TECHNICAL MEMORANDUM

Project: Hinesburg Center II
Date: April 25, 2022, rev. December 20, 2022
From: Roger Dickinson, PE, PTOE
Subject: Updated Traffic Impact Assessment

Introduction

The following presents the results of our assessment of potential traffic congestion impacts associated with the proposed Hinesburg Center II (HC II) mixed-use development in Hinesburg. This development is the last phase of the Creekside and Hinesburg Center I developments located on Farmall Drive. HC II is located on the west side of Kailey's Way and north of Farmall Dr.

The primary access to HC II will be via Farmall Dr to and from VT Route 116 at the existing signalized intersection of Route 116 with Farmall Dr and Commerce St. Secondary access will also be provided via a new roadway crossing of Patrick Brook which will link the Hinesburg Center and Haystack Crossing developments, and create a new street network paralleling Route 116 north to Shelburne Falls Rd.

The HCII proposed land-uses have also been revised from the original to reflect the final project layout of 2,800 sf of light industrial space and 12,000 sf of office/commercial space.

Background Traffic Volumes

Background traffic volumes at the Route 116/Farmall Dr/Commerce St intersection were obtained from a turning movement count performed by the Vermont Agency of Transportation (VTrans) on May 9, 2014.[1] VTrans also performs automatic traffic recorder (ATR) counts, which typically are week-long counts in which hourly traffic volumes are recorded. In this immediate area, the closest and most recent ATR count on Route 116 was performed in September 2016 north of Farmall Dr, between it and Shelburne Falls Rd (D464). From that count, and factoring annual growth, VTrans estimates that the 2021 annual average daily traffic volume (AADT) on Route 116 north of Farmall Dr and Commerce St was 9,412 vpd.

VTrans projects that background traffic will increase by 3.0% from 2022 to 2028.[2] This would increase the Route 116 AADT to 9,694 vpd. The estimated design hour volume (DHV - the 30th highest hour of traffic volumes in a year) for AADT's between 9,100 - 9,900 vpd equals 1,100 vph.[1] In comparison, the highest hourly volume observed during the 2016 ATR count at D464 was 1,124 vph.

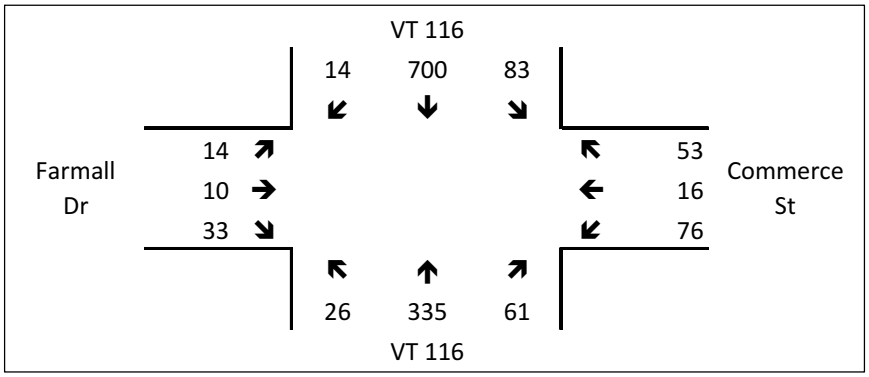
The May 2014 turning movement count at the Farmall Dr/Commerce St intersection observed a pm peak hour volume 1,165 vph on Route 116 north of the intersection. This exceeded both the estimated 2028 DHV and the observed peak hour volume in the 2016 ATR count at D464. For the purposes of this

[1] There is a more recent weekday afternoon turning movement count which was performed by VTrans on July 3, 2017. That count observed lower peak hour volumes due to the holiday.

[2] *Continuous Traffic Counter Report Based on 2020 Traffic Data*, Vermont Agency of Transportation, May 2021

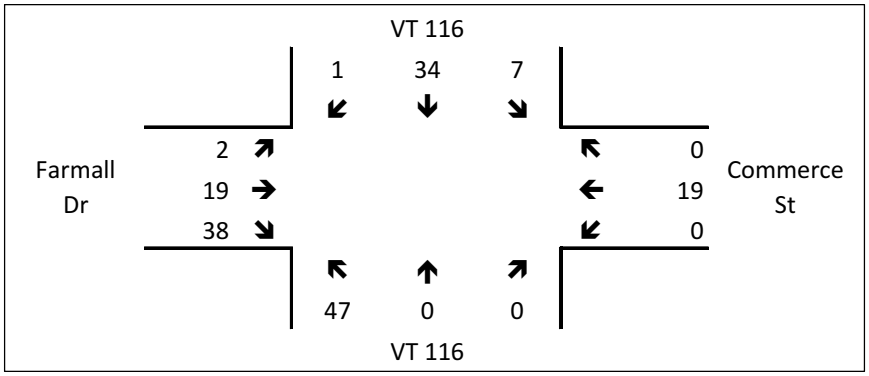
traffic assessment, the pm peak hour volumes observed in that turning movement count were increased by 3.5% in order to adjust for projected background growth to 2028. movement count. The resulting estimated 2028 Background design hour turning movements are shown in Figure 1.

Figure 1 - 2028 Background Design Hour Turning Movements (PM Peak Hour)



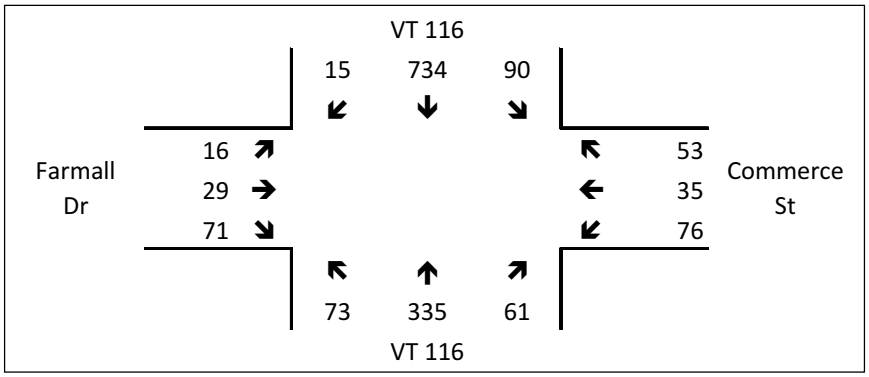
The pm peak hour trips which would have been generated by Hinesburg Center I's unconstructed final building in at the time of the 2014 turning movement count plus Haystack Crossing's estimated future pm peak hour trips are shown in Figure 2. Haystack Crossing's trips shown in Figure 2 include the estimated changes in future traffic patterns created by HCII's Patrick Brook roadway crossing.

Figure 2 – HCI & Haystack Crossing PM Peak Hour Trips



Adding the volumes shown in Figures 1 and 2 then provide the No-Build pm peak hour volumes shown in Figure 3.

Figure 3 – 2028 No-Build Design Hour Turning Movements (PM Peak Hour)



Project-Generated Trips

Anticipated peak hour trips for this Project were calculated using trip generation rates published by the Institute of Transportation Engineers (ITE).[3] Table 1 summarizes the resulting peak hour trip generation estimate.

Table 1 - Weekday Peak Hour Project-Generated Vehicle Trips (vte/hr)

Land-Use	Size	AM Peak Hour			PM Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
#110 - General Light Industrial	2,800 sf	2	0	2	0	3	3
#210 - Single-Family Detached Housing	15 units	3	10	13	11	6	17
#215 - Single-Family Attached Housing	24 units	4	8	12	8	6	14
#220 - Multi-Family Housing (Low-Rise)	34 units	3	11	14	11	6	17
#492 - Health/Fitness Club	2,000 sf	2	1	3	10	8	18
#710 - General Office Building	5,000 sf	11	2	13	2	12	14
#720 - Medical-Dental Office	5,000 sf	13	3	16	6	14	20
Total Trips		**38**	**35**	**73**	**48**	**55**	**103**

The estimated directional patterns of the above pm peak hour trips were estimated using existing traffic patterns at the Route 116/Farmall Dr/Commerce St intersection in combination with U.S. Census journey to work data for Hinesburg. For the purpose of this traffic impact assessment, all project-generated traffic is assumed to enter and exit via Farmall Dr to and from Route 116.

With the proposed Patrick Brook roadway crossing linking this Project with the adjoining Haystack Crossing development to the north, some Project generated traffic will travel to and from Shelburne Falls Rd and Route 116 through that development. Likewise, some Haystack Crossing generated traffic will travel through this Project to and from Route 116. Overall, the Patrick Brook roadway crossing linking the two developments will provide shorter and more efficient traffic routes available to

[3] *Trip Generation*, Institute of Transportation Engineers, 11th Edition

Hinesburg Center and Haystack Crossing traffic, improved emergency vehicle access, and reduced additional traffic volumes on Route 116 between the Shelburne Falls Rd and Farmall Dr intersections.

Figure 4 presents the Project's estimated pm peak hour trip distribution. Following that, Figure 5 presents the 2028 Build design hour turning movements (again including the estimated changed traffic patterns created by the new Patrick Brook roadway crossing).

Figure 4 – HCII Project-Generated PM Peak Hour Trips

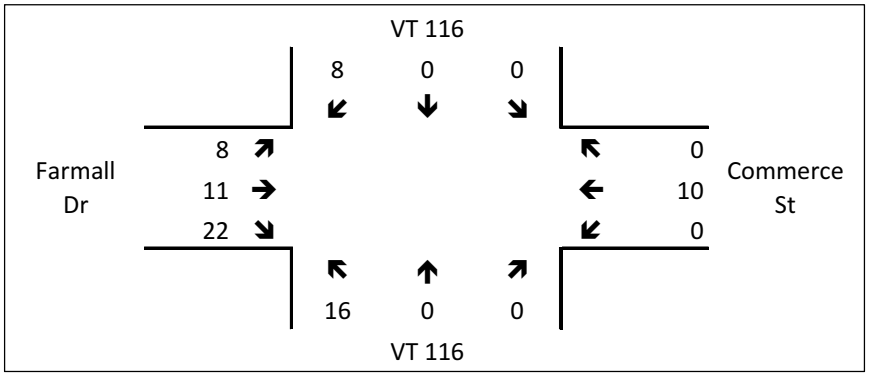
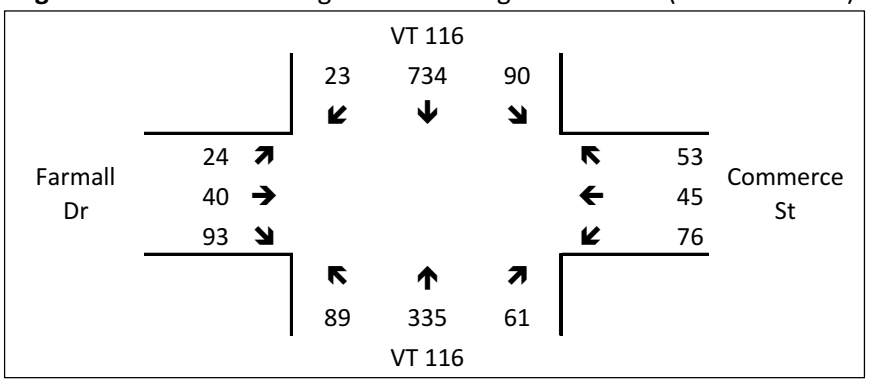


Figure 5 - 2028 Build Design Hour Turning Movements (PM Peak Hour)



Traffic Congestion

Levels of service (LOS) at intersections are determined by the average control delay; measured in seconds per vehicle. The methodology for analyzing LOS is established by the *Highway Capacity Manual* (*HCM*).[4] Table 2 summarizes the LOS delay thresholds for signalized intersections.

Table 2 - Signalized Intersection
Level of Service Delay Thresholds

LOS	Avg. Delay*	LOS	Avg. Delay*
A	≤10	D	≤55
B	≤20	E	≤80
C	≤35	F	>80

* seconds per vehicle

Table 3 presents the results of intersection capacity analyses at the Route 116/Farmall Dr/Commerce St intersection. The potential impacts of this Project can be assessed by comparing the results of the No-Build and the Build analysis scenarios. All analyses were performed using Synchro v10. The results are presented in Table 3. Detailed analysis worksheets are included in Appendix A.

Table 3 - Route 116/Farmall Dr/Commerce St
Intersection Levels of Service

Approach	2028 PM No-Build			2028 PM Build		
	LOS	Delay	V/C	LOS	Delay	V/C
Farmall Dr EB All	C	21.2	0.33	C	22.7	0.44
Commerce St WB All	C	22.1	0.45	C	22.9	0.48
VT Route 116 NB LT	C	23.3	0.25	C	23.9	0.30
VT Route 116 NB TH	B	19.4	0.66	C	20.2	0.67
VT Route 116 NB RT	B	15.4	0.14	B	16.0	0.14
VT Route 116 SB LT	B	11.8	0.12	B	11.9	0.12
VT Route 116 SB TH/RT	B	12.6	0.79	B	13.1	0.80
Overall	**B**	16.2		**B**	17.1	

Traffic Safety

The 2016-2020 five-year crash history of the Route 116/Farmall Dr/Commerce St was examined using VTrans' Public Crash Data Query Tool. This intersection is located at milemarker 4.96 on Route 116. The five-year crash history within ±0.04 miles (211') of the intersection shows 8 crashes. Of those, 5 occurred within ±0.01 mile (50') of the intersection, which is considered to be the operational area of the intersection. The majority of the crashes were rear-end or same-direction collisions. All but one of the 8 crashes were property damage only crashes.

The small amount of additional traffic generated by this Project can be reasonably expected have little, if any, effect on future traffic safety conditions at the Route 116/Farmall Dr/Commerce St intersection or on nearby highways.

[4] *Highway Capacity Manual*, Transportation Research Board, 6th Edition

Conclusions

Based on the results of the foregoing analyses, we conclude that this Project will not create undue levels of traffic congestion or unsafe conditions on the adjacent roadway network.

APPENDIX A

INTERSECTION CAPACITY ANALYSES

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	29	71	76	35	53	73	335	61	90	734	15
Future Volume (veh/h)	16	29	71	76	35	53	73	335	61	90	734	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
Adj Flow Rate, veh/h	16	29	71	76	35	53	73	335	61	90	734	15
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	98	83	171	205	70	86	296	506	429	757	924	19
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.10	0.28	0.28	0.34	0.52	0.52
Sat Flow, veh/h	148	487	1002	648	410	505	1739	1826	1547	1739	1783	36
Grp Volume(v), veh/h	116	0	0	164	0	0	73	335	61	90	0	749
Grp Sat Flow(s),veh/h/ln	1636	0	0	1563	0	0	1739	1826	1547	1739	0	1819
Q Serve(g_s), s	0.0	0.0	0.0	1.6	0.0	0.0	0.0	9.1	1.7	0.0	0.0	18.9
Cycle Q Clear(g_c), s	3.5	0.0	0.0	5.1	0.0	0.0	0.0	9.1	1.7	0.0	0.0	18.9
Prop In Lane	0.14		0.61	0.46		0.32	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	353	0	0	362	0	0	296	506	429	757	0	943
V/C Ratio(X)	0.33	0.00	0.00	0.45	0.00	0.00	0.25	0.66	0.14	0.12	0.00	0.79
Avail Cap(c_a), veh/h	644	0	0	631	0	0	346	1664	1410	757	0	1658
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.7	0.0	0.0	21.2	0.0	0.0	22.9	17.9	15.2	11.7	0.0	11.0
Incr Delay (d2), s/veh	0.5	0.0	0.0	0.9	0.0	0.0	0.4	1.5	0.2	0.1	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	0.0	1.9	0.0	0.0	0.9	3.6	0.5	0.7	0.0	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.2	0.0	0.0	22.1	0.0	0.0	23.3	19.4	15.4	11.8	0.0	12.6
LnGrp LOS	C	A	A	C	A	A	C	B	B	B	A	B
Approach Vol, veh/h		116			164			469			839	
Approach Delay, s/veh		21.2			22.1			19.5			12.5	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	22.9	19.5		13.6	9.4	33.0		13.6				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	5.0	49.0		18.0	5.0	49.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	11.1		5.5	2.0	20.9		7.1				
Green Ext Time (p_c), s	0.0	2.4		0.4	0.0	6.1		0.6				

Intersection Summary	
HCM 6th Ctrl Delay	16.2
HCM 6th LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	40	93	76	45	53	89	335	61	90	734	23
Future Volume (veh/h)	24	40	93	76	45	53	89	335	61	90	734	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826	1826
Adj Flow Rate, veh/h	24	40	93	76	45	53	89	335	61	90	734	23
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	5	5	5	5	5	5	5	5	5	5	5	5
Cap, veh/h	102	85	168	197	84	84	299	501	424	766	915	29
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.10	0.27	0.27	0.35	0.52	0.52
Sat Flow, veh/h	176	494	974	623	490	487	1739	1826	1547	1739	1761	55
Grp Volume(v), veh/h	157	0	0	174	0	0	89	335	61	90	0	757
Grp Sat Flow(s),veh/h/ln	1644	0	0	1600	0	0	1739	1826	1547	1739	0	1816
Q Serve(g_s), s	0.0	0.0	0.0	0.5	0.0	0.0	0.0	9.4	1.7	0.0	0.0	19.8
Cycle Q Clear(g_c), s	4.8	0.0	0.0	5.3	0.0	0.0	0.0	9.4	1.7	0.0	0.0	19.8
Prop In Lane	0.15		0.59	0.44		0.30	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	355	0	0	365	0	0	299	501	424	766	0	944
V/C Ratio(X)	0.44	0.00	0.00	0.48	0.00	0.00	0.30	0.67	0.14	0.12	0.00	0.80
Avail Cap(c_a), veh/h	626	0	0	616	0	0	335	1613	1367	766	0	1604
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.8	0.0	0.0	22.0	0.0	0.0	23.4	18.6	15.8	11.8	0.0	11.4
Incr Delay (d2), s/veh	0.9	0.0	0.0	1.0	0.0	0.0	0.5	1.6	0.2	0.1	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	0.0	2.1	0.0	0.0	1.1	3.8	0.6	0.7	0.0	6.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.7	0.0	0.0	22.9	0.0	0.0	23.9	20.2	16.0	11.9	0.0	13.1
LnGrp LOS	C	A	A	C	A	A	C	C	B	B	A	B
Approach Vol, veh/h		157			174			485			847	
Approach Delay, s/veh		22.7			22.9			20.3			13.0	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	24.0	19.8		13.9	9.8	34.0		13.9				
Change Period (Y+Rc), s	6.0	6.0		6.0	6.0	6.0		6.0				
Max Green Setting (Gmax), s	5.0	49.0		18.0	5.0	49.0		18.0				
Max Q Clear Time (g_c+I1), s	2.0	11.4		6.8	2.0	21.8		7.3				
Green Ext Time (p_c), s	0.0	2.4		0.6	0.0	6.2		0.7				

Intersection Summary	
HCM 6th Ctrl Delay	17.1
HCM 6th LOS	B