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Emergency Vehicle Traffic Control Alternatives

To: Village of Hastings on Hudson
From: Sam Schwartz Engineering, DPC
Date: October 2, 2020
Re: Emergency Vehicle Traffic Control Alternatives at High and Rose Street
Project No: 17-01-2681

1. Overview

Sam Schwartz Engineering, DPC ("*Sam Schwartz*") has been asked to evaluate potential solutions for operational challenges of emergency vehicles navigating through the intersection of High and Rose Street. This analysis describes four potential signing and traffic control strategies and anticipated cost as well as right of way, environmental, and utility impacts.

As part of the evaluation, *Sam Schwartz* reviewed the Manual on Uniform Traffic Control Devices (MUTCD), New York State Department of Transportation (NYSDOT) MUTCD Supplement, and local regulations as it refers to signal design and environmental impacts. For right of way impacts, desktop review was performed and compared to data collected using open source AxisGIS data for Westchester County and Greenburgh, NY.

2. Existing Conditions

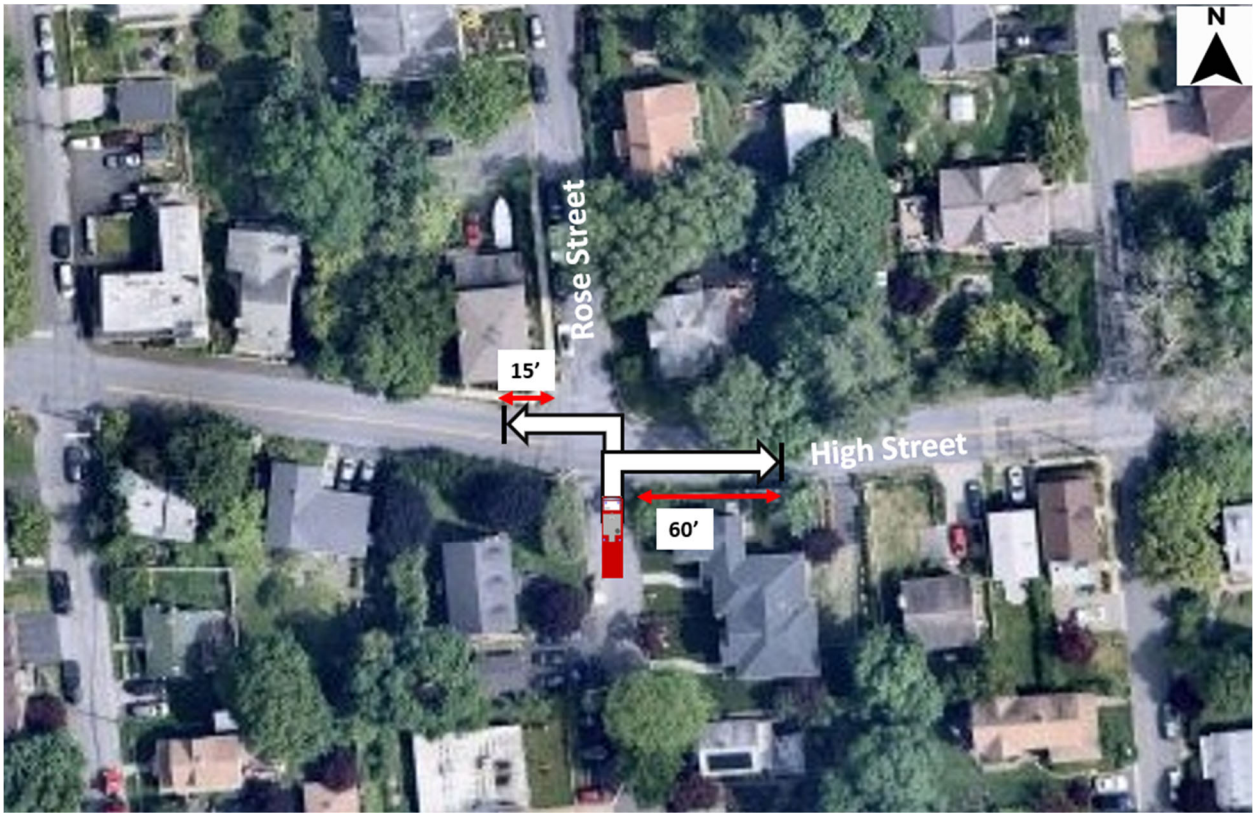
High Street is an eastbound/westbound two-lane municipal roadway with a 28-foot wide pavement width with one 14-foot lane in each direction, parking permitted on the westbound side, and steep inclines. The posted speed within the study area is 25 MPH. Right-of-way maps as provided through Westchester County and Greenburgh, NY AxisGIS pages are included in **Appendix A.** According to these sources, survey has not been recorded recently on the eastbound and westbound approaches of this intersection and new survey is recommended to confirm right of way impacts.

The current traffic flow along High Street between Farragut Avenue and Broadway is uninterrupted, with no stop signs, yield signs, or traffic signals. All intersecting minor streets are two-way stop controlled to give High Street the right of way. However, as per the "High Street Field Visit Memorandum" dated 7/10/2020 and "High Street Field Visit Addendum," an all-way stop control is recommended at Rose Street, James Street, Warren Street, and Harvard Lane intersections.

On September 18, 2020, the Fire Chief of the Village of Hastings on Hudson and Village Trustees performed an emergency vehicle turning demonstration using the emergency vehicles that service the Village of Hastings on Hudson. The turning movement demonstration revealed that as emergency vehicles turned from the Rose Street northbound approach, the emergency vehicles encroached in lanes of opposing traffic. While executing a left turn, emergency vehicles

encroached on the eastbound lane of traffic up to 15 feet away from the intersection and while executing a right turn, emergency vehicles encroached on the westbound lane of traffic up to 60 feet away from the intersection. See **Figure 1** depicting the turning movements and the distance of typical lane encroachments as observed in the field.

Figure 1: In Field Emergency Vehicle Turning Diagram



A typical all-way stop controlled application at this intersection may cause operational difficulties as vehicles stopped at High Street and Rose would impede on the emergency vehicles turning from the northbound approach. Left turning emergency vehicles encroach on the eastbound lane by up to 15 feet from the intersection. This eastbound lane encroachment can be mitigated by placing the stop bar 30 feet from the intersection, as permitted in MUTCD Section 2B.16.10. Right turning emergency vehicles encroach on the westbound lane by up to 60 feet from the intersection. The maximum distance permitted by the MUTCD between stop bars and intersections is 30 feet. Therefore, stop bar location adjustment would not mitigate operational difficulties caused by a vehicle being stopped in the path of emergency vehicles making right turns.

As such, all alternatives, unless mandated by the regulations of the traffic device or otherwise stated, are only considered for the westbound High Street approach of the Rose and High Street intersection. It is also assumed, unless stated otherwise, that all alternatives are implemented with an all-way stop control at the High Street and Rose Street intersection.

3. Alternatives Analysis for Traffic Control and Signage

In considering potential mitigation to improve navigation for emergency vehicles executing northbound right turns at the Rose and High Street intersection, there are four alternatives evaluated. These alternatives will be preliminarily evaluated in the same order for impacts including utility, right of way, and order of magnitude costs to implement.

- "Do Nothing" Alternative – multi-way stop control
- Implement 'Emergency Vehicle Warning' sign (W11-8)
- Implement 'Emergency Vehicle Warning' sign (W11-8) with Warning Beacon
- Implement Emergency Vehicle Hybrid Beacon

3a. "Do Nothing" Alternative - multi-way stop control

The first option is the "Do Nothing" Alternative and explores the impacts of the multi-way stop control condition if no improvements were implemented specifically to alleviate operational challenges at the High and Rose Street intersection. At this location, per the MUTCD and NYSDOT Highway Design Manual, additional signage or traffic controls for the emergency vehicles are not required for the Rose and High Street intersection. Therefore a "Do Nothing" alternative should be considered to anticipate the effects of not implementing any additional traffic signage or control.

Maintaining the current condition of a multi-way stop controlled intersection would not cause any right of way, environmental, or utility impacts. While the location of the stop signs and stop bars present an operational challenge for emergency vehicles navigating the intersection, it is possible that in practice roadway users will heed to emergency vehicles and move as necessary to make way for turning emergency vehicles.

3b. Implement 'Emergency Vehicle Warning' sign (W11-8)

The second option is to implement 'Emergency Vehicle Warning' signage (W11-8) at the westbound approach of the Rose and High Street intersection. This signage is classified as a 'Vehicular Traffic Warning' which may be used to alert road users to locations where unexpected entries into the roadway by emergency vehicles, as referenced in the MUTCD Section 2.C.49.

The MUTCD provides guidance that "Vehicular Traffic Warning signs should be used only at locations where the road user's sight distance is restricted, or the condition, activity, or entering traffic would be unexpected." Due to the sight distances from the northbound and westbound approaches, an emergency vehicle could encroach on the westbound in a way that could be unexpected and require immediate breaking from westbound vehicles. There is not a specific recommendation for the placement of these signs, but in this case, Sam Schwartz recommends signage placement 80 feet from the Rose and High Street intersection along the westbound approach. This distance will allow for the 60 feet needed for emergency vehicles to fully merge into the appropriate lane with an additional 20 feet for a margin of safety. See **Figure 2** for the recommended location of the 'Emergency Vehicle Warning' sign and **Figure 3** for an image of the warning sign at the referenced location.

Figure 2: 'Emergency Vehicle Warning' sign location

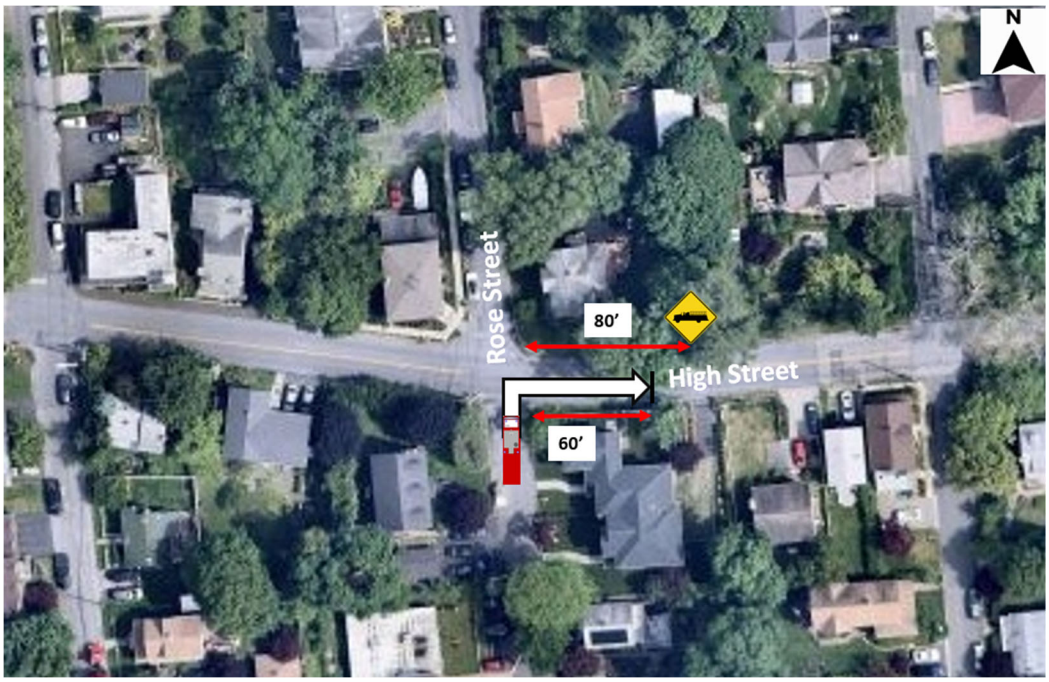


Figure 3: 'Emergency Vehicle Warning' sign location (W11-8) at High Street

Maintaining this sign's visibility may require regular maintenance and trimming of trees along the westbound side of High Street. This implemented signage would have minimal impact on right of way and utilities at this location, and the estimated assembly can be done at a low cost

through the Department of Public Works in Hastings-on-Hudson. It is important to note that while the sign could caution westbound motorists that they may encounter an emergency vehicle crossing, the warning sign does not alert vehicles to active conditions nor does it regulate where vehicles must stop to avoid encroaching on the turning movement of a fire truck.

3c. Implement 'Emergency Vehicle Warning' sign (W11-8) with Warning Beacon

The third option is to implement 'Emergency Vehicle Warning' signage (W11-8) at the westbound approach of the Rose and High Street intersection with an additional warning beacon and 'When Flashing' plaque W16-13P in the same location. The beacon in this option would be actuated by the fire station, and unless actuated, would be dark. For how the signage and warning beacon may look in the context of Hastings-on-Hudson, see **Figure 4.**

Figure 4: 'Emergency Vehicle Warning' sign with Warning Beacon

The 'Emergency Vehicle Warning' signage and warning beacon would caution westbound road users of emergency vehicles in advance of the High and Rose Street intersection. The warning beacon would give supplemental emphasis to the warning signs, and the 'When Flashing' plaque would indicate that the condition is present when the warning beacon is activated. Similar to option 3b, the signage presented in this option would not be regulatory and would not mandate any action at any time, including a safe stopping location; however, with the additional actuated warning beacons and nature of the signage, it is expected roadway users would be alerted to the presence of emergency vehicles and proceed with caution.

The warning beacon mounted on the signpost is assumed to be solar powered and actuated from the fire station remotely. If the solar powered option is not feasible, the 'Emergency Vehicle Warning' sign and beacon will need to be wired to an existing utility pole by constructing underground conduit or tying into existing utilities, if available. This may result in higher costs. A sign and beacon assembly system like this is comparable to a Rectangular Rapid Flashing Beacon, another warning sign with an actuated beacon. According to PEDBIKESAFE pedestrian safety guide and countermeasure selection system, the equipment, labor, and implementation costs are anticipated to be between $4,500 and $52,000, with an average cost of $22,250. Citing this wide variation, PEDBIKESAFE explains that the cost to furnish and install depends on the type of device used.

For adequate level of sunlight for the solar power system, regular trimming or potential removal of trees along the westbound side of High Street may be required. If tree removal is required, according to Hastings-on-Hudson's ordinances, the same number of trees must be planted in the nearest practical location to the site. Other roadway and utility impacts should be minimal with the solar power option.

3d. Implement Emergency-Vehicle Hybrid Beacon

The fourth option is to implement an emergency vehicle traffic control beacon that assigns the right of way to emergency vehicles by giving red indications to westbound and eastbound High Street approaches. According to MUTCD Section 4G.01, "[if] the stopping sight distance for vehicles approaching on the major street is insufficient to permit reasonably safe entrance of emergency vehicles, installing an emergency-vehicle traffic control signal should be considered." Because of the intersection stopping sight distance at the northbound Rose Street approach and the operational difficulty of turning emergency vehicles, considering an emergency-vehicle traffic signal control is appropriate. See **Figure 5** for an example of an emergency-vehicle hybrid beacon in Robbinsville, New Jersey.

Figure 5: Emergency Vehicle Hybrid Vehicle Example (NJ)

In Section 4G.01.00F of the NYSDOT's Supplemental MUTCD manual, the manual puts forward guidance on what warrants an emergency-vehicle hybrid beacon. The guidance states:

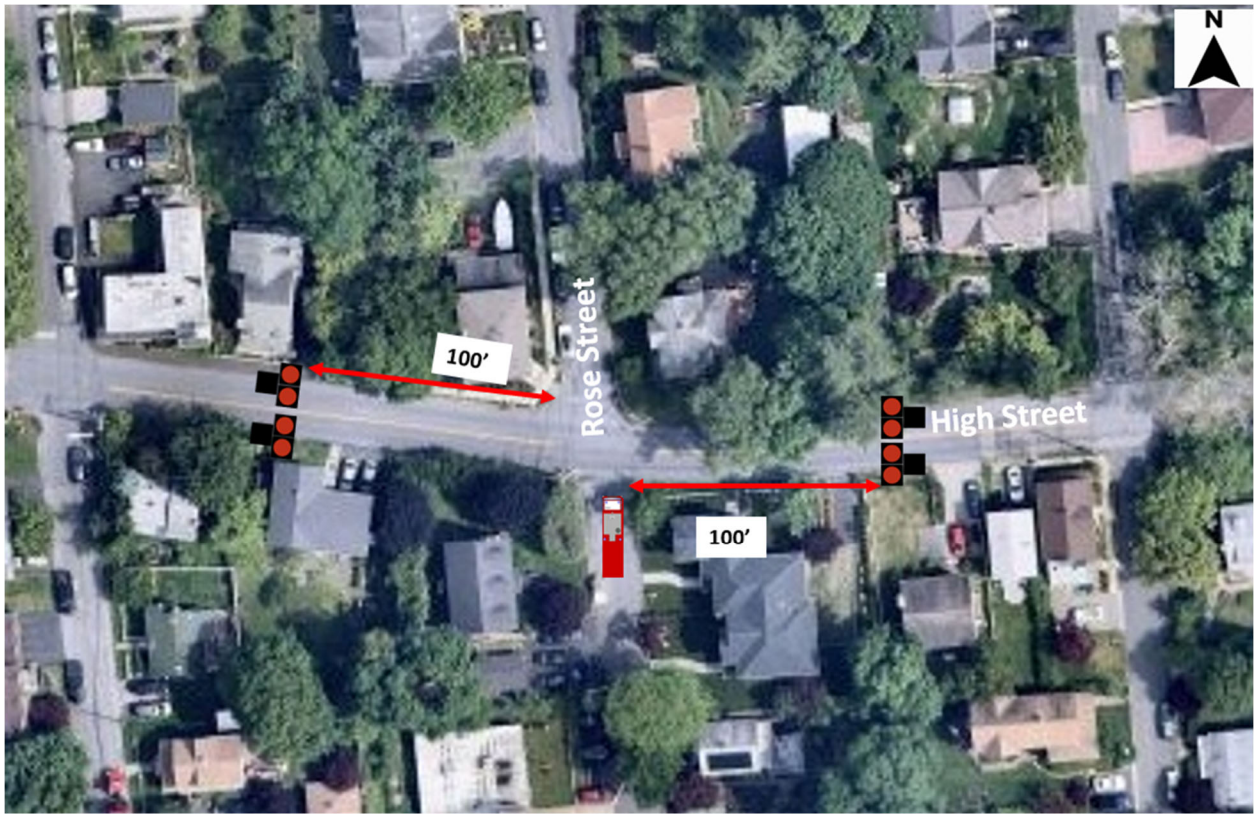
> A. Two-lane highways. Emergency-vehicle traffic control signals should be used on two-lane highways only where, within a two-year period, 200 emergency calls occur during times when the rate of flow on the highway is at least:
>
> 1. 750 vehicles per hour; or
>
> 2. 525 vehicles per hour, if the 85th-percentile highway speed is over 40 miles per hour; or
>
> 3. 525 vehicles per hour if the stopping sight distance for vehicles approaching on the major street is insufficient to permit reasonably safe entrance of emergency vehicles; or
>
> 4. 375 vehicles per hour, if the 85th-percentile highway speed is over 40 miles per hour and the stopping sight distance for vehicles approaching on the major street is insufficient to permit reasonably safe entrance of emergency vehicles.

In previous memos, the High Street volumes were approximated for 2020 volumes using 2015 traffic counts, included in **Appendix B.** Only for one hour, from 5PM to 6PM, did traffic exceed 375 vehicles. Even if the 85th percentile speed was greater than 40 MPH, which is 15 MPH above the speed limit, an emergency call would have to occur once every 3.7 days on average to meet the warrant for an emergency vehicle hybrid beacon. While it is unlikely that the conditions on High Street warrant an emergency-vehicle hybrid beacon according the NYSDOT volume criteria, the justification for the beacon would be installed to mitigate a geometrical concern and would be necessary for motorists to stop at a safe distance away to avoid being

struck from a turning emergency vehicle. From an engineering standpoint, the only appropriate (MUTCD-compliant) method to require westbound vehicles to stop at an adequate distance from the intersection to avoid being impacted by a turning emergency vehicle are using the emergency-vehicle hybrid beacon or an emergency vehicle traffic control signal.

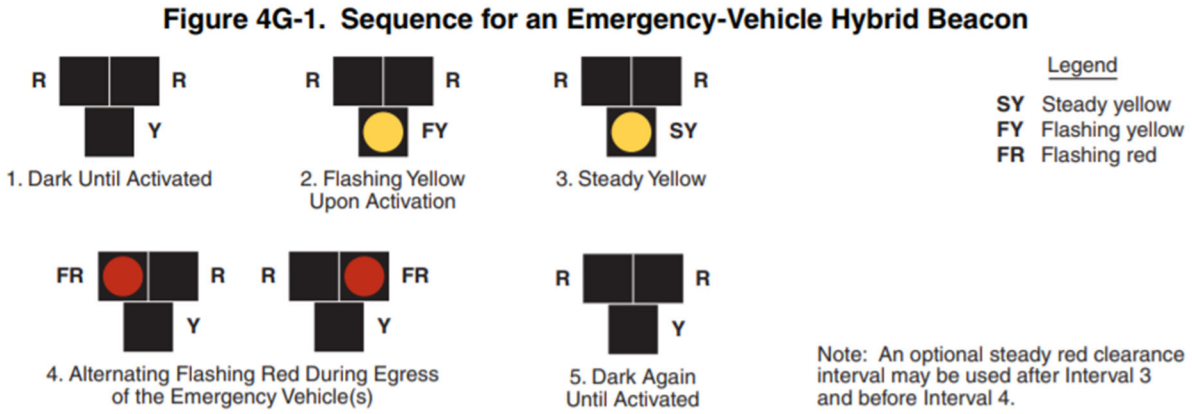
For placement of the hybrid beacons, the MUTCD Guidance in the same section states that the emergency hybrid beacons should not be "within 100 feet from an intersection… controlled by a STOP or YIELD sign." Therefore, the emergency hybrid beacons in this location are recommended 100 feet from the intersection of Rose and High Street. The MUTCD code also requires at least two emergency vehicle hybrid faces for each approach of the major street (High Street). The MUTCD also requires 'Emergency Signal- Stop on Flashing Red' Signage (R10-14) and stop bar pavement markings at each emergency-vehicle hybrid beacon. See **Figure 6** for the preliminary locations of the emergency-vehicle hybrid beacons.

Figure 6: Preliminary Traffic Signal Locations



For this option, the emergency-vehicle hybrid beacons would be in 'dark mode,' with neither red nor yellow indications displayed until the beacons were actuated by emergency personnel. Of all the options, implementing an emergency vehicle signal is the only option that would mandate the stopping of vehicles. See **Figure 7** for the typical emergency-vehicle hybrid beacon operations, as found in Figure 4G-1 of the MUTCD.

Figure 7: Emergency Vehicle Hybrid Beacon Operations



Similar to Option 3c, trimming and/or removal of the trees at the proposed sign structure locations may be required for sign installation and potential underground power connection to existing utility poles. According to the study on estimated costs from PEDBIKESAFE for a similar Hybrid Beacon traffic control, the full cost of each hybrid beacon including equipment and installation is between $21,000 and $128,000, with an average per unit cost of $57,680.

6. Conclusion

The options presented in this memo are to be considered by Hastings-on-Hudson to overcome the operational difficulties of emergency vehicles at the Rose and High Street intersection. The options presented range in right of way impacts, environmental impacts, and cost. The solution for Hastings-on-Hudson will ultimately depend on the anticipated severity of the emergency personnel operational challenges and right of way, utility, and environmental impacts.

Appendix A

High Street from James Street to Rose Street - August 2015

		12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12	12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12
Eastbound High Street from James Street and Rose Street	M														105	81	100	152	133	92	63	42	30	18	18
	T	16	1	0	1	5	13	35	95	122	95	72	85	78	87	103	106	140	215	102	73	39	37	28	14
	W	17	6	1	1	5	8	36	94	95	91	79	85	94	77	99	118	158	194	103	61	42	24	20	26
	Th	9	2	3	1	6	11	38	87	103	88	82	89	93	76	100	113	137	200	89	59	48	33	30	18
	F	4	7	1	3	4	12	28	89	97	97	70													
Westbound High Street from James Street and Rose Street	M														101	90	103	137	133	126	98	64	61	33	22
	T	12	5	1	2	3	11	36	152	195	116	86	105	83	97	80	115	129	160	129	81	73	71	35	18
	W	22	3	2	6	6	10	30	154	176	133	85	107	109	108	101	107	138	138	131	88	74	50	41	26
	Th	13	7	3	1	1	17	37	155	180	143	92	93	112	81	87	111	130	181	106	83	87	65	45	31
	F	14	4	2	3	5	8	42	153	158	133	71													
Total	M														206	171	203	289	266	218	161	106	91	51	40
	T	28	6	1	3	8	24	71	247	317	211	158	190	161	184	183	221	269	375	231	154	112	108	63	32
	W	39	9	3	7	11	18	66	248	271	224	164	192	203	185	200	225	296	332	234	149	116	74	61	52
	Th	22	9	6	2	7	28	75	242	283	231	174	182	205	157	187	224	267	381	195	142	135	98	75	49
	F	18	11	3	6	9	20	70	242	255	230	141													
Weekday Average		**27**	**9**	**3**	**5**	**9**	**23**	**71**	**245**	**282**	**224**	**159**	**188**	**190**	**183**	**185**	**218**	**280**	**339**	**220**	**152**	**117**	**93**	**63**	**43**

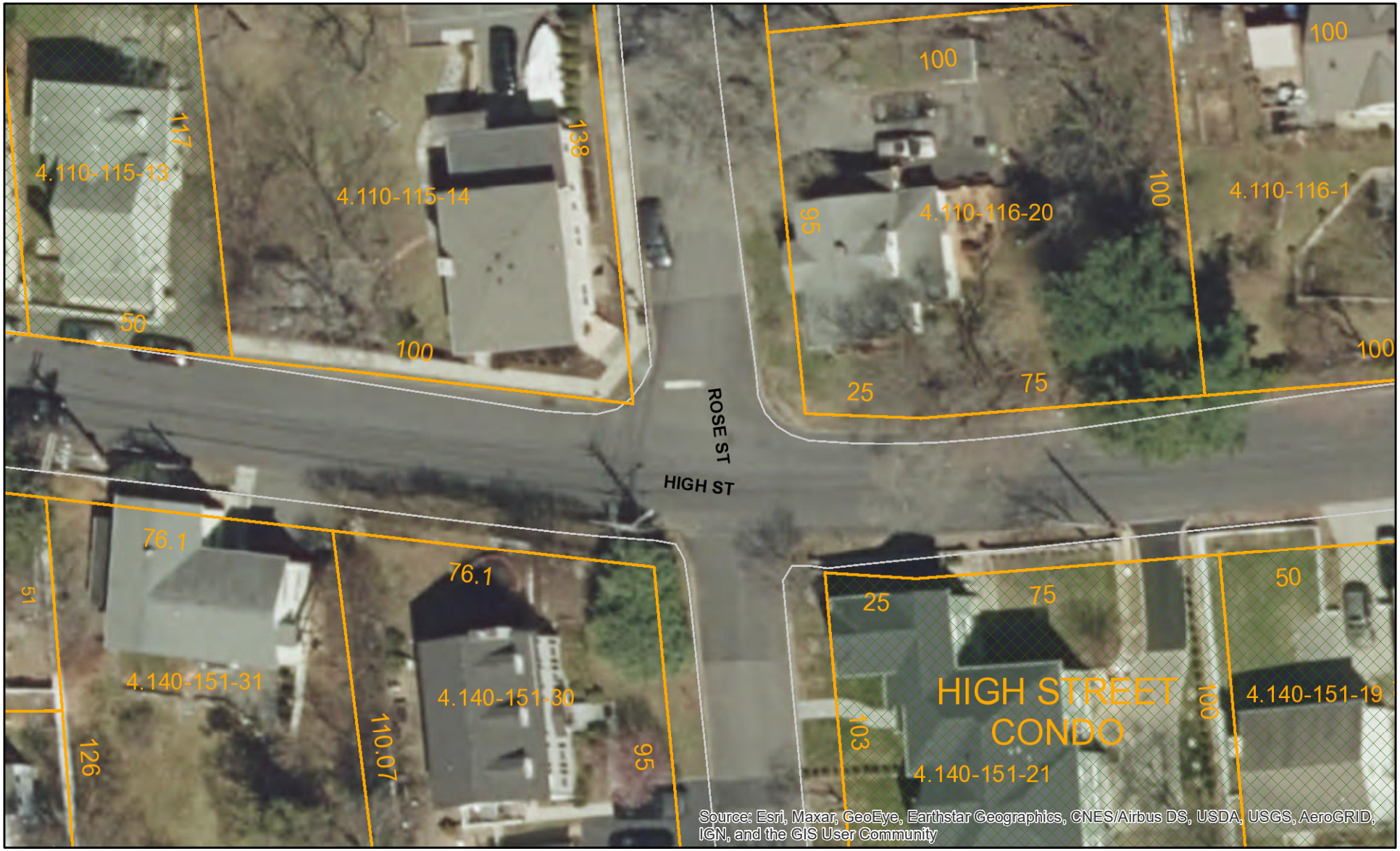
High Street from James Street to Rose Street - August 2020 Volume Adjustment

		12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12	12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12
Eastbound High Street from James Street and Rose Street	M														109	84	104	158	138	96	66	44	31	19	19
	T	17	1	0	1	5	14	36	99	127	99	75	88	81	90	107	110	146	224	106	76	41	38	29	15
	W	18	6	1	1	5	8	37	98	99	95	82	88	98	80	103	123	164	202	107	63	44	25	21	27
	Th	9	2	3	1	6	11	40	90	107	92	85	93	97	79	104	118	142	208	93	61	50	34	31	19
	F	4	7	1	3	4	12	29	93	101	101	73													
Westbound High Street from James Street and Rose Street	M														105	94	107	142	138	131	102	67	63	34	23
	T	12	5	1	2	3	11	37	158	203	121	89	109	86	101	83	120	134	166	134	84	76	74	36	19
	W	23	3	2	6	6	10	31	160	183	138	88	111	113	112	105	111	144	144	136	92	77	52	43	27
	Th	14	7	3	1	1	18	38	161	187	149	96	97	116	84	90	115	135	188	110	86	90	68	47	32
	F	15	4	2	3	5	8	44	159	164	138	74													
Total	M														214	178	211	300	276	227	168	111	94	53	42
	T	29	6	1	3	8	25	73	257	330	220	164	197	167	191	190	230	280	390	240	160	117	112	65	34
	W	41	9	3	7	11	18	68	258	282	233	170	199	211	192	208	234	308	346	243	155	121	77	64	54
	Th	23	9	6	2	7	29	78	251	294	241	181	190	213	163	194	233	277	396	203	147	140	102	78	51
	F	19	11	3	6	9	20	73	252	265	239	147													
Weekday Average		**28**	**9**	**3**	**5**	**9**	**23**	**73**	**255**	**293**	**233**	**166**	**195**	**197**	**190**	**193**	**227**	**291**	**352**	**228**	**158**	**122**	**96**	**65**	**45**

High Street from James Street to Rose Street - 2020 School Year Adjustment

		12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12	12 To 1	1 To 2	2 To 3	3 To 4	4 To 5	5 To 6	6 To 7	7 To 8	8 To 9	9 To 10	10 To 11	11 To 12
Eastbound High Street from James Street and Rose Street	M														120	92	114	174	152	106	73	48	34	21	21
	T	19	1	0	1	6	15	40	109	140	109	83	97	89	99	118	121	161	246	117	84	45	42	32	17
	W	20	7	1	1	6	9	41	108	109	105	90	97	108	88	113	135	180	222	118	69	48	28	23	30
	Th	10	2	3	1	7	12	44	99	118	101	94	102	107	87	114	130	156	229	102	67	55	37	34	21
	F	4	8	1	3	4	13	32	102	111	111	80													
Westbound High Street from James Street and Rose Street	M														116	103	118	156	152	144	112	74	69	37	25
	T	13	6	1	2	3	12	41	174	223	133	98	120	95	111	91	132	147	183	147	92	84	81	40	21
	W	25	3	2	7	7	11	34	176	201	152	97	122	124	123	116	122	158	158	150	101	85	57	47	30
	Th	15	8	3	1	1	20	42	177	206	164	106	107	128	92	99	127	149	207	121	95	99	75	52	35
	F	17	4	2	3	6	9	48	175	180	152	81													
Total	M														236	195	232	330	304	250	185	122	103	58	46
	T	32	7	1	3	9	27	81	283	363	242	181	217	184	210	209	253	308	429	264	176	129	123	72	38
	W	45	10	3	8	13	20	75	284	310	257	187	219	232	211	229	257	338	380	268	170	133	85	70	60
	Th	25	10	6	2	8	32	86	276	324	265	200	209	235	179	213	257	305	436	223	162	154	112	86	56
	F	21	12	3	6	10	22	80	277	291	263	161													
Weekday Average		**31**	**10**	**3**	**5**	**10**	**25**	**81**	**280**	**322**	**257**	**182**	**215**	**217**	**209**	**212**	**250**	**320**	**387**	**251**	**173**	**135**	**106**	**72**	**50**

Appendix B



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