Vanasse & Associates inc
Transportation Engineers & Planners

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

Ref: 8441

January 27, 2022

Ms. Sue Brown
Town Planner
Town of Manchester-by-the-Sea
10 Central Street
Manchester-by-the-Sea, MA 01944

Re: Response to Transportation Peer Review
The Sanctuary at Manchester-by-the-Sea – School Street
Manchester-by-the-Sea, Massachusetts

Dear Ms. Brown:

Vanasse & Associates, Inc. (VAI) is providing responses to the comments that were raised in the January 10th, 2022 *Transportation Peer Review* letter prepared by Environmental Partners (EP) in reference to their review of the December 2021 Updated *Transportation Impact Assessment* (the "December 2021 TIA") prepared by VAI in support of The Sanctuary multifamily residential development to be located off School Street in Manchester-by-the-Sea, Massachusetts (hereafter referred to as the "Project"). Listed below are the comments that were identified by EP in the subject letter that required a response or supplemental information, followed by our response on behalf of the Project proponent.

Existing Conditions

Comment 1: *The TIA identifies shared bicycle accommodations are provided on School Street and Pleasant Street. While shoulders of varying width are provided on School Street and bicycles are not specifically prohibited, no specific accommodations are provided and shoulders in some instances are too narrow to provide comfortable accommodations for bicyclists. While the TIA is correct that shared traveled way accommodations exist, this should not be construed to mean that specific accommodations are provided for bicyclists.*

Response: No response required; VAI concurs that formal bicycle accommodations are no afforded along School Street.

Existing Traffic Data

Traffic Volume Adjustments

Comment 2: *The April 2020 "Guidance on Traffic Counting Data" published by MassDOT establishes a procedure by which 2019 data is considered current data. It is unclear how this data were "expanded" to 2021; additional detail and backup calculations should be provided.*

Response: A compounded annual traffic growth rate of 1.0 percent per year (consistent with the established growth rate in the December 2021 TIA) was applied to Annual Daily Traffic (ADT) obtained from MassDOT Continuous Count Station No. 35 for the month of November 2019 to establish November 2021 traffic volume conditions. The detailed calculations are attached.

Comment 3: *Backup data should be provided for the permanent count station referenced to determine if it is appropriate to apply the same adjustment factor to both weekday morning and weekday afternoon peak hours. It is understood that the pandemic has greatly affected work and travel patterns, and different adjustment factors by time of day may be appropriate.*

Response: The traffic count data from the MassDOT permanent traffic count station is attached.

Comment 4: *Table 2 presents an unclear summary of existing traffic volumes using a mix of ATR data and TMC data at different locations. Daily traffic is taken from ATR data south of Atwater Avenue, while vehicle per hour data is taken from TMC data north of Atwater Avenue. EP recommends using adjusted hourly data from the ATR count for the peak hour values and calculation of K factor and directional distribution or using TMC data from the same location with respect to Atwater Avenue. We note that TMC data taken at this location results in higher adjusted hourly volumes of 723 for the weekday morning peak hour and 727 for the weekday afternoon peak hour.*

Response: Table 2R has been revised to present the ATR and TMC data for School Street south of Atwater Avenue.

Table 2R
2021 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT[a]	VPH[b]	K Factor[c]	Directional Distribution[d]
School Street south of Atwater Avenue:	7,090	--	--	--
Weekday Morning (7:15 – 8:15 AM)	--	723	10.2	56.3% SB
Weekday Evening (4:00 – 5:00 PM)	--	727	10.3	53.9% NB

[a]Average weekday traffic in vehicles per day.
[b]Vehicles per hour.
[c]Percent of daily traffic occurring during the peak hour.
[d]Percent traveling in peak direction.
NB = northbound, SB= southbound

Crash Data

Comment 5: *Backup data has not been provided to support the crash data summary.*

Response: The MassDOT crash data for the study area is attached.

Comment 6: *A corridor crash analysis should be provided for the School Street corridor to identify mid-block and minor intersection crashes within the study area.*

Response: As requested by EP, motor vehicle crash information was obtained for the School Street corridor between Old School Street and Central Street/Union Street (Route 127) from the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2015 though 2019, inclusive) in order to examine motor vehicle crash trends occurring within the study area. For the purpose of this evaluation, the School Street corridor was separated into two (2) roadway segments: Segment 1 - between Old School Street and the Route 128 southbound ramps; Segment 2 – between the Route 128 northbound ramps and Route 127. The data is summarized by for each roadway segment by crash type, severity, roadway and weather conditions, and day of occurrence, and presented in Table 4A.

As can be seen in Table 4A, 10 motor vehicle crashes were reported to have occurred along School Street Segment 1 (between Old School Street and the Route 128 southbound ramps) over the five-year review period, or an average of 2.0 crashes per year, the majority of which occurred on a weekday, during daylight, under clear weather conditions, and were reported as angle-type collisions that occurred at an intersection, with the severity type evenly split between property damage and personal injury.

Thirty-one motor vehicle crashes were reported to have occurred along School Street Segment 2 (between the Route 128 northbound ramps and Route 127) over the five-year review period, or an average of 6.2 crashes per year, the majority of which occurred on a weekday, during daylight, under clear weather conditions, and were reported as angle-type collisions that occurred at an intersection or sideswipe crashes that resulted in property damage only.

The calculated motor vehicle crash rate for both School Street roadway segments were found to be *below* MassDOT statewide and District average crash rates for urban minor arterial roadways, the functional classification for School Street. In addition, a review of the MassDOT statewide High Crash Location List indicated that there are no locations within the Town of Manchester-by-the-Sea that are included on MassDOT's Highway Safety Improvement Program (HSIP) listing as high crash locations. The detailed MassDOT Crash Rate Worksheets are attached.

Table 4A
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	Segment 1: School Street between Old School Street and Route 128 SB Ramps	Segment 2: School Street between Route 128 NB Ramps and Route 127
Traffic Control Type	--	--
Year:		
2015	3	5
2016	2	5
2017	2	10
2018	1	6
2019	2	5
Total	10	31
Average	2.00	6.20
Crash Rate[b]	2.04	1.53
MassDOT Crash Rate:[c]	2.26/3.49[e]	2.26/3.49
Significant?[d]	No	No
Type:		
Angle	5	8
Head-On	1	2
Rear-End	0	7
Rear-to-Rear	0	0
Sideswipe	1	8
Fixed Object	1	4
Pedestrian/Bicycle	1	2
Unknown/Other	1	0
Total	10	31
Conditions:		
Clear	8	22
Cloudy	1	6
Rain	1	1
Snow/Ice	0	2
Not Reported/Other	0	0
Total	10	31
Lighting:		
Daylight	8	26
Dawn/Dusk	0	1
Dark (Road Lit)	1	3
Dark (Road Unlit)	1	1
Total	10	8
Day of Week:		
Monday-Friday	7	26
Saturday	2	3
Sunday	1	2
Total	10	31
Severity:		
Property Damage Only	4	16
Non-fatal Injury	4	10
Not Reported	2	5
Total	10	31

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2015 through 2019.
[b]Crash rate per million vehicles entering the intersection.
[c]Statewide/District crash rate.
[d]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the functional classification of the roadway.
[e]Statewide/average crash rate for an urban minor arterial roadway.

Trip Distribution

Comment 7: *A review of backup data in the Appendix revealed that distribution percentages for Route 127 are transposed in Figure 7. Backup data suggests that 6% travel to/from Central Street and 3% via Union Street. This correction has a negligible impact, affecting one trip as shown in Figure 8.*

Response: Figure 7 has been updated to reflect 6 percent of Project-related traffic using Central Street and 3 percent using Union Street. This change resulted in one (1) trip being removed from Union Street and added to Central Street during the weekday morning peak hour, and two (2) trips being removed from Union Street and added to Central Street during the weekday evening peak hour. The revised figures are attached.

Future Traffic Volumes – Build Condition

Comment 8: *EP requests revisions to Table 6 summarizing all projected traffic volume increases resulting from expected Project-generated traffic.*

Response: Table 6A (an expansion of Table 6) shows the traffic volume increases resulting from the Project between the study area intersections. By way of clarification as to the intent of Table 6; Table 6 is intended to illustrate the traffic volume increases resulting from the Project that occur external to the study area that is assessed in the December 2021 TIA given that the direct impact of the Project is assessed within the study area. Mill Street has been removed from Table 6A as Project-related traffic was not assigned to this roadway.

Traffic Operations

Comment 9: *Analysis results suggest that study area intersections are at or near capacity presently and in need of mitigation to support additional traffic load.*

Response: The Project includes measures that are intended to support improvements along School Street that are desirable and justified independent of the Project to address existing or predicted capacity constraints. The measures are proportionate to the identified impact of the Project and include the preparation of a study, conceptual design plans and associated cost estimates for improvements for the Route 128 north and southbound ramp intersections with School Street. With specific regard to the Project, the regulations under M.G.L. Chapter 40B and the related case law confirm that an Applicant is not expected to solve existing traffic issues, only to mitigate the incremental change that is associated with the development.

Table 6A
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2021 Existing	2029 No-Build	2029 Build	Traffic Volume Increase Over No-Build	Percent Increase Over No-Build
Atwater Avenue, east of School Street:					
Weekday Morning	147	159	160	1	0.6
Weekday Evening	164	178	180	2	1.1
School Street, north of Project Site Roadway:					
Weekday Morning	610	661	664	3	0.5
Weekday Evening	623	676	679	3	0.4
Route 128, east of School Street:					
Weekday Morning	197	214	217	3	1.4
Weekday Evening	245	265	267	2	0.8
Route 128, west of School Street:					
Weekday Morning	654	709	750	41	5.8
Weekday Evening	701	759	809	50	6.6
Pleasant Street, east of School Street:					
Weekday Morning	381	413	415	2	0.5
Weekday Evening	212	229	237	8	3.5
Pleasant Street, west of School Street:					
Weekday Morning	232	252	253	1	0.4
Weekday Evening	177	192	194	2	1.0
Lincoln Street, east of School Street:					
Weekday Morning	385	416	423	7	1.7
Weekday Evening	250	270	274	4	1.5
Route 127, east of School Street:					
Weekday Morning	682	739	743	4	0.5
Weekday Evening	853	924	929	5	0.5
Route 127, west of School Street:					
Weekday Morning	696	755	758	3	0.4
Weekday Evening	759	822	825	3	0.4
School Street, between Atwater Avenue and Route 128 Southbound Ramps:					
Weekday Morning	723	784	845	61	7.8
Weekday Evening	727	788	862	74	9.4
School Street, between Route 128 Northbound Ramps and Pleasant Street:					
Weekday Morning	914	990	1,007	17	1.7
Weekday Evening	860	931	953	22	2.4
School Street, between Pleasant Street and Lincoln Street:					
Weekday Morning	755	819	833	14	1.7
Weekday Evening	725	784	796	12	1.5
School Street, between Lincoln Street and Route 127:					
Weekday Morning	478	518	525	7	1.4
Weekday Evening	466	504	512	8	1.6

Comment 10: *A review of Synchro analysis contained in the Appendix revealed transposed peak hour factors (PHFs) for the eastbound and westbound movements at the intersection of School Street, the Route 128 northbound ramps, and Mill Street in the weekday morning peak hour. EP notes that a reduction in PHF for the Route 128 northbound off-ramp will further increase delays reported for this critical approach to the intersection.*

Response: The PHFs for the identified movements at the School Street/Route 128 Northbound Ramps/Mill Street intersection were corrected for the weekday morning peak-hour and the associated traffic operations analyses were revised, the results of which are summarized in Table 8R with the detailed analysis results attached.

The correction of the PHF's resulted in a general increase in average motorist delay for the Route 128 northbound off-ramp that resulted in a corresponding increase in vehicle queuing of up to three (3) vehicles for left-turn/through movements and up to one (1) vehicle for the right-turn movement under both No-Build and Build conditions. Project-related impacts at the intersection during the weekday morning peak-hour continue to be defined by an increase in motorist delay that resulted in a corresponding increase in vehicle queuing of up to two (2) vehicles.

Site Access

Comment 11: *The offset distance of 135 feet between the proposed site driveway and Atwater Avenue introduces the potential for conflicts between turning vehicles between the two intersections. EP notes that the project site lot provides frontage along School Street in the vicinity of Atwater Avenue; the Applicant should provide justification as to why the site driveway was not located opposite Atwater Avenue.*

Response: The Project site driveway has been purposely located along School Street in order to: i) avoid a wetland resource area that is located opposite Atwater Avenue which prevents any disturbance and a defined riverfront area to the north of the current driveway location; and ii) to be sufficiently removed from Atwater Avenue so as to limit the interaction between the two intersections. As identified in the December 2021 TIA, lines of sight at the Project site driveway intersection exceed the recommended minimum distances for the intersection to operate in a safe and efficient manner.

Comment 12: *The length of the driveway well exceeds Zoning By-Law requirements. Section 6.2.8 of the by-laws states that common driveways should have a maximum length of 500 feet. The proposed site driveway is approximately 1,800 feet from School Street to the parking garage entrance.*

Response: The Fire Chief submitted a formal letter for the record dated January 21, 2022. The Chief confirmed that he has reviewed the design of the Project, including the Project site access and internal circulation, and has determined that the Project, as designed, provides the appropriate accommodations for fire protection and life safety access.

Comment 13: *The site topography requires the driveway to wrap around the building, increasing access and response times for emergency vehicles. An additional emergency access drive should be considered. EP recommends coordination with the Manchester-by-the-Sea Fire Department to obtain their concurrence with proposed emergency access.*

Response: The Fire Chief submitted a formal letter for the record dated January 21, 2022. The Chief confirmed that he has reviewed the design of the Project, including the Project site access and internal circulation, and has determined that the Project, as designed, provides the appropriate accommodations for fire protection and life safety access.

Parking

Comment 14: *The proposed project is in deficit for proposed parking spaces in comparison with the Zoning By-Law requirements. Additional analysis must be provided to justify the proposed parking supply.*

Response: The Project will provide 242 parking spaces to support 136 residential units, or a parking ratio of 1.78 parking spaces per unit. This parking ratio exceeds the parking ratios for multifamily residential communities in similar settings and those documented by the Institute of Transportation Engineers (ITE).[1] Both the ITE data and the parking demand observations indicate that the peak parking demand for a multifamily residential community ranges from 1.13 to 1.47 spaces per residential unit, with 1.5 parking spaces per unit the typical design value. The ITE parking demand data and parking observations conducted by VAI are attached.

For context, we offer the following as a brief list of the many examples of multifamily projects that provide a parking supply that is representative of the 1.5 parking space per unit parking ratio:

- *Waltham/Winter Street Residences:* 315 units with 473 spaces (1.5 spaces/unit)
- *Winchester/416 Cambridge Street:* 96 units with 144 spaces (1.5 spaces/unit)
- *Winchester/River Street Residences:* 147 units with 225 spaces (1.53 spaces/unit)
- *Needham/The Kendrick:* 390 units with 585 spaces (1.5 spaces/unit)
- *Hingham/The Cove:* 220 units with 344 spaces (1.56 spaces per unit)
- *Billerica/The Val:* 200 units with 290 spaces (1.45 spaces per unit)
- Medway/Toll Residential: 190 units with 304 spaces (1.6 spaces per unit)

Comment 15: *Proposed parking stall dimensions of 9 feet by 18 feet do not comply with Section 6.2.2 of the Zoning By-Law, which requires off-street parking spaces with minimum dimensions of 9 feet by 20 feet.*

Response: Please refer to the letter submitted by Embarc dated 1/21/2022 and titled "MBTS EP Letter Response" for a response specific to the parking space dimension.

Comment 16: *Details should be provided regarding garage access and the parking supply expected to be available to visitors and service providers.*

Response: Please refer to the letter submitted by Embarc dated 1/21/2022 and titled "MBTS EP Letter Response" for a response specific to the parking space dimension.

[1] *Parking Generation*, 5th Edition; Institute of Transportation Engineers; Washington D.C.; January 2019.

EVALUATION OF RECOMMENDATIONS

Comment 17: *EP recommends additional commitment from the Proponent to fund design services for potential proposed improvements, which notably benefit Project access from the abutting highway.*

Response: The Project proponent has committed to conduct an improvement study for the Route 128 north and southbound ramp intersections with School Street that will include performing a detailed Traffic Signal Warrants Analysis (TSWA) in accordance with the methodology defined in the Manual on Uniform Traffic Control Devices (MUTCD)[2] and evaluating the reconfiguration of the intersections as modern roundabouts. The study will include the preparation of conceptual improvement plans depicting each of the improvement alternatives that are evaluated and the necessary information to allow the Town to apply for state funding for the recommended improvement strategy.

The Project proponent will consider providing a financial contribution to the Town for the design of the identified improvement measures in the context of the overall mitigation package for the Project, with said contribution to be proportionate to the incremental impact of the Project within the interchange area over No-Build conditions (i.e., a "fair-share" cost contribution).

Comment 18: *A review of site plans for the Project site shows no pedestrian or bicycle focused connections between the site and the study area roadways, limiting the effectiveness of TDM measures intended to promote pedestrian and bicycle activity in the area. EP recommends consideration of off-site pedestrian improvements, potentially in connection with intersection improvements to be considered at School Street and the Route 128 ramps. Additionally, focused pedestrian improvements at study area intersections would benefit residents and the abutting neighborhoods, specifically at the intersection of School Street and Pleasant Street, which serves pedestrian connections to Manchester Essex Regional Middle and High School.*

Response: The Project proponent will consider providing funds to the Town for pedestrian focused improvements at the study area intersections in the context of the overall mitigation package for the Project, with said contribution to be proportionate to the incremental impact of the Project within the interchange area over No-Build conditions (i.e., a "fair-share" cost contribution).

Comment 19: *Off-site improvements should consider traffic calming elements to reduce travel speeds. Recorded speeds well exceed posted speed limits for the School Street corridor.*

Response: The Project proponent will consider the installation of traffic calming elements, including radar speed feedback signs along School Street, in the context of the overall mitigation package for the Project.

[2]Ibid.

We believe that this information is responsive to the comments that were raised in the January 10, 2022, *Transportation Peer Review* letter prepared by EP. If you should have any questions or would like to discuss our responses in more detail, please feel free to contact me.

Sincerely,

VANASSE & ASSOCIATES, INC.

Jeffrey S. Dirk

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

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

Attachments

cc: File

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

Unsignalized Intersection/Peak Hour/Movement	2021 Existing				2029 No-Build				2029 Build			
	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th
School Street at the Route 128 NB Ramps and Mill Street												
Weekday Morning:												
Route 128 NB Off-Ramp EB LT/TH	136	>50.0	F	12	148	>50.0	F	16	158	>50.0	F	18
Route 128 NB Off-Ramp EB RT	146	12.6	B	2	158	13.4	B	2	158	13.6	B	2
Mill Street WB LT/TH/RT	65	14.1	B	1	70	15.3	C	1	70	15.4	C	1
School Street NB LT/TH/RT	477	1.0	A	0	517	1.0	A	0	521	1.0	A	0
School Street SB LT/TH/RT	390	0.7	A	0	423	0.7	A	0	438	0.7	A	0
Weekday Evening:												
Route 128 NB Off-Ramp EB LT/TH	172	>50.0	F	8	186	>50.0	F	11	218	>50.0	F	16
Route 128 NB Off-Ramp EB RT	197	11.6	B	1	213	12.2	B	2	213	12.3	B	2
Mill Street WB LT/TH/RT	44	15.4	C	1	47	16.7	C	1	47	17.2	C	1
School Street NB LT/TH/RT	461	1.3	A	0	500	1.3	A	0	514	1.3	A	0
School Street SB LT/TH/RT	315	0.5	A	0	342	0.5	A	0	351	0.5	A	0

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level-of-Service.
[d]Queue length in vehicles.
NB = northbound; SB = southbound; EB = eastbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

ATTACHMENTS

COVID ADJUSTMENT
MASSDOT PERMANENT COUNT STATION NO. 35
MASSDOT CRASH DATA
MASSDOT CRASH RATE WORKSHEETS
REVISED FIGURES
PARKING DEMAND
CAPACITY ANALYSIS

2019 Average Count Data – Sta. 35

November ADT: 47,447

Growth Rate: 1.0/Year

$47{,}447 \times (1.01^2) = 48{,}401$

2021 Average Count Data – Sta. 35

November ADT: 44,927

COVID Adjustment

$\frac{44{,}927}{48{,}401} = 0.9282$

MASSDOT PERMANENT COUNT STATION NO. 35

Massachusetts Highway Department

35: Monthly Hourly Volume for November 2019

Location ID:	**35**	**Seasonal Factor Group:**	**U2**
County:	**Essex**	**Daily Factor Group:**	
Functional Class	**2**	**Axle Factor Group:**	**U2**
Location:	**YANKEE DIVISION HIGHWAY**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	273	175	122	131	311	1061	2099	3818	3757	3015	2985	3153	3507	3523	4109	4279	4252	4022	3245	2185	1604	1302	1004	695	54627	Accepted
2	400	192	119	103	176	361	782	1686	2294	2776	3288	3777	3881	3839	3865	3826	3913	3296	2848	2096	1519	1309	1197	821	48364	Accepted
3	428	346	75	64	133	266	551	1121	1810	2456	2946	3231	3635	3653	3559	3558	3190	2632	2069	1528	944	710	418	349	39672	Accepted
4	139	97	76	93	356	1246	2525	4357	3787	2967	2659	2862	2912	3023	3288	3992	4287	3595	2958	1762	1300	941	604	359	50185	Accepted
5	191	98	68	109	355	1223	2469	4270	3839	3041	2923	3024	3206	3238	3716	3829	3887	3820	2740	2065	1385	1048	661	367	51572	Accepted
6	175	90	73	116	365	1246	2500	4344	4003	3112	2942	2946	3152	3194	3822	4198	4334	3964	2982	2104	1505	1197	731	392	53487	Accepted
7	190	96	74	121	375	1205	2539	4350	3973	3015	2839	2876	3125	3205	3678	4318	4135	3772	2822	2108	1634	1146	744	481	52821	Accepted
8	218	117	76	117	328	1083	2251	3944	3776	3161	3039	3276	3598	3534	4099	4344	4092	3865	2945	1913	1487	1157	993	645	54058	Accepted
9	350	205	127	94	163	413	818	1544	2196	2719	3283	3855	3895	3776	3678	3725	3512	2947	2431	1757	1339	1131	1091	676	45725	Accepted
10	337	169	112	93	123	191	438	900	1545	2244	2682	3226	3605	3424	3260	3338	3298	2583	1963	1553	1209	861	578	333	38065	Accepted
11	183	115	74	92	278	863	1788	3082	3185	2880	3052	3130	3366	3338	3574	4022	3949	3537	2433	1612	1173	862	530	349	47467	Accepted
12	191	106	80	102	349	1270	2444	4317	3953	3086	2885	2778	2907	2982	3356	3762	3822	3804	2680	1689	1345	956	673	374	49911	Accepted
13	193	101	76	100	301	1188	2380	4065	3827	2981	2731	2716	2942	2970	3525	4172	4093	3791	2906	1909	1423	1060	613	431	50494	Accepted
14	189	109	81	118	346	1161	2293	4176	4014	3119	2901	2941	3069	3126	3827	4185	4152	3977	2994	2135	1534	1216	712	535	52910	Accepted
15	264	133	85	120	302	1054	2219	4047	3705	3179	3032	3018	3265	3484	4012	4348	4111	3910	2968	2074	1485	1323	888	696	53722	Accepted
16	350	178	121	84	162	400	857	1517	2292	2644	3070	3529	3808	3572	3637	3514	3397	2943	2249	1595	1348	1113	1087	703	44170	Accepted
17	347	176	114	60	84	194	437	827	1402	1979	2713	3193	3413	3411	3219	3398	2720	2007	1680	1327	1389	800	394	255	35539	Accepted
18	150	90	62	108	326	1173	2305	4067	3875	2871	2700	2701	2859	2884	3385	3831	3739	3718	2682	1762	1235	875	557	359	48314	Accepted
19	194	101	79	107	345	1205	2355	4045	3930	3006	2756	2872	2891	3100	3637	4171	4127	3878	2851	2035	1496	1093	659	429	51362	Accepted
20	210	105	80	108	315	1189	2381	4230	4103	3091	2784	2922	3066	3089	3572	3859	3918	3717	2736	2021	1457	1107	685	413	51158	Accepted
21	211	122	84	125	284	1147	2308	4081	4028	3194	2915	3054	3156	3229	3795	4334	3600	2889	3050	2242	1766	1232	765	481	52092	Accepted
22	233	127	99	108	315	1100	2282	4040	3821	3055	3133	3380	3636	3677	4123	4040	3899	3851	2858	1981	1459	1272	985	685	54159	Accepted
23	365	213	118	105	170	380	846	1602	2195	2771	3360	3660	3797	3633	3694	3793	3411	2979	2343	1673	1277	1280	985	702	45352	Accepted
24	373	199	116	86	101	206	370	799	1302	1850	2276	2718	2999	2698	2574	2383	2162	1605	1303	1088	1033	687	466	307	29701	Accepted
25	225	114	82	112	327	1240	2324	4136	3940	3084	2940	3074	3204	3343	3723	4130	3926	3817	2911	1976	1384	976	612	420	52020	Accepted
26	211	93	96	124	351	1229	2370	4185	3966	3399	3149	3337	3299	3541	4012	4287	4073	3803	3065	2269	1706	1207	804	481	55057	Accepted
27	248	138	119	110	315	1048	2093	3659	3430	3112	3168	3598	3855	3689	3682	3888	3380	2762	1928	1465	1153	932	784	543	49099	Accepted
28	294	189	113	81	107	166	354	619	829	1395	1843	2578	3380	2784	2006	1581	1849	2084	2216	2101	1780	1158	728	501	30736	Accepted
29	338	193	160	207	264	593	974	1615	1986	2523	2853	3126	3295	3420	3461	3365	3087	2690	1996	1507	1215	966	840	543	41217	Accepted
30	276	159	98	84	175	300	637	1226	1759	2480	3057	3312	3408	3283	3409	3293	3002	2565	2165	1636	1324	1169	876	653	40346	Accepted
																									47446.73	Nov ADT
																									49749	2019 ADT
																									0.953722	
																									4.63%	

Massachusetts Highway Department

35: Monthly Hourly Volume for November 2021

Location ID:	**35**	**Seasonal Factor Group:**	**U2**
County:	**Essex**	**Daily Factor Group:**	
Functional Class	**2**	**Axle Factor Group:**	**U2**
Location:	**YANKEE DIVISION HIGHWAY**	**Growth Factor Group:**	

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	228	126	94	120	333	855	2053	3868	3714	2838	2836	2936	3083	3083	3461	4236	4051	3652	2674	1651	1050	756	572	320	48590	Accepted
2	172	100	105	96	324	877	2061	3756	3471	2820	2896	2924	3120	3195	3553	4058	4112	3698	2817	1722	1201	870	526	312	48786	Accepted
3																										
4	155	96	106	120	304	927	2084	3930	3620	2917	2728	3001	3193	3182	3730	4219	4144	3782	2833	1849	1346	1000	622	422	50310	Accepted
5	234	121	109	113	254	859	1985	3740	3550	2897	2925	3176	3500	3434	3925	4162	3952	3872	3047	1872	1381	1245	947	550	51850	Accepted
6	328	162	106	90	156	385	751	1391	2040	2712	3156	3607	3922	3887	3854	3851	3436	3199	2448	1917	1375	1227	938	554	45492	Accepted
7	321	292	62	74	140	273	507	941	1570	2385	2779	3230	3589	3301	3107	3229	3056	2536	1806	1371	1073	679	405	240	36966	Accepted
8	143	86	94	92	344	923	2219	4006	3578	2731	2636	2798	2985	3037	3445	4139	3891	3618	2202	1440	990	681	442	259	46779	Accepted
9	131	75	95	102	334	945	2308	4200	3735	3083	2977	2988	3075	3194	3718	4089	4072	3651	2525	1547	1207	802	484	317	49654	Accepted
10	152	100	94	104	305	939	2325	4019	3536	2742	2526	2580	2808	2867	3649	4207	4224	3625	2656	1864	1310	1015	593	398	48638	Accepted
11	180	120	87	107	256	765	1791	3047	3054	3146	3210	3400	3609	3673	4002	4209	3873	3537	2395	1667	1202	855	656	331	49172	Accepted
12	185	100	98	110	274	820	1976	3620	3336	2876	2869	3042	3231	3143	3665	3795	3202	3128	2340	1612	1128	961	799	505	46815	Accepted
13	279	148	111	92	151	372	871	1590	2003	2822	3349	3665	3964	3628	3690	3728	3608	2865	2012	1522	1186	994	895	581	44126	Accepted
14	285	142	95	71	89	228	524	946	1595	2276	2720	3538	3803	3435	3088	3134	3176	2351	1829	1389	924	651	453	261	37003	Accepted
15	126	80	62	87	310	912	2075	3909	3625	2743	2784	2785	2935	2996	3481	4015	3840	3411	2257	1475	988	694	451	282	46323	Accepted
16	135	69	109	101	297	947	2196	4047	3734	2885	2794	2829	3014	3100	3518	4062	3929	3590	2513	1648	1166	859	471	302	48315	Accepted
17	161	102	103	125	290	900	2193	3969	3818	2913	2879	2960	3053	3104	3621	4082	4082	3541	2651	1775	1312	879	516	337	49366	Accepted
18	200	98	114	108	331	892	2178	3925	3711	3064	2909	3137	3267	3281	3887	4368	3911	3595	2650	1874	1252	953	600	430	50735	Accepted
19	228	119	123	155	290	880	1983	3706	3606	3012	3019	3307	3667	3762	4049	4374	3917	3507	2662	1732	1305	1021	791	577	51792	Accepted
20	298	148	103	82	182	436	822	1518	2112	2677	3317	3791	3671	3614	3723	3813	3387	2857	2142	1475	1235	1052	876	564	43895	Accepted
21	289	138	87	93	126	250	476	920	1432	2215	2695	3113	3270	3250	3119	2980	2899	2302	1782	1321	997	628	436	252	35070	Accepted
22	144	75	63	100	294	841	1846	3502	3421	2857	2787	2840	3164	3209	3561	4011	3877	3359	2223	1701	1152	738	497	321	46583	Accepted
23	160	98	116	111	317	917	2042	3689	3654	3172	3080	3234	3476	3472	3825	4112	3697	3555	2727	1952	1321	985	638	375	50725	Accepted
24	213	134	123	109	315	798	1888	3249	3190	2894	3194	3478	3882	3587	3601	3685	3420	2693	2007	1485	1151	852	660	449	47057	Accepted
25	230	171	70	60	66	148	374	621	905	1352	1820	2580	3194	2622	1846	1546	1716	1872	1961	1927	1544	1007	613	333	28578	Accepted
26	163	79	74	98	212	450	867	1415	1844	2272	2762	3026	2944	2949	2940	3036	2645	2095	1707	1244	1031	798	600	399	35650	Accepted
27	219	143	83	85	131	287	616	1070	1601	2156	2774	3124	3342	3262	3087	2933	2935	2452	1885	1539	1138	955	747	547	37111	Accepted
28	320	156	97	75	125	240	436	797	1251	1941	2547	3013	3247	3042	2742	2612	2700	2287	1816	1411	1086	724	447	250	33362	Accepted
29	153	70	69	91	327	916	1993	3888	3525	2762	2677	2825	3002	3040	3467	4132	3918	3447	2229	1505	1034	747	457	250	46524	Accepted
30	138	83	101	116	323	904	2014	3830	3677	2782	2734	2735	2910	3097	3645	4153	4055	3562	2456	1569	1132	797	467	342	47622	Accepted
																									44927.21	

MASSDOT CRASH DATA

School Street at Atwater Avenue

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
3999238	01/17/2015	Sat	Not Reported	11:30 AM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Clear/Clear	V1:(Collision with utility pole)
4378033	05/28/2017	Sun	Not Reported	4:44 PM	Daylight	Single vehicle crash	V1: Slowing or stopped in traffic	Cloudy/Cloudy	V1:(Collision with pedestrian)

School Street at Route 128 Southbound Ramps

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
4065438	07/07/2015	Tue	Property damage only (none injured)	12:30 PM	Daylight	Sideswipe, opposite direction	V1: Turning left / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4065439	07/07/2015	Tue	Non-fatal injury	5:58 PM	Daylight	Angle	V1: Turning left / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4275094	10/10/2016	Mon	Non-fatal injury	6:15 AM	Dark - roadway not lighted	Head-on	V1: Travelling straight ahead / V2: Turning left	Clear/Unknown	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4301598	11/23/2016	Wed	Non-fatal injury	9:24 AM	Daylight	Angle	V1: Turning left	Clear/Clear	V1:(Collision with cyclist (bicycle, tricycle, unicycle, pedal car))
4378034	05/31/2017	Wed	Property damage only (none injured)	3:58 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4729579	07/27/2019	Sat	Non-fatal injury	8:30 PM	Dark - lighted roadway	Angle	V1: Turning left / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4752214	09/20/2019	Fri	Property damage only (none injured)	1:50 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)

School Street at Route 128 Northbound Ramps

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
4470610	12/07/2017	Thu	Non-fatal injury	4:45 PM	Dark - roadway not lighted	Angle	V1: Turning left / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4651771	01/16/2019	Wed	Property damage only (none injured)	1:55 PM	Daylight	Rear-end	V1: Travelling straight ahead / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4760314	10/09/2019	Wed	Property damage only (none injured)	3:20 PM	Daylight	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4763098	10/18/2019	Fri	Unknown	5:31 PM	Dusk	Single vehicle crash	V1: Unknown	Clear/Clear	V1:(Collision with tree)

School Street at Pleasant Street

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
4275095	10/20/2016	Thu	Property damage only (none injured)	10:37 AM	Daylight	Angle	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4339099	01/20/2017	Fri	Property damage only (none injured)	4:30 PM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4430659	09/27/2017	Wed	Property damage only (none injured)	7:27 PM	Dark - lighted roadway	Head-on	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	Clear/Unknown	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4476242	12/29/2017	Fri	Property damage only (none injured)	12:49 PM	Daylight	Sideswipe, opposite direction	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	Cloudy/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4478360	01/03/2018	Wed	Property damage only (none injured)	1:00 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4512352	12/02/2017	Sat	Property damage only (none injured)	4:51 PM	Dark - lighted roadway	Angle	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4559204	06/29/2018	Fri	Property damage only (none injured)	10:53 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4703702	05/21/2019	Tue	Property damage only (none injured)	5:11 PM	Daylight	Sideswipe, opposite direction	V1: Not reported / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)

School Street at Route 127

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
4076749	07/30/2015	Thu	Not Reported	8:38 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Turning left	Clear/Clear	V1:(Other) / V2:(Collision with motor vehicle in traffic)
4430652	06/12/2017	Mon	Property damage only (none injured)	12:47 PM	Daylight	Angle	V1: Not reported / V2: Travelling straight ahead	Clear/Clear	V2:(Collision with motor vehicle in traffic)
4594422	09/14/2018	Fri	Non-fatal injury	12:55 PM	Daylight	Single vehicle crash	V1: Turning left	Clear/Clear	V1:(Collision with other fixed object (wall, building, tunnel, etc.))

School Street from Old School Street to Route 128 Southbound Ramps

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
3999238	01/17/2015	Sat	Not Reported	11:30 AM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Clear/Clear	V1:(Collision with utility pole)
4065438	07/07/2015	Tue	Property damage only (none injured)	12:30 PM	Daylight	Sideswipe, opposite direction	V1: Turning left / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4065439	07/07/2015	Tue	Non-fatal injury	5:58 PM	Daylight	Angle	V1: Turning left / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4275094	10/10/2016	Mon	Non-fatal injury	6:15 AM	Dark - roadway not lighted	Head-on	V1: Travelling straight ahead / V2: Turning left	Clear/Unknown	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4301598	11/23/2016	Wed	Non-fatal injury	9:24 AM	Daylight	Angle	V1: Turning left	Clear/Clear	V1:(Collision with cyclist (bicycle, tricycle, unicycle, pedal car))
4378033	05/28/2017	Sun	Not Reported	4:44 PM	Daylight	Single vehicle crash	V1: Slowing or stopped in traffic	Cloudy/Cloudy	V1:(Collision with pedestrian)
4378034	05/31/2017	Wed	Property damage only (none injured)	3:58 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4640667	12/21/2018	Fri	Property damage only (none injured)	8:45 AM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Rain/Cloudy	V1:(Collision with animal - deer)
4729579	07/27/2019	Sat	Non-fatal injury	8:30 PM	Dark - lighted roadway	Angle	V1: Turning left / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4752214	09/20/2019	Fri	Property damage only (none injured)	1:50 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)

School Street from Route 128 Northbound Ramps to Route 127

Crash Number	Crash Date	Day	Crash Severity	Crash Time	Light Conditions	Manner of Collision	Vehicle Actions Prior to Crash (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)
4008718	02/10/2015	Tue	Not Reported	11:14 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Cloudy/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4008719	02/15/2015	Sun	Not Reported	3:40 PM	Daylight	Sideswipe, same direction	V1: Turning left	Snow/Blowing sand, snow	V1:(Collision with motor vehicle in traffic)
4009223	02/11/2015	Wed	Not Reported	8:00 AM	Daylight	Rear-end	V1: Backing / V2: Travelling straight ahead	Snow/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4045744	05/22/2015	Fri	Non-fatal injury	3:11 PM	Daylight	Head-on	V1: Travelling straight ahead / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4076749	07/30/2015	Thu	Not Reported	8:38 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Turning left	Clear/Clear	V1:(Other) / V2:(Collision with motor vehicle in traffic)
4168237	03/13/2016	Sun	Property damage only (none injured)	4:30 PM	Daylight	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	Clear/Clear	V2:(Collision with motor vehicle in traffic)
4205470	06/01/2016	Wed	Non-fatal injury	2:08 PM	Daylight	Single vehicle crash	V1: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with cyclist (bicycle, tricycle, unicycle, pedal car))
4229785	07/06/2016	Wed	Non-fatal injury	10:00 AM	Daylight	Angle	V1: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with cyclist (bicycle, tricycle, unicycle, pedal car))
4258419	09/14/2016	Wed	Property damage only (none injured)	6:48 PM	Dusk	Angle	V1: Travelling straight ahead / V2: Not reported	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4275095	10/20/2016	Thu	Property damage only (none injured)	10:37 AM	Daylight	Angle	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4339099	01/20/2017	Fri	Property damage only (none injured)	4:30 PM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4430503	06/22/2017	Thu	Not Reported	5:29 AM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Clear/Clear	V1:(Collision with utility pole)
4430652	06/12/2017	Mon	Property damage only (none injured)	12:47 PM	Daylight	Angle	V1: Not reported / V2: Travelling straight ahead	Clear/Clear	V2:(Collision with motor vehicle in traffic)
4430655	07/03/2017	Mon	Non-fatal injury	1:48 PM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Clear/Clear	V1:(Collision with pedestrian)
4430659	09/27/2017	Wed	Property damage only (none injured)	7:27 PM	Dark - lighted roadway	Head-on	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	Clear/Unknown	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4431506	09/30/2017	Sat	Non-fatal injury	8:05 AM	Daylight	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead	Rain/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4464260	12/06/2017	Wed	Non-fatal injury	5:44 PM	Dark - lighted roadway	Rear-end	V1: Travelling straight ahead / V2: Not reported	Clear/Clear	V1:(Collision with tree) / V2:(Collision with motor vehicle in traffic)
4470610	12/07/2017	Thu	Non-fatal injury	4:45 PM	Dark - roadway not lighted	Angle	V1: Turning left / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4476242	12/29/2017	Fri	Property damage only (none injured)	12:49 PM	Daylight	Sideswipe, opposite direction	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	Cloudy/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4478360	01/03/2018	Wed	Property damage only (none injured)	1:00 PM	Daylight	Angle	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4512352	12/02/2017	Sat	Property damage only (none injured)	4:51 PM	Dark - lighted roadway	Angle	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4512943	03/10/2018	Sat	Property damage only (none injured)	2:50 PM	Daylight	Single vehicle crash	V1: Travelling straight ahead	Cloudy/Cloudy	V1:(Collision with other movable object)
4545569	05/30/2018	Wed	Non-fatal injury	12:57 PM	Daylight	Rear-end	V1: Turning left / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4559204	06/29/2018	Fri	Property damage only (none injured)	10:53 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4575079	08/01/2018	Wed	Property damage only (none injured)	10:20 AM	Daylight	Sideswipe, opposite direction	V1: Travelling straight ahead / V2: Travelling straight ahead	Cloudy/Cloudy	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4594422	09/14/2018	Fri	Non-fatal injury	12:55 PM	Daylight	Single vehicle crash	V1: Turning left	Clear/Clear	V1:(Collision with other fixed object (wall, building, tunnel, etc.))
4651771	01/16/2019	Wed	Property damage only (none injured)	1:55 PM	Daylight	Rear-end	V1: Travelling straight ahead / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4703702	05/21/2019	Tue	Property damage only (none injured)	5:11 PM	Daylight	Sideswipe, opposite direction	V1: Not reported / V2: Turning left	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)
4734322	08/02/2019	Fri	Property damage only (none injured)	7:30 AM	Daylight	Single vehicle crash	V1: Not reported	Clear/Clear	V1:(Collision with utility pole)
4744158	09/02/2019	Mon	Non-fatal injury	1:32 PM	Daylight	Angle	V1: Travelling straight ahead	Cloudy/Unknown	V1:(Collision with other fixed object (wall, building, tunnel, etc.))
4760314	10/09/2019	Wed	Property damage only (none injured)	3:20 PM	Daylight	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)

MASSDOT CRASH RATE WORKSHEETS

SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : Manchester-by-the-Sea COUNT DATE : Nov-21

DISTRICT : 4

~ SEGMENT DATA ~

ROADWAY NAME: School Street

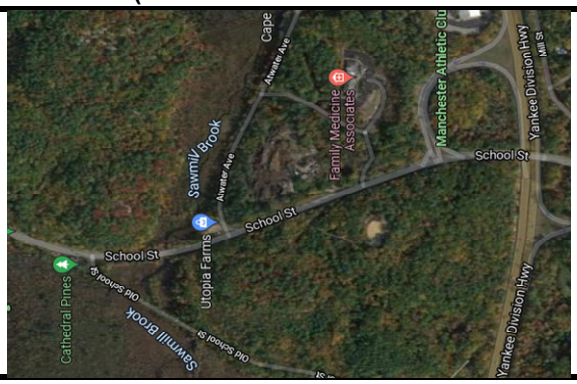
START POINT: Old School Street

END POINT: Route 128 SB Ramps

FUNCTIONAL CLASSIFICATION OF ROADWAY: Urban Minor Arterial Roadway

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)

---> *North*



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**0.379**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	7,090

TOTAL # OF CRASHES:	10	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**2.00**

CRASH RATE CALCULATION : **2.04**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(L * V * 365)}$$

Comments : Below MassDOT crash rate by roadway functional classificiation

Project Title & Date: MBTS - 8441

SEGMENT CRASH RATE WORKSHEET

CITY/TOWN : Manchester-by-the-Sea COUNT DATE : Aug-21

DISTRICT : 4

~ SEGMENT DATA ~

ROADWAY NAME: School Street

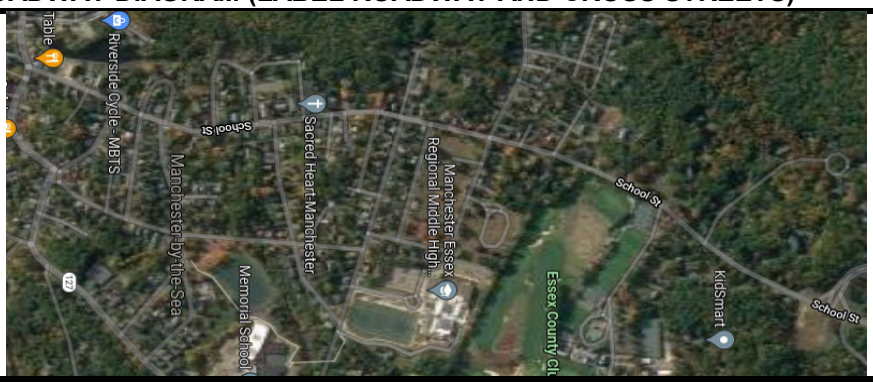
START POINT: Route 128 NB Ramps

END POINT: Route 127

FUNCTIONAL CLASSIFICATION OF ROADWAY: Urban Minor Arterial Roadway

ROADWAY DIAGRAM (LABEL ROADWAY AND CROSS STREETS)

---> *North*



AVERAGE DAILY TRAFFIC

SEGMENT LENGTH IN MILES (**L**):	**1**
AVERAGE DAILY TRAFFIC VOLUME (**V**):	11,105

TOTAL # OF CRASHES:	31	# OF YEARS :	5	AVERAGE # OF CRASHES PER YEAR (**A**) :	**6.20**

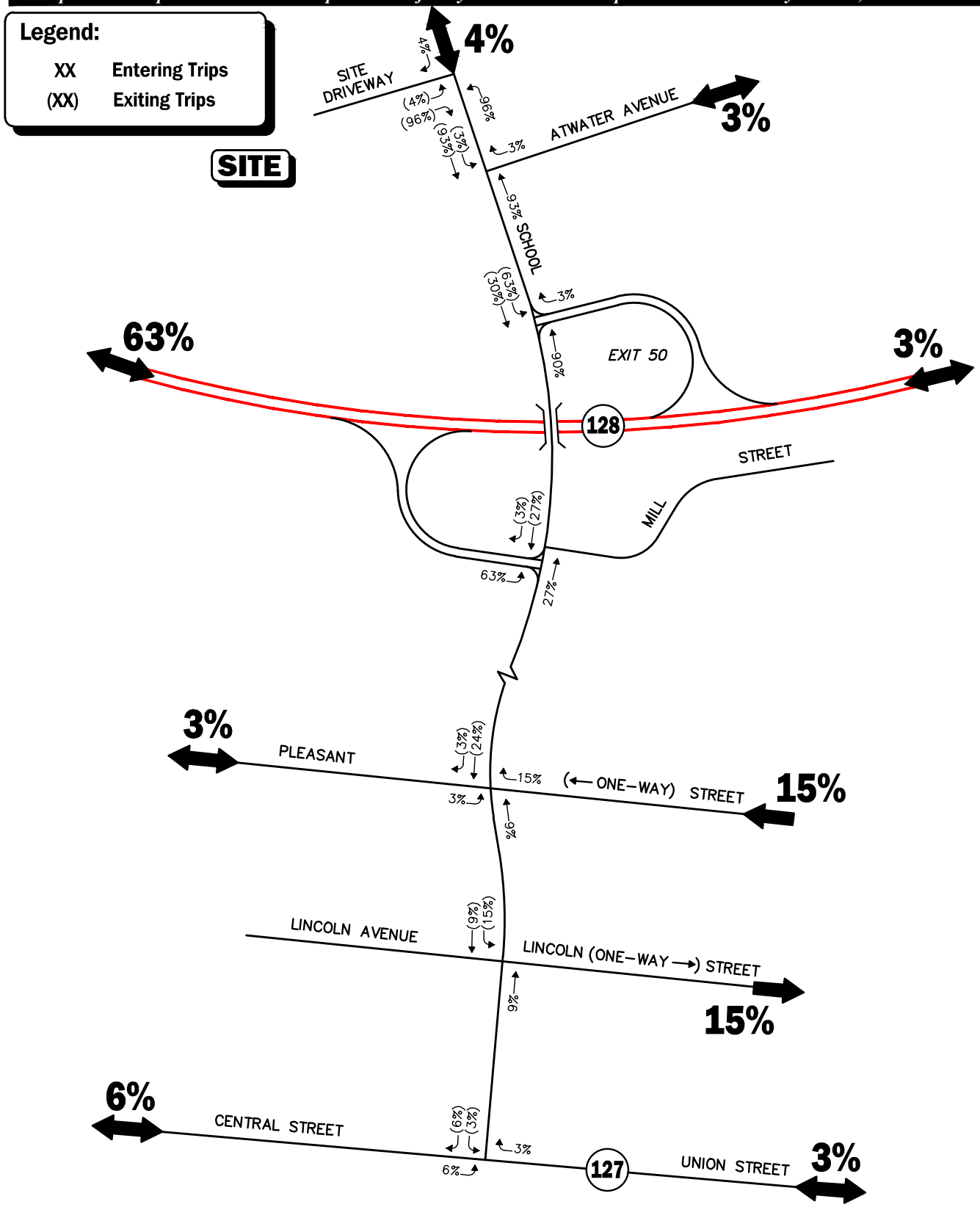
CRASH RATE CALCULATION : **1.53**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(L * V * 365)}$$

Comments : Below MassDOT crash rate by roadway functional classificiation

Project Title & Date: MBTS - 8441

REVISED FIGURES

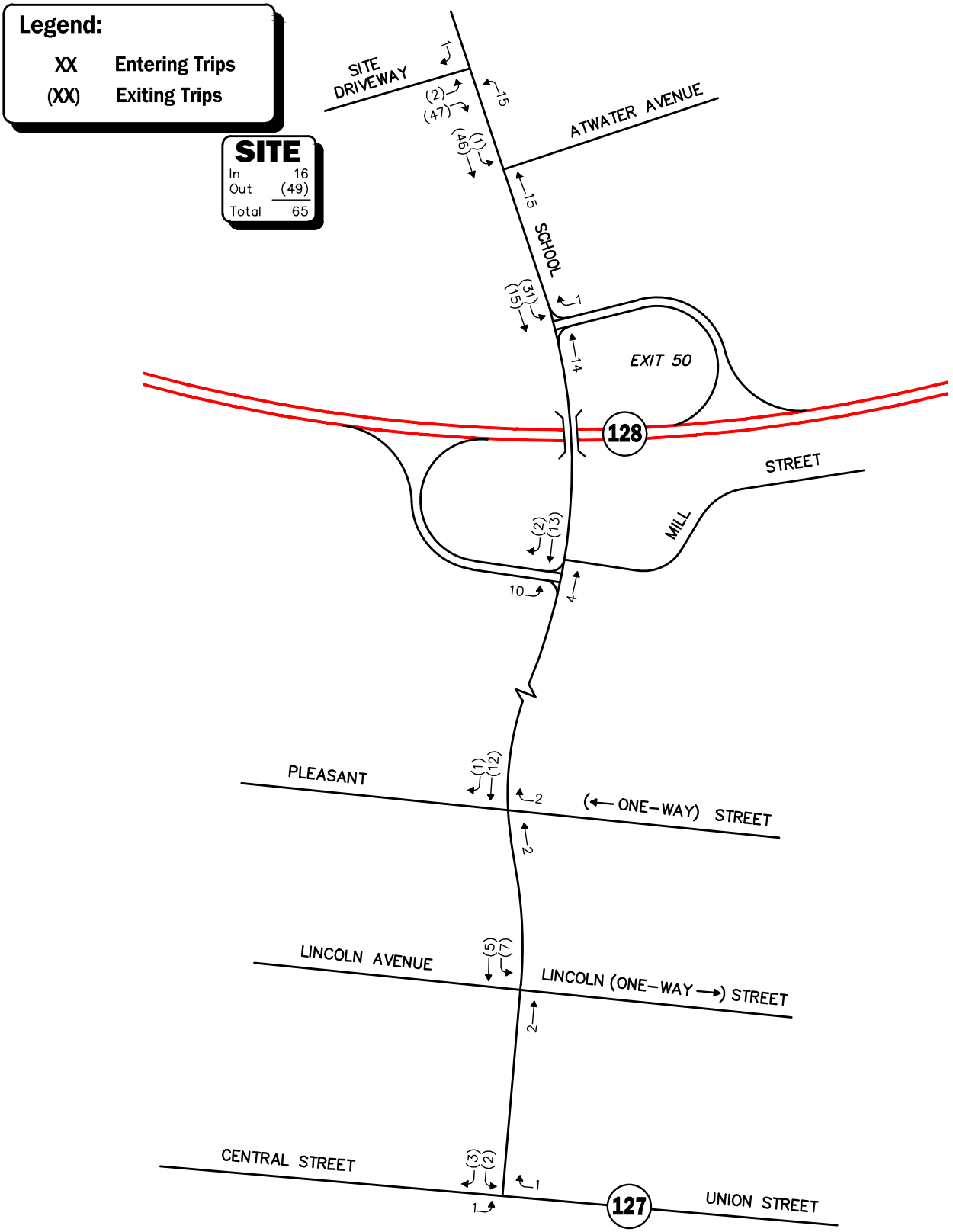


Not To Scale

Figure 7R

Trip Distribution Map

Vanasse & Associates inc



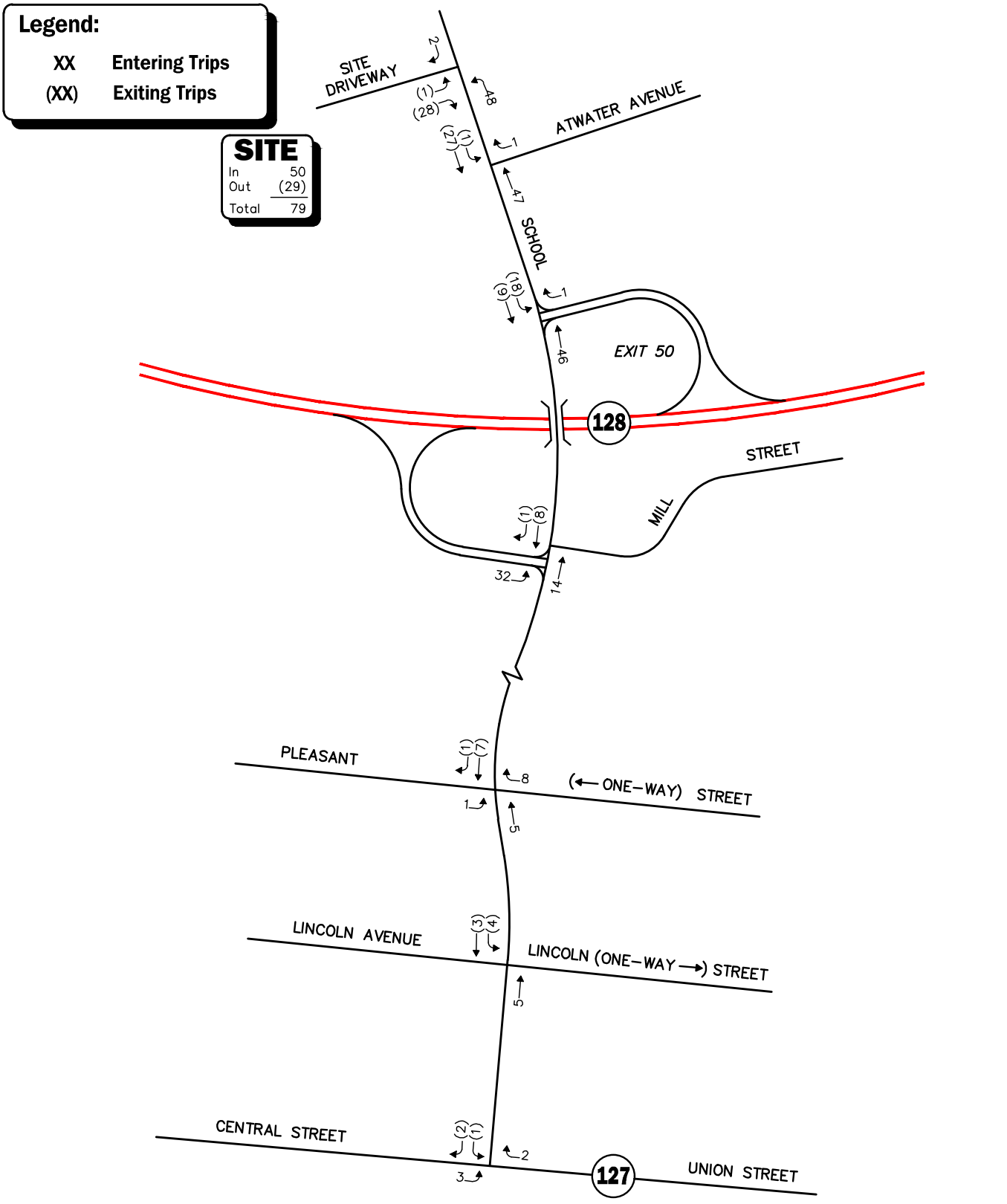
Not To Scale

Figure 8R

Project-Generated Weekday Morning Peak-Hour Traffic Volumes

Vanasse & Associates inc

R:\8441\8441NT2.dwg, 1/24/2022 3:39:14 PM



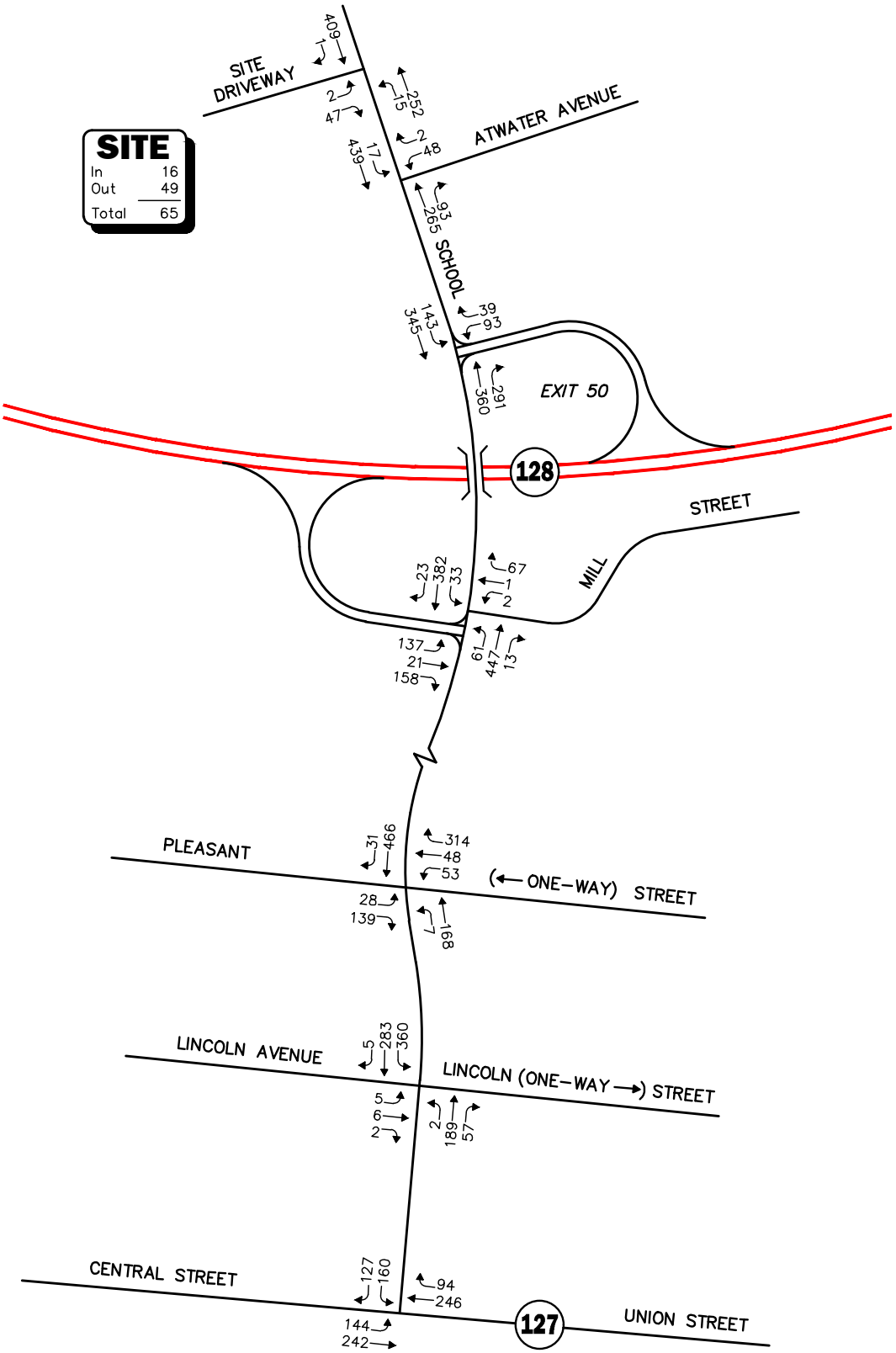
Not To Scale

Figure 9R

Project-Generated Weekday Evening Peak-Hour Traffic Volumes

Vanasse & Associates inc

R:\8441\8441NT2.dwg, 1/24/2022 3:39:23 PM



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

Not To Scale

Figure 10R

Vanasse & Associates inc

2029 Build
Weekday Morning
Peak-Hour Traffic Volumes

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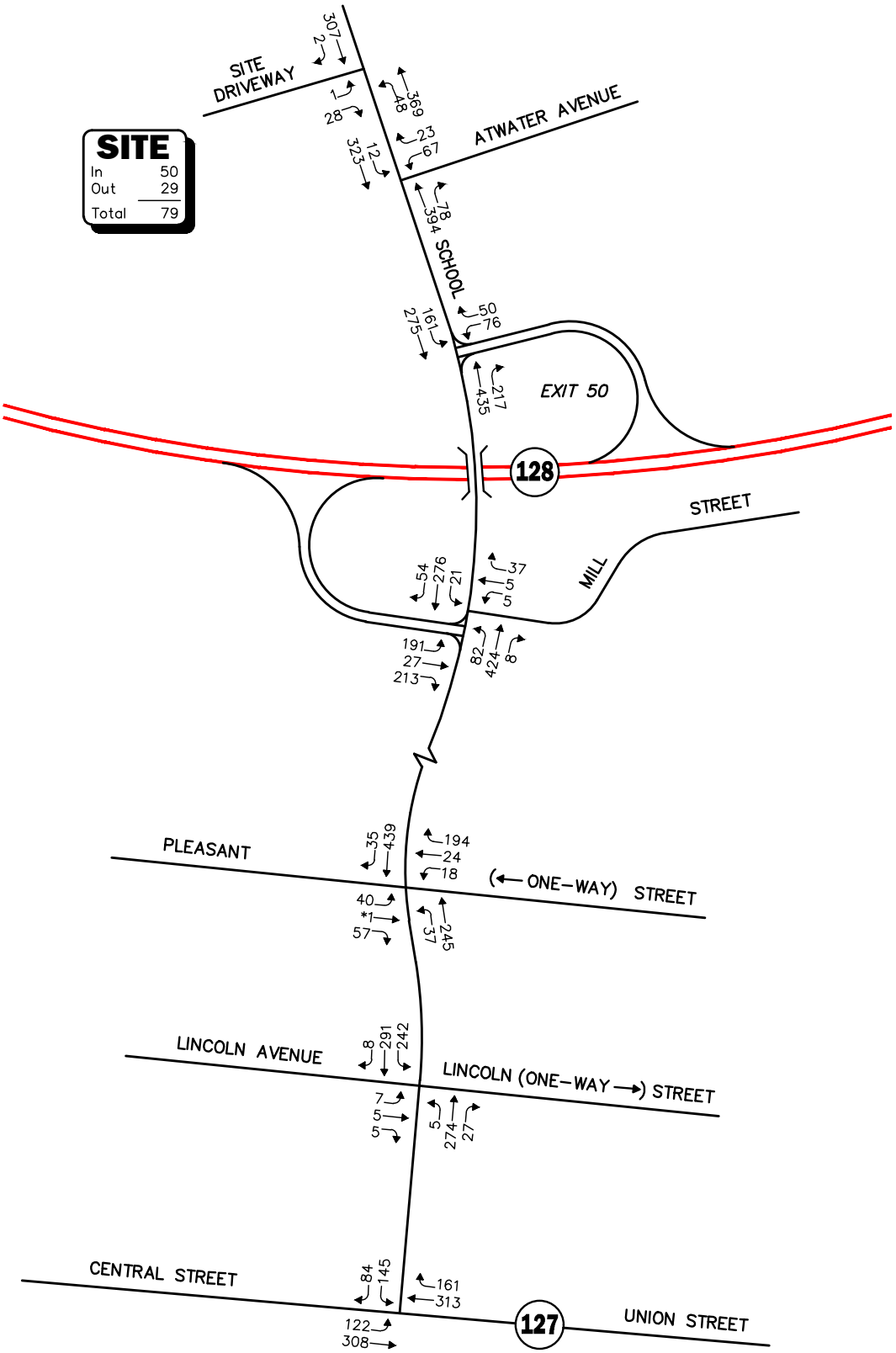


*Illegal maneuver.
Note: Imbalances exist due to numerous curb cuts and side streets that are not shown.

Not To Scale

Figure 11R

2029 Build
Weekday Evening
Peak-Hour Traffic Volumes

Vanasse & Associates inc

R:\8441\8441NT2.dwg, 1/24/2022 3:39:40 PM

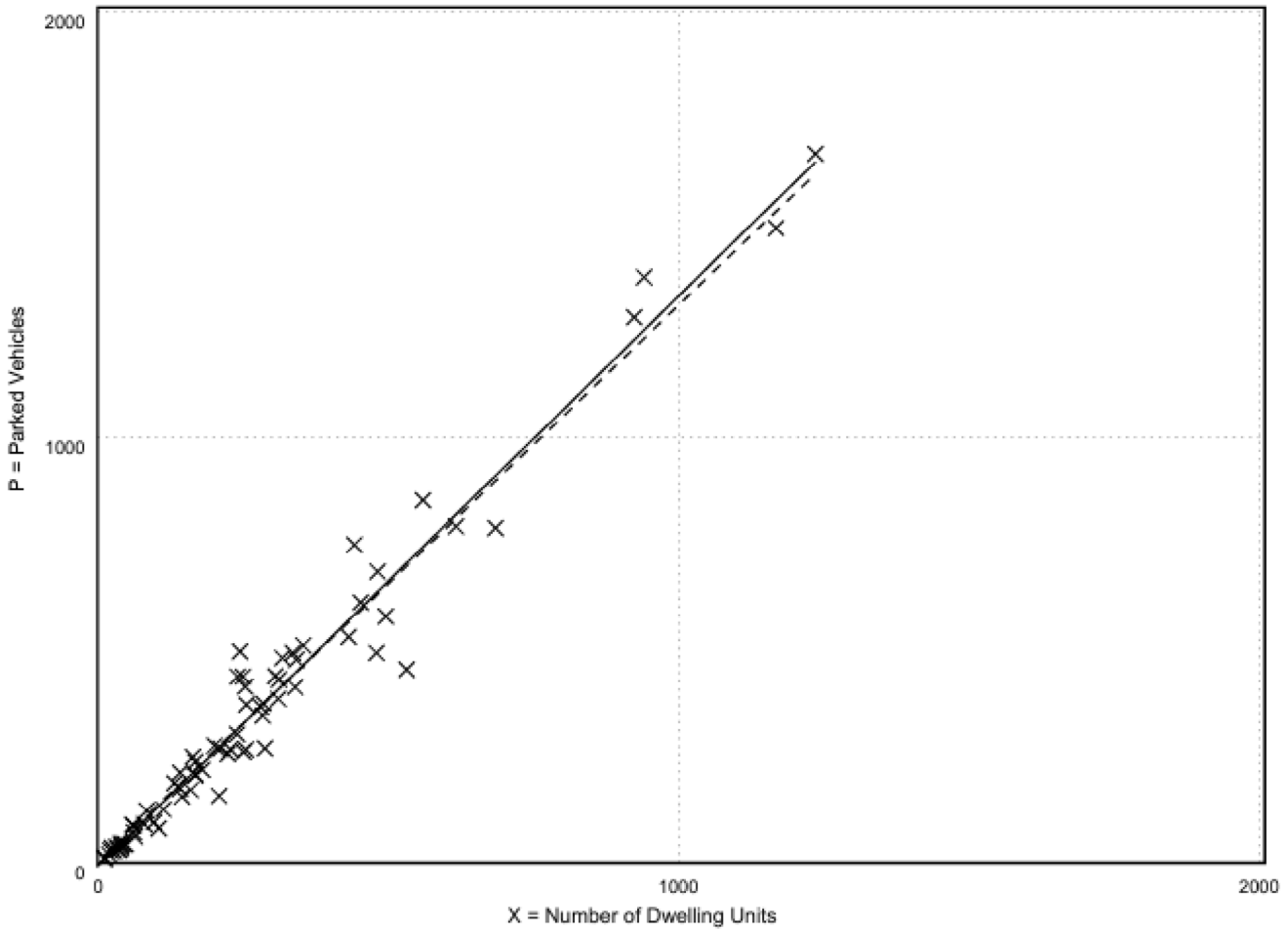
Multifamily Housing (Mid-Rise)
(221)

Peak Period Parking Demand vs: Dwelling Units
On a: Weekday (Monday - Friday)
Setting/Location: General Urban/Suburban (no nearby rail transit)
Peak Period of Parking Demand: 10:00 p.m. - 5:00 a.m.
Number of Studies: 73
Avg. Num. of Dwelling Units: 261

Peak Period Parking Demand per Dwelling Unit

Average Rate	Range of Rates	33rd / 85th Percentile	95% Confidence Interval	Standard Deviation (Coeff. of Variation)
1.31	0.75 - 2.03	1.13 / 1.47	1.26 - 1.36	0.22 (17%)

Data Plot and Equation



Fitted Curve Equation: P = 1.34(X) - 8.73

R^2= 0.97

MEMORANDUM

TO: Mr. Steve Dazzo
Development Partner
The Hanover Company
One Marina Park Drive, Suite 701
Boston, MA 02210

FROM: Mr. Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner
Vanasse & Associates, Inc.
35 New England Business Center Drive
Suite 140
Andover, MA 01810-1066
(978) 269-6830
jdirk@rdva.com
Professional Engineer in CT, MA, ME, NH, RI, and VA

DATE: September 7, 2021

RE: 9069

SUBJECT: Parking Demand Study
Hanover Tuscan Village – 3 Artisan Drive
Salem, New Hampshire

Vanasse & Associates, Inc. (VAI) has completed parking demand observations at the Hanover Tuscan Village multifamily residential community in order to establish baseline parking demands for the community. Parking demands were observed on Tuesday, August 17, 2021, and Saturday, August 28, 2021, between 5:00 and 8:00 AM to determine the parking demand on a typical weekday and on a Saturday. It should be noted that the peak parking demand for a residential community generally occurs on a weekday after 10:00 PM and before 6:00 AM. Table 1 summarizes the parking demands observed at the Hanover Tuscan Village residential community during the observation periods, along with the parking occupancy and corresponding parking ratio.

The Hanover Tuscan Village multifamily community provides individual garages for rent by tenants of the community. The garages are secured by the tenants and, as such, the occupancy could not be determined during the observation periods. As such, it was assumed that the garages were occupied by a vehicle during the observation periods as footnoted in the parking observation summary table.

Table 1
PARKING DEMAND OBSERVATIONS
HANOVER TUSCAN VILLAGE, SALEM, NEW HAMPSHIRE

	Tuesday, August 17, 2021			Saturday, August 28, 2021		
Time	No. of Occupied Spaces[a]	Occupancy[b]	Parking Demand Ratio[c]	No. of Occupied Spaces	Occupancy	Parking Demand Ratio
5:00 AM	350	77.6%	1.35	339	75.2%	1.30
5:30	340	75.4%	1.31	338	74.9%	1.30
6:00	333	73.8%	1.28	337	74.7%	1.30
6:30	327	72.5%	1.26	334	74.1%	1.28
7:00	307	68.1%	1.18	328	72.7%	1.26
7:30	292	64.7%	1.12	324	71.8%	1.25
8:00	283	62.7%	1.09	319	70.7%	1.23

[a]Assumes full occupancy of the 41 individual garages located throughout the property.
[b]The available parking supply consists of 451 parking spaces, including the 41 garage spaces.
[c]Based on approximately 260 occupied units at the time of the parking demand observations.

As can be seen in Table 1, the peak-parking demand at the Hanover Tuscan Village community was observed to occur at 5:00 AM, with approximately 78 percent of the available parking spaces occupied on a typical weekday and approximately 75 percent occupied on a Saturday. The peak-parking demand ratio was found to be 1.35 spaces per occupied dwelling unit on a weekday and 1.30 spaces per occupied dwelling unit on a Saturday. The observed peak-parking demand ratios are within the range of values documented by the Institute of Transportation Engineers (ITE)[1] for similar multifamily residential communities.

cc: File

[1]*Parking Generation Manual*, 5th Edition; Institute of Transportation Engineers; Washington, D.C.; January 2019. Observed parking demand ratios for a multifamily (mid-rise) residential community in a similar setting were found to range from 0.75 to 2.03 spaces per dwelling unit on a weekday, with an average parking demand of 1.31 spaces per dwelling unit and an 85th percentile peak parking demand of 1.47 spaces per dwelling unit.

MEMORANDUM

TO: PREP Hanover Real Estate, LLC
c/o Mr. Lloyd W. Sova
Vice President – Development
PREP Property Group
5905 E. Galbraith Road, Suite 1000
Cincinnati, OH 45236

FROM: Mr. Jeffrey S. Dirk, P.E., PTOE, FITE
Partner
Vanasse & Associates, Inc.
35 New England Business Center Drive
Suite 140
Andover, MA 01810-1066
(978) 269-6830
jdirk@rdva.com

DATE: July 24, 2019

RE: 7902

SUBJECT: Multifamily Residential Parking Demands
Hanover Crossing – 1775 Washington Street (Route 53)
Hanover, Massachusetts

Vanasse & Associates, Inc. (VAI) has completed parking demand observations at two (2) multifamily residential communities in order to establish baseline parking demands for the residential component of the Hanover Crossing mixed-use development to be located at 1775 Washington Street (Route 53) in Hanover, Massachusetts. Parking demands were observed at the Domain Foxborough and Hanover at Andover multifamily residential communities on Wednesday, July 17, 2019, between 4:00 and 6:00 AM. The peak parking demand for a residential community generally occurs on a weekday after 10 PM and before 6:00 AM. Table 1 summarizes the parking demands observed at each residential community during the observation period, along with the parking occupancy and corresponding parking ratio.

Table 1
MULTIFAMILY PARKING DEMAND OBSERVATIONS
WEDNESDAY - JULY 17, 2019

	Domain Foxborough			Hanover at Andover		
Time	No. of Occupied Spaces	Occupancy[a]	Parking Demand Ratio[b]	No. of Occupied Spaces[c]	Occupancy	Parking Demand Ratio[d]
4:00 AM	298	76.4%	1.27	282	78.3%	1.23
4:30	296	75.9%	1.26	281	78.1%	1.23
5:00	295	75.6%	1.26	280	77.8%	1.22
5:30	286	73.3%	1.22	277	76.9%	1.21
6:00	282	72.3%	1.21	273	75.8%	1.19

[a]The available parking supply consists of 390 parking spaces.
[b]Based on 234 occupied units at the time of the parking demand observations.
[c]The available parking supply consists of 360 parking spaces
[d]Based on 229 occupied units at the time of the parking demand observations.

As can be seen in Table 1, the peak parking demand at both communities was observed to occur at 4:00 AM, with between 76 percent and 78 percent of the available parking spaces occupied. The peak parking demand ratio was found to be between 1.23 and 1.27 spaces per occupied dwelling unit, or an average peak parking demand of approximately 1.25 spaces per occupied dwelling unit. The observed peak parking demand ratio at the two multifamily residential communities is within the range of values documented by the Institute of Transportation Engineers (ITE)[1] for similar communities in a suburban setting with limited or no access to public transportation services.

Based on the results of the parking demand observations that were performed at the Domain Foxborough and Hanover at Andover multifamily residential communities, and with consideration of the ITE parking demand data which includes observations from 73 multifamily residential communities in a suburban setting, this analysis confirms that the 1.50 parking spaces per dwelling unit parking ratio that is proposed for the residential component of the Hanover Crossing project will be sufficient to meet the parking demands of residents and visitors, with reserve capacity to accommodate service, delivery and moving vehicles.

cc: File

[1] *Parking Generation Manual*, 5th Edition; Institute of Transportation Engineers; Washington, D.C.; January 2019. Observed parking demand ratios for a multifamily (mid-rise) residential community in a similar setting were found to range from 0.75 to 2.03 spaces per dwelling unit on a weekday, with an average parking demand of 1.31 spaces per dwelling unit and an 85th percentile peak parking demand of 1.47 spaces per dwelling unit.

MEMORANDUM

TO: Winn Development Company LP
c/o Ms. Angela Gile
Project Director
Winn Development
One Washington Mall, Suite 500
Boston, MA 02108

FROM: Mr. Jeffrey S. Dirk, P.E., PTOE, FITE
Managing Partner
Vanasse & Associates, Inc.
35 New England Business Center Drive
Suite 140
Andover, MA 01810-1066
(978) 269-6830
jdirk@rdva.com
Professional Engineer in CT, MA, ME, NH, RI, and VA

DATE: September 28, 2021

RE: 8688

SUBJECT: Parking Demand Study

Vanasse & Associates, Inc. (VAI) has completed parking demand observations at three (3) multifamily residential communities located proximate to transit facilities in order to establish baseline parking demands for each community and to assess parking requirements for the Elm Place multifamily residential community that is to be located off Pitman Road and Elm Place in Swampscott, Massachusetts. Parking demands were observed at the following residential communities: Vantage Pointe Apartments, Swampscott, Massachusetts; Bell North Shore Apartments, Salem, Massachusetts; and Hamilton Highlands in Needham, Massachusetts. The parking demand observations were performed in June and July 2021 on a typical weekday (i.e., Tuesday, Wednesday or Thursday) and on a Saturday, between 5:00 and 8:00 AM. For reference, peak parking demands for a residential community generally occur on a weekday after 10:00 PM and before 6:00 AM.

The Vantage Pointe Apartments and Bell North Shore Apartments are both located within 1.5 miles of Swampscott Station on the Massachusetts Bay Transportation Authority (MBTA) Newburyport/Rockport Commuter Rail Line, and are directly served by MBTA Bus Route 445, *Salem Depot - Wonderland Station*. Hamilton Highlands is located approximately 1,500 feet (an approximate 7-minute walking distance) north of Needham Heights station on the MBTA Needham Commuter Rail Line. As such, it can be reasonably assumed that a portion of the residents of these communities use public transportation and that this utilization is reflected in the observed parking demands.

Table 1 summarizes the observed parking demand ratio at each residential community during the observation periods, along with the average observed parking demand of the three sites.

Table 1
PARKING DEMAND OBSERVATIONS

Time	Weekday Parking Ratio per Unit				Saturday Parking Ratio per Unit			
	Vantage Pointe Apartments[a]	Bell North Shore Apartments[b]	Hamilton Highlands[c]	Average	Vantage Pointe Apartments[a]	Bell North Shore Apartments[b]	Hamilton Highlands[c]	Average
5:00 AM	1.40	0.86	1.08	1.11	1.35	0.85	1.05	1.08
5:15 AM	1.39	0.88	1.06	1.11	1.35	0.85	1.05	1.08
5:30 AM	1.36	0.88	1.05	1.10	1.33	0.83	1.05	1.07
5:45 AM	1.32	0.86	1.05	1.08	1.34	0.83	1.05	1.07
6:00 AM	1.32	0.86	1.03	1.07	1.34	0.81	1.05	1.07
6:15 AM	1.28	0.86	1.01	1.05	1.35	0.80	1.03	1.06
6:30 AM	1.27	0.85	1.00	1.04	1.35	0.80	1.03	1.06
6:45 AM	1.21	0.78	1.00	1.00	1.35	0.76	1.01	1.04
7:00 AM	1.20	0.76	1.01	0.99	1.31	0.73	1.01	1.02
7:15 AM	1.15	0.75	1.00	0.97	1.28	0.73	0.99	1.00
7:30 AM	1.14	0.75	0.97	0.95	1.26	0.75	0.96	0.99
7:45 AM	1.07	0.73	0.95	0.92	1.25	0.71	0.92	0.96
8:00 AM	1.06	0.73	0.92	0.90	1.21	0.68	0.91	0.93

[a]Vantage Pointe Apartments located at 100 Vantage Terrace, Swampscott, Massachusetts with 96 units and 189 parking spaces.
[a]Bell North Shore Apartments located at 1 Carol Way, Salem, Massachusetts with 59 units and 74 parking spaces.
[a]Hamilton Highlands located at 757 Highland Avenue, Needham, Massachusetts with 77 units and 116 parking spaces.

As can be seen in Table 1, the peak parking demand at the **Vantage Point Apartments** was observed to occur at 5:00 AM on both a weekday and a Saturday, with the weekday peak parking demand ratio observed to be 1.40 spaces per dwelling unit and the Saturday peak parking demand ratio observed to be 1.35 spaces per dwelling unit. The peak parking demand at the **Bell North Shore Apartments** was observed to occur at 5:15 AM on a weekday, with an observed peak parking demand ratio of 0.88 spaces per unit, and at 5:00 AM on a Saturday, with an observed peak parking demand of 0.85 spaces per unit. The peak-parking demand at **Hamilton Highlands** was observed to occur at 5:00 AM on both a weekday and a Saturday, with the weekday peak parking demand ratio observed to be 1.08 spaces per dwelling unit and the Saturday peak parking demand ratio observed to be 1.05 spaces per dwelling unit.

On average, the three sites were observed to have a peak-parking demand ratio of 1.11 spaces per dwelling unit on a weekday and 1.08 spaces per dwelling unit on a Saturday. Additionally, the observed peak-parking demand ratios at the three multifamily residential communities are within the range of values documented by the Institute of Transportation Engineers (ITE)[1] for similar communities.

The Elm Place residential community will provide 130 parking spaces to support 120 residential units, or a parking ratio of 1.08 parking spaces per unit, which is generally consistent with the average peak parking demand observed at the three residential communities. Of note with specific regard to the parking demands for Elm Place: i) 70 percent of the residential units will consist of one-bedroom units, which are more likely to be occupied by a single tenant and a lower parking demand than a two or three-bedroom unit; ii) the Massachusetts Bay Transportation Authority (MBTA) Route 455 bus includes a stop along Essex Street at the proposed location of Elm Place that will include a bus shelter to be installed in conjunction with the project; and iii) Swampscott Station on the Newburyport/Rockport Line of the MBTA Commuter Rail system is located approximately 0.3 miles to the southwest of the Project site, or an approximate 4 to 5 minute walking distance.

cc: File

[1] *Parking Generation Manual*, 5th Edition; Institute of Transportation Engineers; Washington, D.C.; January 2019. Observed parking demand ratios for a multifamily (mid-rise) residential community in a similar setting were found to range from 0.75 to 2.03 spaces per dwelling unit on a weekday, with an average parking demand of 1.31 spaces per dwelling unit and an 85th percentile peak parking demand of 1.47 spaces per dwelling unit.

CAPACITY ANALYSIS

School Street at Route 128 Northbound Ramps and Mill Street

School Street at Route 128 Northbound Ramps and Mill Street

Intersection	
Int Delay, s/veh	34.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	117	19	146	2	1	62	56	409	12	30	341	19
Future Vol, veh/h	117	19	146	2	1	62	56	409	12	30	341	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	50	-	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	72	72	72	85	85	85	78	78	78	91	91	91
Heavy Vehicles, %	1	0	1	0	0	2	4	2	0	0	1	0
Mvmt Flow	163	26	203	2	1	73	72	524	15	33	375	21

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1154	1124	375	1130	1117	532	375	0	0	539	0	0
Stage 1	441	441	-	676	676	-	-	-	-	-	-	-
Stage 2	713	683	-	454	441	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.5	6.21	7.1	6.5	6.22	4.14	-	-	4.1	-	-
Critical Hdwy Stg 1	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4	3.309	3.5	4	3.318	2.236	-	-	2.2	-	-
Pot Cap-1 Maneuver	175	207	674	183	209	547	1173	-	-	1040	-	-
Stage 1	597	580	-	446	456	-	-	-	-	-	-	-
Stage 2	424	452	-	589	580	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 137	181	674	103	183	547	1173	-	-	1040	-	-
Mov Cap-2 Maneuver	~ 137	181	-	103	183	-	-	-	-	-	-	-
Stage 1	544	556	-	407	416	-	-	-	-	-	-	-
Stage 2	334	412	-	376	556	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	126.4	14.1	1	0.7
HCM LOS	F	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1173	-	-	142	674	470	1040	-	-
HCM Lane V/C Ratio	0.061	-	-	1.33	0.301	0.163	0.032	-	-
HCM Control Delay (s)	8.3	0	-	248.5	12.6	14.1	8.6	0	-
HCM Lane LOS	A	A	-	F	B	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	11.8	1.3	0.6	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	57.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	127	21	158	2	1	67	61	443	13	33	369	21
Future Vol, veh/h	127	21	158	2	1	67	61	443	13	33	369	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	50	-	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	72	72	72	85	85	85	78	78	78	91	91	91
Heavy Vehicles, %	1	0	1	0	0	2	4	2	0	0	1	0
Mvmt Flow	176	29	219	2	1	79	78	568	17	36	405	23

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1250	1218	405	1225	1210	577	405	0	0	585	0	0
Stage 1	477	477	-	733	733	-	-	-	-	-	-	-
Stage 2	773	741	-	492	477	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.5	6.21	7.1	6.5	6.22	4.14	-	-	4.1	-	-
Critical Hdwy Stg 1	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4	3.309	3.5	4	3.318	2.236	-	-	2.2	-	-
Pot Cap-1 Maneuver	~ 150	182	648	157	184	516	1143	-	-	1000	-	-
Stage 1	571	559	-	415	429	-	-	-	-	-	-	-
Stage 2	393	426	-	562	559	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 113	156	648	79	158	516	1143	-	-	1000	-	-
Mov Cap-2 Maneuver	~ 113	156	-	79	158	-	-	-	-	-	-	-
Stage 1	513	533	-	373	386	-	-	-	-	-	-	-
Stage 2	298	383	-	335	533	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	214.9	15.3	1	0.7
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1143	-	-	118	648	433	1000	-	-
HCM Lane V/C Ratio	0.068	-	-	1.742	0.339	0.19	0.036	-	-
HCM Control Delay (s)	8.4	0	-	$ 430	13.4	15.3	8.7	0	-
HCM Lane LOS	A	A	-	F	B	C	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	15.8	1.5	0.7	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	71.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	137	21	158	2	1	67	61	447	13	33	382	23
Future Vol, veh/h	137	21	158	2	1	67	61	447	13	33	382	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Stop	-	-	None	-	-	None	-	-	Yield
Storage Length	-	-	50	-	-	-	-	-	-	-	-	50
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	72	72	72	85	85	85	78	78	78	91	91	91
Heavy Vehicles, %	1	0	1	0	0	2	4	2	0	0	1	0
Mvmt Flow	190	29	219	2	1	79	78	573	17	36	420	25

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1270	1238	420	1245	1230	582	420	0	0	590	0	0
Stage 1	492	492	-	738	738	-	-	-	-	-	-	-
Stage 2	778	746	-	507	492	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.5	6.21	7.1	6.5	6.22	4.14	-	-	4.1	-	-
Critical Hdwy Stg 1	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4	3.309	3.5	4	3.318	2.236	-	-	2.2	-	-
Pot Cap-1 Maneuver	~ 146	177	635	152	179	513	1128	-	-	995	-	-
Stage 1	560	551	-	413	427	-	-	-	-	-	-	-
Stage 2	391	424	-	552	551	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 109	151	635	76	153	513	1128	-	-	995	-	-
Mov Cap-2 Maneuver	~ 109	151	-	76	153	-	-	-	-	-	-	-
Stage 1	502	525	-	370	383	-	-	-	-	-	-	-
Stage 2	296	380	-	325	525	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	266.1	15.4	1	0.7
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1128	-	-	113	635	428	995	-	-
HCM Lane V/C Ratio	0.069	-	-	1.942	0.346	0.192	0.036	-	-
HCM Control Delay (s)	8.4	0	-	$ 518.6	13.6	15.4	8.8	0	-
HCM Lane LOS	A	A	-	F	B	C	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	17.9	1.5	0.7	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon