT	0.54	9.8	A	2/14	0.53	9.8	A	2/14	0.57	11.5	B	3/13
Driveway NB LT/TH/RT	0.00	26.6	C	0/0	0.00	27.1	C	0/0	0.00	26.3	C	0/0
Burpee Road SB LT/TH/RT	0.30	20.8	C	1/3	0.31	21.5	C	1/3	0.21	20.9	C	1/2
Overall	**--**	**13.5**	**B**	**--**	**--**	**13.5**	**B**	**--**	**--**	**15.9**	**B**	**--**
Weekday Evening:												
Essex Street NEB LT	0.38	5.8	A	0/3	0.39	6.0	A	0/3	0.32	5.1	A	1/2
Essex Street NEB TH/RT	0.67	7.5	A	3/21	0.67	7.6	A	3/21	0.63	6.9	A	4/19
Essex Street SWB LT/TH/RT	0.69	7.8	A	4/27	0.70	7.9	A	4/27	0.66	7.2	A	5/26
Driveway NB LT/TH/RT	0.00	0.0	A	0/0	0.00	0.0	A	0/0	0.00	0.0	A	0/0
Burpee Road SB LT/TH/RT	0.10	23.7	C	0/2	0.10	23.7	C	0/2	0.07	28.8	C	0/2
Overall	**--**	**8.5**	**A**	**--**	**--**	**8.6**	**A**	**--**	**--**	**8.3**	**A**	**--**

[a]Volume-to-capacity ratio.
[b]Control (signal) delay per vehicle in seconds.
[c]Level of service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; NEB = northeastbound; SWB = southwestbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

MANUAL TURNING MOVEMENT COUNTS

VAI Calculations

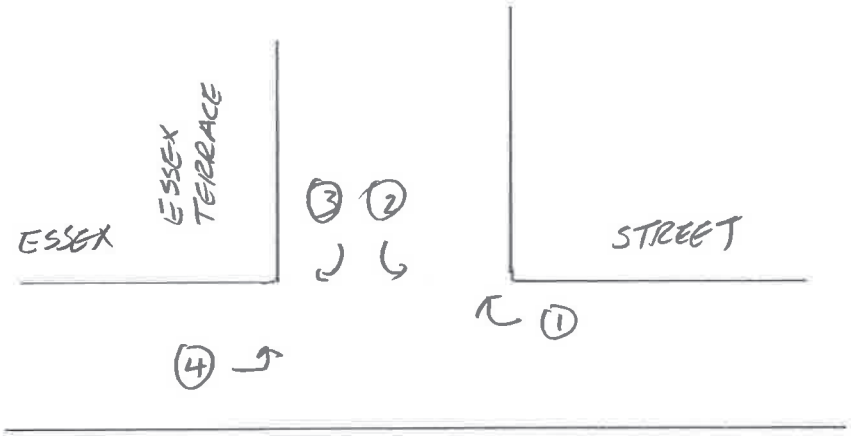
Job:	Swampscott	Job Number:	8688
Location:	Essex Street at Essex Terrace	Date:	11/2/21
Title:	Traffic Count	Sheet:	1 of 1
Calculated by:	SRF	Checked by:	



Start Time	1	2	3	4	Total	Hourly Total
7:00AM	0	0	1	0	1	
7:15	0	0	0	0	0	
7:30	0	1	1	1	3	
7:45	1	1	0	0	2	6
8:00	0	0	1	0	1	6
8:15	0	0	0	0	0	6
8:30	0	0	0	0	0	3
8:45	0	0	0	1	1	2
Total	1	2	3	2	8	
Pk Hr Total	1	2	2	1	6	

VAI Calculations

Job:	Swampscott	Job Number:	8688
Location:	Essex Street at Essex Terrace	Date:	11/2/21
Title:	Traffic Count	Sheet:	1 of 1
Calculated by:	SRF	Checked by:	



Start Time	1	2	3	4	Total	Hourly Total
4:00PM	0	0	0	1	1	
4:15	0	0	1	0	1	
4:30	0	0	0	1	1	
4:45	0	0	0	0	0	3
5:00	0	0	0	1	1	3
5:15	0	0	0	0	0	2
5:30	0	2	0	0	2	3
5:45	1	0	0	0	1	4
Total	1	2	1	3	7	
Pk Hr Total	0	0	0	2	2	

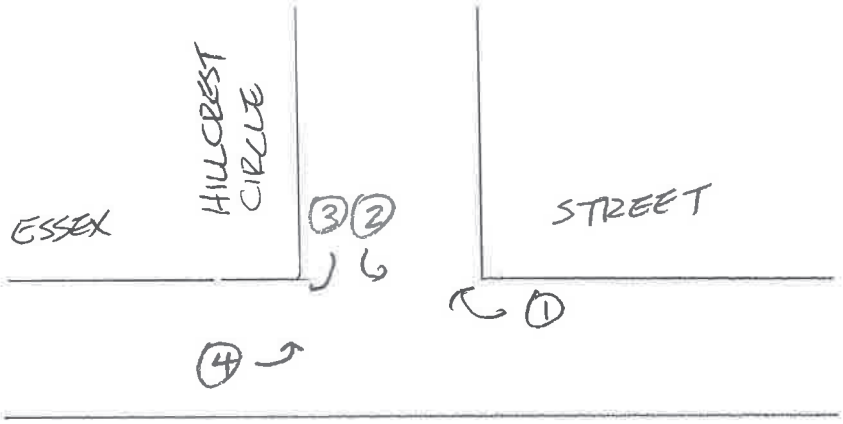
VAI Calculations

Job:	Swampscott	Job Number:	8688
Location:	Essex Street at Hillcrest Circle	Date:	11/3/21
Title:	Traffic Count	Sheet:	1 of 1
Calculated by:	SRF	Checked by:	

Start Time	1	2	3	4	Total	Hourly Total
7:00AM	0	1	2	1	4	
7:15	0	1	0	0	1	
7:30	0	1	3	0	4	
7:45	1	0	2	0	3	12
8:00	0	3	3	1	7	15
8:15	0	0	2	1	3	17
8:30	1	1	0	1	3	16
8:45	0	1	0	1	2	15
Total	2	8	12	5	27	
Pk Hr Total	1	4	10	2	17	

VAI Calculations

Job:	Swampscott	Job Number:	8688
Location:	Essex Street at Hillcrest Circle	Date:	11/3/21
Title:	Traffic Count	Sheet:	1 of 1
Calculated by:	SRF	Checked by:	



Start Time	1	2	3	4	Total	Hourly Total
4:00PM	2	1	1	0	4	
4:15	4	1	0	3	8	
4:30	1	1	1	0	3	
4:45	3	2	0	1	6	21
5:00	0	1	1	3	5	22
5:15	3	2	0	3	8	22
5:30	1	3	1	4	9	28
5:45	2	2	0	1	5	27
Total	16	13	4	15	48	
Pk Hr Total	7	6	2	7	22	

CAPACITY ANALYSIS WORKSHEETS

Lane Group	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (vph)	2	544	442	1	4	10
Future Volume (vph)	2	544	442	1	4	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		141	87		141	
Travel Time (s)		3.2	2.0		3.2	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Heavy Vehicles (%)	0%	3%	3%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	642	509	0	18	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Volume (veh/h)	2	544	442	1	4	10
Future Volume (Veh/h)	2	544	442	1	4	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Hourly flow rate (vph)	2	640	508	1	5	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		547	87			
pX, platoon unblocked	0.83				0.88	0.83
vC, conflicting volume	509				1152	508
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	309				674	308
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	98
cM capacity (veh/h)	1051				371	613

Direction, Lane #	EB 1	WB 1	SE 1
Volume Total	642	509	18
Volume Left	2	0	5
Volume Right	0	1	13
cSH	1051	1700	519
Volume to Capacity	0.00	0.30	0.03
Queue Length 95th (ft)	0	0	3
Control Delay (s)	0.1	0.0	12.2
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	12.2
Approach LOS			B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	647	729	7	6	2
Future Volume (vph)	7	647	729	7	6	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		56	171		142	
Travel Time (s)		1.3	3.9		3.2	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	769	792	0	11	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	2	604	495	1	4	10
Future Volume (vph)	2	604	495	1	4	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		75	153		176	
Travel Time (s)		1.7	3.5		4.0	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Heavy Vehicles (%)	0%	3%	3%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	713	570	0	18	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	604	495	1	4	10
Future Volume (Veh/h)	2	604	495	1	4	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Hourly flow rate (vph)	2	711	569	1	5	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		481	153			
pX, platoon unblocked	0.81				0.86	0.81
vC, conflicting volume	570				1284	570
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	351				749	350
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	98
cM capacity (veh/h)	987				328	565

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	713	570	18
Volume Left	2	0	5
Volume Right	0	1	13
cSH	987	1700	470
Volume to Capacity	0.00	0.34	0.04
Queue Length 95th (ft)	0	0	3
Control Delay (s)	0.1	0.0	13.0
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	13.0
Approach LOS			B

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		43.4%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	647	729	7	6	2
Future Volume (Veh/h)	7	647	729	7	6	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Hourly flow rate (vph)	8	761	784	8	8	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		462	171			
pX, platoon unblocked	0.71				0.83	0.71
vC, conflicting volume	792				1565	788
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	509				961	503
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				97	99
cM capacity (veh/h)	762				235	409

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	769	792	11
Volume Left	8	0	8
Volume Right	0	8	3
cSH	762	1700	266
Volume to Capacity	0.01	0.47	0.04
Queue Length 95th (ft)	1	0	3
Control Delay (s)	0.3	0.0	19.1
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	19.1
Approach LOS			C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	723	812	7	6	2
Future Volume (vph)	7	723	812	7	6	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		66	162		152	
Travel Time (s)		1.5	3.7		3.5	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	859	881	0	11	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	723	812	7	6	2
Future Volume (Veh/h)	7	723	812	7	6	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Hourly flow rate (vph)	8	851	873	8	8	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		471	162			
pX, platoon unblocked	0.69				0.81	0.69
vC, conflicting volume	881				1744	877
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	597				1085	591
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	99
cM capacity (veh/h)	678				195	350

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	859	881	11
Volume Left	8	0	8
Volume Right	0	8	3
cSH	678	1700	222
Volume to Capacity	0.01	0.52	0.05
Queue Length 95th (ft)	1	0	4
Control Delay (s)	0.3	0.0	22.1
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	22.1
Approach LOS			C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	2	612	498	1	4	10
Future Volume (vph)	2	612	498	1	4	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		66	161		102	
Travel Time (s)		1.5	3.7		2.3	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Heavy Vehicles (%)	0%	3%	3%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	722	573	0	18	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	612	498	1	4	10
Future Volume (Veh/h)	2	612	498	1	4	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.87	0.87	0.75	0.75
Hourly flow rate (vph)	2	720	572	1	5	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		471	161			
pX, platoon unblocked	0.81				0.86	0.81
vC, conflicting volume	573				1296	572
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	357				766	356
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	98
cM capacity (veh/h)	984				319	561

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	722	573	18
Volume Left	2	0	5
Volume Right	0	1	13
cSH	984	1700	464
Volume to Capacity	0.00	0.34	0.04
Queue Length 95th (ft)	0	0	3
Control Delay (s)	0.1	0.0	13.1
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	13.1
Approach LOS			B

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	729	820	7	6	2
Future Volume (vph)	7	729	820	7	6	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	12	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		66	162		127	
Travel Time (s)		1.5	3.7		2.9	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	866	890	0	11	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	729	820	7	6	2
Future Volume (Veh/h)	7	729	820	7	6	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.85	0.85	0.93	0.93	0.75	0.75
Hourly flow rate (vph)	8	858	882	8	8	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		472	162			
pX, platoon unblocked	0.68				0.81	0.68
vC, conflicting volume	890				1760	886
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	601				1098	595
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	99
cM capacity (veh/h)	669				190	345

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	866	890	11
Volume Left	8	0	8
Volume Right	0	8	3
cSH	669	1700	216
Volume to Capacity	0.01	0.52	0.05
Queue Length 95th (ft)	1	0	4
Control Delay (s)	0.3	0.0	22.5
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	22.5
Approach LOS			C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1	546	443	1	2	2
Future Volume (vph)	1	546	443	1	2	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		124	176		125	
Travel Time (s)		2.8	4.0		2.8	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Heavy Vehicles (%)	0%	4%	4%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	608	528	0	6	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	546	443	1	2	2
Future Volume (Veh/h)	1	546	443	1	2	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	1	607	527	1	3	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		124	510			
pX, platoon unblocked					0.78	
vC, conflicting volume	528				1136	264
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	528				1037	264
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1049				181	741

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	608	351	177	6
Volume Left	1	0	0	3
Volume Right	0	0	1	3
cSH	1049	1700	1700	290
Volume to Capacity	0.00	0.21	0.10	0.02
Queue Length 95th (ft)	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	17.7
Lane LOS	A			C
Approach Delay (s)	0.0	0.0		17.7
Approach LOS				C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	2	656	732	0	0	0
Future Volume (vph)	2	656	732	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		145	155		129	
Travel Time (s)		3.3	3.5		2.9	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	723	796	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	656	732	0	0	0
Future Volume (Veh/h)	2	656	732	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	721	796	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		145	488			
pX, platoon unblocked					0.76	
vC, conflicting volume	796				1521	398
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	796				1528	398
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	835				84	607

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	723	531	265	0
Volume Left	2	0	0	0
Volume Right	0	0	0	0
cSH	835	1700	1700	1700
Volume to Capacity	0.00	0.31	0.16	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.1	0.0	0.0	0.0
Lane LOS	A			A
Approach Delay (s)	0.1	0.0		0.0
Approach LOS				A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1	606	495	1	2	2
Future Volume (vph)	1	606	495	1	2	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		114	186		202	
Travel Time (s)		2.6	4.2		4.6	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Heavy Vehicles (%)	0%	4%	4%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	674	590	0	6	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	606	495	1	2	2
Future Volume (Veh/h)	1	606	495	1	2	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	1	673	589	1	3	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		114	520			
pX, platoon unblocked					0.76	
vC, conflicting volume	590				1264	295
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	590				1189	295
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	995				139	707

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	674	393	197	6
Volume Left	1	0	0	3
Volume Right	0	0	1	3
cSH	995	1700	1700	232
Volume to Capacity	0.00	0.23	0.12	0.03
Queue Length 95th (ft)	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	20.9
Lane LOS	A			C
Approach Delay (s)	0.0	0.0		20.9
Approach LOS				C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	2	733	814	0	0	0
Future Volume (vph)	2	733	814	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		134	165		156	
Travel Time (s)		3.0	3.8		3.5	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	807	885	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	733	814	0	0	0
Future Volume (Veh/h)	2	733	814	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	805	885	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		134	499			
pX, platoon unblocked					0.73	
vC, conflicting volume	885				1694	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	885				1764	442
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	773				56	568

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	807	590	295	0
Volume Left	2	0	0	0
Volume Right	0	0	0	0
cSH	773	1700	1700	1700
Volume to Capacity	0.00	0.35	0.17	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.1	0.0	0.0	0.0
Lane LOS	A			A
Approach Delay (s)	0.1	0.0		0.0
Approach LOS				A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1	613	513	1	2	2
Future Volume (vph)	1	613	513	1	2	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		134	165		132	
Travel Time (s)		3.0	3.8		3.0	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Heavy Vehicles (%)	0%	4%	1%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	682	612	0	6	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	613	513	1	2	2
Future Volume (Veh/h)	1	613	513	1	2	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	1	681	611	1	3	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		134	498			
pX, platoon unblocked					0.75	
vC, conflicting volume	612				1294	306
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	612				1228	306
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	977				131	696

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	682	407	205	6
Volume Left	1	0	0	3
Volume Right	0	0	1	3
cSH	977	1700	1700	220
Volume to Capacity	0.00	0.24	0.12	0.03
Queue Length 95th (ft)	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	21.8
Lane LOS	A			C
Approach Delay (s)	0.0	0.0		21.8
Approach LOS				C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	2	752	827	0	0	0
Future Volume (vph)	2	752	827	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	11	12	8	12
Link Speed (mph)		30	30		30	
Link Distance (ft)		127	173		115	
Travel Time (s)		2.9	3.9		2.6	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	1%	1%	0%	0%	0%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	828	899	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	752	827	0	0	0
Future Volume (Veh/h)	2	752	827	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	826	899	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		127	507			
pX, platoon unblocked					0.73	
vC, conflicting volume	899				1729	450
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	899				1814	450
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	764				52	562

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	828	599	300	0
Volume Left	2	0	0	0
Volume Right	0	0	0	0
cSH	764	1700	1700	1700
Volume to Capacity	0.00	0.35	0.18	0.00
Queue Length 95th (ft)	0	0	0	0
Control Delay (s)	0.1	0.0	0.0	0.0
Lane LOS	A			A
Approach Delay (s)	0.1	0.0		0.0
Approach LOS				A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	444	60	188	327	0	45	3	170	0	1	0
Future Volume (vph)	0	444	60	188	327	0	45	3	170	0	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	11	12	12	12	14	12	12	10	12
Storage Length (ft)	0		0	175		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		475			134			389			94	
Travel Time (s)		10.8			3.0			8.8			2.1	
Peak Hour Factor	0.90	0.90	0.90	0.84	0.84	0.84	0.84	0.84	0.84	0.25	0.25	0.25
Heavy Vehicles (%)	2%	4%	0%	1%	4%	0%	0%	0%	1%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	560	0	224	389	0	0	260	0	0	4	0
Turn Type		NA		pm+pt	NA		Split	NA			NA	
Protected Phases		4		3	8		2	2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	22.5	22.5		11.0	22.5		19.0	19.0		12.0	12.0	
Total Split (s)	30.0	30.0		13.0	43.0		19.0	19.0		12.0	12.0	
Total Split (%)	30.0%	30.0%		13.0%	43.0%		19.0%	19.0%		12.0%	12.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0		-2.0	-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	None	None		None	None		None	None		None	None	
v/c Ratio		0.65		0.59	0.34			0.60			0.02	
Control Delay		23.6		19.1	10.6			19.1			33.0	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		23.6		19.1	10.6			19.1			33.0	
Queue Length 50th (ft)		138		24	45			34			1	
Queue Length 95th (ft)		#566		#189	242			127			3	
Internal Link Dist (ft)		395			54			309			14	
Turn Bay Length (ft)				175								
Base Capacity (vph)		858		382	1143			541			227	
Starvation Cap Reductn		0		0	0			0			0	
Spillback Cap Reductn		0		0	0			0			0	
Storage Cap Reductn		0		0	0			0			0	
Reduced v/c Ratio		0.65		0.59	0.34			0.48			0.02	

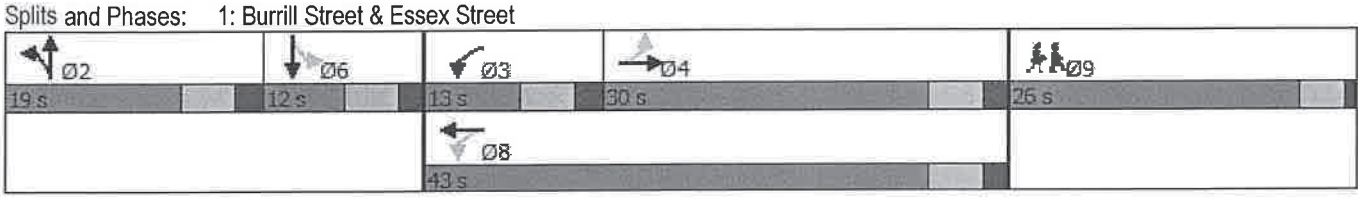
Intersection Summary	
Area Type:	Other
Cycle Length: 100	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	26.0
Total Split (s)	26.0
Total Split (%)	26%
Yellow Time (s)	3.5
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Actuated Cycle Length: 65.2
Natural Cycle: 95
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Burrill Street & Essex Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↰	↱			↕			↕	
Traffic Volume (vph)	0	444	60	188	327	0	45	3	170	0	1	0
Future Volume (vph)	0	444	60	188	327	0	45	3	170	0	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	11	12	12	12	14	12	12	10	12
Total Lost time (s)		4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor		1.00		1.00	1.00			1.00			1.00	
Frt		0.98		1.00	1.00			0.90			1.00	
Flt Protected		1.00		0.95	1.00			0.99			1.00	
Satd. Flow (prot)		2046		1728	1827			1782			1773	
Flt Permitted		1.00		0.15	1.00			0.99			1.00	
Satd. Flow (perm)		2046		276	1827			1782			1773	
Peak-hour factor, PHF	0.90	0.90	0.90	0.84	0.84	0.84	0.84	0.84	0.84	0.25	0.25	0.25
Adj. Flow (vph)	0	493	67	224	389	0	54	4	202	0	4	0
RTOR Reduction (vph)	0	4	0	0	0	0	0	125	0	0	0	0
Lane Group Flow (vph)	0	556	0	224	389	0	0	135	0	0	4	0
Heavy Vehicles (%)	2%	4%	0%	1%	4%	0%	0%	0%	1%	0%	0%	0%
Turn Type		NA		pm+pt	NA		Split	NA			NA	
Protected Phases		4		3	8		2	2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		25.4		38.7	38.7			9.3			0.8	
Effective Green, g (s)		27.4		40.7	40.7			11.3			2.8	
Actuated g/C Ratio		0.37		0.55	0.55			0.15			0.04	
Clearance Time (s)		6.0		6.0	6.0			6.0			6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)		760		335	1008			273			67	
v/s Ratio Prot		c0.27		c0.08	0.21			c0.08			c0.00	
v/s Ratio Perm				0.28								
v/c Ratio		0.73		0.67	0.39			0.49			0.06	
Uniform Delay, d1		20.0		12.6	9.4			28.6			34.2	
Progression Factor		1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2		3.6		5.0	0.2			1.4			0.4	
Delay (s)		23.6		17.6	9.6			30.0			34.6	
Level of Service		C		B	A			C			C	
Approach Delay (s)		23.6			12.5			30.0			34.6	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	22.5
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↰	↱			↕			↕	
Traffic Volume (vph)	1	494	63	218	609	0	97	1	260	0	0	1
Future Volume (vph)	1	494	63	218	609	0	97	1	260	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	11	12	12	12	14	12	12	10	12
Storage Length (ft)	0		0	175		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		475			127			389			94	
Travel Time (s)		10.8			2.9			8.8			2.1	
Peak Hour Factor	0.91	0.91	0.91	0.92	0.92	0.92	0.81	0.81	0.81	0.25	0.25	0.25
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	613	0	237	662	0	0	442	0	0	4	0
Turn Type	Perm	NA		pm+pt	NA		Split	NA			NA	
Protected Phases		4		3	8		2	2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	22.5	22.5		11.0	22.5		19.0	19.0		12.0	12.0	
Total Split (s)	29.0	29.0		12.0	41.0		21.0	21.0		12.0	12.0	
Total Split (%)	29.0%	29.0%		12.0%	41.0%		21.0%	21.0%		12.0%	12.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0		-2.0	-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	None	None		None	None		None	None		None	None	
v/c Ratio		0.78		0.69	0.64			0.81			0.01	
Control Delay		29.9		25.7	17.7			33.4			0.0	
Queue Delay		0.0		0.0	0.0			0.0			0.0	
Total Delay		29.9		25.7	17.7			33.4			0.0	
Queue Length 50th (ft)		184		36	135			111			0	
Queue Length 95th (ft)		#643		#240	#596			#353			0	
Internal Link Dist (ft)		395			47			309			14	
Turn Bay Length (ft)				175								
Base Capacity (vph)		790		343	1042			545			626	
Starvation Cap Reductn		0		0	0			0			0	
Spillback Cap Reductn		0		0	0			0			0	
Storage Cap Reductn		0		0	0			0			0	
Reduced v/c Ratio		0.78		0.69	0.64			0.81			0.01	

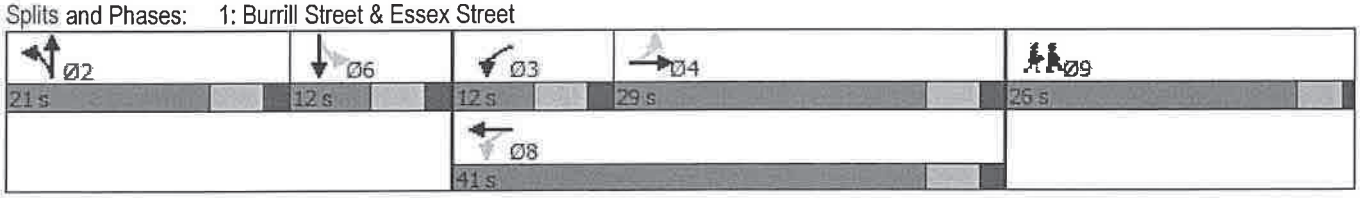
Intersection Summary	
Area Type:	Other
Cycle Length: 100	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	26.0
Total Split (s)	26.0
Total Split (%)	26%
Yellow Time (s)	3.5
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Actuated Cycle Length: 68.8
Natural Cycle: 115
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Burrill Street & Essex Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕		↰	↕			↕			↕	
Traffic Volume (vph)	1	494	63	218	609	0	97	1	260	0	0	1
Future Volume (vph)	1	494	63	218	609	0	97	1	260	0	0	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	11	12	12	12	14	12	12	10	12
Total Lost time (s)		4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor		1.00		1.00	1.00			1.00			1.00	
Frt		0.98		1.00	1.00			0.90			0.86	
Flt Protected		1.00		0.95	1.00			0.99			1.00	
Satd. Flow (prot)		2102		1745	1881			1803			1534	
Flt Permitted		1.00		0.17	1.00			0.99			1.00	
Satd. Flow (perm)		2100		309	1881			1803			1534	
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.81	0.81	0.81	0.25	0.25	0.25
Adj. Flow (vph)	1	543	69	237	662	0	120	1	321	0	0	4
RTOR Reduction (vph)	0	4	0	0	0	0	0	89	0	0	4	0
Lane Group Flow (vph)	0	609	0	237	662	0	0	353	0	0	0	0
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		pm+pt	NA		Split	NA			NA	
Protected Phases		4		3	8		2	2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		23.9		36.1	36.1			15.5			0.8	
Effective Green, g (s)		25.9		38.1	38.1			17.5			2.8	
Actuated g/C Ratio		0.33		0.49	0.49			0.23			0.04	
Clearance Time (s)		6.0		6.0	6.0			6.0			6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)		701		303	924			407			55	
v/s Ratio Prot				0.08	c0.35			c0.20			c0.00	
v/s Ratio Perm		c0.29		0.30								
v/c Ratio		0.87		0.78	0.72			0.87			0.00	
Uniform Delay, d1		24.2		15.7	15.5			28.9			36.0	
Progression Factor		1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2		11.1		12.4	2.7			17.4			0.0	
Delay (s)		35.3		28.1	18.1			46.3			36.0	
Level of Service		D		C	B			D			D	
Approach Delay (s)		35.3			20.8			46.3			36.0	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	22.5
Intersection Capacity Utilization	100.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	585	0	0	445	45	0	0	1	76	0	54
Future Volume (vph)	31	585	0	0	445	45	0	0	1	76	0	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	16	12	12	12	12	12	12	12
Storage Length (ft)	75		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		161			590			449			248	
Travel Time (s)		3.7			13.4			10.2			5.6	
Peak Hour Factor	0.85	0.85	0.85	0.87	0.87	0.87	0.25	0.25	0.25	0.73	0.73	0.73
Heavy Vehicles (%)	14%	3%	0%	0%	3%	3%	0%	0%	0%	0%	0%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	36	688	0	0	563	0	0	4	0	0	178	0
Turn Type	Perm	NA			NA			NA		Split	NA	
Protected Phases		4			8			2		6	6	
Permitted Phases	4			8			2					
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	22.5	22.5		22.5	22.5		12.0	12.0		14.0	14.0	
Total Split (s)	55.0	55.0		55.0	55.0		13.0	13.0		14.0	14.0	
Total Split (%)	55.0%	55.0%		55.0%	55.0%		13.0%	13.0%		14.0%	14.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)	4.0	4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None		None	None	
v/c Ratio	0.14	0.70			0.50			0.01			0.39	
Control Delay	10.2	15.3			10.5			0.0			12.4	
Queue Delay	0.0	0.3			0.0			0.0			0.0	
Total Delay	10.2	15.6			10.5			0.0			12.4	
Queue Length 50th (ft)	3	83			57			0			6	
Queue Length 95th (ft)	30	461			325			0			52	
Internal Link Dist (ft)		81			510			369			168	
Turn Bay Length (ft)	75											
Base Capacity (vph)	424	1604			1859			643			514	
Starvation Cap Reductn	0	367			0			0			0	
Spillback Cap Reductn	0	0			0			0			0	
Storage Cap Reductn	0	0			0			0			0	
Reduced v/c Ratio	0.08	0.56			0.30			0.01			0.35	

Intersection Summary

Area Type: Other

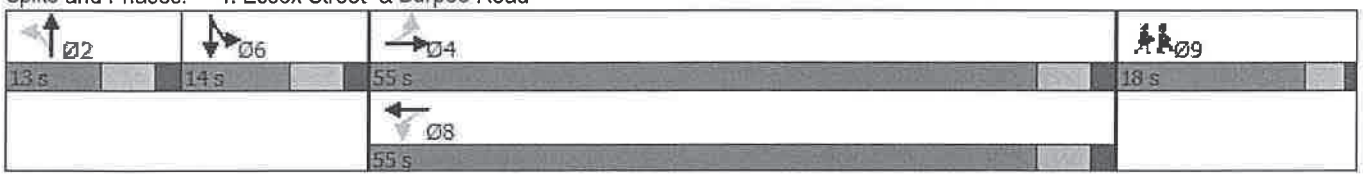
Cycle Length: 100

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	18.0
Total Split (s)	18.0
Total Split (%)	18%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Actuated Cycle Length: 50.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 4: Essex Street & Burpee Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	585	0	0	445	45	0	0	1	76	0	54
Future Volume (vph)	31	585	0	0	445	45	0	0	1	76	0	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	1.00			0.99			0.86			0.94	
Flt Protected	0.95	1.00			1.00			1.00			0.97	
Satd. Flow (prot)	1531	1783			2065			1644			1721	
Flt Permitted	0.29	1.00			1.00			1.00			0.97	
Satd. Flow (perm)	473	1783			2065			1644			1721	
Peak-hour factor, PHF	0.85	0.85	0.85	0.87	0.87	0.87	0.25	0.25	0.25	0.73	0.73	0.73
Adj. Flow (vph)	36	688	0	0	511	52	0	0	4	104	0	74
RTOR Reduction (vph)	0	0	0	0	4	0	0	4	0	0	118	0
Lane Group Flow (vph)	36	688	0	0	559	0	0	0	0	0	60	0
Heavy Vehicles (%)	14%	3%	0%	0%	3%	3%	0%	0%	0%	0%	0%	3%
Turn Type	Perm	NA			NA			NA		Split	NA	
Protected Phases		4			8			2		6	6	
Permitted Phases	4			8			2					
Actuated Green, G (s)	25.4	25.4			25.4			0.5			7.7	
Effective Green, g (s)	27.4	27.4			27.4			2.5			9.7	
Actuated g/C Ratio	0.48	0.48			0.48			0.04			0.17	
Clearance Time (s)	6.0	6.0			6.0			6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)	225	851			985			71			290	
v/s Ratio Prot		c0.39			0.27			c0.00			c0.03	
v/s Ratio Perm	0.08											
v/c Ratio	0.16	0.81			0.57			0.00			0.21	
Uniform Delay, d1	8.5	12.8			10.8			26.3			20.5	
Progression Factor	1.00	1.00			1.00			1.00			1.00	
Incremental Delay, d2	0.3	5.7			0.8			0.0			0.4	
Delay (s)	8.8	18.5			11.5			26.3			20.9	
Level of Service	A	B			B			C			C	
Approach Delay (s)		18.0			11.5			26.3			20.9	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	676	0	0	779	120	0	0	0	64	0	48
Future Volume (vph)	59	676	0	0	779	120	0	0	0	64	0	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	16	12	12	12	12	12	12	12
Storage Length (ft)	75		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		162			590			449			248	
Travel Time (s)		3.7			13.4			10.2			5.6	
Peak Hour Factor	0.85	0.85	0.85	0.93	0.93	0.93	0.25	0.25	0.25	0.95	0.95	0.95
Heavy Vehicles (%)	2%	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	69	795	0	0	967	0	0	0	0	0	118	0
Turn Type	Perm	NA			NA					Split	NA	
Protected Phases		4			8			2		6	6	
Permitted Phases	4			8			2					
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	22.5	22.5		22.5	22.5		12.0	12.0		19.0	19.0	
Total Split (s)	51.0	51.0		51.0	51.0		12.0	12.0		19.0	19.0	
Total Split (%)	51.0%	51.0%		51.0%	51.0%		12.0%	12.0%		19.0%	19.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)	4.0	4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None		None	None	
v/c Ratio	0.29	0.58			0.60						0.34	
Control Delay	11.2	9.8			9.7						7.6	
Queue Delay	0.0	0.1			0.0						0.0	
Total Delay	11.2	9.9			9.7						7.6	
Queue Length 50th (ft)	6	94			116						0	
Queue Length 95th (ft)	55	456			#655						35	
Internal Link Dist (ft)		82			510			369			168	
Turn Bay Length (ft)	75											
Base Capacity (vph)	240	1377			1605						520	
Starvation Cap Reductn	0	47			0						0	
Spillback Cap Reductn	0	0			0						0	
Storage Cap Reductn	0	0			0						0	
Reduced v/c Ratio	0.29	0.60			0.60						0.23	

Intersection Summary

Area Type: Other

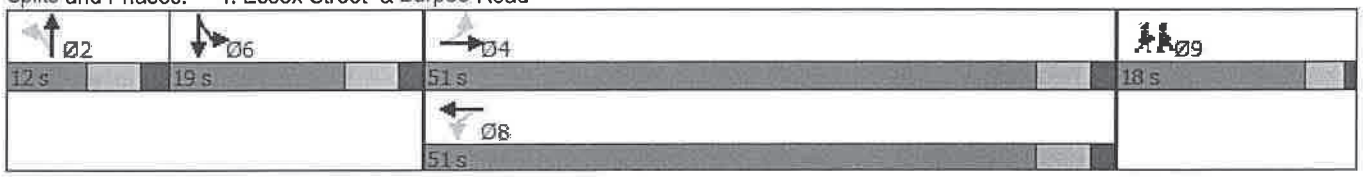
Cycle Length: 100

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Right Turn on Red	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	18.0
Total Split (s)	18.0
Total Split (%)	18%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Actuated Cycle Length: 65.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Essex Street & Burpee Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	676	0	0	779	120	0	0	0	64	0	48
Future Volume (vph)	59	676	0	0	779	120	0	0	0	64	0	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0						4.0	
Lane Util. Factor	1.00	1.00			1.00						1.00	
Frt	1.00	1.00			0.98						0.94	
Flt Protected	0.95	1.00			1.00						0.97	
Satd. Flow (prot)	1711	1818			2115						1740	
Flt Permitted	0.18	1.00			1.00						0.97	
Satd. Flow (perm)	317	1818			2115						1740	
Peak-hour factor, PHF	0.85	0.85	0.85	0.93	0.93	0.93	0.25	0.25	0.25	0.95	0.95	0.95
Adj. Flow (vph)	69	795	0	0	838	129	0	0	0	67	0	51
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	107	0
Lane Group Flow (vph)	69	795	0	0	964	0	0	0	0	0	11	0
Heavy Vehicles (%)	2%	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA			NA					Split	NA	
Protected Phases		4			8			2		6	6	
Permitted Phases	4			8			2					
Actuated Green, G (s)	46.4	46.4			46.4						4.8	
Effective Green, g (s)	48.4	48.4			48.4						6.8	
Actuated g/C Ratio	0.69	0.69			0.69						0.10	
Clearance Time (s)	6.0	6.0			6.0						6.0	
Vehicle Extension (s)	3.0	3.0			3.0						3.0	
Lane Grp Cap (vph)	219	1258			1464						169	
v/s Ratio Prot		0.44			c0.46						c0.01	
v/s Ratio Perm	0.22											
v/c Ratio	0.32	0.63			0.66						0.07	
Uniform Delay, d1	4.2	5.9			6.1						28.7	
Progression Factor	1.00	1.00			1.00						1.00	
Incremental Delay, d2	0.8	1.0			1.1						0.2	
Delay (s)	5.1	6.9			7.2						28.8	
Level of Service	A	A			A						C	
Approach Delay (s)		6.8			7.2			0.0			28.8	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group