Sam Schwartz
1 North Broadway, Suite 403
White Plains, NY 10601
(914) 340-0020
samschwartz.com

Sam Schwartz

High Street Field Visit Memo Addendum

To: Village of Hastings on Hudson
From: Sam Schwartz Engineering, DPC
Date: September 1, 2020
Re: High Street Field Observations
Project No: 17-01-2681

1. Overview

Sam Schwartz Engineering, DPC ("Sam Schwartz") has been asked to evaluate traffic operations and safety at two (2) intersections along High Street in the Village of Hastings-on-Hudson as an addendum to the "High Street Field Visit" memorandum submitted July 10, 2020. The intersections evaluated in this document are the intersections of Harvard Lane and High Street as well as Hall Place and High Street.

As part of the evaluation, Sam Schwartz reviewed traffic volume data, crash data, and conducted field measurements and observations. The information was collected to determine the need for safety improvements and assess operational impacts of improvements along the corridor. Improvements evaluated included implementing all-way stop control at each of the intersections, prohibiting parking in certain locations, and installing pedestrian infrastructure along the corridor. This memorandum documents these efforts and the results of the analyses performed.

2. Existing Conditions

On August 19, 2020, Sam Schwartz conducted field observations and measurements of stopping sight distance deficiencies and parking restrictions.

High Street is an eastbound/westbound two-lane municipal collector with no marked shoulders and a 22-foot wide pavement width with one 11-foot lane in each direction. The posted speed within the study area is 25 MPH. Parking is permitted along the westbound side High Street except for prohibited parking 175 feet east and 130 feet west of Hall Place.

Traffic flow along High Street at the Hall Place and Harvard Lane intersections is uninterrupted, with no stop signs, yield signs, or traffic signals. High Street turns sharply at Hall Place creating an approximate 105-degree turn with an approximate curve radius of 65 feet. Hall Place and Harvard Lane are stop controlled to give High Street traffic the right of way. Both streets support two-way traffic, although Hall Place has no through traffic and only serves five homes on a cul-de-sac.

On a field visit on March 4, 2020, several children were observed crossing or walking along High Street as part of their morning routine getting to school. On High Street between Farragut Avenue and Broadway, there is one walkway segment along the north curb line from Rose Street to James Street. Aside from this location, there are no curb ramps or crosswalks along

major and minor streets. Intersection measurements and aerial images can be found in **Appendix A.**

3. Preliminary Safety and Complete Streets Analysis

Crash data and field observations were also reviewed to evaluate vehicular and pedestrian safety along the corridor and the area surrounding it. Pedestrians observed during the March 2020 field visit included children on their way to school, people walking their dogs, and adults presumably going to work. High Street has minimal pedestrian facilities and no marked shoulders, forcing these pedestrians to walk in the travel lanes. These conditions are not compliant with the Village of Hastings-on-Hudson Complete Streets Policy, which was adopted in October of 2014.

Further, there have been 22 bicycle and pedestrian crashes from years 2015 to 2019 along High Street and its intersecting roads, with one crash occurring on High Street at Hall Place in March 2019. Almost half of the total crashes (10) occurred between 7:30 – 8:30 AM and 3:00 – 4:00PM, when there are likely to be higher volumes of walking schoolchildren and motor vehicles. A detailed vehicle crash analysis was not completed as part of this evaluation.

The safety of pedestrians in the Hastings-on-Hudson community would be improved by implementing pedestrian infrastructure, like sidewalks and marked crosswalks, that connect residential communities and high pedestrian trip generators such as schools, parks, and transit.

4. Traffic Control Warrants and Traffic Volume Review

Consideration was given to implementing all-way stop control at the intersection of High Street and Hall Place and the intersection of High Street and Harvard Lane. The FHWA Manual on Uniform Traffic Control Devices (MUTCD) guidance (Section 2B.07) was utilized to determine if an all-way stop condition should be installed at the two intersections. The evaluation was performed using 2020 traffic growth estimates from New York State Department of Transportation (NYSDOT) Traffic Count Hourly Report Data and is included in **Appendix B**.

The threshold for implementing all-way stop control based on traffic volume in Section 2B.07 of the MUTCD reads, "*The vehicular volume entering the intersection from the major street approaches (total of both approaches) average at least 300 vehicles per hour for any 8 hours of an average day; and The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) average at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour."*

As discussed in the "High Street Field Visit" Memorandum dated July 10, 2020, High Street is not estimated to have an average of 300 or more vehicles per hour for 8 hours during a typical day, even when using conservative calculations to account for population growth and seasonal traffic patterns. Traffic volume estimates with seasonal and population growth adjustments are included in **Appendix B.** Additionally, the minor street approach at Hall Place and Harvard Lane are not likely to have enough vehicle, pedestrian, and bicycle volumes to warrant an all-way stop control as a minor street. Therefore, traffic volumes are not a basis for recommending an

all-way stop at the intersection of High Street and Hall Place or the intersection of High Street and Harvard Lane.

5. Stopping Sight Distance Deficiencies

Per the MUTCD (Section 2B.07.05), "*Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop"* are candidates for multi-way stop sign applications. Field observations and measurements were taken to evaluate the current sight distance from Hall Place and Harvard Lane onto High Street. High Street and Harvard Lane was observed to have insufficient sight distances.

Sight distance standards are calculated using the speed of the road, type of traffic control, and typical reaction time to give vehicles adequate opportunity to avoid collision while maneuvering through an intersection. The sight distance standards on High Street were determined by NYSDOT Highway Design Manual guidelines for scenarios with minor street stop control and a design speed of 30 miles per hour (roadway speed limits are generally posted 5 MPH below the design speed). In these conditions, 355 feet of sight distance is required to the right in order to execute a left turn, and 290 feet of sight distance is required to the left in order to execute a right turn.

Based on our field observations, Harvard Lane does not have adequate sight distance due to the surrounding elevated landscape. The stopping sight distance at Harvard Place was further obstructed due to shrubbery west of the intersection. At Hall Place, substandard sight distance was not observed in the field, however, potential parking obstructions on the westbound side of High Street are a cause for concern. If a vehicle is parked at the regulatory parking sign 175 feet east of the Hall Place intersection, the sight distance could potentially be 250 feet rather than the standard of 295 feet. Due to the contradictory in field observation, *Sam Schwartz* will practice its engineering judgement and not recommend a stop sign at this location due to sight distance. Graphics depicting the stopping sight distance at these intersections can be found in **Appendix C.**

To address stopping sight distance deficiencies at Harvard Lane, measures may be taken including roadway realignment, grading, speed limit adjustments, and altering traffic controls at intersections. Converting this intersection to all-way stop control would eliminate the need for stopping sight distance requirements at the minor approach. Implementing an all-way stop control may be the most feasible and cost-effective measure to address stopping sight distance deficiencies at Harvard Lane. At Hall Place, if there are continued concerns regarding sight distance, the most cost-effective measure may be restricting on-street parking 225 feet east from the intersection, or 15 feet east of the fire hydrant.

6. High Street Geometric Deficiencies

According to the NYSDOT Highway Design Manual guidelines Exhibit 2-6 as a Non-NHS collector, High Street should have a minimum curve radius of 176 feet as a 30 MPH design speed roadway assuming 4% e_{max}. See **Appendix D** for the NYSDOT Highway Design Manual Exhibit 2-6 for applicable geometric design guides. At the sharp turn of High Street at Hall Place, the curve radius is approximately 65 feet, which is substandard for the current design

speed of 30 MPH. Per the latest edition of the American Association of State Highway and Transportation Officials' (AASHTO) "A Policy on Geometric Design of Highways and Streets" Equation 3-8 and Table 3-7, for a curve with a radius of 65 feet, 4% e_{max} , and side friction factor of 0.30, the calculated design speed of the curve is 18.2 MPH. As the posted or advisory speed should be less than the design speed, the recommended advisory speed at this location is 15 MPH.

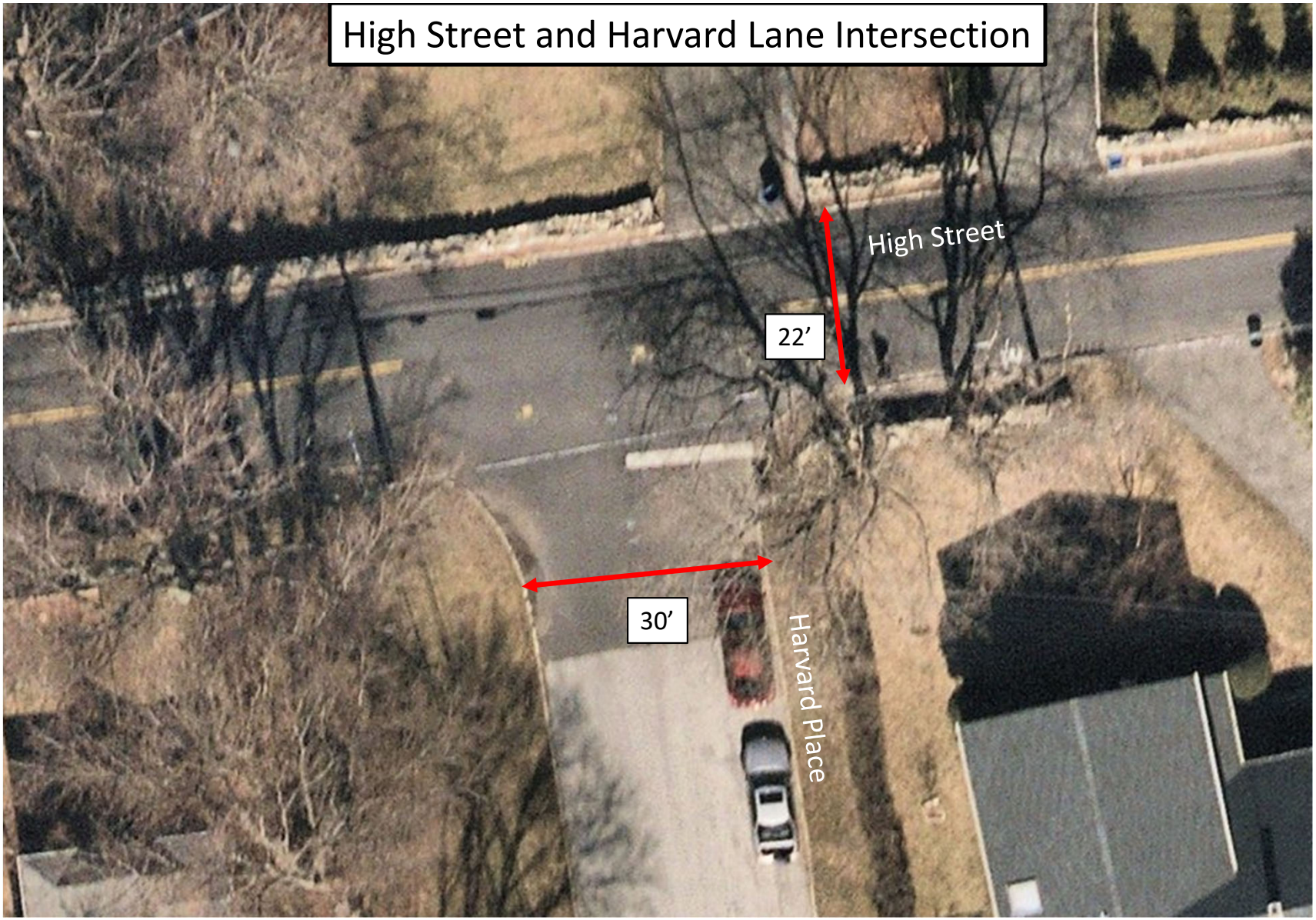
The horizontal curve along High Street at Hall Place has a substandard curve radius for the design speed of High Street, which may cause safety issues at this location. The difference between the speed limit and the recommended advisory speed at this location is 15 MPH. Per MUTCD Table 2C-5, the difference between the speed limit and advisory speed mandates the installation of Turn (W1-1) signs and an Advisory Speed Plaque (W13-1P) signs. It also is recommended per the same MUTCD table that Chevron (W1-8) and/or One Direction Large Arrow (W1-6) signs are implemented.

7. Recommendations

Per our assessment, implementation of an all-way stop control at the intersection of High Street and Harvard Lane may be feasible. Implementing all-way stop control at Harvard Lane would eliminate the need for sight distance improvements along High Street and would allow vehicles from minor streets to maneuver through the intersection more safely. At Hall Place, High Street has too small a curve radius for its design speed of 30 MPH, and based on the existing curve radius, the advisory travel speed at this location should be 15 MPH. Due to the difference between posted and advisory speeds, the MUTCD requires Turn (W1-1) signs and Advisory Speed Plaque (W13-1P) signs in both directions, and Sam Schwartz recommends One Direction Large Arrow (W1-6) signs.

Given the presence of pedestrians and the Village of Hastings-on-Hudson's Complete Streets Policy, it is recommended that Americans with Disabilities (ADA) compliant pedestrian facilities, including curb ramps, crosswalks and sidewalks be implemented in this area. Next steps should include the design of these facilities, which will require a field survey to determine Right-of-Way constraints, subsurface utilities, ground utilities, and roadway elevation.

Appendix A


High Street and Harvard Lane Intersection
High Street
22’
30’
Harvard Place


High Street and Hall Place Intersection
Hall Place
High Street
24’
25’

Appendix B

New York State Department of Transportation

Traffic Count Hourly Report

ROAD #: ROAD NAME: **HIGH ST** FROM: **JAMES ST** TO: **ROSE ST** COUNTY: **Westchester**
DIRECTION: Eastbound FACTOR GROUP: 30 REC. SERIAL #: JA97 FUNC. CLASS: 19 VILLAGE:
STATE DIR CODE: 6 WK OF YR: 34 PLACEMENT: 107 Ft E of James Street NHS: no LION#:
DATE OF COUNT: 08/17/2015 @ REF MARKER: JURIS: County BIN:
NOTES LANE 1: ADDL DATA: CC Stn: RR CROSSING:
COUNT TYPE: AXLE PAIRS BATCH ID: DOT-R08V34ETDB5156 HPMS SAMPLE:
COUNT TAKEN BY: ORG CODE: TDB INITIALS: dja PROCESSED BY: ORG CODE: DOT INITIALS: KCF

DATE	DAY	12 TO 1 AM	1 TO 2 AM	2 TO 3 AM	3 TO 4 AM	4 TO 5 AM	5 TO 6 AM	6 TO 7 AM	7 TO 8 AM	8 TO 9 AM	9 TO 10 AM	10 TO 11 AM	11 TO 12 AM	12 TO 1 PM	1 TO 2 PM	2 TO 3 PM	3 TO 4 PM	4 TO 5 PM	5 TO 6 PM	6 TO 7 PM	7 TO 8 PM	8 TO 9 PM	9 TO 10 PM	10 TO 11 PM	11 TO 12 PM	DAILY TOTAL	DAILY HIGH COUNT	DAILY HIGH HOUR
1	S																											
2	S																											
3	M																											
4	T																											
5	W																											
6	T																											
7	F																											
8	S																											
9	S																											
10	M																											
11	T																											
12	W																											
13	T																											
14	F																											
15	S																											
16	S																											
17	M													**105**	**81**	**100**	**152**	**133**	**92**	**63**	**42**	**30**	**18**	**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**	1562	215	17
19	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**	1534	194	17
20	T	**9**	**2**	**3**	**1**	**6**	**11**	**38**	**87**	**103**	**88**	**82**	**89**	**93**	**76**	**100**	**113**	**137**	**200**	**89**	**59**	**48**	**33**	**30**	**18**	1515	200	17
21	F	**4**	**7**	**1**	**3**	**4**	**12**	**28**	**89**	**97**	**97**	**70**																
22	S																											
23	S																											
24	M																											
25	T																											
26	W																											
27	T																											
28	F																											
29	S																											
30	S																											
31	M																											

AVERAGE WEEKDAY HOURS (Axle Factored, Mon 6AM to Fri Noon)

12	4	1	2	5	11	34	91	104	93	76	86	88	86	96	109	147	186	96	64	43	31	24	19	ADT 1508

DAYS Counted	HOURS Counted	WEEKDAYS Counted	WEEKDAY Hours	AVERAGE WEEKDAY High Hour	AVERAGE WEEKDAY % of day	Axle Adj. Factor	Seasonal/Weekday Adjustment Factor
4	94	4	94	186	12%	1.000	1.089

ESTIMATED

AADT

1385

New York State Department of Transportation

Traffic Count Hourly Report

ROAD #: ROAD NAME: **HIGH ST** FROM: **JAMES ST** TO: **ROSE ST** COUNTY: **Westchester**
DIRECTION: Westbound FACTOR GROUP: 30 REC. SERIAL #: JA97 FUNC. CLASS: 19 VILLAGE:
STATE DIR CODE: 7 WK OF YR: 34 PLACEMENT: 107 Ft E of James Street NHS: no LION#:
DATE OF COUNT: 08/17/2015 @ REF MARKER: JURIS: County BIN:
NOTES LANE 1: ADDL DATA: CC Stn: RR CROSSING:
COUNT TYPE: AXLE PAIRS BATCH ID: DOT-R08V34ETDB5156 HPMS SAMPLE:
COUNT TAKEN BY: ORG CODE: TDB INITIALS: dja PROCESSED BY: ORG CODE: DOT INITIALS: KCF

DATE	DAY	12 TO 1 AM	1 TO 2 AM	2 TO 3 AM	3 TO 4 AM	4 TO 5 AM	5 TO 6 AM	6 TO 7 AM	7 TO 8 AM	8 TO 9 AM	9 TO 10 AM	10 TO 11 AM	11 TO 12 AM	12 TO 1 PM	1 TO 2 PM	2 TO 3 PM	3 TO 4 PM	4 TO 5 PM	5 TO 6 PM	6 TO 7 PM	7 TO 8 PM	8 TO 9 PM	9 TO 10 PM	10 TO 11 PM	11 TO 12 PM	DAILY TOTAL	DAILY HIGH COUNT	DAILY HIGH HOUR
1	S																											
2	S																											
3	M																											
4	T																											
5	W																											
6	T																											
7	F																											
8	S																											
9	S																											
10	M																											
11	T																											
12	W																											
13	T																											
14	F																											
15	S																											
16	S																											
17	M													**101**	**90**	**103**	**137**	**133**	**126**	**98**	**64**	**61**	**33**	**22**				
18	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**	1795	195	8
19	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**	1845	176	8
20	T	**13**	**7**	**3**	**1**	**1**	**17**	**37**	**155**	**180**	**143**	**92**	**93**	**112**	**81**	**87**	**111**	**130**	**181**	**106**	**83**	**87**	**65**	**45**	**31**	1861	181	17
21	F	**14**	**4**	**2**	**3**	**5**	**8**	**42**	**153**	**158**	**133**	**71**																
22	S																											
23	S																											
24	M																											
25	T																											
26	W																											
27	T																											
28	F																											
29	S																											
30	S																											
31	M																											

AVERAGE WEEKDAY HOURS (Axle Factored, Mon 6AM to Fri Noon)

																								ADT
15	**5**	**2**	**3**	**4**	**12**	**36**	**154**	**177**	**131**	**84**	**102**	**101**	**97**	**90**	**109**	**134**	**153**	**123**	**88**	**74**	**62**	**38**	**24**	**1818**

DAYS Counted	HOURS Counted	WEEKDAYS Counted	WEEKDAY Hours	AVERAGE WEEKDAY High Hour	AVERAGE WEEKDAY % of day	Axle Adj. Factor	Seasonal/Weekday Adjustment Factor
5	94	5	94	177	10%	1.000	1.089

ESTIMATED

AADT

1669

High Street from James Street to Rose Street - August 2015

	HOURS	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**

LEGEND	
#	Hourly Volumes Greater Than 300 Vehicles

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

	HOURS	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**

LEGEND	
#	Hourly Volumes Greater Than 300 Vehicles

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

	HOURS	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**

LEGEND	
#	Hourly Volumes Greater Than 300 Vehicles

Appendix C

High Street and Harvard Lane Sight Distance

High Street and Hall Place Sight Distance

Appendix D

Exhibit 2-6 Design Criteria for Non-NHS Rural Town, Suburban, Urban, and Urban Core Collectors

Lanes[1,2]	Width (ft.)	
Travel Lanes (with curb)	**Minimum**	**Desirable**
Residential and commercial areas	10	12
Routes designated as Qualifying Highways on the National Network (1982 STAA Highways)	12	-
Industrial area without severe ROW limitations;	12	-
Industrial area with severe ROW limitations	11	-
Wide curb lane that will accommodate cyclists, per HDM §2.6.2.1	13[3]	15
Travel Lanes (uncurbed)	Refer to Exhibit 2-5	
Bicycle Lane (dedicated preferential use travel lane for bicycling)	5[3]	6 -7[4]
Turning Lanes	**Minimum**	**Desirable**
Truck volume ≤ 2%	10	12
Truck volume > 2%	11	12
Two-way left-turn lanes (trucks ≤ 2%)	10	16
Two-way left-turn lanes (trucks > 2%)	11	16
Parking Lanes	**Minimum**	**Desirable**
Residential area	7	8
Commercial / industrial areas	8	11

Shoulders [1,2]	Width (ft.)	
Curbed	**Minimum**	**Desirable**
Left shoulder for divided urban collectors	0	1 to 2
Right shoulder that will not accommodate cyclists, per HDM §2.6.2.1, and no provision for breakdowns or turning movements	0	4
Right shoulder that will accommodate cyclists, per HDM §2.6.2.1	5[3]	6[5]
Right shoulder, provision for breakdowns and turning movements	6	10
Uncurbed	Refer to Exhibit 2-5	

Design Speed (mph)	Maximum Percent Grade[6]			Minimum Stopping Sight Distance (ft)	Minimum Radius Curve (ft) e_{max} = 4%	Minimum Radius Curve (ft) e_{max} = 6%
	Level	Rolling	Mountainous			
25	9	12	13	133	113	120
30	9	11	12	175	176	177
35	9	10	12	220	252	248
40	9	10	12	271	356	334
45	8	9	11	327	466	436
50	7	8	10	387	595	557

Notes:

1. For bridges, refer to the NYSDOT Bridge Manual, Section 2. Where the Bridge Manual only furnishes roadway width, subtract the lane width on this table from the roadway width to determine the shoulder width.
2. Refer to HDM §2.6.2.1 for information on determining lane and shoulder widths for bicycling in urban areas. Note that bicyclists have the same rights and responsibilities as motorists, except as provided in Sections 1230-1236 of the New York State Vehicle and Traffic Law.
3. If high bicycling demand is anticipated or a bicycle route is present, and neither a 5 ft. min. shoulder/bicycle lane nor a 13 ft. min. shared lane can be provided, a justification is required for the nonstandard lane width. Refer to HDM §2.6.2.1 for more information.
4. Widths greater than 5 ft. (up to 7 ft.) are desirable for bicycle lanes adjacent to parking lanes.
5. It is desirable to provide 6 ft. where truck traffic is high and anticipated bicycle demand for the shoulder is high.
6. Maximum grades of short length (< 490 ft.) and on one-way downgrades may be 2% steeper.