

TECHNICAL MEMORANDUM

Project: Hinesburg Center II
Date: April 25, 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. Access to it 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.

Background Traffic Volumes

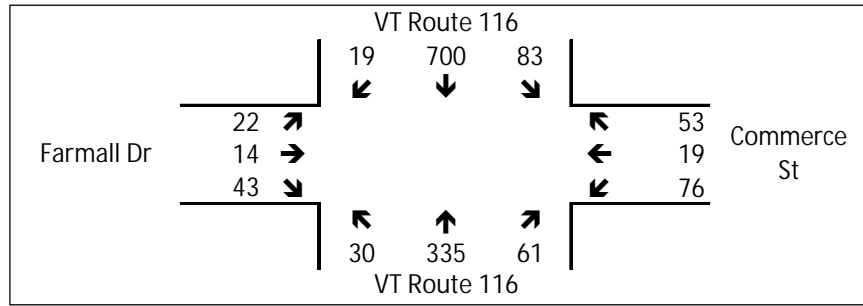
Background traffic volumes at the Route 116/Farmall Dr/Commerce St intersection were obtained from a turning movement count performed by the Vermont Agency of Transportation (VTrans) on May 9, 2014. VTrans also performs automatic traffic recorder (ATR) counts, which typically are week-long counts in 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 2028.¹ 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 traffic assessment, the pm peak hour volumes observed in that turning movement count were increased by 3.0% in order to adjust for projected background growth to 2028. Peak hour trips were also added to adjust for the yet unconstructed final building in Hinesburg Center I at the time of the 2014 turning movement count. The resulting estimated 2028 No-Build design hour turning movements are shown in Figure 1.

¹ *Continuous Traffic Counter Report Based on 2020 Traffic Data*, Vermont Agency of Transportation, May 2021

Figure 1 - 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).² 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	4,000 sf	10	1	11	2	9	11
#720 - Medical-Dental Office	4,000 sf	10	3	13	5	11	16
Total Trips		34	34	68	47	49	96

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. Figure 2 presents the Project's estimated pm peak hour trip distribution. Following that, Figure 3 presents the 2028 Build design hour turning movements.

² Trip Generation, Institute of Transportation Engineers, 11th Edition

Figure 2 - Directional Distribution of Project-Generated PM Peak Hour Trips

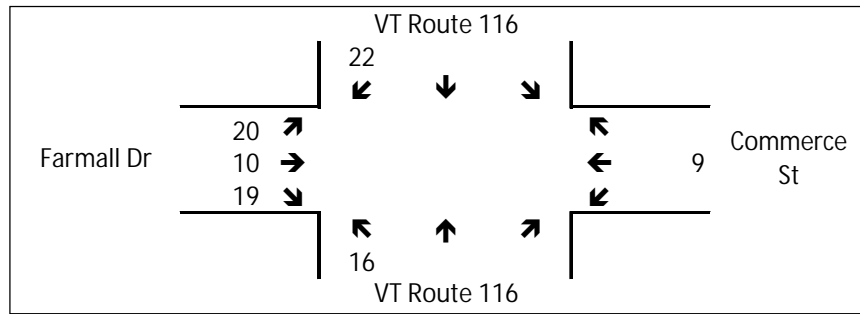
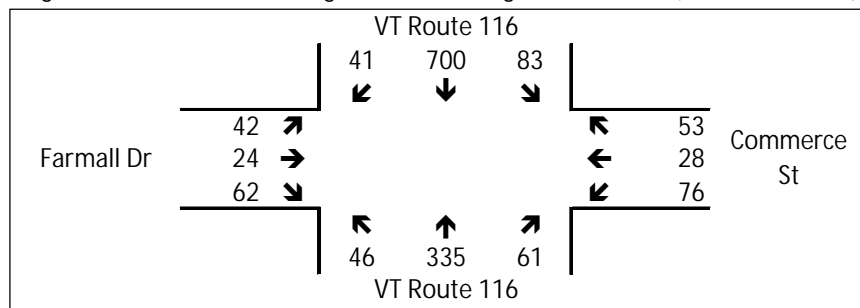


Figure 3 - 2028 Build Design Hour Turning Movements (PM Peak Hour)



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)*.³ 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.

³ *Highway Capacity Manual*, Transportation Research Board, 6th Edition

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	B	18.3	0.22	C	20.5	0.35
Commerce St WB All	B	19.6	0.40	C	21.0	0.43
VT Route 116 NB LT	C	21.6	0.11	C	22.6	0.16
VT Route 116 NB TH	B	16.8	0.64	B	18.2	0.65
VT Route 116 NB RT	B	13.3	0.14	B	14.5	0.14
VT Route 116 SB LT	B	11.6	0.12	B	11.6	0.11
VT Route 116 SB TH/RT	B	11.1	0.77	B	11.8	0.79
Overall	B	14.0		B	15.3	

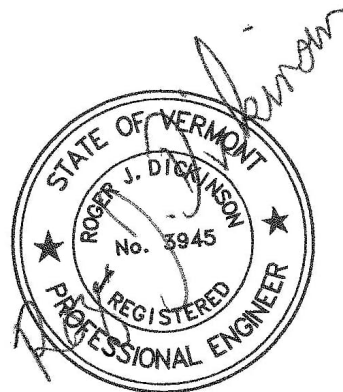
Traffic Safety

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.

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

HCM 6th Signalized Intersection Summary
 3: VT 116 & Farmall Dr/Commerce St

2028 No-Build
 Hinesburg Center II

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	14	43	76	19	53	30	335	61	83	700	19
Future Volume (veh/h)	22	14	43	76	19	53	30	335	61	83	700	19
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	22	14	43	76	19	53	30	335	61	83	700	19
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	147	70	150	230	45	93	273	527	446	714	912	25
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.07	0.29	0.29	0.30	0.52	0.52
Sat Flow, veh/h	323	413	879	711	265	545	1739	1826	1547	1739	1769	48
Grp Volume(v), veh/h	79	0	0	148	0	0	30	335	61	83	0	719
Grp Sat Flow(s),veh/h/ln	1615	0	0	1521	0	0	1739	1826	1547	1739	0	1817
Q Serve(g_s), s	0.0	0.0	0.0	2.2	0.0	0.0	0.0	8.0	1.5	0.0	0.0	15.8
Cycle Q Clear(g_c), s	2.1	0.0	0.0	4.2	0.0	0.0	0.0	8.0	1.5	0.0	0.0	15.8
Prop In Lane	0.28		0.54	0.51		0.36	1.00		1.00	1.00		0.03
Lane Grp Cap(c), veh/h	367	0	0	368	0	0	273	527	446	714	0	937
V/C Ratio(X)	0.22	0.00	0.00	0.40	0.00	0.00	0.11	0.64	0.14	0.12	0.00	0.77
Avail Cap(c_a), veh/h	714	0	0	700	0	0	388	1864	1580	714	0	1855
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	18.1	0.0	0.0	18.9	0.0	0.0	21.4	15.5	13.2	11.5	0.0	9.7
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.7	0.0	0.0	0.2	1.3	0.1	0.1	0.0	1.4
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	0.7	0.0	0.0	1.5	0.0	0.0	0.3	3.1	0.5	0.6	0.0	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	18.3	0.0	0.0	19.6	0.0	0.0	21.6	16.8	13.3	11.6	0.0	11.1
LnGrp LOS	B	A	A	B	A	A	C	B	B	B	A	B
Approach Vol, veh/h		79			148			426			802	
Approach Delay, s/veh		18.3			19.6			16.6			11.1	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	19.0	18.4		12.5	7.7	29.7		12.5				
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+1), s	2.0	10.0		4.1	2.0	17.8		6.2				
Green Ext Time (p_c), s	0.0	2.4		0.3	0.0	5.9		0.6				
Intersection Summary												
HCM 6th Ctrl Delay			14.0									
HCM 6th LOS			B									

Timings
3: VT 116 & Farmall Dr/Commerce St

2028 No-Build
Hinesburg Center II

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	22	14	76	19	30	335	61	83	700
Future Volume (vph)	22	14	76	19	30	335	61	83	700
Lane Group Flow (vph)	0	79	0	148	30	335	61	83	719
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA
Protected Phases		4		8	5	2		1	6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	5	2	2	1	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	11.0	24.0	24.0	11.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	11.0	55.0	55.0	11.0	55.0
Total Split (%)	26.7%	26.7%	26.7%	26.7%	12.2%	61.1%	61.1%	12.2%	61.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0		-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Min	Min	None	Min
v/c Ratio		0.22		0.44	0.08	0.40	0.08	0.11	0.68
Control Delay		16.0		25.0	7.3	17.9	1.1	4.9	14.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		16.0		25.0	7.3	17.9	1.1	4.9	14.5
Queue Length 50th (ft)		9		33	2	82	0	9	126
Queue Length 95th (ft)		62		134	14	257	12	30	512
Internal Link Dist (ft)		625		867		869			686
Turn Bay Length (ft)					90		90	100	
Base Capacity (vph)		565		525	362	1496	1290	772	1490
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.14		0.28	0.08	0.22	0.05	0.11	0.48

Intersection Summary





















Cycle Length: 90
 Actuated Cycle Length: 62.3
 Natural Cycle: 70
 Control Type: Actuated-Uncoordinated

Splits and Phases: 3: VT 116 & Farmall Dr/Commerce St

55 s		11 s	24 s
55 s		11 s	24 s

HCM 6th Signalized Intersection Summary
 3: VT 116 & Farmall Dr/Commerce St

2028 Build
 Hinesburg Center II

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	24	62	76	28	53	46	335	61	83	700	41
Future Volume (veh/h)	42	24	62	76	28	53	46	335	61	83	700	41
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	42	24	62	76	28	53	46	335	61	83	700	41
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	162	69	133	217	60	90	281	515	436	742	891	52
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.08	0.28	0.28	0.32	0.52	0.52
Sat Flow, veh/h	428	408	785	688	352	530	1739	1826	1547	1739	1708	100
Grp Volume(v), veh/h	128	0	0	157	0	0	46	335	61	83	0	741
Grp Sat Flow(s),veh/h/ln	1622	0	0	1569	0	0	1739	1826	1547	1739	0	1808
Q Serve(g_s), s	0.0	0.0	0.0	1.0	0.0	0.0	0.0	8.6	1.6	0.0	0.0	17.7
Cycle Q Clear(g_c), s	3.5	0.0	0.0	4.5	0.0	0.0	0.0	8.6	1.6	0.0	0.0	17.7
Prop In Lane	0.33		0.48	0.48		0.34	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	364	0	0	366	0	0	281	515	436	742	0	943
V/C Ratio(X)	0.35	0.00	0.00	0.43	0.00	0.00	0.16	0.65	0.14	0.11	0.00	0.79
Avail Cap(c_a), veh/h	671	0	0	663	0	0	363	1747	1480	742	0	1730
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	19.9	0.0	0.0	20.2	0.0	0.0	22.4	16.8	14.3	11.5	0.0	10.3
Incr Delay (d2), s/veh	0.6	0.0	0.0	0.8	0.0	0.0	0.3	1.4	0.1	0.1	0.0	1.5
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	1.4	0.0	0.0	1.7	0.0	0.0	0.5	3.4	0.5	0.6	0.0	5.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.5	0.0	0.0	21.0	0.0	0.0	22.6	18.2	14.5	11.6	0.0	11.8
LnGrp LOS	C	A	A	C	A	A	C	B	B	B	A	B
Approach Vol, veh/h		128			157			442			824	
Approach Delay, s/veh		20.5			21.0			18.2			11.8	
Approach LOS		C			C			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	21.3	19.0		13.0	8.5	31.8		13.0				
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	10.6		5.5	2.0	19.7		6.5				
Green Ext Time (p_c), s	0.0	2.4		0.5	0.0	6.1		0.6				
Intersection Summary												
HCM 6th Ctrl Delay			15.3									
HCM 6th LOS			B									

Timings
3: VT 116 & Farmall Dr/Commerce St

2028 Build
Hinesburg Center II

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	42	24	76	28	46	335	61	83	700
Future Volume (vph)	42	24	76	28	46	335	61	83	700
Lane Group Flow (vph)	0	128	0	157	46	335	61	83	741
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA
Protected Phases		4		8	5	2		1	6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	5	2	2	1	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	24.0	24.0	24.0	24.0	11.0	24.0	24.0	11.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	11.0	55.0	55.0	11.0	55.0
Total Split (%)	26.7%	26.7%	26.7%	26.7%	12.2%	61.1%	61.1%	12.2%	61.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		-2.0		-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	Min	Min	None	Min
v/c Ratio		0.36		0.50	0.14	0.42	0.08	0.10	0.73
Control Delay		21.2		28.8	9.2	20.3	1.1	4.9	17.4
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		21.2		28.8	9.2	20.3	1.1	4.9	17.4
Queue Length 50th (ft)		29		50	5	122	0	10	239
Queue Length 95th (ft)		103		146	19	257	12	30	#551
Internal Link Dist (ft)		625		867		869			686
Turn Bay Length (ft)					90		90	100	
Base Capacity (vph)		523		473	320	1413	1224	791	1402
Starvation Cap Reductn		0		0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0
Reduced v/c Ratio		0.24		0.33	0.14	0.24	0.05	0.10	0.53

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 66.1

Natural Cycle: 70

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: VT 116 & Farmall Dr/Commerce St

	Ø2		Ø1		Ø4
55 s		11 s		24 s	
	Ø6		Ø5		Ø8
55 s		11 s		24 s	