VT 116 and Charlotte Road Intersection Improvements

Hinesburg, VT

PREPARED FOR

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AUGUST 2019

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Introduction and Existing Conditions

The intersection of VT 116 and Charlotte Road in Hinesburg, VT is an intersection of interest to the Town of Hinesburg, Chittenden County, and the State due to it being widely recognized as the primary cause of traffic congestion and queuing along VT 116 through Hinesburg village. This area has been previously analyzed as part of a proposed Hannaford supermarket development. An operational efficiency improvement identified as part of this proposed development was to change the minor approach operations of Charlotte Rd and the Lantman's Market driveway from split phasing to concurrent phasing. For this adjustment to be possible, the sidewalk on the eastern side of VT 116 needs to be realigned to increase the visibility, and therefore, safety of the intersection for vehicles and pedestrians. This is an improvement that Hannaford is planned to implement prior to opening for business. Due to the current uncertainty of the Hannaford development, the Town is interested in pursuing this improvement on their own. This report examines realigning the sidewalk, operational effects of changing the signal phasing, and other minor improvements that could be implemented in tandem to improve safety for all roadway users.

1.1 Project Location

The project intersection is located in Hinesburg, VT along VT 116 at Charlotte Road and the driveway for Lantman’s Market.

A graphic showing the location of the project intersection is shown in **Figure 1.**

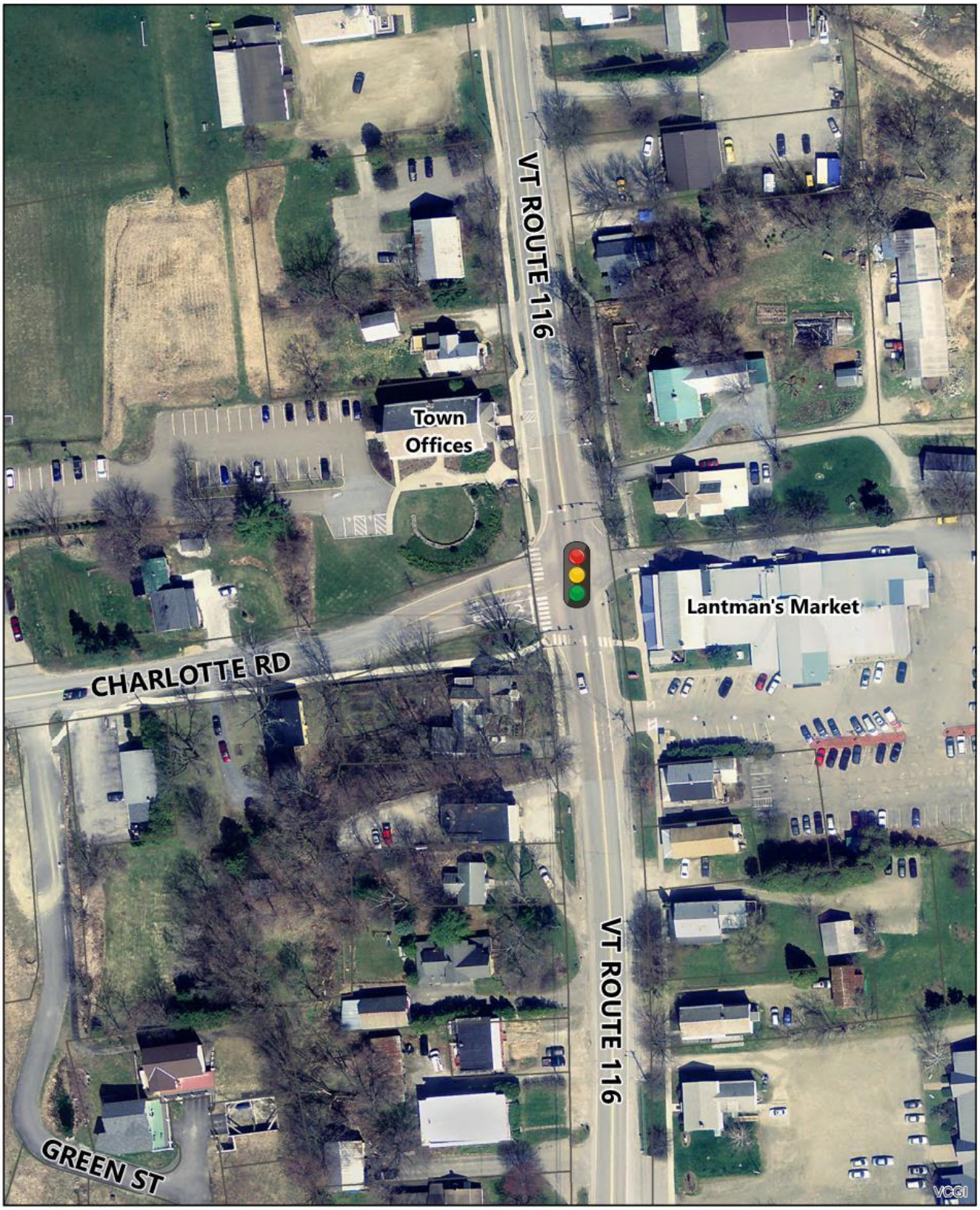


Figure 1: Project Area Map
Hinesburg, VT

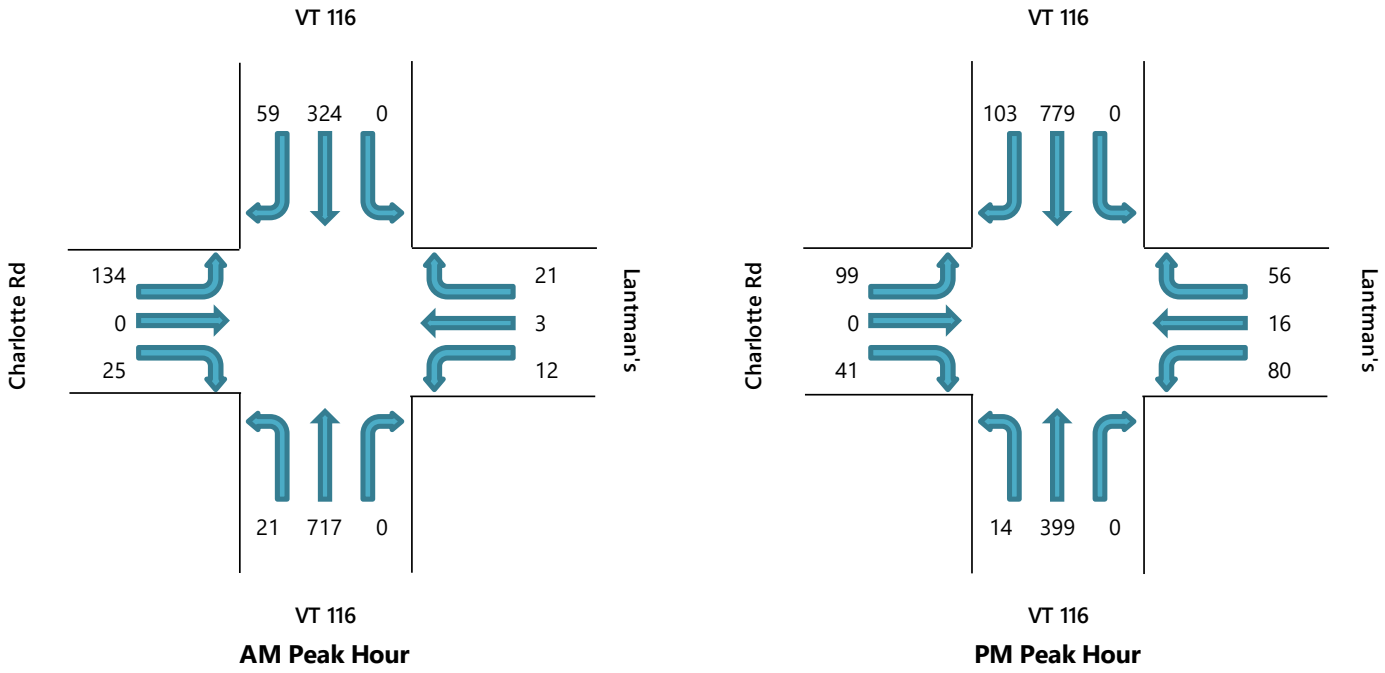
1.2 Existing Conditions

1.2.1 Traffic Network

In the vicinity of the project intersection, VT 116 and Charlotte Road are two-way with one lane in each direction of travel with a speed limit of 30 miles per hour (mph). A left turn lane on Charlotte Road is present at the intersection. Lantman's Driveway provides one-way westbound access exiting the property. The entrance to the market parking lot from the roadway is located directly south of the project intersection.

Traffic volumes were acquired from a 2017 VTrans count which was grown to the current year of 2019 using VTrans Red Book annual growth rates. The projected 2019 traffic volumes are shown in **Figure 2**.

Figure 2: 2019 AM and PM Weekday Peak Hour Traffic Volumes



1.2.1 Safety Assessment

As part of the existing conditions evaluations, a review of crash data and potential safety concerns has been conducted. The intersection is located within a 0.3-mile High Crash Location (HCL) segment, as identified by VTrans for the 5 years from 2012 – 2016. The crash data for this segment provided in the HCL Report, is shown in **Table 1**.

Table 1: High Crash Location Segment Summary (2012-2016)

Route	Mileage	Crashes	Fatalities	Injuries	PDO Crashes	Critical Rate	Actual Rate	Ratio Actual / Critical
VT-116	4.378 - 4.678	20	0	3	18	2.384	3.724	1.562

In addition to crash data, the existing geometry of the intersection was studied to identify potential safety concerns. One element identified is the location of the crosswalk and stop bar on the Lantman's Driveway approach. The sidewalk and crossing are immediately adjacent to the building, creating a barrier for pedestrians being seen by vehicles waiting at the stop bar. Another potential issue is the lack of signage on this same approach. "Do Not Enter" and "One Way" signs are not present at the driveway. Left and right turn restriction signs are present, but additional signage will increase driver awareness of permitted and restricted movements.

1.2.2 Traffic Operations

Existing signal timing for the intersection was obtained from VTrans to evaluate existing operations of the intersection. The intersection currently operates with the major approaches (VT 116) running concurrently, the minor phases (Charlotte Road and Lantman's) running as split phases, and an exclusive pedestrian phase to cross VT 116 and Charlotte Road. A primary aspect of this project is to evaluate potential concurrent phasing on the minor approaches. The existing signal timing and phasing plan is shown in **Figure 3**.

Discussions with the Town confirmed the need for an exclusive pedestrian phase to increase the visibility of pedestrians and ensure safe crossings on the two longest crosswalks. The pedestrian signal across Lantman's Driveway is much shorter than the other two crosswalks and runs concurrently with VT 116. This is deemed acceptable as Lantman's Driveway allows only one-way westbound traffic, therefore there are minimal conflicting vehicle movements.

Intersection operations in the current year, 2019, and future year, 2024, were evaluated using this existing signal timing. The results of this analysis are provided in **Table 2**.

Figure 3: Existing AM (Upper) and PM (Lower) Peak Hour Timing and Phasing Plan

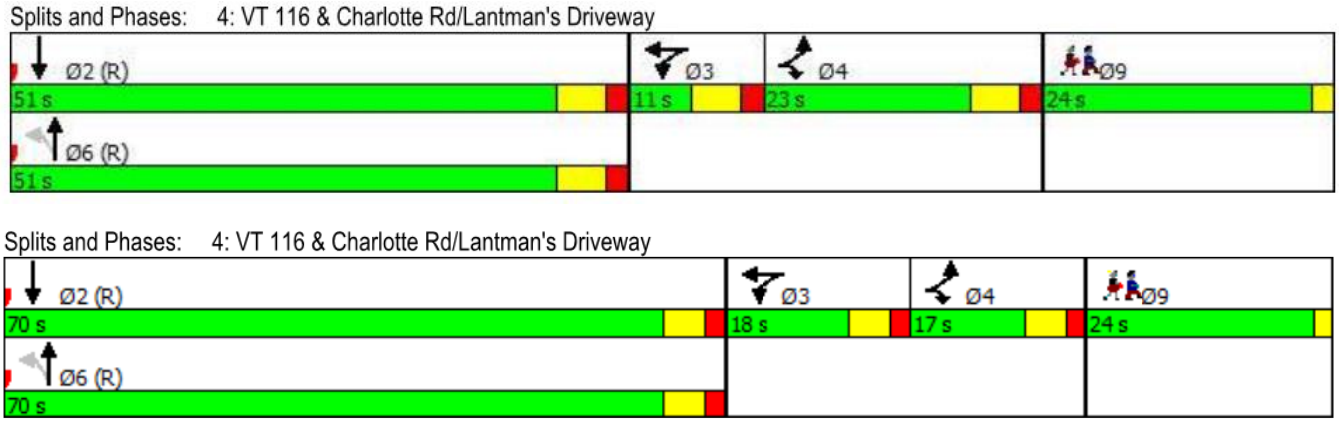


Table 2: No Build Intersection Capacity Analysis

		2019 No Build				2024 No Build			
Peak Hour	Approach	v/c*	Delay**	LOS***	Queue⁺	v/c	Delay	LOS	Queue
Weekday AM	Charlotte Road (EB)	0.67	51.4	D	149	0.68	51.6	D	153
	Lantman's Driveway (WB)	0.31	53.4	D	42	0.31	53.4	D	42
	VT 116 (NB)	0.64	15.1	B	762	0.66	15.5	B	783
	VT 116 (SB)	0.36	10.3	B	305	0.36	10.4	D	314
	Overall	**0.60**	**18.9**	**B**	**-**	**0.61**	**19.2**	**B**	**-**
Weekday PM	Charlotte Road (EB)	0.73	68.7	E	160	0.74	69.5	E	167
	Lantman's Driveway (WB)	0.83	85.9	F	215	0.83	85.8	F	219
	VT 116 (NB)	0.36	11.4	B	310	0.37	11.7	B	321
	VT 116 (SB)	0.75	20.2	C	998	0.78	21.4	C	1047
	Overall	**0.73**	**28.1**	**C**	**-**	**0.75**	**28.8**	**C**	-

** v/c - Volume to capacity ratio, per Synchro*
*** Average delay expressed in seconds per vehicle*
**** LOS - Level of service, per Synchro*
⁺ 95th Percentile, shown in feet, per Synchro

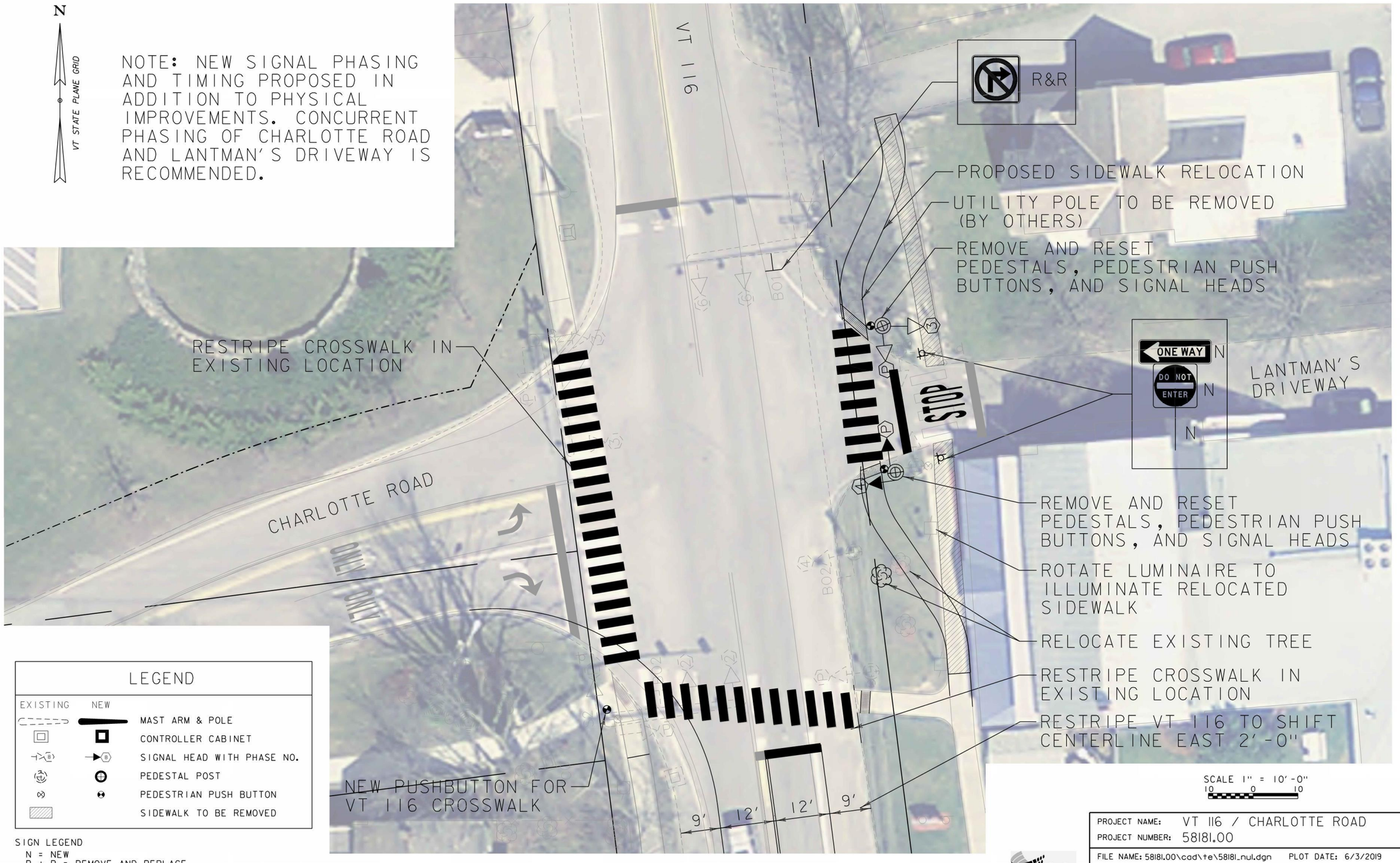
2

Proposed Improvements

2.1 Proposed Sidewalk Relocation

It is being proposed that the sidewalk currently located west of Lantman's Market be relocated closer to the curb between the VT 116 crosswalk and the driveway immediately north of the Lantman's intersection approach. This involves the removal of the existing sidewalk, construction of new sidewalk, relocation of two signal pedestals, relocation of a small tree, and new roadway striping of the crosswalk and stop bar. A graphic of this proposed design is provided in the following figure, **Figure 4**.

Also included in these proposed improvements is upgraded signage and shifted striping on the northbound VT 116 approach. This striping change involves the shift of the centerline to the east by two-feet. By doing this, additional space is provided on the southbound shoulder for vehicles to get around those waiting to turn left into the Lantman's main entrance, located south of the intersection. Southbound congestion is currently worsened by people making this turn and it is anticipated that this change will help to alleviate this additional queuing and delay.



PROJECT NAME:	VT 116 / CHARLOTTE ROAD
PROJECT NUMBER:	58181.00

FILE NAME: 58181.00\cad\te\58181_nul.dgn	PLOT DATE: 6/3/2019
PROJECT LEADER: EPD	DRAWN BY: ELQ
DESIGNED BY: ELQ	CHECKED BY: DMP
FIGURE 4: CONCEPTUAL INTERSECTION DESIGN	SHEET 1 OF 2

2.2 Proposed Signal Timing

As noted on the previous graphic, the proposed signal timing includes converting to concurrent phasing between the Charlotte Road and Lantman's Driveway approaches. This phasing has been deemed reasonable from a safety standpoint given the low volumes from Lantman's driveway, as well the amount of pavement provided for left turning movements to occur simultaneously. This change is in response to an initial memorandum by Lamoureux & Dickinson in 2011. It is proposed that the exclusive pedestrian phase for the VT 116 and Charlotte Road crosswalks remain in place to reduce conflicts and improve pedestrian safety. The proposed weekday morning and evening peak hours timing and phasing totals to 109 and 129 second cycle lengths (including pedestrian phase), respectively, with the splits allocated as **Figure 5** shows. These cycle lengths are consistent with the current timing and phasing to maintain consistency and coordination with the signal to the north at Commerce Street. In this figure, phases 2 and 6 represent the VT 116 approaches and phases 4 and 8 represent Charlotte Road and Lantman's Driveway, respectively.

By implementing the signal timing and phasing plans shown in **Figure 5**, the intersection operations are expected to improve on nearly all intersection approaches. Under the Build conditions, there are no longer any approaches operating at LOS F. In addition to capacity and delay, 95th percentile queue lengths are anticipated to decrease for all approaches from the No Build to Build scenario. The overall intersection operations improve from LOS C to LOS B in the evening peak hour.

The results of the traffic analysis are shown in **Table 3**.

Figure 5: Proposed AM (Upper) and PM (Lower) Signal Timing Plans

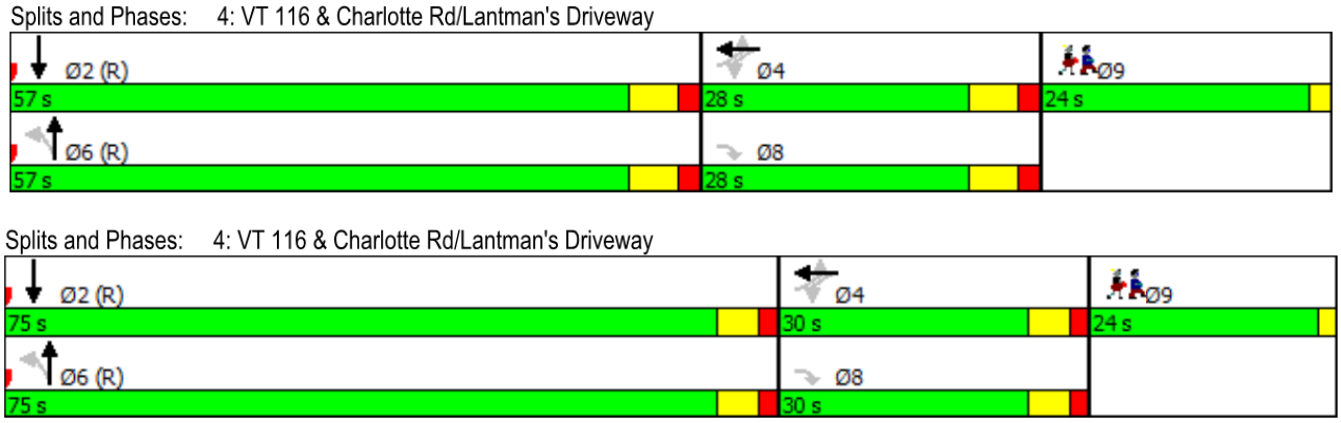


Table 3: Build Intersection Capacity Analysis

		2019 No Build				2019 Build			
Peak Hour	Approach	v/c*	Delay**	LOS***	Queue+	v/c	Delay	LOS	Queue
Weekday AM	Charlotte Road (EB)	0.67	51.4	D	149	0.72	52.9	D	148
	Lantman's Driveway (WB)	0.31	53.4	D	42	0.07	40.9	D	35
	VT 116 (NB)	0.64	15.1	B	762	0.59	10.8	B	688
	VT 116 (SB)	0.36	10.3	B	305	0.33	7.4	A	273
	Overall	**0.60**	**18.9**	**B**	**-**	**0.58**	**15.5**	**B**	**-**
Weekday PM	Charlotte Road (EB)	0.73	68.7	E	160	0.71	64.0	E	136
	Lantman's Driveway (WB)	0.83	85.9	F	215	0.58	57.2	E	159
	VT 116 (NB)	0.36	11.4	B	310	0.32	6.7	A	284
	VT 116 (SB)	0.75	20.2	C	998	0.66	11.7	B	935
	Overall	**0.73**	**28.1**	**C**	**-**	**0.64**	**19.1**	**B**	**-**
		2024 No Build				**2024 Build**			
Peak Hour	Approach	v/c	Delay	LOS	Queue	v/c	Delay	LOS	Queue
Weekday AM	Charlotte Road (EB)	0.68	51.6	D	153	0.72	53.3	D	150
	Lantman's Driveway (WB)	0.31	53.4	D	42	0.07	40.7	D	35
	VT 116 (NB)	0.66	15.5	B	783	0.60	11.1	B	710
	VT 116 (SB)	0.36	10.4	D	314	0.33	7.5	A	281
	Overall	**0.61**	**19.2**	**B**	**-**	**0.59**	**15.7**	**B**	**-**
Weekday PM	Charlotte Road (EB)	0.74	69.5	E	167	0.72	63.9	E	137
	Lantman's Driveway (WB)	0.83	85.8	F	219	0.57	56.7	E	158
	VT 116 (NB)	0.37	11.7	B	321	0.32	6.8	A	290
	VT 116 (SB)	0.78	21.4	C	1047	0.68	12.1	B	960
	Overall	**0.75**	**28.8**	**C**	-	**0.66**	**19.3**	**B**	**-**

** v/c - Volume to capacity ratio, per Synchro*

*** Delay expressed in seconds per vehicle, per Synchro*

**** LOS - Level of service, per Synchro*

+ 95th Percentile, shown in feet, per Synchro

2.3 Additional Proposed Improvements

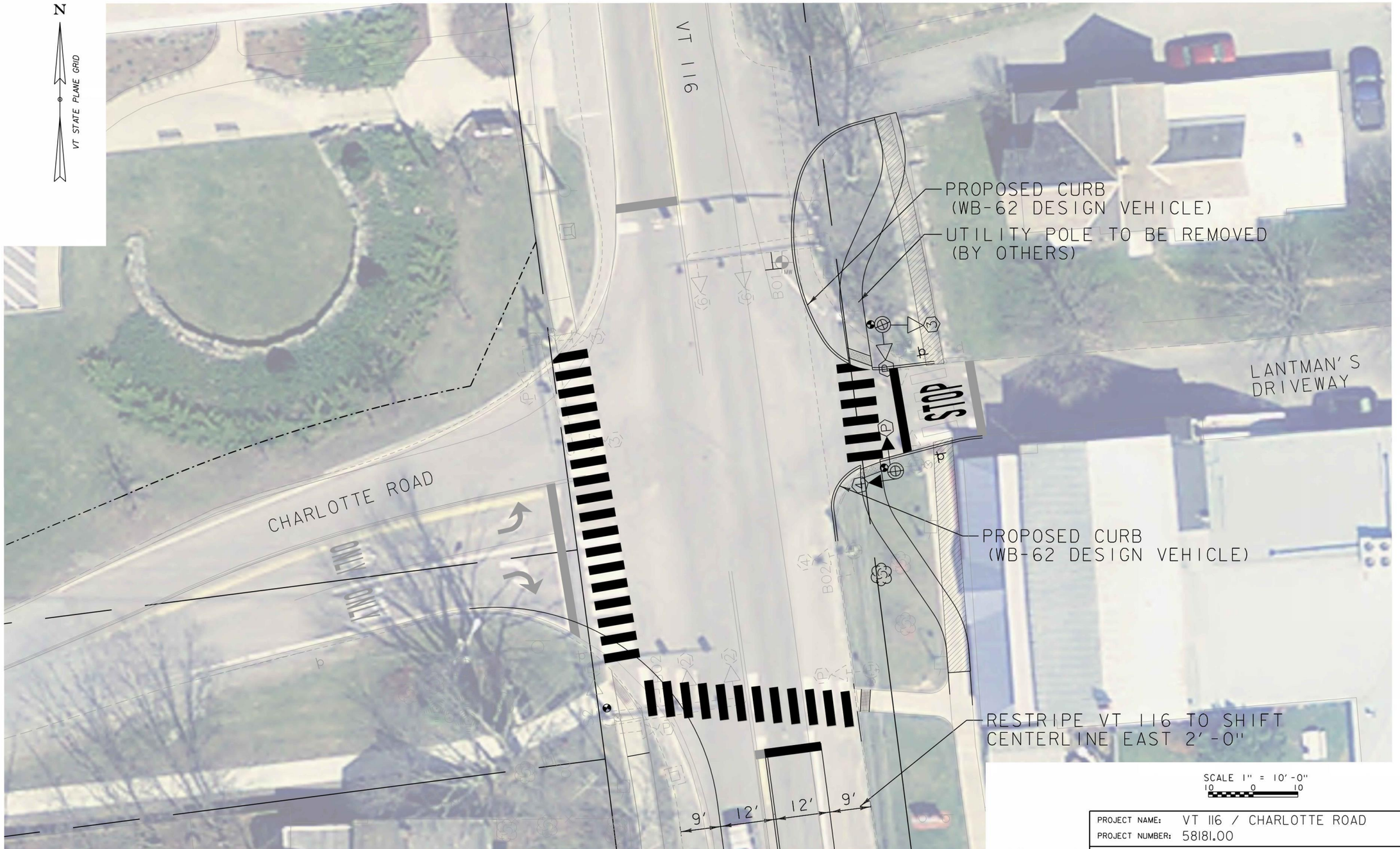
In addition to the proposed sidewalk relocation and adjustments to the signal timing and phasing, the intersection was evaluated for other potential improvements. The recommendations for additional improvements include the reconstruction of the curbline on the eastern side of the intersection. The proposed curb is shown in **Figure 6** and is designed to accommodate truck turning movements of a design vehicle of a WB-62. By tightening the radii of the curb, the crosswalk can be shortened, and vehicle speeds are likely to decrease which further improves safety for all users.

2.4 Conceptual Cost Estimates

Cost estimates were completed at the conceptual level for the proposed sidewalk, signal, and curb improvements. These were developed using unit costs from VTrans 2-Year Average Price List, the Report on Shared-Use Path and Sidewalk Unit Costs, and research of bid histories of similar projects. On top of the construction costs, additional costs including signing and striping, a contingency, mobilization and traffic control, and engineering and design. Assuming that all improvements are constructed concurrently, the anticipated cost associated with all improvements totals to approximately $88,000. A breakdown of unit costs and quantities are provided in the Appendix.

2.5 Next Steps

The improvements proposed as a result of this project are anticipated to improve traffic operations and provide safer accommodations for pedestrians. In this area, VT 116 is a State owned and maintained highway, therefore, these improvements will require final designs to be developed and approved by VTrans before construction can occur. All design elements included in this report have been presented to and supported by VTrans representatives from numerous departments of interest. The next steps for the Town will be to coordinate with the State to begin the final design process and acquire funding for this project.



SCALE 1" = 10'-0"
10 0 10

PROJECT NAME:	VT 116 / CHARLOTTE ROAD
PROJECT NUMBER:	58181.00
FILE NAME: 58181.00\cad\te\58181_nul.dgn	PLOT DATE: 6/3/2019
PROJECT LEADER: EPD	DRAWN BY: ELQ
DESIGNED BY: ELQ	CHECKED BY: DMP
FIGURE 6: PROPOSED CURBLINE ADJUSTMENTS	SHEET 2 OF 2

Appendix

Technical Appendix

- Traffic Volume Data
- High Crash Location Listing
- Intersection Capacity Analyses
- Proposed Improvement Plans
- Conceptual Cost Estimate

Traffic Volume Data

Peak Hour Data for Intersection

Int ID:	30407820		
Community:	HINESBURG	**Corridor:**	NA
Road 1:	VT-116	**Road 3:**	VT-116
Road 2:	LANTMAN	**Road 4:**	CHARLOTTE RD

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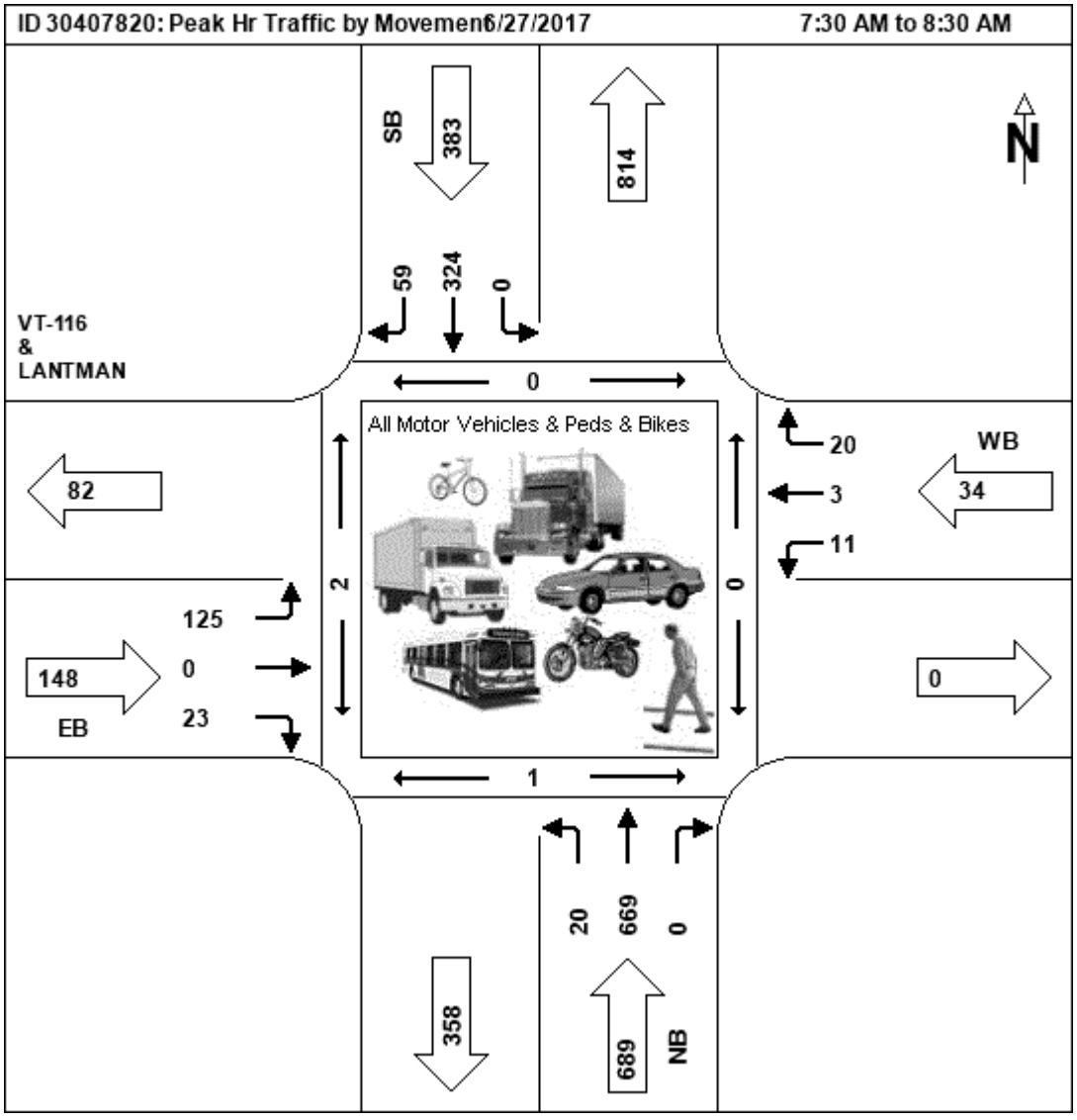
AM Peak Hour
06/27/2017

Start Time	NB Left	NB Thru	NB Right	NB Ped	NB App Total	EB Left	EB Thru	EB Right	EB Ped	EB App Total	SB Left	SB Thru	SB Right	SB Ped	SB App Total	WB Left	WB Thru	WB Right	WB Ped	WB App Total	Int Total
7:30 AM	4	178	0	0	182	37	0	5	0	42	0	74	10	0	84	3	0	6	0	9	317
7:45 AM	3	182	0	0	185	34	0	7	1	41	0	65	15	1	80	1	0	6	0	7	313
8:00 AM	5	155	0	0	160	24	0	6	0	30	0	99	16	0	115	3	2	3	0	8	313
8:15 AM	8	154	0	0	162	30	0	5	0	35	0	86	18	1	104	4	1	5	0	10	311
Total	20	669	0	0	689	125	0	23	1	148	0	324	59	2	383	11	3	20	0	34	1254
PHF	0.63	0.92			0.93	0.84		0.82		0.88		0.82	0.82		0.83	0.69	0.38	0.83		0.85	
HV %	25	4				4		17				10	8			0	0	10			

Cars Trucks Pedestrians Bikes

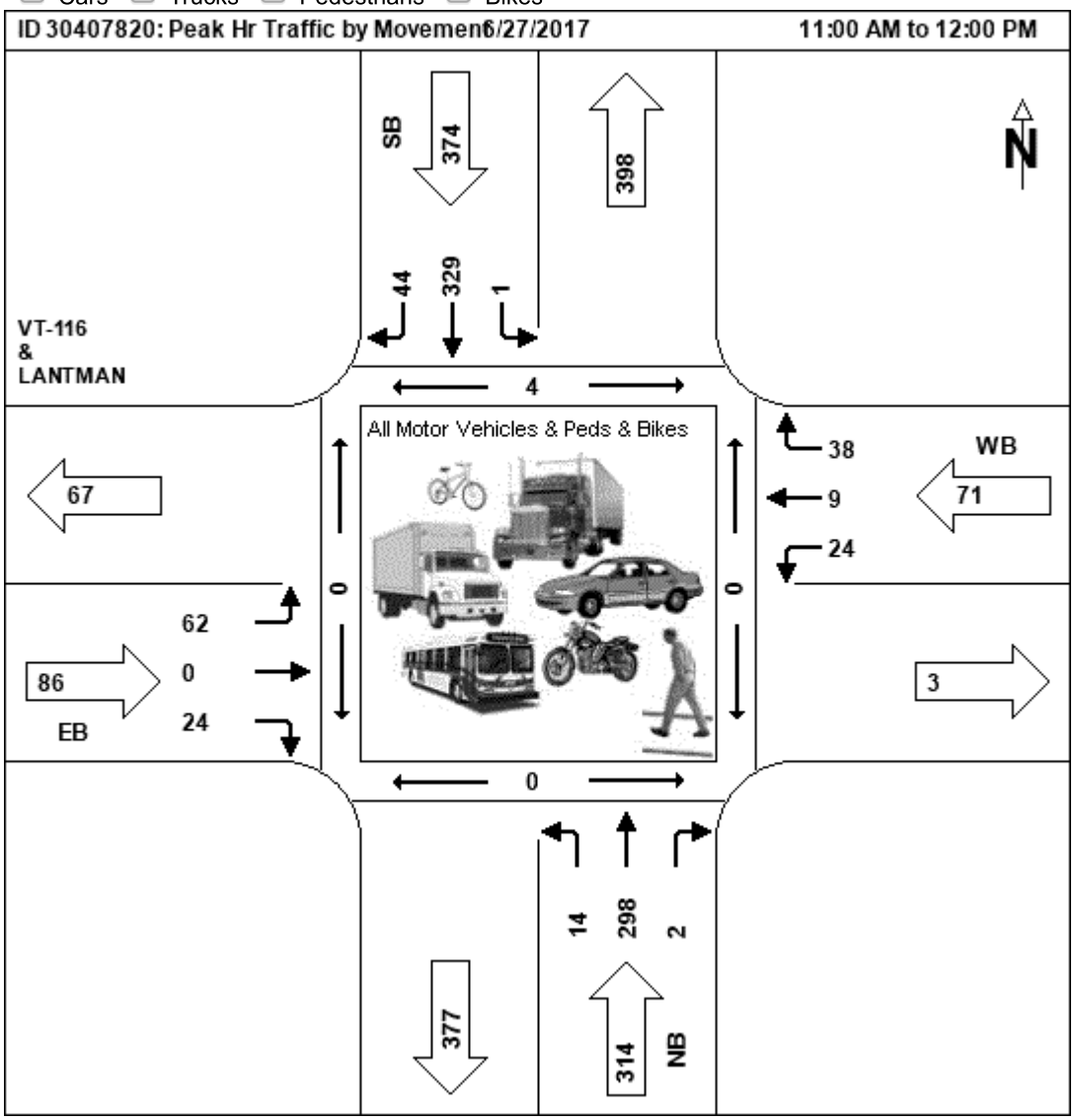


Midday Peak Hour
06/27/2017

Start Time	NB Left	NB Thru	NB Right	NB Ped	NB App Total	EB Left	EB Thru	EB Right	EB Ped	EB App Total	SB Left	SB Thru	SB Right	SB Ped	SB App Total	WB Left	WB Thru	WB Right	WB Ped	WB App Total	Int Total
11:00 AM	2	72	2	0	76	11	0	6	0	17	1	95	14	0	110	8	1	8	0	17	220

11:15 AM	4	75	0	0	79	18	0	7	0	25	0	65	16	0	81	4	1	10	0	15	200
11:30 AM	4	82	0	0	86	17	0	6	0	23	0	78	6	0	84	5	5	8	2	18	211
11:45 AM	4	69	0	0	73	16	0	5	0	21	0	91	8	0	99	7	2	12	2	21	214
Total	14	298	2	0	314	62	0	24	0	86	1	329	44	0	374	24	9	38	4	71	845
PHF	0.88	0.91	0.25		0.91	0.86		0.86		0.86	0.25	0.87	0.69		0.85	0.75	0.45	0.79		0.85	
HV %	7	10	0			8		13			0	9	0			4	0	5			

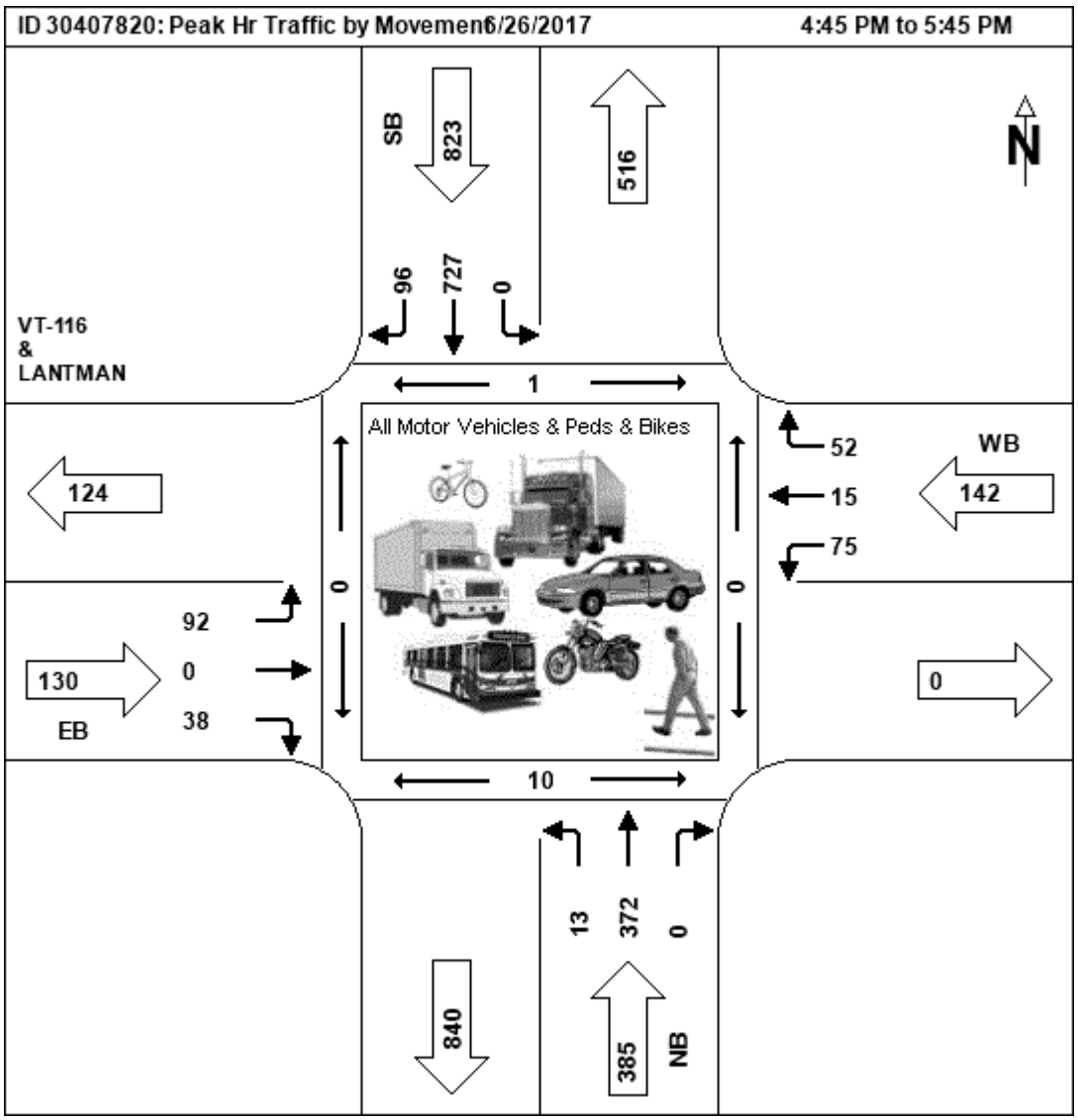
☑ Cars ☑ Trucks ☑ Pedestrians ☑ Bikes



PM Peak Hour
06/26/2017

	NB					EB					SB					WB					
Start Time	Left	Thru	Right	Ped	App Total	Left	Thru	Right	Ped	App Total	Left	Thru	Right	Ped	App Total	Left	Thru	Right	Ped	App Total	Int Total
4:45 PM	1	101	0	0	102	26	0	9	3	35	0	176	23	0	199	14	2	10	0	26	362
5:00 PM	3	93	0	0	96	23	0	11	2	34	0	188	22	0	210	18	4	12	0	34	374
5:15 PM	5	82	0	0	87	19	0	12	0	31	0	197	21	0	218	22	5	14	0	41	377
5:30 PM	4	96	0	0	100	24	0	6	5	30	0	166	30	0	196	21	4	16	1	41	367
Total	13	372	0	0	385	92	0	38	10	130	0	727	96	0	823	75	15	52	1	142	1480
PHF	0.65	0.92			0.94	0.88		0.79		0.93		0.92	0.80		0.94	0.85	0.75	0.81		0.87	
HV %	0	3				3		5				3	4			0	0	0			

☑ Cars ☑ Trucks ☑ Pedestrians ☑ Bikes


ID 30407820: Peak Hr Traffic by Movemen6/26/2017
4:45 PM to 5:45 PM
SB
823
516
N
96
727
0
VT-116
&
LANTMAN
1
All Motor Vehicles & Peds & Bikes
52
WB
15
142
75
124
0
0
92
130
0
38
EB
0
10
13
372
0
840
385
NB

High Crash Location Listing

Vermont Agency of Transportation

Formal Statewide Sections - Route Log Order /2 - Statewide

Years: 2012 - 2016

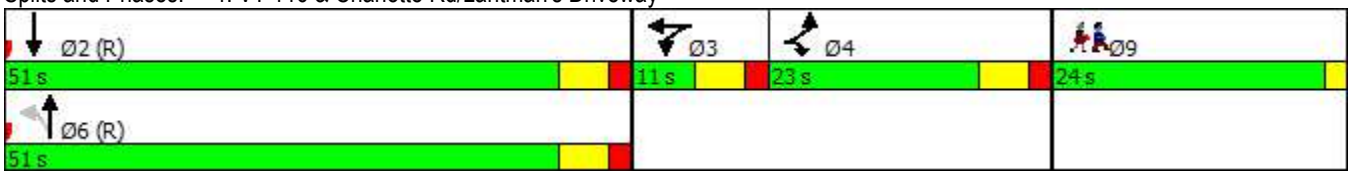
H.C.L No.	/3.	Route	System	Town	Mileage	AADT	Years	Crashes	Fatalities	Injuries	PDO Crashes	Critical Rate	Actual Rate	Ratio Actual/Critical	Severity Index ($/Crash/1.)
	67	VT-108	Major Collector (r)	Stowe	1.000 - 1.300	8,200	5	21	0	3	19	1.933	4.678	2.420	$22,867
	730	VT-108	Major Collector (r)	Stowe	1.500 - 1.800	8,200	5	9	0	0	9	1.933	2.005	1.037	$11,300
	31	VT-108	Major Collector (r)	Stowe	1.800 - 2.100	7,691	5	25	0	1	24	1.963	5.937	3.025	$14,388
	336	VT-108	Major Collector (r)	Stowe	3.200 - 3.500	6,800	5	11	0	2	9	2.023	2.955	1.461	$25,336
	426	VT-108	Major Collector (r)	Stowe	4.400 - 4.700	6,800	5	10	0	1	9	2.023	2.686	1.328	$19,020
	427	VT-108	Major Collector (r)	Stowe	4.900 - 5.200	6,800	5	10	0	1	9	2.023	2.686	1.328	$19,020
	510	VT-108	Major Collector (r)	Stowe	5.900 - 6.200	3,800	5	6	0	1	5	2.343	2.884	1.231	$24,167
	513	VT-108	Major Collector (r)	Stowe	6.800 - 7.100	3,800	5	6	0	0	6	2.343	2.884	1.231	$11,300
	15	VT-108	Major Collector (r)	Stowe	7.300 - 7.600	1,500	5	9	0	0	9	2.975	10.959	3.684	$11,300
	129	VT-108	Major Collector (r)	Cambridge	0.566 - 0.866	1,500	5	5	0	5	1	2.975	6.088	2.046	$90,760
	126	VT-108	Major Collector (r)	Cambridge	3.666 - 3.966	2,800	5	8	0	3	5	2.536	5.219	2.057	$40,250
	599	VT-108	Major Collector (r)	Cambridge	7.366 - 7.666	5,100	5	7	0	1	6	2.173	2.507	1.153	$22,329
	155	VT-108	Minor Arterial (r)	Cambridge	9.466 - 9.766	1,196	5	5	0	3	3	4.023	7.636	1.898	$59,880
	112	VT-110	Major Collector (r)	Tunbridge	4.480 - 4.780	1,433	5	5	0	3	4	3.009	6.373	2.118	$62,140
	44	VT-112	Minor Arterial (r)	Halifax	2.500 - 2.800	1,200	5	7	0	6	4	4.020	10.654	2.651	$82,314
	755	VT-114	Major Collector (r)	Lyndon	0.600 - 0.900	3,850	5	5	0	3	4	2.335	2.372	1.016	$62,140
	271	VT-114	Major Collector (r)	Burke	0.270 - 0.570	3,351	5	7	0	0	7	2.421	3.815	1.576	$11,300
	174	VT-116	Minor Arterial (r)	Middlebury	0.300 - 0.600	1,250	5	5	0	1	4	3.979	7.306	1.836	$26,740
	389	VT-116	Minor Arterial (r)	Middlebury	4.000 - 4.300	2,352	5	6	0	1	5	3.380	4.659	1.378	$24,167
	550	VT-116	Minor Arterial (r)	Middlebury, Bristol	6.500 - 0.213	2,240	5	5	0	2	3	3.424	4.077	1.191	$42,180
	201	VT-116	Minor Arterial (r)	Bristol	2.113 - 2.413	2,500	5	8	0	2	7	3.327	5.845	1.757	$32,012
	306	VT-116	Minor Arterial (r)	Hinesburg	0.278 - 0.578	3,600	5	9	0	0	9	3.030	4.566	1.507	$11,300
	598	VT-116	Minor Arterial (r)	Hinesburg	2.278 - 2.578	4,400	5	8	0	3	5	2.881	3.321	1.153	$40,250
	274	VT-116	Minor Arterial (r)	Hinesburg	4.378 - 4.678	9,808	5	20	0	3	18	2.384	3.724	1.562	$23,445
	76	VT-116	Minor Arterial (r)	Hinesburg	4.878 - 5.178	8,600	5	27	0	2	25	2.456	5.734	2.335	$17,019
	441	VT-116	Minor Arterial (r)	Hinesburg	6.278 - 6.578	8,500	5	15	0	3	12	2.462	3.223	1.309	$26,740
	137	VT-116	Minor Arterial (r)	St. George	0.240 - 0.540	6,154	5	18	0	7	13	2.654	5.342	2.013	$42,578
	450	VT-116	Minor Arterial (r)	St. George, Shelburne	1.437 - 1.182	5,100	5	10	0	10	4	2.778	3.581	1.289	$93,020
	176	VT-117	Minor Arterial (r)	Jericho	0.269 - 0.569	5,500	5	15	0	3	12	2.727	4.981	1.827	$26,740
	133	VT-117	Minor Arterial (r)	Richmond	0.276 - 0.576	5,200	5	16	0	4	13	2.765	5.620	2.033	$31,306
	223	VT-118	Major Collector (r)	Montgomery	5.514 - 5.814	1,926	5	5	0	0	5	2.794	4.742	1.697	$11,300
	387	VT-122	Major Collector (r)	Lyndon	0.500 - 0.800	2,541	5	5	0	0	5	2.601	3.594	1.382	$11,300
	237	VT-122	Major Collector (r)	Lyndon	1.800 - 2.100	2,000	5	5	0	1	4	2.767	4.566	1.650	$26,740

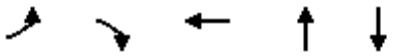
Intersection Capacity Analysis

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	134	25	3	21	717	347	
Future Volume (vph)	134	25	3	21	717	347	
Turn Type	Prot	Prot	NA	Perm	NA	NA	
Protected Phases	4	4	3		6	2	9
Permitted Phases				6			
Detector Phase	4	4	3	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	23.0	23.0	11.0	51.0	51.0	51.0	24.0
Total Split (%)	21.1%	21.1%	10.1%	46.8%	46.8%	46.8%	22%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	12.5	12.5	5.0		73.1	73.1	
Actuated g/C Ratio	0.11	0.11	0.05		0.67	0.67	
v/c Ratio	0.67	0.09	0.35		0.61	0.34	
Control Delay	61.9	0.7	38.7		17.4	12.2	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	61.9	0.7	38.7		17.4	12.2	
LOS	E	A	D		B	B	
Approach Delay			38.7		17.4	12.2	
Approach LOS			D		B	B	

Intersection Summary	
Cycle Length: 109	
Actuated Cycle Length: 109	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 20.5	Intersection LOS: C
Intersection Capacity Utilization 77.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

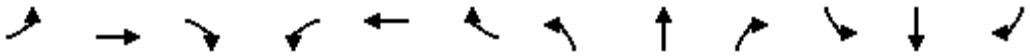




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	134	25	34	738	410
v/c Ratio	0.67	0.09	0.35	0.61	0.34
Control Delay	61.9	0.7	38.7	17.4	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	61.9	0.7	38.7	17.4	12.2
Queue Length 50th (ft)	91	0	10	257	106
Queue Length 95th (ft)	149	0	42	#761	305
Internal Link Dist (ft)			208	745	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	273	332	98	1217	1212
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.08	0.35	0.61	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	134	0	25	11	3	20	21	717	0	0	347	63
Future Volume (vph)	134	0	25	11	3	20	21	717	0	0	347	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.92			1.00			0.98	
Flt Protected	0.95		1.00		0.98			1.00			1.00	
Satd. Flow (prot)	1752		1538		1721			1844			1804	
Flt Permitted	0.95		1.00		0.98			0.98			1.00	
Satd. Flow (perm)	1752		1538		1721			1815			1804	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	134	0	25	11	3	20	21	717	0	0	347	63
RTOR Reduction (vph)	0	0	22	0	19	0	0	0	0	0	4	0
Lane Group Flow (vph)	134	0	3	0	15	0	0	738	0	0	406	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Prot		Prot	Split	NA		Perm	NA			NA	
Protected Phases	4		4	3	3			6			2	
Permitted Phases							6					
Actuated Green, G (s)	12.5		12.5		3.0			69.1			69.1	
Effective Green, g (s)	12.5		12.5		3.0			69.1			69.1	
Actuated g/C Ratio	0.11		0.11		0.03			0.63			0.63	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		2.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	200		176		47			1150			1143	
v/s Ratio Prot	c0.08		0.00		c0.01						0.23	
v/s Ratio Perm								c0.41				
v/c Ratio	0.67		0.02		0.31			0.64			0.36	
Uniform Delay, d1	46.3		42.8		52.0			12.3			9.4	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	6.7		0.0		1.4			2.8			0.9	
Delay (s)	53.0		42.8		53.4			15.1			10.3	
Level of Service	D		D		D			B			B	
Approach Delay (s)		51.4			53.4			15.1			10.3	
Approach LOS		D			D			B			B	

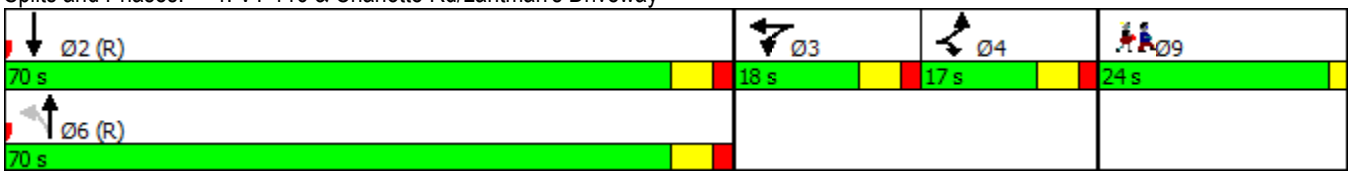
Intersection Summary			
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

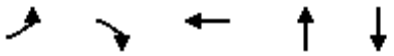
c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	99	41	15	14	399	779	
Future Volume (vph)	99	41	15	14	399	779	
Turn Type	Prot	Prot	NA	Perm	NA	NA	
Protected Phases	4	4	3		6	2	9
Permitted Phases				6			
Detector Phase	4	4	3	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	17.0	17.0	18.0	70.0	70.0	70.0	24.0
Total Split (%)	13.2%	13.2%	14.0%	54.3%	54.3%	54.3%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	10.0	10.0	11.3		84.9	84.9	
Actuated g/C Ratio	0.08	0.08	0.09		0.66	0.66	
v/c Ratio	0.73	0.20	0.84		0.35	0.74	
Control Delay	87.3	2.2	87.3		12.9	21.7	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	87.3	2.2	87.3		12.9	21.7	
LOS	F	A	F		B	C	
Approach Delay			87.3		12.9	21.7	
Approach LOS			F		B	C	

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 129	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 100	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.84	
Intersection Signal Delay: 28.9	Intersection LOS: C
Intersection Capacity Utilization 74.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

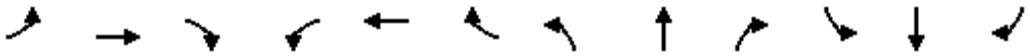




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	99	41	142	413	882
v/c Ratio	0.73	0.20	0.84	0.35	0.74
Control Delay	87.3	2.2	87.3	12.9	21.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	87.3	2.2	87.3	12.9	21.7
Queue Length 50th (ft)	82	0	103	131	414
Queue Length 95th (ft)	#160	0	#215	310	#998
Internal Link Dist (ft)			208	1652	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	149	216	178	1169	1195
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.66	0.19	0.80	0.35	0.74

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	0	41	75	15	52	14	399	0	0	779	103
Future Volume (vph)	99	0	41	75	15	52	14	399	0	0	779	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		1.00		0.99			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.95			1.00			0.98	
Flt Protected	0.95		1.00		0.97			1.00			1.00	
Satd. Flow (prot)	1752		1538		1743			1843			1814	
Flt Permitted	0.95		1.00		0.97			0.96			1.00	
Satd. Flow (perm)	1752		1538		1743			1779			1814	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	99	0	41	75	15	52	14	399	0	0	779	103
RTOR Reduction (vph)	0	0	38	0	16	0	0	0	0	0	2	0
Lane Group Flow (vph)	99	0	3	0	126	0	0	413	0	0	880	0
Confl. Peds. (#/hr)	1		10	10		1						
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Prot		Prot	Split	NA		Perm	NA			NA	
Protected Phases	4		4	3	3			6			2	
Permitted Phases							6					
Actuated Green, G (s)	10.0		10.0		11.3			83.3			83.3	
Effective Green, g (s)	10.0		10.0		11.3			83.3			83.3	
Actuated g/C Ratio	0.08		0.08		0.09			0.65			0.65	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		2.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	135		119		152			1148			1171	
v/s Ratio Prot	c0.06		0.00		c0.07						c0.48	
v/s Ratio Perm								0.23				
v/c Ratio	0.73		0.03		0.83			0.36			0.75	
Uniform Delay, d1	58.2		55.0		57.9			10.5			15.7	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	16.2		0.0		28.0			0.9			4.5	
Delay (s)	74.4		55.0		85.9			11.4			20.2	
Level of Service	E		E		F			B			C	
Approach Delay (s)		68.7			85.9			11.4			20.2	
Approach LOS		E			F			B			C	

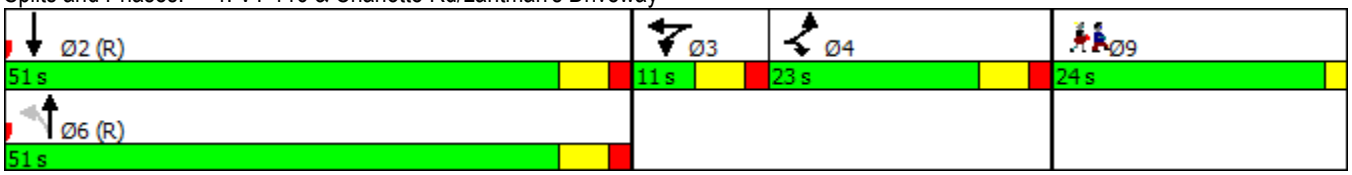
Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	129.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

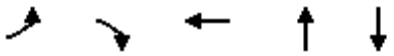
c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	137	25	3	22	731	354	
Future Volume (vph)	137	25	3	22	731	354	
Turn Type	Prot	Prot	NA	Perm	NA	NA	
Protected Phases	4	4	3		6	2	9
Permitted Phases				6			
Detector Phase	4	4	3	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	23.0	23.0	11.0	51.0	51.0	51.0	24.0
Total Split (%)	21.1%	21.1%	10.1%	46.8%	46.8%	46.8%	22%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	12.6	12.6	5.0		73.0	73.0	
Actuated g/C Ratio	0.12	0.12	0.05		0.67	0.67	
v/c Ratio	0.68	0.09	0.35		0.62	0.35	
Control Delay	62.3	0.6	38.7		17.8	12.3	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	62.3	0.6	38.7		17.8	12.3	
LOS	E	A	D		B	B	
Approach Delay			38.7		17.8	12.3	
Approach LOS			D		B	B	

Intersection Summary	
Cycle Length: 109	
Actuated Cycle Length: 109	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay: 20.8	Intersection LOS: C
Intersection Capacity Utilization 78.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

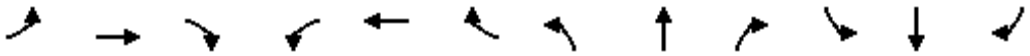




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	137	25	34	753	419
v/c Ratio	0.68	0.09	0.35	0.62	0.35
Control Delay	62.3	0.6	38.7	17.8	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	62.3	0.6	38.7	17.8	12.3
Queue Length 50th (ft)	93	0	10	267	110
Queue Length 95th (ft)	153	0	42	#783	314
Internal Link Dist (ft)			208	1605	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	273	332	98	1213	1210
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.08	0.35	0.62	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	137	0	25	11	3	20	22	731	0	0	354	65
Future Volume (vph)	137	0	25	11	3	20	22	731	0	0	354	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.92			1.00			0.98	
Flt Protected	0.95		1.00		0.98			1.00			1.00	
Satd. Flow (prot)	1752		1538		1721			1844			1803	
Flt Permitted	0.95		1.00		0.98			0.98			1.00	
Satd. Flow (perm)	1752		1538		1721			1813			1803	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	137	0	25	11	3	20	22	731	0	0	354	65
RTOR Reduction (vph)	0	0	22	0	19	0	0	0	0	0	4	0
Lane Group Flow (vph)	137	0	3	0	15	0	0	753	0	0	415	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Prot		Prot	Split	NA		Perm	NA			NA	
Protected Phases	4		4	3	3			6			2	
Permitted Phases							6					
Actuated Green, G (s)	12.6		12.6		3.0			69.0			69.0	
Effective Green, g (s)	12.6		12.6		3.0			69.0			69.0	
Actuated g/C Ratio	0.12		0.12		0.03			0.63			0.63	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		2.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	202		177		47			1147			1141	
v/s Ratio Prot	c0.08		0.00		c0.01						0.23	
v/s Ratio Perm								c0.42				
v/c Ratio	0.68		0.02		0.31			0.66			0.36	
Uniform Delay, d1	46.3		42.7		52.0			12.6			9.5	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	6.9		0.0		1.4			2.9			0.9	
Delay (s)	53.2		42.7		53.4			15.5			10.4	
Level of Service	D		D		D			B			B	
Approach Delay (s)		51.6			53.4			15.5			10.4	
Approach LOS		D			D			B			B	

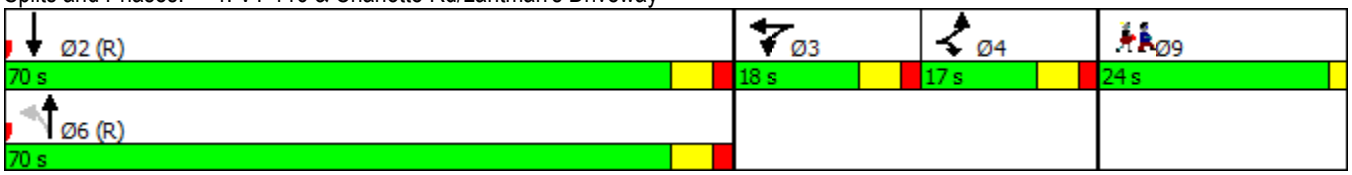
Intersection Summary			
HCM 2000 Control Delay	19.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

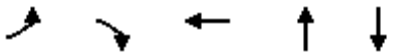
c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	101	42	15	14	407	795	
Future Volume (vph)	101	42	15	14	407	795	
Turn Type	Prot	Prot	NA	Perm	NA	NA	
Protected Phases	4	4	3		6	2	9
Permitted Phases				6			
Detector Phase	4	4	3	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	17.0	17.0	18.0	70.0	70.0	70.0	24.0
Total Split (%)	13.2%	13.2%	14.0%	54.3%	54.3%	54.3%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	10.1	10.1	11.4		84.7	84.7	
Actuated g/C Ratio	0.08	0.08	0.09		0.66	0.66	
v/c Ratio	0.74	0.20	0.85		0.36	0.76	
Control Delay	88.6	2.2	88.9		13.1	22.7	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	88.6	2.2	88.9		13.1	22.7	
LOS	F	A	F		B	C	
Approach Delay			88.9		13.1	22.7	
Approach LOS			F		B	C	

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 129	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 29.7	Intersection LOS: C
Intersection Capacity Utilization 76.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

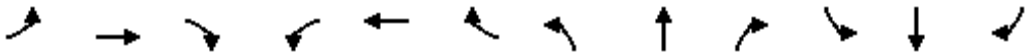




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	102	42	144	425	909
v/c Ratio	0.74	0.20	0.85	0.36	0.76
Control Delay	88.6	2.2	88.9	13.1	22.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	88.6	2.2	88.9	13.1	22.7
Queue Length 50th (ft)	84	0	105	136	440
Queue Length 95th (ft)	#167	0	#219	321	#1047
Internal Link Dist (ft)			208	1652	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	149	216	178	1167	1193
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.68	0.19	0.81	0.36	0.76

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



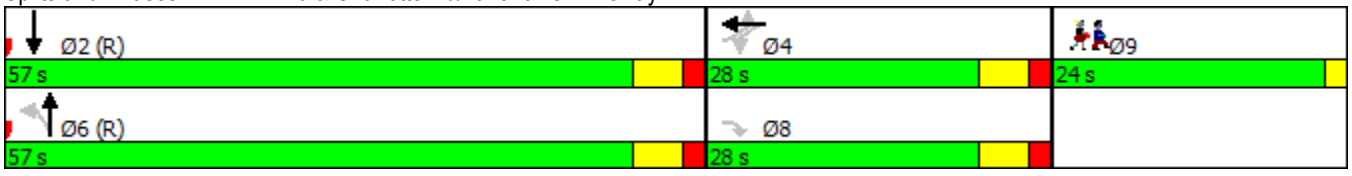
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	0	42	75	15	52	14	407	0	0	795	105
Future Volume (vph)	101	0	42	75	15	52	14	407	0	0	795	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		1.00		0.99			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.95			1.00			0.98	
Flt Protected	0.95		1.00		0.97			1.00			1.00	
Satd. Flow (prot)	1752		1538		1743			1843			1814	
Flt Permitted	0.95		1.00		0.97			0.96			1.00	
Satd. Flow (perm)	1752		1538		1743			1778			1814	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%	101%
Adj. Flow (vph)	102	0	42	76	15	53	14	411	0	0	803	106
RTOR Reduction (vph)	0	0	39	0	16	0	0	0	0	0	2	0
Lane Group Flow (vph)	102	0	3	0	128	0	0	425	0	0	907	0
Confl. Peds. (#/hr)	1		10	10		1						
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Prot		Prot	Split	NA		Perm	NA			NA	
Protected Phases	4		4	3	3			6			2	
Permitted Phases							6					
Actuated Green, G (s)	10.1		10.1		11.4			83.1			83.1	
Effective Green, g (s)	10.1		10.1		11.4			83.1			83.1	
Actuated g/C Ratio	0.08		0.08		0.09			0.64			0.64	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		2.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	137		120		154			1145			1168	
v/s Ratio Prot	c0.06		0.00		c0.07						c0.50	
v/s Ratio Perm								0.24				
v/c Ratio	0.74		0.03		0.83			0.37			0.78	
Uniform Delay, d1	58.2		54.9		57.8			10.7			16.3	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	17.3		0.0		28.0			0.9			5.1	
Delay (s)	75.5		54.9		85.8			11.7			21.4	
Level of Service	E		D		F			B			C	
Approach Delay (s)		69.5			85.8			11.7			21.4	
Approach LOS		E			F			B			C	

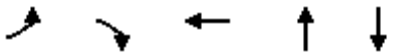
Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	129.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	134	25	3	21	717	347	
Future Volume (vph)	134	25	3	21	717	347	
Turn Type	D.Pm	Perm	NA	Perm	NA	NA	
Protected Phases			4		6	2	9
Permitted Phases	4	8		6			
Detector Phase	4	8	4	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	28.0	28.0	28.0	57.0	57.0	57.0	24.0
Total Split (%)	25.7%	25.7%	25.7%	52.3%	52.3%	52.3%	22%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Min	C-Min	C-Min	None
Act Effct Green (s)	15.1	13.1	15.1		77.1	77.1	
Actuated g/C Ratio	0.14	0.12	0.14		0.71	0.71	
v/c Ratio	0.72	0.11	0.13		0.58	0.32	
Control Delay	64.9	4.1	22.7		13.9	9.5	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	64.9	4.1	22.7		13.9	9.5	
LOS	E	A	C		B	A	
Approach Delay			22.7		13.9	9.5	
Approach LOS			C		B	A	

Intersection Summary	
Cycle Length: 109	
Actuated Cycle Length: 109	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 17.7	Intersection LOS: B
Intersection Capacity Utilization 77.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

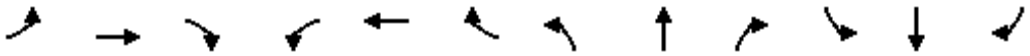




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	134	25	34	738	410
v/c Ratio	0.72	0.11	0.13	0.58	0.32
Control Delay	64.9	4.1	22.7	13.9	9.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	64.9	4.1	22.7	13.9	9.5
Queue Length 50th (ft)	91	0	9	182	75
Queue Length 95th (ft)	148	9	35	#688	273
Internal Link Dist (ft)			208	745	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	273	343	363	1283	1278
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.07	0.09	0.58	0.32

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	134	0	25	11	3	20	21	717	0	0	347	63
Future Volume (vph)	134	0	25	11	3	20	21	717	0	0	347	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		0.98		1.00			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.92			1.00			0.98	
Flt Protected	0.95		1.00		0.98			1.00			1.00	
Satd. Flow (prot)	1752		1502		1719			1844			1804	
Flt Permitted	0.73		1.00		0.98			0.98			1.00	
Satd. Flow (perm)	1356		1502		1719			1815			1804	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	134	0	25	11	3	20	21	717	0	0	347	63
RTOR Reduction (vph)	0	0	22	0	17	0	0	0	0	0	3	0
Lane Group Flow (vph)	134	0	3	0	17	0	0	738	0	0	407	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	D.Pm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					4			6			2	
Permitted Phases	4		8	4			6					
Actuated Green, G (s)	15.1		15.1		15.1			75.4			75.4	
Effective Green, g (s)	15.1		15.1		15.1			75.4			75.4	
Actuated g/C Ratio	0.14		0.14		0.14			0.69			0.69	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		3.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	187		208		238			1255			1247	
v/s Ratio Prot											0.23	
v/s Ratio Perm	c0.10		0.00		0.01			c0.41				
v/c Ratio	0.72		0.02		0.07			0.59			0.33	
Uniform Delay, d1	44.9		40.5		40.8			8.7			6.7	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	10.4		0.0		0.0			2.0			0.7	
Delay (s)	55.3		40.6		40.9			10.8			7.4	
Level of Service	E		D		D			B			A	
Approach Delay (s)		52.9			40.9			10.8			7.4	
Approach LOS		D			D			B			A	

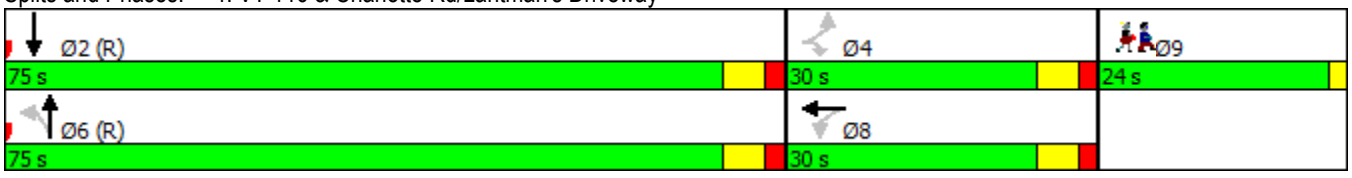
Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

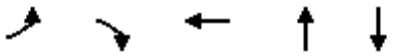
c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	99	41	15	14	399	779	
Future Volume (vph)	99	41	15	14	399	779	
Turn Type	Perm	Perm	NA	Perm	NA	NA	
Protected Phases			8		6	2	9
Permitted Phases	4	4		6			
Detector Phase	4	4	8	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	17.0	17.0	17.0	22.5	22.5	22.5	24.0
Total Split (s)	30.0	30.0	30.0	75.0	75.0	75.0	24.0
Total Split (%)	23.3%	23.3%	23.3%	58.1%	58.1%	58.1%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	16.2	16.2	16.2		95.9	95.9	
Actuated g/C Ratio	0.13	0.13	0.13		0.74	0.74	
v/c Ratio	0.71	0.19	0.61		0.31	0.65	
Control Delay	79.9	14.8	55.8		8.8	14.7	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	79.9	14.8	55.8		8.8	14.7	
LOS	E	B	E		A	B	
Approach Delay			55.8		8.8	14.7	
Approach LOS			E		A	B	

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 129	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 20.9	Intersection LOS: C
Intersection Capacity Utilization 74.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

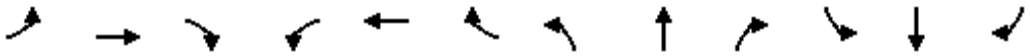




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	99	41	142	413	882
v/c Ratio	0.71	0.19	0.61	0.31	0.65
Control Delay	79.9	14.8	55.8	8.8	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	79.9	14.8	55.8	8.8	14.7
Queue Length 50th (ft)	81	0	98	83	262
Queue Length 95th (ft)	136	32	159	284	#935
Internal Link Dist (ft)			208	2037	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	206	307	336	1323	1349
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.48	0.13	0.42	0.31	0.65

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	99	0	41	75	15	52	14	399	0	0	779	103
Future Volume (vph)	99	0	41	75	15	52	14	399	0	0	779	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		0.94		0.99			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		0.98			1.00			1.00	
Frt	1.00		0.85		0.95			1.00			0.98	
Flt Protected	0.95		1.00		0.97			1.00			1.00	
Satd. Flow (prot)	1748		1447		1708			1843			1814	
Flt Permitted	0.60		1.00		0.97			0.96			1.00	
Satd. Flow (perm)	1108		1447		1708			1780			1814	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	99	0	41	75	15	52	14	399	0	0	779	103
RTOR Reduction (vph)	0	0	36	0	17	0	0	0	0	0	2	0
Lane Group Flow (vph)	99	0	5	0	125	0	0	413	0	0	880	0
Confl. Peds. (#/hr)	1		10	10		1						
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Perm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					8			6			2	
Permitted Phases	4		4	8			6					
Actuated Green, G (s)	16.2		16.2		16.2			94.3			94.3	
Effective Green, g (s)	16.2		16.2		16.2			94.3			94.3	
Actuated g/C Ratio	0.13		0.13		0.13			0.73			0.73	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	3.0		3.0		3.0			4.0			4.0	
Lane Grp Cap (vph)	139		181		214			1301			1326	
v/s Ratio Prot											c0.49	
v/s Ratio Perm	c0.09		0.00		0.07			0.23				
v/c Ratio	0.71		0.03		0.58			0.32			0.66	
Uniform Delay, d1	54.2		49.5		53.2			6.1			9.1	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	15.8		0.1		4.0			0.6			2.6	
Delay (s)	70.0		49.6		57.2			6.7			11.7	
Level of Service	E		D		E			A			B	
Approach Delay (s)		64.0			57.2			6.7			11.7	
Approach LOS		E			E			A			B	

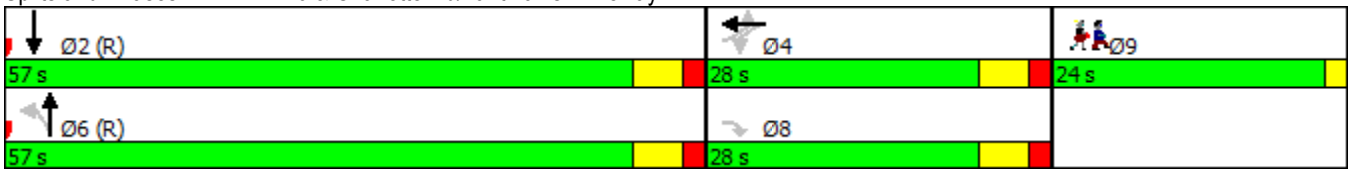
Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	129.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

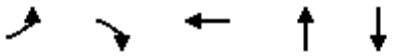
c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	137	25	3	22	731	354	
Future Volume (vph)	137	25	3	22	731	354	
Turn Type	D.Pm	Perm	NA	Perm	NA	NA	
Protected Phases			4		6	2	9
Permitted Phases	4	8		6			
Detector Phase	4	8	4	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	8.0	8.0	8.0	1.0
Minimum Split (s)	11.0	11.0	11.0	22.5	22.5	22.5	24.0
Total Split (s)	28.0	28.0	28.0	57.0	57.0	57.0	24.0
Total Split (%)	25.7%	25.7%	25.7%	52.3%	52.3%	52.3%	22%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Min	C-Min	C-Min	None
Act Effct Green (s)	15.3	13.3	15.3		76.9	76.9	
Actuated g/C Ratio	0.14	0.12	0.14		0.71	0.71	
v/c Ratio	0.72	0.11	0.13		0.59	0.33	
Control Delay	64.8	4.0	22.6		14.3	9.6	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	64.8	4.0	22.6		14.3	9.6	
LOS	E	A	C		B	A	
Approach Delay			22.6		14.3	9.6	
Approach LOS			C		B	A	

Intersection Summary	
Cycle Length: 109	
Actuated Cycle Length: 109	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 17.9	Intersection LOS: B
Intersection Capacity Utilization 78.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway

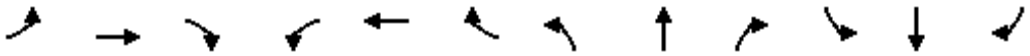




Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	137	25	34	753	419
v/c Ratio	0.72	0.11	0.13	0.59	0.33
Control Delay	64.8	4.0	22.6	14.3	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	64.8	4.0	22.6	14.3	9.6
Queue Length 50th (ft)	93	0	9	192	78
Queue Length 95th (ft)	150	9	35	#710	281
Internal Link Dist (ft)			208	745	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	273	343	363	1278	1274
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.07	0.09	0.59	0.33

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	137	0	25	11	3	20	22	731	0	0	354	65
Future Volume (vph)	137	0	25	11	3	20	22	731	0	0	354	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		0.98		1.00			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.92			1.00			0.98	
Flt Protected	0.95		1.00		0.98			1.00			1.00	
Satd. Flow (prot)	1752		1502		1719			1844			1803	
Flt Permitted	0.73		1.00		0.98			0.98			1.00	
Satd. Flow (perm)	1356		1502		1719			1813			1803	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	137	0	25	11	3	20	22	731	0	0	354	65
RTOR Reduction (vph)	0	0	21	0	17	0	0	0	0	0	3	0
Lane Group Flow (vph)	137	0	4	0	17	0	0	753	0	0	416	0
Confl. Peds. (#/hr)			1	1								
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	D.Pm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					4			6			2	
Permitted Phases	4		8	4			6					
Actuated Green, G (s)	15.3		15.3		15.3			75.3			75.3	
Effective Green, g (s)	15.3		15.3		15.3			75.3			75.3	
Actuated g/C Ratio	0.14		0.14		0.14			0.69			0.69	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	2.0		3.0		2.0			4.0			4.0	
Lane Grp Cap (vph)	190		210		241			1252			1245	
v/s Ratio Prot											0.23	
v/s Ratio Perm	c0.10		0.00		0.01			c0.42				
v/c Ratio	0.72		0.02		0.07			0.60			0.33	
Uniform Delay, d1	44.8		40.4		40.7			8.9			6.8	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	10.8		0.0		0.0			2.1			0.7	
Delay (s)	55.6		40.4		40.7			11.1			7.5	
Level of Service	E		D		D			B			A	
Approach Delay (s)		53.3			40.7			11.1			7.5	
Approach LOS		D			D			B			A	

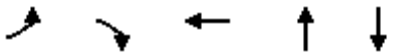
Intersection Summary			
HCM 2000 Control Delay	15.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	WBT	NBL	NBT	SBT	Ø9
Lane Configurations							
Traffic Volume (vph)	101	42	15	14	407	795	
Future Volume (vph)	101	42	15	14	407	795	
Turn Type	Perm	Perm	NA	Perm	NA	NA	
Protected Phases			8		6	2	9
Permitted Phases	4	4		6			
Detector Phase	4	4	8	6	6	2	
Switch Phase							
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	1.0
Minimum Split (s)	17.0	17.0	17.0	22.5	22.5	22.5	24.0
Total Split (s)	30.0	30.0	30.0	75.0	75.0	75.0	24.0
Total Split (%)	23.3%	23.3%	23.3%	58.1%	58.1%	58.1%	19%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0		6.0	6.0	
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	None	None	None	C-Max	C-Max	C-Max	None
Act Effct Green (s)	16.4	16.4	16.4		95.7	95.7	
Actuated g/C Ratio	0.13	0.13	0.13		0.74	0.74	
v/c Ratio	0.72	0.19	0.60		0.32	0.67	
Control Delay	79.7	15.0	55.1		8.9	15.1	
Queue Delay	0.0	0.0	0.0		0.0	0.0	
Total Delay	79.7	15.0	55.1		8.9	15.1	
LOS	E	B	E		A	B	
Approach Delay			55.1		8.9	15.1	
Approach LOS			E		A	B	

Intersection Summary	
Cycle Length: 129	
Actuated Cycle Length: 129	
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 21.1	Intersection LOS: C
Intersection Capacity Utilization 75.5%	ICU Level of Service D
Analysis Period (min) 15	

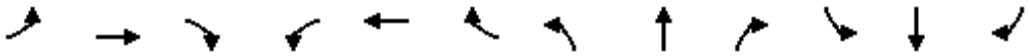
Splits and Phases: 4: VT 116 & Charlotte Rd/Lantman's Driveway



Lane Group	EBL	EBR	WBT	NBT	SBT
Lane Group Flow (vph)	101	42	142	421	900
v/c Ratio	0.72	0.19	0.60	0.32	0.67
Control Delay	79.7	15.0	55.1	8.9	15.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	79.7	15.0	55.1	8.9	15.1
Queue Length 50th (ft)	82	0	97	86	277
Queue Length 95th (ft)	137	33	158	290	#968
Internal Link Dist (ft)			208	2037	1784
Turn Bay Length (ft)	75				
Base Capacity (vph)	206	307	336	1320	1347
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.14	0.42	0.32	0.67

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	0	42	75	15	52	14	407	0	0	795	105
Future Volume (vph)	101	0	42	75	15	52	14	407	0	0	795	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0			6.0			6.0	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frpb, ped/bikes	1.00		0.94		0.99			1.00			1.00	
Flpb, ped/bikes	1.00		1.00		0.98			1.00			1.00	
Frt	1.00		0.85		0.95			1.00			0.98	
Flt Protected	0.95		1.00		0.97			1.00			1.00	
Satd. Flow (prot)	1748		1448		1708			1843			1814	
Flt Permitted	0.60		1.00		0.97			0.96			1.00	
Satd. Flow (perm)	1110		1448		1708			1780			1814	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	101	0	42	75	15	52	14	407	0	0	795	105
RTOR Reduction (vph)	0	0	37	0	17	0	0	0	0	0	2	0
Lane Group Flow (vph)	101	0	5	0	125	0	0	421	0	0	898	0
Confl. Peds. (#/hr)	1		10	10		1						
Heavy Vehicles (%)	3%	0%	5%	0%	0%	0%	0%	3%	0%	0%	3%	4%
Turn Type	Perm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					8			6			2	
Permitted Phases	4		4	8			6					
Actuated Green, G (s)	16.4		16.4		16.4			94.2			94.2	
Effective Green, g (s)	16.4		16.4		16.4			94.2			94.2	
Actuated g/C Ratio	0.13		0.13		0.13			0.73			0.73	
Clearance Time (s)	6.0		6.0		6.0			6.0			6.0	
Vehicle Extension (s)	3.0		3.0		3.0			4.0			4.0	
Lane Grp Cap (vph)	141		184		217			1299			1324	
v/s Ratio Prot											c0.50	
v/s Ratio Perm	c0.09		0.00		0.07			0.24				
v/c Ratio	0.72		0.03		0.57			0.32			0.68	
Uniform Delay, d1	54.1		49.3		53.0			6.1			9.3	
Progression Factor	1.00		1.00		1.00			1.00			1.00	
Incremental Delay, d2	15.9		0.1		3.6			0.7			2.8	
Delay (s)	69.9		49.4		56.7			6.8			12.1	
Level of Service	E		D		E			A			B	
Approach Delay (s)		63.9			56.7			6.8			12.1	
Approach LOS		E			E			A			B	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	129.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Proposed Improvement Plans

N

VT STATE PLANE GRID

NOTE: NEW SIGNAL PHASING AND TIMING PROPOSED IN ADDITION TO PHYSICAL IMPROVEMENTS. CONCURRENT PHASING OF CHARLOTTE ROAD AND LANTMAN'S DRIVEWAY IS RECOMMENDED.

VT 116

CHARLOTTE ROAD

ONE WAY

STOP

R&R

PROPOSED SIDEWALK RELOCATION

UTILITY POLE TO BE REMOVED (BY OTHERS)

REMOVE AND RESET PEDESTALS, PEDESTRIAN PUSH BUTTONS, AND SIGNAL HEADS

ONE WAY N

DO NOT ENTER N

N

LANTMAN'S DRIVEWAY

RESTRIPE CROSSWALK IN EXISTING LOCATION

REMOVE AND RESET PEDESTALS, PEDESTRIAN PUSH BUTTONS, AND SIGNAL HEADS

ROTATE LUMINAIRE TO ILLUMINATE RELOCATED SIDEWALK

RELOCATE EXISTING TREE

RESTRIPE CROSSWALK IN EXISTING LOCATION

RESTRIPE VT 116 TO SHIFT CENTERLINE EAST 2'-0"

NEW PUSHBUTTON FOR VT 116 CROSSWALK

9' 12' 12' 9'

SCALE 1" = 10'-0"

10 0 10

LEGEND

EXISTING	NEW	
		MAST ARM & POLE
		CONTROLLER CABINET
		SIGNAL HEAD WITH PHASE NO.
		PEDESTAL POST
		PEDESTRIAN PUSH BUTTON
		SIDEWALK TO BE REMOVED

SIGN LEGEND
N = NEW
R + R = REMOVE AND REPLACE

vhb

PROJECT NAME: VT 116 / CHARLOTTE ROAD
PROJECT NUMBER: 58181.00

FILE NAME: 58181.00\cad\te\58181_nul.dgn
PROJECT LEADER: EPD
DESIGNED BY: ELQ
PLOT DATE: 6/3/2019
DRAWN BY: ELQ
CHECKED BY: DMP
FIGURE 4: CONCEPTUAL INTERSECTION DESIGN
SHEET 1 OF 2

N

VT STATE PLANE GRID

VT 116

CHARLOTTE ROAD

ONLY ONLY

STOP

LANTMAN'S DRIVEWAY

PROPOSED CURB
(WB-62 DESIGN VEHICLE)

UTILITY POLE TO BE REMOVED
(BY OTHERS)

PROPOSED CURB
(WB-62 DESIGN VEHICLE)

RESTRIPE VT 116 TO SHIFT
CENTERLINE EAST 2'-0"

9' 12' 12' 9'

SCALE 1" = 10'-0"
10 0 10

PROJECT NAME:	VT 116 / CHARLOTTE ROAD
PROJECT NUMBER:	58181.00
FILE NAME: 58181.00\cad\te\58181_nul.dgn	PLOT DATE: 6/3/2019
PROJECT LEADER: EPD	DRAWN BY: ELQ
DESIGNED BY: ELQ	CHECKED BY: DMP
FIGURE 6: PROPOSED CURBLINE ADJUSTMENTS	SHEET 2 OF 2

vhb

Conceptual Cost Estimate

Computations

Project:	VT 116 / Charlotte Rd	**Project #:**	58181.00
Location:	Hinesburg, VT	**Sheet:**	
Calculated by:	ELQ	**Date:**	5/29/19
Checked by:	EPD	**Date:**	5/30/19
Title:	Conceptual Cost Estimate Calculations		

Conceptual Cost Estimates - VT 116 / Charlotte Road Intersection Design

Sidewalk Relocation and Curb Adjustments

Design Element	Unit Cost	Unit	Quantity	Total Cost
Solid Rock Excavation	$124	CY	80	$9,920
Remove and Reset Ped Signal Head and Push Buttor	$5,000	EACH	2	$10,000
5' Sidewalk with No Curb	$155	LF	125	$19,375
Removal of Existing Curb	$15	LF	125	$1,875
Vertical Granite Curb	$50	LF	135	$6,750
Transplanting Tree	$500	EACH	1	$500
SUBTOTAL				$48,420
10% Signing and Striping				$4,842
20% Contingency				$9,684
Mobilization and Traffic Control				$10,000
Engineering and Design				$15,000
Note: Solid Rock Excavation Cost Adjusted for Small Quantity			SUBTOTAL	$87,946
			ROUNDED TOTAL	**$88,000**

Computations

Project: VT 116 / Charlotte Rd | Project #: 58181.00
Location: Hinesburg, VT | Sheet:
Calculated by: ELQ | Date: 5/29/19
Checked by: | Date:
Title: Conceptual Cost Estimate Calculations

Conceptual Cost Estimates: Unit Costs

Remove and Reset Pedestrian Signal Head and Push Button

	Est. Cost	Cost Unit
Remove and Reset Ped Signal Head and Push Button	$5,000	EACH

* Source: Research of Bid History and Similar Projects

Unit Cost: $5,000 each

5' Sidewalk with No Curb

	Est. Cost	Cost Unit
5' Sidewalk with No Curb	$155	LF

* Source: Report on Shared-Use Path and Sidewalk Unit Costs. VTrans Bicycle and Pedestrian Program. August 2014)

Unit Cost: $155 per foot

Vertical Granite Curb

	Est. Cost	Cost Unit
Vertical Granite Curb	$35	LF

* Source: VTrans 2-Year Average Price List (English)

Unit Cost: $35 per foot

Solid Rock Excavation

	Est. Cost	Cost Unit
Solid Rock Excavation	$31	CY

* Source: VTrans 2-Year Average Price List (English)

Unit Cost: $31 per CY

Removal of Existing Curb

	Est. Cost	Cost Unit
Removal of Existing Curb	$10	LF

* Source: VTrans 2-Year Average Price List (English)

Unit Cost: $10 per foot

Transplanting Tree

	Est. Cost	Cost Unit
Transplanting Tree	$500	EACH

* Source: VTrans 2-Year Average Price List (English)

Unit Cost: $500 each