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Transportation Engineers & Planners

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Ref: 8975

May 24, 2024

Lisa Schwarz, Assistant Director
Town of Andover
36 Bartlett Street
Andover, MA 01810

Re: VAI Response to Traffic Engineering Peer Review #2
Town Yard Redevelopment
Andover, Massachusetts

Dear Lisa:

Vanasse & Associates, Inc. (VAI) has provided responses to comments that were raised in the April 18, 2024 *Traffic Engineering Peer Review #2* letter prepared by The Engineering Corp (TEC) concerning their review of the March 18, 2024 *VAI Response to Traffic Engineering Peer Review* letter that was been prepared by VAI in support the proposed Town Yard redevelopment to be located in Andover, Massachusetts (hereafter referred to as the "Project"). Listed below are the comments that were identified by TEC in the subject letter that pertain to the March 18, 2024 report and require a response, followed by our response on behalf of the Project proponent.

The TEC comments included a section on the Transportation Impact Assessment (TIA) and a section on Initial Site Plan Comments. Responses to the TIA comments were prepared by VAI and responses to the site plan comments were prepared by the Morin-Cameron Group, the Project site engineer.

Traffic Impact Assessment Comments

Comment 1: *The Traffic Impact Assessment (TIA) included the following intersections within the study area:*

- *North Main Street (Route 28) / Railroad Street / Private Driveway / Retail Plaza*
- *North Main Street (Route 28) / Lewis Street*
- *North Main Street (Route 28) / Pearson Street*
- *Pearson Street / Lewis Street [Site Driveway] / Depot Pizza Parking Driveway*
- *Pearson Street / Essex Street / Railroad Street / Dundee Park Drive*
- *Essex Street / School Street*
- *Essex Street / Ridge Street / Brook Street*
- *School Street / Lupine Road / Ridge Street*

The North Main Street (Route 28) / Main Street (Route 28) / Elm Street / Central Street intersection, also referred to as Elm Square, was evaluated as part the separate Supplemental Traffic Analysis (STA) document discussed at the end of this TIA review section.

TEC believes that the intersection of Lewis Street / Buxton Court should be added to the study area in terms of safety review and, at a minimum, a qualitative analysis of the traffic operations. Note that a qualitative analysis of the operations will not require formal turning movement counts (TMCs) to be conducted; however, the TIA should provide information as to the traffic volume impacts to each approach.

VAI Response: Lewis Street at Buxton Court is currently a T-intersection operating with Buxton Court as the minor street under STOP-like control, with no pavement markings delineating travel direction present. In terms of safety, no crashes have occurred at this intersection between 2016 and 2022. Under the future Build condition with the Project, this T-intersection will be modified to a 90-degree junction without conflicting traffic volumes, so there will be no need for traffic control signage. Build-condition traffic volumes at the intersection are projected to increase by 16 to 20 vehicles compared to No-Build traffic volumes. This is equivalent to 1 vehicle every 3 minutes. Under Existing conditions Lewis Street connects to Pearson Street at the west end of the roadway. Under Build conditions, Lewis Street west of Buxton Court will be a dead-end and Buxton Court will wrap around the residential building and become the site driveway at the west end of the roadway.

TEC Response: *Comment addressed. No further response required.*

Comment 2: *The TIA states that a comprehensive field inventory of the study area was conducted in August and September 2023. The inventory consisted of existing roadway geometrics, traffic volumes, operating characteristics, posted speed limits, parking characteristics, access driveways, and the current configuration. Many components of the roadway characteristics are not described as part of the study.*

Although the TIA notes that exclusive turn lanes have been provided at some intersections following repaving, please provide more detail as to the location of these turn lanes as the width of Pearson Street (roughly 24 feet curb-to-curb) does not seem to support any additional lanes beyond the two opposing general-purpose lanes. Was the intent to describe the new turn lane along north main Street at its intersection with Pearson Street?

VAI Response: The statement in the Comprehensive Field Inventory section was general and not indicative of every roadway in the study area.

TEC Response: *See Comment #3 and TEC's response to Comment #3.*

Comment 3: *In conjunction with Comment #2 above, please provide detailed description of each study area intersection beyond the data / information provided in Figure 2 such as on-street parking, approach-by-approach control, control signage and pavement markings, directional separation, etc. Please include any other descriptive measures that may be pertinent to the analysis and recommendations further described alter in the TIA.*

VAI Response: **Intersections**

North Main Street (Route 28) / Railroad Street / Private Driveway / Retail Plaza:

Route 28 provides on-street parking on both sides of the roadway and Railroad Street provides on-street parking on one side of the roadway that alternates sides of the street. All approaches are under signalized control. The Route 28 north and Railroad Street approaches have "NO RIGHT TURN ON RED" signs. All roadways are bi-directional and have a double-yellow centerline with NO TURN LANE pavement markings.

North Main Street (Route 28) / Lewis Street

Route 28 provides on-street parking on both sides of the roadway and Lewis Street provides on-street parking on the north side of the roadway. All approaches are under signalized control. The Lewis Street approach has a "NO RIGHT TURN ON RED" sign. All roadways are bi-directional and have a double-yellow centerline with NO TURN LANE pavement markings.

North Main Street (Route 28) / Pearson Street

Route 28 provides on-street parking on both sides of the roadway north of the intersection and Pearson Street provides on-street parking on the north side of the roadway. The Pearson Street approach is under STOP-sign control. All roadways are bi-directional and have a double-yellow centerline with a LEFT-TURN LANE pavement marking on the Route 28 northbound approach.

Pearson Street / Lewis Street [Site Driveway] / Depot Pizza Parking Driveway

Pearson Street provides on-street parking on the north side of the roadway. The Lewis Street and the Depot Pizza driveway approaches are under STOP-sign control. There is no intersection signage. All roadways are bi-directional, and Pearson Street has a double-yellow centerline with NO TURN LANE pavement markings.

Pearson Street / Essex Street / Railroad Street / Dundee Park Drive

Pearson Street and Essex Street provide on-street parking on the north side of the roadway. The Railroad Street and Dundee Park Drive approaches are under STOP-sign control. The Essex Street west approach has a "DO NOT STOP ON TRACKS" sign. All roadways are bi-directional, and Pearson Street, Essex Street, and Railroad Street have a double-yellow centerline with NO TURN LANE pavement markings.

Essex Street / School Street

Essex Street provides on-street parking on the north side of the roadway and School Street provides on-street parking on the east side of the roadway. The School Street approach is under YIELD-sign control. There is no intersection signage. All roadways are bi-directional and have a double-yellow centerline with NO TURN LANE pavement markings.

Essex Street / Ridge Street / Brook Street

Essex Street provides on-street parking on the north side of the roadway west of the intersection and on both sides of the roadway east of the intersection. Ridge Street provides on-street parking on the west side sides of the roadway and Brook Street provides on-street parking on the north side of the roadway. The Ridge Street approach is under STOP-sign control. The Essex Street approach east of the intersection has "DO NOT ENTER" sign and the Brook Street approach has a "ONE-WAY" sign. The Ridge Street and the Essex Street west approaches are bi-directional and each street has a double-yellow centerline with NO TURN LANE pavement markings. The Brook Street approach is one-way eastbound, and the Essex Street east approach is one-way westbound, with NO TURN LANE pavement markings.

School Street / Lupine Road / Ridge Street

School Street provides on-street parking on the north/west side of the roadway, Ridge Street provides on-street parking on the west side of the roadway, and Lupine Road provides on-street parking on both sides of the roadway. The Ridge Street approach is under STOP-sign control and Lupine Road is under YIELD-sign control. There is no intersection signage. All roadways are bi-directional, and School Street and Lupine Road have a double-yellow centerline with NO TURN LANE pavement markings.

TEC Response: *Comment generally addressed. TEC notes that there are a few minor text discrepancies; including at the intersection of Essex Street / Ridge Street / Brook Street there is notation of The Ridge Street and the Essex Street west approaches are bi-directional, and each street has a double yellow centerline with no pavement markings. If there is a double yellow centerline there actually are pavement markings.*

VAI Response: The appropriate changes have been made in the description of the intersection of Essex Street / Ridge Street / Brook Street section of the response above.

Comment 4: *TMCs were conducted at the study area intersections in September 2023 between the hours of 7:00 AM and 9:00 AM for the weekday morning peak period and between the hours of 4:00 PM and 6:00 PM for the weekday evening peak period. Peak hours analyzed within these periods have not been specifically mentioned in the body of the TIA. In reviewing the TMCs in the Appendix, the AM and PM peak hours appear to begin at 8:00 AM and 4:45 PM, respectively, at most locations. This should be clarified so to note locations that may be different, leading to unbalanced traffic volumes intersection-to-intersection.*

VAI Response: The morning and evening peak hours for the study area intersections:

- North Main Street (Route 28) at Railroad Street (8:00, 4:45)
- Route 28 at Lewis Street (8:00, 4:45)
- Route 28 at Pearson Street (8:00, 4:45)
- Pearson Street at the site driveway/Depot Pizza parking lot (8:00, 5:00)
- Pearson Street at Essex Street and Railroad Street/Dundee Park Drive (7:45, 4:30)
- Essex Street at School Street (7:45, 5:00)

- Essex Street at Ridge Street and Brook Street (7:45, 5:00)
- School Street at Lupine Road and Ridge Street (7:45, 5:00)

It is mentioned in the figures that some intersections are not balanced to one another; however, the peak-hour volumes for each individual intersection were used for analysis purposes.

TEC Response: *Comment addressed. No further response required.*

Comment 5: *Traffic volumes were reviewed for weekday seasonal adjustments based on historical traffic-volume data from Massachusetts Department of Transportation (MassDOT). Traffic counts for September reflect above average conditions, so they were not seasonally adjusted. TEC concurs with this methodology*

VAI Response: No response required.

TEC Response: *Comment addressed. No further response required.*

Comment 6: *Bicycle and pedestrian counts were evaluated during the same periods noted in Comment #4. A comprehensive field inventory of existing sidewalks, pedestrian crossing locations, and bicycle facilities was conducted as well, and is described on page 7 of the TIA. Figure 2 also shows pedestrian facilities graphically. In a field review, TEC determined that there is one additional pedestrian crossing on Railroad Street at the MBTA Commuter Rail Station. This should be stated in the TIA.*

VAI Response: The indicated pedestrian crossing has been added to Figure 2 which is included in the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Comment 7: *Public transportation consists of the MBTA Haverhill Line via Andover Station to/from North Station in Boston as well as MVRTA bus service on Routes 21 and 2. Description of the proximity for each public transportation use is provided in Table 2 and scheduling information has been provided in the Appendix. No response required.*

VAI Response: No response required.

TEC Response: *Comment addressed. No further response required.*

Comment 8: *MassDOT crash records were evaluated for the years 2016-2020, the latest available 5-year period of complete data and have been described in the TIA. Of the eight (8) study area intersections studied, three (3) were shown to have crash rates above 0.57 crashes per million entering vehicles (MEV) for unsignalized intersections (MassDOT District 4 rate). These intersections include Pearson Street / Lewis Street [Site Driveway] / Depot Pizza Parking Driveway (0.86 crashes per MEV), Essex Street / School Street (0.64 crashes per MEV), and Essex Street / Brook Street / Ridge Street (1.25 crashes per MEV). The TIA does not describe direct off-site mitigation by the Applicant to reduce these crash rates or directly address safety at these locations. Although off-site mitigation is further described in subsequent comments, the*

Applicant should work with the Town to evaluate and implement, at a minimum, short-term / low-cost safety improvement countermeasures at these key locations.

VAI Response: The intersections noted to have crash rates above the MassDOT average crash rates are projected to be improved by the MassWorks grant project.

TEC Response: *It is possible the Town Yard redevelopment could occur with or without the Mass Works project. TEC understands that the Mass Works project is funded and still in the design stage; however, until design is complete, and the construction is commenced, there is no guarantee that the project will be completed. With the understanding that any commitments to mitigation may be moot upon this, the Applicant should work with the Town to evaluate and implement, at a minimum, short-term / low-cost safety improvement countermeasures at these key locations.*

VAI Response: Due to the Project's minor effects, the Project should not be required to implement improvements at these intersections. At the Essex Street/School Street intersection and the Essex Street/Ridge Street/Brook Street intersection, the Project adds 2 to 3 trips without the closure of Pearson Street and this shows negligible impacts from the Project. In the event of the closure of Pearson Street, the Project sends 18 to 23 trips through these intersections; however, the closure of Pearson Street would likely coincide with the implementation of the MassWorks improvements at these locations. No improvements are necessary at the intersection of Pearson Street / Lewis Street [Site Driveway] / Depot Pizza Parking Driveway, as 2 crashes in 5 years is not significant, regardless of the crash rate.

Comment 9: *To obtain future year volumes (2030), the September counts were adjusted at a rate of 1% per year compounded, based on area growth between 2009 and 2019. This growth rate accounts for background traffic as well as for a specific development by others (#305 North Main Redevelopment). TEC finds this acceptable. Another project described is located at the Draper Block – #27 Main Street. The TIA states that based on a special permit for this project site-generated trips were included in the Town Yard Redevelopment; however, the trip generation for Draper Block, which would be applied to the 2030 No-Build volumes, has not been provided in the TIA, and therefore, cannot be confirmed.*

VAI Response: The 27 Main Street project (Draper Block project) site-generated trips are shown in the Appendix to this letter as Figure A1 and Figure A2.

TEC Response: *The Applicant has provided a marked-up version of the trip generation. Is there a clean version directly from the project's TIA?*

VAI Response: The Town did not have a traffic study for the Draper Block project, and the only documentation available was a copy of the Special Permit. Trip generation was therefore estimated using ITE data and the information in the Special Permit, and trips were assigned using engineering judgment. The trip generation and figures are included in the Appendix to this letter.

Comment 10: *The TIA describes roadway improvement work conceptually planned under a Mass Works Infrastructure Grant along the Essex Street Corridor. The $3.3 million grant was obtained by the town in October 2023 to directly support the Town Yard site. These improvements include, but are not limited to:*

- *Removal of the Pearson Street connection to the existing Pearson Street / Essex Street / Railroad Street / Dundee Park Drive intersection.*

- *Essex Street and Brook Street will be reconstructed to provide one-way and two-way bike lanes. At certain locations, there will be on-street parking provided along one or both sides of the roadway.*

- *A marked crosswalk will be provided for crossing the approach of School Street for the intersection of Essex Street / School Street.*

- *At the Depot Pizza location along Pearson Street is where Pearson Street will be turned into a small roundabout and cut back from the five-way intersection with Essex Street.*

The timing of this Mass Works project construction would generally coincide with the redevelopment of the Town Yard based on redevelopment-specific supporting nature of the public infrastructure improvements defined in the grant application. It is possible the Town Yard redevelopment could occur with or without the Mass Works project. Additional comments regarding operational analyses and off-site mitigation for these possibilities are subsequently identified in this peer review letter.

VAI Response: No response required.

TEC Response: *Comment addressed. No further response required.*

Comment 11: *The project's trip generation calculations were generated based on the industry standard Institute of Transportation Engineers (ITE) publication, Trip Generation, 11th Edition for Land Use Code (LUC) 221 Multifamily Housing (Mid-Rise), LUC 492 Health/Fitness Club, LUC 712 Small Office Building, LUC 495 Recreation Community Center, and LUC 937 Coffee/Donut Shop with Drive-Through Window. TEC notes the following concurrence and notations:*

As the gym, office, and coffee shop uses on the site would almost exclusively be utilized by the residents of the development, separate trip generation calculations for these uses would generally be seen as conservative in nature. TEC would concur that the overall reporting of total trip generation to/from the site is likely higher than the real-life scenario expected following occupancy.

Since the site will have multiple land uses, not all trips will originate from external traffic. An internal trip capture of 10 percent was assumed for all site land uses except the recreational community center. The Applicant should provide a more detailed breakdown of the results and the specific justification of the 10 percent internal capture rate. Note that from a macroscopic review level, TEC does agree that a 10 percent internal capture for these uses; considering the trip generation calculations were not necessarily required (see above bullet), is generally conservative in nature.

In Table 4 of the TIA, the mode split by land use has been provided. The Appendix includes a table showing the derivation of these mode splits based on area census percentages; however, no details of the derivation of the results have been provided for review. TEC is unable to determine their validity.

The Applicant should provide a more detailed step-by-step breakdown of both internal capture, person trips, and mode share credits, as well as documentation to the justification of each credit value. This includes looking into the trip generation calculation results shown in Table 5, which effectively shows that the coffee shop, almost exclusively used by the residents, as the primary use in the AM and an extensive use throughout the day. For instance, the 'walk' and 'other' mode share for coffee shop are 30% while they are only 13% and 21%, respectively for residential land use. If the credits applied forces the resulting 'residential' trip levels down in favor of coffee shop, the higher mode split credits for coffee shop as compared to residential result in less overall trips projected; even when the residential units are the primary use.

VAI Response: The Project is intended as a mixed-use development with convenient access to multiple public transit services. Unfortunately, there is no one ITE land use code that represents a mixed-use development with the uses proposed that are adjacent to multiple transit services. While ITE has a Mixed-Use Development[1] methodology for developing the exact rate of internal capture between several land uses at a site, this detailed methodology is intended for sites ranging between 100,000 square feet (sf) and 2,000,000 sf, which would have peak-hour trip generation in the hundreds or potentially thousands of trips. By comparison, this site has 163 residential units with 5,000 sf of mixed commercial space. Not including the residential units, the commercial space is expected to generate 48 to 79 peak-hour trips with 63 to 89 percent of that from the café space. While the overall methodology may not be strictly applicable to this Project due to its smaller size and trip generation, some data that could be used is for internal capture rates. Rates of internal capture between residential and restaurant uses in the ITE methodology range between 12 and 20 percent during peak hours; accordingly, VAI used a base internal capture rate of 10 percent.

In addition to the 10 percent internal capture rate, other adjustments were considered for the Project trip generation. The initial base step was to calculate vehicle trips using ITE discrete (stand-alone) land uses. This is a conservative assumption as the commercial land uses are generally considered as an accessory to the residential uses, both on-site and in the neighborhood. It was estimated that there are nearly 400 housing units within 0.25-mile (a 5-minute walk) of the Project, in addition to the proposed 163 units for the Project. For many of these residents, walking or biking through the site to the café or the gym on their way to another destination or back home for remote work is a probability. In this case, assumptions for 30 percent walking/biking and 30 percent working from home with only 40 percent driving for these commercial uses is expected to be a conservative assumption.

Trips associated with the café have the added component of pass-by traffic to consider. Studies have indicated the amount of trips to a coffee shop originating from existing traffic passing by the use can be as high as 90[2] percent. No formal pass-by traffic was assumed for this analysis, but the café should have a similar experience with customers able to walk to the café from the neighborhood or the residences on-

[1] *Trip Generation for Mixed-Use Development; Trip Generation Handbook, 3rd Edition;* ITE; Washington, D.C.; 2017.
[2] *Pass-By Rates by Land Use; ITE Trip Generation Manual, 11th Edition;* ITE; Washington, D.C.; 2021.

site or picking up an order before departing the site in their personal vehicle or utilizing public transit.

With regard to the mode split for the residences, the existing census data for the census tract the site is located in likely does not reflect the same proximity of the residences to the commuter rail station as is the case with this Project. Accordingly, this data was revised and adjusted to account for increased public transit usage and reduced auto usage. Additional justification for this change is shown in data from ITE related to Transit-Friendly Site Mode Share data, which indicated percentage of transit for motorized trips could be between 62 and 78 percent for work/school-based trips and between 56 and 68 percent for all trips for sites within 600 feet of a heavy (commuter) rail facility. This is shown in the Appendix to this letter, Figure D.4 from the ITE *Trip Generation Handbook.*[3]

TEC Response: *The information provided in the updated TIA is still similar to the original study. The Applicant should provide a more detailed step-by-step breakdown of calculation of both internal capture, person trips, and mode share credits, as well as documentation to the justification of each credit value. Please separate out each step of the calculation and provide source references for credits. Please also note the following:*

- *Although not included in the analysis, pass-by trips to/from the coffee shop would be expected to be limited with the closure of Pearson Street as part of the Mass Works project.*

- *TEC understands the use of the Figure D.4 from the ITE Trip Generation Handbook; however, this data is taken from the WMATA which pertains to the Washington DC rail system which, in comparison, is more like the MBTA's Red Line and Orange Line, not commuter rail including small headways and destination stops in close proximity. TEC agrees that the percentage of potential use is high; however, would generally only pertain to key destinations along that rail line; particularly Boston, Malden Center, Wakefield, etc.*

VAI Response: A detailed step-by-step breakdown of the trip calculations for internal capture and mode split is included in the Appendix of this letter. With regard to references and justification for credits, the previously provided information sources are what is available.

The WMATA data is noted in the ITE reference as proximity to "Heavy Rail"; however, a review of the study indicates this refers to sites with the presence of both commuter rail (similar to the MBTA commuter rail system) as well as rapid rail transit (similar to the MBTA Orange/Red/Blue line subway system). A more detailed review of the data indicates there were 12 sites that were studied for this analysis and of the 3 sites near stations where the Metrorail, Metrobus, and other transit services were available, the residential auto mode split was lower than that used in the TIA. A summary of this data is provided in the Appendix to this letter.

While the MBTA Andover Station adjacent to the site provides commuter rail service which can be used for travel to the hub of North Station and other connections along

[3] *Figure D.4, Appendix D. Key Research with Transit-Friendly Site Mode Share Data; Trip Generation Handbook, 3rd Edition;* ITE; Washington, D.C.; 2017.

the way, the MVRTA bus line 2 and bus line 21 both stop at the Andover Station as well, and these stop at local destinations including Shawsheen Plaza, the North Andover Mall, and The Robb Center Senior Center. These transit services, located a 2-3 minute walk from the site, would appear to increase the likelihood of transit use by Project residents, although there is no hard data or references to confirm this.

In an effort to move beyond this issue, an alternative analysis was conducted based on unadjusted vehicle trip-generation estimates from ITE without any trip adjustments based on internal capture, mode split, or pass-by traffic. This analysis was conducted at the four intersections closest to the Project as these would be the locations most affected by what would be an effective increase in the Project trip generation. The results of this alternative analysis were compared to the analysis provided in the March 2024 *Updated Transportation Impact Assessment*. The comparison is shown in Tables 12R and 13R.

Table 12R
SIGNALIZED INTERSECTION LEVEL OF SERVICE SUMMARY – NO TRIP ADJUSTMENTS

Signalized Intersection/ Peak Hour/Movement	2030 Build				2030 Build No Trip Adjustments			
	V/C[a]	Delay[b]	LOS[c]	Queue[d] Avg/95th	V/C	Delay	LOS	Queue Avg/95th
Route 28 at Lewis Street								
Weekday Morning:								
Lewis Street EB LT/RT	0.14	18.5	B	1/1	0.24	17.4	B	1/1
Route 28 NB LT/TH	0.35	5.5	A	0/8	0.39	7.1	A	2/8
Route 28 SB TH/RT	0.41	6.1	A	0/12	0.46	8.0	A	3/13
Overall	--	**6.1**	**A**	--	--	**8.0**	**A**	--
Weekday Evening:								
Lewis Street EB LT/RT	0.14	18.9	B	1/1	0.23	17.5	B	1/1
Route 28 NB LT/TH	0.43	6.6	A	0/14	0.48	8.5	A	3/15
Route 28 SB TH/RT	0.34	5.3	A	0/10	0.37	6.7	A	2/10
Overall	--	**6.3**	**A**	--	--	**8.1**	**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; EB = eastbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

Table 13R
UNSIGNALIZED INTERSECTION LEVEL OF SERVICE SUMMARY – NO TRIP ADJUSTMENTS

Unsignalized Intersection/ Critical Movement/Peak Hour	2030 Build				2030 Build No Trip Adjustments			
	Demand[a]	Delay[b]	LOS[c]	Queue[d]	Demand	Delay	LOS	Queue
Route 28 at Pearson Street								
Weekday Morning:								
Pearson Street EB LT/RT	97	33.0	D	3	97	36.8	E	3
Weekday Evening:								
Pearson Street EB LT/RT	115	30.0	D	3	115	32.1	D	3
Pearson Street at the Project Site Dwy/Depot Pizza								
Weekday Morning:								
Depot Pizza NB LT/TH/RT	1	8.8	A	0	1	8.8	A	0
Project Site Dwy SB LT/TH/RT	18	9.0	A	1	18	9.4	A	1
Weekday Evening:								
Depot Pizza NB LT/TH/RT	0	0.0	A	0	0	0.0	A	0
Project Site Dwy SB LT/TH/RT	11	9.3	A	1	11	9.8	A	1
Essex Street at Pearson Street/Railroad Street/ Dundee Park Drive								
Weekday Morning:								
Dundee Park Drive NB LT/TH/RT/HRT	13	20.3	C	1	13	21.2	C	1
Essex Street WB LT/TH/RT/HRT	366	5.4	A	2	366	5.6	A	3
Pearson Street SWB HLT/LT/RT/HRT	55	6.9	A	1	55	7.5	A	1
Railroad Street SB HLT/LT/TH/RT	207	>50.0	F	8	207	>50.0	F	9
Essex Street EB HLT/LT/TH/RT	388	5.4	A	2	388	5.7	A	3
Weekday Evening:								
Dundee Park Drive NB LT/TH/RT/HRT	105	>50.0	F	9	105	>50.0	F	9
Essex Street WB LT/TH/RT/HRT	454	7.4	A	4	454	7.6	A	5
Pearson Street SWB HLT/LT/RT/HRT	75	8.1	A	1	75	8.5	A	1
Railroad Street SB HLT/LT/TH/RT	191	>50.0	F	7	191	>50.0	F	8
Essex Street EB HLT/LT/TH/RT	391	6.2	A	3	391	6.5	A	3

[a]Demand in vehicles per hour.
[b]Delay in seconds per vehicle.
[c]Level of service.
[d]95th percentile queue length (veh).
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; SWB = southwestbound; LT = left-turning movements; TH = through movements; RT = right-turning movements; HRT = hard right-turning movements.

This alternative analysis is the most conservative approach of trip generation for an area close to public transportation and other alternative modes of transportation. The only change in level of service for the new 2030 Build condition over the previous 2030 Build condition is from LOS D to LOS E during the weekday morning peak hour at the Route 28/Lewis Street intersection. However, the delay increase at this location due to the Project is 3.8 seconds, and only 1.8 seconds over the threshold of LOS E. The unadjusted trip generation is provided in the Appendix to this letter.

This analysis was conducted to show that, even neglecting the effects of the nearby commuter rail stop, the likely correlation between the proposed uses, and the adjustments in mode split for all the uses due to their proximity to each other, the Project does not have a significant effect on area intersections closest to the site.

Comment 12: *The trip distribution provided in the TIA appears to match the Journey to Work US Census data provided in the Appendix. TEC would note that the overall percentage to/from the west on Essex Street appears high and may be skewed by the Boston-metro*

portion of the distribution. TEC suggests that the Applicant reevaluate the trip distribution in conjunction with the public transportation credit taken as much of the site trips utilizing the MBTA Commuter Rail next door will be travelling to/from Boston (2nd highest worker destination) and Cambridge (5th highest worker destination) representing 17% of the overall workforce breakdown. Some communities will not utilize public transportation at all based on the ability to provide continuous service to/from the origin / destination of the trip.

VAI Response: The census data was reevaluated based on the comment above. In addition to Boston and Cambridge, a number of Andover residents work in other locations accessible by the Haverhill commuter rail line which raises the potential for use of the commuter rail to 20 percent. The updated trip distribution is included in the updated TIA.

TEC Response: *TEC has no further comment on the above referenced comment; however, TEC does note that the distribution at the site driveway may be different based on the Town's Mass Works Grant project where the connection of Pearson Street over the tracks is expected to be eliminated.*

VAI Response: We concur, no response required.

Comment 13: *The Applicant has provided stopping sight distance (SSD) and intersection sight distance (ISD) measurements for the Site Driveway along Pearson Street. The results are shown in Table 8 of the TIA and have been compared to recommended values obtained from A Policy on Geometric Design of Highways and Streets, 7th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2018. The measured distances have been shown in the TIA to exceed these values, except for the ISD for vehicles looking west while exiting the site (111 feet). However, Table 8 contains notes stating that three of the four measured distances have been determined if parked cars to the east were removed and if a hedge to the west were cut. The fourth measured distance of 241 feet (SSD approaching from the west) is questionable since Pearson Street is roughly 100 feet from its intersection with Essex Street to the site driveway. A distance of 241 feet could only be attained by measuring further west along Essex Street, which places the limit about 150 feet from the railroad tracks. At this point, the sight distance is further affected by a concrete retaining wall in the parking area of Ann's Cleaners at #2 Railroad Street, as well as a railroad signal gate and utility poles on Pearson Street near the proposed site driveway. The Applicant should provide a graphical depiction, preferably in the form of a sight triangle sheet in the site plans, of the sight lines for this driveway. Sight lines to the east along Pearson Street should not cross over the head-in parking stalls proposed along the northerly side of the roadway.*

VAI Response: The sight distance graphic for this intersection (SD-1) is included in the Appendix to this letter and in the updated TIA.

TEC Response: *TEC acknowledges the sight line graphic SD-1 provided; however, the Applicant has not addressed sight line related items towards the west or the tracks in the above comment. TEC acknowledges that these sight lines may be moot based on the Mass Works project; however, there is no guarantee that the project will be completed even if funded.*

VAI Response: See updated Figures SD-1A and SD-1B in the Appendix to this letter depicting sight distances east and west of the driveway assuming Pearson Street remains continuous to Essex Street.

Comment 14: *The Applicant should provide sight distance measurements for the intersection of Lewis Street / Buxton Court as a primary access/egress point to/from the site. The Applicant should provide a graphical depiction, preferably in the form of a sight triangle sheet in the site plans, of the sight lines at this location.*

VAI Response: As there is no conflicting traffic volume at this location, the need for sight distance is reduced from a standard intersection. However, a graphical depiction (SD-2) is included in the Appendix to this letter and in the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Comment 15: *TEC reviewed the results of the traffic operational analysis provided as part of the TIA. Signalized and unsignalized intersections were analyzed using Synchro 10TM software, except for the intersection of Essex Street / Pearson Street / Railroad Street / Dundee Park Drive, which was analyzed using SIDRA software since the intersection contains five approach roadways. The methodology utilized was discussed in the TIA and is compatible with MassDOT guidelines and is appropriate. For signalized intersections, the Highway Capacity Manual (HCM) 2010 percentile delay method was used. For unsignalized intersections, the HCM 2000 delay method was used. For the SIDRA model, the delays were calculated using the SIDRA Intersection 9.0TM user Guide, which produces results based on the HCM. TEC concurs with the use of these analysis tools; however, the TIA should be clarified as Table 9 depicts the threshold from the incorrect corresponding HCM used for signalized intersections.*

VAI Response: VAI has provided the LOS delay ranges from the correct HCM methodology in the Appendix to this letter.

TEC Response: *Note that this material was not provided in the Appendix; but was provided in the revised TIA.*

Comment 16: *Narratives on the traffic operational analysis results for all study locations have been provided in the TIA as well as summary tables for 2023 Existing, 2030 No-Build, and 2030 Build conditions. Overall, the signalized results show levels of service (LOS) C or better for the subject signalized intersections; however, there are individual movements (Railroad Street eastbound) at the intersection of North Main Street / Railroad Street / Private Driveway / Retail Plaza that are shown to operate at LOS E for 2030 No-Build and Build conditions. The Applicant should coordinate with the Town on opportunities at 75% occupancy to reevaluate the operations at this location in the field to adjust traffic signal timings as necessary.*

VAI Response: The locations noted are expected to be improved through the MassWorks project which is expected to begin construction in fall 2024 or spring 2025 and should be complete prior to 2030; therefore, there is no need for additional evaluation.

TEC Response: *Note that the location in question is the intersection of North Main Street / Railroad Street / Private Driveway / Retail Plaza which is not part of the Mass Works project. Comment not addressed.*

VAI Response: As noted in the initial comment, the Project does not change the LOS of this individual movement since the Project is not expected to add traffic to this movement. Accordingly, there is no need for additional evaluation.

Comment 17: *Most of the individual movements at unsignalized intersections are at LOS D or better; however, some of the approaches at the Essex Street / Pearson Street / Railroad Street / Dundee Park Drive intersection are shown to operate at LOS D, E, or F, depending on the condition analyzed. A LOS of "D" or better is generally defined as "acceptable" operating conditions. Additional off-site mitigation should be explored and considered to improve the LOS E and F conditions noted. At a minimum, the Applicant should evaluate opportunities to modify the traffic control at this location. These enhancements may be an expansion of Mass Works improvements proposed at the location.*

A Traffic Signal Warrant Analysis (TSWA) was conducted for the Essex Street / Pearson Street / Railroad Street / Dundee Park Drive intersection. A design speed of 25 MPH was used, and traffic volumes were adjusted downward to average month conditions for 2023 Existing and 2030 Build. The TIA indicates that a traffic signal is not warranted under 2023 Existing or 2030 Build conditions. TEC generally concurs with the analysis parameters and results. The Applicant should provide supporting documentation showing the traffic volume adjustments in the Appendix.

VAI Response: As noted above, the Essex Street/Railroad Street/Dundee Park Drive intersection is expected to be improved through the MassWorks project which include cutting off Pearson Street prior to this intersection. The traffic signal warrant analysis of the reconfigured intersection that was provided in the TIA indicated a signal was not warranted. Therefore, options to improve operations at this location are limited to changes in unsignalized control. Currently, the intersection operates with Essex Street under free-flow conditions. Implementing all-way STOP control will deteriorate operations on Essex Street and may not improve operations for Railroad Street or Pearson Street. Due to the location of this intersection, a roundabout is not feasible. Supporting documentation for the traffic-volume adjustments is in the Appendix to the updated TIA.

TEC Response: *TEC understands that the Mass Works project is funded and still in the design stage; however, until design is complete, and the construction is commenced, there is no guarantee that the project will be completed. With the understanding that any commitments to mitigation may be moot upon this, the Applicant should work with the Town to evaluate opportunities to modify the traffic control at this location. These enhancements may be an expansion of Mass Works improvements proposed at the location.*

VAI Response: See response to Comment 8. The Project should not be required to provide mitigation where impacts are negligible.

Comment 18: *An alternative analysis has been described in the TIA involving the removal of the Pearson Street approach at the Essex Street / Pearson Street / Railroad Street /*

Dundee Park Drive intersection, which has been proposed as part of the Mass Works Project. It is stated in the TIA that the traffic volumes were redistributed for the 2030 No-Build and Build conditions with analysis results shown in Table 14; however, the redistribution has not been shown in the Appendix, as stated, nor has it been described in any detail. TEC is, therefore, unable to verify the alternative analysis results.

VAI Response: VAI has provided redistribution figures in the Appendix of the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Comment 19: *To further expound on Comment #18, all the study area intersections should be analyzed for 2030 No-Build and Build conditions, with and without the Mass Works project when directly affected by traffic redistribution of the project's improvements.*

VAI Response: VAI reached out to confirm the configuration of Pearson Street prior to conducting this expanded analysis to determine if the Town emergency response and public works staff preferred a two-way or one-way configuration for Pearson Street. Based on discussions with the Town Engineer, the Town prefers the two-way configuration; therefore, VAI assumed Pearson Street remains as a two-way street in the revised analysis. This analysis is provided in the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Comment 20: *In a field review conducted with the Town on January 18, 2024, TEC noted that the railroad gates at the Essex Street / Pearson Street track crossing are in the down position when a commuter rail train is present at the MBTA station located further to the north on Railroad Street. Queueing and delays occur, not only on Essex Street and Pearson Street, but also on Railroad Street, Dundee Park Drive, and School Street, as a result. A separate sensitivity analysis should be provided for this location based on the gate closure timeframe and frequency during the peak hour periods for this location.*

VAI Response: The Project does not change the gate closure time at the railroad crossing. A sensitivity analysis that reviews the frequency of the closure, which will not change with or without the Project, is not relevant to the discussion of the Project impacts.

TEC Response: *TEC disagrees with the Applicant's response. The several gate closures during the peak periods as analyzed will affect the operations at this location and are not accounted for in the TIA's operational analysis. TEC acknowledged that the Project does not change the gate closure time at the railroad crossing; however, the operational analysis evaluated in the TIA is currently not showing the correct operations if the railroad closures are not part of the evaluation. This is even more crucial as an inbound train keeps the gates down even with the train stopped at the station.*

VAI Response: VAI disagrees with TEC. This Project will not affect the railroad closures, nor will this Project propose or incorporate any modifications to change gate closure duration or frequency. The same relative effects of the Project will occur whether the intersection is treated as an isolated unsignalized intersection, or one influenced by a railroad crossing. The effects on Pearson Street due to the Project are 0.2 seconds delay during the morning peak hour and 0.2 seconds delay during the evening peak

hour. If these increase by 10 times due to the overall delay added by the railroad closures, the Project increase would be 2 seconds, which is still not significant.

It should also be noted that the effects of the railroad closure were not considered by the Town's consultant DCI in the traffic analysis for the Historic Mill District Circulation and Street Design Study. This analysis was instrumental (along with the support of the Minco project) in the Town being awarded the MassWorks grant for design and construction of the Essex Street Corridor Improvements.

In an attempt to resolve this issue, VAI observed the gate closures at Essex Street and identified the average closure time during the morning and evening peak hours for the purposes of modeling the effect of the gate closures on the intersection. It was noted that during the weekday morning peak hour, there were two gate closures inbound, no closures outbound, and during the weekday evening peak hour, there was one gate closure inbound and two gate closures outbound. One of the gate closures outbound was the Downeaster Amtrak train, with a gate closure of approximately 35 seconds, the shortest observed. The longest closures were for the morning inbound trains and varied between 3 minutes and 20 seconds (3:20) and 2:40. In general, the observations indicated that after the gates were reopened queues dissipated within 3 minutes. When the 2 outbound trains caused gate closures to occur within 5 minutes of each other, the queues required closer to 5 minutes to dissipate.

The initial analysis of this intersection was conducted using SIDRA due to the five-legged approach. However, SIDRA was not able to model the gate closure; therefore, the gate closure effects were modeled using Synchro and SimTraffic. A description of the methodology used and the results of the analysis are provided in the Appendix to this letter; however, a summary is that using two separate methods, the delay increase due to the Project was under 3.5 seconds regardless of the gate closure status. During the longest gate closure, the intersection would have operated at LOS D using Method 1 with or without the Project and at LOS E using Method 2 with or without the Project.

As has been stated previously, the Project has a minimal effect on operations at this intersection with the railroad gates opened or closed, and this has been verified with the latest analysis.

Comment 21: *TEC suggests the following additional off-site mitigation that the Applicant should evaluate in conjunction with the Town of Andover:*

- *Several unsignalized intersections have crash rates higher than the MassDOT District 4 average (0.57 per MEV). The Applicant has not offered any mitigation to address to address short-term / low-cost safety issues at these locations. The Applicant should work with the Town to evaluate and implement, at a minimum, short-term / low-cost safety improvement countermeasures at these key locations.*

- *The Applicant should coordinate with the Town on opportunities at 75% occupancy to reevaluate the operations at this location in the field to adjust traffic signal timings as necessary.*

- *Additional off-site mitigation should be explored and considered to improve the LOS E and F conditions noted at the several intersection locations within the*

study area. At a minimum, the Applicant should evaluate opportunities to modify the traffic control at this location. These enhancements may be an expansion of Mass Works improvements proposed at the location.

- *The Applicant should explore opportunities to extend sight lines as necessary from each key driveway location, including the intersection of Lewis Street / Buxton Court, based on the resulting sight triangle described in Comments #13 and #14.*

The analysis indicates that the Project will result in minimal impacts to traffic at the study intersection. Is the Applicant referring only to the site driveway or to all the intersections in the TIA? As noted in Comment #17 above, there are individual movements that will experience LOS "E" and "F". The Applicant has not offered any mitigation to address these issues.

VAI Response: Many of the comments made here have been responded to previously. The MassWorks project is expected to address operations and safety at the intersections noted. Based on discussions with Town staff, the Town and their MassWorks consultant are working on the design and construction as was indicated by Town staff to start as early as fall 2024 or spring 2025. It should be noted that the Project was instrumental to the Town receiving the MassWorks grant that provided funds for the proposed improvements in the area.

TEC Response: *Comment not addressed. TEC understands that the Mass Works project is funded and still in the design stage; however, until design is complete, and the construction is commenced, there is no guarantee that the project will be completed. With the understanding that any commitments to mitigation may be moot upon this, the Applicant should work with the Town to evaluate opportunities for off-site mitigation as noted above.*

VAI Response: See responses to Comment 8 and Comment 16.

Comment 22: *The Applicant should define Transportation Demand Management (TDM) to be utilized on the site. At a minimum, the Applicant should provide the following TDM considerations:*

- *Seek to provide MBTA and MVRTA maps and schedules to all tenants as part of welcome packets and to locate such documents in all lobbies and entryways.*
- *Provide electric vehicle and EV-ready parking spaces within the site.*
- *Consider providing transit subsidies to tenants to encourage use of the neighboring public transportation uses.*
- *Provide weather-protected and secure bicycle parking on-site.*
- *Provide on-site laundry services if not internal to each residential unit.*
- *Provide parking for ride-hailing services on-site*

VAI Response: The Applicant expects to provide TDM measures for the Project. These are expected to include the following:

1. A "Welcome Packet" will be provided to all residents and employees detailing available transportation services and facilities.

2. EV parking spaces will be provided at locations approved by the Andover Fire Department.

3. Public transportation schedules will be posted in a centralized location for residents and employees.

4. A pick-up/drop-off area for rideshare services is provided near the lobby area.

TEC Response: *TEC will note that the Applicant should provide reconsideration to provide weather-protected and secure bicycle parking on-site, provide on-site laundry services if not internal to each residential unit, and providing transit subsidies to tenants to encourage use of the neighboring public transportation uses.*

VAI Response: The Applicant is an experienced multi-family residential developer. Secure bicycle storage is provided in the parking garage and each residential unit has its own washer and dryer.

Comment 23: *Note that the Mass Works Infrastructure Project is in a conceptual stage and has been programmed in direct support of the subject redevelopment project. Whereas the funding and construction of the project is not guaranteed at this time, The Applicant should discuss with the Town and commit to other off-site mitigation within the limits of the Mass Works project should the infrastructure not be completed.*

VAI Response: Based on comments from Town staff, the Town has received the MassWorks grant and their consultant has begun working on the preferred design with the start of construction identified as fall 2024 or spring 2025. The MassWorks project includes improvements to many of the intersections in the study area including the closure of Pearson Street.

TEC Response: *Comment not addressed. TEC understands that the Mass Works project is funded and still in the design stage; however, until design is complete, and the construction is commenced, there is no guarantee that the project will be completed. With the understanding that any commitments to mitigation may be moot upon this, the Applicant should work with the Town to evaluate opportunities for off-site mitigation as noted above.*

VAI Response: See response to Comment 8 and to Comment 16.

Comment 24: *TEC reviewed the supplemental traffic analysis for the project's effect on Elm Square. Generally, TEC concurs that the development will have negligible to limited impacts on the traffic conditions at Elm Square as much of the trip distribution to/from the site will be focused towards the high-capacity routes of I-495 and I-93 which is accessed without going through Elm Square. TEC will note that prior comments have noted modifications to be made on both the trip generation and trip distribution of the project which may result in additional operational and safety impacts to Elm Square. As part of TIA revisions noted from these comments, the Applicant should similarly evaluate the change in impacts at Elm Square.*

VAI Response: VAI has updated the supplemental Elm Square analysis to reflect the redistribution due to the closure of Pearson Street and this is provided in the Appendix of the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Comment 25: *TEC notes that the Supplemental Traffic Analysis document for Elm Square refers to North Main Street and Main Street at Route 38 as opposed to Route 28. Further revisions to the analysis based on the above comments should update references accordingly.*

VAI Response: VAI has made the indicated changes in the Elm Square supplemental memo, which is included in the appendix of the updated TIA.

TEC Response: *Comment addressed. No further response required.*

Initial Site Plan Comments – Responses provided by Morin-Cameron Group (MC)

Note: A revised plan set was submitted to the town by the Morin-Cameron Group on May 7, 2024.

Comment 26: *The Off-Street Parking Requirements (Town of Andover Zoning Bylaw, Section 8.5.9 - Off-Street Parking and Loading Areas [Historic Mill Overlay District]) require that residential uses provide one (1) space per dwelling unit minimum and two (2) spaces per 1,000 SF of non-residential uses minimum. The site will therefore require 165 off-street parking spaces for the site's residential component with an additional 7 parking spaces for the non-residential uses (800 SF of coffee shop, 2,730 SF of recreational community center, and 3,400 SF dog park). The calculations in the parking Table on Sheet C4.0 do not denote parking spaces for the gym or office uses as they are direct amenities to the residents.*

The site provides 255 off-street parking spaces (76 surface spaces and 177 garage spaces) in excess of the Bylaw minimum requirements. The residential component is effectively a 1.4 spaces per dwelling ratio. Considering the direct proximity to the MBTA commuter rail and the short distance to the Downtown Andover amenities, this level of parking could be considered excessive although compliant. The Applicant should consider the reduction of parking where possible, especially in relation to the head-in parking along Pearson Street. Alternatively, the Applicant should consider the relocation of these head-in parking to another location internal to the site as to remove the head-in parking spaces along Pearson Street.

MC Response: The client will consider a reduction in parking and the relocation of the head-in parking to another location internal to the site.

TEC Response: *The Applicant has retained the head-in parking within the plans and converted them to angled style. The closure of Pearson Street as part of the Mass Works project and construction of the raised crossing just east of the parking stalls along Pearson Street will assist in lowering travel speeds approaching from the mainline roadway. Although TEC and the Town have reservations regarding this parking, the parking style is allowed at this location and the Applicant has provided other amenities to assist with the safety challenge that is inherent with 'head-in' parking. No further response required.*

Comment 27: *The garage parking layout sheet of the plans should be enhanced with the location of columns and other internal obstructions which may impact parking space locations and the ability for vehicles to access/egress individual parking spaces.*

MC Response: The structural drawing showing the location of the columns and other internal obstructions will be provided once completed.

TEC Response: *The Town should consider as a condition of approval that review of the garage parking plan be completed to access the location of columns and other internal obstructions which may impact parking space locations and the ability for vehicles to access/egress individual parking spaces.*

MINCO Response: A building permit application including plans prepared by a Registered Architect will be submitted to the building inspector for review.

Comment 28: *The garage layout sheet of the plan should be enhanced to show the location of internal access points such as elevators and stairwells to determine proximity to/from accessible parking spaces and preferential parking spaces.*

MC Response: The Site Plan has been updated to depict the elevator and stairs on the garage level. All aisles will be 24 feet in width.

TEC Response: *The garage layout, shown in Sheet C4.0, depicts only one (1) elevator and one (1) stair location within the garage. Please note whether this in the intent. It may be appropriate to provide additional access points considering the layout of the building above and the ease of access across the garage and across above-ground floors.*

MC Response: The Site Plan has been updated to depict the location of the second elevator and stairs in the building lobby.

Comment 29: *The overall parking layout internal and external to the building should define the locations of preferential parking spaces and other parking amenities, such as electric vehicle charging stations and spaces that will be designated as EV-ready.*

MC Response: Sheet C-4.0 of the Site Plan depicts the compact cars spaces and handicap spaces. The individual garages on the building frontage have EV chargers, the plan has been updated to depict that.

TEC Response: *Acknowledged. It appears the four (4) designated accessible parking spaces within the garage are set far from both the internal elevator and stairwell requiring a person with accessible needs to travel far across and through other parking stalls to get to these locations. This should be corrected.*

MC Response: The garage parking layout has been updated to depict handicap spaces next to the garage elevator and by the elevator at the lobby entrance, both of which provide accessible access to the residential floors above.

Comment 30: *The two (2) accessible parking spaces at the northwest corner of the site are located at the far end of the lot approximately 200-feet from the nearest building entryway. The Applicant should relocate accessible spaces to close proximity to building*

entryways and provide all necessary infrastructure, such as accessible ramps, along the path of travel as needed.

MC Response: The accessible parking spaces located at the northwest corner of the site are intended to be accessible spaces for the dog park, not for the main building. The accessible spaces for the building residents are in the garage.

TEC Response: *Comment addressed. No further response required.*

Comment 31: *Whereas the Applicant has noted that the head-in parking along Pearson Street is generally for the use of the recreation center, there are no specific accessible spaces provided for this head-in parking area, if retained.*

MC Response: The parking along Pearson Street follows the road topography, having a slope of approximately 6.3%, which is too steep for an accessible space. The accessible parking spaces for the courtyard area and community building are in front of the courtyard area.

TEC Response: *Comment addressed. No further response required.*

Comment 32: *The Applicant has provided an Auto Turn Exhibit showing the Andover Fire Laddar Truck currently housed at the Central Fire Station. The exhibit shows the apparatus entering, circulating the site, and exiting through both driveways. The vehicle can enter and exit both access points and circulate the internal roadway; however, there would be encroachment into opposing travel lanes at the access points and internally at the northwest corner of the site. TEC defers to the Town of Andover Fire Department to verify whether the dimensions of their fire trucks match the dimensions used in the turning analysis.*

MC Response: Lt. Ryan T. Beal, Fire Prevention Officer for Andover Fire Rescue indicated on March 6, 2024 in an email to Leticia Oliveira of MC that the swept path analysis is acceptable.

TEC Response: *Comment closed. No further response required.*

Comment 33: *The Applicant should coordinate with the Town of Andover Fire Department for preferred locations of fire lanes (if needed), confirmation of on-site hydrant locations (if needed), and sign requirements for fire lanes within the site.*

MC Response: Lt. Beal also indicated on March 6, 2024 in an email to Leticia Oliveira of MC that the hydrant locations are acceptable. Fire lanes have been added to the design, MC met with Lt. Beal on March 14, 2024 to review plans and he is satisfied with the design.

TEC Response: *Comment closed. No further response required.*

Comment 34: *The Applicant should provide turning templates showing the ability of refuse trucks to access, circulate, and egress the site through the circulation pattern without leaving the paved surface while providing access to the dumpster enclosures on the site.*

MC Response: VAI has provided turning templates for the refuse vehicle requested in the Appendix to this letter. There are no dumpster enclosures; instead, dumpsters will be wheeled out of the garage for pickup from the lower circulating roadway.

TEC Response: *Comment closed. No further response required.*

Comment 35: *The Applicant should provide turning templates showing the ability of the standard delivery vehicle or service vehicle to be utilized on-site to access, circulate, and egress the site through the circulation pattern without leaving the paved surface and while providing access to the secured receiving area. The Applicant should confirm that this is or is separate from the 'drop-off' area at the southwest end of the building.*

MC Response: VAI has provided turning templates for the moving and delivery vehicles requested in the Appendix to this letter. These paths depict vehicles utilizing the drop-off area near the building lobby as well as the loading area at the north end of the building.

TEC Response: *Comment closed. No further response required.*

Comment 36: *The Applicant should provide a dedicated area for package deliveries to the mail room or individual units (U.S. Mail, Amazon, FedEx, etc.) and confirm there is sufficient room for bypassing resident traffic.*

MC Response: The mail room is located on the southwestern corner of the building. There is a drop-off area located next to the southwestern corner of the building that will be used for passenger rideshare drop-off and for deliveries. The plan has been updated to clarify that.

TEC Response: *Comment closed. No further response required.*

Comment 37: *Concrete sidewalks are provided along Pearson Street at the site frontage. The site plans should denote the limits of all off-site pedestrian and bicycle accommodation work off-site.*

MC Response: Sharrows have been added on Pearson Street, Buxton Court, and on the proposed driveway to indicate to drivers to share the road with the bicyclists. The concrete sidewalks shall be for pedestrian use only.

TEC Response: *Comment closed. No further response required.*

Comment 38: *The Applicant should denote the designated locations of secure and weather protected bicycle storage within the building and/or as part of the courtyard area.*

MC Response: The bike storage for residents is inside the garage.

TEC Response: *Comment closed. No further response required.*

Comment 39: *The two-way drive aisle along the westerly property line ranges from 20-feet to 24-feet whereas the Bylaw denotes a 24-foot minimum width for two-way drive aisles. This is especially important at the proposed garage bays on the west side of the building. The Applicant should rectify or provide justification for a variance.*

MC Response: This Project was designed under the Historic Mill Overlay District (HMOD) (Section 8.5 of the Andover Bylaw). According to section 8.5.2 of the Bylaw, the overlay district is superimposed over the underlying zoning districts and "the requirements of the underlying zoning districts shall remain in full force and effect, except for Projects undergoing development pursuant to section 8.5". The HMOD does not have requirements for driveway width; therefore, a rectification or variance should not be necessary. The HMOD has Design Objectives (section 8.5.7) which the project complies with, such as "safe vehicular and pedestrian ways, and minimize traffic impacts", "minimize the visual impact of parking areas" and "Assure safe interior circulation within its site by separating pedestrian, bike, and vehicular traffic."

TEC Response: *Comment closed. No further response required.*

Comment 40: *The bottom of all traffic signs on-site should be a minimum of 7 feet above the ground surface per the Manual on Uniform Traffic Control Devices (MUTCD) when directly impeding sidewalks or travel paths.*

MC Response: Comment noted. The signs will not obstruct sidewalks or travel paths, however, the "Sign Post" detail on Sheet C8.5 has been revised to depict this requirement.

TEC Response: *Comment closed. No further response required.*

Comment 41: *The site plans should provide a plan sheet depicting the sight triangles to and from the site driveway and identify areas to restrict vegetation, signage, and off-street parking to maintain AASHTO minimum recommendations. Notes should indicate: "Signs, landscaping and other features located within sight triangle areas shall be designed, installed, and maintained so as not to exceed 2.5 feet in height. Snow windrows located within sight triangle areas that exceed 3.5 feet in height or that would otherwise inhibit sight lines shall be promptly removed." All permanent and temporary (such as unit/tenant advertisements) signs should be located outside the sight line triangles.*

MC Response: An updated sight triangle plan is provided as Sheet C4.2 provided to address this comment.

TEC Response: *Comment closed. No further response required.*

Comment 42: *There may be changes to the Pearson Street access/egress depending on the Mass Works Project and alternate plans to remove the Pearson Street approach from its intersection with Essex Street. TEC will comment on this further if plan changes are submitted for review.*

MC Response: No response required.

TEC Response: *Comment closed. No further response required.*

Comment 43: *There are discrepancies between the TIA and Plan Sheet C4.2 for the sight distance measurements shown at the Pearson Street access driveway.*

MC Response: The TIA reflected existing conditions sight distances while Sheet C4.2 reflected proposed conditions. However, due to changes noted previously, Plan Sheet C4.2 was updated.

TEC Response: *Note that the same discrepancy exists where the TIA responses to comment Figure SD-1 denotes 150-feet and the plan sheet C4.2 denoted 140-feet.*

VAI Response: The Site Plan has been updated to depict the 150 feet sight distance.

Comment 44: *The parking area on Pearson Street adjacent to the proposed community building will limit sight distance to the east. The Applicant should eliminate or limit the amount of parking to address this issue. Note that the sight line triangles must not cross through these parking spaces. What opportunities exist to relocate to the site? Note that the overall amount of parking spaces does exceed zoning minimums.*

MC Response: The parking area on Pearson Street has been updated to improve sight distance from the site driveway. This is shown in the appendix to this letter and revised Plan Sheet C4.2.

TEC Response: *Comment closed. No further response required.*

Comment 45: *The Applicant proposes modifications to their site drive access to Pearson Street consisting of sidewalk reconstruction and pedestrian ramps. The Applicant should provide roadway/driveway profiles and confirm ADA/AAB compliance for these elements and internal sidewalks around the building or seek a variance for the project, if necessary, as the slope for the corridor exceeds typical ADA/AAB compliance. The plans and the construction details show that all new sidewalks are to be a minimum of 5 feet wide, excluding the width of any curbing, which is acceptable to TEC.*

MC Response: The existing sidewalk along Pearson isn't ADA-compliant. The proposed sidewalk is ADA-compliant; the proposed slope is 5%.

TEC Response: *Comment closed. No further response required.*

Comment 46: *It appears that guardrail (type unspecified) is proposed on site at the parking areas adjacent to the MBTA property. Details have not been provided in the plan set.*

MC Response: A guardrail detail has been added to the Detail Sheet C8.5.

TEC Response: *Comment closed. No further response required.*

Comment 47: *Although snow storage areas are shown on the plan, the Applicant should provide a snow removal and parking management plan for Town staff review.*

MC Response: We suggest that a condition of approval to be attained prior to the issuance of a Building Occupancy Permit.

TEC Response: *TEC agrees that a snow removal and parking management plan should be, at a minimum, provided as a condition of approval to be attained prior to the issuance of a Building Occupancy Permit.*

MC Response: No further response required.

New Comments

Comment 48: *As the Applicant is relying heavily on the various trip credits for mode split, public transportation use, and internal capture, the Applicant should commit to a traffic monitoring program to ensure that the Project impacts are consistent with those predicted in the Project's permitting process, evaluate the effectiveness of the TDM measures in meeting the mode share targets, and assess the need for additional off-site improvements or TDM measures. As part of the monitoring program, the Applicant will complete the following tasks following 70% occupancy of the residential building and following full occupancy of the proposed mixed-use tenants:*

- *Collect manual Turning Movement Counts (TMCs) during the weekday morning (7:00 AM to 9:00 AM) and weekday evening (4:00 to 6:00 PM) at the following intersections:*
  - *Route 28 / Lewis Street*
  - *Route 28 / Person Street*
  - *Route 28 / Elm Street [Elm Square]*
  - *Railroad Street / Essex Street / Dundee Park*
- *Collect ATR data for a continuous 7-day week-long period along each Buxton Court and Pearson Street positioned at locations to capture site related trips only.*
- *Collect parking demand counts during the peak parking demand periods for the specific land use areas, including:*
  - *Residential - 5:00 AM to 9:00 AM;*
  - *Other Site Uses - 10:00 AM to 1:00 PM; and*
- *Collect motor vehicle crash reports from the Town of Andover Police Department for the most recent one-year period to ascertain changes in crash frequency, crash trends, and severity at the monitored locations.*
- *Compare the TMCs collected above with those projected within the TIA for the Project to determine whether the total vehicles entering each intersection exceeds the volumes projected.*
- *Perform a capacity and queuing analysis using Synchro analysis software to evaluate the traffic operations at each of the intersections listed above and compare to the operations projected in the TIA prepared for the Project.*
- *Assess whether additional mitigation is necessary at any of the study intersections and identify measures to improve operations and/or reduce vehicular traffic volumes. The need or evaluation for further mitigation will be conditioned upon:*
  - *The measured site generated traffic volumes for the Project exceed the projected site generated traffic volumes established in this TIA, or subsequent*

revisions as presented to the Town of Andover, by more than 10 percent (i.e., 110 percent of the projected site generated traffic volumes.

- *One or more of the movements at the monitored intersections is identified to be operating at or over capacity (defined as a V/C ratio equal to or exceeds 1.00).*

- *There is a pronounced increase in the frequency of occurrence of motor vehicle crashes at a monitored location and the calculated motor vehicle crash rate exceeds the MassDOT average crash rate for similar locations.*

Corrective actions to reduce the unmitigated impact of the Project should be proposed and implemented based on the thresholds listed above. The corrective actions should be documented in the TMP, approved and coordinated with the Town if desired; and be undertaken by the Applicant subject to receipt of all necessary rights, permits, and approvals.

- *Assess whether the constructed parking supply is adequate for the parking demand as observed; and*

- *Prepare a memorandum summarizing the results of the TMCs, ATRs, parking demand counts, traffic impact*

VAI Response: As shown in the alternative analysis summarized in this letter, the Project does not require the application of the various trip-generation adjustments to result in minimal impact to the intersections closest to the Project. This conservative analysis was conducted to demonstrate that the Project impact at these locations can be accommodated with minimal increases in delays. This does not change the expectation that the traffic impact of the Project is expected to be even smaller given the proximity to the commuter rail, as discussed in previous submittals.

Accordingly, the Applicant has considered the above request for traffic monitoring of the Project but is concerned that there is a potential for additional background development and/or roadway modifications to affect operations at the study area intersections, unrelated to the Project. The only real measure of the Project-related impact on the area would be how the actual vehicle trip generation compares with the estimated values. The Applicant will therefore conduct ATR counts of Buxton Court and the site driveway to Pearson Street to capture Project-related traffic volumes for a seven-day period as well as parking utilization counts of the garage, surface parking, and community building parking on Pearson Street for one weekday and one weekend day during typical overnight (10:00 PM and 4:00 AM) for residential demands and weekday evening (4:00 and 7:00 PM) and Saturday midday (11:00 AM and 3:00 PM). While there will still be non-Project related traffic in this count program, the majority of trips should be related to the Project. This information will be summarized in a memo to the Town planning and engineering staff. As noted previously, since the Project is not relying on trip adjustments and reduction in trip generation to demonstrate a low overall traffic impact, the trip generation and parking information will be provided for informational purposes only.

We trust that this information is responsive to the comments that were identified in the April 18, 2024 document prepared by TEC concerning their review of the March 18, 2024 Letter and Updated 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.

Scott W. Thornton

Scott W. Thornton, P.E.
Partner

Professional Engineer in CT, MA, and NH

Appendix
- Draper Block Trip Generation and Figures
- Trip Generation Adjustments and Calculations
- No Mode Split Alternative Analysis Results
- Updated Sight Distance Exhibits
- Railroad Gate Closure Methodology and Analysis Results

APPENDIX

DRAPER BLOCK TRIP GENERATION AND FIGURES
TRIP GENERATION ADJUSTMENTS AND CALCULATIONS
NO MODE SPLIT ALTERNATIVE ANALYSIS RESULTS
UPDATED SIGHT DISTANCE GRAPHICS
RAILROAD GATE CLOSURE METHODOLOGY AND ANALYSIS RESULTS

DRAPER BLOCK TRIP GENERATION AND FIGURES

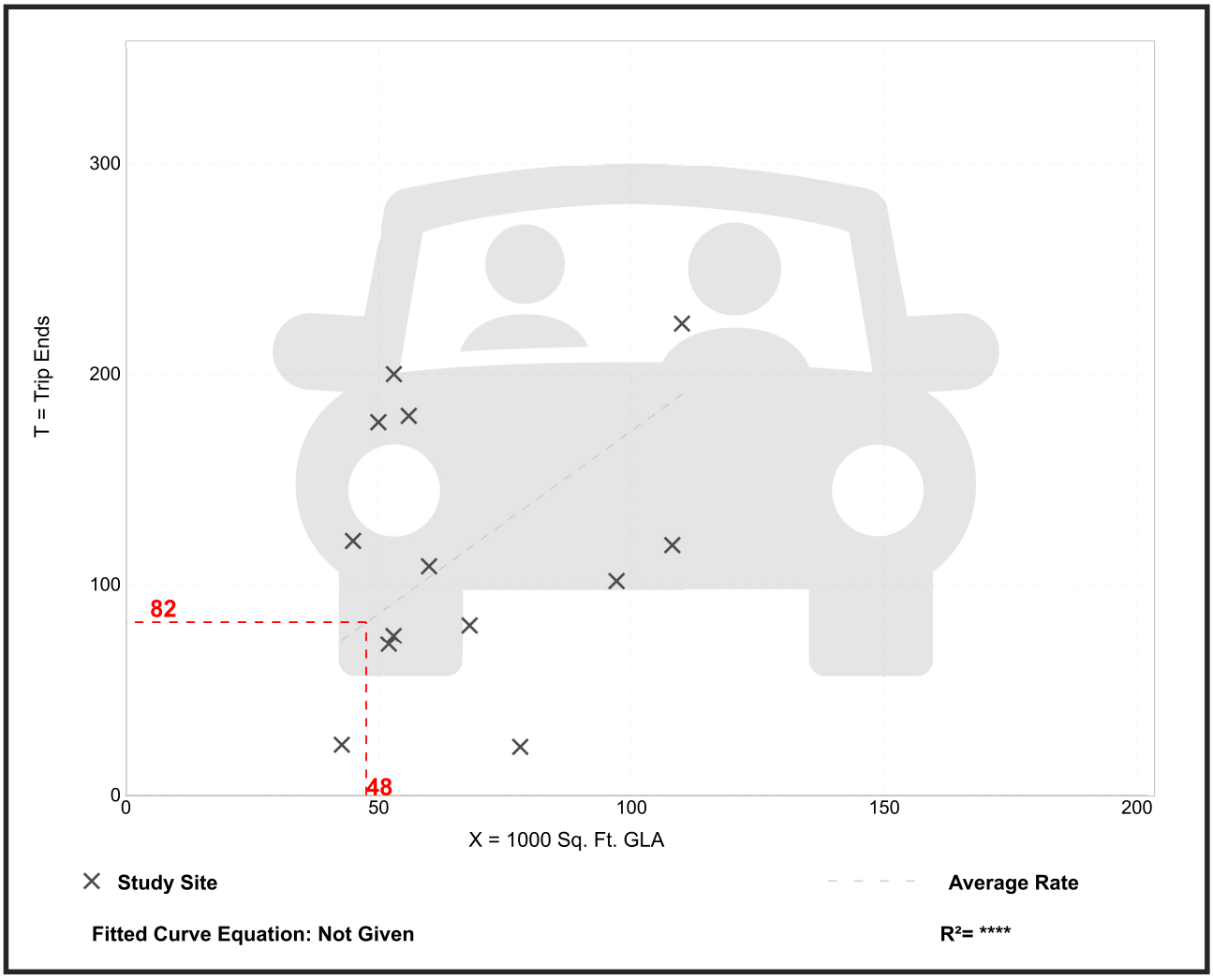
Shopping Plaza (40-150k) - Supermarket - No (821)

Vehicle Trip Ends vs: **1000 Sq. Ft. GLA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 13
Avg. 1000 Sq. Ft. GLA: 67
Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
1.73	0.29 - 3.77	1.06

Data Plot and Equation



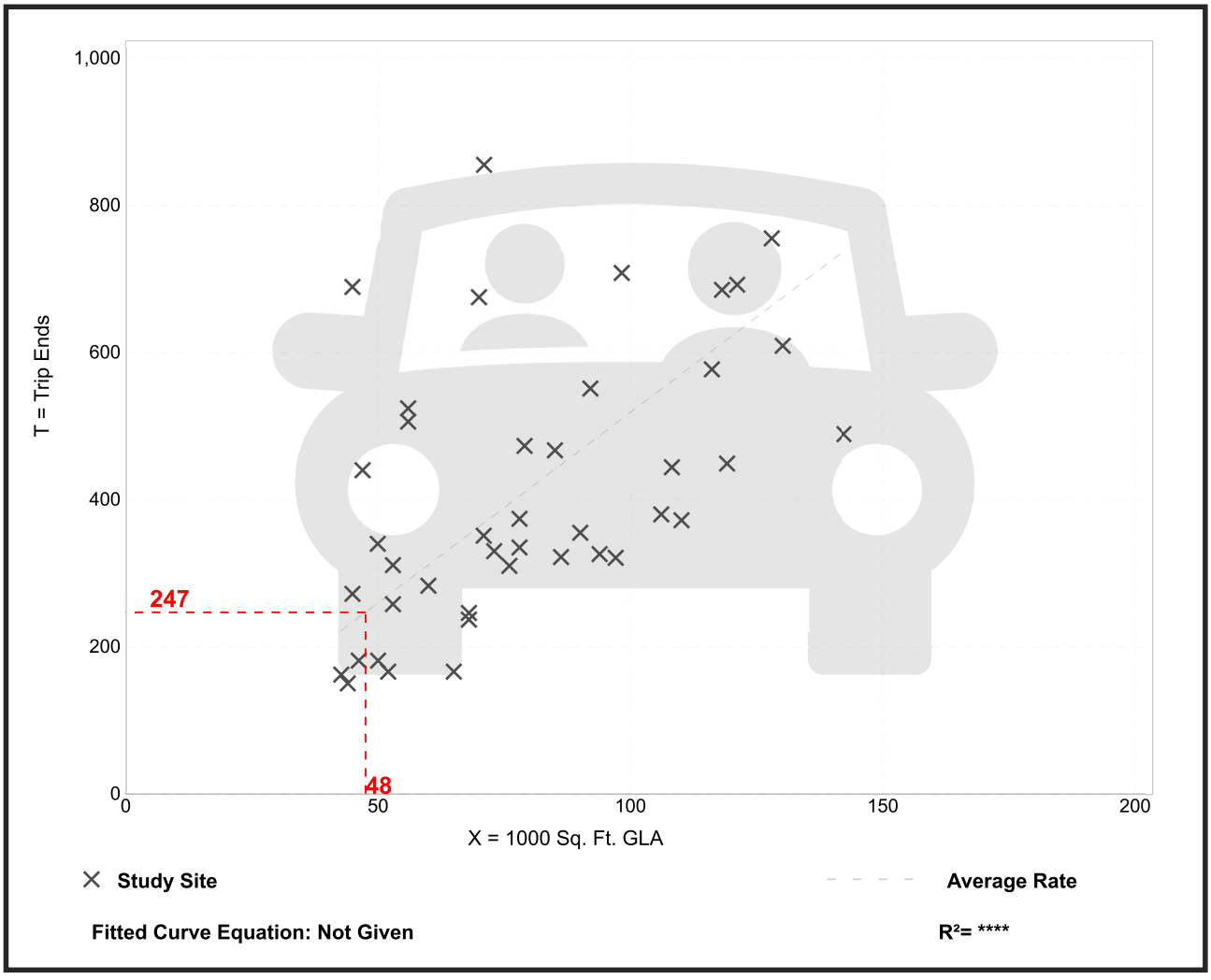
Shopping Plaza (40-150k) - Supermarket - No (821)

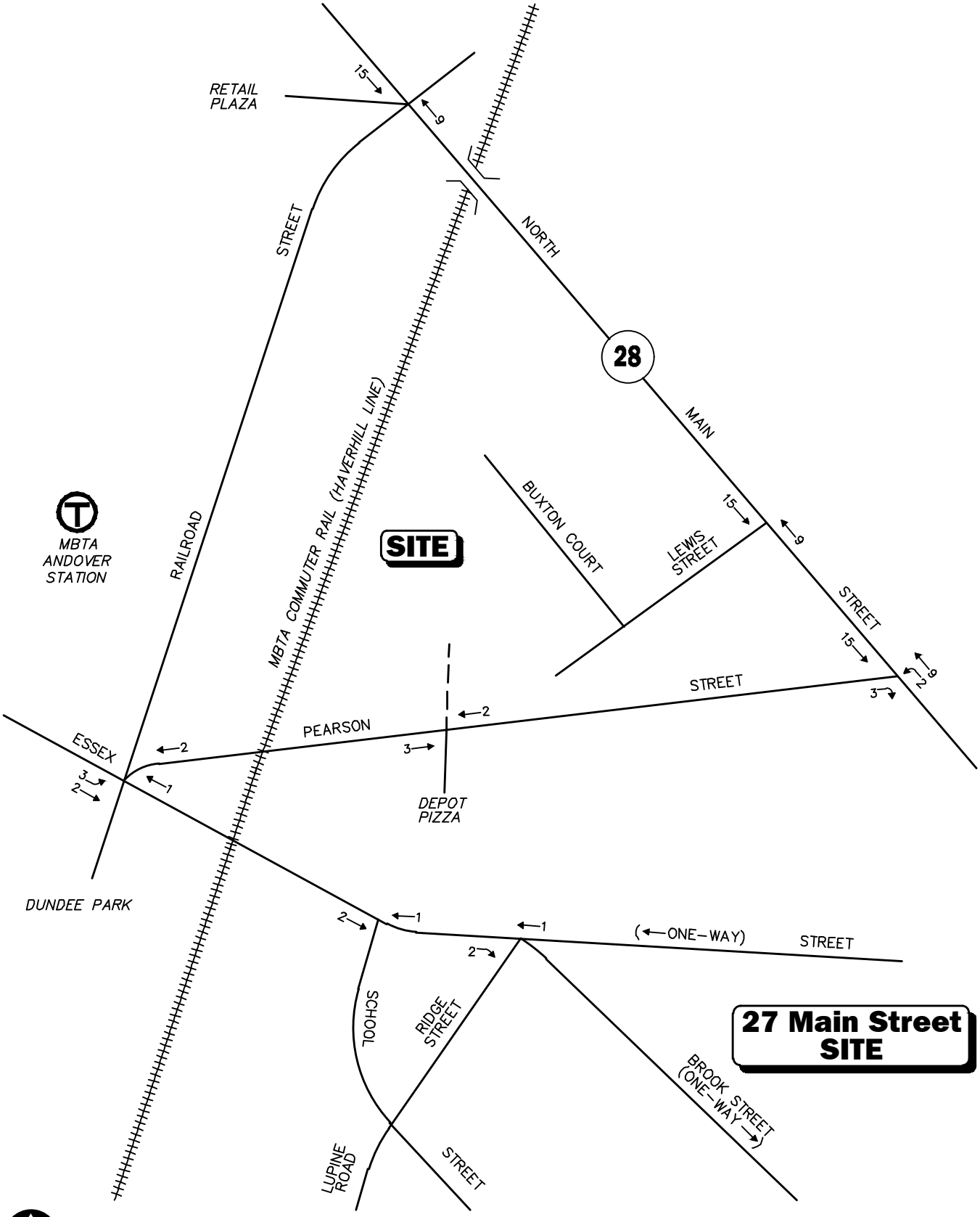
Vehicle Trip Ends vs: **1000 Sq. Ft. GLA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 42
Avg. 1000 Sq. Ft. GLA: 79
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
5.19	2.55 - 15.31	2.28

Data Plot and Equation





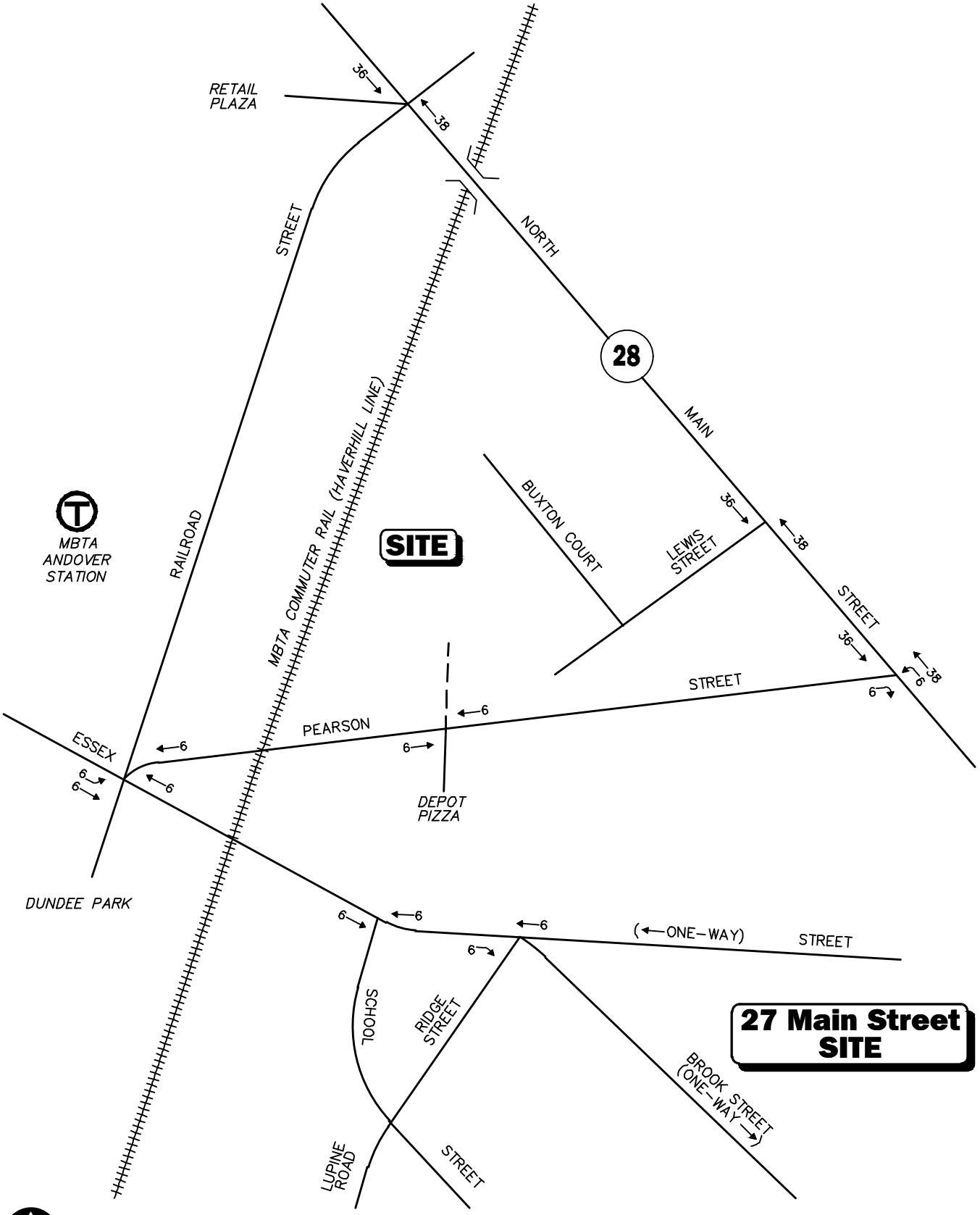
Not To Scale

Figure A1

27 Main Street/Draper Block Project
Weekday Morning
Peak-Hour Traffic Volumes

Vanasse & Associates inc

R:\8975\8975NT1.dwg, 5/24/2024 9:01:51 AM



Not To Scale

Figure A2

27 Main Street/Draper Block Project
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

TRIP GENERATION ADJUSTMENTS AND CALCULATIONS

	Original Total Trips Generated (Units/Square Footage multiplied by ITE Trip Rate)											
	Daily				AM				PM			
Multifamily (164 Units)	164	* 4.54	=	744.56	164	*0.37	=	60.68	164	* 0.39	=	63.96
Health Club (2.5ksf)a	2.5	* 25.03	=	62.575	2.5	*1.31	=	3.275	2.5	* 3.45	=	8.625
Small Office (1.7 ksf)	1.7	* 14.39	=	24.463	1.7	*1.67	=	2.839	1.7	* 2.16	=	3.672
Coffee Shop (0.8 ksf)	0.8	* 533.57	=	426.856	0.8	*85.88	=	68.704	0.8	* 38.99	=	31.192
Commercial Center (2.2 ksf)	2.2	* 28.82	=	63.404	2.2	*1.91	=	4.202	2.2	* 2.5	=	5.5

BASE ITE TRIP GENERATION BY LAND-USE

[a] ITE does not have data on Health Clubs for daily trips.Daily rate derived from ratio of daily to peak hour rates between LUC 492 and LUC 491

	Internal Trips of 10% are Removed											
	Daily				AM				PM			
Multifamily	744.56	*(100%-10%)	=	670.104	60.68	*(100%-10%)	=	54.612	63.96	*(100%-10%)	=	57.564
Health Club	62.575	*(100%-10%)	=	56.3175	3.275	*(100%-10%)	=	2.9475	8.625	*(100%-10%)	=	7.7625
Small Office	24.463	*(100%-10%)	=	22.0167	2.839	*(100%-10%)	=	2.5551	3.672	*(100%-10%)	=	3.3048
Coffee Shop	426.856	*(100%-10%)	=	384.1704	68.704	*(100%-10%)	=	61.8336	31.192	*(100%-10%)	=	28.0728
Commercial Center	63.404	*(100%-0%)	=	63.404	4.202	*(100%-0%)	=	4.202	5.5	*(100%-0%)	=	5.5

10% INTERNAL TRIP CALCULATION - APPLIED TO EACH LAND-USE

		Adjusted Mode Splits				
Base Mode Splits from Census		Residential	Gym	WeWorks	Com Cen	Coffee
Drove Vehicle	64	41	40	33	100	40
Public Transportation	2	25	--	33	0	--
Walked	13	13	30	34	0	30
Worked From Home	21	21	30	--	0	30
Total	100	100	100	100	100	100

CENSUS MODE SPLITS WITH ADJUSTMENTS BASED ON EXPECTED MULTI-MODAL NATURE OF MIXED-USE PROJECT SITED IN WALKABLE AREA ADJACENT TO MULTIPLE TRANSIT SERVICES

	Vehicle Trips of Total Trips From the Site											
	Daily				AM				PM			
Multifamily	670.104	* 41%	=	274.7426	54.612	* 41%	=	22.39092	57.564	* 41%	=	23.60124
Health Club	56.3175	* 40%	=	22.527	2.9475	* 40%	=	1.179	7.7625	* 40%	=	3.105
Small Office	22.0167	* 33%	=	7.265511	2.5551	* 33%	=	0.843183	3.3048	* 33%	=	1.090584
Coffee Shop	384.1704	* 40%	=	153.6682	61.8336	* 40%	=	24.73344	28.0728	* 40%	=	11.22912
Commercial Center	63.404	* 100%	=	63.404	4.202	* 100%	=	4.202	5.5	* 100%	=	5.5

APPLICATION OF ADJUSTED MODE SPLITS BY LAND USE TO EACH ADJUSTED TRIP GENERATION

	Final		
	Daily	AM	PM
Multifamily	276	22	24
Health Club	24	2	3
Small Office	8	1	1
Coffee Shop	154	25	12
Commercial Center	64	4	6

FINAL TOTAL TRIP GENERATION

	Adjusted Trip-Gen by Land-Use			ITE Directional Distribution
Multifamily	Daily	IN	138	50%
		OUT	138	50%
		TOTAL	276	100%
	AM	IN	5	23%
		OUT	17	77%
		TOTAL	22	100%
	PM	IN	15	61%
		OUT	9	39%
		TOTAL	24	100%
Health Club	Daily	IN	12	50%
		OUT	12	50%
		TOTAL	24	100%
	AM	IN	1	51%
		OUT	1	49%
		TOTAL	2	100%
	PM	IN	2	57%
		OUT	1	43%
		TOTAL	3	100%
Small Office	Daily	IN	4	50%
		OUT	4	50%
		TOTAL	8	100%
	AM	IN	1	82%
		OUT	0	18%
		TOTAL	1	100%
	PM	IN	0	34%
		OUT	1	66%
		TOTAL	1	100%
Coffee Shop	Daily	IN	77	50%
		OUT	77	50%
		TOTAL	154	100%
	AM	IN	13	51%
		OUT	12	49%
		TOTAL	25	100%
	PM	IN	6	50%
		OUT	6	50%
		TOTAL	12	100%
Commercial Center	Daily	IN	32	50%
		OUT	32	50%
		TOTAL	64	100%
	AM	IN	3	66%
		OUT	1	34%
		TOTAL	4	100%
	PM	IN	3	47%
		OUT	3	53%
		TOTAL	6	100%

ENTERING AND EXITING DAILY TRIPS AND PEAK HOUR TRIPS BY LAND-USE AND THE ITE LAND-USE BASED DIRECTIONAL DISTRIBUTION

TIA Site Trip Generation			
Daily	IN	263	
	OUT	263	
	TOTAL	526	
AM	IN	23	
	OUT	31	
	TOTAL	54	
PM	IN	26	
	OUT	20	
	TOTAL	46	

TRIP GENERATION FOR ENTIRE SITE AS SHOWN IN THE TIA

Station Summary

MARC	BRUNSWICK - WASHINGTON	Silver Spring
MARC	PENN - WASHINGTON	New Carrollton
VRE	Manassas Line	Crystal City
VRE	Fredericksburg Line	Crystal City

Stations	MARC Stops at Station	VRE Stops at Station
Ballston		
Court House		
Crystal City		Yes
Dunn-Loring		
Eisenhower Avenue		
Farragut West		
Friendship Heights		
Gallery Place		
Grosvenor		
King Street		
New Carrollton	Yes	
Silver Spring	Yes	
U Street/AfricanAmer Civil War Memorial/Cardozo		

Source: 2005 Development-Related Ridership Survey Final Report
Washington Metropolitan Area Transit Authority

Mode Split by Use

Lane Use	Number Site in Study	Crystal City Station			
		Metrorail	Metrobus & other Transit	Auto	Walk & Other
Residential	2	46	0	47	7
Office	2	20	8	69	3
Retail	2	34	5	26	35

Lane Use	Number Site in Study	New Carrollton Station			
		Metrorail	Metrobus & other Transit	Auto	Walk & Other
Residential	0	0	0	0	0
Office	1	8	3	89	0
Retail	0	0	0	0	0

Lane Use	Number Site in Study	Silver Spring Station			
		Metrorail	Metrobus & other Transit	Auto	Walk & Other
Residential	2	46	7	31	16
Office	3	13	13	65	9
Retail	1	9	10	67	14

Lane Use	Number Site in Study	3 Station Where MARC and VRE Stop				
		Metrorail	Metrobus & other Transit	Auto	Walk & Other	
Residential	4	46	4	39	11	100
Office	6	14	8	74	4	100
Retail	3	22	7	47	24	100

Source: 2005 Development-Related Ridership Survey Final Report
Washington Metropolitan Area Transit Authority

	Unadjusted Base ITE Trip-Generation		
	Daily	AM	PM
Multifamily	746	61	64
Health Club	64	3	9
Small Office	26	3	4
Coffee Shop	428	69	31
Commercial Center	64	4	6

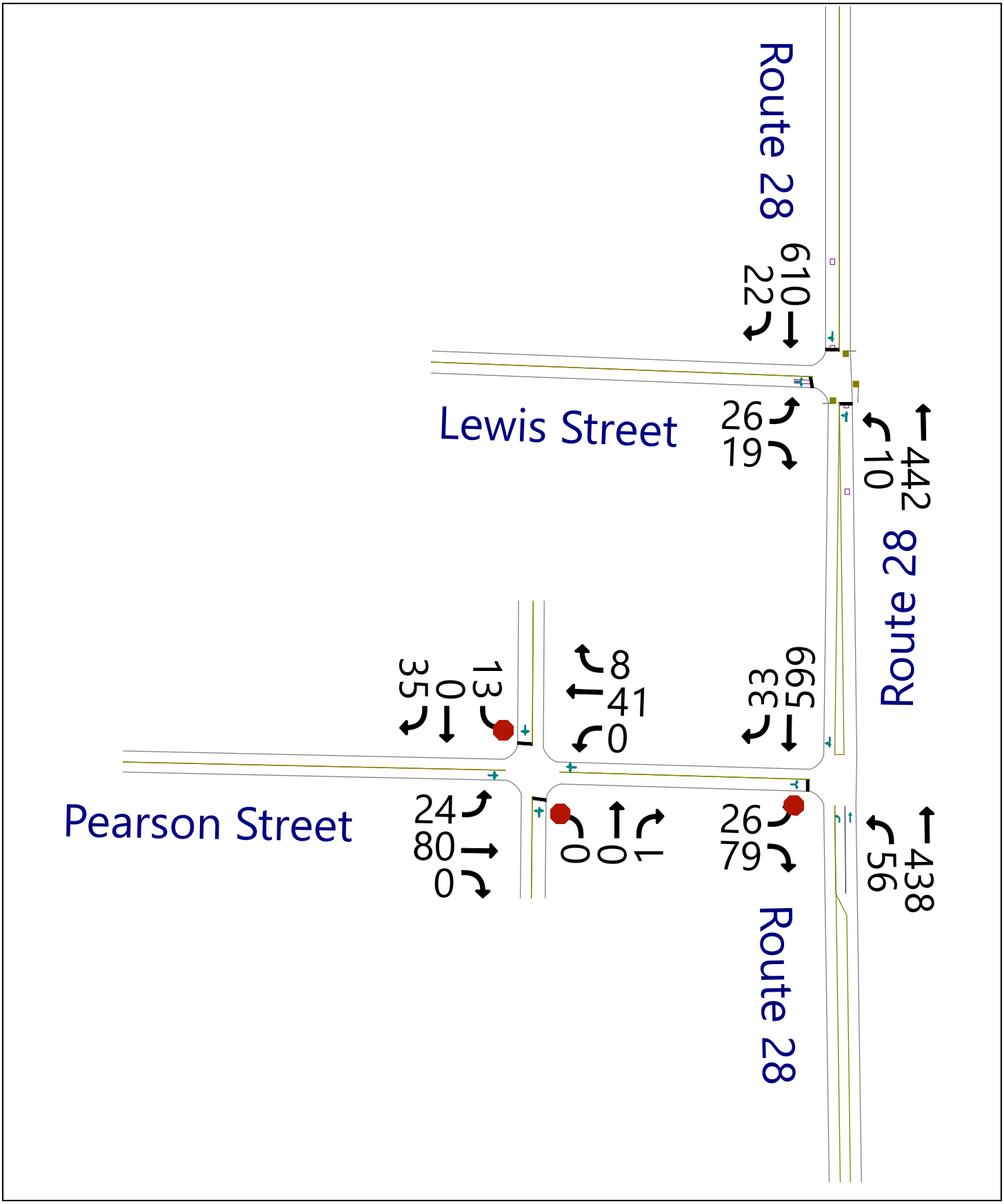
Unadjusted Daily and Peak Hour Trip-Generation by Land-Use

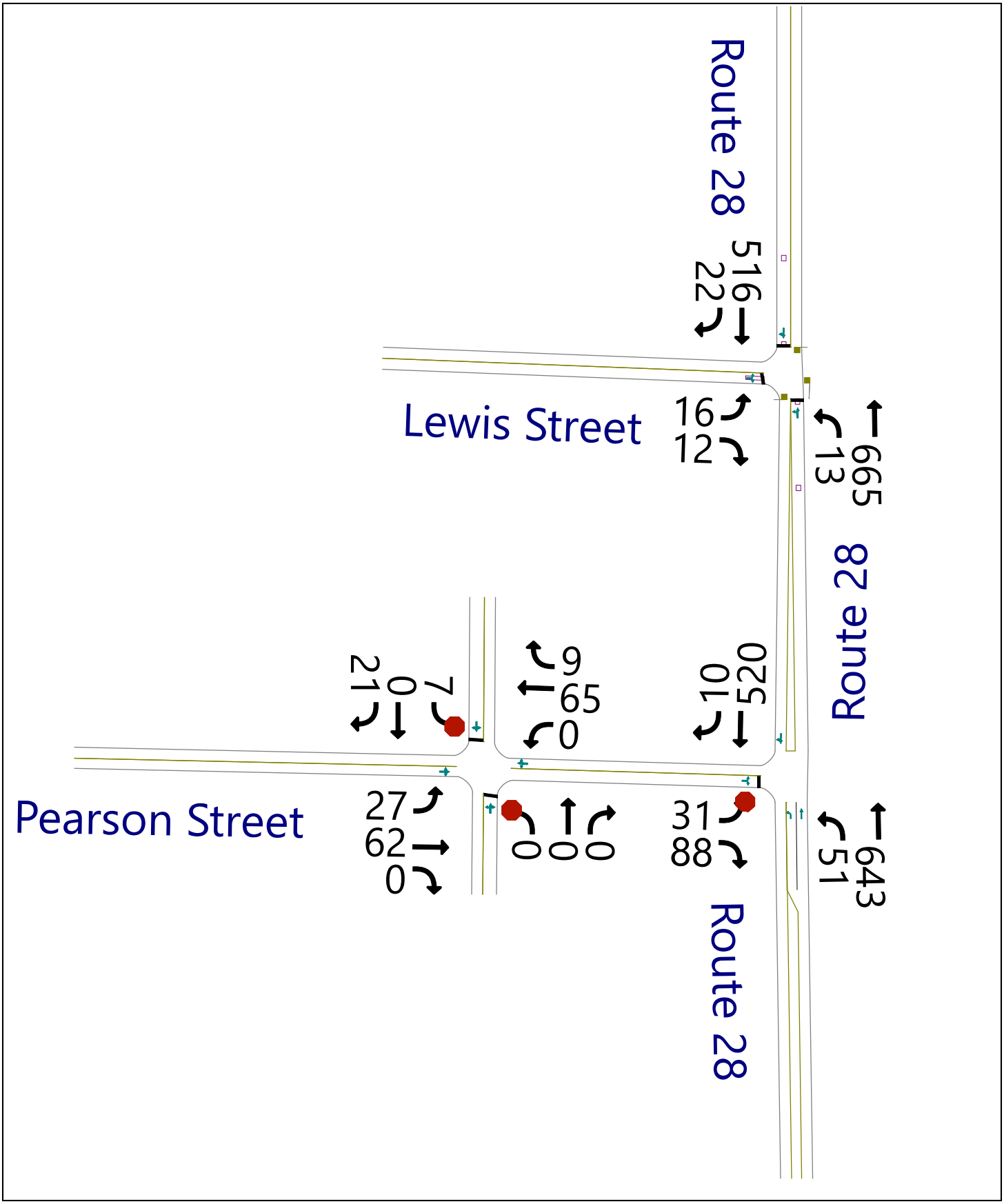
Multifamily	Daily	IN	373
		OUT	373
		TOTAL	746
	AM	IN	14
		OUT	47
		TOTAL	61
	PM	IN	39
		OUT	25
		TOTAL	64
Health Club	Daily	IN	32
		OUT	32
		TOTAL	64
	AM	IN	2
		OUT	1
		TOTAL	3
	PM	IN	5
		OUT	4
		TOTAL	9
Small Office	Daily	IN	13
		OUT	13
		TOTAL	26
	AM	IN	2
		OUT	1
		TOTAL	3
	PM	IN	1
		OUT	3
		TOTAL	4
Coffee Shop	Daily	IN	214
		OUT	214
		TOTAL	428
	AM	IN	35
		OUT	34
		TOTAL	69
	PM	IN	16
		OUT	15
		TOTAL	31
Commercial Center	Daily	IN	32
		OUT	32
		TOTAL	64
	AM	IN	3
		OUT	1
		TOTAL	4
	PM	IN	3
		OUT	3
		TOTAL	6

No Mode Split Site Trip Generation

Daily	IN	664
	OUT	664
	TOTAL	1328
AM	IN	56
	OUT	84
	TOTAL	140
PM	IN	64
	OUT	50
	TOTAL	114

NO MODE SPLIT ALTERNATIVE ANALYSIS RESULTS


Route 28
610
22
Lewis Street
26
19
442
10
Route 28
8
41
0
13
0
35
33
599
Pearson Street
24
80
0
0
0
1
26
79
438
56
Route 28


Route 28
516
22
Lewis Street
16
12
665
13
Route 28
9
65
0
7
0
21
520
10
Pearson Street
27
62
0
0
0
0
31
88
643
51
Route 28

Volumes

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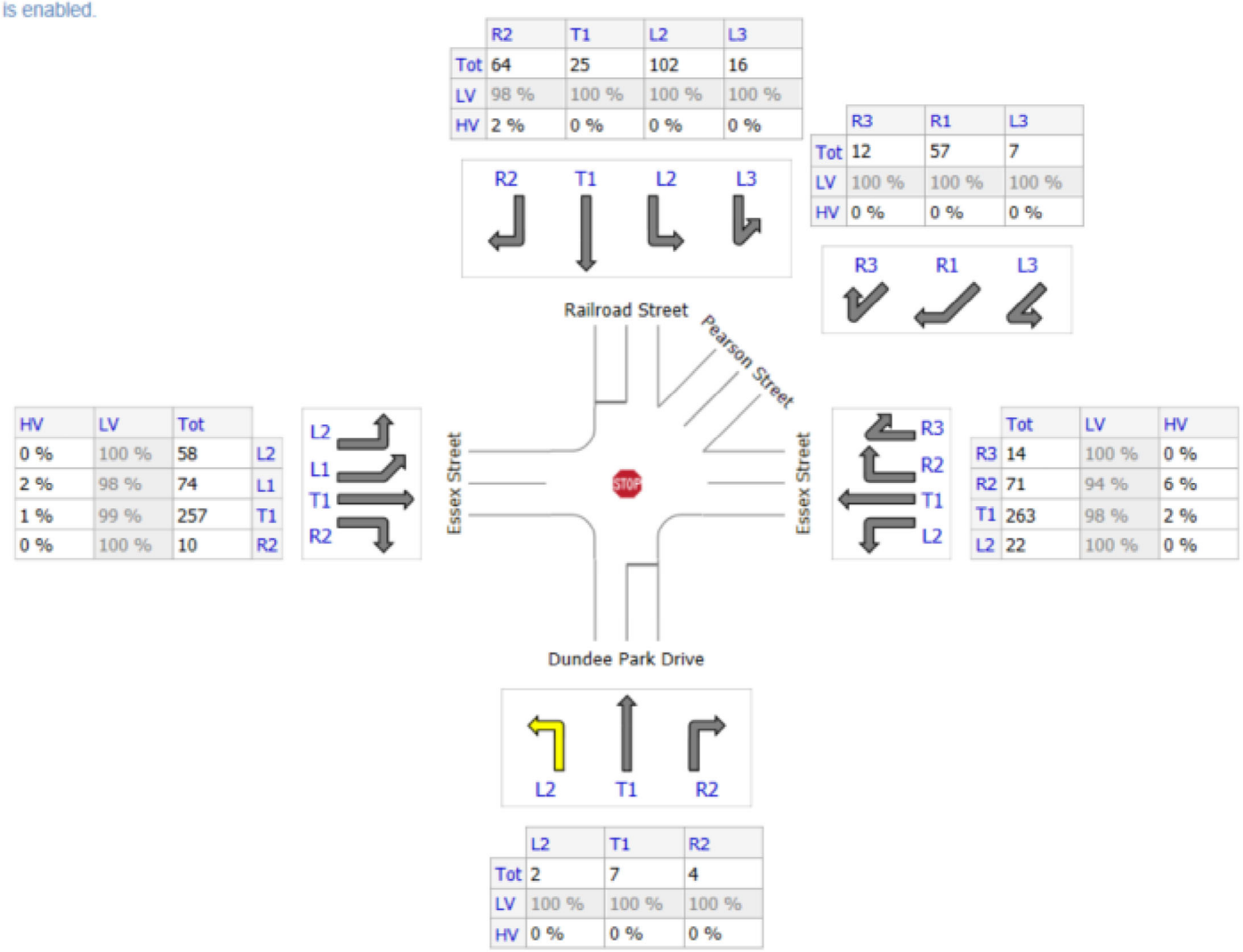


	R2	T1	L2	L3
Tot	64	25	102	16
LV	98 %	100 %	100 %	100 %
HV	2 %	0 %	0 %	0 %

	R3	R1	L3
Tot	12	57	7
LV	100 %	100 %	100 %
HV	0 %	0 %	0 %

HV	LV	Tot	
0 %	100 %	58	L2
2 %	98 %	74	L1
1 %	99 %	257	T1
0 %	100 %	10	R2

	Tot	LV	HV
R3	14	100 %	0 %
R2	71	94 %	6 %
T1	263	98 %	2 %
L2	22	100 %	0 %

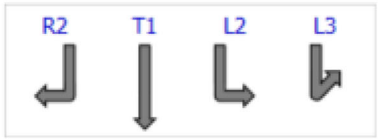
	L2	T1	R2
Tot	2	7	4
LV	100 %	100 %	100 %
HV	0 %	0 %	0 %

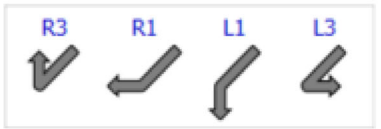
Volumes

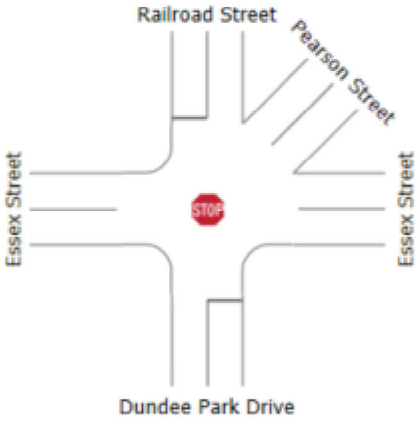
Direct data entry in the display is enabled.

	R2	T1	L2	L3
Tot	86	22	75	8
LV	100 %	100 %	97 %	100 %
HV	0 %	0 %	3 %	0 %

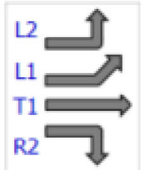
	R3	R1	L1	L3
Tot	15	64	2	5
LV	100 %	100 %	100 %	100 %
HV	0 %	0 %	0 %	0 %

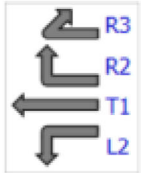




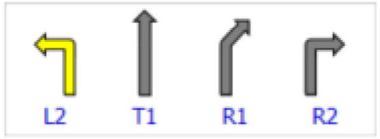


HV	LV	Tot	
0 %	100 %	62	L2
0 %	100 %	65	L1
1 %	99 %	240	T1
0 %	100 %	36	R2

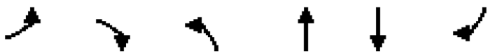




	Tot	LV	HV
R3	12	100 %	0 %
R2	129	97 %	3 %
T1	305	100 %	0 %
L2	13	100 %	0 %



	L2	T1	R1	R2
Tot	37	32	4	32
LV	100 %	100 %	100 %	100 %
HV	0 %	0 %	0 %	0 %

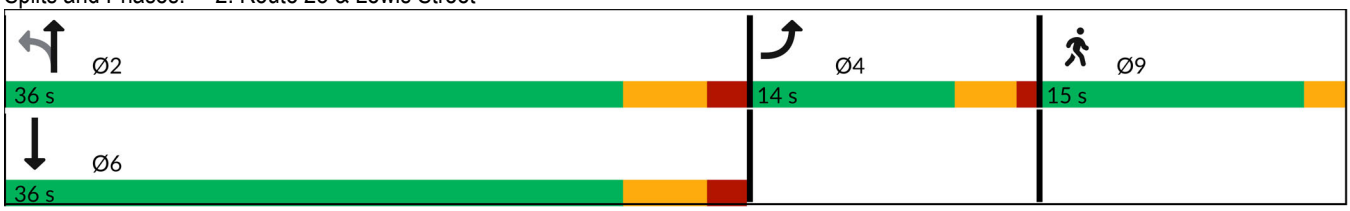


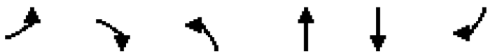
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø9
Lane Configurations							
Traffic Volume (vph)	26	19	10	442	610	22	
Future Volume (vph)	26	19	10	442	610	22	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	0.944				0.995		
Flt Protected	0.972			0.999			
Satd. Flow (prot)	1743	0	0	1986	2040	0	
Flt Permitted	0.972			0.983			
Satd. Flow (perm)	1743	0	0	1954	2040	0	
Satd. Flow (RTOR)	25				4		
Adj. Flow (vph)	35	25	13	567	693	25	
Lane Group Flow (vph)	60	0	0	580	718	0	
Turn Type	Prot		Perm	NA	NA		
Protected Phases	4			2	6		9
Permitted Phases			2				
Detector Phase	4		2	2	6		
Switch Phase							
Minimum Initial (s)	5.0		5.0	5.0	5.0		1.0
Minimum Split (s)	9.5		11.0	11.0	11.0		15.0
Total Split (s)	14.0		36.0	36.0	36.0		15.0
Total Split (%)	21.5%		55.4%	55.4%	55.4%		23%
Maximum Green (s)	10.0		30.0	30.0	30.0		13.0
Yellow Time (s)	3.0		4.0	4.0	4.0		2.0
All-Red Time (s)	1.0		2.0	2.0	2.0		0.0
Lost Time Adjust (s)	0.0			0.0	0.0		
Total Lost Time (s)	4.0			6.0	6.0		
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0		3.0	3.0	3.0		3.0
Recall Mode	None		Max	Max	Max		None
Walk Time (s)							7.0
Flash Dont Walk (s)							6.0
Pedestrian Calls (#/hr)							16
Act Effct Green (s)	6.8			40.5	40.5		
Actuated g/C Ratio	0.13			0.76	0.76		
v/c Ratio	0.24			0.39	0.46		
Control Delay (s/veh)	17.4			7.0	7.9		
Queue Delay	0.0			0.0	0.0		
Total Delay (s/veh)	17.4			7.0	7.9		
LOS	B			A	A		
Approach Delay (s/veh)	17.4			7.1	8.0		
Approach LOS	B			A	A		
Queue Length 50th (ft)	10			60	81		
Queue Length 95th (ft)	33			207	329		
Internal Link Dist (ft)	365			358	462		
Turn Bay Length (ft)							
Base Capacity (vph)	350			1483	1549		
Starvation Cap Reductn	0			0	0		
Spillback Cap Reductn	0			0	0		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø9
Storage Cap Reductn	0			0	0		
Reduced v/c Ratio	0.17			0.39	0.46		

Intersection Summary		
Cycle Length: 65		
Actuated Cycle Length: 53.4		
Natural Cycle: 60		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.46		
Intersection Signal Delay (s/veh): 8.0	Intersection LOS: A	
Intersection Capacity Utilization 45.9%	ICU Level of Service A	
Analysis Period (min) 15		

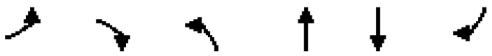
Splits and Phases: 2: Route 28 & Lewis Street





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	26	79	56	438	599	33
Future Volume (vph)	26	79	56	438	599	33
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.899				0.993	
Flt Protected	0.988		0.950			
Satd. Flow (prot)	1727	0	1745	1863	1852	0
Flt Permitted	0.988		0.950			
Satd. Flow (perm)	1727	0	1745	1863	1852	0
Adj. Flow (vph)	38	114	71	554	689	38
Lane Group Flow (vph)	152	0	71	554	727	0
Sign Control	Stop			Free	Free	

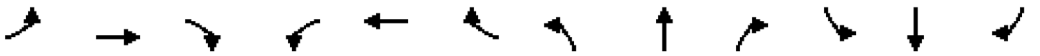
Intersection Summary			
Control Type: Unsignalized			
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	26	79	56	438	599	33
Future Volume (Veh/h)	26	79	56	438	599	33
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.79	0.79	0.87	0.87
Hourly flow rate (vph)	38	114	71	554	689	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					438	
pX, platoon unblocked	0.78	0.78	0.78			
vC, conflicting volume	1404	708	727			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1377	485	509			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	66	75	91			
cM capacity (veh/h)	113	457	832			

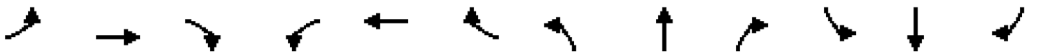
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	152	71	554	727
Volume Left	38	71	0	0
Volume Right	114	0	0	38
cSH	259	832	1700	1700
Volume to Capacity	0.59	0.09	0.33	0.43
Queue Length 95th (ft)	85	7	0	0
Control Delay (s/veh)	36.8	9.7	0.0	0.0
Lane LOS	E	A		
Approach Delay (s/veh)	36.8	1.1		0.0
Approach LOS	E			

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	53.2%	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)	24	80	0	0	41	8	0	0	1	13	0	35
Future Volume (vph)	24	80	0	0	41	8	0	0	1	13	0	35
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.978			0.865			0.902	
Flt Protected		0.989									0.987	
Satd. Flow (prot)	0	1775	0	0	1796	0	0	1808	0	0	1917	0
Flt Permitted		0.989									0.987	
Satd. Flow (perm)	0	1775	0	0	1796	0	0	1808	0	0	1917	0
Adj. Flow (vph)	29	98	0	0	52	10	0	0	4	26	0	70
Lane Group Flow (vph)	0	127	0	0	62	0	0	4	0	0	96	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Control Type: Unsignalized			
Intersection Capacity Utilization 28.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	80	0	0	41	8	0	0	1	13	0	35
Future Volume (Veh/h)	24	80	0	0	41	8	0	0	1	13	0	35
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.79	0.79	0.79	0.25	0.25	0.25	0.50	0.50	0.50
Hourly flow rate (vph)	29	98	0	0	52	10	0	0	4	26	0	70
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	62			98			283	218	98	217	213	57
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	62			98			283	218	98	217	213	57
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			100	100	100	96	100	93
cM capacity (veh/h)	1554			1508			618	671	963	730	675	1015

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	127	62	4	96
Volume Left	29	0	0	26
Volume Right	0	10	4	70
cSH	1554	1508	963	918
Volume to Capacity	0.02	0.00	0.00	0.10
Queue Length 95th (ft)	1	0	0	9
Control Delay (s/veh)	1.8	0.0	8.8	9.4
Lane LOS	A		A	A
Approach Delay (s/veh)	1.8	0.0	8.8	9.4
Approach LOS			A	A

Intersection Summary				
Average Delay	4.0			
Intersection Capacity Utilization	28.4%	ICU Level of Service	A	
Analysis Period (min)	15			

LANE SUMMARY

Site: 8975 [Andover (Site Folder: General)]

2030 Build Weekday Morning Peak Hour
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Dundee Park Drive													
Lane 1	24	0.0	246	0.098	100	21.2	LOS C	0.3	8.0	Full	1600	0.0	0.0
Approach	24	0.0		0.098		21.2	LOS C	0.3	8.0				
East: Essex Street													
Lane 1	552	2.6	1501	0.368	100	5.6	LOS A	2.5	63.0	Full	1600	0.0	0.0
Approach	552	2.6		0.368		5.6	NA	2.5	63.0				
NorthEast: Pearson Street													
Lane 1	104	0.0	692	0.151	100	7.5	LOS A	0.8	19.4	Full	1600	0.0	0.0
Approach	104	0.0		0.151		7.5	NA	0.8	19.4				
North: Railroad Street													
Lane 1	223	0.6	265	0.841	100	63.1	LOS F	8.6	216.9	Full	1600	0.0	0.0
Approach	223	0.6		0.841		63.1	LOS F	8.6	216.9				
West: Essex Street													
Lane 1	532	1.0	1482	0.359	100	5.7	LOS A	2.8	71.8	Full	1600	0.0	0.0
Approach	532	1.0		0.359		5.7	NA	2.8	71.8				
Intersection	1435	1.5		0.841		15.0	NA	8.6	216.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Approach Lane Flows (veh/h)

South: Dundee Park Drive

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	4	13	7	24	0.0	246	0.098	100	NA	NA
Approach	4	13	7	24	0.0		0.098			

East: Essex Street

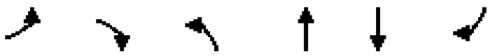
Mov. From E To Exit:	L2 S	T1 W	R2 N	R3 NE	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	33	393	106	21	552	2.6	1501	0.368	100	NA	NA
Approach	33	393	106	21	552	2.6		0.368			
NorthEast: Pearson Street											
Mov. From NE To Exit:	L3 E	R1 W	R3 N	Total	%HV		Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	10	78	16	104	0.0		692	0.151	100	NA	NA
Approach	10	78	16	104	0.0			0.151			
North: Railroad Street											
Mov. From N To Exit:	L3 NE	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	17	110	27	69	223	0.6	265	0.841	100	NA	NA
Approach	17	110	27	69	223	0.6		0.841			
West: Essex Street											
Mov. From W To Exit:	L2 N	L1 NE	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	77	99	343	13	532	1.0	1482	0.359	100	NA	NA
Approach	77	99	343	13	532	1.0		0.359			
	Total	%HV	Deg.Satn (v/c)								
Intersection	1435	1.5	0.841								

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Dundee Park Drive Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Essex Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
NorthEast Exit: Pearson Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Railroad Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Essex Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										



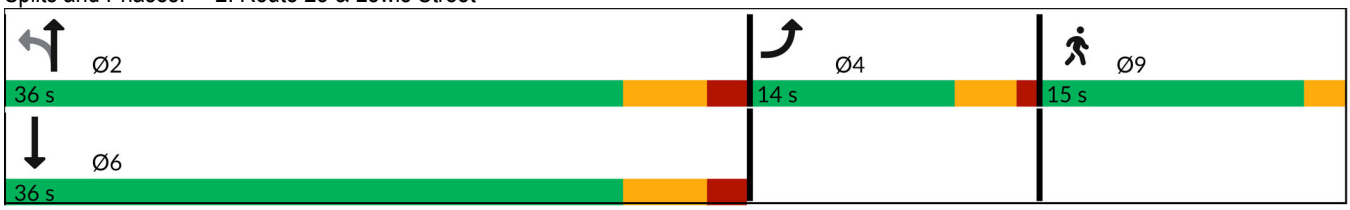
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø9
Lane Configurations							
Traffic Volume (vph)	16	12	13	665	516	22	
Future Volume (vph)	16	12	13	665	516	22	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	0.942				0.995		
Flt Protected	0.972			0.999			
Satd. Flow (prot)	1740	0	0	2005	2060	0	
Flt Permitted	0.972			0.987			
Satd. Flow (perm)	1740	0	0	1981	2060	0	
Satd. Flow (RTOR)	24				4		
Adj. Flow (vph)	32	24	14	715	573	24	
Lane Group Flow (vph)	56	0	0	729	597	0	
Turn Type	Prot		Perm	NA	NA		
Protected Phases	4			2	6		9
Permitted Phases			2				
Detector Phase	4		2	2	6		
Switch Phase							
Minimum Initial (s)	5.0		5.0	5.0	5.0		1.0
Minimum Split (s)	9.5		11.0	11.0	11.0		15.0
Total Split (s)	14.0		36.0	36.0	36.0		15.0
Total Split (%)	21.5%		55.4%	55.4%	55.4%		23%
Maximum Green (s)	10.0		30.0	30.0	30.0		13.0
Yellow Time (s)	3.0		4.0	4.0	4.0		2.0
All-Red Time (s)	1.0		2.0	2.0	2.0		0.0
Lost Time Adjust (s)	0.0			0.0	0.0		
Total Lost Time (s)	4.0			6.0	6.0		
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0		3.0	3.0	3.0		3.0
Recall Mode	None		Max	Max	Max		None
Walk Time (s)							7.0
Flash Dont Walk (s)							6.0
Pedestrian Calls (#/hr)							4
Act Effct Green (s)	6.7			41.1	41.1		
Actuated g/C Ratio	0.12			0.76	0.76		
v/c Ratio	0.23			0.48	0.37		
Control Delay (s/veh)	17.5			8.5	6.7		
Queue Delay	0.0			0.0	0.0		
Total Delay (s/veh)	17.5			8.5	6.7		
LOS	B			A	A		
Approach Delay (s/veh)	17.5			8.5	6.7		
Approach LOS	B			A	A		
Queue Length 50th (ft)	10			84	60		
Queue Length 95th (ft)	18			#383	258		
Internal Link Dist (ft)	365			358	462		
Turn Bay Length (ft)							
Base Capacity (vph)	346			1511	1572		
Starvation Cap Reductn	0			0	0		
Spillback Cap Reductn	0			0	0		

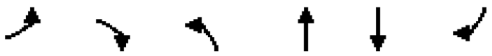
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	Ø9
Storage Cap Reductn	0			0	0		
Reduced v/c Ratio	0.16			0.48	0.38		

Intersection Summary			
Cycle Length: 65			
Actuated Cycle Length: 53.9			
Natural Cycle: 60			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.48			
Intersection Signal Delay (s/veh): 8.1		Intersection LOS: A	
Intersection Capacity Utilization 57.9%		ICU Level of Service B	
Analysis Period (min) 15			

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

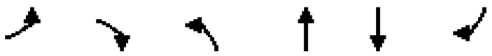
Splits and Phases: 2: Route 28 & Lewis Street





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	88	51	643	520	10
Future Volume (vph)	31	88	51	643	520	10
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.900				0.998	
Flt Protected	0.987		0.950			
Satd. Flow (prot)	1744	0	1745	1881	1878	0
Flt Permitted	0.987		0.950			
Satd. Flow (perm)	1744	0	1745	1881	1878	0
Adj. Flow (vph)	45	128	53	670	591	11
Lane Group Flow (vph)	173	0	53	670	602	0
Sign Control	Stop			Free	Free	

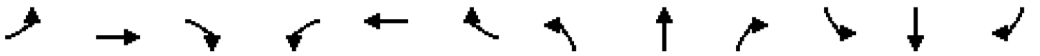
Intersection Summary			
Control Type: Unsignalized			
Intersection Capacity Utilization 48.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	31	88	51	643	520	10
Future Volume (Veh/h)	31	88	51	643	520	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.96	0.96	0.88	0.88
Hourly flow rate (vph)	45	128	53	670	591	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					438	
pX, platoon unblocked	0.85	0.85	0.85			
vC, conflicting volume	1373	597	602			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1350	436	443			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	76	94			
cM capacity (veh/h)	134	530	958			

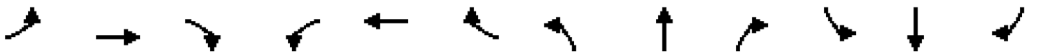
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	173	53	670	602
Volume Left	45	53	0	0
Volume Right	128	0	0	11
cSH	300	958	1700	1700
Volume to Capacity	0.58	0.06	0.39	0.35
Queue Length 95th (ft)	84	4	0	0
Control Delay (s/veh)	32.1	9.0	0.0	0.0
Lane LOS	D	A		
Approach Delay (s/veh)	32.1	0.7		0.0
Approach LOS	D			

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	48.4%	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)	27	62	0	0	65	9	0	0	0	7	0	21
Future Volume (vph)	27	62	0	0	65	9	0	0	0	7	0	21
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.984						0.899	
Flt Protected		0.985									0.988	
Satd. Flow (prot)	0	1784	0	0	1807	0	0	2090	0	0	1913	0
Flt Permitted		0.985									0.988	
Satd. Flow (perm)	0	1784	0	0	1807	0	0	2090	0	0	1913	0
Adj. Flow (vph)	33	75	0	0	108	15	0	0	0	28	0	84
Lane Group Flow (vph)	0	108	0	0	123	0	0	0	0	0	112	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Control Type: Unsignalized			
Intersection Capacity Utilization 21.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	62	0	0	65	9	0	0	0	7	0	21
Future Volume (Veh/h)	27	62	0	0	65	9	0	0	0	7	0	21
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.60	0.60	0.60	0.25	0.25	0.25	0.25	0.25	0.25
Hourly flow rate (vph)	33	75	0	0	108	15	0	0	0	28	0	84
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	123			75			341	264	75	257	257	116
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	123			75			341	264	75	257	257	116
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			100	100	100	96	100	91
cM capacity (veh/h)	1477			1537			553	630	992	689	636	942

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	108	123	0	112
Volume Left	33	0	0	28
Volume Right	0	15	0	84
cSH	1477	1537	1700	863
Volume to Capacity	0.02	0.00	0.00	0.13
Queue Length 95th (ft)	2	0	0	11
Control Delay (s/veh)	2.4	0.0	0.0	9.8
Lane LOS	A		A	A
Approach Delay (s/veh)	2.4	0.0	0.0	9.8
Approach LOS			A	A

Intersection Summary				
Average Delay	4.0			
Intersection Capacity Utilization	21.4%	ICU Level of Service	A	
Analysis Period (min)	15			

LANE SUMMARY

Site: 8975 [Andover (Site Folder: General)]

2030 Build Weekday Evening Peak Hour
Site Category: (None)
Stop (Two-Way)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Dundee Park Drive													
Lane 1	194	0.0	212	0.918	100	89.3	LOS F	9.4	236.0	Full	1600	0.0	0.0
Approach	194	0.0		0.918		89.3	LOS F	9.4	236.0				
East: Essex Street													
Lane 1	685	0.8	1419	0.483	100	7.6	LOS A	4.5	113.9	Full	1600	0.0	0.0
Approach	685	0.8		0.483		7.6	NA	4.5	113.9				
NorthEast: Pearson Street													
Lane 1	118	0.0	642	0.184	100	8.5	LOS A	1.0	24.0	Full	1600	0.0	0.0
Approach	118	0.0		0.184		8.5	NA	1.0	24.0				
North: Railroad Street													
Lane 1	205	1.2	242	0.848	100	68.3	LOS F	8.2	208.1	Full	1600	0.0	0.0
Approach	205	1.2		0.848		68.3	LOS F	8.2	208.1				
West: Essex Street													
Lane 1	537	0.6	1406	0.382	100	6.5	LOS A	3.5	87.4	Full	1600	0.0	0.0
Approach	537	0.6		0.382		6.5	NA	3.5	87.4				
Intersection	1740	0.7		0.918		23.6	NA	9.4	236.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Approach Lane Flows (veh/h)

South: Dundee Park Drive

Mov. From S To Exit:	L2 W	T1 N	R1 NE	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	69	59	7	59	194	0.0	212	0.918	100	NA	NA
Approach	69	59	7	59	194	0.0		0.918			

East: Essex Street

Mov. From E To Exit:	L2 S	T1 W	R2 N	R3 NE	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.

Lane 1	19	455	193	18	685	0.8	1419	0.483	100	NA	NA
Approach	19	455	193	18	685	0.8		0.483			
NorthEast: Pearson Street											
Mov. From NE To Exit:	L3 E	L1 S	R1 W	R3 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	7	3	88	21	118	0.0	642	0.184	100	NA	NA
Approach	7	3	88	21	118	0.0		0.184			
North: Railroad Street											
Mov. From N To Exit:	L3 NE	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	9	81	24	92	205	1.2	242	0.848	100	NA	NA
Approach	9	81	24	92	205	1.2		0.848			
West: Essex Street											
Mov. From W To Exit:	L2 N	L1 NE	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	83	87	320	48	537	0.6	1406	0.382	100	NA	NA
Approach	83	87	320	48	537	0.6		0.382			
	Total	%HV	Deg.Satn (v/c)								
Intersection	1740	0.7	0.918								

Lane flow rates given in this report are based on the arrival flow rates subject to upstream capacity constraint where applicable.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow-up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Dundee Park Drive Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
East Exit: Essex Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
NorthEast Exit: Pearson Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
North Exit: Railroad Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										
West Exit: Essex Street Merge Type: **Not Applied**												
Full Length Lane	1	Merge Analysis not applied.										

UPDATED SIGHT DISTANCE GRAPHICS

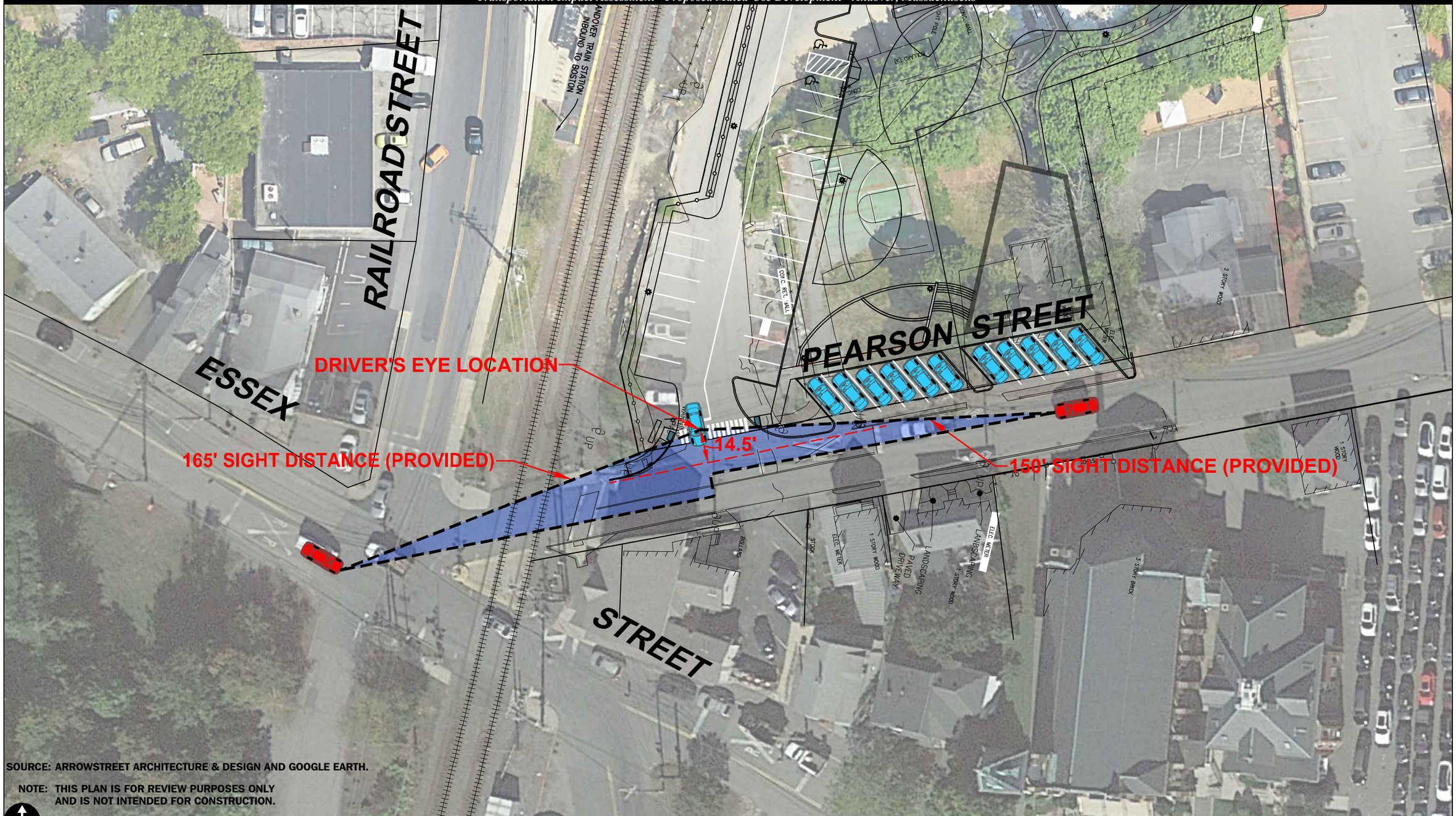


Figure SD-1A

Intersection Sight Distance Plan

Vanasse & Associates inc

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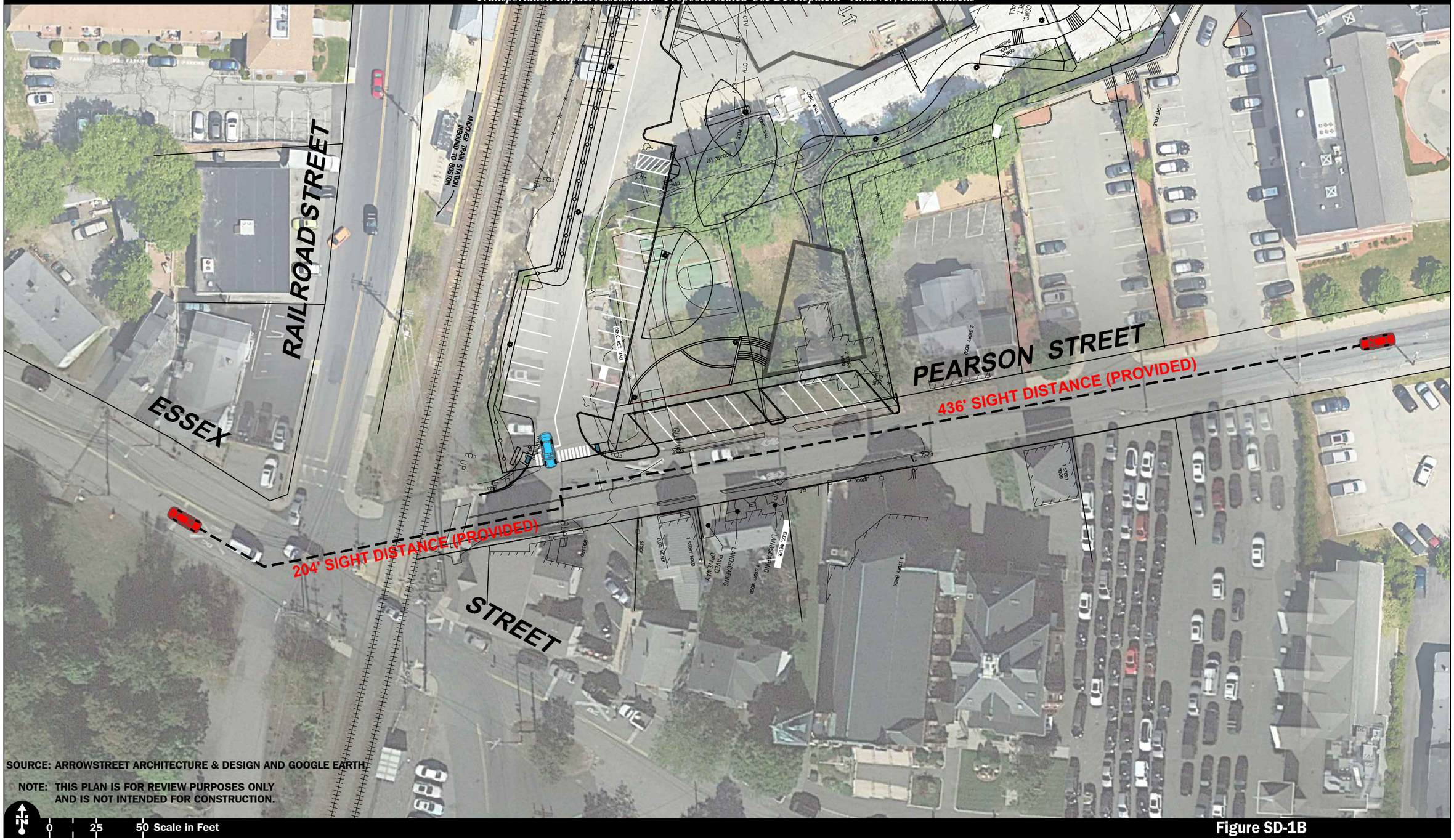

Figure SD-1B

Stopping Sight Distance Plan

Vanasse & Associates inc

RAILROAD GATE CLOSURE METHODOLOGY AND ANALYSIS RESULTS

RAILROAD GATE CLOSURE METHODOLOGY

Introduction

VAI visited the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive between 4:00 and 5:30 PM on May 8, 2024 (during the weekday evening peak hour) and between 7:30 and 9:00 AM on May 9, 2024 (during the weekday morning peak hour) to observe the railroad crossing gate closures. On May 8, 2024, VAI observed three train closures during the peak hour. The first was an inbound Haverhill Line train, the second was a northbound Downeaster train, and the third was an outbound Haverhill Line train. The Downeaster schedule notes northbound and southbound directions, which would correspond to outbound and inbound directions. On May 9, 2024, VAI observed two train closures during the peak hour which were both inbound trains on the Haverhill Line. The closure times were recorded with the results shown in Table RR-1.

Table RR-1
RAILROAD GATE CLOSURE OBSERVATIONS[a]

Scenario	Date	Train Arrival	Train	Direction	Length of Closure
Scenario 2	5/8/2024	4:13 PM	Haverhill Line	Inbound	142 seconds
Scenario 3	5/8/2024	4:18 PM	Downeaster	Northbound	35 seconds
Scenario 4	5/8/2024	4:32 PM	Haverhill Line	Outbound	48 seconds
Scenario 5	5/9/2024	7:41 AM	Haverhill Line	Inbound	200 seconds
Scenario 6	5/9/2024	8:46 AM	Haverhill Line	Inbound	160 seconds

[a]Based on observations conducted by VAI.

This data was then used to set up an analysis to determine the impacts of the railroad crossing closures on the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive. In order to do this, VAI followed the Synchro Studio 12 User Guide which suggests modeling railroad closures as a dummy T-intersection with a phase of the main roadway and a hold phase for the train. The hold phase would be the length of the observed railroad closures. However, the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive has five approaches and Synchro will not provide results for an intersection with five approaches, which is why the SIDRA traffic analysis software was used in previous analyses to model this intersection.

In order to capture the effect of the dummy, T-intersections on the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive the use of SimTraffic was reviewed. SimTraffic is a microsimulation model that can capture the effect of queues spilling over from other intersections. The five-way intersection was analyzed along with two dummy intersections that were created to model the railroad closures: one representing the gate closure with Pearson Street and the other representing the gate closure with Essex Street. SimTraffic was then used to run a traffic simulation and calculate delays of the closures and their impacts on the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive. This was conducted for the 2030 No Build and 2030 Build conditions. Simulations were conducted of the model for conditions with no gate closures (Scenario 1) and then the various other gate closures (Scenarios

2 through 6). As is standard practice, multiple simulations (five in this case) were conducted with the average of the simulations calculated. The results of these delays on the five-way intersection are shown in Table RR-2.

Table RR-2
RAILROAD GATE CLOSURE ANALYSIS SUMMARY: ESSEX STREET AT PEARSON STREET/RAILROAD STREET/DUNDEE PARK DRIVE

Unsignalized Intersection/ Critical Movement/Peak Hour	2030 No-Build				2030 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d]	Demand	Delay	LOS	Queue Build
Scenario 1 (No Train)								
Weekday Morning:								
Dundee Park Drive NB LT/TH/RT/HRT	13	16.8	C	9/35	13	20.6	C	11/39
Essex Street WB LT/TH/RT/HRT	365	0.7	A	23/53	366	1.0	A	28/69
Pearson Street SWB HLT/LT/RT/HRT	43	0.7	A	2/12	55	1.5	A	6/26
Railroad Street SB HLT/LT/TH/RT	207	48.7	E	104/164	207	60.3	F	106/163
Essex Street EB HLT/LT/TH/RT	381	1.6	A	21/53	388	2.5	A	32/101
Overall	--	**12.3**	**B**	--	--	**15.5**	**C**	--
Weekday Evening:								
Dundee Park Drive NB LT/TH/RT/HRT	105	35.7	E	59/109	105	47.2	E	42/98
Essex Street WB LT/TH/RT/HRT	453	2.0	A	28/72	454	2.2	A	14/42
Pearson Street SWB HLT/LT/RT/HRT	66	3.1	A	12/37	75	2.7	A	74/121
Railroad Street SB HLT/LT/TH/RT	191	51.8	F	101/161	191	57.6	F	106/160
Essex Street EB HLT/LT/TH/RT	383	3.2	A	44/95	391	3.1	A	33/73
Overall	--	**13.9**	**B**	--	--	**15.6**	**C**	--
Scenario 2 (Inbound, 142 seconds of closure)								
Weekday Evening:								
Dundee Park Drive NB LT/TH/RT/HRT	105	94.7	F	87/141	105	120.1	F	100/145
Essex Street WB LT/TH/RT/HRT	453	1.3	A	28/55	454	1.4	A	27/52
Pearson Street SWB HLT/LT/RT/HRT	66	3.6	A	12/40	75	3.7	A	15/49
Railroad Street SB HLT/LT/TH/RT	191	123.1	F	124/139	191	148.9	F	125/142
Essex Street EB HLT/LT/TH/RT	383	20.6	C	121/251	391	19.1	C	113/249
Overall	--	**32.4**	**D**	--	--	**34.8**	**D**	--
Scenario 3 (Downeaster, 35 seconds of closure)								
Weekday Evening:								
Dundee Park Drive NB LT/TH/RT/HRT	105	47.0	E	63/114	105	49.3	E	67/124
Essex Street WB LT/TH/RT/HRT	453	0.9	A	28/54	454	1.0	A	32/54
Pearson Street SWB HLT/LT/RT/HRT	66	1.8	A	7/32	75	3.0	A	13/41
Railroad Street SB HLT/LT/TH/RT	191	64.8	F	87/155	191	72.0	F	111/164
Essex Street EB HLT/LT/TH/RT	383	5.2	A	54/139	391	5.0	A	58/138
Overall	--	**14.6**	**B**	--	--	**16.9**	**C**	--
Scenario 4 (Outbound, 48 seconds of closure)								
Weekday Evening:								
Dundee Park Drive NB LT/TH/RT/HRT	105	42.9	E	58/110	105	49.0	E	68/126
Essex Street WB LT/TH/RT/HRT	453	1.0	A	28/54	454	1.1	A	30/52
Pearson Street SWB HLT/LT/RT/HRT	66	3.1	A	12/41	75	2.7	A	14/42
Railroad Street SB HLT/LT/TH/RT	191	80.1	F	115/167	191	86.2	F	122/156
Essex Street EB HLT/LT/TH/RT	383	4.9	A	55/140	391	4.7	A	55/138
Overall	--	**17.5**	**C**	--	--	**19.5**	**C**	--
Scenario 5 (Inbound 1, 200 seconds of closure)								
Weekday Morning:								
Dundee Park Drive NB LT/TH/RT/HRT	13	26.3	D	15/40	13	41.5	E	16/42
Essex Street WB LT/TH/RT/HRT	365	1.4	A	20/57	366	1.3	A	21/55
Pearson Street SWB HLT/LT/RT/HRT	43	2.7	A	4/20	55	4.8	A	9/40
Railroad Street SB HLT/LT/TH/RT	207	112.3	F	122/136	207	130.8	F	123/138
Essex Street EB HLT/LT/TH/RT	381	29.3	D	129/279	388	29.4	D	132/281
Overall	--	**32.9**	**D**	--	--	**33.5**	**D**	--

See notes at end of table.

Table RR-2 (Continued)
RAILROAD GATE CLOSURE ANALYSIS SUMMARY: ESSEX STREET AT PEARSON STREET/RAILROAD STREET/ DUNDEE PARK DRIVE

Unsignalized Intersection/ Critical Movement/Peak Hour	2030 No-Build				2030 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d]	Demand	Delay	LOS	Queue
Scenario 6 (Inbound 2, 160 seconds of closure)								
Weekday Morning:								
Dundee Park Drive NB LT/TH/RT/HRT	13	44.7	E	18/49	13	49.2	E	20/52
Essex Street WB LT/TH/RT/HRT	365	1.4	A	22/59	366	1.7	A	22/54
Pearson Street SWB HLT/LT/RT/HRT	43	2.3	A	6/29	55	8.2	A	11/46
Railroad Street SB HLT/LT/TH/RT	207	117.5	F	125/141	207	134.5	F	20/52
Essex Street EB HLT/LT/TH/RT	381	22.8	C	147/294	388	23.7	C	144/295
Overall	--	**29.8**	**D**	--	--	**31.2**	**D**	--

[a]Demand in vehicles per hour.
[b]Delay in seconds per vehicle.
[c]Level of service.
[d]95th percentile queue length (veh).
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; SWB = southwestbound; LT = left-turning movements; TH = through movements; RT = right-turning movements; HLT = hard left-turning movements; HRT = hard right-turning movements.

As shown in Table RR-2, the gate closures clearly have an effect on the intersection operations, with intersection level of service changing from LOS B/C during the weekday morning/evening peak hours without the closure, to as low as LOS D with some of the longest gate closures. The simulations of the effects of the closures on the five-way intersection resulted in delays ranging between 14.6 and 34.8 seconds using this approach. In all conditions, the Project traffic resulted in increases to delay of between 0.6 and 3.2 seconds.

SimTraffic also provides an overall network performance delay. This allows for comparison of the different scenarios utilizing just one Measure of Effectiveness (MOE) number. This analysis was conducted with the results shown in Table RR-3.

Table RR-3
RAILROAD GATE CLOSURE ANALYSIS SUMMARY: ENTIRE NETWORK

Unsignalized Intersection/ Critical Movement/Peak Hour	2030 No-Build		2030 Build	
	Delay[a]	LOS[b]	Delay	LOS
Scenario 1 (No Train)				
Weekday Morning:				
Network Performance	13.1	B	16.2	C
Weekday Evening:				
Network Performance	14.2	B	15.9	C
Scenario 2 (Inbound, 142 seconds of closure)				
Weekday Evening:				
Network Performance	43.0	E	44.3	E
Scenario 3 (Downeaster, 35 seconds of closure)				
Weekday Evening:				
Network Performance	16.9	C	18.9	C
Scenario 4 (Outbound, 48 seconds of closure)				
Weekday Evening:				
Network Performance	19.8	C	22.1	C
Scenario 5 (Inbound 1, 200 seconds of closure)				
Weekday Morning:				
Network Performance	47.4	E	48.0	E
Scenario 6 (Inbound 2, 160 seconds of closure)				
Weekday Morning:				
Network Performance	41.2	E	44.0	E

[a]Delay in seconds per vehicle.
[b]Level of service.

As shown in Table RR-3, this analysis also identifies an impact of the closures on the intersection of Essex Street at Pearson Street/Railroad Street/Dundee Park Drive. With no closures, the network operates at LOS B under 2030 No-Build conditions and LOS C under 2030 Build conditions. Railroad closures over 140 seconds caused the network level of service to degrade to LOS E under both No-Build and Build conditions while closures under 50 seconds caused the network level of service to degrade to LOS C under both No-Build and Build conditions. In each scenario, the increase in delay under 2030 Build conditions due to the Project traffic volume is under 3.5 seconds, indicating minimal impact from the Project-generated traffic on operations with the railroad gates opened or closed.

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						4.0
Total Del/Veh (s)	1.6	0.7	16.8	48.7	0.7	12.3

Total Network Performance

Denied Del/Veh (s)	4.1
Total Del/Veh (s)	13.1

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	43	13	38	133	44
Average Queue (ft)	21	2	9	104	23
95th Queue (ft)	53	12	35	164	53
Link Distance (ft)	194	54	104	113	20
Upstream Blk Time (%)				37	3
Queuing Penalty (veh)				0	0
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						2.9
Total Del/Veh (s)	3.2	3.1	35.7	51.8	2.0	13.9

Total Network Performance

Denied Del/Veh (s)	2.9
Total Del/Veh (s)	14.2

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	88	35	108	134	76
Average Queue (ft)	44	12	59	101	28
95th Queue (ft)	95	37	109	161	72
Link Distance (ft)	194	413	106	115	403
Upstream Blk Time (%)			4	33	
Queuing Penalty (veh)			0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						46.6
Total Del/Veh (s)	20.6	3.6	94.7	123.1	1.3	32.4

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			2.7
Total Del/Veh (s)	3.7	22.2	14.4

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	11.6	9.2	10.3

Total Network Performance

Denied Del/Veh (s)	48.3
Total Del/Veh (s)	43.0

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	218	48	115	133	48
Average Queue (ft)	121	12	87	124	28
95th Queue (ft)	251	40	141	139	55
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	14	0	43	99	6
Queuing Penalty (veh)	0	0	0	0	28
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	350
Average Queue (ft)	13	128
95th Queue (ft)	47	378
Link Distance (ft)	32	331
Upstream Blk Time (%)	16	13
Queuing Penalty (veh)	56	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	42	45
Average Queue (ft)	10	10
95th Queue (ft)	45	47
Link Distance (ft)	66	220
Upstream Blk Time (%)	3	
Queuing Penalty (veh)	2	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 85

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						5.4
Total Del/Veh (s)	5.2	1.8	47.0	64.8	0.9	14.6

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.2
Total Del/Veh (s)	1.0	4.2	2.9

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	2.5	2.2	2.3

Total Network Performance

Denied Del/Veh (s)	5.6
Total Del/Veh (s)	16.9

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	149	36	102	132	48
Average Queue (ft)	54	7	63	87	28
95th Queue (ft)	139	32	114	155	54
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	1	0	14	34	5
Queuing Penalty (veh)	0	0	0	0	20
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	53	155
Average Queue (ft)	11	39
95th Queue (ft)	44	148
Link Distance (ft)	32	331
Upstream Blk Time (%)	4	1
Queuing Penalty (veh)	13	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	22	39
Average Queue (ft)	5	7
95th Queue (ft)	24	33
Link Distance (ft)	66	220
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 34

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						9.0
Total Del/Veh (s)	4.9	3.1	42.9	80.1	1.0	17.5

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.2
Total Del/Veh (s)	1.4	4.0	2.9

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	3.4	1.0	2.1

Total Network Performance

Denied Del/Veh (s)	9.1
Total Del/Veh (s)	19.8

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	161	51	103	133	46
Average Queue (ft)	55	12	58	115	28
95th Queue (ft)	140	41	110	167	54
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	0	0	7	62	5
Queuing Penalty (veh)	0	0	0	0	21
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	151
Average Queue (ft)	7	34
95th Queue (ft)	37	126
Link Distance (ft)	32	331
Upstream Blk Time (%)	6	
Queuing Penalty (veh)	19	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	31	12
Average Queue (ft)	4	2
95th Queue (ft)	30	13
Link Distance (ft)	66	220
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 41

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						72.9
Total Del/Veh (s)	29.3	2.7	26.3	112.3	1.4	32.9

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			2.8
Total Del/Veh (s)	4.8	32.1	18.9

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.0
Total Del/Veh (s)	5.4	16.4	9.8

Total Network Performance

Denied Del/Veh (s)	74.5
Total Del/Veh (s)	47.4

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	222	20	33	133	58
Average Queue (ft)	129	4	15	122	20
95th Queue (ft)	279	20	40	136	57
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	32			99	5
Queuing Penalty (veh)	0			0	17
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	350
Average Queue (ft)	18	146
95th Queue (ft)	54	402
Link Distance (ft)	32	331
Upstream Blk Time (%)	22	13
Queuing Penalty (veh)	80	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	10	48
Average Queue (ft)	4	15
95th Queue (ft)	24	55
Link Distance (ft)	66	220
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 97

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						60.3
Total Del/Veh (s)	22.8	2.3	44.7	117.5	1.4	29.8

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			1.4
Total Del/Veh (s)	3.6	25.6	14.3

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.0
Total Del/Veh (s)	7.3	18.8	11.6

Total Network Performance

Denied Del/Veh (s)	61.5
Total Del/Veh (s)	41.2

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	231	27	48	137	58
Average Queue (ft)	147	6	18	125	22
95th Queue (ft)	294	29	49	141	59
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	31	0		100	5
Queuing Penalty (veh)	0	0		0	19
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	50	339
Average Queue (ft)	12	119
95th Queue (ft)	46	351
Link Distance (ft)	32	331
Upstream Blk Time (%)	18	9
Queuing Penalty (veh)	65	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	60	60
Average Queue (ft)	14	14
95th Queue (ft)	58	55
Link Distance (ft)	66	220
Upstream Blk Time (%)	4	
Queuing Penalty (veh)	3	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 87

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	<LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						77.6
Total Del/Veh (s)	19.1	3.7	120.1	148.9	1.4	34.8

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			1.0
Total Del/Veh (s)	3.7	19.0	12.3

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	8.2	16.4	12.7

Total Network Performance

Denied Del/Veh (s)	78.4
Total Del/Veh (s)	44.3

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	<LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	209	48	115	137	49
Average Queue (ft)	113	15	100	125	27
95th Queue (ft)	249	49	145	142	52
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	18	1	67	96	7
Queuing Penalty (veh)	0	0	0	0	30
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	53	327
Average Queue (ft)	13	113
95th Queue (ft)	47	322
Link Distance (ft)	32	331
Upstream Blk Time (%)	16	4
Queuing Penalty (veh)	56	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	26	86
Average Queue (ft)	6	21
95th Queue (ft)	31	90
Link Distance (ft)	66	220
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 86

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	<LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						6.7
Total Del/Veh (s)	5.0	3.0	49.3	72.0	1.0	16.9

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.2
Total Del/Veh (s)	1.0	3.5	2.4

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	1.5	1.8	1.7

Total Network Performance

Denied Del/Veh (s)	6.9
Total Del/Veh (s)	18.9

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	<LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	144	46	110	136	50
Average Queue (ft)	58	13	67	111	32
95th Queue (ft)	138	41	124	164	54
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	0	0	12	48	5
Queuing Penalty (veh)	0	0	0	0	22
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	135
Average Queue (ft)	10	39
95th Queue (ft)	42	124
Link Distance (ft)	32	331
Upstream Blk Time (%)	4	
Queuing Penalty (veh)	12	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	6	32
Average Queue (ft)	1	6
95th Queue (ft)	11	30
Link Distance (ft)	66	220
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 34

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	<LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						13.9
Total Del/Veh (s)	4.7	2.7	49.0	86.2	1.1	19.5

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.2
Total Del/Veh (s)	1.4	4.7	3.3

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	5.0	1.2	3.0

Total Network Performance

Denied Del/Veh (s)	14.1
Total Del/Veh (s)	22.1

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	<LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	155	48	106	137	49
Average Queue (ft)	55	14	68	122	30
95th Queue (ft)	138	42	126	156	52
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	0	0	11	72	5
Queuing Penalty (veh)	0	0	0	0	24
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	158
Average Queue (ft)	7	43
95th Queue (ft)	37	138
Link Distance (ft)	32	331
Upstream Blk Time (%)	6	
Queuing Penalty (veh)	20	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	47	18
Average Queue (ft)	7	3
95th Queue (ft)	39	17
Link Distance (ft)	66	220
Upstream Blk Time (%)	2	
Queuing Penalty (veh)	1	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 45

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	<LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						97.9
Total Del/Veh (s)	29.4	4.8	41.5	130.8	1.3	33.5

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			3.2
Total Del/Veh (s)	5.4	30.8	18.6

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	3.3	19.1	10.2

Total Network Performance

Denied Del/Veh (s)	99.6
Total Del/Veh (s)	48.0

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	<LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	222	41	37	132	49
Average Queue (ft)	132	9	16	123	21
95th Queue (ft)	281	40	42	138	55
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	33	1		100	4
Queuing Penalty (veh)	0	1		0	16
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	57	358
Average Queue (ft)	20	142
95th Queue (ft)	61	394
Link Distance (ft)	32	331
Upstream Blk Time (%)	22	12
Queuing Penalty (veh)	82	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	6	65
Average Queue (ft)	2	22
95th Queue (ft)	12	72
Link Distance (ft)	66	220
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 98

3: Dundee Park/Railroad Street & Essex Street & Pearson Street Performance by lane

Lane	EB	WB	NB	SB	NW	All
Movements Served	LTR>	<LTR	LTR>	<LTR	<LR>	
Denied Del/Veh (s)						62.0
Total Del/Veh (s)	23.7	8.2	49.2	134.5	1.7	31.2

6: Railroad Tracks & Essex Street Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			1.9
Total Del/Veh (s)	3.7	30.8	16.9

9: Pearson Street /Person Street & Railroad Tracks Performance by lane

Lane	EB	WB	All
Movements Served	T	T	
Denied Del/Veh (s)			0.1
Total Del/Veh (s)	5.3	18.9	10.9

Total Network Performance

Denied Del/Veh (s)	63.7
Total Del/Veh (s)	44.0

Intersection: 3: Dundee Park/Railroad Street & Essex Street & Pearson Street

Movement	EB	WB	NB	SB	NW
Directions Served	LTR>	<LTR	LTR>	<LTR	<LR>
Maximum Queue (ft)	224	45	44	128	46
Average Queue (ft)	144	11	20	124	22
95th Queue (ft)	295	46	52	136	54
Link Distance (ft)	194	66	100	113	32
Upstream Blk Time (%)	31	4		100	7
Queuing Penalty (veh)	0	2		0	26
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Railroad Tracks & Essex Street

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	52	346
Average Queue (ft)	13	133
95th Queue (ft)	46	371
Link Distance (ft)	32	331
Upstream Blk Time (%)	18	12
Queuing Penalty (veh)	66	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9: Pearson Street /Person Street & Railroad Tracks

Movement	EB	WB
Directions Served	T	T
Maximum Queue (ft)	61	83
Average Queue (ft)	11	19
95th Queue (ft)	50	77
Link Distance (ft)	66	220
Upstream Blk Time (%)	3	
Queuing Penalty (veh)	3	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 97