

TRAFFIC SIGNAL EVALUATION – OAKWOOD, OH

APPENDIX D: SIGNAL WARRANTS



FAR HILLS AVENUE AT SPRINGHOUSE ROAD/OLD RIVER TRAIL

This four-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 75 vehicles when evaluating Condition B. There are eight hours for which this threshold is met as a single lane approach. *Warrant #1 is satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 5A**) results in the following:

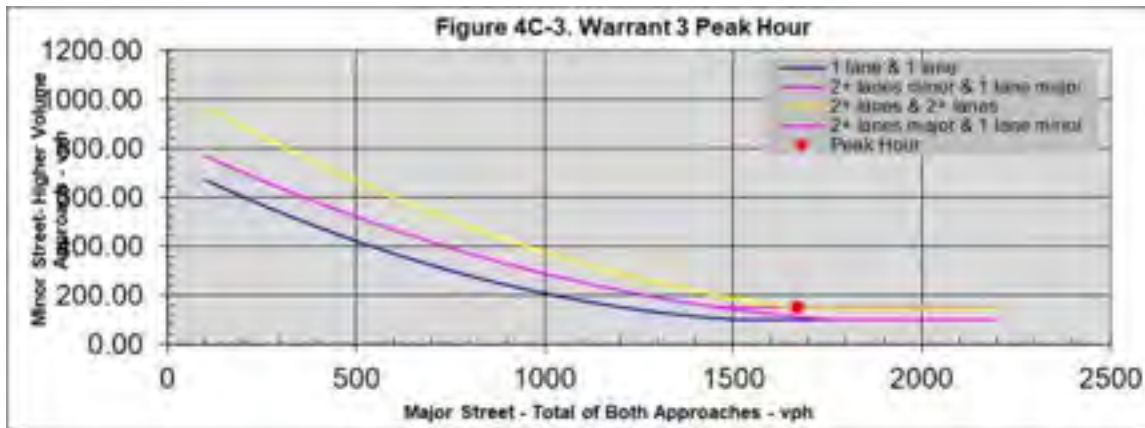
FIGURE 5A: SPRINGHOUSE ROAD/OLD RIVER TRAIL WARRANT #2



Five of the ten measured hours have major and minor street volume-pairs exceeding the thresholds of warrant #2. *Warrant #2 is satisfied.*

Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 5B**) results in the following:

FIGURE 5B: SPRINGHOUSE ROAD/OLD RIVER TRAIL WARRANT #3



The higher minor street volume is 38 vehicles more than the 112 vehicle threshold.
Warrant #3 is satisfied.

The existing traffic signal at the Far Hills Avenue & Springhouse Road/Old River Trail intersection is **warranted** as it meets warrants #1, #2, #3 with unadjusted volumes.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/11/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/22/2022
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

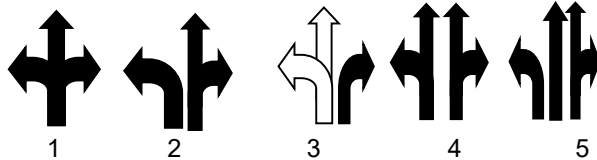
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Springhouse/Old River

Minor Street Approach Configuration: 3 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	Yes	Condition B was met.
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes	Figure 4C-1 (100%)
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

Peak Hour
4:30 PM
5:30 PM

Peak Hour
5:00 PM
6:00 PM

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
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Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes Major Minor		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
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5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	181	12																
6:30 AM	443	27			1									1				
6:45 AM	767	59	1					1	1	1		1				1	1	
7:00 AM	1126	92					1	1										
7:15 AM	1239	95																
7:30 AM	1256	96			1									1	1			
7:45 AM	1187	90	1					1	1	1		1	1			1	1	
8:00 AM	1090	81					1	1										
8:15 AM	796	66																
8:30 AM	517	50			1									1				
8:45 AM	262	24																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Springhouse-Old River Trail (9-22-22 Data)

10:00 AM	0	0																	
10:15 AM	204	15																	
10:30 AM	459	28		1									1						
10:45 AM	700	43	1					1		1							1	1	
11:00 AM	927	55				1						1							
11:15 AM	985	70																	
11:30 AM	947	78		1													1		
11:45 AM	930	93	1					1	1	1								1	1
12:00 PM	920	97				1	1						1	1					
12:15 PM	658	67																	
12:30 PM	441	46		1														1	
12:45 PM	217	16																	
1:00 PM	0	0																	
1:15 PM	254	20																	
1:30 PM	507	56		1						1							1		1
1:45 PM	796	87	1					1	1				1	1					
2:00 PM	1077	116				1	1												
2:15 PM	1102	130																	
2:30 PM	1164	137		1	1					1	1						1	1	1
2:45 PM	1203	144	1					1	1				1	1					
3:00 PM	1231	150				1	1												
3:15 PM	1269	143																	
3:30 PM	1301	119		1	1					1							1	1	1
3:45 PM	1374	101	1					1	1				1	1					
4:00 PM	1450	88				1	1												
4:15 PM	1590	83																	
4:30 PM	1671	87		1						1							1	1	1
4:45 PM	1632	90	1					1	1				1	1					
5:00 PM	1588	85				1	1												
5:15 PM	1429	93																	
5:30 PM	1239	99		1						1							1	1	1
5:45 PM	1132	95	1					1	1				1	1					
6:00 PM	1018	98				1	1												
6:15 PM	720	68																	
6:30 PM	482	39		1						1							1		
6:45 PM	227	22																	
7:00 PM	0	0																	
7:15 PM	0	0																	
7:30 PM	0	0																	
7:45 PM	0	0																	
8:00 PM	0	0																	
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8:30 PM	0	0																	
8:45 PM	0	0																	
9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			9	0	12	2	9	8	9	8	10	1	9	7	12	5	9	9	
WARRANT SATISFIED?			NO		N/A		YES		N/A				NO				NO		

Warrant Met: **Yes**

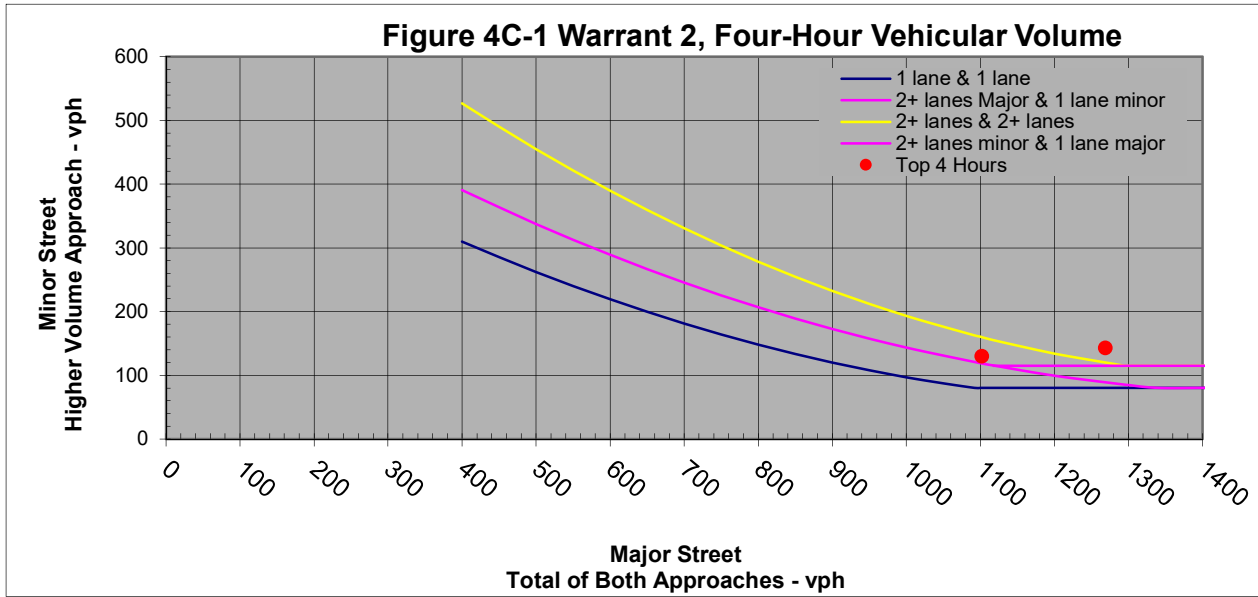
Notes: **Condition B was met.**

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	5
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	8
Minor Street: 1 Lane		

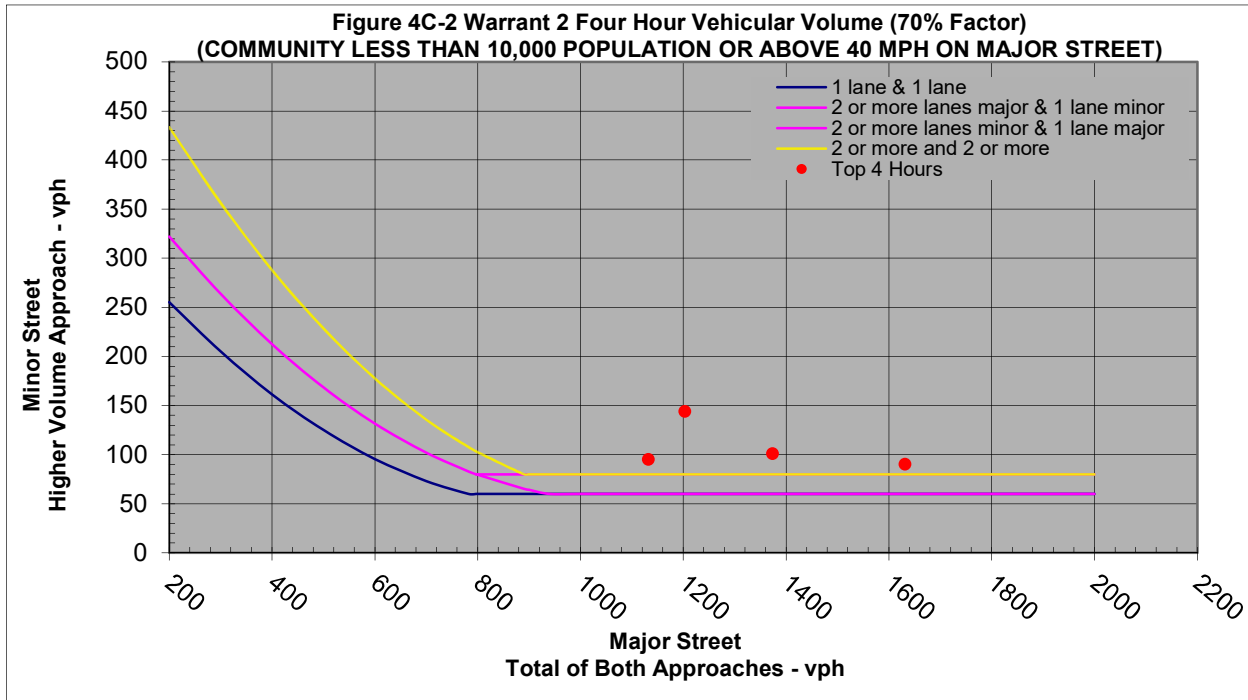
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
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Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Springhouse/Old River					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	116	65	12	2	181	12		
6:30 AM	289	154	27	10	443	27		
6:45 AM	505	262	59	15	767	59		
7:00 AM	738	388	92	25	1126	92		Met
7:15 AM	810	429	95	38	1239	95	Met	
7:30 AM	826	430	96	43	1256	96		
7:45 AM	782	405	90	43	1187	90		
8:00 AM	691	399	81	40	1090	81		Met
8:15 AM	503	293	66	25	796	66		
8:30 AM	314	203	50	12	517	50		
8:45 AM	142	120	24	7	262	24		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	94	110	15	2	204	15		
10:30 AM	214	245	28	3	459	28		
10:45 AM	315	385	43	7	700	43		
11:00 AM	435	492	55	12	927	55		
11:15 AM	465	520	70	13	985	70		Met
11:30 AM	447	500	78	16	947	78		
11:45 AM	443	487	93	23	930	93		
12:00 PM	432	488	97	25	920	97		
12:15 PM	308	350	67	22	658	67		
12:30 PM	206	235	46	18	441	46		
12:45 PM	109	108	16	7	217	16		
1:00 PM	0	0	0	0	0	0		
1:15 PM	102	152	20	4	254	20		
1:30 PM	216	291	56	10	507	56		
1:45 PM	328	468	87	13	796	87		Met
2:00 PM	458	619	116	16	1077	116		
2:15 PM	479	623	130	21	1102	130	Met	
2:30 PM	499	665	137	18	1164	137		
2:45 PM	525	678	144	21	1203	144		Met
3:00 PM	519	712	150	21	1231	150		
3:15 PM	508	761	143	13	1269	143	Met	
3:30 PM	509	792	119	14	1301	119		
3:45 PM	502	872	101	22	1374	101		Met
4:00 PM	511	939	88	33	1450	88		
4:15 PM	567	1023	83	45	1590	83	Met	
4:30 PM	616	1055	87	59	1671	87		
4:45 PM	637	995	90	64	1632	90		Met
5:00 PM	679	909	85	61	1588	85		
5:15 PM	666	763	93	64	1429	93	Met	
5:30 PM	602	637	99	66	1239	99		
5:45 PM	554	578	95	64	1132	95		Met
6:00 PM	491	527	98	75	1018	98		
6:15 PM	336	384	68	59	720	68		
6:30 PM	216	266	39	39	482	39		
6:45 PM	112	115	20	22	227	22		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	3:15 PM	4:15 PM	1269	143
2nd Highest Hour	5:15 PM	6:15 PM	1429	93
3rd Highest Hour	2:15 PM	3:15 PM	1102	130
4th Highest Hour	4:15 PM	5:15 PM	1590	83

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	2:45 PM	3:45 PM	1203	144
2nd Highest Hour	3:45 PM	4:45 PM	1374	101
3rd Highest Hour	4:45 PM	5:45 PM	1632	90
4th Highest Hour	5:45 PM	6:45 PM	1132	95



Are the requirements for Warrant 2 met?: Yes

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:30 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:30 PM

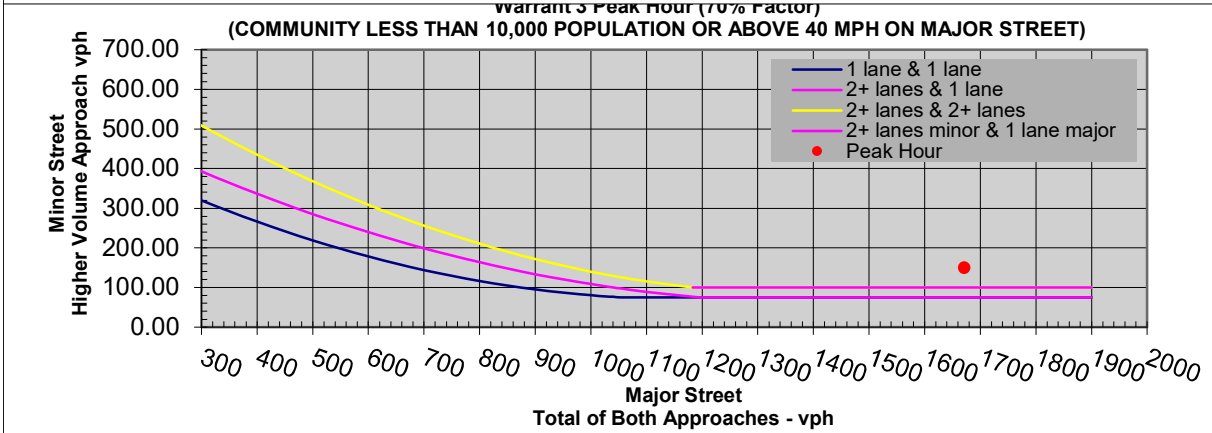
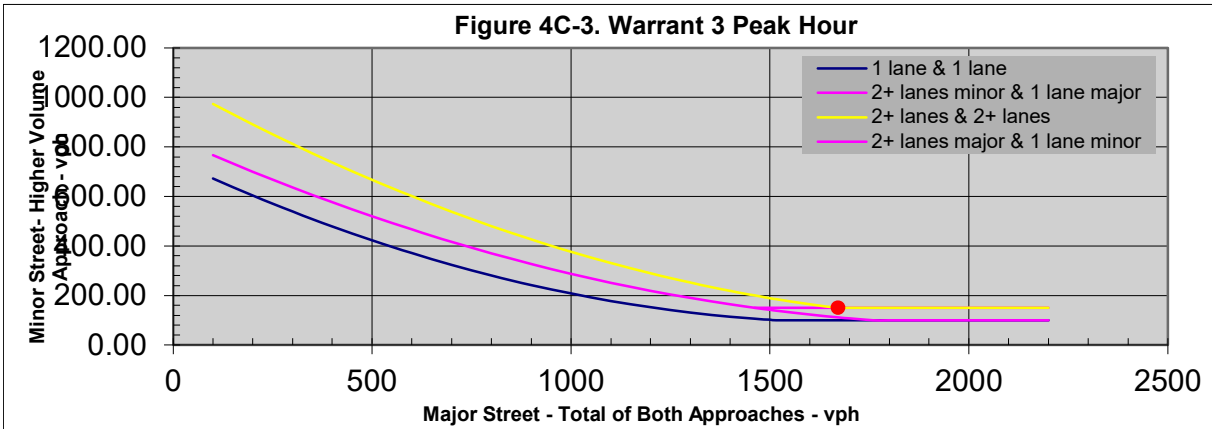
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
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Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
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Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**



Signal Warrant SR 48 and Springhouse-Old River Trail (9-22-22 Data)

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	181	12	193	195
6:30 AM	443	27	470	480
6:45 AM	767	59	826	841
7:00 AM	1126	92	1218	1243
7:15 AM	1239	95	1334	1372
7:30 AM	1256	96	1352	1395
7:45 AM	1187	90	1277	1320
8:00 AM	1090	81	1171	1211
8:15 AM	796	66	862	887
8:30 AM	517	50	567	579
8:45 AM	262	24	286	293
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	204	15	219	221
10:30 AM	459	28	487	490
10:45 AM	700	43	743	750
11:00 AM	927	55	982	994
11:15 AM	985	70	1055	1068
11:30 AM	947	78	1025	1041
11:45 AM	930	93	1023	1046
12:00 PM	920	97	1017	1042
12:15 PM	658	67	725	747
12:30 PM	441	46	487	505
12:45 PM	217	16	233	240
1:00 PM	0	0	0	0
1:15 PM	254	20	274	278
1:30 PM	507	56	563	573
1:45 PM	796	87	883	896
2:00 PM	1077	116	1193	1209
2:15 PM	1102	130	1232	1253
2:30 PM	1164	137	1301	1319
2:45 PM	1203	144	1347	1368
3:00 PM	1231	150	1381	1402
3:15 PM	1269	143	1412	1425
3:30 PM	1301	119	1420	1434
3:45 PM	1374	101	1475	1497
4:00 PM	1450	88	1538	1571
4:15 PM	1590	83	1673	1718
4:30 PM	1671	87	1758	1817
4:45 PM	1632	90	1722	1786
5:00 PM	1588	85	1673	1734
5:15 PM	1429	93	1522	1586
5:30 PM	1239	99	1338	1404
5:45 PM	1132	95	1227	1291
6:00 PM	1018	98	1116	1191
6:15 PM	720	68	788	847
6:30 PM	482	39	521	560
6:45 PM	227	22	249	269
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1671	150	112	75

FAR HILLS AVENUE AT SCHANTZ AVENUE

This four-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. Only four hours of traffic data were collected at this intersection since it was expected to meet Warrants #2 and #3 at a minimum. *Warrant #1 is n/a.*

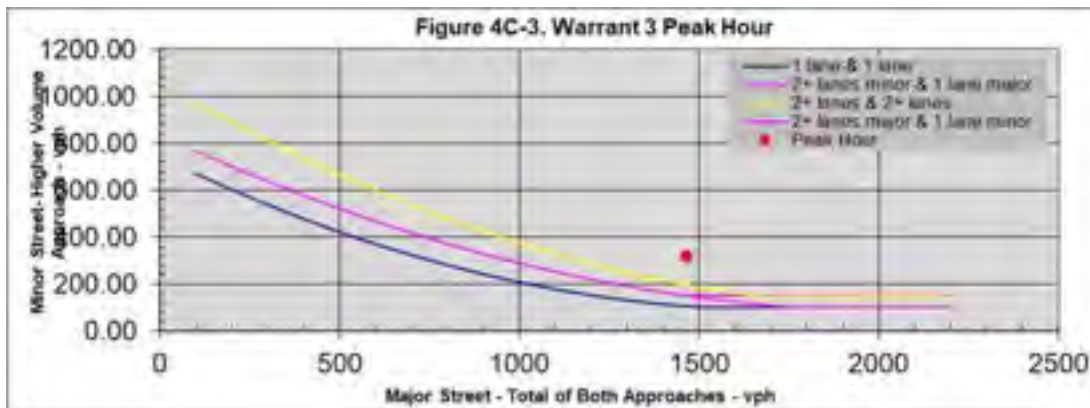
Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 6A**) resulted in all four volume pairs exceeding warrant #2 threshold. *Warrant #2 is satisfied.*

FIGURE 6A: SCHANTZ AVENUE WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 6B**) resulted in the volume pair exceeding warrant #3 threshold. *Warrant #3 is satisfied.*

FIGURE 6B: SCHANTZ AVENUE WARRANT #3



The existing traffic signal at the Far Hills Avenue & Schantz Avenue intersection **is warranted** as it meets signal warrant #2 and warrant #3.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/6/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/8/2022
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

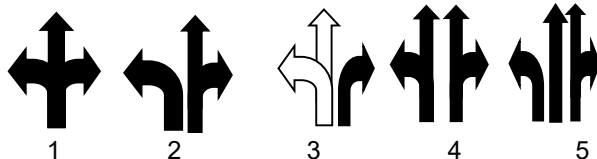
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Schantz

Minor Street Approach Configuration: 5 E-Bound
2 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No	
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes	Figure 4C-1 (100%)
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

Peak Hour
4:30 PM
5:30 PM

Peak Hour
4:30 PM
5:30 PM

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
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Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
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6:00 AM	0	0																
6:15 AM	177	14																
6:30 AM	412	29													1			
6:45 AM	747	72	1		1				1	1	1		1	1			1	1
7:00 AM	1148	117					1	1										
7:15 AM	1276	132																
7:30 AM	1322	149													1	1		
7:45 AM	1221	137	1		1	1			1	1	1	1	1	1			1	1
8:00 AM	1087	126					1	1										
8:15 AM	782	97																
8:30 AM	501	65													1			
8:45 AM	267	34																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Schantz

10:00 AM	0	0																
10:15 AM	0	0																
10:30 AM	0	0																
10:45 AM	0	0																
11:00 AM	0	0																
11:15 AM	0	0																
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3:00 PM	0	0																
3:15 PM	312	51																
3:30 PM	585	109			1	1				1				1	1	1	1	
3:45 PM	952	172	1	1				1	1	1	1			1	1			
4:00 PM	1269	238																
4:15 PM	1338	284																
4:30 PM	1464	312			1	1					1	1			1	1	1	1
4:45 PM	1417	320	1	1				1	1	1	1			1	1			
5:00 PM	1418	292																
5:15 PM	1037	195																
5:30 PM	638	109			1	1					1				1	1	1	1
5:45 PM	318	38																
6:00 PM	0	0																
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9:45 PM	0	0																
HOURS MET			4	2	5	4	4	4	4	4	5	2	4	4	6	4	5	5
WARRANT SATISFIED?			NO		N/A		NO		N/A				NO				NO	

Warrant Met: **No**

Notes:

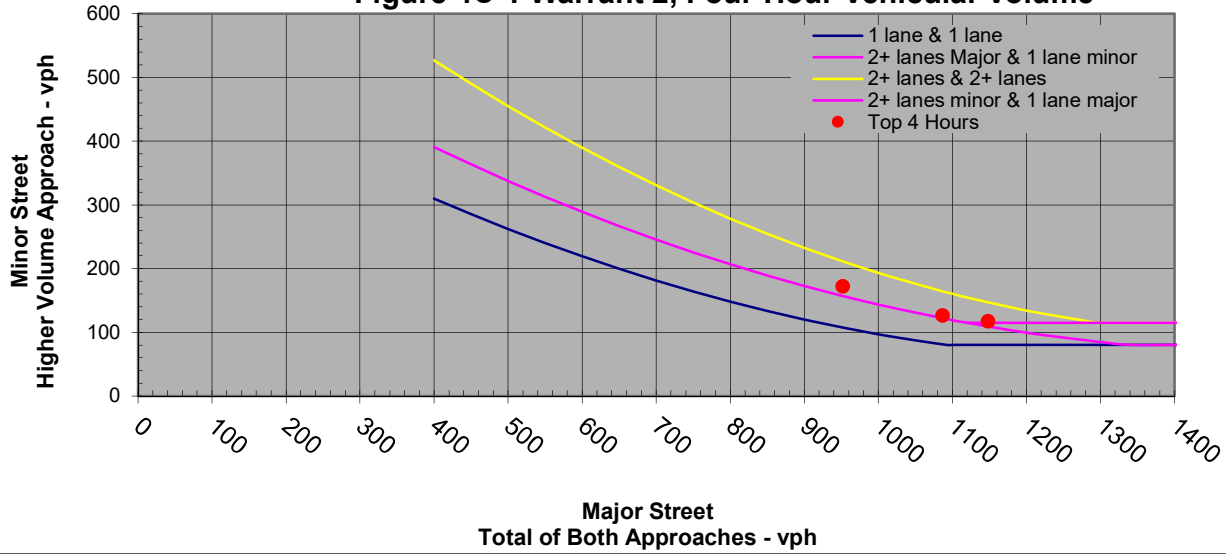
OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	4
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	4
Minor Street: 1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Schantz					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	121	56	10	14	177	14		
6:30 AM	294	118	25	29	412	29		
6:45 AM	538	209	47	72	747	72		
7:00 AM	821	327	73	117	1148	117	Met	Met
7:15 AM	904	372	76	132	1276	132		
7:30 AM	924	398	72	149	1322	149		
7:45 AM	843	378	65	137	1221	137		
8:00 AM	722	365	53	126	1087	126	Met	Met
8:15 AM	518	264	40	97	782	97		
8:30 AM	325	176	29	65	501	65		
8:45 AM	162	105	14	34	267	34		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	0	0	0	0	0	0		
10:30 AM	0	0	0	0	0	0		
10:45 AM	0	0	0	0	0	0		
11:00 AM	0	0	0	0	0	0		
11:15 AM	0	0	0	0	0	0		
11:30 AM	0	0	0	0	0	0		
11:45 AM	0	0	0	0	0	0		
12:00 PM	0	0	0	0	0	0		
12:15 PM	0	0	0	0	0	0		
12:30 PM	0	0	0	0	0	0		
12:45 PM	0	0	0	0	0	0		
1:00 PM	0	0	0	0	0	0		
1:15 PM	0	0	0	0	0	0		
1:30 PM	0	0	0	0	0	0		
1:45 PM	0	0	0	0	0	0		
2:00 PM	0	0	0	0	0	0		
2:15 PM	0	0	0	0	0	0		
2:30 PM	0	0	0	0	0	0		
2:45 PM	0	0	0	0	0	0		
3:00 PM	0	0	0	0	0	0		
3:15 PM	124	188	23	51	312	51		
3:30 PM	236	349	50	109	585	109		
3:45 PM	364	588	79	172	952	172	Met	Met
4:00 PM	487	782	99	238	1269	238		
4:15 PM	500	838	101	284	1338	284		
4:30 PM	595	869	94	312	1464	312		
4:45 PM	614	803	87	320	1417	320	Met	Met
5:00 PM	685	733	79	292	1418	292		
5:15 PM	548	489	54	195	1037	195		
5:30 PM	341	297	34	109	638	109		
5:45 PM	194	124	12	38	318	38		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		

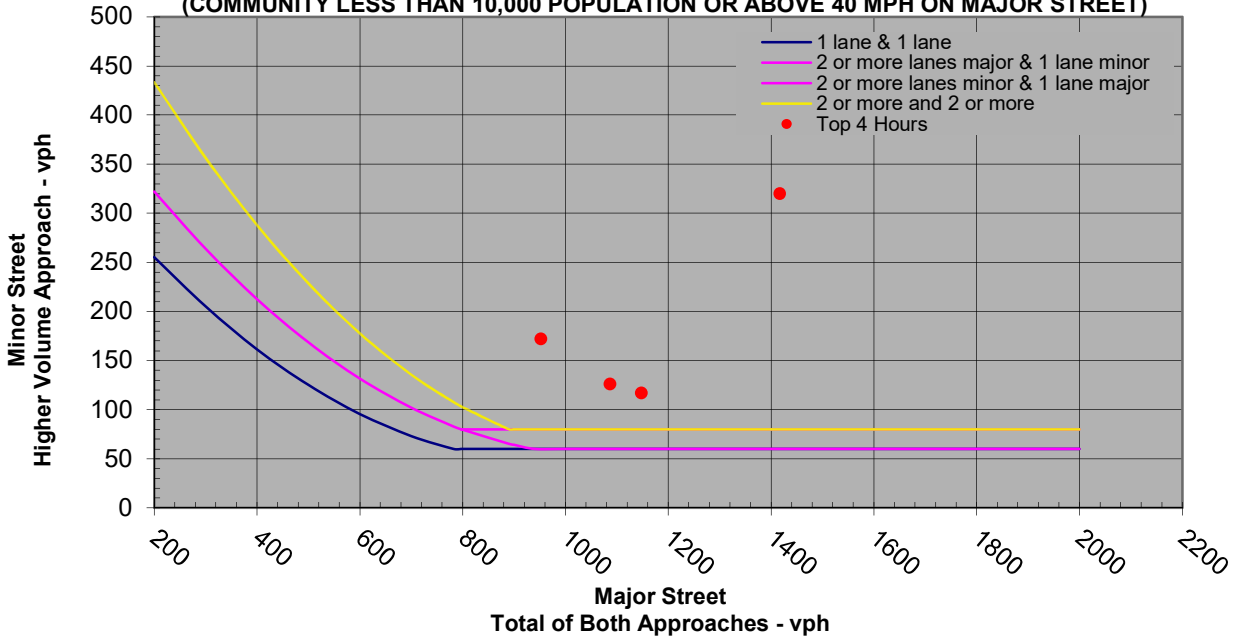
Figure 4C-1 Warrant 2, Four-Hour Vehicular Volume



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	1417	320
2nd Highest Hour	3:45 PM	4:45 PM	952	172
3rd Highest Hour	7:00 AM	8:00 AM	1148	117
4th Highest Hour	8:00 AM	9:00 AM	1087	126

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	1417	320
2nd Highest Hour	3:45 PM	4:45 PM	952	172
3rd Highest Hour	7:00 AM	8:00 AM	1148	117
4th Highest Hour	8:00 AM	9:00 AM	1087	126

**Figure 4C-2 Warrant 2 Four Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**



Are the requirements for Warrant 2 met?: Yes

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:30 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:30 PM

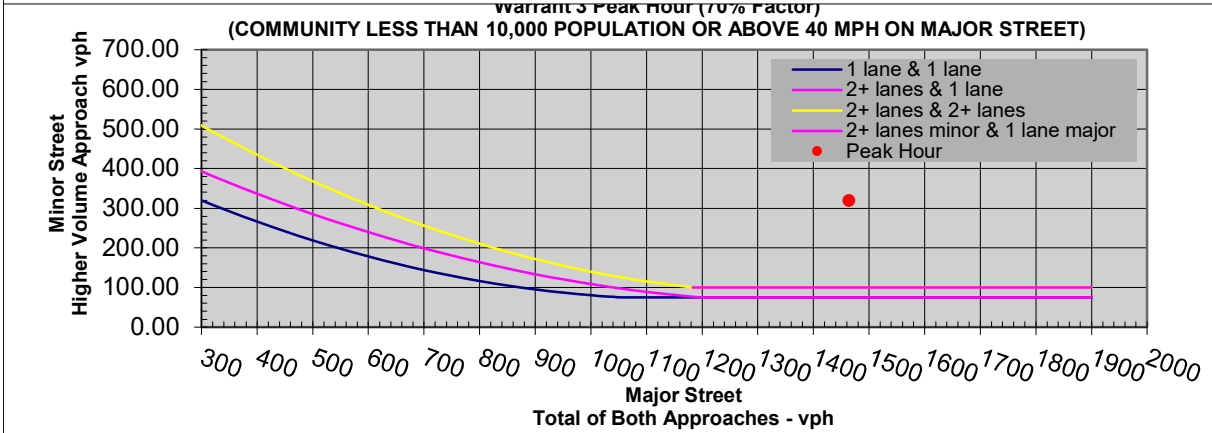
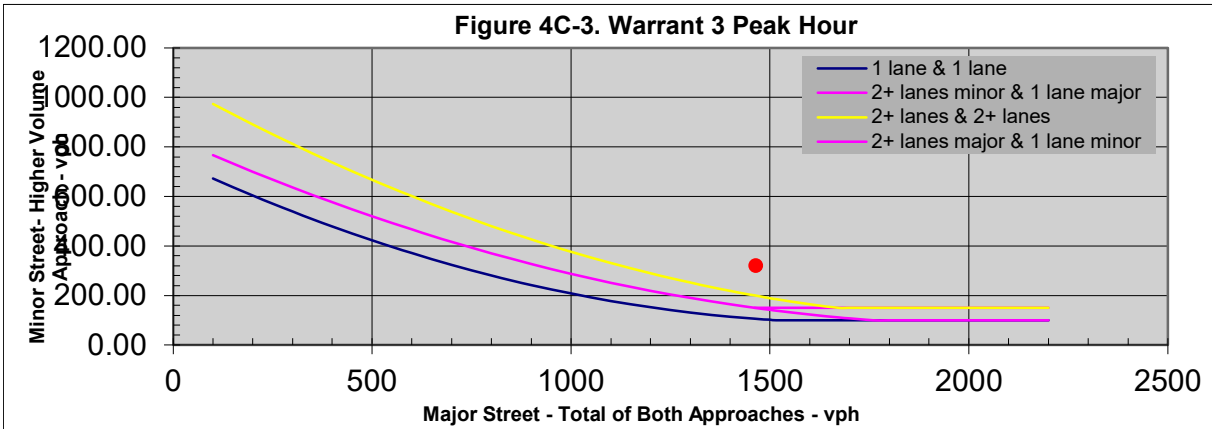
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**



Signal Warrant SR 48 and Schantz

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	177	14	191	201
6:30 AM	412	29	441	466
6:45 AM	747	72	819	866
7:00 AM	1148	117	1265	1338
7:15 AM	1276	132	1408	1484
7:30 AM	1322	149	1471	1543
7:45 AM	1221	137	1358	1423
8:00 AM	1087	126	1213	1266
8:15 AM	782	97	879	919
8:30 AM	501	65	566	595
8:45 AM	267	34	301	315
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	0	0	0	0
10:30 AM	0	0	0	0
10:45 AM	0	0	0	0
11:00 AM	0	0	0	0
11:15 AM	0	0	0	0
11:30 AM	0	0	0	0
11:45 AM	0	0	0	0
12:00 PM	0	0	0	0
12:15 PM	0	0	0	0
12:30 PM	0	0	0	0
12:45 PM	0	0	0	0
1:00 PM	0	0	0	0
1:15 PM	0	0	0	0
1:30 PM	0	0	0	0
1:45 PM	0	0	0	0
2:00 PM	0	0	0	0
2:15 PM	0	0	0	0
2:30 PM	0	0	0	0
2:45 PM	0	0	0	0
3:00 PM	0	0	0	0
3:15 PM	312	51	363	386
3:30 PM	585	109	694	744
3:45 PM	952	172	1124	1203
4:00 PM	1269	238	1507	1606
4:15 PM	1338	284	1622	1723
4:30 PM	1464	312	1776	1870
4:45 PM	1417	320	1737	1824
5:00 PM	1418	292	1710	1789
5:15 PM	1037	195	1232	1286
5:30 PM	638	109	747	781
5:45 PM	318	38	356	368
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1464	320	149	75

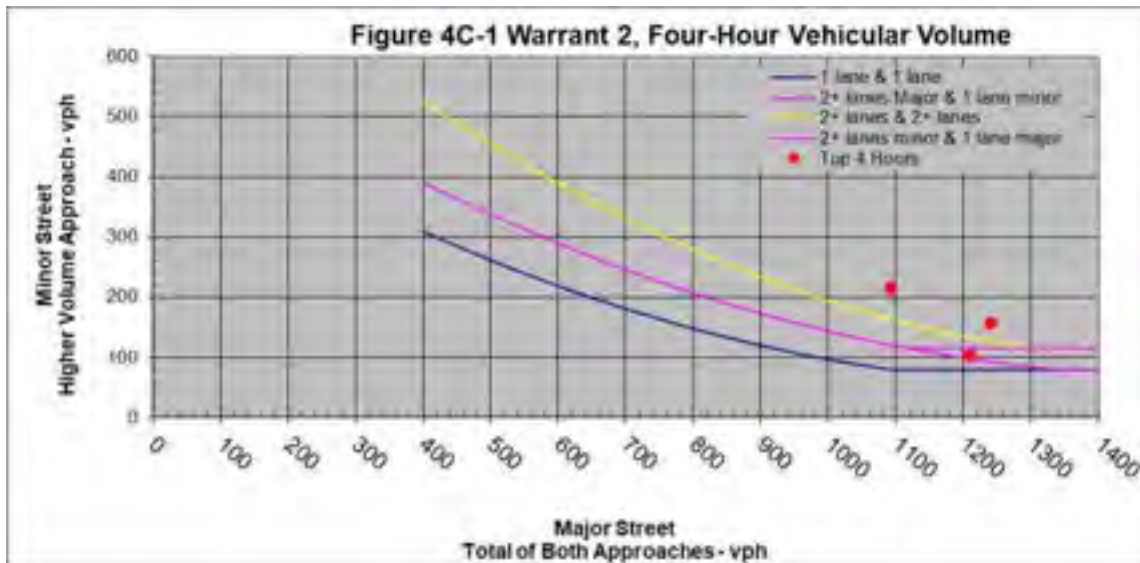
FAR HILLS AVENUE AT OAKWOOD AVENUE/THRUSTON BOULEVARD

This six-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approaches, resulting in the following:

Warrant #1. Only four hours of traffic data were collected at this intersection since it was expected to meet Warrants #2 and #3 at a minimum. *Warrant #1 is n/a.*

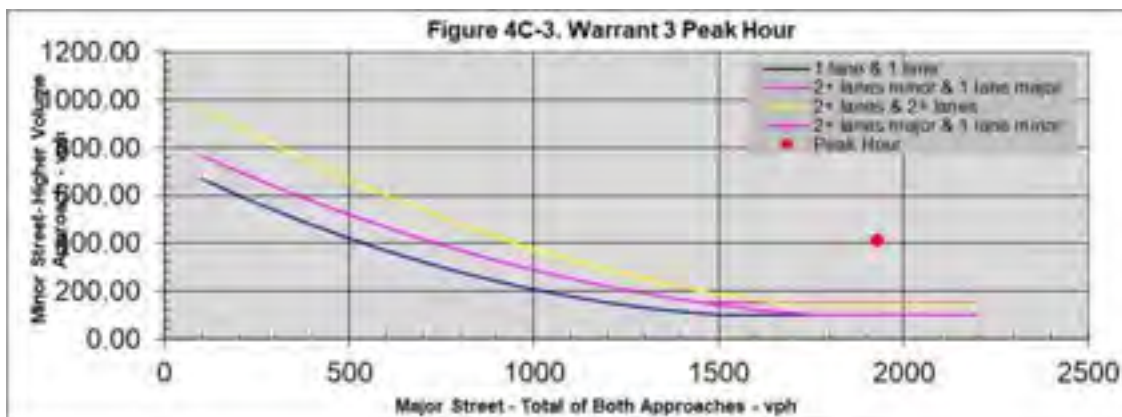
Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 7A**) resulted in all four volume pairs exceeding warrant #2 threshold. *Warrant #2 is satisfied.*

FIGURE 7A: OAKWOOD AVENUE/THRUSTON BOULEVARD WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 7B**) resulted in the volume pair exceeding warrant #3 threshold. *Warrant #3 is satisfied.*

FIGURE 7B: OAKWOOD AVENUE/THRUSTON BOULEVARD WARRANT #3



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/1/2022
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

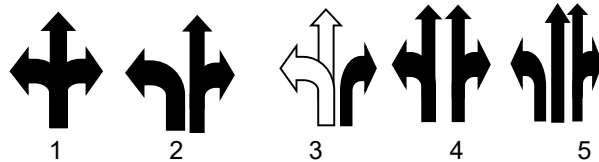
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Oakwood/Thruston

Minor Street Approach Configuration: 1 E-Bound
4 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No	
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes	Figure 4C-1 (100%)
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
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Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes Major Minor		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
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6:15 AM	198	23																
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6:45 AM	835	75	1					1	1	1		1	1			1	1	
7:00 AM	1210	103					1	1										
7:15 AM	1350	120																
7:30 AM	1435	142			1	1								1	1			
7:45 AM	1345	154	1	1				1	1	1	1	1	1			1	1	
8:00 AM	1241	157					1	1										
8:15 AM	903	117																
8:30 AM	559	70			1									1				
8:45 AM	271	31																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Oakwood-Thruston

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3:30 PM	728	131	1		1	1			1	1	1	1	1	1			1	1
3:45 PM	1092	215					1	1										
4:00 PM	1780	375																
4:15 PM	1828	397												1	1			
4:30 PM	1891	413	1	1	1	1			1	1	1	1	1	1			1	1
4:45 PM	1928	413					1	1										
5:00 PM	1596	295																
5:15 PM	1175	208												1	1			
5:30 PM	757	126	1		1	1			1	1	1	1	1	1			1	1
5:45 PM	356	42																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
7:00 PM	0	0																
7:15 PM	0	0																
7:30 PM	0	0																
7:45 PM	0	0																
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8:15 PM	0	0																
8:30 PM	0	0																
8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			5	2	6	4	4	4	5	5	5	4	5	5	6	3	5	5
WARRANT SATISFIED?			NO		N/A		NO		N/A		NO		NO		NO		NO	

Warrant Met: **No**

Notes:

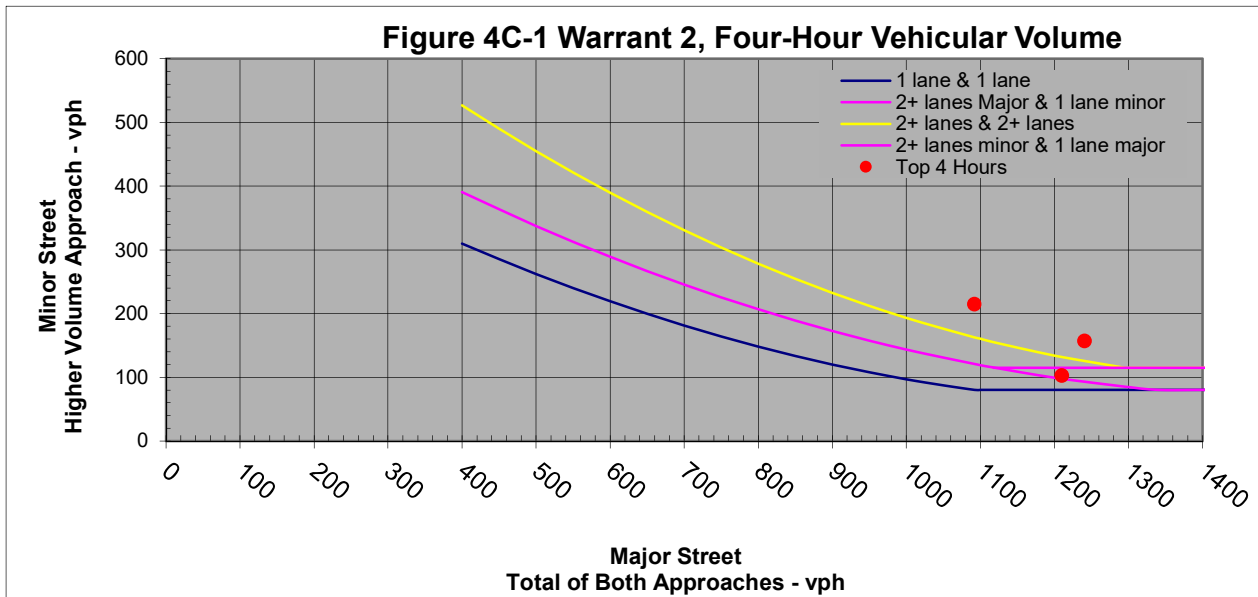
OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	4
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	5
Minor Street: 1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Oakwood/Thruston					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	143	55	23	6	198	23		
6:30 AM	346	111	48	8	457	48		
6:45 AM	640	195	75	15	835	75		Met
7:00 AM	923	287	103	21	1210	103	Met	
7:15 AM	1030	320	120	27	1350	120		
7:30 AM	1106	329	142	50	1435	142		
7:45 AM	1039	306	154	55	1345	154		Met
8:00 AM	944	297	157	51	1241	157	Met	
8:15 AM	694	209	117	39	903	117		
8:30 AM	415	144	70	14	559	70		
8:45 AM	188	83	31	2	271	31		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	0	0	0	0	0	0		
10:30 AM	0	0	0	0	0	0		
10:45 AM	0	0	0	0	0	0		
11:00 AM	0	0	0	0	0	0		
11:15 AM	0	0	0	0	0	0		
11:30 AM	0	0	0	0	0	0		
11:45 AM	0	0	0	0	0	0		
12:00 PM	0	0	0	0	0	0		
12:15 PM	0	0	0	0	0	0		
12:30 PM	0	0	0	0	0	0		
12:45 PM	0	0	0	0	0	0		
1:00 PM	0	0	0	0	0	0		
1:15 PM	0	0	0	0	0	0		
1:30 PM	0	0	0	0	0	0		
1:45 PM	0	0	0	0	0	0		
2:00 PM	0	0	0	0	0	0		
2:15 PM	0	0	0	0	0	0		
2:30 PM	0	0	0	0	0	0		
2:45 PM	0	0	0	0	0	0		
3:00 PM	0	0	0	0	0	0		
3:15 PM	191	182	65	6	373	65		
3:30 PM	341	387	131	11	728	131		Met
3:45 PM	492	600	215	16	1092	215	Met	
4:00 PM	681	1099	375	20	1780	375		
4:15 PM	686	1142	397	20	1828	397		
4:30 PM	756	1135	413	19	1891	413		Met
4:45 PM	805	1123	413	19	1928	413	Met	
5:00 PM	827	769	295	20	1596	295		
5:15 PM	631	544	208	14	1175	208		
5:30 PM	411	346	126	10	757	126		Met
5:45 PM	211	145	42	5	356	42		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		

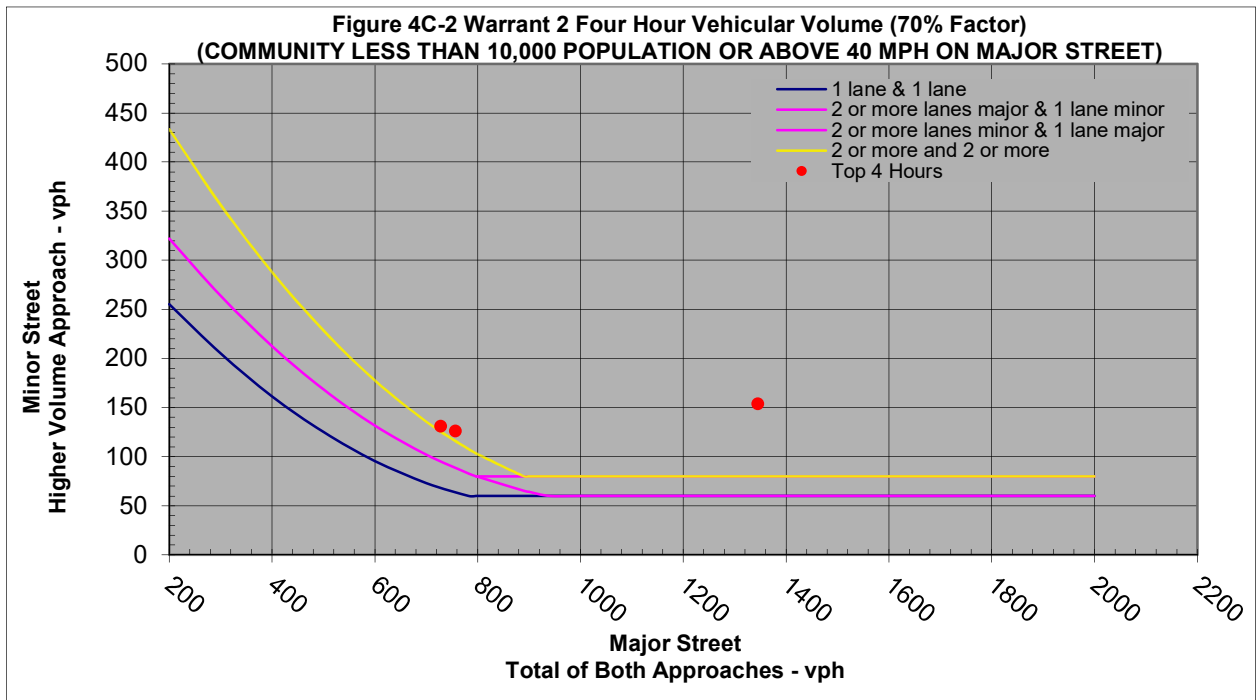
Figure 4C-1 Warrant 2, Four-Hour Vehicular Volume



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	1928	413
2nd Highest Hour	3:45 PM	4:45 PM	1092	215
3rd Highest Hour	8:00 AM	9:00 AM	1241	157
4th Highest Hour	7:00 AM	8:00 AM	1210	103

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	1891	413
2nd Highest Hour	7:45 AM	8:45 AM	1345	154
3rd Highest Hour	5:30 PM	6:30 PM	757	126
4th Highest Hour	3:30 PM	4:30 PM	728	131

**Figure 4C-2 Warrant 2 Four Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**



Are the requirements for Warrant 2 met?: Yes

OMUTCD WARRANT 3, PEAK HOUR			
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time	4:45 PM
Major Street:	2 or More Lanes	Peak Hour End Time	5:45 PM
Minor Street:	1 Lane		

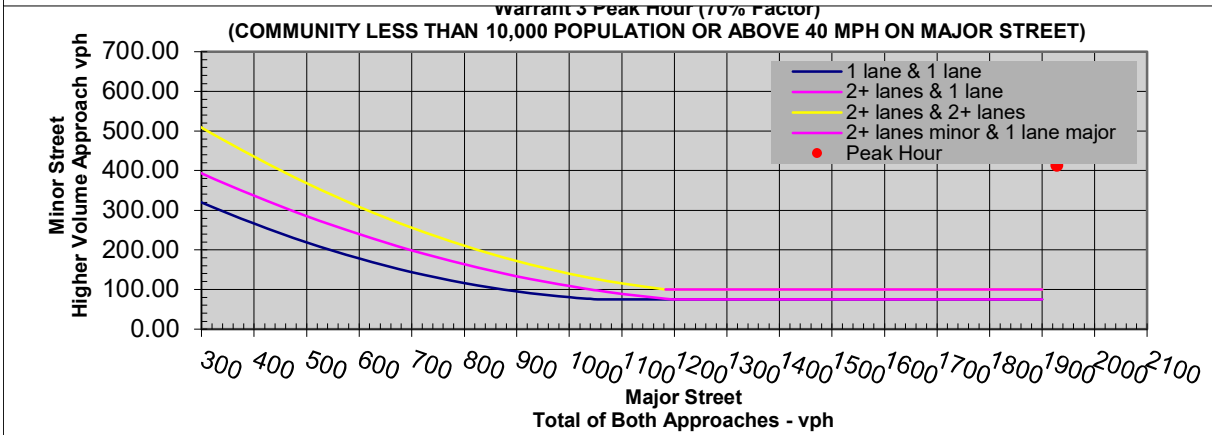
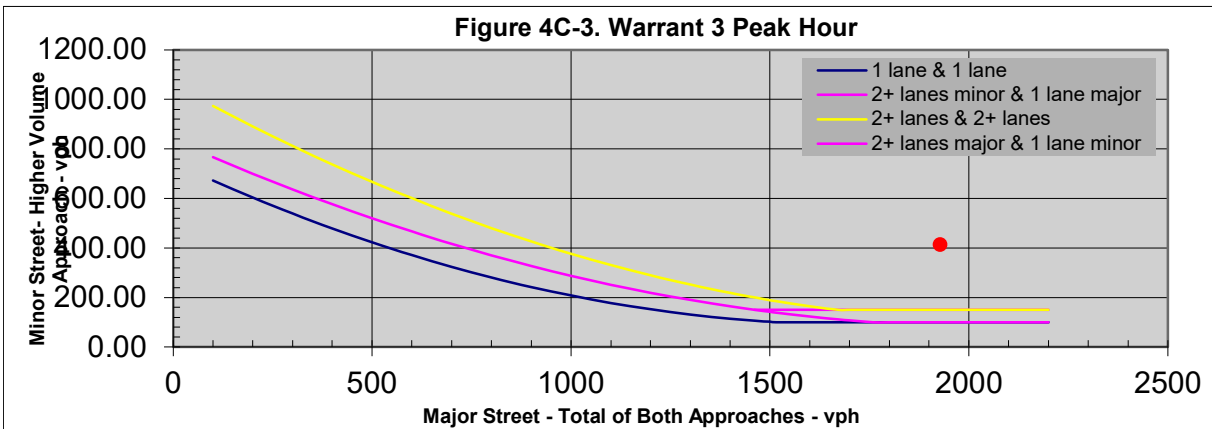
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**



Signal Warrant SR 48 and Oakwood-Thruston

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	198	23	221	227
6:30 AM	457	48	505	513
6:45 AM	835	75	910	925
7:00 AM	1210	103	1313	1334
7:15 AM	1350	120	1470	1497
7:30 AM	1435	142	1577	1627
7:45 AM	1345	154	1499	1554
8:00 AM	1241	157	1398	1449
8:15 AM	903	117	1020	1059
8:30 AM	559	70	629	643
8:45 AM	271	31	302	304
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	0	0	0	0
10:30 AM	0	0	0	0
10:45 AM	0	0	0	0
11:00 AM	0	0	0	0
11:15 AM	0	0	0	0
11:30 AM	0	0	0	0
11:45 AM	0	0	0	0
12:00 PM	0	0	0	0
12:15 PM	0	0	0	0
12:30 PM	0	0	0	0
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1:00 PM	0	0	0	0
1:15 PM	0	0	0	0
1:30 PM	0	0	0	0
1:45 PM	0	0	0	0
2:00 PM	0	0	0	0
2:15 PM	0	0	0	0
2:30 PM	0	0	0	0
2:45 PM	0	0	0	0
3:00 PM	0	0	0	0
3:15 PM	373	65	438	444
3:30 PM	728	131	859	870
3:45 PM	1092	215	1307	1323
4:00 PM	1780	375	2155	2175
4:15 PM	1828	397	2225	2245
4:30 PM	1891	413	2304	2323
4:45 PM	1928	413	2341	2360
5:00 PM	1596	295	1891	1911
5:15 PM	1175	208	1383	1397
5:30 PM	757	126	883	893
5:45 PM	356	42	398	403
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1928	413	100	75

The existing traffic signal at the Far Hills Avenue & Oakwood Avenue/Thruston Boulevard intersection **is warranted** as it meets signal warrant #2 and warrant #3.

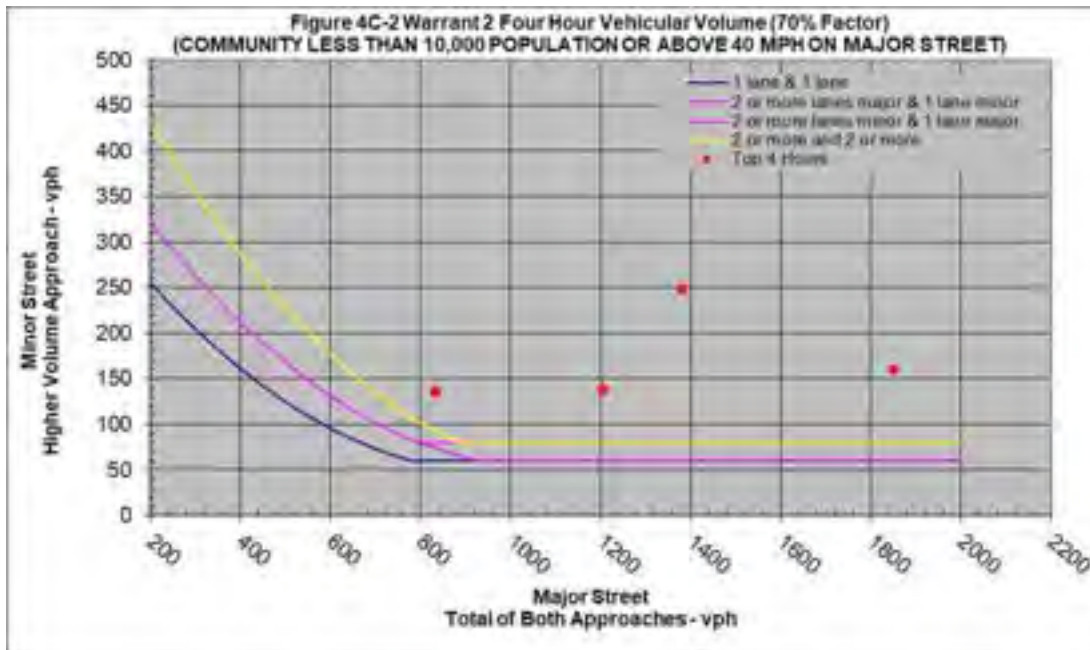
FAR HILLS AVENUE AT PATTERSON ROAD

This three-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. Only four hours of traffic data were collected at this intersection since it was expected to meet Warrants #2 and #3 at a minimum. *Warrant #1 is n/a.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 8A**) resulted in all four volume pairs exceeding warrant #2 threshold. *Warrant #2 is satisfied.*

FIGURE 8A: PATTERSON ROAD WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 8B**) resulted in the volume pair exceeding warrant #3 threshold. *Warrant #3 is satisfied.*

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/6/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/8/2022
Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 3

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

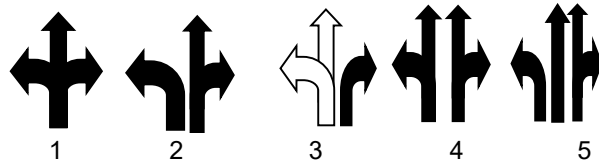
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Patterson

Minor Street Approach Configuration: 2 E-Bound
W-Bound



Number of Thru Lanes on Each Minor Street Approach: 2 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No	
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes	Figure 4C-1 (100%)
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-10
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	2 or More Lanes

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+		X	600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
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5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	180	33																
6:30 AM	476	68			1									1				
6:45 AM	834	135	1					1	1	1		1	1			1	1	
7:00 AM	1221	198					1	1										
7:15 AM	1420	221																
7:30 AM	1438	263			1	1								1	1			
7:45 AM	1383	248	1	1				1	1	1	1	1	1			1	1	
8:00 AM	1352	237					1	1										
8:15 AM	973	181																
8:30 AM	659	104			1									1				
8:45 AM	356	52																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Patterson

10:00 AM	0	0																	
10:15 AM	0	0																	
10:30 AM	0	0																	
10:45 AM	0	0																	
11:00 AM	0	0																	
11:15 AM	0	0																	
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2:30 PM	0	0																	
2:45 PM	0	0																	
3:00 PM	0	0																	
3:15 PM	401	52											1						
3:30 PM	757	84	1		1				1	1	1		1	1			1	1	
3:45 PM	1205	137					1	1											
4:00 PM	1650	167																	
4:15 PM	1757	153												1	1				
4:30 PM	1899	170	1		1	1			1	1	1	1	1	1			1	1	
4:45 PM	1851	159					1	1											
5:00 PM	1785	162																	
5:15 PM	1277	124											1	1					
5:30 PM	779	75	1		1				1	1	1		1				1	1	
5:45 PM	379	33																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			5	1	6	2	4	4	5	5	5	2	5	4	6	3	5	5	
WARRANT SATISFIED?			NO		N/A		NO		N/A		NO		NO		NO		NO		

Warrant Met: **No**

Notes:

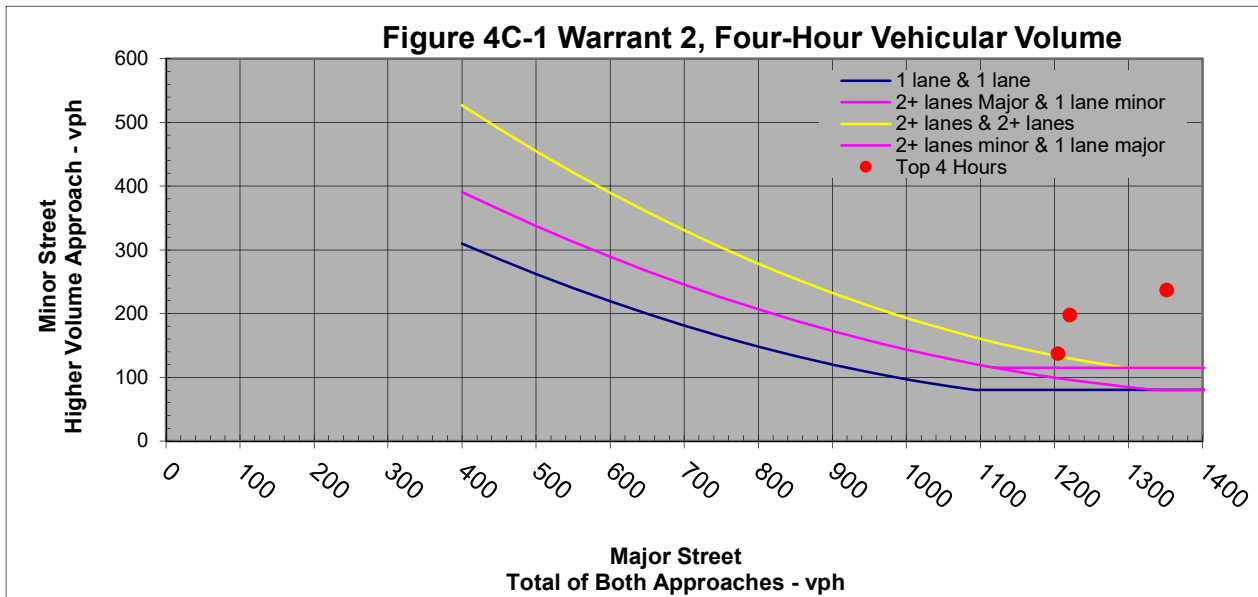
OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	4
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	4
Minor Street: 2 or More Lanes		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Patterson					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	105	75	33	0	180	33		
6:30 AM	304	172	68	0	476	68		
6:45 AM	550	284	135	0	834	135		Met
7:00 AM	824	397	198	0	1221	198	Met	
7:15 AM	972	448	221	0	1420	221		
7:30 AM	982	456	263	0	1438	263		
7:45 AM	936	447	248	0	1383	248		Met
8:00 AM	887	465	237	0	1352	237	Met	
8:15 AM	634	339	181	0	973	181		
8:30 AM	425	234	104	0	659	104		
8:45 AM	225	131	52	0	356	52		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	0	0	0	0	0	0		
10:30 AM	0	0	0	0	0	0		
10:45 AM	0	0	0	0	0	0		
11:00 AM	0	0	0	0	0	0		
11:15 AM	0	0	0	0	0	0		
11:30 AM	0	0	0	0	0	0		
11:45 AM	0	0	0	0	0	0		
12:00 PM	0	0	0	0	0	0		
12:15 PM	0	0	0	0	0	0		
12:30 PM	0	0	0	0	0	0		
12:45 PM	0	0	0	0	0	0		
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1:30 PM	0	0	0	0	0	0		
1:45 PM	0	0	0	0	0	0		
2:00 PM	0	0	0	0	0	0		
2:15 PM	0	0	0	0	0	0		
2:30 PM	0	0	0	0	0	0		
2:45 PM	0	0	0	0	0	0		
3:00 PM	0	0	0	0	0	0		
3:15 PM	144	257	52	0	401	52		
3:30 PM	272	485	84	0	757	84		
3:45 PM	435	770	137	0	1205	137	Met	Met
4:00 PM	605	1045	167	0	1650	167		
4:15 PM	640	1117	153	0	1757	153		
4:30 PM	736	1163	170	0	1899	170		
4:45 PM	743	1108	159	0	1851	159	Met	Met
5:00 PM	809	976	162	0	1785	162		
5:15 PM	630	647	124	0	1277	124		
5:30 PM	406	373	75	0	779	75		
5:45 PM	236	143	33	0	379	33		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		

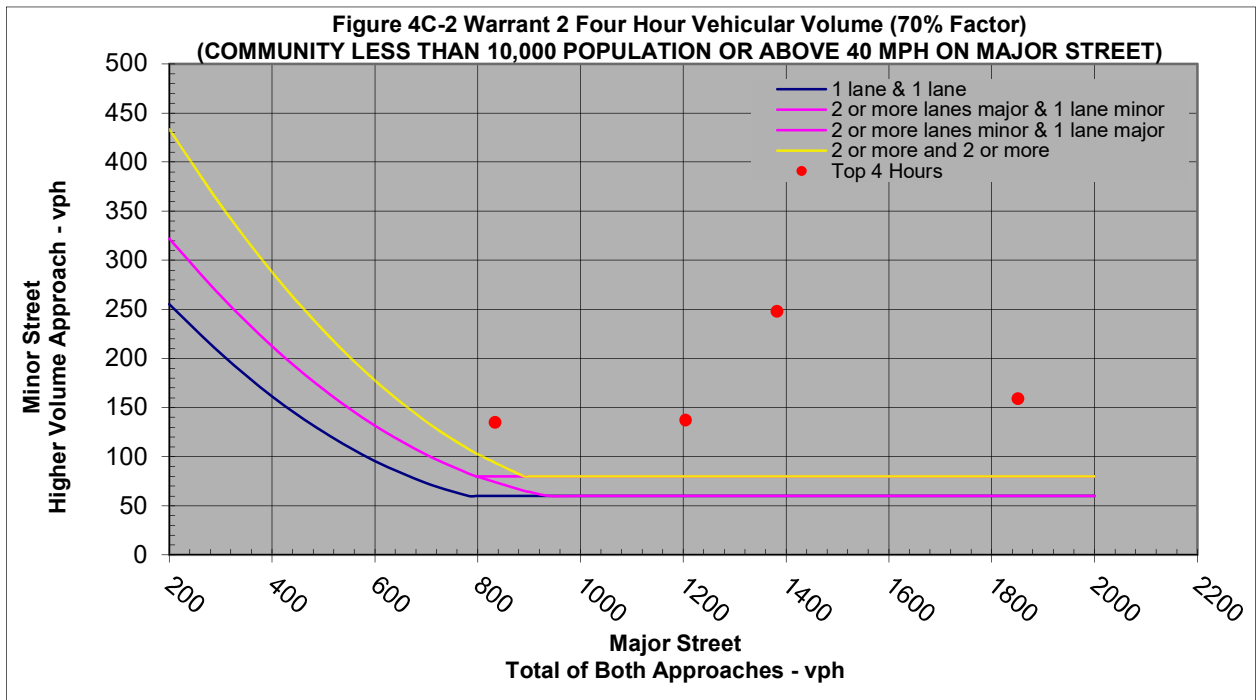
Figure 4C-1 Warrant 2, Four-Hour Vehicular Volume



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	8:00 AM	9:00 AM	1352	237
2nd Highest Hour	7:00 AM	8:00 AM	1221	198
3rd Highest Hour	4:45 PM	5:45 PM	1851	159
4th Highest Hour	3:45 PM	4:45 PM	1205	137

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	7:45 AM	8:45 AM	1383	248
2nd Highest Hour	4:45 PM	5:45 PM	1851	159
3rd Highest Hour	3:45 PM	4:45 PM	1205	137
4th Highest Hour	6:45 AM	7:45 AM	834	135

**Figure 4C-2 Warrant 2 Four Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**



Are the requirements for Warrant 2 met?: Yes

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	7:30 AM
Minor Street:	2 or More Lanes	Peak Hour End Time
		8:30 AM

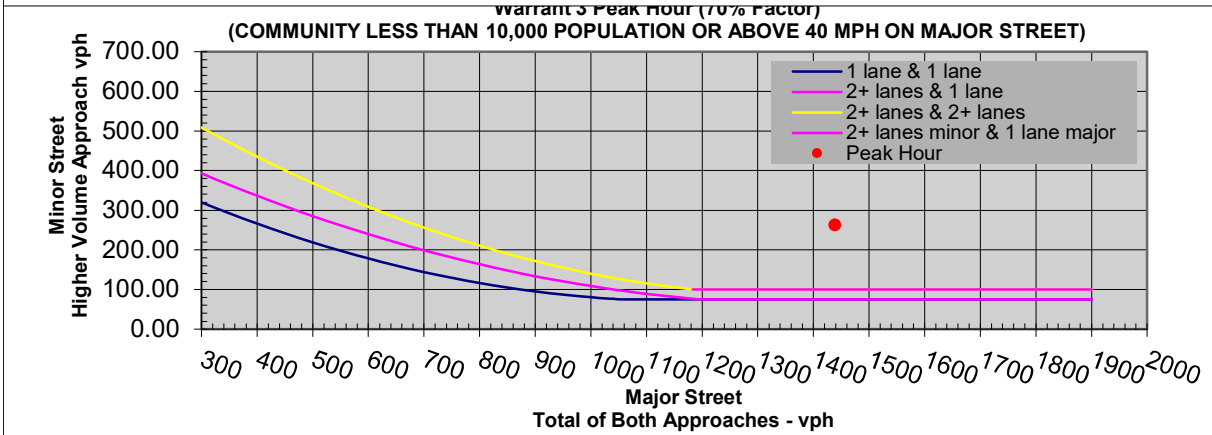
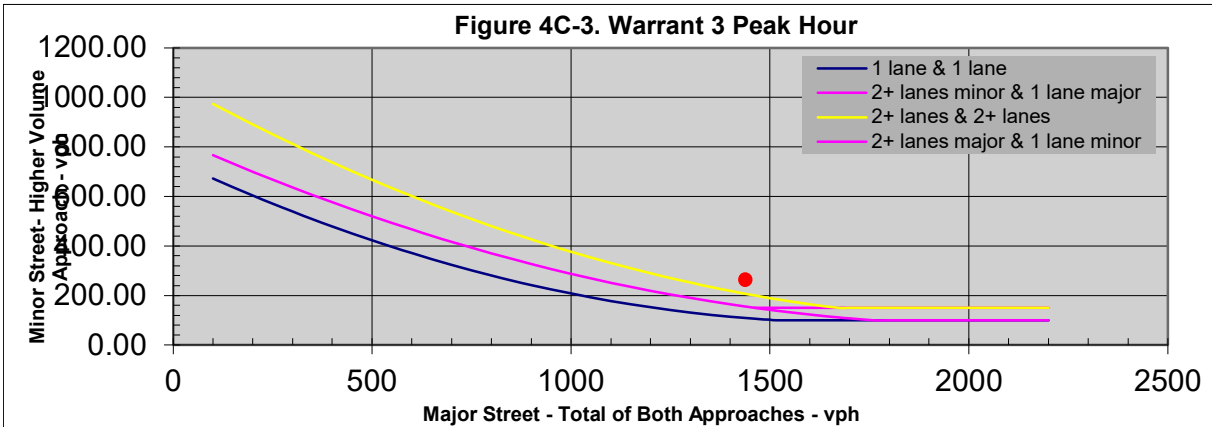
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
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Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**

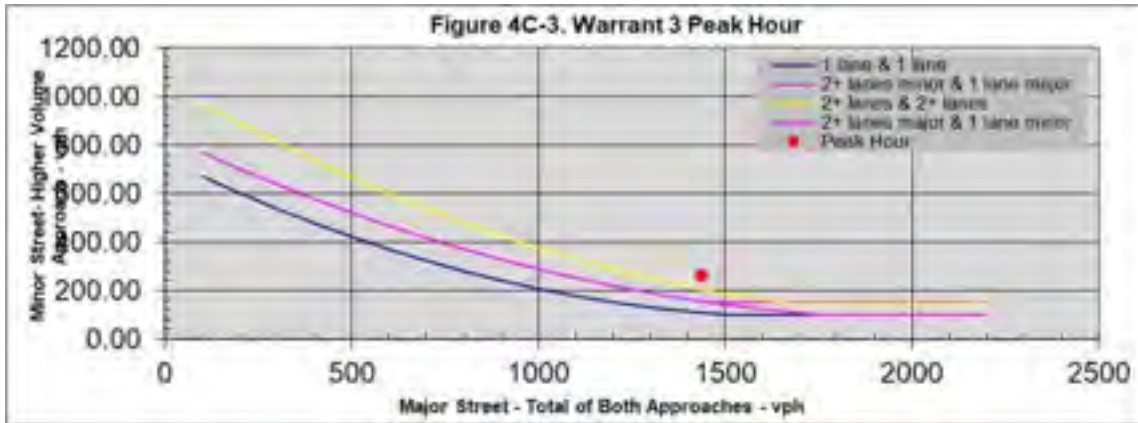


Signal Warrant SR 48 and Patterson

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	180	33	213	213
6:30 AM	476	68	544	544
6:45 AM	834	135	969	969
7:00 AM	1221	198	1419	1419
7:15 AM	1420	221	1641	1641
7:30 AM	1438	263	1701	1701
7:45 AM	1383	248	1631	1631
8:00 AM	1352	237	1589	1589
8:15 AM	973	181	1154	1154
8:30 AM	659	104	763	763
8:45 AM	356	52	408	408
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	0	0	0	0
10:30 AM	0	0	0	0
10:45 AM	0	0	0	0
11:00 AM	0	0	0	0
11:15 AM	0	0	0	0
11:30 AM	0	0	0	0
11:45 AM	0	0	0	0
12:00 PM	0	0	0	0
12:15 PM	0	0	0	0
12:30 PM	0	0	0	0
12:45 PM	0	0	0	0
1:00 PM	0	0	0	0
1:15 PM	0	0	0	0
1:30 PM	0	0	0	0
1:45 PM	0	0	0	0
2:00 PM	0	0	0	0
2:15 PM	0	0	0	0
2:30 PM	0	0	0	0
2:45 PM	0	0	0	0
3:00 PM	0	0	0	0
3:15 PM	401	52	453	453
3:30 PM	757	84	841	841
3:45 PM	1205	137	1342	1342
4:00 PM	1650	167	1817	1817
4:15 PM	1757	153	1910	1910
4:30 PM	1899	170	2069	2069
4:45 PM	1851	159	2010	2010
5:00 PM	1785	162	1947	1947
5:15 PM	1277	124	1401	1401
5:30 PM	779	75	854	854
5:45 PM	379	33	412	412
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1438	263	207	100

FIGURE 8B: PATTERSON ROAD WARRANT #3



The existing traffic signal at the Far Hills Avenue & Patterson Road intersection is **warranted** as it meets signal warrant #2 and warrant #3.

FAR HILLS AVENUE AT PARK AVENUE

This three-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. Only 1 hour of the 8 collected in the TMC data set exceeded the warrant #1 threshold shown in OMUTCD Table 4C-1 condition B, and combo warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 9A**) resulted in only one volume pair exceeding warrant #2 threshold for both the 100% and 70% volume thresholds. *Warrant #2 is NOT satisfied.*

FIGURE 9A: PARK AVENUE WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 9B**) resulted in the volume pair exceeding warrant #3 threshold utilizing a 70% threshold allowable for an existing traffic signal. *Warrant #3 is satisfied.*

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/6/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/14/2022
 Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 3

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

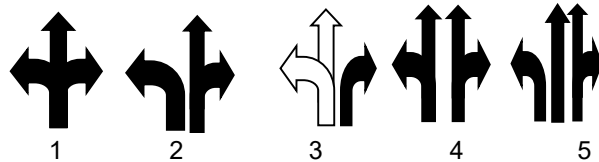
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Park

Minor Street Approach Configuration: 2 E-Bound
W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No	
Warrant 2, Four-Hour Vehicular Volume	Yes	No	
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

Peak Hour
5:00 PM
6:00 PM

Peak Hour
2:45 PM
3:45 PM

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:

1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The **Modeling and Forecasting Section** should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. **Please fill inputs on PHB Score Sheet and submit to ODOT.**

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes: 70% volumes

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes Major Minor		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
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5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	208	2																
6:30 AM	527	7			1						1				1		1	
6:45 AM	933	10	1				1		1			1						
7:00 AM	1313	24																
7:15 AM	1471	49																
7:30 AM	1479	82			1						1				1		1	1
7:45 AM	1408	92	1				1	1	1	1			1	1				
8:00 AM	1364	89																
8:15 AM	998	62																
8:30 AM	671	24			1						1				1		1	
8:45 AM	336	11																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Park

10:00 AM	0	0																
10:15 AM	216	12																
10:30 AM	506	23		1				1			1		1		1			
10:45 AM	796	37	1					1			1		1		1			
11:00 AM	1104	51				1												
11:15 AM	1212	48																
11:30 AM	1216	44		1					1				1		1		1	
11:45 AM	1225	40	1					1				1						
12:00 PM	1241	35				1												
12:15 PM	917	26																
12:30 PM	623	19		1					1				1		1			
12:45 PM	324	9																
1:00 PM	0	0																
1:15 PM	283	7																
1:30 PM	583	16		1					1				1		1			
1:45 PM	912	23	1			1		1				1						
2:00 PM	1254	27																
2:15 PM	1312	34																
2:30 PM	1417	44		1					1				1		1		1	
2:45 PM	1472	47	1			1		1				1						
3:00 PM	1550	55																
3:15 PM	1581	53																
3:30 PM	1541	38		1					1				1		1			
3:45 PM	1542	38	1			1		1				1						
4:00 PM	1570	31																
4:15 PM	1701	33																
4:30 PM	1794	37		1					1				1		1			
4:45 PM	1820	37	1			1		1				1						
5:00 PM	1761	38																
5:15 PM	1258	24																
5:30 PM	800	16		1					1				1		1			
5:45 PM	389	6																
6:00 PM	0	0																
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9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			8	0	11	0	8	1	8	1	11	0	8	1	11	0	11	3
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

Notes:

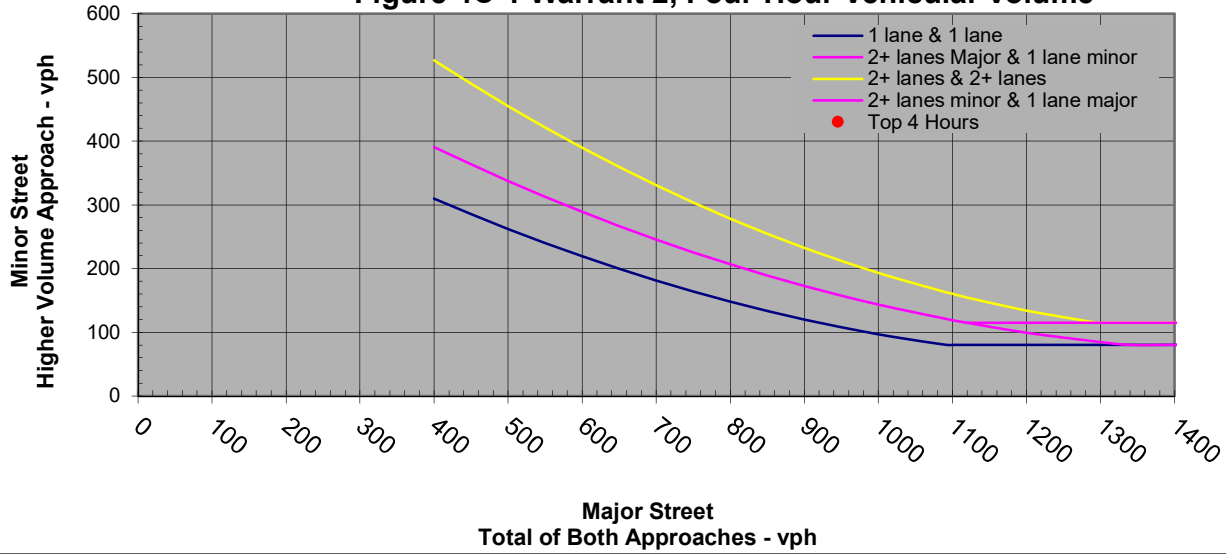
OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	1
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	1
Minor Street: 1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Park					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	137	71	0	2	208	2		
6:30 AM	351	176	0	7	527	7		
6:45 AM	637	296	0	10	933	10		
7:00 AM	912	401	0	24	1313	24		
7:15 AM	1054	417	0	49	1471	49		
7:30 AM	1070	409	0	82	1479	82	Met	Met
7:45 AM	995	413	0	92	1408	92		
8:00 AM	915	449	0	89	1364	89		
8:15 AM	636	362	0	62	998	62		
8:30 AM	406	265	0	24	671	24		
8:45 AM	195	141	0	11	336	11		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	92	124	0	12	216	12		
10:30 AM	239	267	0	23	506	23		
10:45 AM	382	414	0	37	796	37		
11:00 AM	548	556	0	51	1104	51		
11:15 AM	606	606	0	48	1212	48		
11:30 AM	590	626	0	44	1216	44		
11:45 AM	579	646	0	40	1225	40		
12:00 PM	576	665	0	35	1241	35		
12:15 PM	426	491	0	26	917	26		
12:30 PM	295	328	0	19	623	19		
12:45 PM	163	161	0	9	324	9		
1:00 PM	0	0	0	0	0	0		
1:15 PM	150	133	0	7	283	7		
1:30 PM	285	298	0	16	583	16		
1:45 PM	451	461	0	23	912	23		
2:00 PM	620	634	0	27	1254	27		
2:15 PM	630	682	0	34	1312	34		
2:30 PM	687	730	0	44	1417	44		
2:45 PM	698	774	0	47	1472	47		
3:00 PM	687	863	0	55	1550	55		
3:15 PM	674	907	0	53	1581	53		
3:30 PM	636	905	0	38	1541	38		
3:45 PM	605	937	0	38	1542	38		
4:00 PM	607	963	0	31	1570	31		
4:15 PM	647	1054	0	33	1701	33		
4:30 PM	690	1104	0	37	1794	37		
4:45 PM	714	1106	0	37	1820	37		
5:00 PM	745	1016	0	38	1761	38		
5:15 PM	558	700	0	24	1258	24		
5:30 PM	361	439	0	16	800	16		
5:45 PM	191	198	0	6	389	6		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		

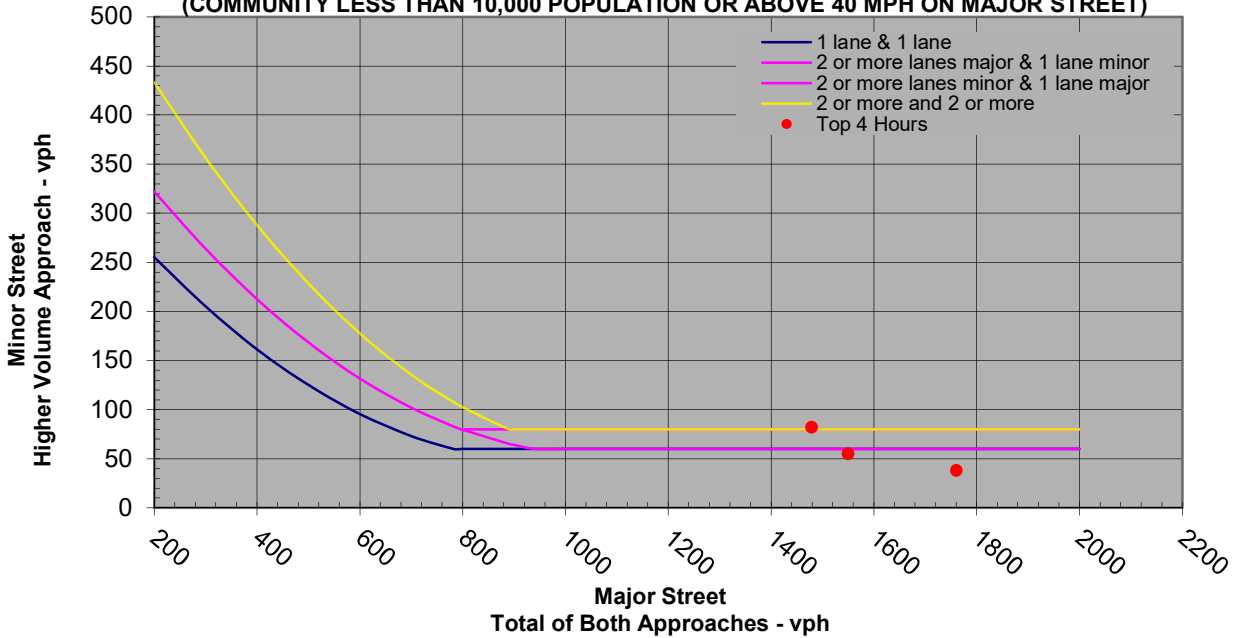
Figure 4C-1 Warrant 2, Four-Hour Vehicular Volume



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	7:30 AM	8:30 AM	1479	82
2nd Highest Hour	7:30 AM	8:30 AM	1479	82
3rd Highest Hour	3:00 PM	4:00 PM	1550	55
4th Highest Hour	5:00 PM	6:00 PM	1761	38

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	7:30 AM	8:30 AM	1479	82
2nd Highest Hour	12:00 AM	1:00 AM	0	55
3rd Highest Hour	3:00 PM	4:00 PM	1550	55
4th Highest Hour	5:00 PM	6:00 PM	1761	38

**Figure 4C-2 Warrant 2 Four Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	5:00 PM
Minor Street:	1 Lane	Peak Hour End Time
		6:00 PM

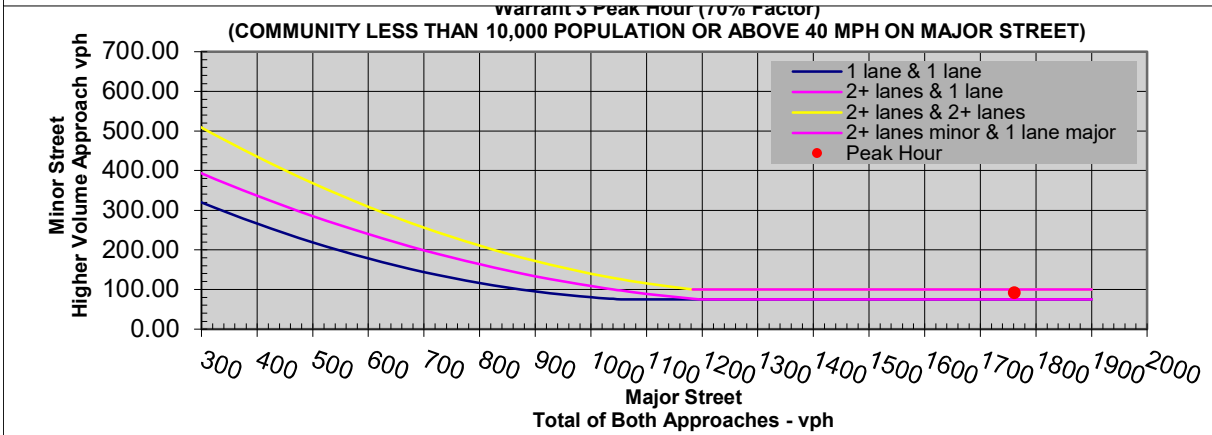
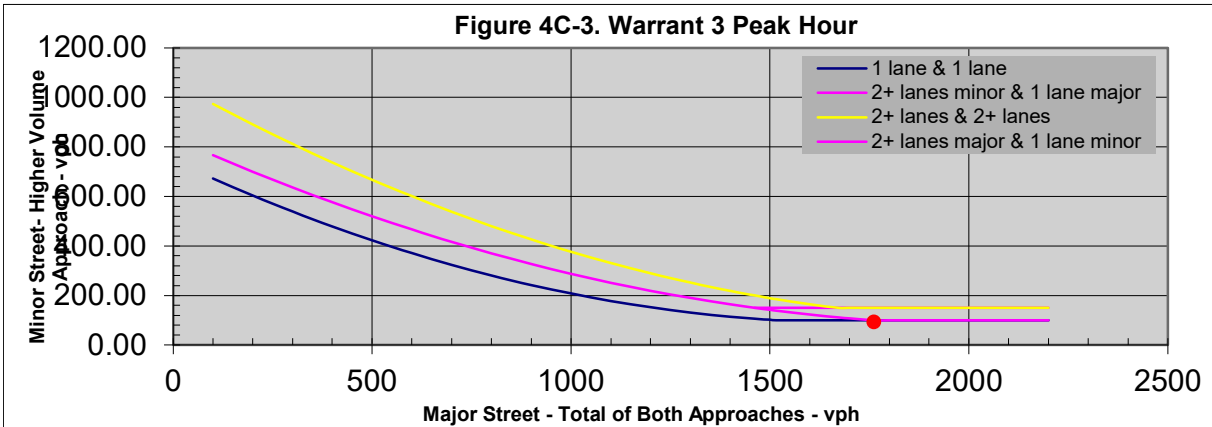
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
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Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**

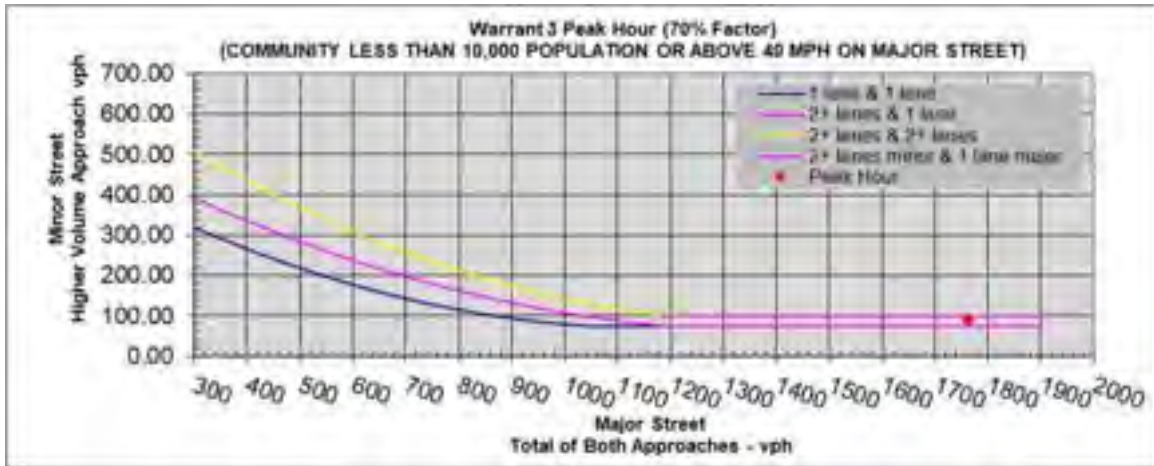


Signal Warrant SR 48 and Park

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	208	2	210	210
6:30 AM	527	7	534	534
6:45 AM	933	10	943	943
7:00 AM	1313	24	1337	1337
7:15 AM	1471	49	1520	1520
7:30 AM	1479	82	1561	1561
7:45 AM	1408	92	1500	1500
8:00 AM	1364	89	1453	1453
8:15 AM	998	62	1060	1060
8:30 AM	671	24	695	695
8:45 AM	336	11	347	347
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	216	12	228	228
10:30 AM	506	23	529	529
10:45 AM	796	37	833	833
11:00 AM	1104	51	1155	1155
11:15 AM	1212	48	1260	1260
11:30 AM	1216	44	1260	1260
11:45 AM	1225	40	1265	1265
12:00 PM	1241	35	1276	1276
12:15 PM	917	26	943	943
12:30 PM	623	19	642	642
12:45 PM	324	9	333	333
1:00 PM	0	0	0	0
1:15 PM	283	7	290	290
1:30 PM	583	16	599	599
1:45 PM	912	23	935	935
2:00 PM	1254	27	1281	1281
2:15 PM	1312	34	1346	1346
2:30 PM	1417	44	1461	1461
2:45 PM	1472	47	1519	1519
3:00 PM	1550	55	1605	1605
3:15 PM	1581	53	1634	1634
3:30 PM	1541	38	1579	1579
3:45 PM	1542	38	1580	1580
4:00 PM	1570	31	1601	1601
4:15 PM	1701	33	1734	1734
4:30 PM	1794	37	1831	1831
4:45 PM	1820	37	1857	1857
5:00 PM	1761	38	1799	1799
5:15 PM	1258	24	1282	1282
5:30 PM	800	16	816	816
5:45 PM	389	6	395	395
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1761	92	100	75

FIGURE 9B: PARK AVENUE WARRANT #3



The existing traffic signal at the Far Hills Avenue & Park Avenue intersection **is warranted** as it meets signal warrant #3.

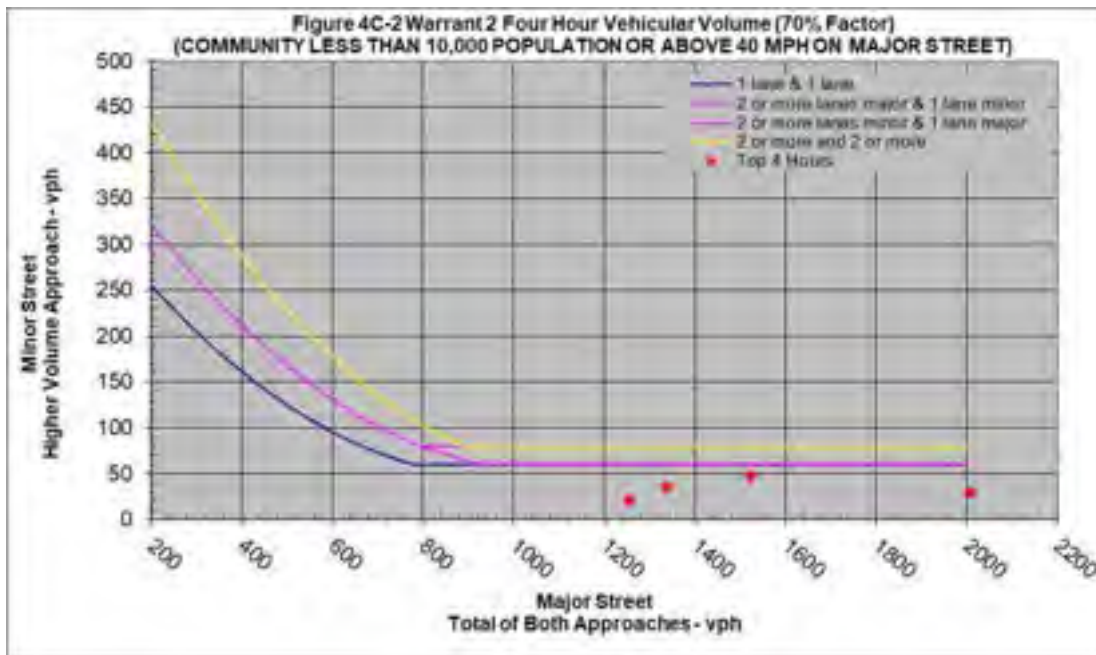
FAR HILLS AVENUE AT HARMAN AVENUE

This three-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. None of the hours from the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A, condition B, or the combination warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

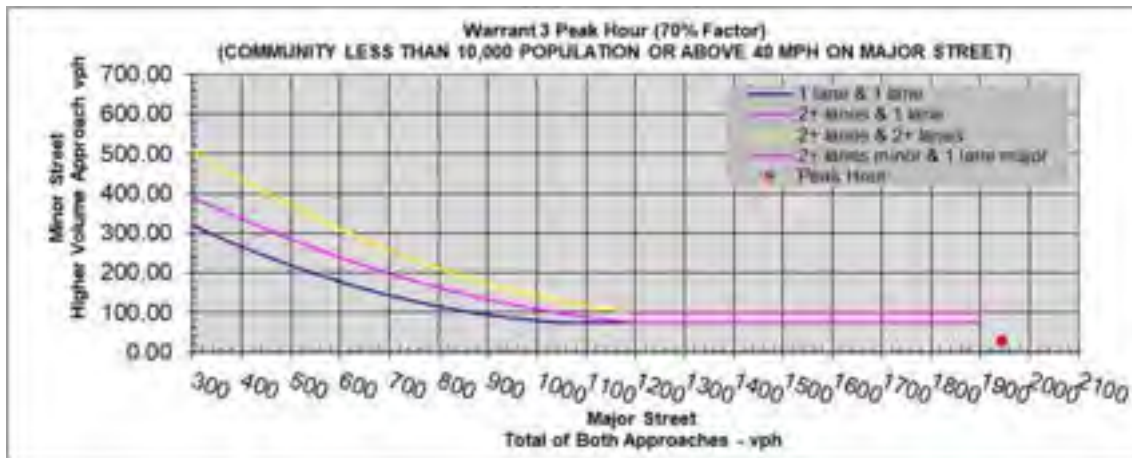
Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-2 (**Figure 10A**) resulted in no volume pairs exceeding the warrant #2 threshold. An 11% COVID factor is not expected to help meet this four-hour warrant. *Warrant #2 is NOT satisfied.*

FIGURE 10A: HARMAN AVENUE WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 (**Figure 10B**) resulted in no volume pair exceeding the warrant #3 threshold. There are 47 vehicles on the side street when 100 are needed for Figure 4C-3 or 75 are needed for Figure 4C-4. Adding an 11% COVID factor would still not provide enough side street traffic volume to meet the threshold. *Warrant #3 is NOT satisfied.*

FIGURE 10B: HARMAN AVENUE WARRANT #3



Warrant #5. A total of 62 pedestrians were observed crossing Far Hills Avenue during the highest crossing hour (3:15PM – 4:15PM). The OMUTCD states that the need for a traffic signal shall be considered when there is a minimum of 20 schoolchildren (i.e., elementary through high school students) during the highest crossing hour. Assuming 67% of the pedestrians (i.e., 41 pedestrians) during the highest crossing hour are high school students, the criteria needed to perform warrant #5 is qualified. This assumption is reasonable due to the location of Oakwood Junior and Senior High School at this intersection.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Far Hills Avenue at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Far Hills Avenue, crossing distance from curb ramp to curb ramp (measured at 50 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

Where:

- $\lambda = \text{Total bidirectional volume at Harman Ave}$
- $t = \text{Crossing Time} = \frac{50 \text{ ft}}{3.5 \text{ ft/s}} = 14.2 \text{ seconds}$

The resulting number of gaps for each peak hour volume are shown in **Figure 10C**.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/7/2022
Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 3

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

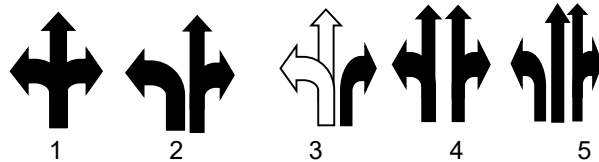
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Harman

Minor Street Approach Configuration: 1 E-Bound
W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:15 PM</td></tr> <tr><td style="text-align: center;">4:15 PM</td></tr> </table>	Peak Hour	3:15 PM	4:15 PM
Peak Hour						
3:15 PM						
4:15 PM						
Warrant 5, School Crossing	No		Based on Estimation of Expected Gaps. Please refer to the OMUTCD 4C.05 for Guidance.			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
2:00 AM	0	0																
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5:00 AM	0	0																
5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	226	3																
6:30 AM	518	4			1					1				1			1	
6:45 AM	892	8	1						1			1						
7:00 AM	1286	17					1											
7:15 AM	1360	28																
7:30 AM	1337	35			1					1				1			1	
7:45 AM	1289	37	1						1			1						
8:00 AM	1207	36					1											
8:15 AM	907	22																
8:30 AM	638	14			1					1				1			1	
8:45 AM	312	8																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Harman

10:00 AM	0	0																
10:15 AM	225	3																
10:30 AM	504	9		1				1			1		1		1			
10:45 AM	808	18	1					1			1		1		1			
11:00 AM	1097	27				1												
11:15 AM	1150	28																
11:30 AM	1159	26		1						1			1		1		1	
11:45 AM	1161	23	1					1				1						
12:00 PM	1153	24				1												
12:15 PM	875	20																
12:30 PM	587	16		1						1			1		1		1	
12:45 PM	281	10																
1:00 PM	0	0																
1:15 PM	277	1																
1:30 PM	590	7		1						1			1		1		1	
1:45 PM	895	13	1					1				1						
2:00 PM	1228	18				1												
2:15 PM	1256	20																
2:30 PM	1302	36		1						1			1		1		1	
2:45 PM	1372	40	1					1				1						
3:00 PM	1430	47				1												
3:15 PM	1524	47																
3:30 PM	1557	34		1						1			1		1		1	
3:45 PM	1566	28	1					1				1						
4:00 PM	1656	21				1												
4:15 PM	1784	25																
4:30 PM	1945	23		1						1			1		1		1	
4:45 PM	2009	28	1					1				1						
5:00 PM	1941	27				1												
5:15 PM	1414	20																
5:30 PM	861	13		1						1			1		1		1	
5:45 PM	413	4																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
7:00 PM	0	0																
7:15 PM	0	0																
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8:15 PM	0	0																
8:30 PM	0	0																
8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			8	0	11	0	8	0	8	0	11	0	8	0	11	0	11	0
WARRANT SATISFIED?			NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A

Warrant Met: **No**

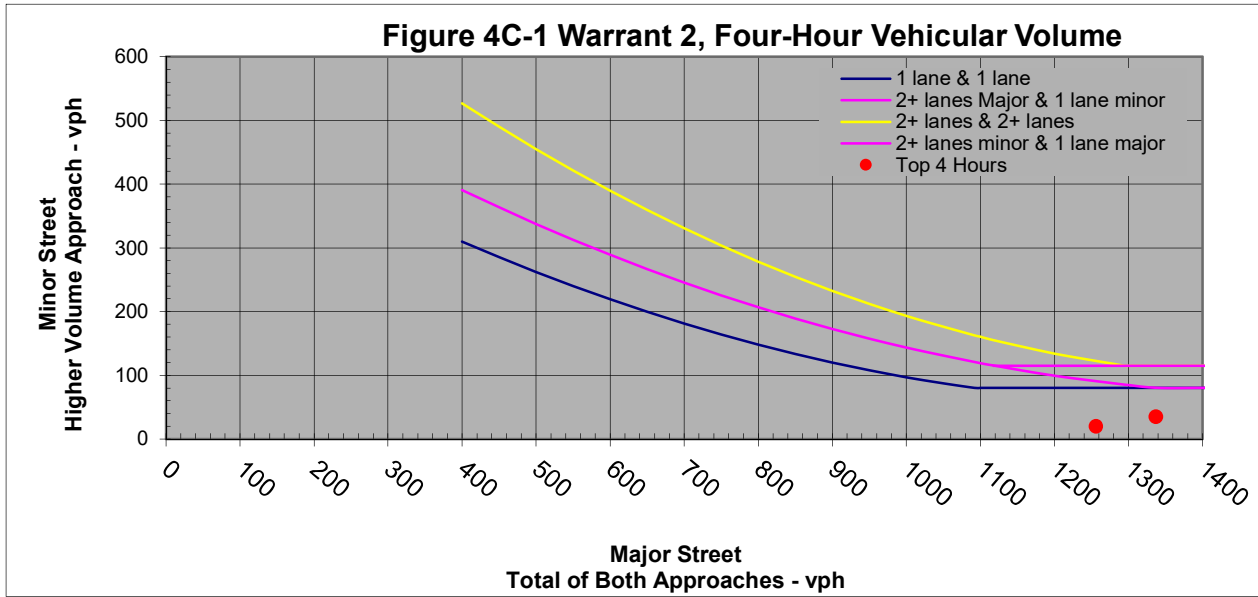
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

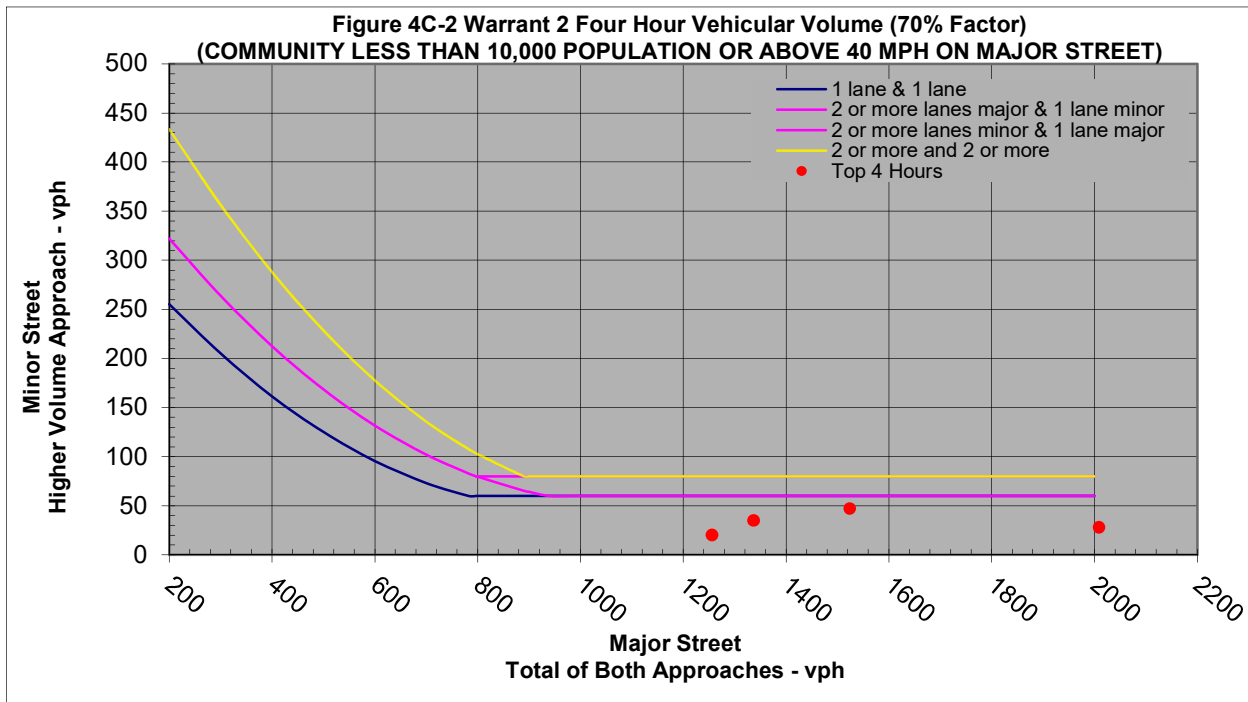
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Harman					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	141	85	0	3	226	3		
6:30 AM	329	189	0	4	518	4		
6:45 AM	599	293	0	8	892	8		
7:00 AM	898	388	0	17	1286	17		
7:15 AM	978	382	0	28	1360	28		
7:30 AM	980	357	0	35	1337	35		
7:45 AM	936	353	0	37	1289	37		
8:00 AM	828	379	0	36	1207	36		
8:15 AM	607	300	0	22	907	22		
8:30 AM	417	221	0	14	638	14		
8:45 AM	191	121	0	8	312	8		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	112	113	0	3	225	3		
10:30 AM	248	256	0	9	504	9		
10:45 AM	401	407	0	18	808	18		
11:00 AM	555	542	0	27	1097	27		
11:15 AM	582	568	0	28	1150	28		
11:30 AM	589	570	0	26	1159	26		
11:45 AM	584	577	0	23	1161	23		
12:00 PM	575	578	0	24	1153	24		
12:15 PM	436	439	0	20	875	20		
12:30 PM	293	294	0	16	587	16		
12:45 PM	145	136	0	10	281	10		
1:00 PM	0	0	0	0	0	0		
1:15 PM	130	147	0	1	277	1		
1:30 PM	269	321	0	7	590	7		
1:45 PM	404	491	0	13	895	13		
2:00 PM	551	677	0	18	1228	18		
2:15 PM	590	666	0	20	1256	20		
2:30 PM	611	691	0	36	1302	36		
2:45 PM	627	745	0	40	1372	40		
3:00 PM	653	777	0	47	1430	47		
3:15 PM	625	899	0	47	1524	47		
3:30 PM	610	947	0	34	1557	34		
3:45 PM	604	962	0	28	1566	28		
4:00 PM	593	1063	0	21	1656	21		
4:15 PM	649	1135	0	25	1784	25		
4:30 PM	705	1240	0	23	1945	23		
4:45 PM	741	1268	0	28	2009	28		
5:00 PM	796	1145	0	27	1941	27		
5:15 PM	599	815	0	20	1414	20		
5:30 PM	398	463	0	13	861	13		
5:45 PM	217	196	0	4	413	4		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	3:15 PM	4:15 PM	1524	47
2nd Highest Hour	7:30 AM	8:30 AM	1337	35
3rd Highest Hour	4:45 PM	5:45 PM	2009	28
4th Highest Hour	2:15 PM	3:15 PM	1256	20

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	3:15 PM	4:15 PM	1524	47
2nd Highest Hour	7:30 AM	8:30 AM	1337	35
3rd Highest Hour	4:45 PM	5:45 PM	2009	28
4th Highest Hour	2:15 PM	3:15 PM	1256	20



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

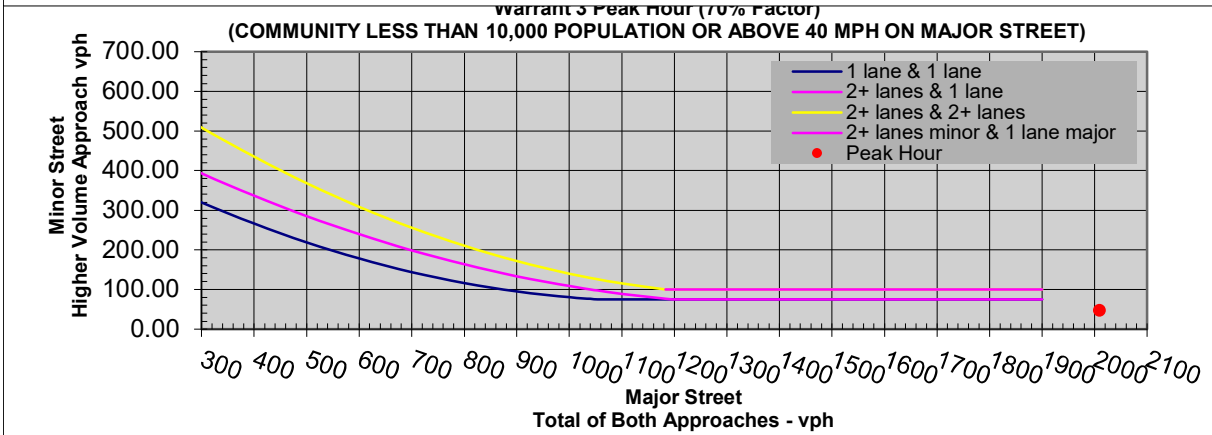
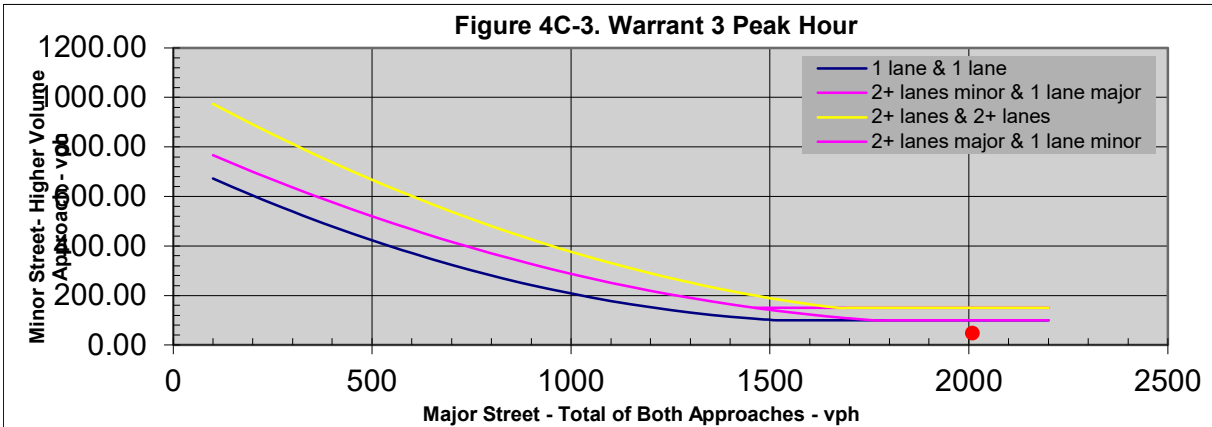
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant SR 48 and Harman

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	226	3	229	229
6:30 AM	518	4	522	522
6:45 AM	892	8	900	900
7:00 AM	1286	17	1303	1303
7:15 AM	1360	28	1388	1388
7:30 AM	1337	35	1372	1372
7:45 AM	1289	37	1326	1326
8:00 AM	1207	36	1243	1243
8:15 AM	907	22	929	929
8:30 AM	638	14	652	652
8:45 AM	312	8	320	320
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	225	3	228	228
10:30 AM	504	9	513	513
10:45 AM	808	18	826	826
11:00 AM	1097	27	1124	1124
11:15 AM	1150	28	1178	1178
11:30 AM	1159	26	1185	1185
11:45 AM	1161	23	1184	1184
12:00 PM	1153	24	1177	1177
12:15 PM	875	20	895	895
12:30 PM	587	16	603	603
12:45 PM	281	10	291	291
1:00 PM	0	0	0	0
1:15 PM	277	1	278	278
1:30 PM	590	7	597	597
1:45 PM	895	13	908	908
2:00 PM	1228	18	1246	1246
2:15 PM	1256	20	1276	1276
2:30 PM	1302	36	1338	1338
2:45 PM	1372	40	1412	1412
3:00 PM	1430	47	1477	1477
3:15 PM	1524	47	1571	1571
3:30 PM	1557	34	1591	1591
3:45 PM	1566	28	1594	1594
4:00 PM	1656	21	1677	1677
4:15 PM	1784	25	1809	1809
4:30 PM	1945	23	1968	1968
4:45 PM	2009	28	2037	2037
5:00 PM	1941	27	1968	1968
5:15 PM	1414	20	1434	1434
5:30 PM	861	13	874	874
5:45 PM	413	4	417	417
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
2009	47	100	75

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	226	0
6:30 AM	518	4
6:45 AM	892	12
7:00 AM	1286	27
7:15 AM	1360	72
7:30 AM	1337	69
7:45 AM	1289	63
8:00 AM	1207	50
8:15 AM	907	5
8:30 AM	638	4
8:45 AM	312	2
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	225	0
10:30 AM	504	1
10:45 AM	808	4
11:00 AM	1097	22
11:15 AM	1150	22
11:30 AM	1159	25
11:45 AM	1161	26
12:00 PM	1153	29
12:15 PM	875	29
12:30 PM	587	25
12:45 PM	281	21
1:00 PM	0	0
1:15 PM	277	0
1:30 PM	590	4
1:45 PM	895	4
2:00 PM	1228	6
2:15 PM	1256	8
2:30 PM	1302	62
2:45 PM	1372	64
3:00 PM	1430	63
3:15 PM	1524	62
3:30 PM	1557	6
3:45 PM	1566	4
4:00 PM	1656	4
4:15 PM	1784	3
4:30 PM	1945	1
4:45 PM	2009	4
5:00 PM	1941	5
5:15 PM	1414	5
5:30 PM	861	5
5:45 PM	413	2
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? No

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No
**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:15 AM	8:15 AM	1360	72
2nd Highest Hour	2:45 PM	3:45 PM	1372	64
3rd Highest Hour	12:00 PM	1:00 PM	1153	29
4th Highest Hour	11:00 AM	12:00 PM	1097	22

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:15 AM	8:15 AM	1360	72
2nd Highest Hour	2:45 PM	3:45 PM	1372	64
3rd Highest Hour	12:00 PM	1:00 PM	1153	29
4th Highest Hour	11:00 AM	12:00 PM	1097	22

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
3:15 PM	4:15 PM	1524	62

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

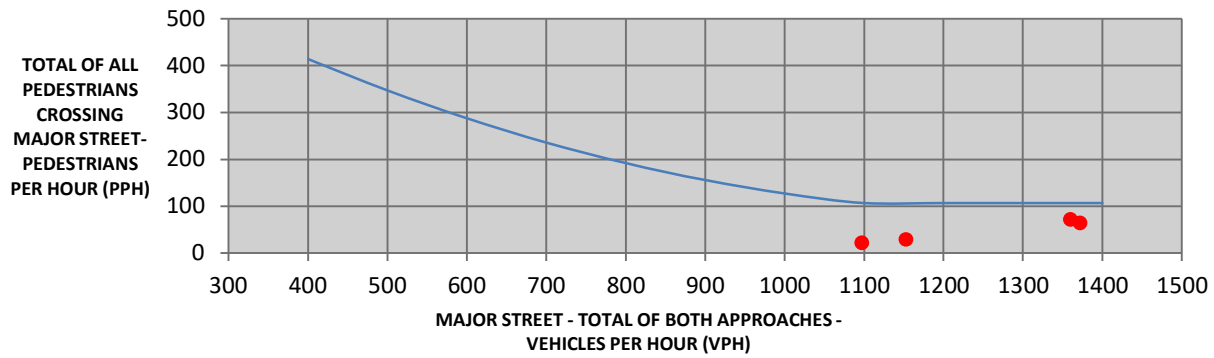
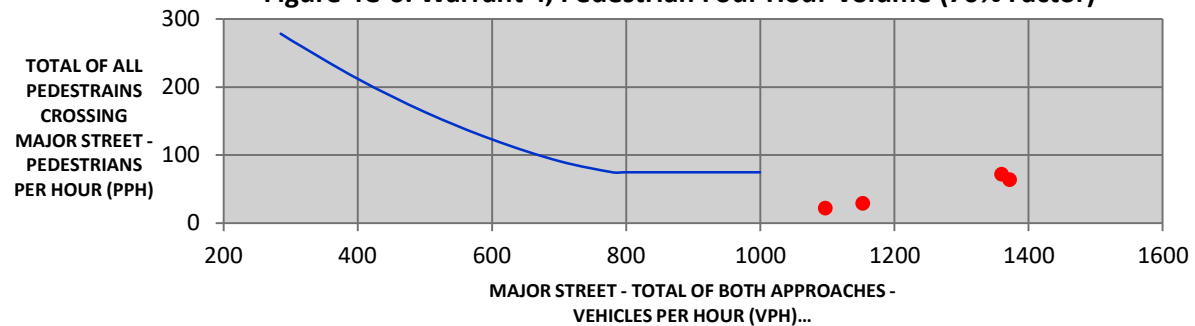
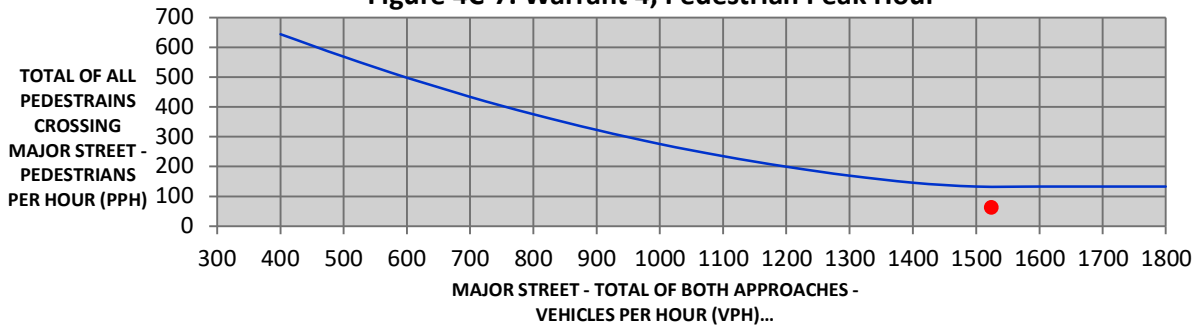


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)



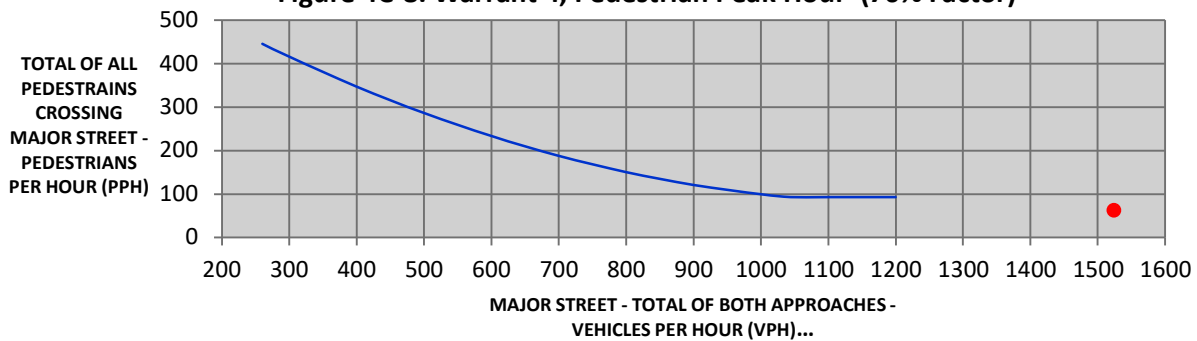
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)

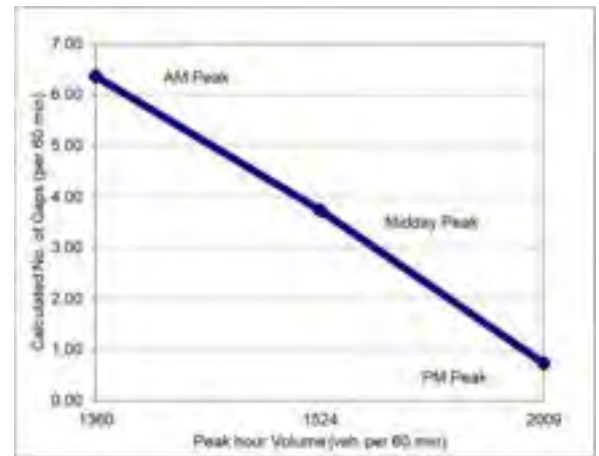


*Note: 93 pph applies as the lower threshold volume.

The gap analysis shows that the number of gaps to cross Far Hills Avenue at the intersection during peak hours are less than 7 gaps per hour. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). The calculations show that there is less than four gaps per hour during the peak pedestrian crossing time after the afternoon school dismissal and little to no opportunities to cross Far Hills Avenue during the PM peak hour. The existing traffic signal contributes significantly to providing adequate crossing time by stopping Far Hills Avenue traffic through the use of available push buttons. *Warrant #5 is satisfied.*

The existing traffic signal at the Far Hills Avenue and Harman Avenue intersection **is warranted** as it meets signal warrant #5 (Gap Analysis). Gap analysis shows this traffic signal provides adequate gaps for pedestrians to cross Far Hills Avenue, especially during peak school pedestrian hours.

FIGURE 10C: GAP ANALYSIS (50 FT CROSSING DISTANCE)



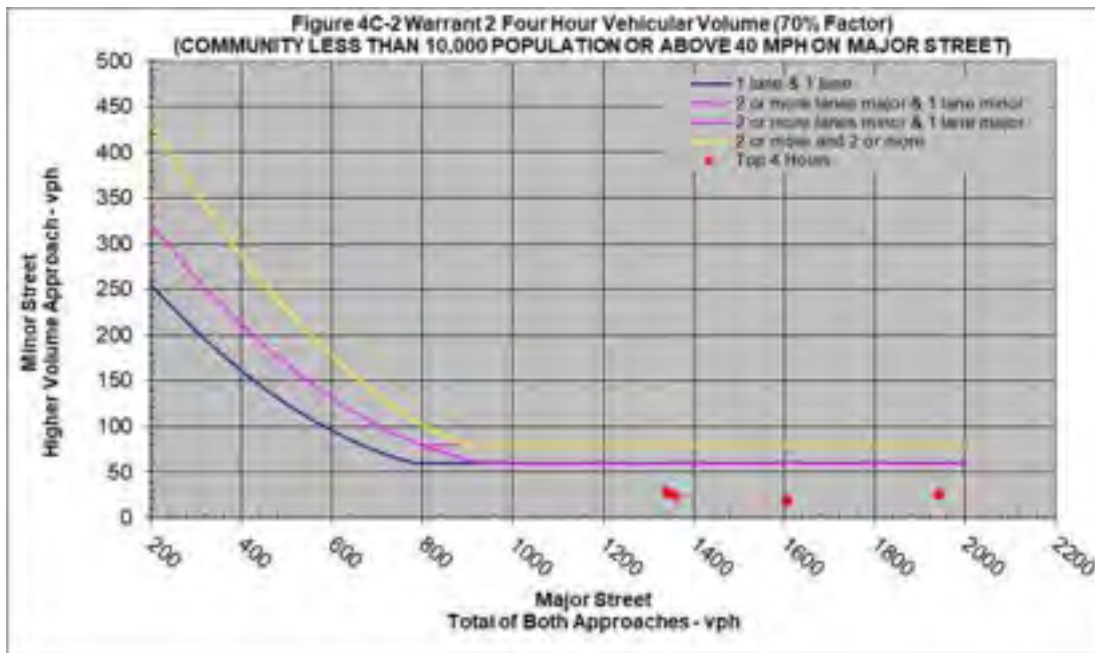
FAR HILLS AVENUE AT ABERDEEN AVENUE/PARK ROAD

This four-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. None of the hours from the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A, condition B, or the combination warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

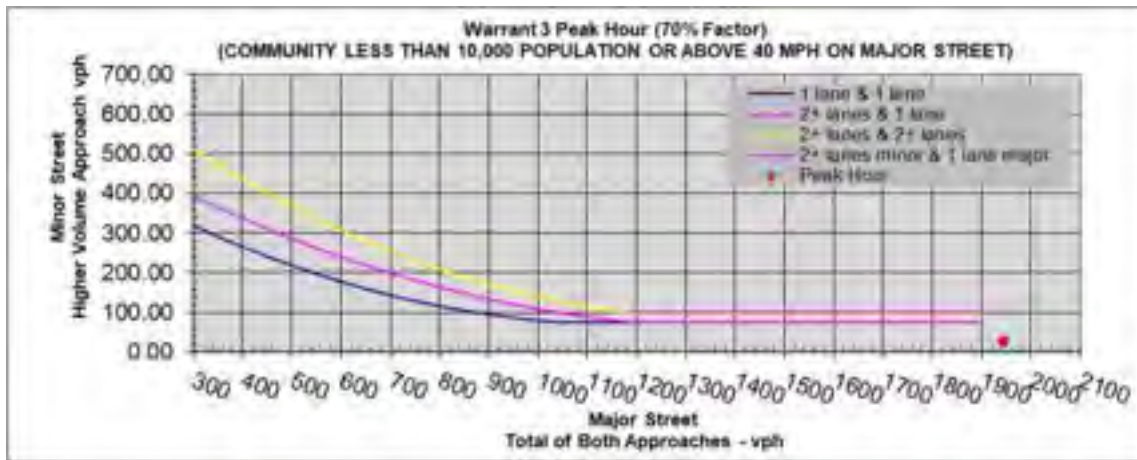
Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-2 (**Figure 11A**) resulted in no volume pairs exceeding the warrant #2 threshold. Adding an 11% COVID factor would not adjust the volumes enough to satisfy this four hour warrant. *Warrant #2 is NOT satisfied.*

FIGURE 11A: ABERDEEN AVENUE/PARK ROAD WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 resulted in no volume pair exceeding warrant #3 threshold. There are 25 vehicles on the side street during the peak hour when 100 are needed. *Warrant #3 is NOT satisfied.*

FIGURE 11B: ABERDEEN AVENUE/PARK ROAD WARRANT #3



Warrant #5. A total of 51 pedestrians were observed crossing Far Hills Avenue during the highest crossing hour (3:00PM – 4:00PM). The OMUTCD states that the need for a traffic signal shall be considered when there is a minimum of 20 schoolchildren (i.e., elementary through high school students) during the highest crossing hour. Assuming half of pedestrians (i.e., 25 pedestrians) during the highest crossing hour are school students, the criteria needed to perform warrant #5 is qualified. This assumption is reasonable due to the location of Edwin D. Smith Elementary School one block to the east of this intersection and the Oakwood Junior and Senior High School being located 1/3rd of a mile north of the intersection. The Wright Memorial Public Library is also located at this intersection.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/7/2022
 Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
 S-Bound

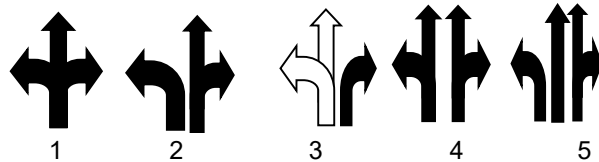
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
 *Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Aberdeen/Park

Minor Street Approach Configuration: 1 E-Bound
 1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:00 PM</td></tr> <tr><td style="text-align: center;">4:00 PM</td></tr> </table>	Peak Hour	3:00 PM	4:00 PM
Peak Hour						
3:00 PM						
4:00 PM						
Warrant 5, School Crossing	No		Based on Estimation of Expected Gaps. Please refer to the OMUTCD 4C.05 for Guidance.			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes Major Minor		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
2:00 AM	0	0																
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5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	221	3																
6:30 AM	503	9			1						1				1			
6:45 AM	893	12	1						1			1					1	
7:00 AM	1294	21					1											
7:15 AM	1384	23																
7:30 AM	1411	26			1						1				1			
7:45 AM	1342	27	1						1			1					1	
8:00 AM	1275	28					1											
8:15 AM	964	23																
8:30 AM	655	14			1						1				1			
8:45 AM	334	10																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Aberdeen-Park

10:00 AM	0	0																
10:15 AM	234	7																
10:30 AM	517	9		1				1			1		1		1			
10:45 AM	853	17	1					1			1		1		1			
11:00 AM	1170	21				1												
11:15 AM	1217	19																
11:30 AM	1231	19		1						1			1		1		1	
11:45 AM	1225	16	1					1			1		1					
12:00 PM	1224	14				1												
12:15 PM	943	10																
12:30 PM	646	6		1						1			1		1		1	
12:45 PM	316	3																
1:00 PM	0	0																
1:15 PM	293	2																
1:30 PM	602	6	1		1					1			1		1		1	
1:45 PM	924	14				1		1				1						
2:00 PM	1233	16																
2:15 PM	1277	25																
2:30 PM	1362	24	1		1					1			1		1		1	
2:45 PM	1425	21				1		1				1						
3:00 PM	1512	21																
3:15 PM	1576	15																
3:30 PM	1606	17	1		1					1			1		1		1	
3:45 PM	1607	18				1		1				1						
4:00 PM	1671	23																
4:15 PM	1754	21																
4:30 PM	1882	24	1		1					1			1		1		1	
4:45 PM	1945	25				1		1				1						
5:00 PM	1903	23																
5:15 PM	1419	20																
5:30 PM	867	12	1		1					1			1		1		1	
5:45 PM	418	5																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
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8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			9	0	11	0	8	0	8	0	11	0	8	0	11	0	10	0
WARRANT SATISFIED?			NO		N/A		NO		N/A		NO		NO		NO		NO	

Warrant Met: **No**

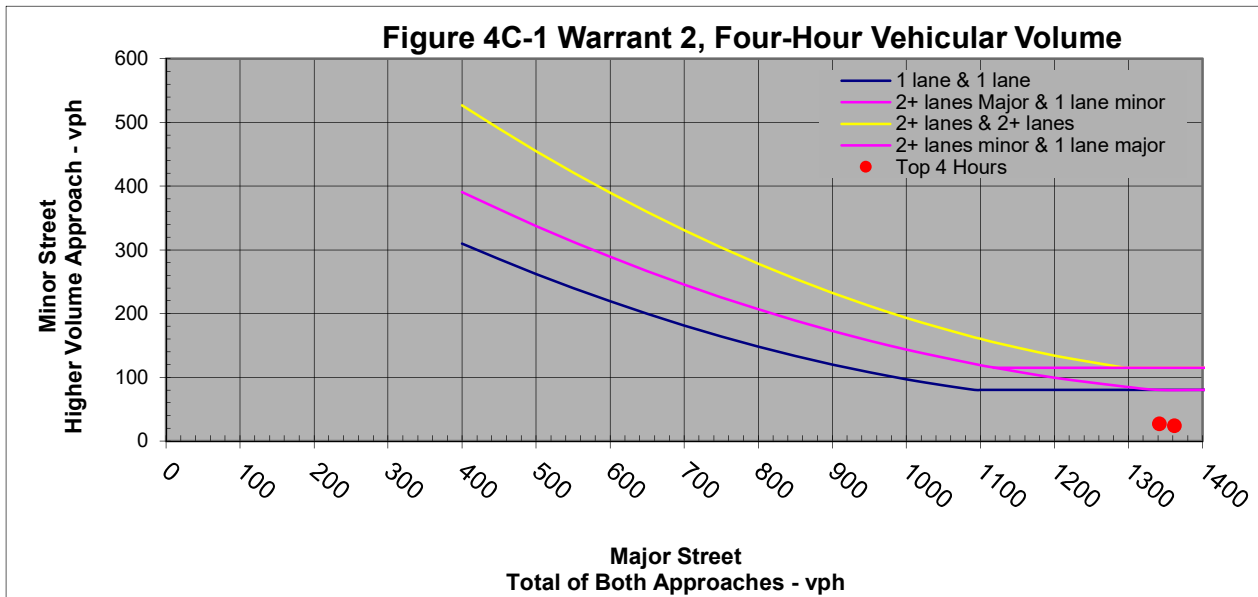
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

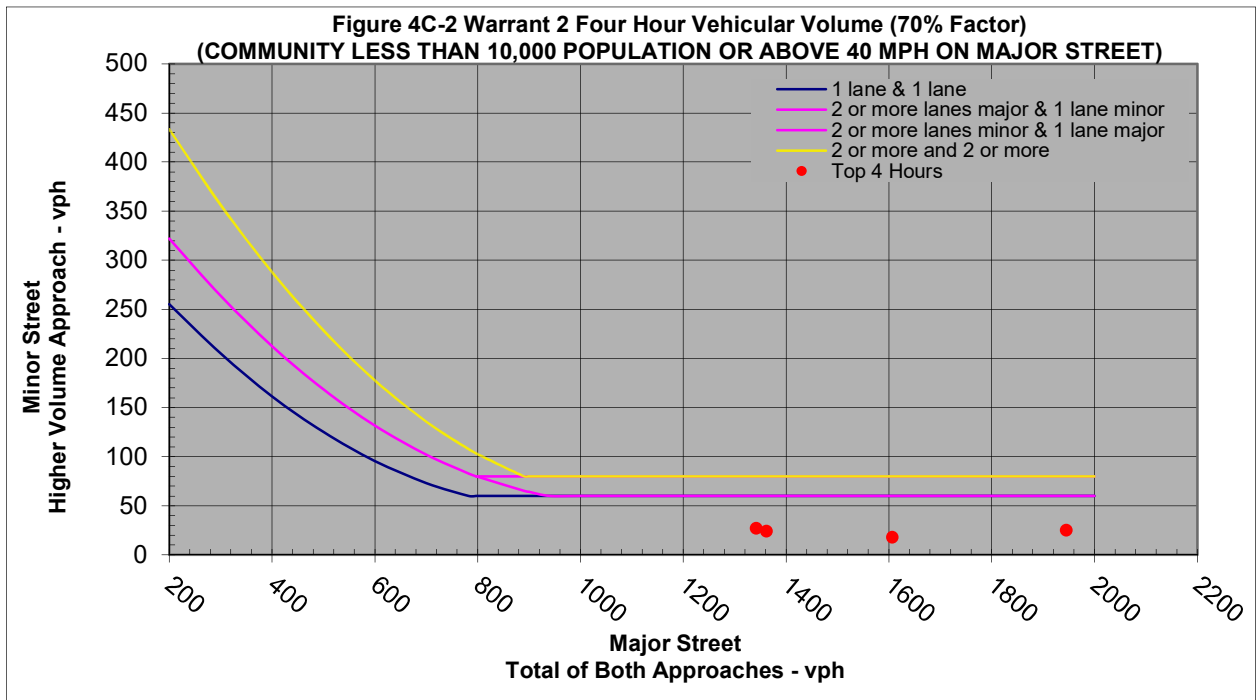
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Aberdeen/Park					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	136	85	2	3	221	3		
6:30 AM	311	192	3	9	503	9		
6:45 AM	589	304	11	12	893	12		
7:00 AM	881	413	13	21	1294	21		
7:15 AM	959	425	18	23	1384	23		
7:30 AM	990	421	22	26	1411	26		
7:45 AM	925	417	17	27	1342	27		
8:00 AM	840	435	17	28	1275	28		
8:15 AM	626	338	10	23	964	23		
8:30 AM	420	235	5	14	655	14		
8:45 AM	207	127	2	10	334	10		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	116	118	0	7	234	7		
10:30 AM	251	266	3	9	517	9		
10:45 AM	421	432	7	17	853	17		
11:00 AM	583	587	9	21	1170	21		
11:15 AM	597	620	13	19	1217	19		
11:30 AM	608	623	15	19	1231	19		
11:45 AM	601	624	13	16	1225	16		
12:00 PM	588	636	14	13	1224	14		
12:15 PM	458	485	10	8	943	10		
12:30 PM	312	334	5	6	646	6		
12:45 PM	149	167	3	1	316	3		
1:00 PM	0	0	0	0	0	0		
1:15 PM	131	162	2	2	293	2		
1:30 PM	266	336	3	6	602	6		
1:45 PM	402	522	5	14	924	14		
2:00 PM	544	689	8	16	1233	16		
2:15 PM	598	679	9	25	1277	25		
2:30 PM	624	738	10	24	1362	24		
2:45 PM	624	801	12	21	1425	21		
3:00 PM	647	865	13	21	1512	21		
3:15 PM	601	975	12	15	1576	15		
3:30 PM	600	1006	14	17	1606	17		
3:45 PM	605	1002	12	18	1607	18		
4:00 PM	600	1071	10	23	1671	23		
4:15 PM	642	1112	11	21	1754	21		
4:30 PM	686	1196	9	24	1882	24		
4:45 PM	738	1207	11	25	1945	25		
5:00 PM	798	1105	11	23	1903	23		
5:15 PM	617	802	8	20	1419	20		
5:30 PM	413	454	6	12	867	12		
5:45 PM	220	198	2	5	418	5		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	7:45 AM	8:45 AM	1342	27
2nd Highest Hour	4:45 PM	5:45 PM	1945	25
3rd Highest Hour	2:30 PM	3:30 PM	1362	24
4th Highest Hour	3:45 PM	4:45 PM	1607	18

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	7:45 AM	8:45 AM	1342	27
2nd Highest Hour	4:45 PM	5:45 PM	1945	25
3rd Highest Hour	2:30 PM	3:30 PM	1362	24
4th Highest Hour	3:45 PM	4:45 PM	1607	18



Are the requirements for Warrant 2 met?: No

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

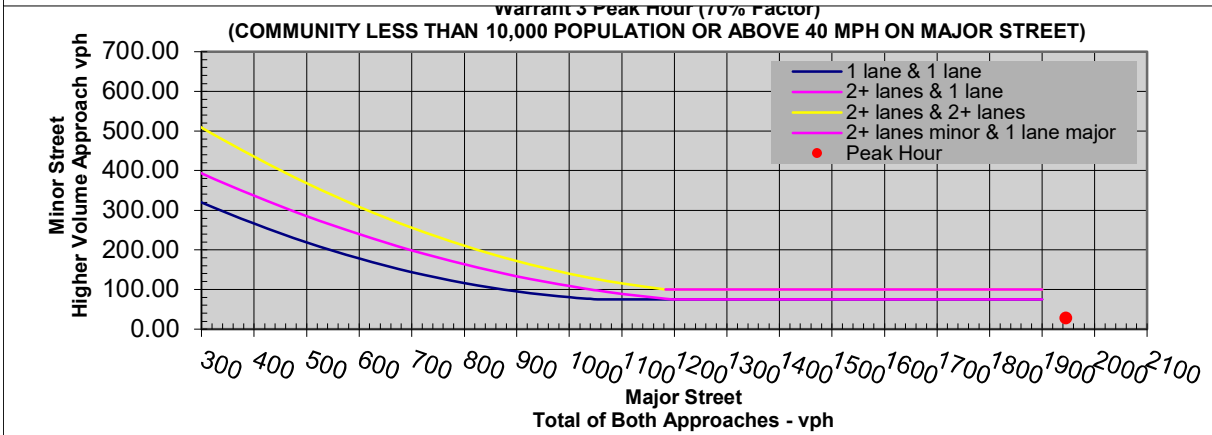
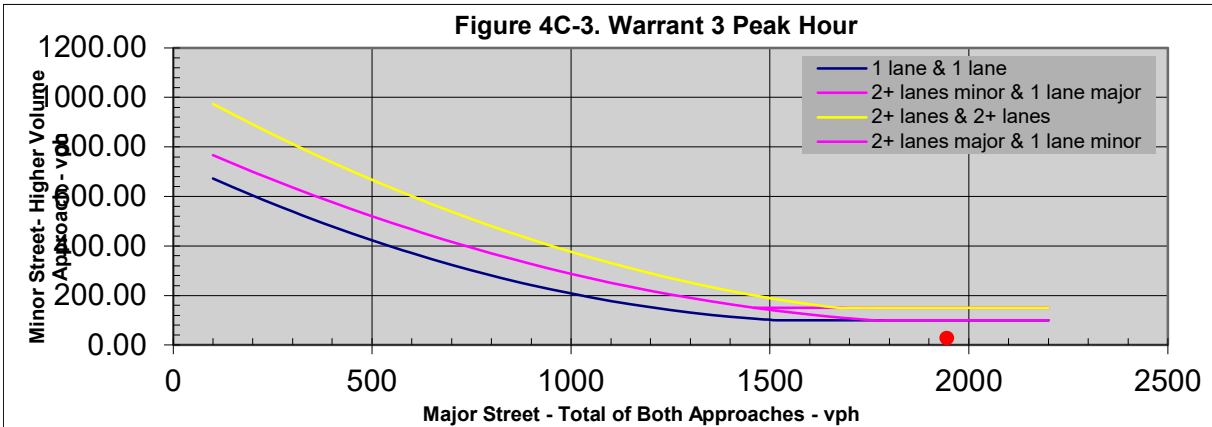
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant SR 48 and Aberdeen-Park

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	221	3	224	226
6:30 AM	503	9	512	515
6:45 AM	893	12	905	916
7:00 AM	1294	21	1315	1328
7:15 AM	1384	23	1407	1425
7:30 AM	1411	26	1437	1459
7:45 AM	1342	27	1369	1386
8:00 AM	1275	28	1303	1320
8:15 AM	964	23	987	997
8:30 AM	655	14	669	674
8:45 AM	334	10	344	346
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	234	7	241	241
10:30 AM	517	9	526	529
10:45 AM	853	17	870	877
11:00 AM	1170	21	1191	1200
11:15 AM	1217	19	1236	1249
11:30 AM	1231	19	1250	1265
11:45 AM	1225	16	1241	1254
12:00 PM	1224	14	1238	1251
12:15 PM	943	10	953	961
12:30 PM	646	6	652	657
12:45 PM	316	3	319	320
1:00 PM	0	0	0	0
1:15 PM	293	2	295	297
1:30 PM	602	6	608	611
1:45 PM	924	14	938	943
2:00 PM	1233	16	1249	1257
2:15 PM	1277	25	1302	1311
2:30 PM	1362	24	1386	1396
2:45 PM	1425	21	1446	1458
3:00 PM	1512	21	1533	1546
3:15 PM	1576	15	1591	1603
3:30 PM	1606	17	1623	1637
3:45 PM	1607	18	1625	1637
4:00 PM	1671	23	1694	1704
4:15 PM	1754	21	1775	1786
4:30 PM	1882	24	1906	1915
4:45 PM	1945	25	1970	1981
5:00 PM	1903	23	1926	1937
5:15 PM	1419	20	1439	1447
5:30 PM	867	12	879	885
5:45 PM	418	5	423	425
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1945	28	100	75

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	221	2
6:30 AM	503	3
6:45 AM	893	6
7:00 AM	1294	23
7:15 AM	1384	35
7:30 AM	1411	60
7:45 AM	1342	60
8:00 AM	1275	45
8:15 AM	964	31
8:30 AM	655	5
8:45 AM	334	2
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	234	0
10:30 AM	517	4
10:45 AM	853	9
11:00 AM	1170	12
11:15 AM	1217	16
11:30 AM	1231	12
11:45 AM	1225	9
12:00 PM	1224	9
12:15 PM	943	5
12:30 PM	646	5
12:45 PM	316	3
1:00 PM	0	0
1:15 PM	293	0
1:30 PM	602	2
1:45 PM	924	3
2:00 PM	1233	5
2:15 PM	1277	14
2:30 PM	1362	36
2:45 PM	1425	41
3:00 PM	1512	51
3:15 PM	1576	46
3:30 PM	1606	23
3:45 PM	1607	19
4:00 PM	1671	9
4:15 PM	1754	7
4:30 PM	1882	11
4:45 PM	1945	13
5:00 PM	1903	14
5:15 PM	1419	12
5:30 PM	867	7
5:45 PM	418	3
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? No

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet? No

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:30 AM	8:30 AM	1411	60
2nd Highest Hour	3:00 PM	4:00 PM	1512	51
3rd Highest Hour	11:15 AM	12:15 PM	1217	16
4th Highest Hour	5:00 PM	6:00 PM	1903	14

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:30 AM	8:30 AM	1411	60
2nd Highest Hour	3:00 PM	4:00 PM	1512	51
3rd Highest Hour	11:15 AM	12:15 PM	1217	16
4th Highest Hour	5:00 PM	6:00 PM	1903	14

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
3:00 PM	4:00 PM	1512	51

Number of Hours That Met the 4-Hour Criteria 4C-5	0
---	---

Number of Hours That Met the 4-Hour Criteria 4C-6	0
---	---

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

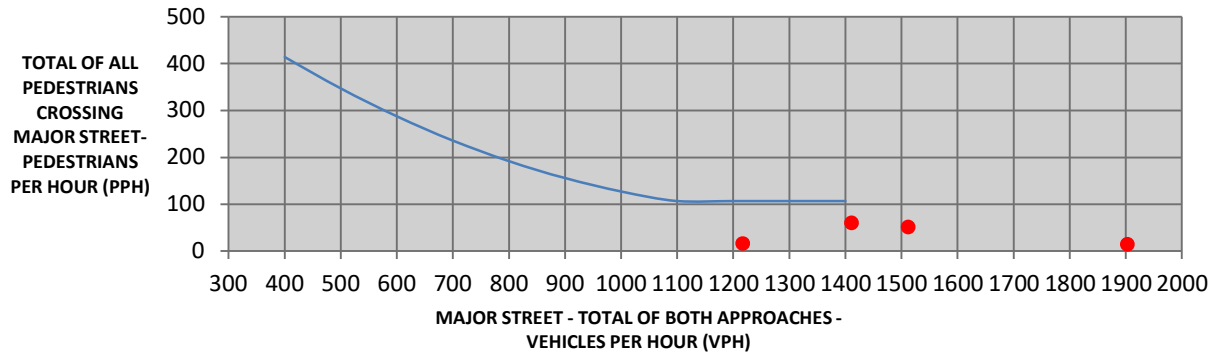
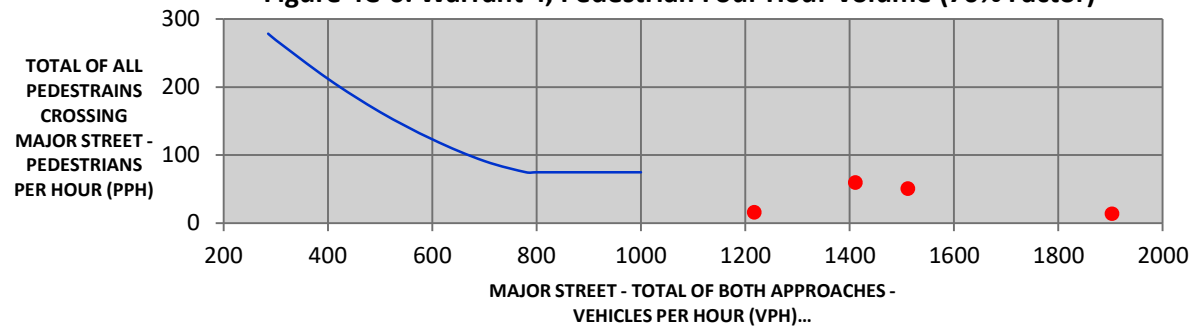
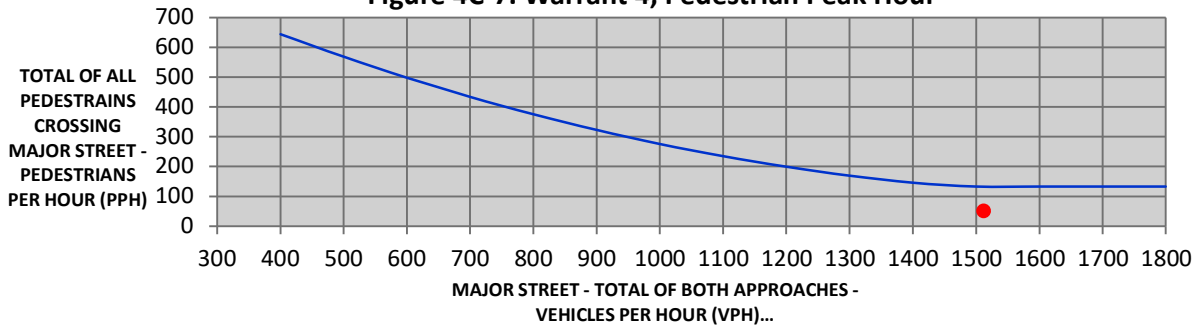


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)



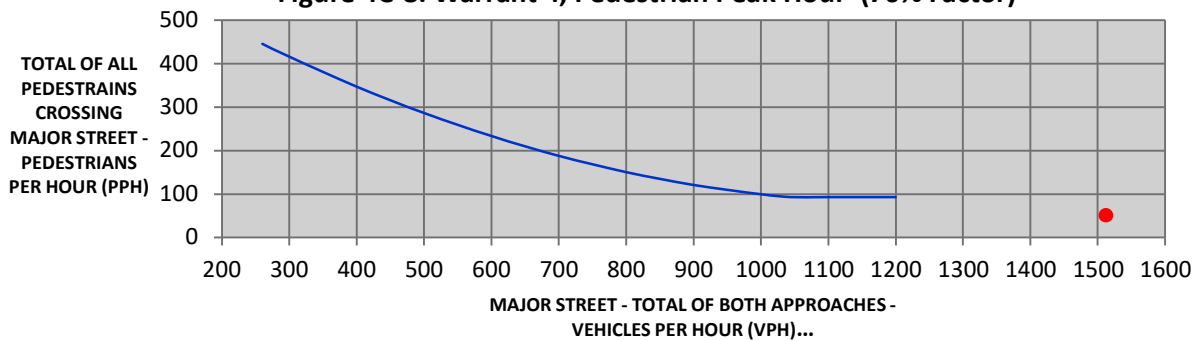
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Far Hills Avenue at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Far Hills Avenue, crossing distance from curb ramp to curb ramp (measured at 84 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

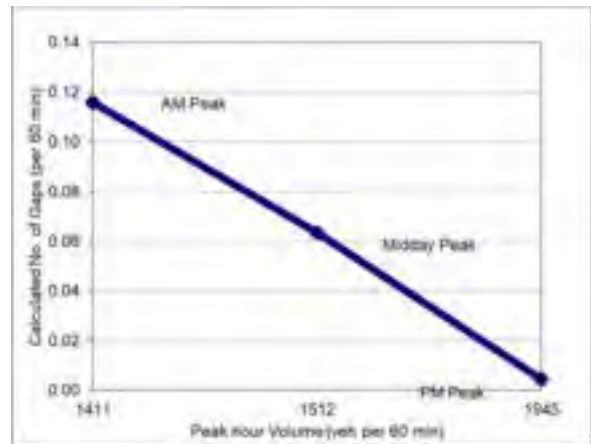
Where:

- $\lambda = \text{Total bidirectional volume at Aberdeen Ave} - \text{Park Ave}$
- $t = \text{Crossing Time} = \frac{84 \text{ ft}}{3.5 \text{ ft/s}} = 24 \text{ seconds}$

The resulting number of gaps for each peak hour volume are shown in **Figure 11C**.

The gap analysis shows that the number of gaps to cross Far Hills Avenue at the intersection during peak hours are less than 1 gap per hour. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). There are little to no opportunities to completely cross Far Hills Avenue. The existing traffic signal contributes significantly to providing adequate crossing time by stopping Far Hills Avenue traffic through the use of available push buttons. *Warrant #5 is satisfied.*

FIGURE 11C: GAP ANALYSIS (84 FT CROSSING DISTANCE)



The existing traffic signal at the Far Hills Avenue and Aberdeen Avenue/Park Road intersection **is warranted** as it meets signal warrant #5 (Gap Analysis). Gap analysis shows this traffic signal provides adequate gaps for pedestrians to cross Far Hills Avenue, especially during peak school pedestrian hours.

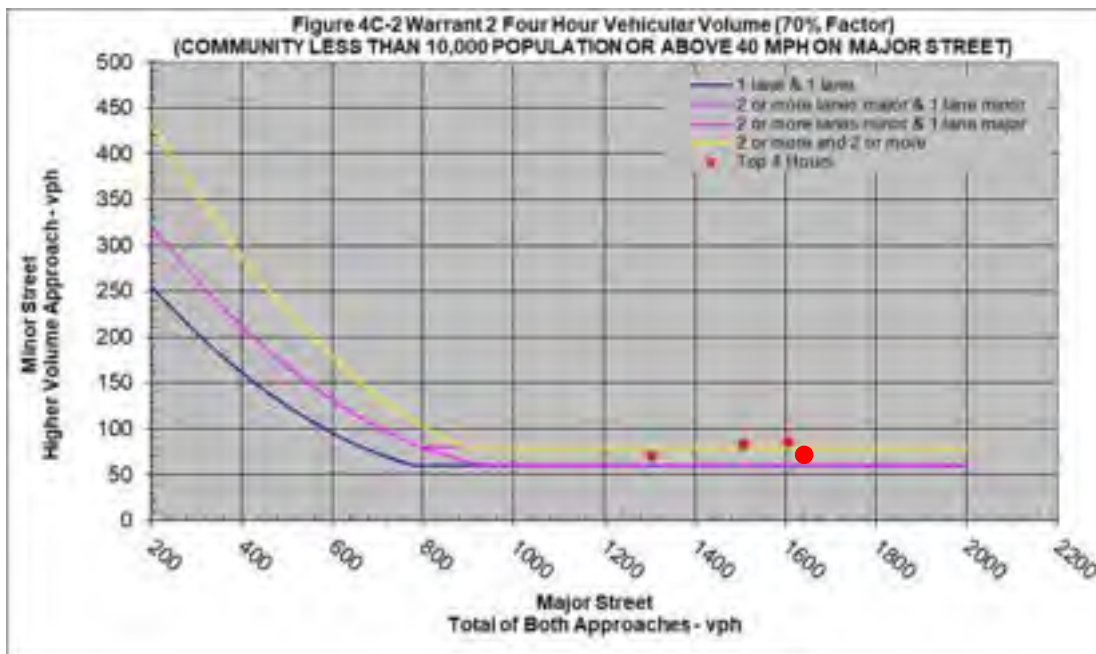
FAR HILLS AVENUE AT PEACH ORCHARD ROAD

This four-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. Four hours from the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition B using the 70% threshold, or 3 hours using the combination warrant (evaluated at 80%). Eight hours are needed for these warrants. *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-3 (**Figure 12A**) resulted in three volume pairs exceeding warrant #2 threshold when four volume pairs are needed. The 4th volume pair has a minor street volume of 58 vehicles. It is expected that an 11% COVID factor would push this volume over the threshold to meet warrant #2. *Warrant #2 is satisfied using COVID factors.*

FIGURE 12A: PEACH ORCHARD AVENUE WARRANT #2



Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 (**Figure 12B**) resulted in the volume pair exceeding warrant #3 threshold. *Warrant #3 is satisfied.*

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/6/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/14/2022
Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 5

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

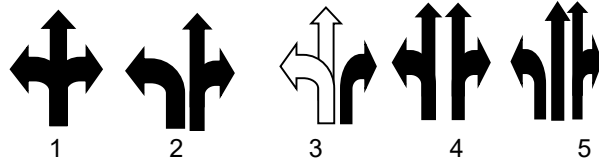
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Peach Orchard

Minor Street Approach Configuration: 1 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:			
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.			
<table border="1" style="float: right; border-collapse: collapse;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:15 PM</td></tr> <tr><td style="text-align: center;">5:15 PM</td></tr> </table>				Peak Hour	4:15 PM	5:15 PM
Peak Hour						
4:15 PM						
5:15 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.			
<table border="1" style="float: right; border-collapse: collapse;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:15 PM</td></tr> <tr><td style="text-align: center;">4:15 PM</td></tr> </table>				Peak Hour	3:15 PM	4:15 PM
Peak Hour						
3:15 PM						
4:15 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	184	4																
6:30 AM	467	12			1									1				
6:45 AM	849	21	1					1		1		1					1	
7:00 AM	1241	35					1											
7:15 AM	1378	52																
7:30 AM	1427	58			1									1				
7:45 AM	1382	54	1					1	1	1		1					1	1
8:00 AM	1324	55					1											
8:15 AM	1003	34																
8:30 AM	671	25			1									1				
8:45 AM	334	15																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Peach Orchard

10:00 AM	0	0																
10:15 AM	230	12																
10:30 AM	551	18		1				1			1		1		1			
10:45 AM	865	31	1					1			1		1		1			
11:00 AM	1177	43				1												
11:15 AM	1261	45																
11:30 AM	1274	49		1					1				1		1	1	1	
11:45 AM	1289	47	1					1			1		1					
12:00 PM	1308	56				1												
12:15 PM	994	45																
12:30 PM	660	36		1					1				1		1			
12:45 PM	331	18																
1:00 PM	0	0																
1:15 PM	301	15																
1:30 PM	594	27		1					1				1		1			
1:45 PM	934	37	1			1		1			1							
2:00 PM	1267	55																
2:15 PM	1305	70																
2:30 PM	1369	77		1					1				1		1	1	1	
2:45 PM	1372	80	1			1	1	1	1			1	1					
3:00 PM	1443	76																
3:15 PM	1507	83																
3:30 PM	1553	74		1					1				1		1	1	1	
3:45 PM	1586	74	1			1		1	1			1	1					
4:00 PM	1606	77																
4:15 PM	1607	85																
4:30 PM	1634	78		1					1				1		1	1	1	
4:45 PM	1653	74	1			1		1	1			1	1					
5:00 PM	1595	75																
5:15 PM	1191	51																
5:30 PM	761	37		1					1				1		1			
5:45 PM	366	22																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
7:00 PM	0	0																
7:15 PM	0	0																
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8:15 PM	0	0																
8:30 PM	0	0																
8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			8	0	11	0	8	1	8	4	10	0	8	3	11	0	10	5
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

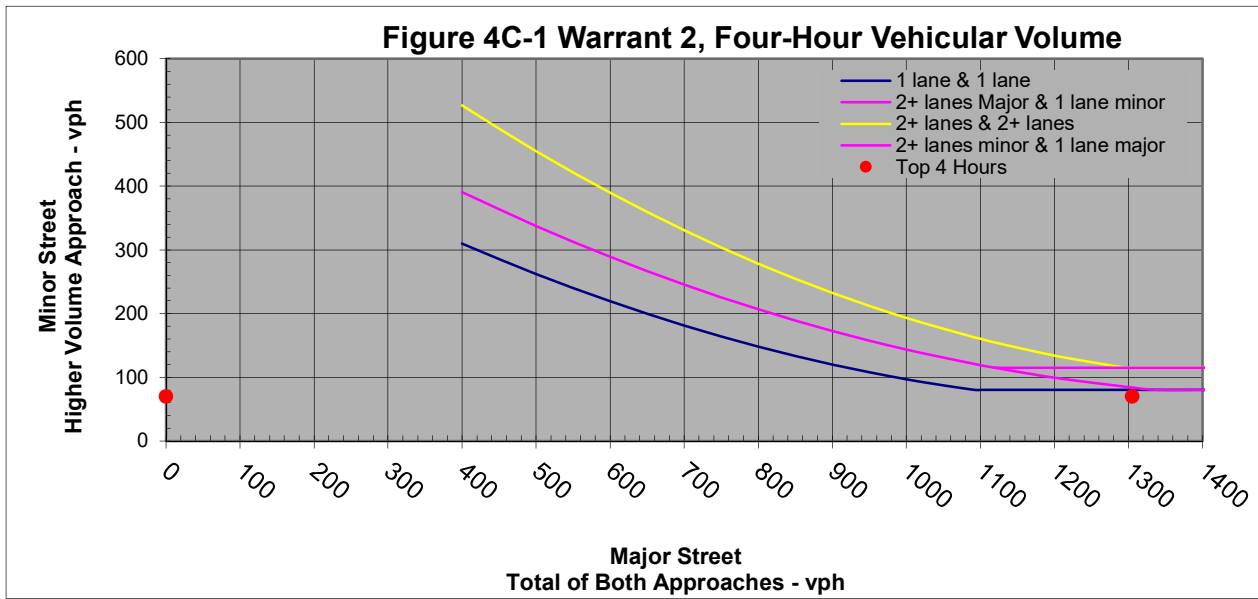
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	2
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	3
Minor Street: 1 Lane		

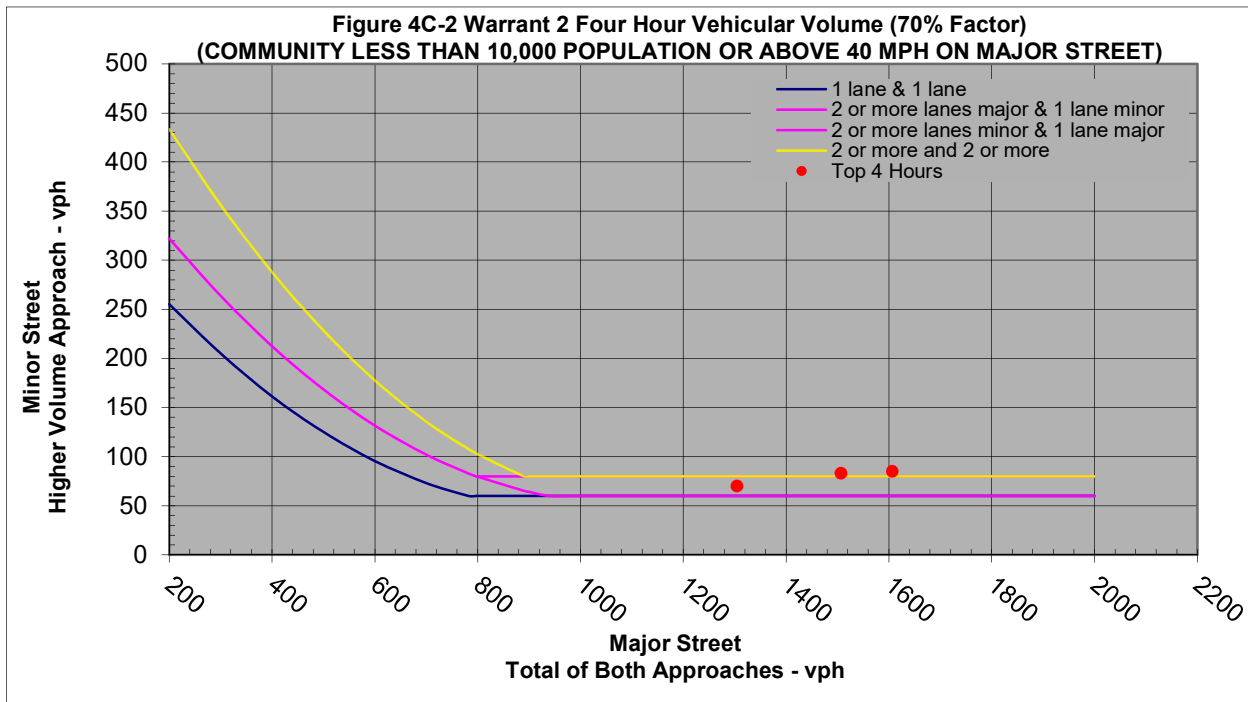
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Peach Orchard					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	118	66	0	4	184	4		
6:30 AM	295	172	3	12	467	12		
6:45 AM	545	304	7	21	849	21		
7:00 AM	802	439	11	35	1241	35		
7:15 AM	901	477	21	52	1378	52		
7:30 AM	919	508	26	58	1427	58		
7:45 AM	871	511	38	54	1382	54		
8:00 AM	787	537	43	55	1324	55		
8:15 AM	570	433	33	34	1003	34		
8:30 AM	375	296	25	20	671	25		
8:45 AM	173	161	9	15	334	15		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	100	130	7	12	230	12		
10:30 AM	257	294	14	18	551	18		
10:45 AM	386	479	26	31	865	31		
11:00 AM	529	648	35	43	1177	43		
11:15 AM	569	692	39	45	1261	45		
11:30 AM	556	718	41	49	1274	49		
11:45 AM	574	715	47	46	1289	47		
12:00 PM	588	720	56	48	1308	56		
12:15 PM	448	546	45	34	994	45		
12:30 PM	304	356	36	24	660	36		
12:45 PM	157	174	18	14	331	18		
1:00 PM	0	0	0	0	0	0		
1:15 PM	148	153	15	11	301	15		
1:30 PM	276	318	27	23	594	27		
1:45 PM	433	501	37	35	934	37		
2:00 PM	598	669	47	55	1267	55		
2:15 PM	600	705	42	70	1305	70		Met
2:30 PM	634	735	50	77	1369	77		
2:45 PM	608	764	61	80	1372	80		
3:00 PM	594	849	69	76	1443	76		
3:15 PM	582	925	83	66	1507	83	Met	Met
3:30 PM	565	988	74	68	1553	74		
3:45 PM	581	1005	74	72	1586	74		
4:00 PM	574	1032	67	77	1606	77		
4:15 PM	600	1007	49	85	1607	85	Met	Met
4:30 PM	628	1006	53	78	1634	78		
4:45 PM	644	1009	48	74	1653	74		
5:00 PM	654	941	48	75	1595	75		
5:15 PM	490	701	42	51	1191	51		
5:30 PM	317	444	27	37	761	37		
5:45 PM	154	212	11	22	366	22		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:15 PM	5:15 PM	1607	85
2nd Highest Hour	3:15 PM	4:15 PM	1507	83
3rd Highest Hour	12:00 AM	1:00 AM	0	70
4th Highest Hour	2:15 PM	3:15 PM	1305	70

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:15 PM	5:15 PM	1607	85
2nd Highest Hour	3:15 PM	4:15 PM	1507	83
3rd Highest Hour	2:15 PM	3:15 PM	1305	70
4th Highest Hour	12:00 AM	1:00 AM	0	58



Are the requirements for Warrant 2 met?: No

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:15 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:15 PM

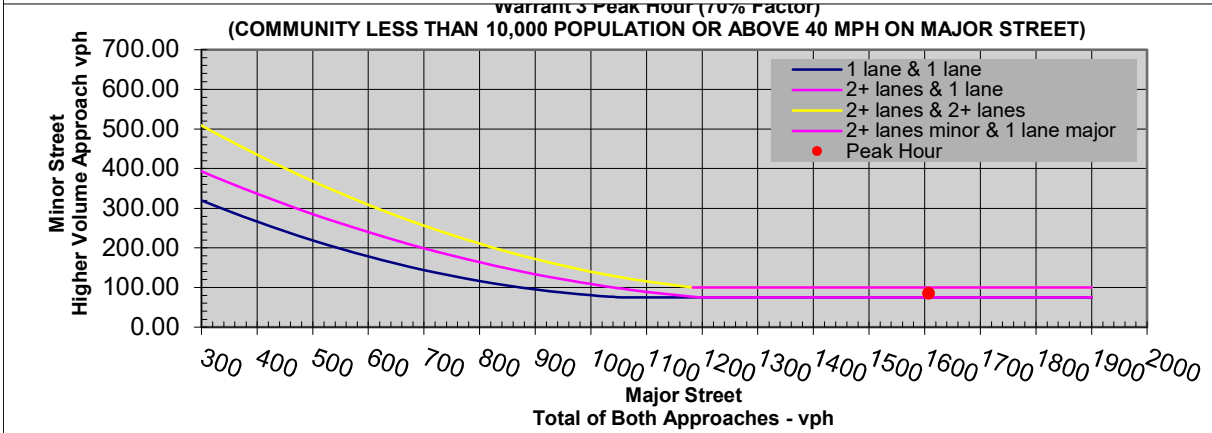
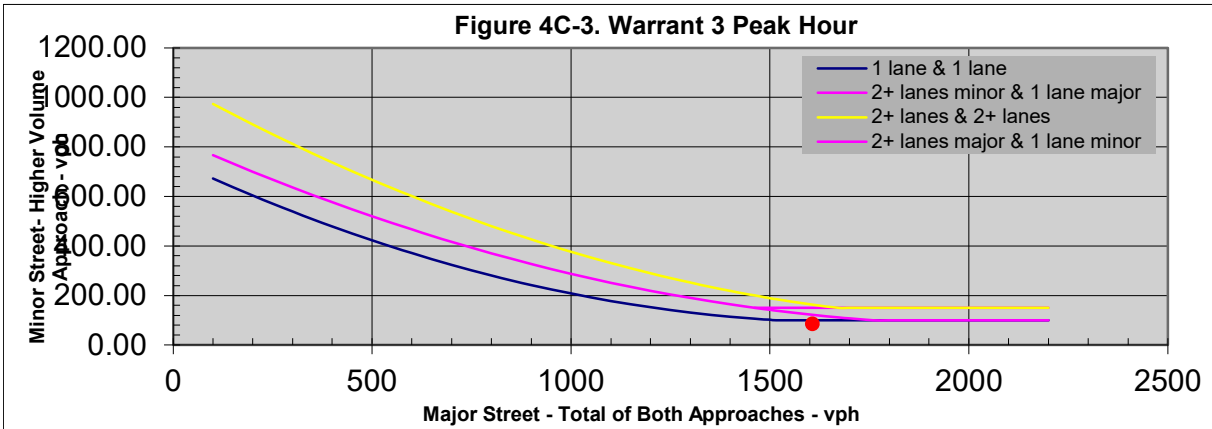
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**

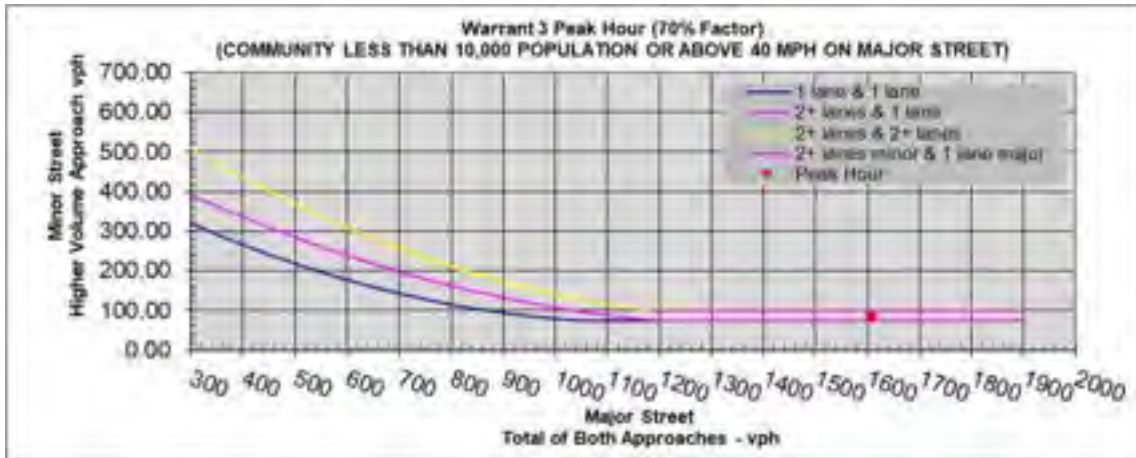


Signal Warrant SR 48 and Peach Orchard

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	184	4	188	188
6:30 AM	467	12	479	482
6:45 AM	849	21	870	877
7:00 AM	1241	35	1276	1287
7:15 AM	1378	52	1430	1451
7:30 AM	1427	58	1485	1511
7:45 AM	1382	54	1436	1474
8:00 AM	1324	55	1379	1422
8:15 AM	1003	34	1037	1070
8:30 AM	671	25	696	716
8:45 AM	334	15	349	358
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	230	12	242	249
10:30 AM	551	18	569	583
10:45 AM	865	31	896	922
11:00 AM	1177	43	1220	1255
11:15 AM	1261	45	1306	1345
11:30 AM	1274	49	1323	1364
11:45 AM	1289	47	1336	1382
12:00 PM	1308	56	1364	1412
12:15 PM	994	45	1039	1073
12:30 PM	660	36	696	720
12:45 PM	331	18	349	363
1:00 PM	0	0	0	0
1:15 PM	301	15	316	327
1:30 PM	594	27	621	644
1:45 PM	934	37	971	1006
2:00 PM	1267	55	1322	1369
2:15 PM	1305	70	1375	1417
2:30 PM	1369	77	1446	1496
2:45 PM	1372	80	1452	1513
3:00 PM	1443	76	1519	1588
3:15 PM	1507	83	1590	1656
3:30 PM	1553	74	1627	1695
3:45 PM	1586	74	1660	1732
4:00 PM	1606	77	1683	1750
4:15 PM	1607	85	1692	1741
4:30 PM	1634	78	1712	1765
4:45 PM	1653	74	1727	1775
5:00 PM	1595	75	1670	1718
5:15 PM	1191	51	1242	1284
5:30 PM	761	37	798	825
5:45 PM	366	22	388	399
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1607	85	122	75

FIGURE 12B: PEACH ORCHARD AVENUE WARRANT #3



The existing traffic signal at the Far Hills Avenue and Peach Orchard Avenue intersection **is warranted** as it meets signal warrants #2 (with COVID factors applied) #3 (without COVID factors applied).

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/6/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/15/2022
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 3

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

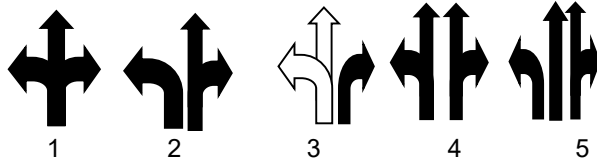
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Orchard

Minor Street Approach Configuration: E-Bound
W-Bound



Number of Thru Lanes on Each Minor Street Approach: LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:			
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">5:00 PM</td></tr> <tr><td style="text-align: center;">6:00 PM</td></tr> </table>	Peak Hour	5:00 PM	6:00 PM
Peak Hour						
5:00 PM						
6:00 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:00 PM</td></tr> <tr><td style="text-align: center;">4:00 PM</td></tr> </table>	Peak Hour	3:00 PM	4:00 PM
Peak Hour						
3:00 PM						
4:00 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No					
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	2 or More Lanes

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+		X	600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
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5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	169	0																
6:30 AM	425	0			1									1				
6:45 AM	823	0	1					1		1		1					1	
7:00 AM	1208	0					1											
7:15 AM	1355	0																
7:30 AM	1389	0			1									1				
7:45 AM	1271	0	1					1		1		1					1	
8:00 AM	1224	0					1											
8:15 AM	908	0																
8:30 AM	618	0			1									1				
8:45 AM	338	0																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and Orchard

10:00 AM	0	0																
10:15 AM	299	0																
10:30 AM	596	0		1				1			1		1		1			
10:45 AM	918	0	1			1		1			1							
11:00 AM	1265	0																
11:15 AM	1306	0																
11:30 AM	1359	0		1					1				1		1			
11:45 AM	1376	0	1			1		1			1							
12:00 PM	1371	0																
12:15 PM	1031	0																
12:30 PM	681	0		1					1				1		1			
12:45 PM	342	0																
1:00 PM	0	0																
1:15 PM	303	0																
1:30 PM	626	0	1		1					1			1		1			
1:45 PM	975	0				1		1			1							
2:00 PM	1338	0																
2:15 PM	1362	0																
2:30 PM	1421	0	1		1				1				1		1			
2:45 PM	1424	0				1		1			1							
3:00 PM	1430	0																
3:15 PM	1446	0																
3:30 PM	1432	0	1		1				1				1		1			
3:45 PM	1411	0				1		1			1							
4:00 PM	1354	0																
4:15 PM	1483	0																
4:30 PM	1608	0	1		1					1			1		1			
4:45 PM	1694	0				1		1			1							
5:00 PM	1755	0																
5:15 PM	1283	0																
5:30 PM	790	0	1		1				1				1		1			
5:45 PM	373	0																
6:00 PM	0	0																
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9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			9	0	11	0	8	0	8	0	10	0	8	0	11	0	10	0
WARRANT SATISFIED?			NO		NO		NO		NO		NO		NO		NO		NO	

Warrant Met: **No**

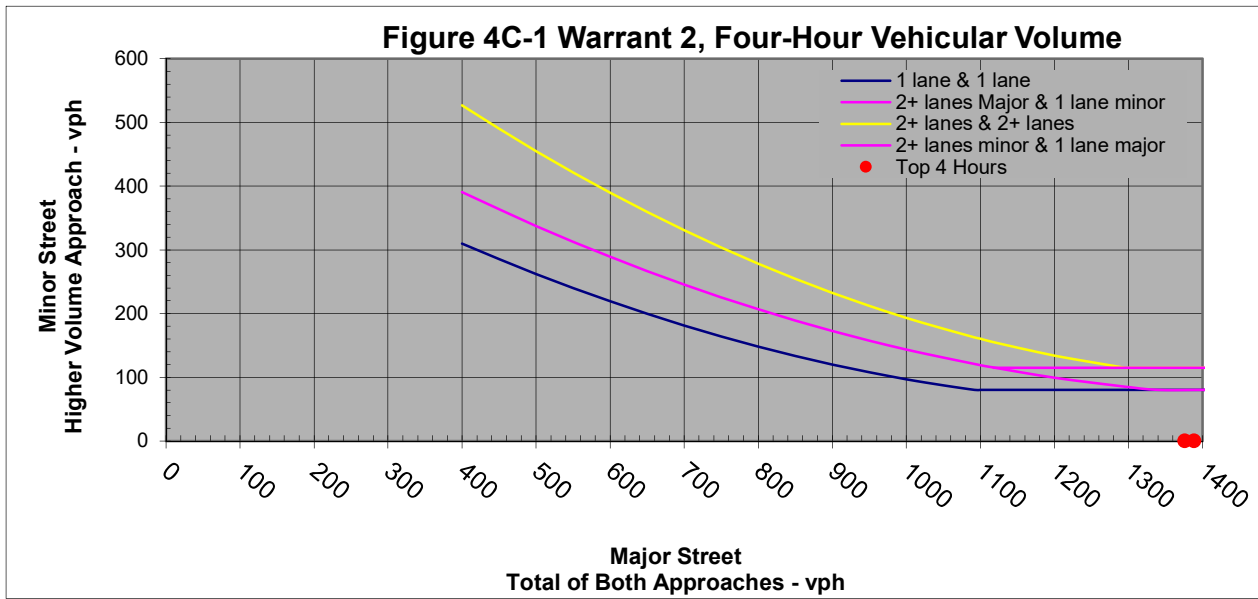
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 2 or More Lanes		

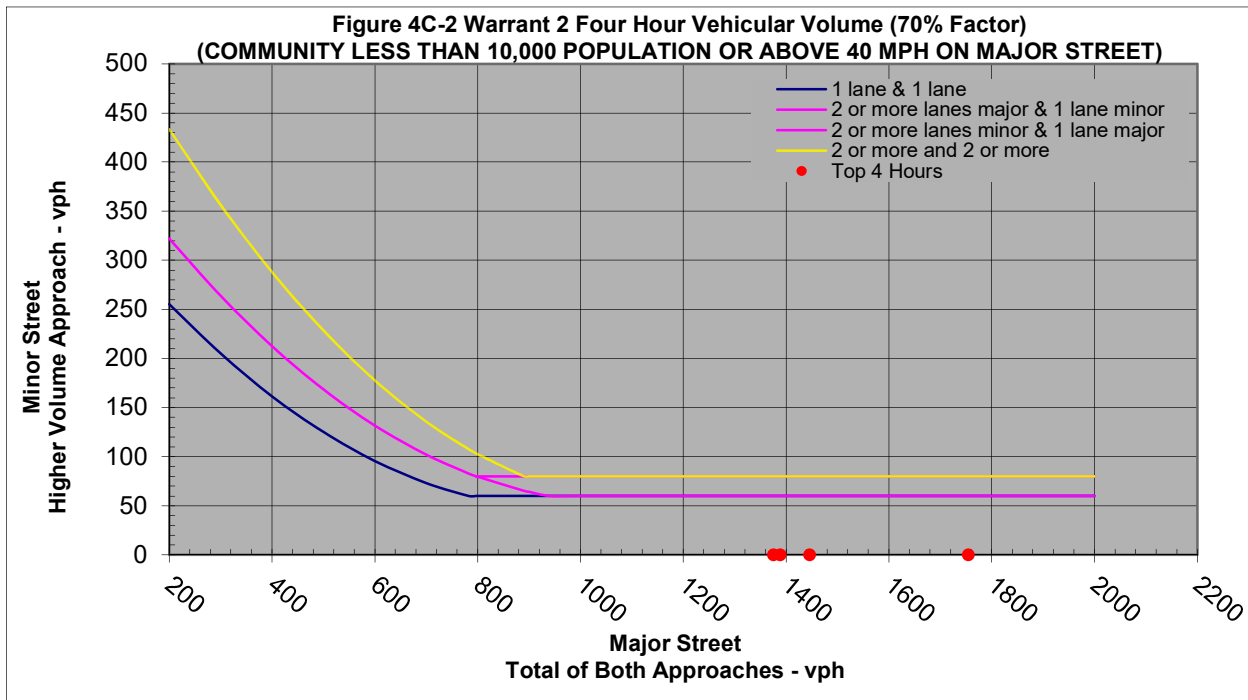
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - Orchard					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	104	65	0	0	169	0		
6:30 AM	266	159	0	0	425	0		
6:45 AM	525	298	0	0	823	0		
7:00 AM	790	418	0	0	1208	0		
7:15 AM	871	484	0	0	1355	0		
7:30 AM	894	495	0	0	1389	0		
7:45 AM	799	472	0	0	1271	0		
8:00 AM	725	499	0	0	1224	0		
8:15 AM	540	368	0	0	908	0		
8:30 AM	355	263	0	0	618	0		
8:45 AM	191	147	0	0	338	0		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	146	153	0	0	299	0		
10:30 AM	282	314	0	0	596	0		
10:45 AM	429	489	0	0	918	0		
11:00 AM	610	655	0	0	1265	0		
11:15 AM	616	690	0	0	1306	0		
11:30 AM	646	713	0	0	1359	0		
11:45 AM	678	698	0	0	1376	0		
12:00 PM	660	711	0	0	1371	0		
12:15 PM	508	523	0	0	1031	0		
12:30 PM	342	339	0	0	681	0		
12:45 PM	163	179	0	0	342	0		
1:00 PM	0	0	0	0	0	0		
1:15 PM	138	165	0	0	303	0		
1:30 PM	280	346	0	0	626	0		
1:45 PM	449	526	0	0	975	0		
2:00 PM	638	700	0	0	1338	0		
2:15 PM	665	697	0	0	1362	0		
2:30 PM	694	727	0	0	1421	0		
2:45 PM	663	761	0	0	1424	0		
3:00 PM	621	809	0	0	1430	0		
3:15 PM	610	836	0	0	1446	0		
3:30 PM	607	825	0	0	1432	0		
3:45 PM	602	809	0	0	1411	0		
4:00 PM	622	732	0	0	1354	0		
4:15 PM	670	813	0	0	1483	0		
4:30 PM	709	899	0	0	1608	0		
4:45 PM	771	923	0	0	1694	0		
5:00 PM	799	956	0	0	1755	0		
5:15 PM	597	686	0	0	1283	0		
5:30 PM	390	400	0	0	790	0		
5:45 PM	195	178	0	0	373	0		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	5:00 PM	6:00 PM	1755	0
2nd Highest Hour	3:15 PM	4:15 PM	1446	0
3rd Highest Hour	7:30 AM	8:30 AM	1389	0
4th Highest Hour	11:45 AM	12:45 PM	1376	0

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	5:00 PM	6:00 PM	1755	0
2nd Highest Hour	3:15 PM	4:15 PM	1446	0
3rd Highest Hour	7:30 AM	8:30 AM	1389	0
4th Highest Hour	11:45 AM	12:45 PM	1376	0



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	5:00 PM
Minor Street:	2 or More Lanes	Peak Hour End Time
		6:00 PM

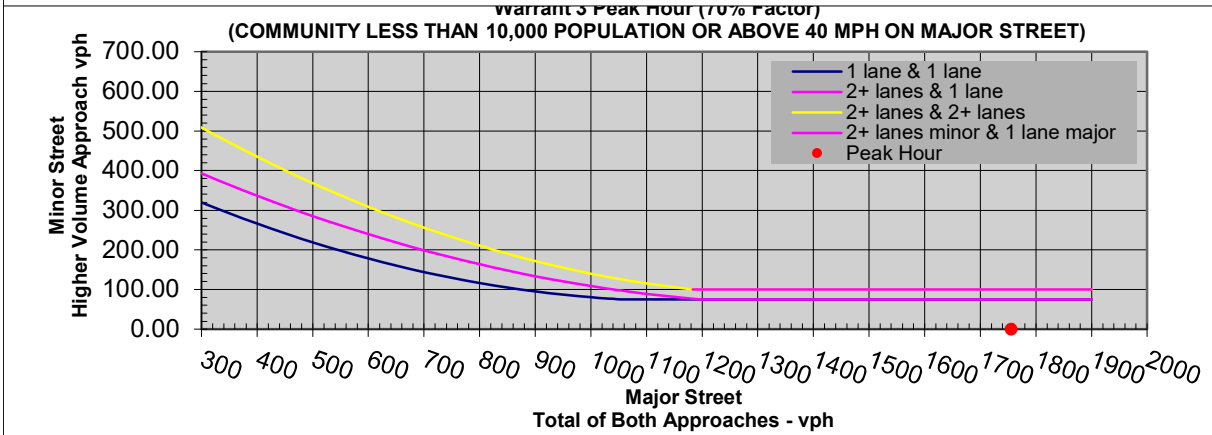
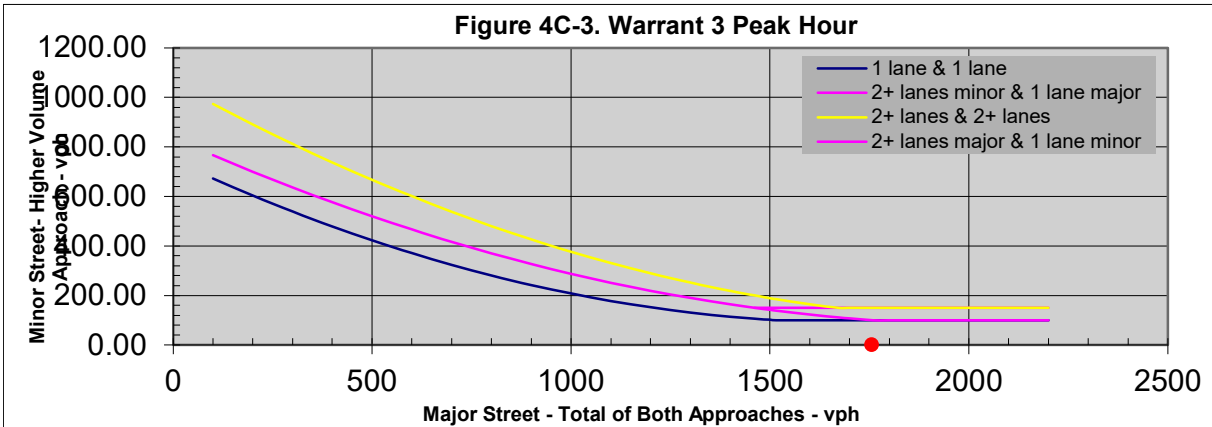
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant SR 48 and Orchard

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	169	0	169	169
6:30 AM	425	0	425	425
6:45 AM	823	0	823	823
7:00 AM	1208	0	1208	1208
7:15 AM	1355	0	1355	1355
7:30 AM	1389	0	1389	1389
7:45 AM	1271	0	1271	1271
8:00 AM	1224	0	1224	1224
8:15 AM	908	0	908	908
8:30 AM	618	0	618	618
8:45 AM	338	0	338	338
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	299	0	299	299
10:30 AM	596	0	596	596
10:45 AM	918	0	918	918
11:00 AM	1265	0	1265	1265
11:15 AM	1306	0	1306	1306
11:30 AM	1359	0	1359	1359
11:45 AM	1376	0	1376	1376
12:00 PM	1371	0	1371	1371
12:15 PM	1031	0	1031	1031
12:30 PM	681	0	681	681
12:45 PM	342	0	342	342
1:00 PM	0	0	0	0
1:15 PM	303	0	303	303
1:30 PM	626	0	626	626
1:45 PM	975	0	975	975
2:00 PM	1338	0	1338	1338
2:15 PM	1362	0	1362	1362
2:30 PM	1421	0	1421	1421
2:45 PM	1424	0	1424	1424
3:00 PM	1430	0	1430	1430
3:15 PM	1446	0	1446	1446
3:30 PM	1432	0	1432	1432
3:45 PM	1411	0	1411	1411
4:00 PM	1354	0	1354	1354
4:15 PM	1483	0	1483	1483
4:30 PM	1608	0	1608	1608
4:45 PM	1694	0	1694	1694
5:00 PM	1755	0	1755	1755
5:15 PM	1283	0	1283	1283
5:30 PM	790	0	790	790
5:45 PM	373	0	373	373
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1755	0	150	100

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	169	0
6:30 AM	425	0
6:45 AM	823	0
7:00 AM	1208	0
7:15 AM	1355	9
7:30 AM	1389	12
7:45 AM	1271	14
8:00 AM	1224	15
8:15 AM	908	6
8:30 AM	618	3
8:45 AM	338	1
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	299	1
10:30 AM	596	3
10:45 AM	918	8
11:00 AM	1265	10
11:15 AM	1306	11
11:30 AM	1359	12
11:45 AM	1376	15
12:00 PM	1371	21
12:15 PM	1031	19
12:30 PM	681	16
12:45 PM	342	8
1:00 PM	0	0
1:15 PM	303	8
1:30 PM	626	13
1:45 PM	975	15
2:00 PM	1338	18
2:15 PM	1362	15
2:30 PM	1421	13
2:45 PM	1424	23
3:00 PM	1430	22
3:15 PM	1446	17
3:30 PM	1432	14
3:45 PM	1411	2
4:00 PM	1354	2
4:15 PM	1483	2
4:30 PM	1608	5
4:45 PM	1694	5
5:00 PM	1755	4
5:15 PM	1283	4
5:30 PM	790	1
5:45 PM	373	1
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	2:45 PM	3:45 PM	1424	23
2nd Highest Hour	12:00 PM	1:00 PM	1371	21
3rd Highest Hour	8:00 AM	9:00 AM	1224	15
4th Highest Hour	11:00 AM	12:00 PM	1265	10

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	2:45 PM	3:45 PM	1424	23
2nd Highest Hour	12:00 PM	1:00 PM	1371	21
3rd Highest Hour	8:00 AM	9:00 AM	1224	15
4th Highest Hour	1:45 PM	2:45 PM	975	15

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
3:00 PM	4:00 PM	1430	22

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

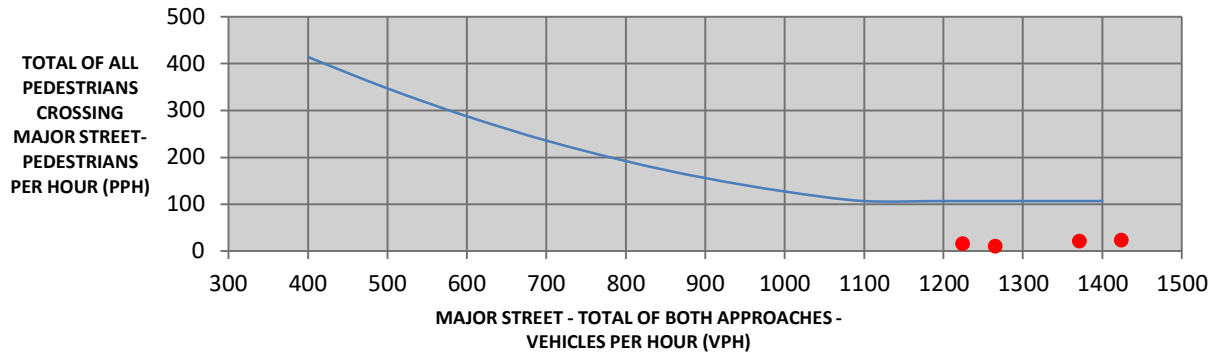


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)

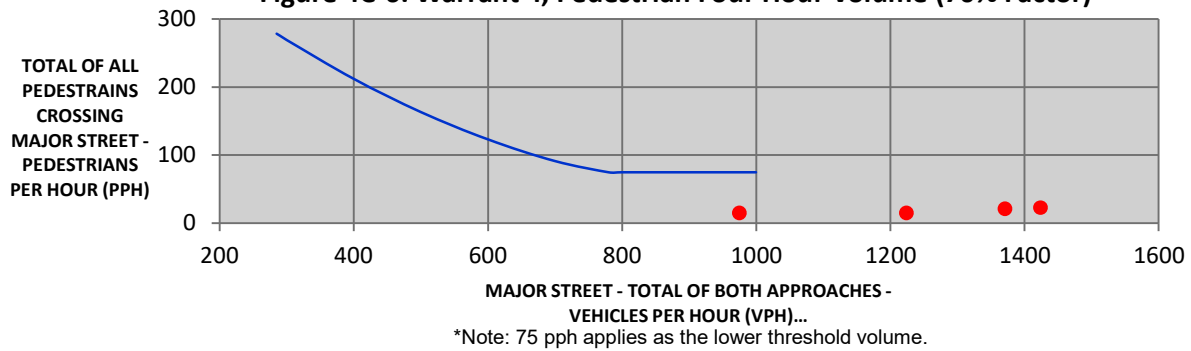


Figure 4C-7. Warrant 4, Pedestrian Peak Hour

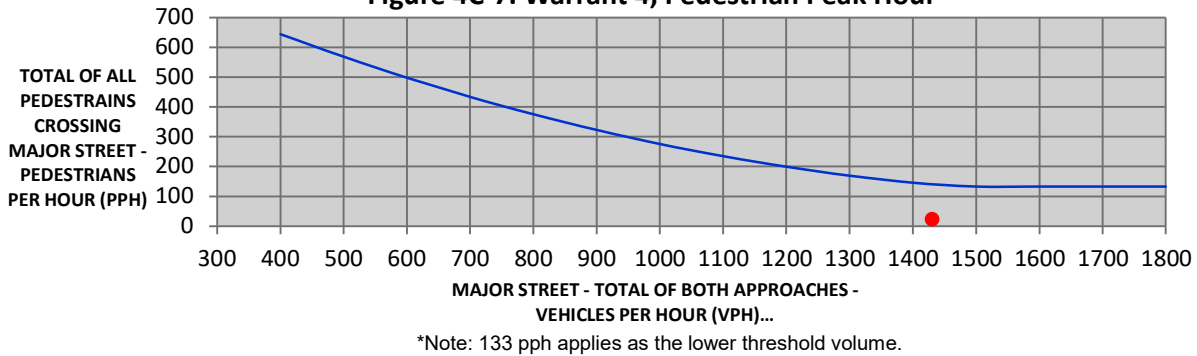
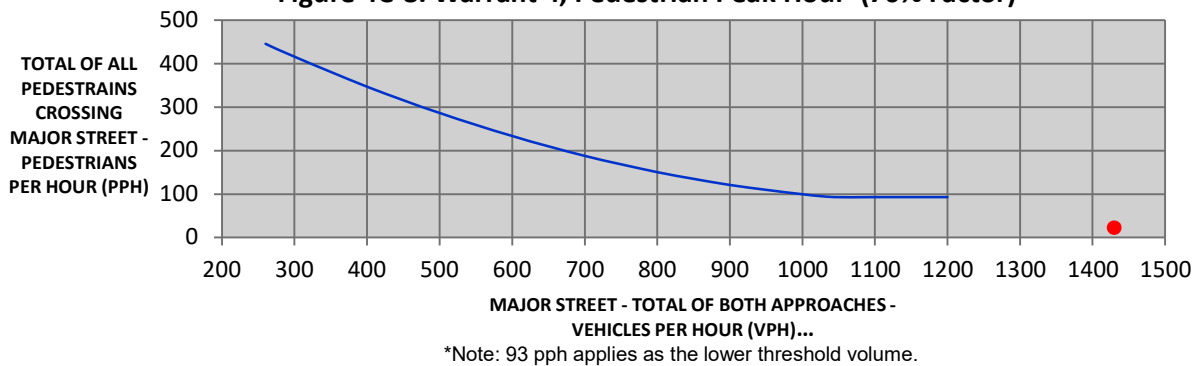


Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



FAR HILLS AVENUE AT ORCHARD DRIVE

This three-leg intersection is a signalized crosswalk and is analyzed only for Signal Warrant 4.

Warrant #4. A total of 148 pedestrians were observed crossing Far Hills Avenue at Orchard Avenue during the 8 hour data collection periods. Due to the intersection being located in the middle of the Oakwood commercial district, a gap analysis was performed at the intersection despite the low number of observed pedestrians to understand the impact of pedestrian crossings without the existing signal.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Far Hills Avenue at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Far Hills Avenue, crossing distance from curb ramp to curb ramp (measured at 59 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

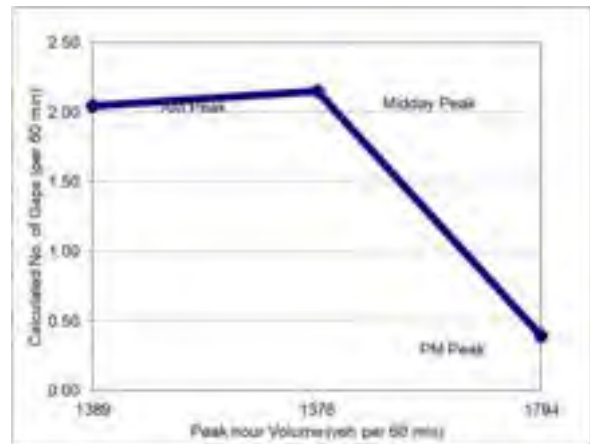
Where:

- λ = Total bidirectional volume at Orchard Ave
- t = Crossing Time = $\frac{59 \text{ ft}}{3.5 \text{ ft/s}} = 16.9 \text{ seconds}$

The resulting number of gaps for each peak hour volume are shown in **Figure 13A**.

The gap analysis shows that the number of gaps to cross Far Hills Avenue at the intersection during peak hours are less than 3 gaps per hour. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). The calculations show that there is little to no opportunities to cross during the PM peak hour. The existing traffic signal contributes significantly to providing adequate crossing time by stopping Bagley Road traffic through the use of available push buttons. *Warrant #4 is satisfied.*

FIGURE 13A: GAP ANALYSIS (59 FT CROSSING DISTANCE)



The existing traffic signal at the Far Hills Avenue and Orchard Avenue is **warranted** as it meets Warrant #4 (gap analysis). Gap analysis shows that the existing traffic signal provides adequate gaps for pedestrians to cross Far Hills Avenue.

FAR HILLS AVENUE AT EAST DRIVE

This four-leg intersection is analyzed assuming 2 lanes on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. The minimum threshold for vehicles per hour on the higher volume, minor side street single lane approach is 120 vehicles when evaluating the combo warrant #1 at condition A and 60 vehicles at condition B. Although all highest eight hours exceeds the 120-vehicle threshold, only seven exceeded 60 vehicles. *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-1 (**Figure 14A**) resulted in all four volume pairs exceeding warrant #2 threshold. *Warrant #2 is satisfied.*

Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-3 resulted in the volume pair exceeding warrant #3 threshold. The higher minor street volume shown in **Figure 14B** is equal to 120 vehicles, which exceeds the 100 vehicles threshold. *Warrant #3 is satisfied.*

The existing traffic signal at the Far Hills Avenue and East Drive intersection **is warranted** as it meets signal warrant #2 and warrant #3.

FIGURE 14A: EAST DRIVE WARRANT #2



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/15/2022
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: SR 48

Major Street Approach Direction: N-Bound
S-Bound

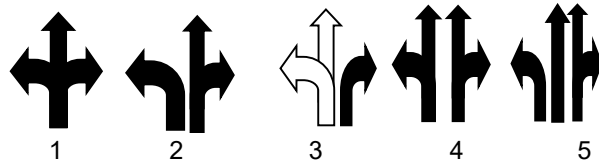
Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: East

Minor Street Approach Configuration: 3 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:
	Applicable?	Satisfied?	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No	
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes	Figure 4C-1 (100%)
Warrant 3, Peak Hour	Yes	Yes	Signals installed under Warrant 3 should be traffic actuated.
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Retain Existing Traffic Signal

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
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5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	171	14																
6:30 AM	452	26			1									1				
6:45 AM	817	51	1					1		1		1				1	1	
7:00 AM	1221	65					1											
7:15 AM	1361	57																
7:30 AM	1367	71			1									1				
7:45 AM	1277	68	1					1	1	1		1	1			1	1	
8:00 AM	1204	69					1											
8:15 AM	893	63																
8:30 AM	606	37			1									1				
8:45 AM	331	15																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant SR 48 and East

10:00 AM	0	0																
10:15 AM	313	24																
10:30 AM	612	45	1		1					1				1		1	1	
10:45 AM	949	71						1		1	1			1	1			
11:00 AM	1304	101																
11:15 AM	1331	100																
11:30 AM	1372	103	1		1					1				1	1	1	1	
11:45 AM	1388	103						1	1	1	1			1	1			
12:00 PM	1395	91																
12:15 PM	1055	68																
12:30 PM	715	44	1		1					1				1		1	1	
12:45 PM	362	18																
1:00 PM	0	0																
1:15 PM	339	22																
1:30 PM	679	40	1		1					1				1		1		
1:45 PM	1043	65						1						1	1			
2:00 PM	1401	90																
2:15 PM	1409	85																
2:30 PM	1460	94	1		1					1	1	1			1	1	1	
2:45 PM	1466	90						1	1					1	1			
3:00 PM	1474	86																
3:15 PM	1538	92																
3:30 PM	1542	101	1		1					1	1	1			1	1	1	
3:45 PM	1570	107						1	1					1	1			
4:00 PM	1682	106																
4:15 PM	1786	120																
4:30 PM	1870	102	1		1					1	1	1			1	1	1	
4:45 PM	1926	107						1	1					1	1			
5:00 PM	1824	112																
5:15 PM	1309	75																
5:30 PM	830	57	1		1					1	1	1			1		1	
5:45 PM	376	25																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
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9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			10	0	11	0	8	4	9	7	10	0	8	7	11	4	10	9
WARRANT SATISFIED?			NO		N/A		NO		N/A		NO		NO		NO		NO	

Warrant Met: **No**

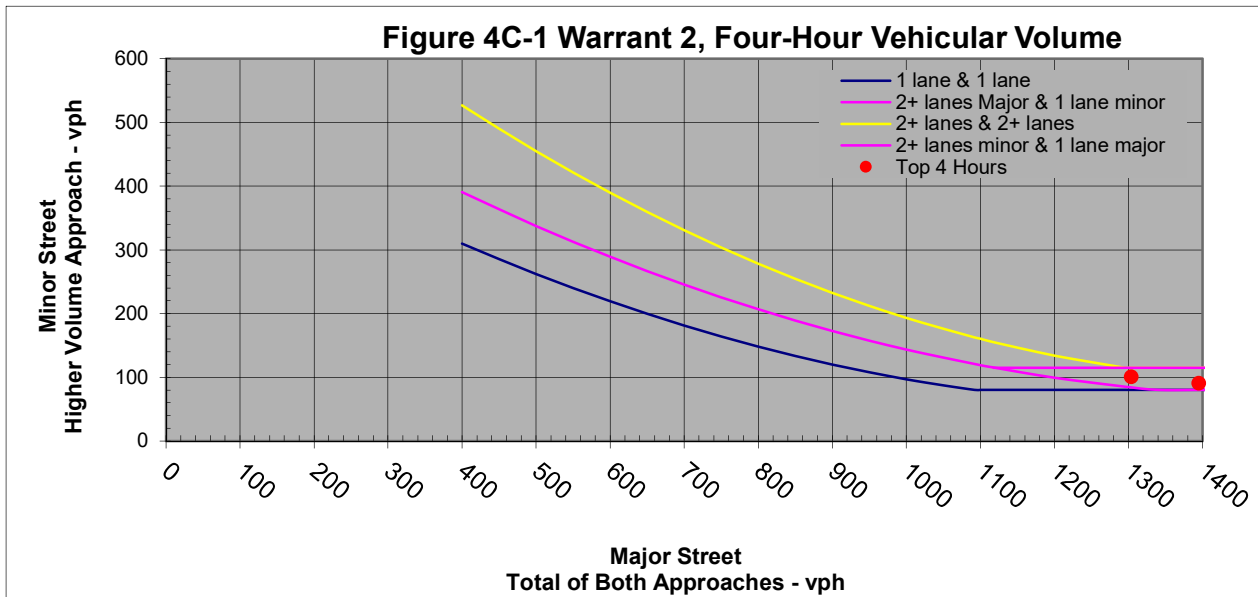
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	6
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	8
Minor Street: 1 Lane		

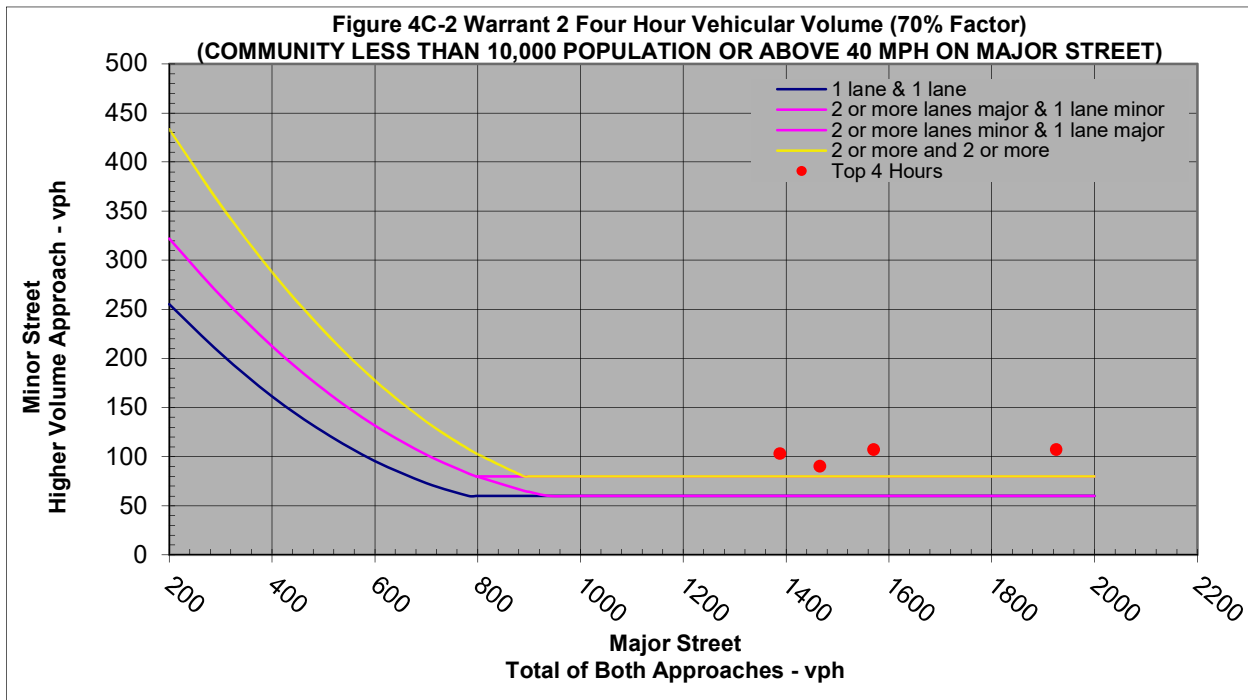
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 48		Minor - East					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	98	73	14	0	171	14		
6:30 AM	277	175	26	1	452	26		
6:45 AM	514	303	51	4	817	51		
7:00 AM	778	443	65	4	1221	65		Met
7:15 AM	876	485	57	4	1361	57		
7:30 AM	881	486	71	6	1367	71		
7:45 AM	796	481	68	3	1277	68		
8:00 AM	728	476	69	8	1204	69		Met
8:15 AM	532	361	63	8	893	63		
8:30 AM	348	258	37	5	606	37		
8:45 AM	196	135	15	5	331	15		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	159	154	24	8	313	24		
10:30 AM	300	312	45	21	612	45		
10:45 AM	471	478	71	26	949	71		Met
11:00 AM	653	651	101	33	1304	101	Met	
11:15 AM	655	676	100	44	1331	100		
11:30 AM	684	688	103	44	1372	103		
11:45 AM	695	693	103	44	1388	103		Met
12:00 PM	698	697	91	44	1395	91	Met	
12:15 PM	537	518	68	25	1055	68		
12:30 PM	367	348	44	12	715	44		
12:45 PM	185	177	18	7	362	18		
1:00 PM	0	0	0	0	0	0		
1:15 PM	169	170	22	15	339	22		
1:30 PM	332	347	40	20	679	40		
1:45 PM	511	532	65	33	1043	65		Met
2:00 PM	694	707	90	47	1401	90	Met	
2:15 PM	695	714	85	41	1409	85		
2:30 PM	709	751	94	47	1460	94		
2:45 PM	689	777	90	43	1466	90		Met
3:00 PM	652	822	86	41	1474	86	Met	
3:15 PM	672	866	92	43	1538	92		
3:30 PM	664	878	101	48	1542	101		
3:45 PM	645	925	107	53	1570	107		Met
4:00 PM	691	991	106	56	1682	106	Met	
4:15 PM	725	1061	120	62	1786	120		
4:30 PM	745	1125	102	58	1870	102		
4:45 PM	820	1106	107	52	1926	107		Met
5:00 PM	821	1003	112	52	1824	112	Met	
5:15 PM	597	712	75	35	1309	75		
5:30 PM	408	422	57	23	830	57		
5:45 PM	193	183	25	15	376	25		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	5:00 PM	6:00 PM	1824	112
2nd Highest Hour	4:00 PM	5:00 PM	1682	106
3rd Highest Hour	11:00 AM	12:00 PM	1304	101
4th Highest Hour	12:00 PM	1:00 PM	1395	91

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	1926	107
2nd Highest Hour	3:45 PM	4:45 PM	1570	107
3rd Highest Hour	11:45 AM	12:45 PM	1388	103
4th Highest Hour	2:45 PM	3:45 PM	1466	90



Are the requirements for Warrant 2 met?: Yes

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:15 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:15 PM

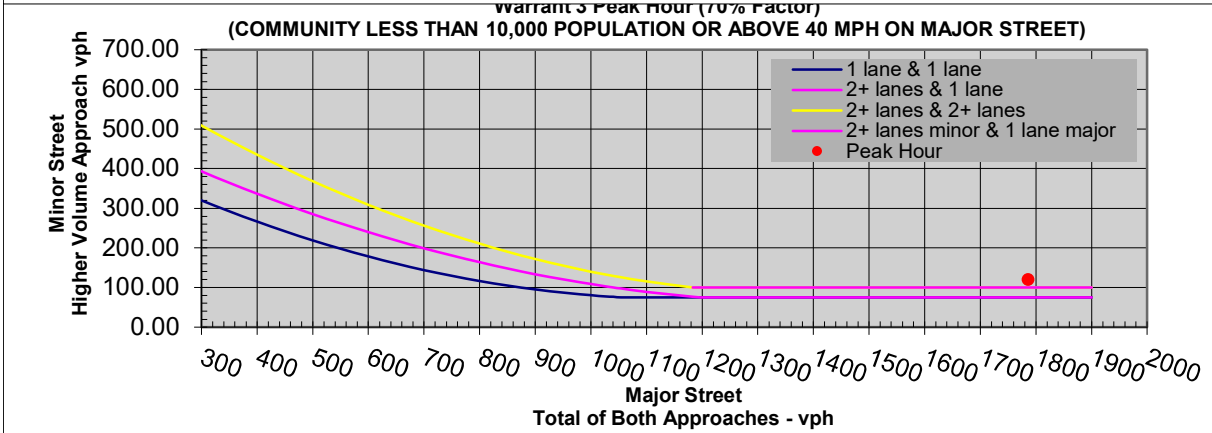
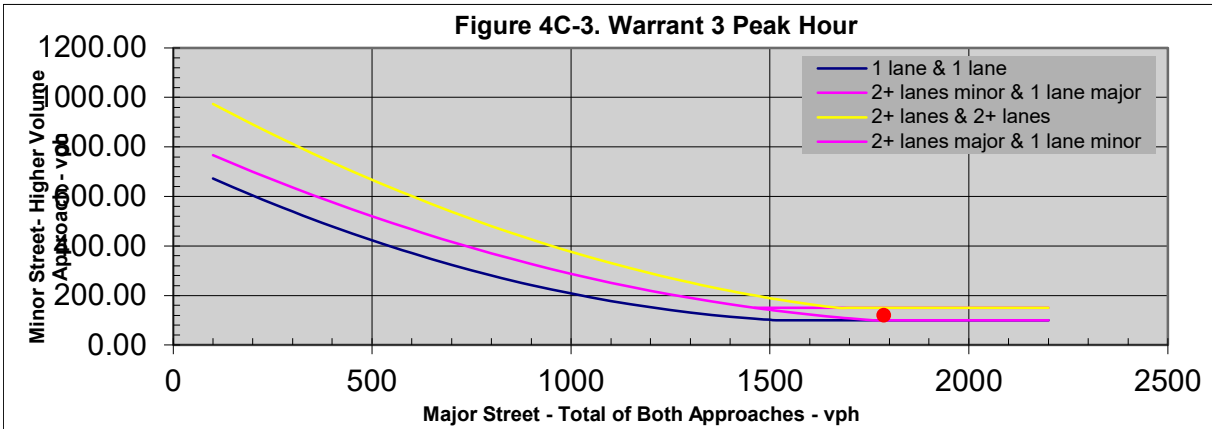
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
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Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	Yes

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **Yes**

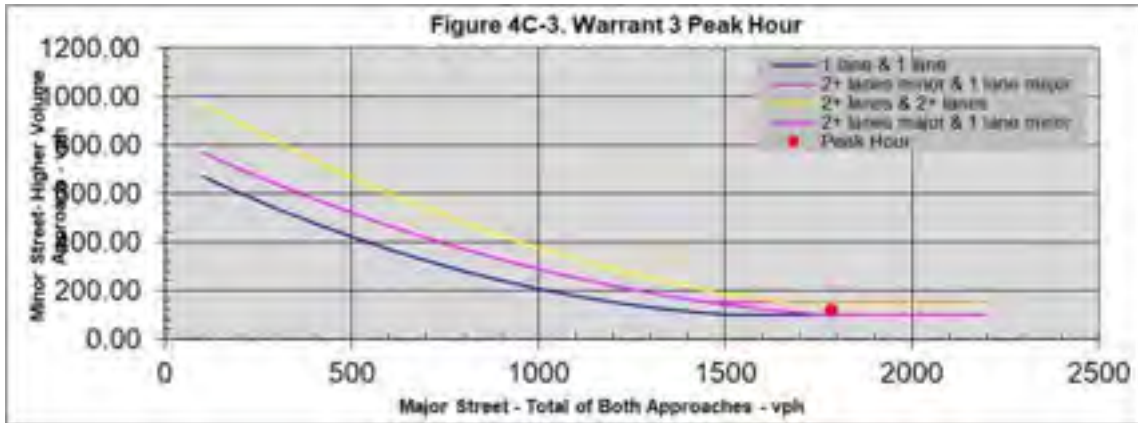


Signal Warrant SR 48 and East

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	171	14	185	185
6:30 AM	452	26	478	479
6:45 AM	817	51	868	872
7:00 AM	1221	65	1286	1290
7:15 AM	1361	57	1418	1422
7:30 AM	1367	71	1438	1444
7:45 AM	1277	68	1345	1348
8:00 AM	1204	69	1273	1281
8:15 AM	893	63	956	964
8:30 AM	606	37	643	648
8:45 AM	331	15	346	351
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	313	24	337	345
10:30 AM	612	45	657	678
10:45 AM	949	71	1020	1046
11:00 AM	1304	101	1405	1438
11:15 AM	1331	100	1431	1475
11:30 AM	1372	103	1475	1519
11:45 AM	1388	103	1491	1535
12:00 PM	1395	91	1486	1530
12:15 PM	1055	68	1123	1148
12:30 PM	715	44	759	771
12:45 PM	362	18	380	387
1:00 PM	0	0	0	0
1:15 PM	339	22	361	376
1:30 PM	679	40	719	739
1:45 PM	1043	65	1108	1141
2:00 PM	1401	90	1491	1538
2:15 PM	1409	85	1494	1535
2:30 PM	1460	94	1554	1601
2:45 PM	1466	90	1556	1599
3:00 PM	1474	86	1560	1601
3:15 PM	1538	92	1630	1673
3:30 PM	1542	101	1643	1691
3:45 PM	1570	107	1677	1730
4:00 PM	1682	106	1788	1844
4:15 PM	1786	120	1906	1968
4:30 PM	1870	102	1972	2030
4:45 PM	1926	107	2033	2085
5:00 PM	1824	112	1936	1988
5:15 PM	1309	75	1384	1419
5:30 PM	830	57	887	910
5:45 PM	376	25	401	416
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
1786	120	100	75

FIGURE 14B: EAST DRIVE WARRANT #3



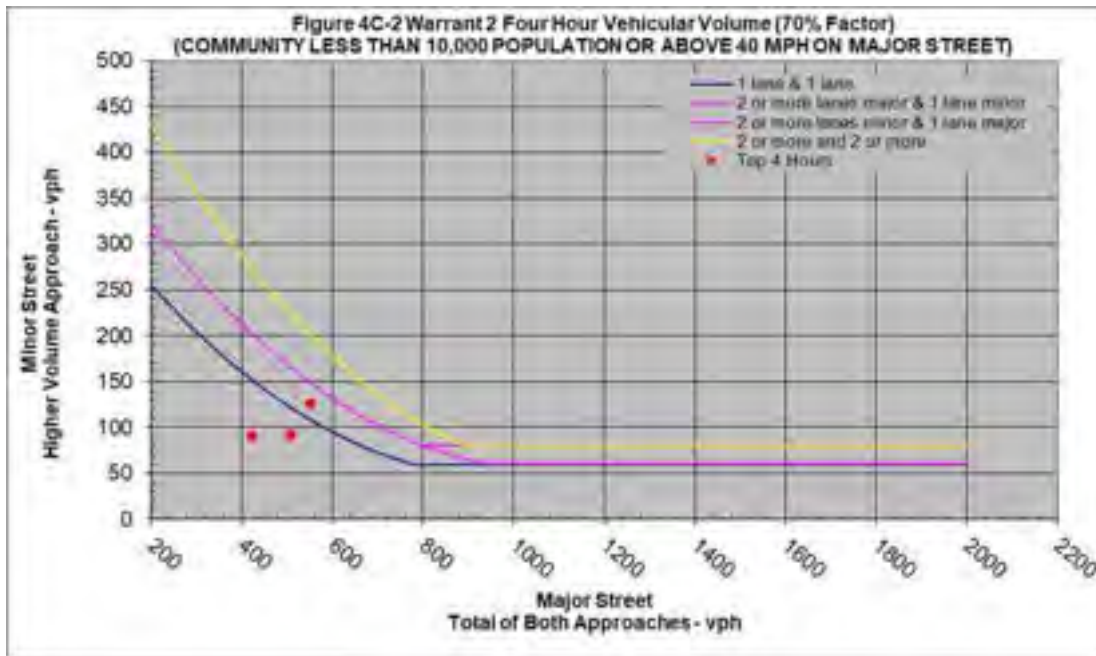
SCHANTZ AVENUE AT OAKWOOD AVENUE

This four-leg intersection is analyzed assuming 1 lane on the major street approach (Oakwood Avenue) and 1 through lane on the minor street approach (Schantz Avenue), resulting in the following:

Warrant #1. The minimum threshold for vehicles per hour on the higher volume, minor side street single lane approach is 120 vehicles when evaluating the combo warrant #1 at condition A and 60 vehicles at condition B. Only 5 hours meet the major street volumes for the combination warrant condition B, while there are no hours that meet the minor street volumes. *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-2 (**Figure 15A**) results in the following:

FIGURE 15A: SCHANTZ AVENUE AT OAKWOOD AVENUE WARRANT #2 (70% FACTOR)



One out of the four highest volume-pairs exceeded the thresholds of warrant #2. Adjusting the minor street volumes by 11% with respect to the established COVID factor for Montgomery County by ODOT does not exceed the minimum warrant thresholds. *Warrant #2 is NOT satisfied.*

Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 (**Figure 15B**) resulted in the volume pair falling short of the warrant #3 threshold using the 70% factor. For Figure 4C-4, a minimum required peak hour traffic volume for the side street is 199 vehicles when 134 were actually present. Adjusting for COVID, the 11% increase to 149 vehicles still falls short for Warrant #3. *Warrant #3 is NOT satisfied.*

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/11/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date:
 Day of the Week:

Is the intersection in a built-up area of an isolated community of <10,000 population?

Existing Traffic Signal at intersection:

Total Number of Approaches at Intersection:

Major Street Information

Major Street Name and Route Number:

Major Street Approach Direction:

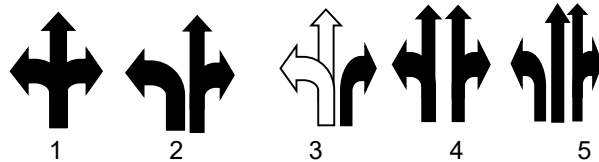
Number of Thru Lanes on Each Major Street Approach: LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number:

Minor Street Approach Configuration: E-Bound
 W-Bound



Number of Thru Lanes on Each Minor Street Approach: LANE(S)

Apply Right Turn Lane Reduction*:

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:30 PM</td></tr> <tr><td style="text-align: center;">5:30 PM</td></tr> </table>	Peak Hour	4:30 PM	5:30 PM
Peak Hour						
4:30 PM						
5:30 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes Major Minor		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
			Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
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5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	59	7																
6:30 AM	118	10																
6:45 AM	197	22																
7:00 AM	309	35												1				
7:15 AM	339	45																
7:30 AM	381	59			1													
7:45 AM	443	65								1							1	1
8:00 AM	434	65												1				
8:15 AM	345	48																
8:30 AM	244	30																
8:45 AM	103	18																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Schantz and Oakwood

10:00 AM	0	0																	
10:15 AM	93	15																	
10:30 AM	184	35																	
10:45 AM	262	59																	
11:00 AM	361	72		1									1						
11:15 AM	377	78																	
11:30 AM	401	85							1										
11:45 AM	423	81															1	1	
12:00 PM	423	90		1									1	1					
12:15 PM	314	69																	
12:30 PM	199	42																	
12:45 PM	99	22																	
1:00 PM	0	0																	
1:15 PM	96	24																	
1:30 PM	189	43																	
1:45 PM	308	67											1						
2:00 PM	399	87		1															
2:15 PM	401	84								1									
2:30 PM	433	98															1	1	
2:45 PM	455	89											1	1					
3:00 PM	471	91		1															
3:15 PM	510	91	1							1									
3:30 PM	502	71															1	1	
3:45 PM	486	85											1	1					
4:00 PM	515	94		1															
4:15 PM	543	101	1						1	1	1								
4:30 PM	554	126																1	1
4:45 PM	548	134											1	1					
5:00 PM	539	129		1	1														
5:15 PM	374	101																	
5:30 PM	246	63																	
5:45 PM	127	26																	
6:00 PM	0	0																	
6:15 PM	0	0																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			2	0	7	1	0	0	1	1	5	0	0	0	8	4	5	5	
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Warrant Met: **No**

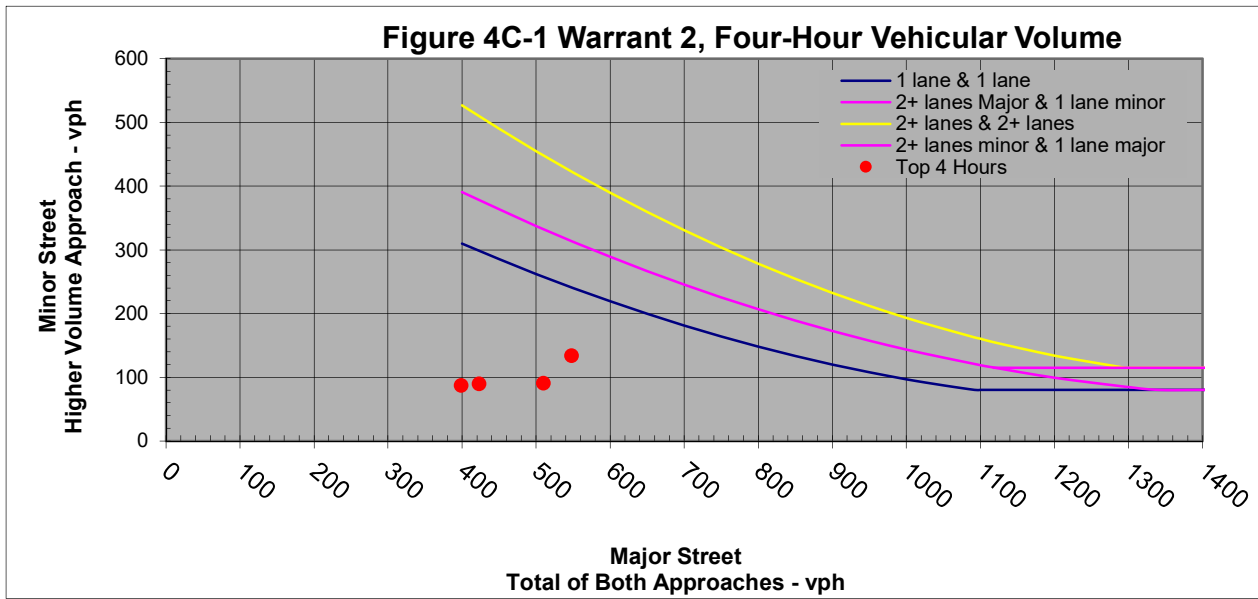
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	1
Minor Street: 1 Lane		

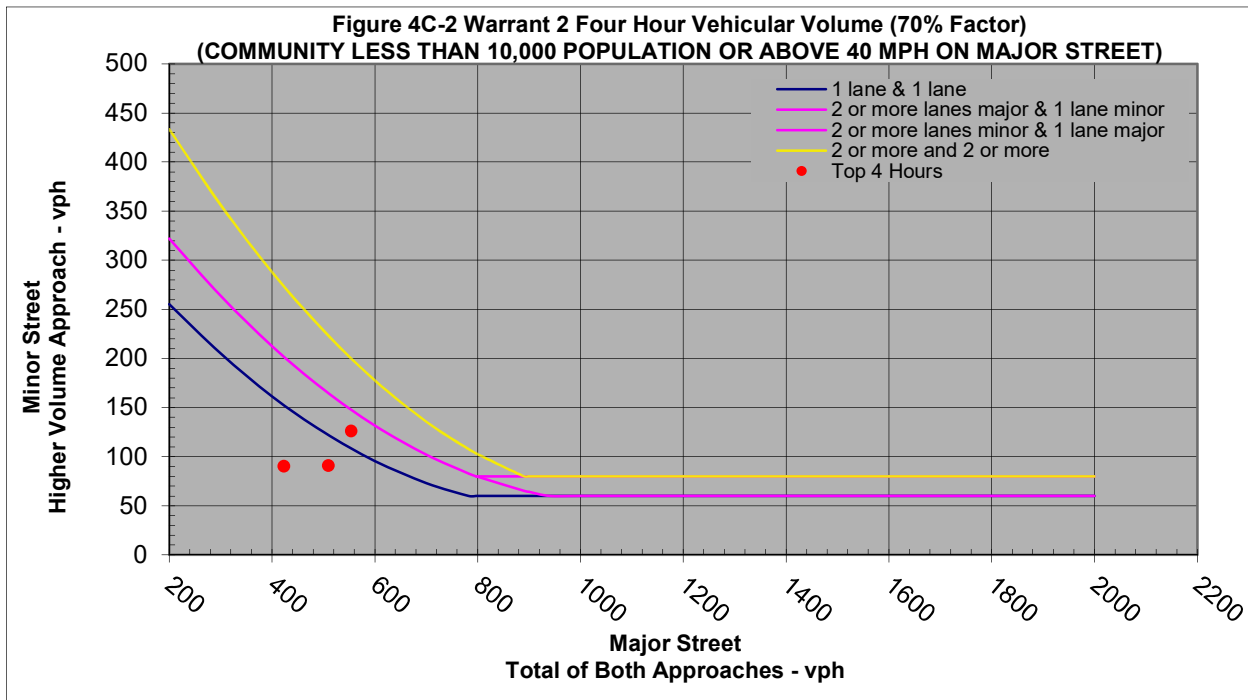
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - Oakwood		Minor - Schantz					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	29	30	7	4	59	7		
6:30 AM	66	52	10	8	118	10		
6:45 AM	118	79	22	14	197	22		
7:00 AM	197	112	35	32	309	35		
7:15 AM	225	114	41	45	339	45		
7:30 AM	265	116	51	59	381	59		
7:45 AM	307	136	50	65	443	65		
8:00 AM	301	133	45	65	434	65		
8:15 AM	244	101	32	48	345	48		
8:30 AM	167	77	19	30	244	30		
8:45 AM	73	30	8	18	103	18		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	37	56	8	15	93	15		
10:30 AM	71	113	15	35	184	35		
10:45 AM	109	153	23	59	262	59		
11:00 AM	151	210	33	72	361	72		
11:15 AM	166	211	29	78	377	78		
11:30 AM	190	211	27	85	401	85		
11:45 AM	199	224	25	81	423	81		
12:00 PM	199	224	27	90	423	90		
12:15 PM	147	167	23	69	314	69		
12:30 PM	89	110	18	42	199	42		
12:45 PM	42	57	12	22	99	22		
1:00 PM	0	0	0	0	0	0		
1:15 PM	41	55	5	24	96	24		
1:30 PM	79	110	16	43	189	43		
1:45 PM	114	194	22	67	308	67		
2:00 PM	153	246	35	87	399	87		
2:15 PM	161	240	42	84	401	84		
2:30 PM	180	253	42	98	433	98		
2:45 PM	206	249	54	89	455	89		
3:00 PM	210	261	52	91	471	91		
3:15 PM	202	308	54	91	510	91		
3:30 PM	193	309	53	71	502	71		
3:45 PM	178	308	48	85	486	85		
4:00 PM	171	344	44	94	515	94		
4:15 PM	183	360	43	101	543	101		
4:30 PM	191	363	46	126	554	126		Met
4:45 PM	198	350	44	134	548	134		
5:00 PM	210	329	59	129	539	129		
5:15 PM	157	217	46	101	374	101		
5:30 PM	101	145	33	63	246	63		
5:45 PM	48	79	22	26	127	26		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	548	134
2nd Highest Hour	3:15 PM	4:15 PM	510	91
3rd Highest Hour	12:00 PM	1:00 PM	423	90
4th Highest Hour	2:00 PM	3:00 PM	399	87

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	554	126
2nd Highest Hour	12:00 AM	1:00 AM	0	98
3rd Highest Hour	3:15 PM	4:15 PM	510	91
4th Highest Hour	12:00 PM	1:00 PM	423	90



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

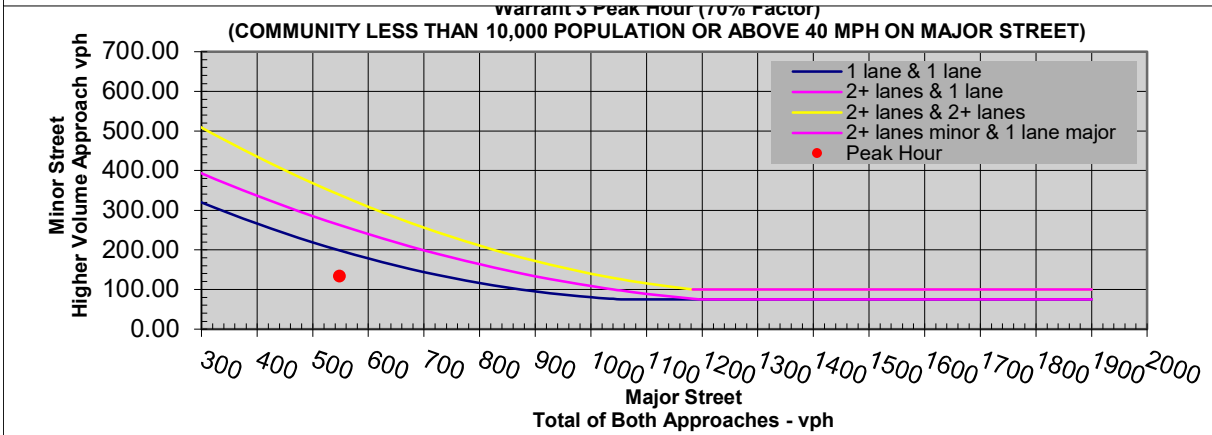
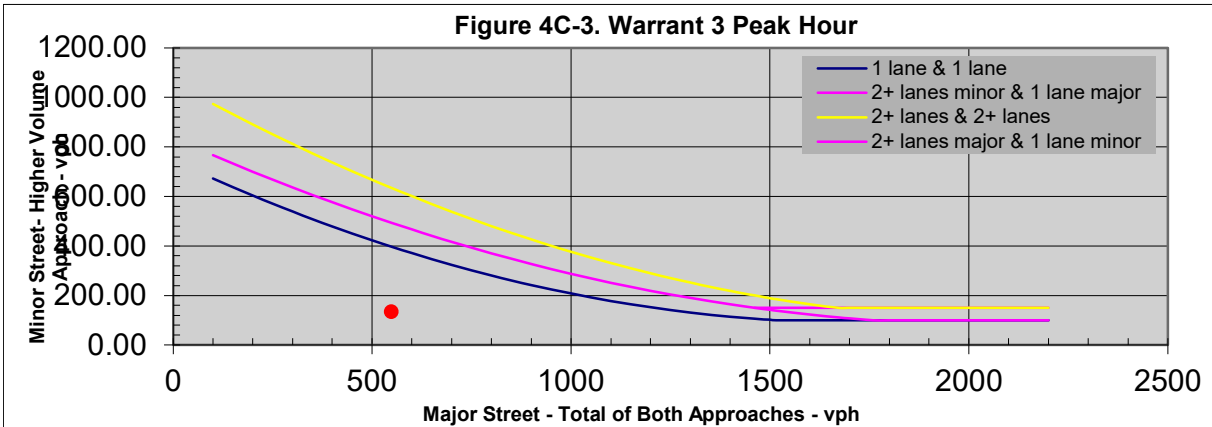
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Schantz and Oakwood

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	59	7	66	70
6:30 AM	118	10	128	136
6:45 AM	197	22	219	233
7:00 AM	309	35	344	376
7:15 AM	339	45	384	425
7:30 AM	381	59	440	491
7:45 AM	443	65	508	558
8:00 AM	434	65	499	544
8:15 AM	345	48	393	425
8:30 AM	244	30	274	293
8:45 AM	103	18	121	129
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	93	15	108	116
10:30 AM	184	35	219	234
10:45 AM	262	59	321	344
11:00 AM	361	72	433	466
11:15 AM	377	78	455	484
11:30 AM	401	85	486	513
11:45 AM	423	81	504	529
12:00 PM	423	90	513	540
12:15 PM	314	69	383	406
12:30 PM	199	42	241	259
12:45 PM	99	22	121	133
1:00 PM	0	0	0	0
1:15 PM	96	24	120	125
1:30 PM	189	43	232	248
1:45 PM	308	67	375	397
2:00 PM	399	87	486	521
2:15 PM	401	84	485	527
2:30 PM	433	98	531	573
2:45 PM	455	89	544	598
3:00 PM	471	91	562	614
3:15 PM	510	91	601	655
3:30 PM	502	71	573	626
3:45 PM	486	85	571	619
4:00 PM	515	94	609	653
4:15 PM	543	101	644	687
4:30 PM	554	126	680	726
4:45 PM	548	134	682	726
5:00 PM	539	129	668	727
5:15 PM	374	101	475	521
5:30 PM	246	63	309	342
5:45 PM	127	26	153	175
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
548	134	397	199

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	59	1
6:30 AM	118	1
6:45 AM	197	5
7:00 AM	309	7
7:15 AM	339	11
7:30 AM	381	11
7:45 AM	443	11
8:00 AM	434	9
8:15 AM	345	4
8:30 AM	244	4
8:45 AM	103	0
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	93	2
10:30 AM	184	2
10:45 AM	262	2
11:00 AM	361	3
11:15 AM	377	1
11:30 AM	401	1
11:45 AM	423	1
12:00 PM	423	0
12:15 PM	314	0
12:30 PM	199	0
12:45 PM	99	0
1:00 PM	0	0
1:15 PM	96	0
1:30 PM	189	0
1:45 PM	308	0
2:00 PM	399	0
2:15 PM	401	0
2:30 PM	433	2
2:45 PM	455	5
3:00 PM	471	6
3:15 PM	510	6
3:30 PM	502	5
3:45 PM	486	4
4:00 PM	515	3
4:15 PM	543	4
4:30 PM	554	3
4:45 PM	548	7
5:00 PM	539	7
5:15 PM	374	6
5:30 PM	246	6
5:45 PM	127	0
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	4:45 PM	5:45 PM	548	7
2nd Highest Hour	3:15 PM	4:15 PM	510	6
3rd Highest Hour	7:45 AM	8:45 AM	443	11
4th Highest Hour	11:45 AM	12:45 PM	423	1

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	4:45 PM	5:45 PM	548	7
2nd Highest Hour	3:15 PM	4:15 PM	510	6
3rd Highest Hour	7:45 AM	8:45 AM	443	11
4th Highest Hour	11:45 AM	12:45 PM	423	1

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
4:30 PM	5:30 PM	554	3

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

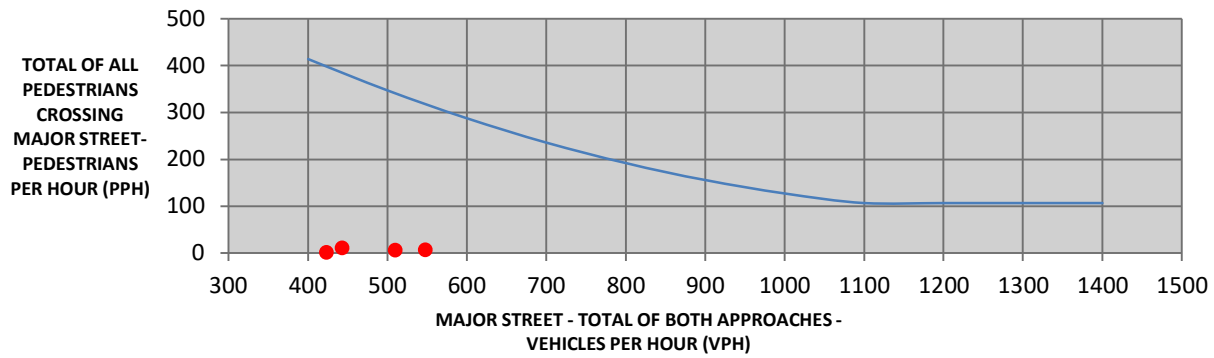


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)

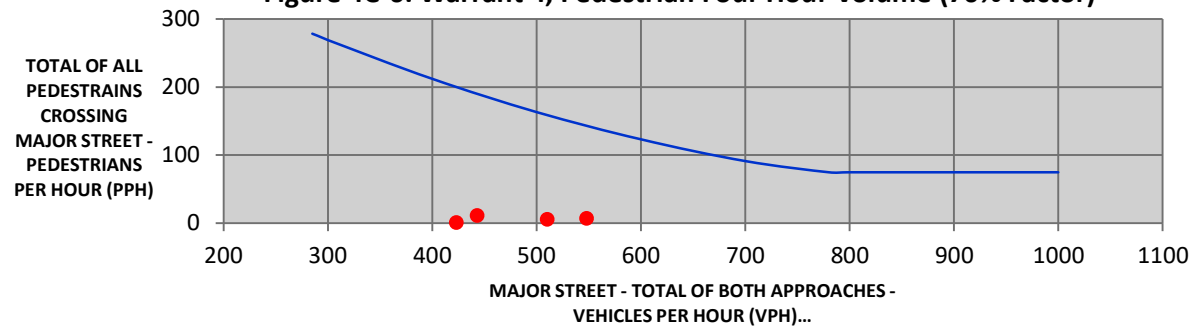


Figure 4C-7. Warrant 4, Pedestrian Peak Hour

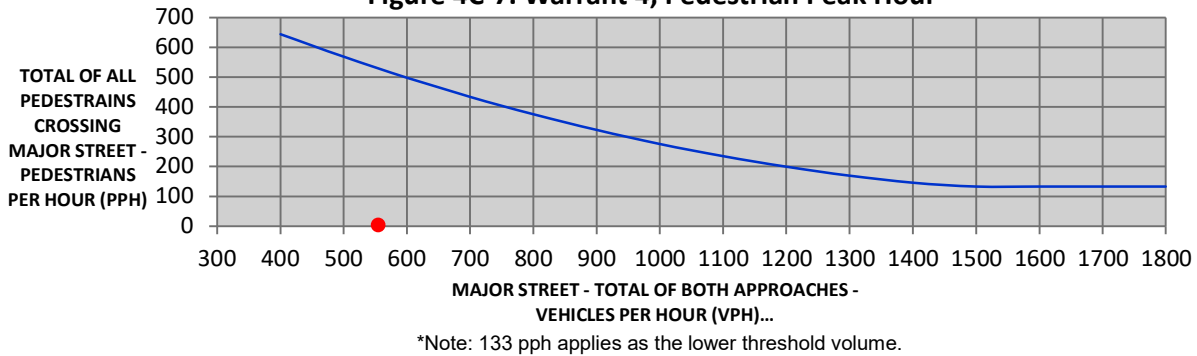
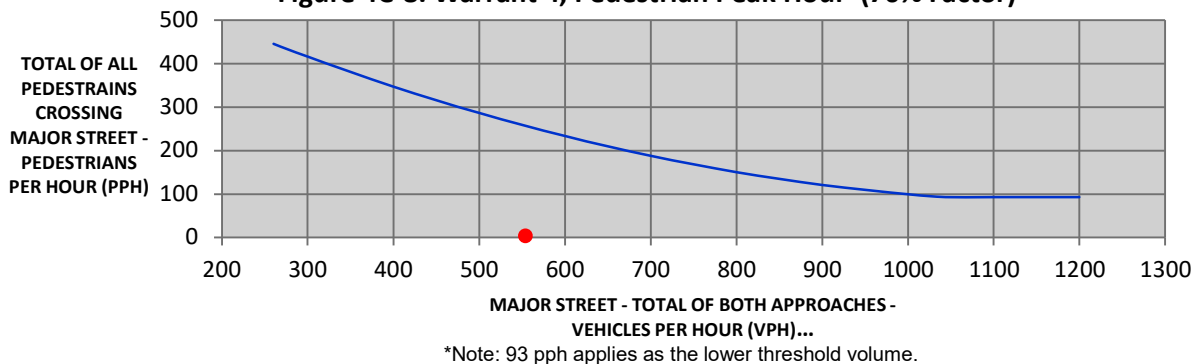
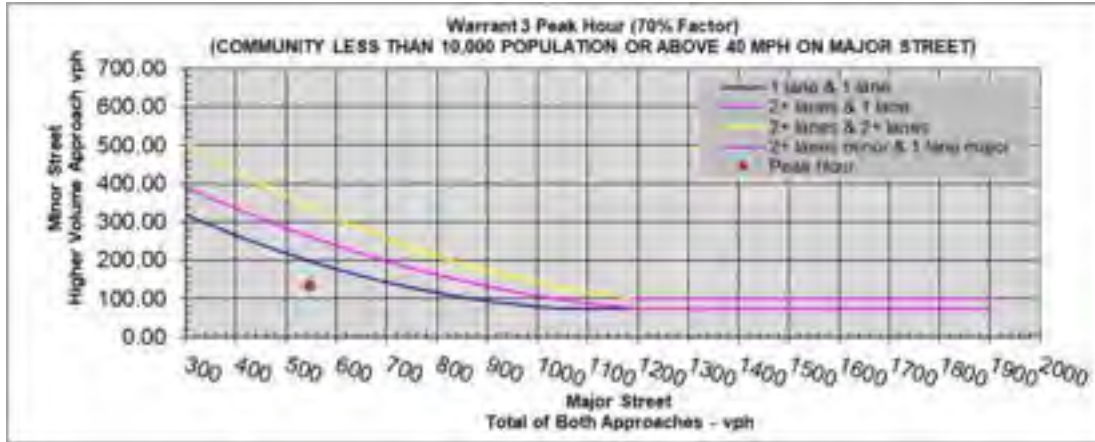


Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



Warrants #4 and #5. There is no school nearby the intersection and the maximum number of pedestrians per hour crossing Oakwood Avenue was 11. *Warrant #4 is NOT satisfied and Warrant #5 does not apply.*

FIGURE 15B: SCHANTZ AVENUE AT OAKWOOD AVENUE WARRANT #3 (70% FACTOR)



The existing traffic signal at the Schantz Avenue and Oakwood Avenue intersection **is not warranted** due to traffic volumes being less than the required thresholds to meet any volume-based warrants.

SCHANTZ AVENUE AT PATTERSON ROAD

This four-leg intersection is analyzed assuming 1 lane on the major street approach (Patterson Road) and 1 through lane on the minor street approach (Schantz Avenue), resulting in the following:

Warrant #1. No hours of the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A, condition B, and combo warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-2 (**Figure 16A**) resulted in no volume pairs exceeding the warrant #2 threshold. Adjusting the collected volumes by 11% would still not result enough hours exceeding the warrant #2 thresholds. *Warrant #2 is NOT satisfied.*

Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 (**Figure 16B**) resulted in the volume pair not exceeding warrant #3 threshold. For Figure 4C-4, a minimum required peak hour traffic volume for the side street is 298 vehicles when 104 were actually present. Adjusting for COVID, the 11% increase to 116 vehicles still falls short for Warrant #3. *Warrant #3 is NOT satisfied.*

FIGURE 16A: SCHANTZ AVENUE AT PATTERSON ROAD WARRANT #2 (70% FACTOR)

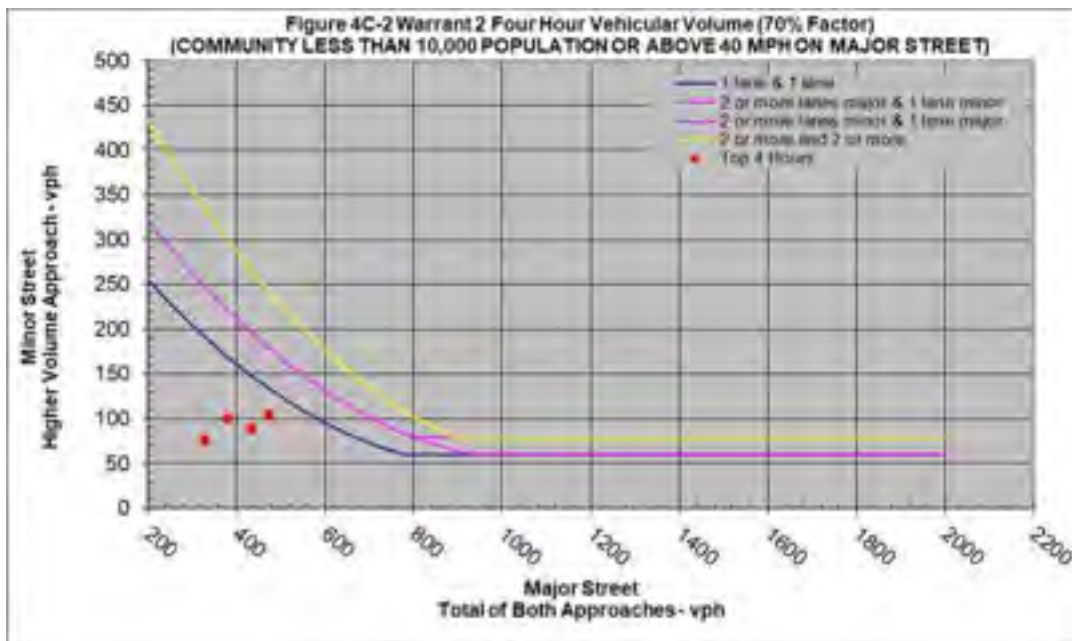
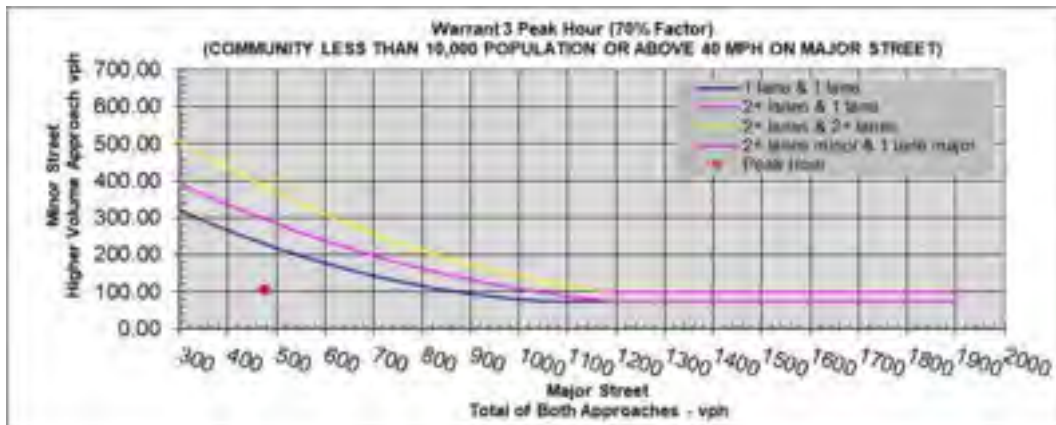


FIGURE 16B: SCHANTZ AVENUE AT PATTERSON ROAD WARRANT #3 (70% FACTOR)



Warrants #4 and #5. A total of 470 pedestrians were observed crossing Patterson Road at Schantz Avenue during the 8-hour data collection periods. This includes 135 pedestrians crossing Patterson Road between 3:00PM and 4:00PM which coincides with the school dismissal times. Of the 135 pedestrians, it is expected that at least half (i.e. 62 pedestrians) are students. Due to the intersection being located near the Oakwood Community Center and about 1/3rd of a mile from Oakwood Junior and Senior High School, a gap analysis was performed at the intersection to understand the impact of pedestrian crossings without the existing signal.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Patterson Road at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Patterson Road, crossing distance from curb ramp to curb ramp (measured at 30 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

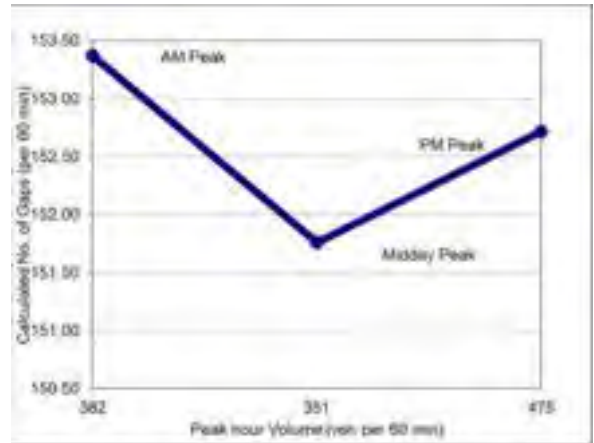
Where:

- $\lambda = \text{Total bidirectional volume at Patterson Rd @ Shafor Blvd}$
- $t = \text{Crossing Time} = \frac{30 \text{ ft}}{3.5 \frac{\text{ft}}{\text{s}}} = 8.6 \text{ seconds}$

The resulting number of gaps for each peak hour volume are shown in **Figure 16C**.

The gap analysis shows that the number of gaps to cross Patterson Road is over 150 at this intersection during peak hours. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). With acceptable headway available to cross the major street at this location, *warrants #4 and #5 are NOT satisfied based on gap analysis.*

FIGURE 16C: GAP ANALYSIS (30 FT CROSSING DISTANCE)



Checking OMTUCD Section 4C.05 states that warrant #4 thresholds may be reduced to 70% for an existing traffic signal. The results of the signal warrant #4 analyses using 70% criteria are shown in **Figure 16D** and **Figure 16E**. The thresholds for warrant #4 are not met.

Warrant #4 would not be expected to meet if the 11% COVID adjustment factor was applied. *Warrant #4 is NOT satisfied based on OMTUCD Section 4C.05.*

FIGURE 16D: SCHANTZ AVE AT PATTERSON RD WARRANT #4 (PED. 4 HOUR VOLUME AT 70%)



FIGURE 16E: SCHANTZ AVENUE AT PATTERSON ROAD WARRANT #4 (PK HR AT 70%)



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/11/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/20/2022
 Day of the Week: Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Patterson

Major Street Approach Direction: E-Bound
W-Bound

Number of Thru Lanes on Each Major Street Approach: 2 LANE(S)

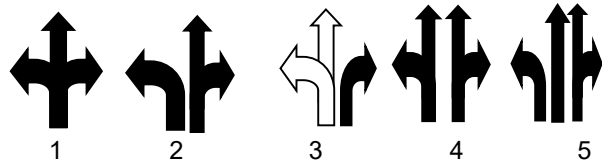
Speed Limit or 85th Percentile Speed on the Major Street*: 25 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Schantz

Minor Street Approach Configuration:

1	N-Bound
1	S-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant		Notes and Comments:			
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:15 PM</td></tr> <tr><td style="text-align: center;">4:15 PM</td></tr> </table>	Peak Hour	3:15 PM	4:15 PM
Peak Hour						
3:15 PM						
4:15 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	2 or More Lanes
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1			500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1	X		600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
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6:15 AM	29	2																
6:30 AM	99	11																
6:45 AM	173	21																
7:00 AM	264	45																
7:15 AM	332	96																
7:30 AM	372	101																
7:45 AM	382	100												1	1			
8:00 AM	370	83																
8:15 AM	273	30																
8:30 AM	163	16																
8:45 AM	79	7																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Schantz and Patterson

10:00 AM	0	0																	
10:15 AM	53	12																	
10:30 AM	116	22																	
10:45 AM	184	37																	
11:00 AM	266	46																	
11:15 AM	294	48																	
11:30 AM	306	46																	
11:45 AM	333	52																	
12:00 PM	351	62												1					
12:15 PM	270	48																	
12:30 PM	195	40																	
12:45 PM	100	19																	
1:00 PM	0	0																	
1:15 PM	96	10																	
1:30 PM	170	27																	
1:45 PM	251	42																	
2:00 PM	341	60												1					
2:15 PM	330	76																	
2:30 PM	364	86																	
2:45 PM	390	89																	
3:00 PM	419	85												1	1				
3:15 PM	435	88		1															
3:30 PM	422	73																	
3:45 PM	417	74																	
4:00 PM	397	82												1					
4:15 PM	442	83		1															
4:30 PM	474	101																	
4:45 PM	475	104																	
5:00 PM	455	97												1	1				
5:15 PM	309	67																	
5:30 PM	182	37																	
5:45 PM	79	15																	
6:00 PM	0	0																	
6:15 PM	0	0																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			0	0	2	0	0	0	0	0	0	0	0	0	6	3	0	0	
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Warrant Met: **No**

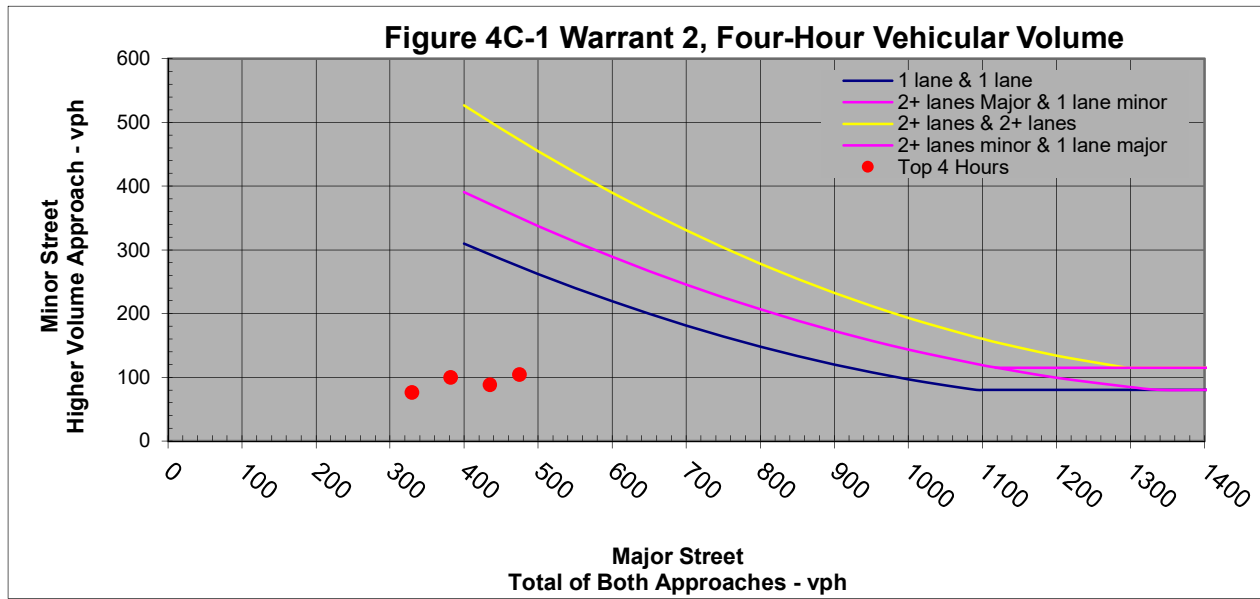
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 2 or More Lanes	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

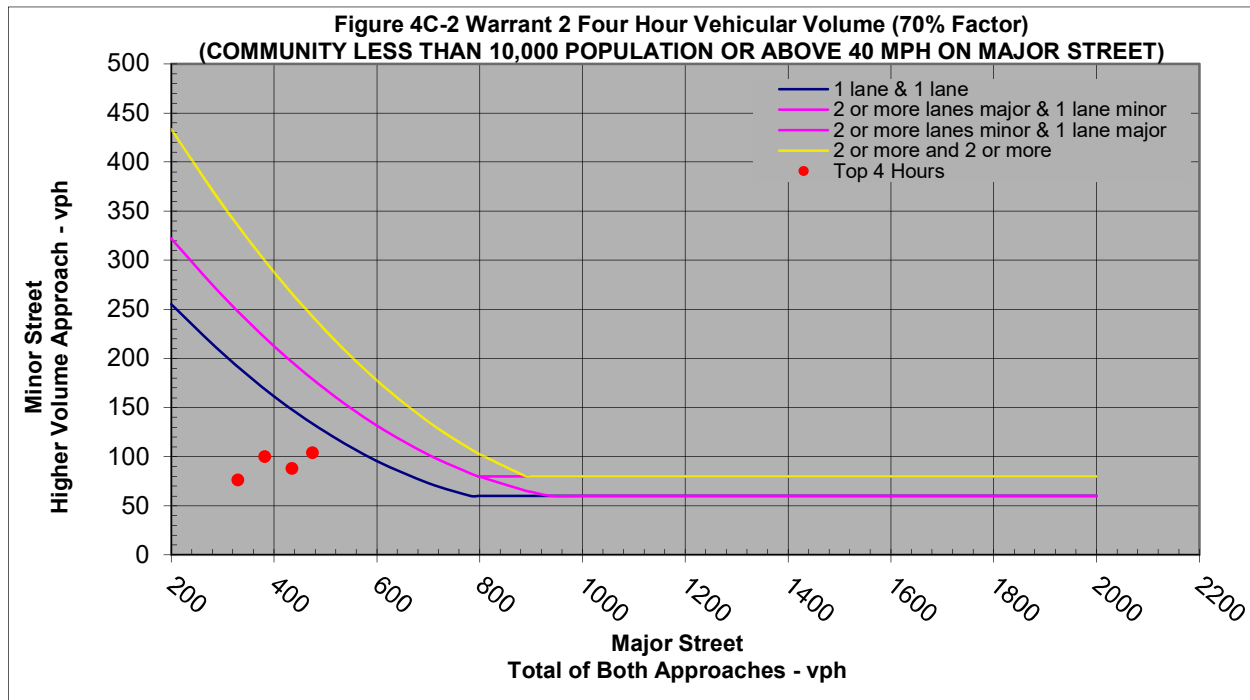
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Minor - Schantz		Major - Patterson					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	0	2	18	11	29	2		
6:30 AM	5	11	60	39	99	11		
6:45 AM	10	21	117	56	173	21		
7:00 AM	18	45	184	80	264	45		
7:15 AM	39	96	221	111	332	96		
7:30 AM	44	101	252	120	372	101		
7:45 AM	44	100	243	139	382	100		
8:00 AM	41	83	233	137	370	83		
8:15 AM	20	30	178	95	273	30		
8:30 AM	10	16	105	58	163	16		
8:45 AM	5	7	57	22	79	7		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	2	12	32	21	53	12		
10:30 AM	10	22	67	49	116	22		
10:45 AM	20	37	104	80	184	37		
11:00 AM	24	46	144	122	266	46		
11:15 AM	25	48	157	137	294	48		
11:30 AM	21	46	163	143	306	46		
11:45 AM	20	52	179	154	333	52		
12:00 PM	22	62	186	165	351	62		
12:15 PM	19	48	141	129	270	48		
12:30 PM	15	40	100	95	195	40		
12:45 PM	6	19	47	53	100	19		
1:00 PM	0	0	0	0	0	0		
1:15 PM	4	10	51	45	96	10		
1:30 PM	7	27	87	83	170	27		
1:45 PM	15	42	132	119	251	42		
2:00 PM	17	60	187	154	341	60		
2:15 PM	22	76	186	144	330	76		
2:30 PM	44	86	198	166	364	86		
2:45 PM	48	89	204	186	390	89		
3:00 PM	54	85	191	228	419	85		
3:15 PM	49	88	184	251	435	88		
3:30 PM	29	73	168	254	422	73		
3:45 PM	25	74	164	253	417	74		
4:00 PM	22	82	161	236	397	82		
4:15 PM	21	83	180	262	442	83		
4:30 PM	25	101	199	275	474	101		
4:45 PM	26	104	202	273	475	104		
5:00 PM	31	97	201	254	455	97		
5:15 PM	28	67	139	170	309	67		
5:30 PM	19	37	88	94	182	37		
5:45 PM	10	15	38	41	79	15		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	475	104
2nd Highest Hour	3:15 PM	4:15 PM	435	88
3rd Highest Hour	7:45 AM	8:45 AM	382	100
4th Highest Hour	2:15 PM	3:15 PM	330	76

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	475	104
2nd Highest Hour	3:15 PM	4:15 PM	435	88
3rd Highest Hour	7:45 AM	8:45 AM	382	100
4th Highest Hour	2:15 PM	3:15 PM	330	76



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	2 or More Lanes	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

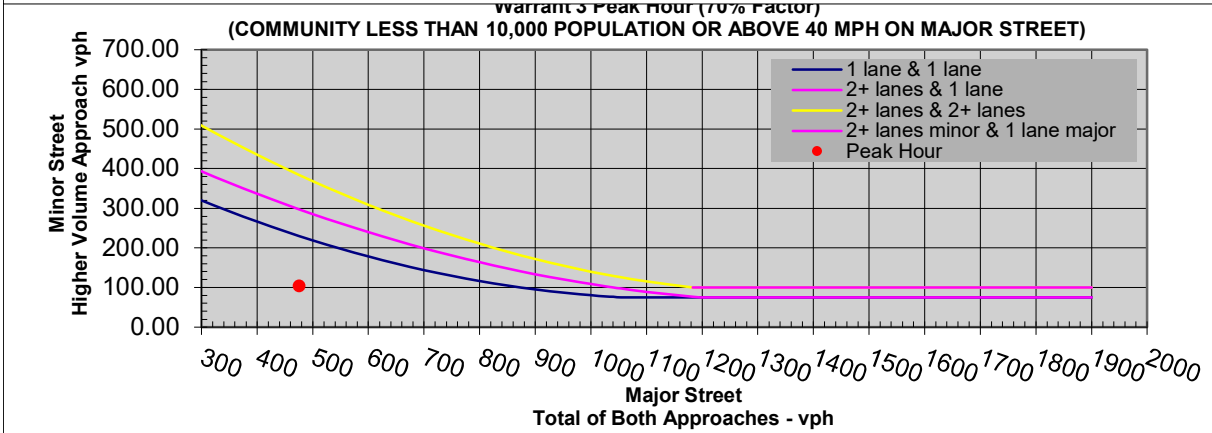
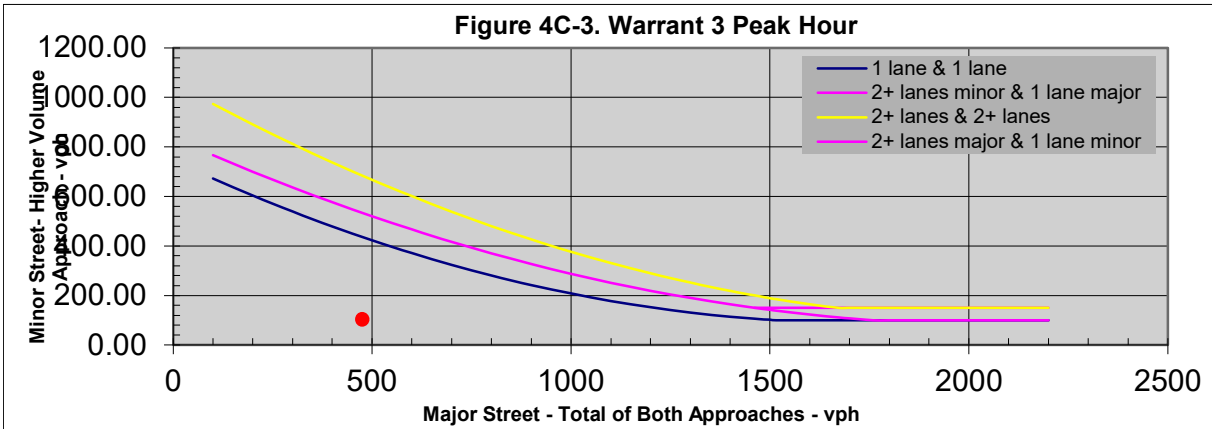
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Schantz and Patterson

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	29	2	31	31
6:30 AM	99	11	110	115
6:45 AM	173	21	194	204
7:00 AM	264	45	309	327
7:15 AM	332	96	428	467
7:30 AM	372	101	473	517
7:45 AM	382	100	482	526
8:00 AM	370	83	453	494
8:15 AM	273	30	303	323
8:30 AM	163	16	179	189
8:45 AM	79	7	86	91
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	53	12	65	67
10:30 AM	116	22	138	148
10:45 AM	184	37	221	241
11:00 AM	266	46	312	336
11:15 AM	294	48	342	367
11:30 AM	306	46	352	373
11:45 AM	333	52	385	405
12:00 PM	351	62	413	435
12:15 PM	270	48	318	337
12:30 PM	195	40	235	250
12:45 PM	100	19	119	125
1:00 PM	0	0	0	0
1:15 PM	96	10	106	110
1:30 PM	170	27	197	204
1:45 PM	251	42	293	308
2:00 PM	341	60	401	418
2:15 PM	330	76	406	428
2:30 PM	364	86	450	494
2:45 PM	390	89	479	527
3:00 PM	419	85	504	558
3:15 PM	435	88	523	572
3:30 PM	422	73	495	524
3:45 PM	417	74	491	516
4:00 PM	397	82	479	501
4:15 PM	442	83	525	546
4:30 PM	474	101	575	600
4:45 PM	475	104	579	605
5:00 PM	455	97	552	583
5:15 PM	309	67	376	404
5:30 PM	182	37	219	238
5:45 PM	79	15	94	104
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
475	104	533	298

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	29	2
6:30 AM	99	5
6:45 AM	173	10
7:00 AM	264	38
7:15 AM	332	67
7:30 AM	372	80
7:45 AM	382	80
8:00 AM	370	61
8:15 AM	273	30
8:30 AM	163	14
8:45 AM	79	9
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	53	3
10:30 AM	116	7
10:45 AM	184	30
11:00 AM	266	39
11:15 AM	294	40
11:30 AM	306	39
11:45 AM	333	35
12:00 PM	351	28
12:15 PM	270	24
12:30 PM	195	21
12:45 PM	100	2
1:00 PM	0	0
1:15 PM	96	1
1:30 PM	170	5
1:45 PM	251	8
2:00 PM	341	12
2:15 PM	330	23
2:30 PM	364	109
2:45 PM	390	135
3:00 PM	419	135
3:15 PM	435	139
3:30 PM	422	90
3:45 PM	417	82
4:00 PM	397	102
4:15 PM	442	89
4:30 PM	474	73
4:45 PM	475	71
5:00 PM	455	55
5:15 PM	309	52
5:30 PM	182	27
5:45 PM	79	8
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	3:15 PM	4:15 PM	435	139
2nd Highest Hour	4:30 PM	5:30 PM	474	73
3rd Highest Hour	7:45 AM	8:45 AM	382	80
4th Highest Hour	12:00 PM	1:00 PM	351	28

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	3:15 PM	4:15 PM	435	139
2nd Highest Hour	4:15 PM	5:15 PM	442	89
3rd Highest Hour	7:45 AM	8:45 AM	382	80
4th Highest Hour	12:00 PM	1:00 PM	351	28

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
3:15 PM	4:15 PM	435	139

Number of Hours That Met the 4-Hour Criteria 4C-5	0
---	---

Number of Hours That Met the 4-Hour Criteria 4C-6	0
---	---

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

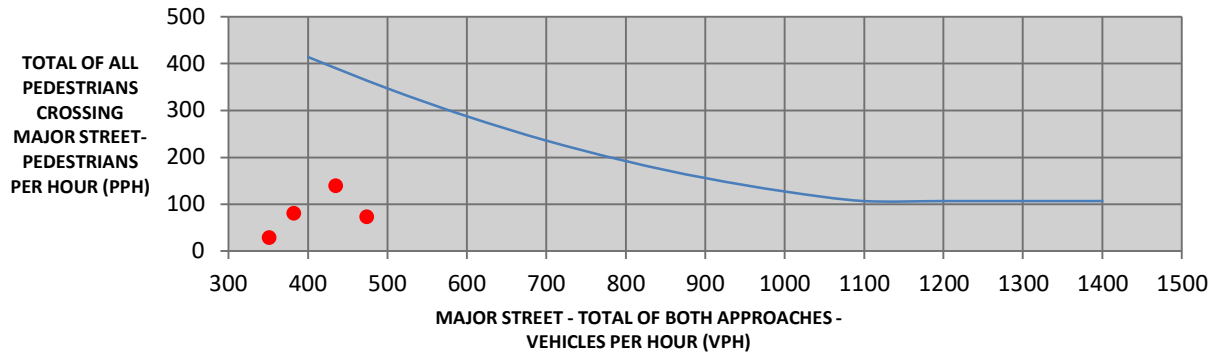
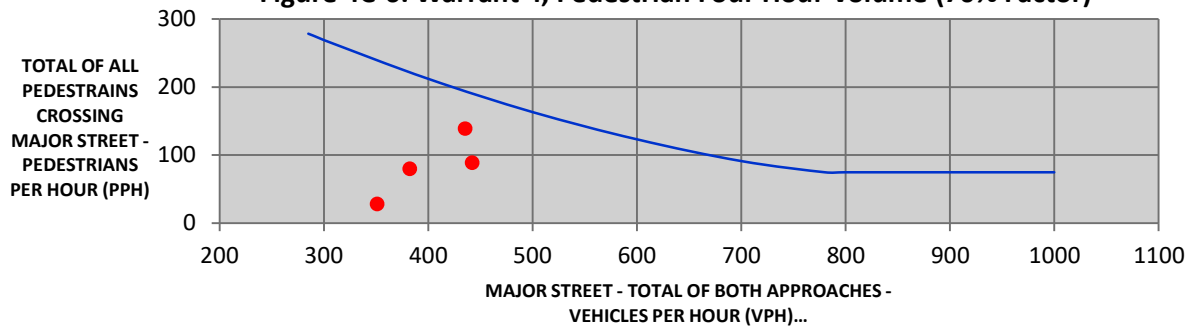
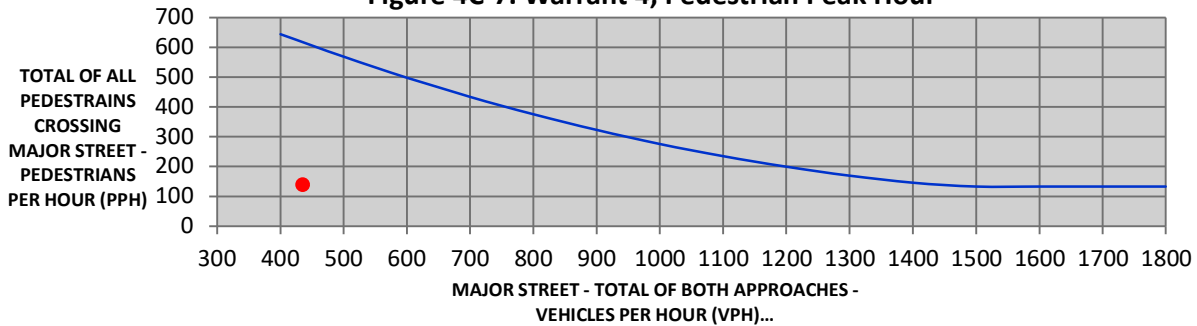


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)



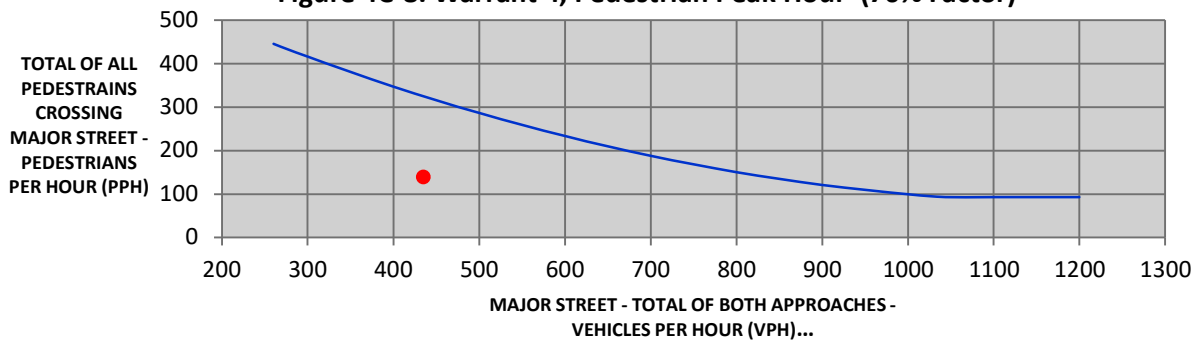
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

The existing traffic signal at the Schantz Avenue & Patterson Road intersection **is not warranted** as it does not meet volume based warrants and the available headway provides enough gaps for pedestrian crossings over Patterson Road during peak hours.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/21/2022
Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Schantz

Major Street Approach Direction: E-Bound
W-Bound

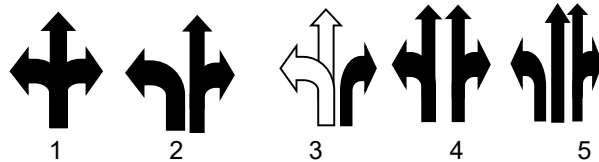
Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 35 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Kramer/Sugar Camp

Minor Street Approach Configuration: 1 N-Bound
2 S-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:30 PM</td></tr> <tr><td style="text-align: center;">5:30 PM</td></tr> </table>	Peak Hour	4:30 PM	5:30 PM
Peak Hour						
4:30 PM						
5:30 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">5:00 PM</td></tr> <tr><td style="text-align: center;">6:00 PM</td></tr> </table>	Peak Hour	5:00 PM	6:00 PM
Peak Hour						
5:00 PM						
6:00 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
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5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	36	0																
6:30 AM	88	2																
6:45 AM	185	6																
7:00 AM	308	12												1				
7:15 AM	362	16		1														
7:30 AM	401	19								1								
7:45 AM	376	20																
8:00 AM	321	20												1				
8:15 AM	231	16																
8:30 AM	140	13																
8:45 AM	68	7																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Schantz and Kramer

10:00 AM	0	0																
10:15 AM	65	8																
10:30 AM	123	16																
10:45 AM	210	23																
11:00 AM	280	28											1					
11:15 AM	302	39																
11:30 AM	327	39																
11:45 AM	333	39																
12:00 PM	342	37											1					
12:15 PM	255	18																
12:30 PM	172	10																
12:45 PM	79	4																
1:00 PM	0	0																
1:15 PM	75	9																
1:30 PM	146	18																
1:45 PM	257	22																
2:00 PM	327	33											1					
2:15 PM	342	31																
2:30 PM	379	34		1														
2:45 PM	357	42																
3:00 PM	379	40											1					
3:15 PM	379	45																
3:30 PM	347	50																
3:45 PM	351	56		1														
4:00 PM	359	59											1					
4:15 PM	403	70							1									
4:30 PM	449	64														1	1	
4:45 PM	447	49		1														
5:00 PM	456	41											1					
5:15 PM	322	26																
5:30 PM	200	18																
5:45 PM	109	6																
6:00 PM	0	0																
6:15 PM	0	0																
6:30 PM	0	0																
6:45 PM	0	0																
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8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			0	0	4	0	0	0	0	0	2	0	0	0	8	0	1	1
WARRANT SATISFIED?			NO	N/A	NO	N/A	NO	N/A	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

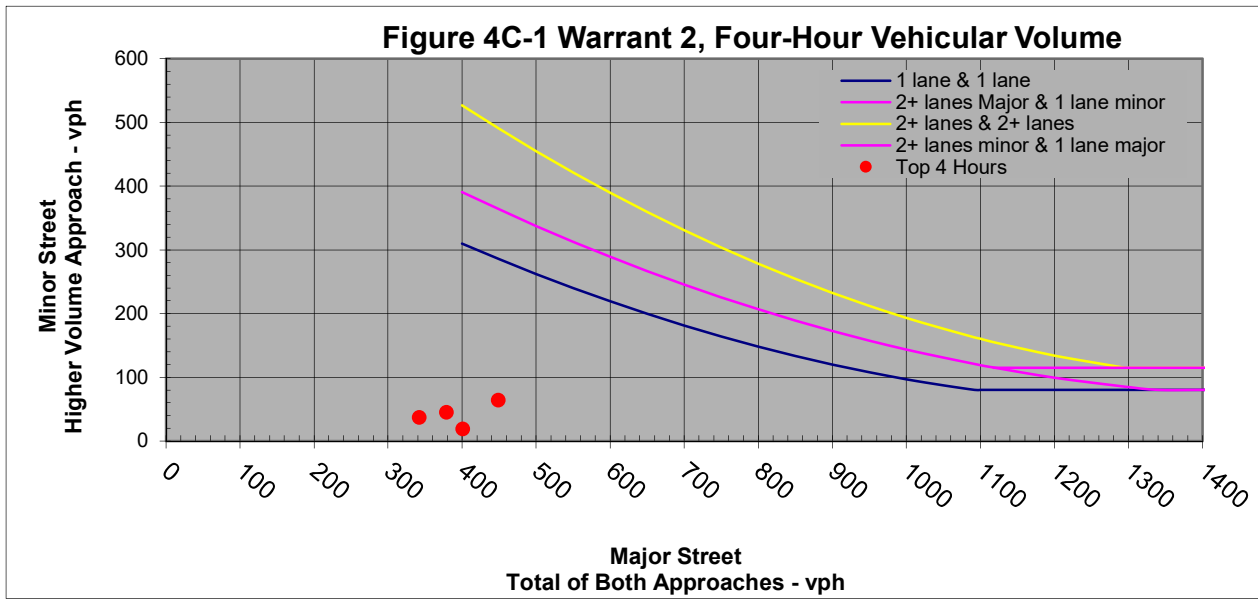
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

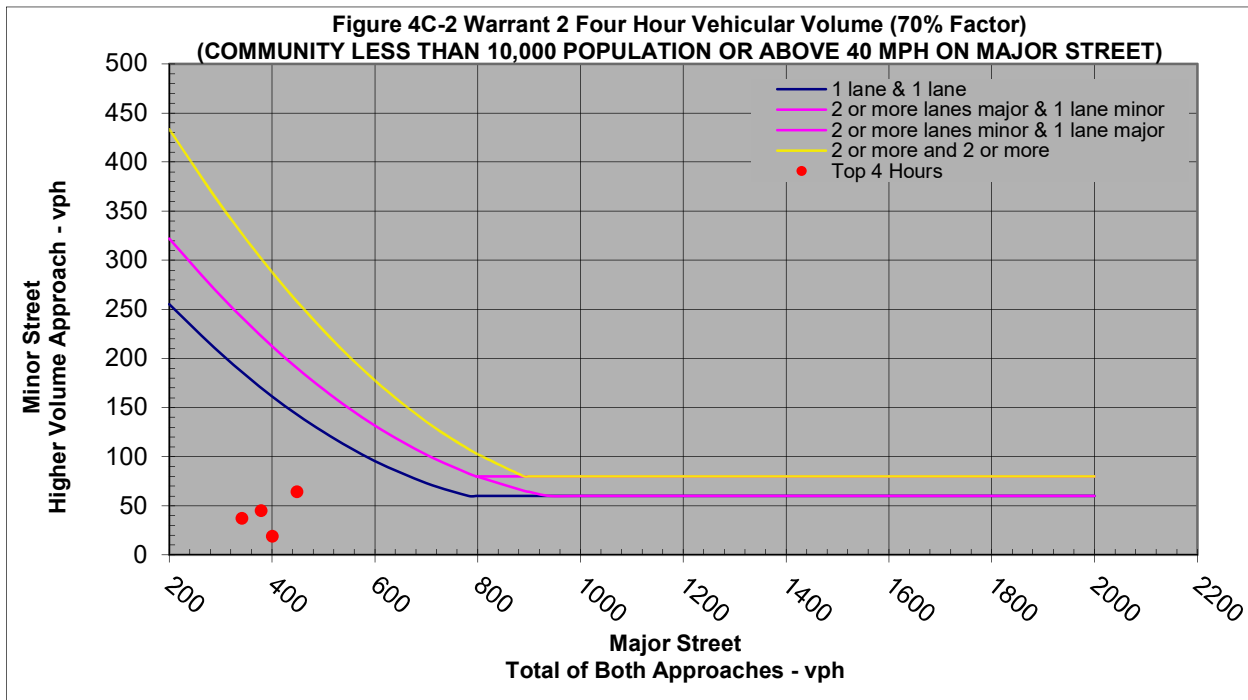
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Minor - Kramer/Sugar Camp		Major - Schantz					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	0	0	22	14	36	0		
6:30 AM	2	0	55	33	88	2		
6:45 AM	6	5	117	68	185	6		
7:00 AM	8	12	204	104	308	12		
7:15 AM	12	16	242	120	362	16		
7:30 AM	14	19	264	137	401	19		
7:45 AM	14	20	242	134	376	20		
8:00 AM	15	20	195	126	321	20		
8:15 AM	11	16	135	96	231	16		
8:30 AM	7	13	80	60	140	13		
8:45 AM	3	7	40	28	68	7		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	2	8	38	27	65	8		
10:30 AM	4	16	67	56	123	16		
10:45 AM	7	23	110	100	210	23		
11:00 AM	7	28	145	135	280	28		
11:15 AM	6	39	154	148	302	39		
11:30 AM	10	39	161	166	327	39		
11:45 AM	12	39	161	172	333	39		
12:00 PM	16	37	170	172	342	37		
12:15 PM	15	18	123	132	255	18		
12:30 PM	9	10	87	85	172	10		
12:45 PM	4	3	44	35	79	4		
1:00 PM	0	0	0	0	0	0		
1:15 PM	5	9	35	40	75	9		
1:30 PM	12	18	72	74	146	18		
1:45 PM	14	22	141	116	257	22		
2:00 PM	19	33	186	141	327	33		
2:15 PM	15	31	196	146	342	31		
2:30 PM	11	34	214	165	379	34		
2:45 PM	13	42	191	166	357	42		
3:00 PM	12	40	194	185	379	40		
3:15 PM	19	45	194	185	379	45		
3:30 PM	20	50	183	164	347	50		
3:45 PM	23	56	180	171	351	56		
4:00 PM	25	59	170	189	359	59		
4:15 PM	21	70	191	212	403	70		
4:30 PM	25	64	200	249	449	64		
4:45 PM	30	49	186	261	447	49		
5:00 PM	30	41	203	253	456	41		
5:15 PM	26	18	137	185	322	26		
5:30 PM	18	7	84	116	200	18		
5:45 PM	6	4	55	54	109	6		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	449	64
2nd Highest Hour	3:15 PM	4:15 PM	379	45
3rd Highest Hour	7:30 AM	8:30 AM	401	19
4th Highest Hour	12:00 PM	1:00 PM	342	37

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:30 PM	5:30 PM	449	64
2nd Highest Hour	3:15 PM	4:15 PM	379	45
3rd Highest Hour	7:30 AM	8:30 AM	401	19
4th Highest Hour	12:00 PM	1:00 PM	342	37



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	4:30 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:30 PM

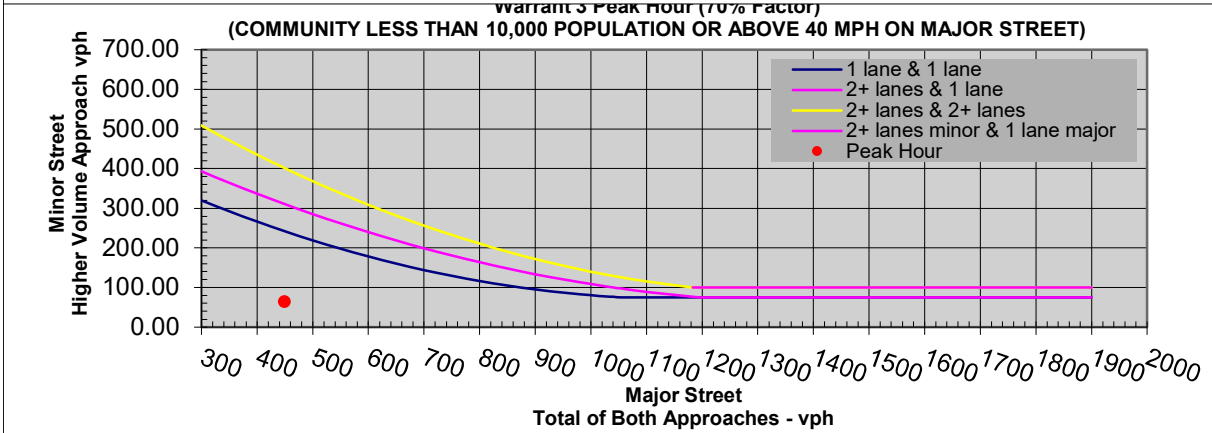
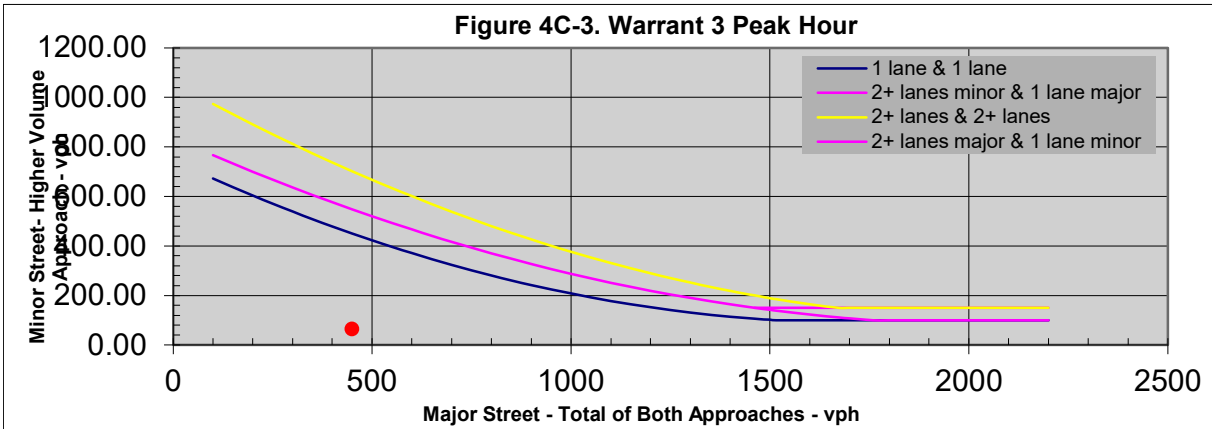
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Schantz and Kramer

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	36	0	36	36
6:30 AM	88	2	90	90
6:45 AM	185	6	191	196
7:00 AM	308	12	320	328
7:15 AM	362	16	378	390
7:30 AM	401	19	420	434
7:45 AM	376	20	396	410
8:00 AM	321	20	341	356
8:15 AM	231	16	247	258
8:30 AM	140	13	153	160
8:45 AM	68	7	75	78
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	65	8	73	75
10:30 AM	123	16	139	143
10:45 AM	210	23	233	240
11:00 AM	280	28	308	315
11:15 AM	302	39	341	347
11:30 AM	327	39	366	376
11:45 AM	333	39	372	384
12:00 PM	342	37	379	395
12:15 PM	255	18	273	288
12:30 PM	172	10	182	191
12:45 PM	79	4	83	86
1:00 PM	0	0	0	0
1:15 PM	75	9	84	89
1:30 PM	146	18	164	176
1:45 PM	257	22	279	293
2:00 PM	327	33	360	379
2:15 PM	342	31	373	388
2:30 PM	379	34	413	424
2:45 PM	357	42	399	412
3:00 PM	379	40	419	431
3:15 PM	379	45	424	443
3:30 PM	347	50	397	417
3:45 PM	351	56	407	430
4:00 PM	359	59	418	443
4:15 PM	403	70	473	494
4:30 PM	449	64	513	538
4:45 PM	447	49	496	526
5:00 PM	456	41	497	527
5:15 PM	322	26	348	366
5:30 PM	200	18	218	225
5:45 PM	109	6	115	119
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
449	64	450	242

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	36	0
6:30 AM	88	0
6:45 AM	185	0
7:00 AM	308	0
7:15 AM	362	0
7:30 AM	401	1
7:45 AM	376	1
8:00 AM	321	2
8:15 AM	231	2
8:30 AM	140	1
8:45 AM	68	1
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	65	0
10:30 AM	123	0
10:45 AM	210	0
11:00 AM	280	1
11:15 AM	302	2
11:30 AM	327	2
11:45 AM	333	2
12:00 PM	342	2
12:15 PM	255	1
12:30 PM	172	1
12:45 PM	79	1
1:00 PM	0	0
1:15 PM	75	0
1:30 PM	146	1
1:45 PM	257	1
2:00 PM	327	1
2:15 PM	342	1
2:30 PM	379	0
2:45 PM	357	0
3:00 PM	379	0
3:15 PM	379	0
3:30 PM	347	0
3:45 PM	351	0
4:00 PM	359	0
4:15 PM	403	0
4:30 PM	449	0
4:45 PM	447	0
5:00 PM	456	1
5:15 PM	322	1
5:30 PM	200	1
5:45 PM	109	1
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? No

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	5:00 PM	6:00 PM	456	1
2nd Highest Hour	7:30 AM	8:30 AM	401	1
3rd Highest Hour	2:30 PM	3:30 PM	379	0
4th Highest Hour	12:00 PM	1:00 PM	342	2

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	5:00 PM	6:00 PM	456	1
2nd Highest Hour	7:30 AM	8:30 AM	401	1
3rd Highest Hour	2:30 PM	3:30 PM	379	0
4th Highest Hour	12:00 PM	1:00 PM	342	2

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
5:00 PM	6:00 PM	456	1

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

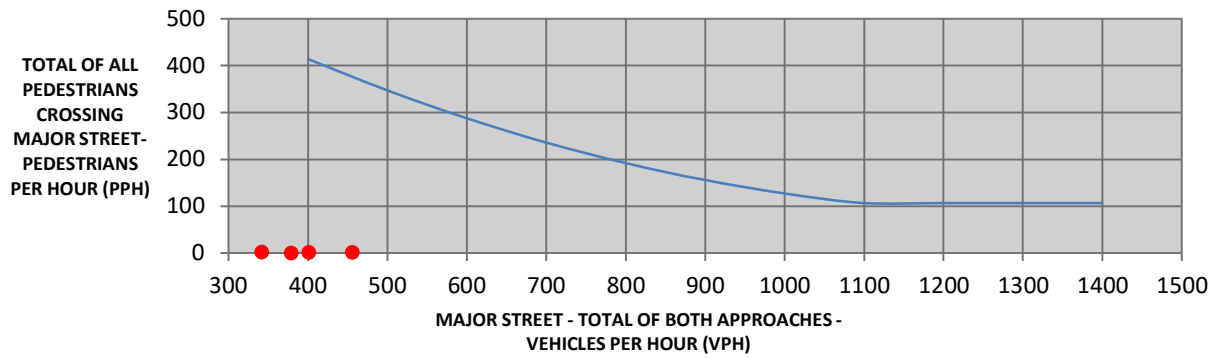


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)

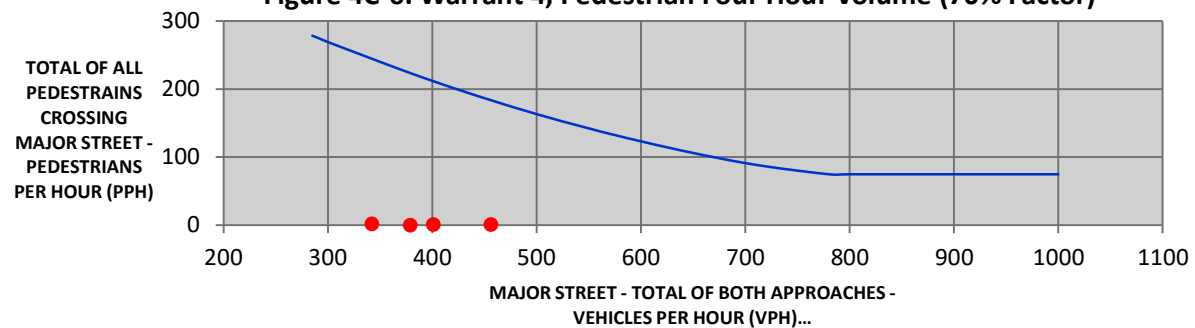


Figure 4C-7. Warrant 4, Pedestrian Peak Hour

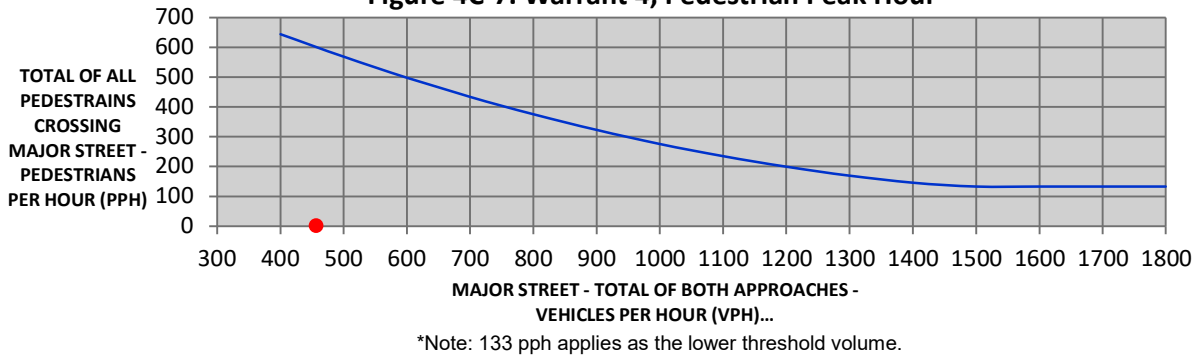
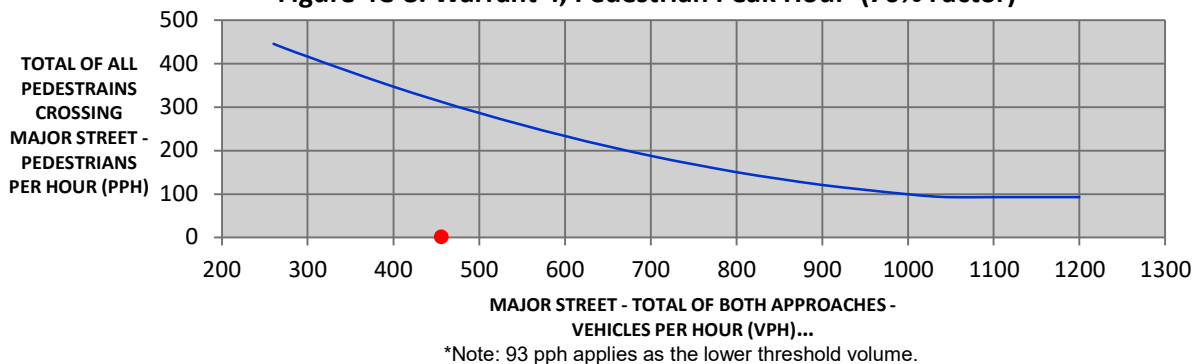


Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



SCHANTZ AVENUE AT KRAMER ROAD

This four-leg intersection is analyzed assuming 1 lane on the major street approach and 1 through lane on the minor street approach, resulting in the following:

Warrant #1. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 60 vehicles when evaluating the combo warrant #1 at condition B. None of the thirteen-hour count periods exceeds the minimum volume threshold of 60 vehicles. *Warrant #1 is NOT satisfied.*

Warrant #2. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 60 vehicles when evaluating warrant #2 at 70% criteria. The highest observed minor side street volume is 45 vehicles. *Warrant #2 is NOT satisfied.*

Warrant #3. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 242 vehicles when evaluating warrant #3 at 70% criteria when the major street volume is 450 vehicles. The highest observed minor side street volume is 64 vehicles. *Warrant #3 is NOT satisfied.*

Warrants #4. A total of 7 pedestrians (less than 107 minimum warrant #4 threshold) were observed crossing Schantz Avenue across the 8-hour data collection period. *Warrant #4 is NOT satisfied.*

The existing traffic signal at the Schantz Avenue and Kramer Road intersection is **not warranted** due to low volumes collected on both the major and minor streets and limited pedestrian activity.

SHAFOR BOULEVARD AT PATTERSON ROAD

This four-leg intersection is analyzed assuming 1 lane on the major street approach (Patterson Road) and 1 through lane on the minor street approach (Shafor Boulevard), resulting in the following:

Warrant #1. No hours of the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A and combo warrant (evaluated at 80%). Only one hour meets the warrant #1 thresholds for condition B. *Warrant #1 is NOT satisfied.*

Warrant #2. Plotting the four highest volume-pairs as described in the methodology section on top of OMUTCD Figure 4C-2 (**Figure 17A**) resulted in no volume pairs exceeding the warrant #2 threshold. Adjusting the collected volumes by 11% would still not result enough hours exceeding the warrant #2 thresholds. *Warrant #2 is NOT satisfied.*

Warrant #3. Plotting the highest volume-pair as described in the methodology section on top of OMUTCD Figure 4C-4 (**Figure 17B**) resulted in the volume pair not exceeding warrant #3 threshold. For Figure 4C-4, a minimum required peak hour traffic volume for the side street is 204 vehicles when 82 were actually present. Adjusting for COVID, the 11% increase to 91 vehicles still falls short for Warrant #3. *Warrant #3 is NOT satisfied.*

FIGURE 17A: SHAFOR BOULEVARD AT PATTERSON ROAD WARRANT #2 (70% FACTOR)

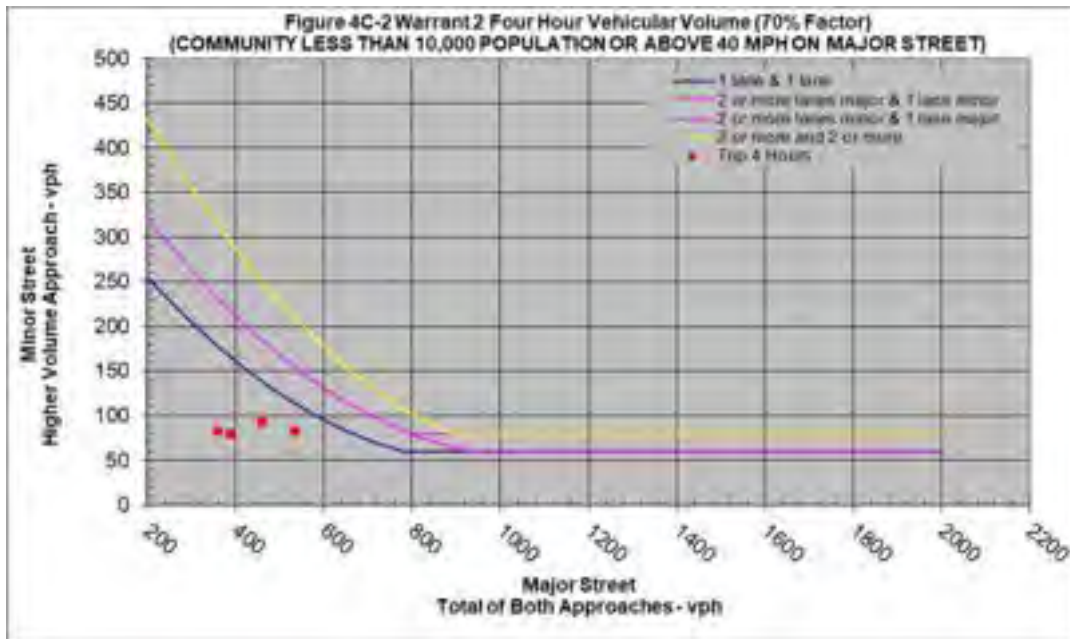
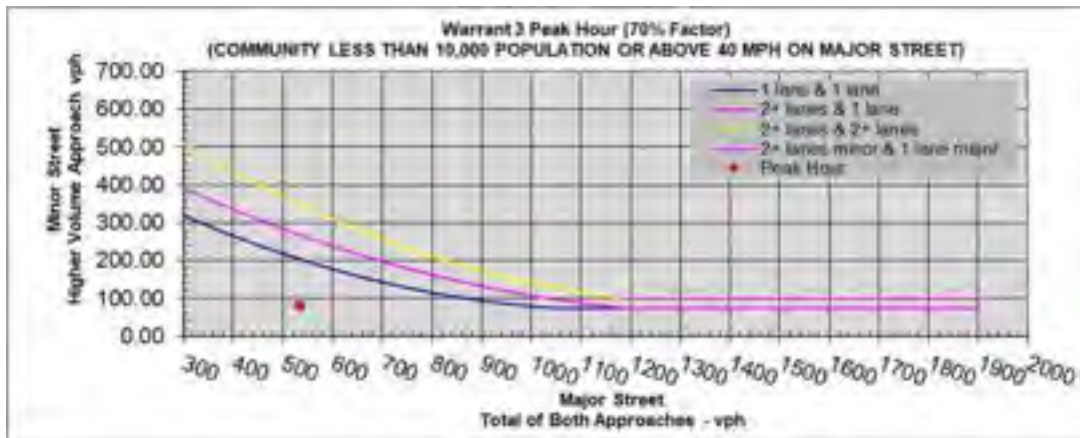


FIGURE 17B: SHAFOR BOULEVARD AT PATTERSON ROAD WARRANT #3 (70% FACTOR)



Warrants #4 and #5. A total of 148 pedestrians were observed crossing Patterson Road at Shafor Boulevard during the 8-hour data collection periods. Due to the intersection being located near the Oakwood Community Center and about 1/3rd of a mile from Oakwood Junior and Senior High School, a gap analysis was performed at the intersection to understand the impact of pedestrian crossings without the existing signal.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Patterson Road at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Patterson Road, crossing distance from curb ramp to curb ramp (measured at 30 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

Where:

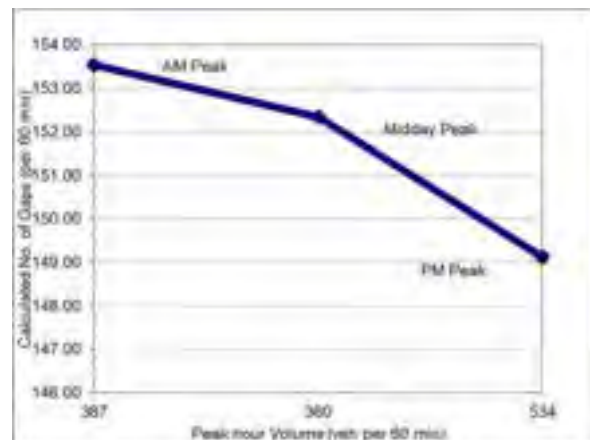
- λ = Total bidirectional volume at Patterson Rd @ Shafor Blvd
- t = Crossing Time = $\frac{30 \text{ ft}}{3.5 \frac{\text{ft}}{\text{s}}}$

8.6 seconds

The resulting number of gaps for each peak hour volume are shown in **Figure 17C**.

The gap analysis shows that the number of gaps to cross Patterson Road is over 148 at this intersection during peak hours. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). With acceptable headway available to cross the major street at this location, *warrants #4 and #5 are NOT satisfied based on gap analysis.*

FIGURE 17C: GAP ANALYSIS (30 FT CROSSING DISTANCE)



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/20/2022
Day of the Week: Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Patterson

Major Street Approach Direction: E-Bound
W-Bound

Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

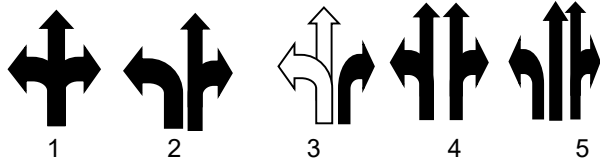
Speed Limit or 85th Percentile Speed on the Major Street*: 25 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Shafor

Minor Street Approach Configuration:

1	N-Bound
1	S-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

*Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	34	9																
6:30 AM	118	21																
6:45 AM	202	37																
7:00 AM	315	54												1				
7:15 AM	372	72		1														
7:30 AM	387	78																
7:45 AM	388	79																
8:00 AM	356	76												1				
8:15 AM	265	49																
8:30 AM	166	31																
8:45 AM	81	14																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Shafor and Patterson

10:00 AM	0	0																	
10:15 AM	59	13																	
10:30 AM	130	21																	
10:45 AM	202	42																	
11:00 AM	293	59												1					
11:15 AM	321	67																	
11:30 AM	335	68																	
11:45 AM	349	76																	
12:00 PM	360	83			1										1				
12:15 PM	273	69																	
12:30 PM	188	51																	
12:45 PM	102	22																	
1:00 PM	0	0																	
1:15 PM	98	20																	
1:30 PM	178	32																	
1:45 PM	262	43																	
2:00 PM	340	60													1				
2:15 PM	335	63																	
2:30 PM	362	95			1														
2:45 PM	390	100																	
3:00 PM	435	104								1					1	1	1	1	1
3:15 PM	461	93																	
3:30 PM	455	94			1														
3:45 PM	455	86																	
4:00 PM	442	98								1					1	1	1	1	1
4:15 PM	491	80																	
4:30 PM	533	80	1		1					1	1								
4:45 PM	534	82																	
5:00 PM	511	76								1					1			1	1
5:15 PM	343	57																	
5:30 PM	200	35																	
5:45 PM	87	19																	
6:00 PM	0	0																	
6:15 PM	0	0																	
6:30 PM	0	0																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			1	0	5	0	0	0	1	1	3	0	0	0	8	2	3	3	
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Warrant Met: **No**

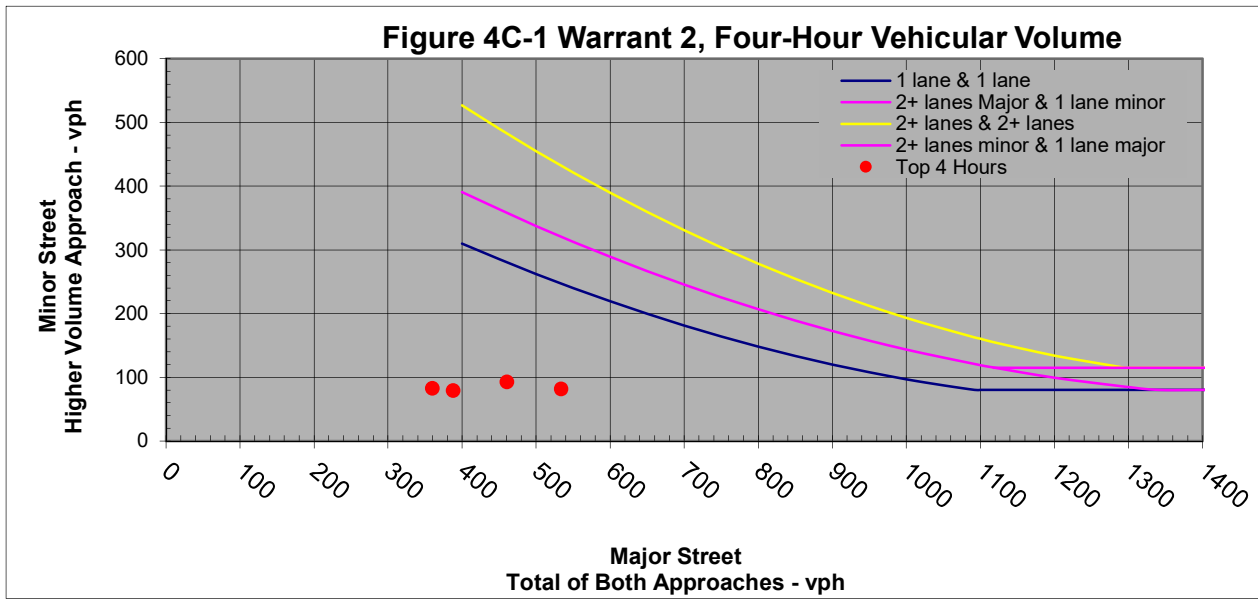
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

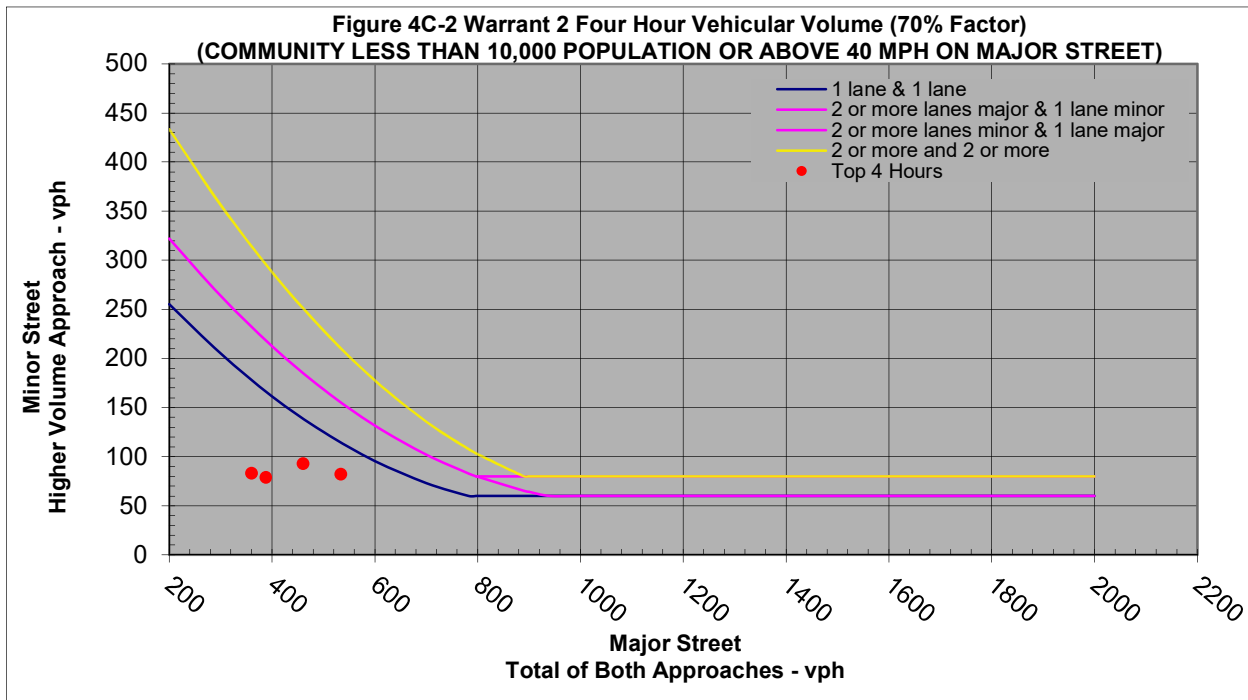
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Minor - Shafor		Major - Patterson					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	9	4	25	9	34	9		
6:30 AM	21	12	83	35	118	21		
6:45 AM	37	26	143	59	202	37		
7:00 AM	54	38	225	90	315	54		
7:15 AM	72	61	256	116	372	72		
7:30 AM	78	67	260	127	387	78		
7:45 AM	79	62	249	139	388	79		
8:00 AM	76	64	221	135	356	76		
8:15 AM	49	37	165	100	265	49		
8:30 AM	31	23	103	63	166	31		
8:45 AM	14	14	54	27	81	14		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	8	13	39	20	59	13		
10:30 AM	21	21	77	53	130	21		
10:45 AM	42	37	114	88	202	42		
11:00 AM	59	52	164	129	293	59		
11:15 AM	67	53	172	149	321	67		
11:30 AM	68	63	182	153	335	68		
11:45 AM	69	76	191	158	349	76		
12:00 PM	69	83	186	174	360	83		
12:15 PM	53	69	139	134	273	69		
12:30 PM	39	51	91	97	188	51		
12:45 PM	17	22	45	57	102	22		
1:00 PM	0	0	0	0	0	0		
1:15 PM	7	20	53	45	98	20		
1:30 PM	17	32	93	85	178	32		
1:45 PM	32	43	137	125	262	43		
2:00 PM	46	60	183	157	340	60		
2:15 PM	63	63	184	151	335	63		
2:30 PM	95	62	189	173	362	95		
2:45 PM	100	78	199	191	390	100		
3:00 PM	104	74	194	241	435	104		
3:15 PM	93	86	186	275	461	93		
3:30 PM	69	94	180	275	455	94		
3:45 PM	66	86	176	279	455	86		
4:00 PM	69	98	176	266	442	98		
4:15 PM	75	80	202	289	491	80		
4:30 PM	79	80	221	312	533	80		
4:45 PM	78	82	226	308	534	82		
5:00 PM	76	69	232	279	511	76		
5:15 PM	57	52	160	183	343	57		
5:30 PM	35	33	102	98	200	35		
5:45 PM	19	12	47	40	87	19		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	534	82
2nd Highest Hour	3:15 PM	4:15 PM	461	93
3rd Highest Hour	7:45 AM	8:45 AM	388	79
4th Highest Hour	12:00 PM	1:00 PM	360	83

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	534	82
2nd Highest Hour	3:15 PM	4:15 PM	461	93
3rd Highest Hour	7:45 AM	8:45 AM	388	79
4th Highest Hour	12:00 PM	1:00 PM	360	83



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

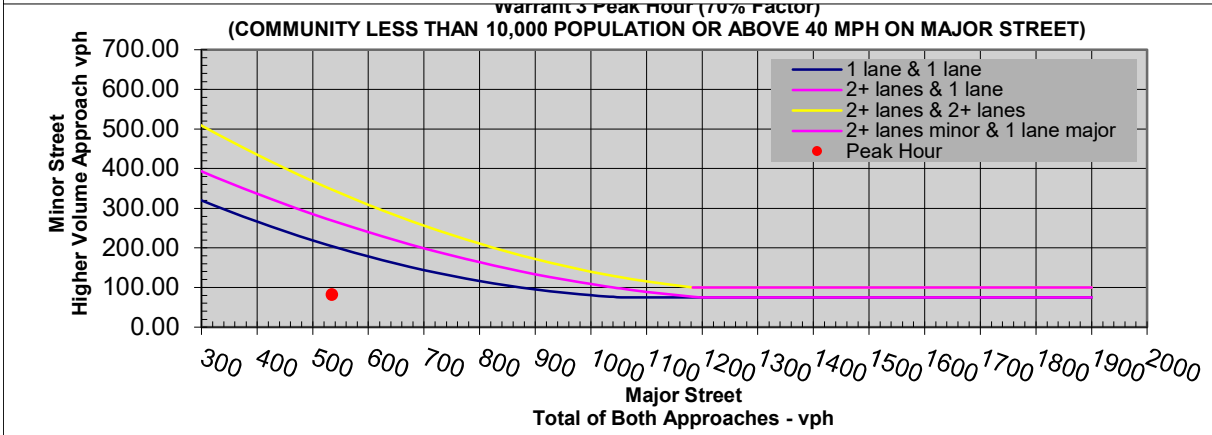
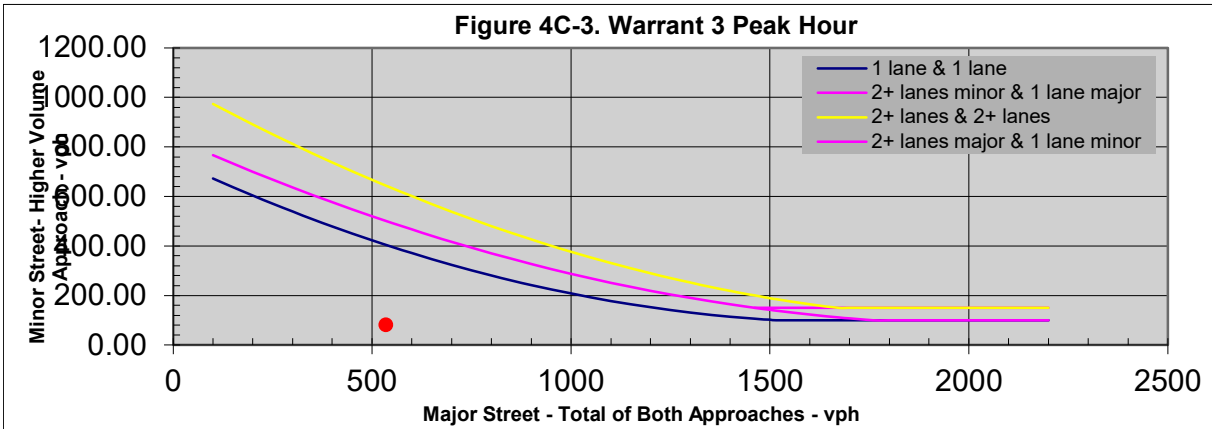
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	Yes
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Shafor and Patterson

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	34	9	43	47
6:30 AM	118	21	139	151
6:45 AM	202	37	239	265
7:00 AM	315	54	369	407
7:15 AM	372	72	444	505
7:30 AM	387	78	465	532
7:45 AM	388	79	467	529
8:00 AM	356	76	432	496
8:15 AM	265	49	314	351
8:30 AM	166	31	197	220
8:45 AM	81	14	95	109
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	59	13	72	80
10:30 AM	130	21	151	172
10:45 AM	202	42	244	281
11:00 AM	293	59	352	404
11:15 AM	321	67	388	441
11:30 AM	335	68	403	466
11:45 AM	349	76	425	494
12:00 PM	360	83	443	512
12:15 PM	273	69	342	395
12:30 PM	188	51	239	278
12:45 PM	102	22	124	141
1:00 PM	0	0	0	0
1:15 PM	98	20	118	125
1:30 PM	178	32	210	227
1:45 PM	262	43	305	337
2:00 PM	340	60	400	446
2:15 PM	335	63	398	461
2:30 PM	362	95	457	519
2:45 PM	390	100	490	568
3:00 PM	435	104	539	613
3:15 PM	461	93	554	640
3:30 PM	455	94	549	618
3:45 PM	455	86	541	607
4:00 PM	442	98	540	609
4:15 PM	491	80	571	646
4:30 PM	533	80	613	692
4:45 PM	534	82	616	694
5:00 PM	511	76	587	656
5:15 PM	343	57	400	452
5:30 PM	200	35	235	268
5:45 PM	87	19	106	118
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
534	82	404	204

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	34	1
6:30 AM	118	1
6:45 AM	202	1
7:00 AM	315	14
7:15 AM	372	14
7:30 AM	387	17
7:45 AM	388	25
8:00 AM	356	17
8:15 AM	265	16
8:30 AM	166	13
8:45 AM	81	5
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	59	3
10:30 AM	130	5
10:45 AM	202	6
11:00 AM	293	7
11:15 AM	321	5
11:30 AM	335	6
11:45 AM	349	12
12:00 PM	360	16
12:15 PM	273	15
12:30 PM	188	12
12:45 PM	102	5
1:00 PM	0	0
1:15 PM	98	2
1:30 PM	178	4
1:45 PM	262	6
2:00 PM	340	10
2:15 PM	335	9
2:30 PM	362	13
2:45 PM	390	18
3:00 PM	435	16
3:15 PM	461	20
3:30 PM	455	27
3:45 PM	455	26
4:00 PM	442	28
4:15 PM	491	25
4:30 PM	533	24
4:45 PM	534	34
5:00 PM	511	40
5:15 PM	343	38
5:30 PM	200	26
5:45 PM	87	10
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No

**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	4:45 PM	5:45 PM	534	34
2nd Highest Hour	3:30 PM	4:30 PM	455	27
3rd Highest Hour	7:45 AM	8:45 AM	388	25
4th Highest Hour	12:00 PM	1:00 PM	360	16

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	4:45 PM	5:45 PM	534	34
2nd Highest Hour	3:30 PM	4:30 PM	455	27
3rd Highest Hour	7:45 AM	8:45 AM	388	25
4th Highest Hour	12:00 PM	1:00 PM	360	16

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
4:45 PM	5:45 PM	534	34
Number of Hours That Met the 4-Hour Criteria 4C-5			0
Number of Hours That Met the 4-Hour Criteria 4C-6			0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

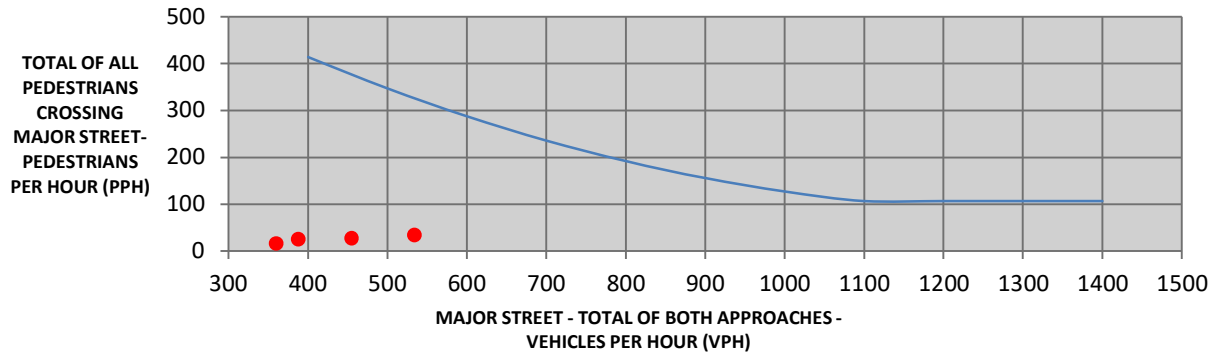
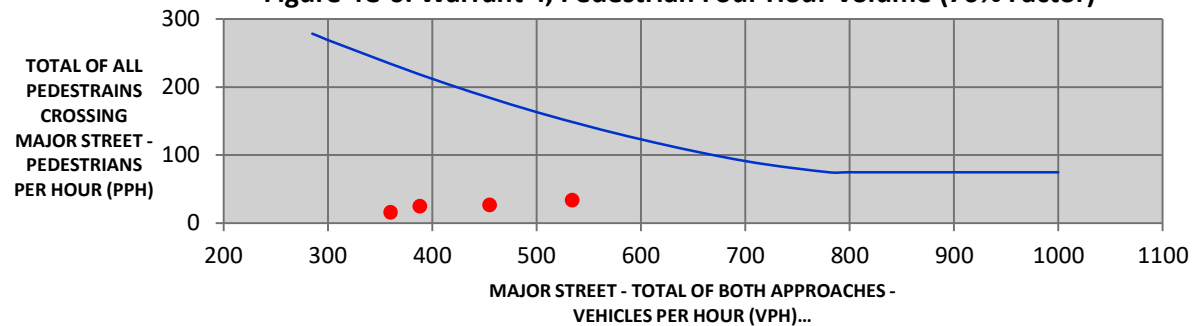
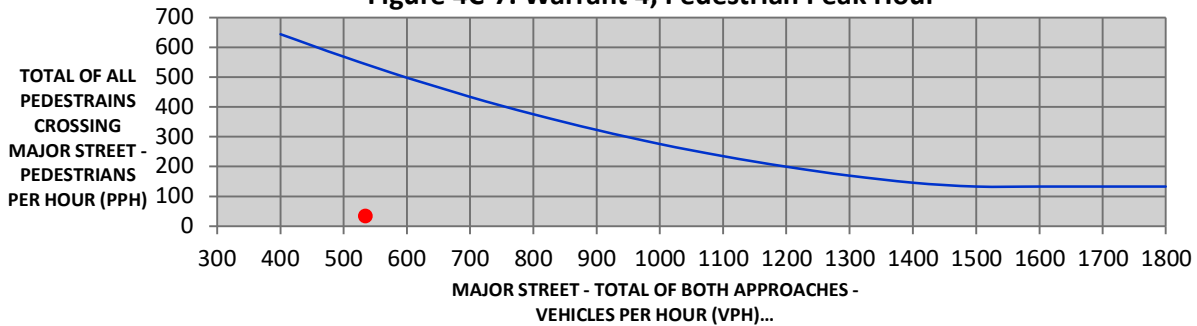


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)



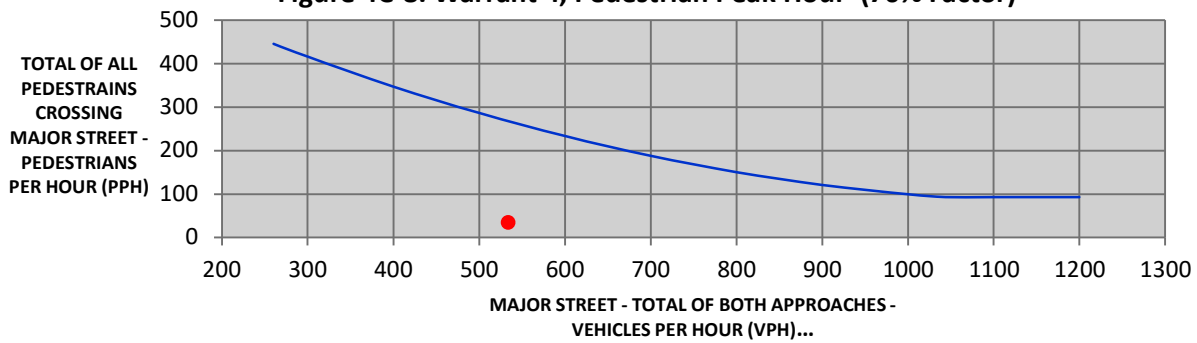
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Checking OMTUCD Section **4C.05** states that warrant #4 thresholds may be reduced to 70% for an existing traffic signal. The results of the signal warrant #4 analyses using 70% criteria are shown in **Figure 17D** and **Figure 17E**. The thresholds for warrant #4 are not met. Warrant #4 would not be expected to meet if the 11% COVID adjustment factor was applied. *Warrant #4 is NOT satisfied based on OMTUCD Section 4C.05.*

FIGURE 17D: SHAFOR BLVD AT PATTERSON ROAD WARRANT #4 (PED. 4 HOUR VOLUME AT 70%)



FIGURE 17E: SHAFOR BLVD AT PATTERSON ROAD WARRANT #4 (PK HR AT 70%)



The existing traffic signal at the Shafor Boulevard & Patterson Road intersection **is not warranted** as it does not meet volume based warrants and the available headway provides enough gaps for pedestrian crossings over Patterson Road during peak hours.

SHAFOR BOULEVARD AT ABERDEEN AVENUE

This four-leg intersection is analyzed assuming 1 lanes on the major street approach (Shafor Boulevard) and 1 through lane on the minor street approach (Aberdeen Avenue), resulting in the following:

Warrant #1. No hours of the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A, B, and combo warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

Warrant #2. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 60 vehicles when evaluating warrant #2 at 70% criteria. The highest observed minor side street volume is 41 vehicles. *Warrant #2 is NOT satisfied.*

Warrant #3. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 344 vehicles when evaluating warrant #3 at 70% criteria. The highest observed minor side street volume is 37 vehicles. *Warrant #3 is NOT satisfied.*

Warrants #4 and #5. A total of 363 pedestrians were observed crossing Shafor Boulevard at Aberdeen Avenue during the 8-hour data collection periods. Due to the intersection being located on the corner of Edwin D Smith Elementary School, a gap analysis was performed at the intersection to understand the impact of pedestrian crossings without the existing signal.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Shafor Boulevard at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Shafor Boulevard, crossing distance from curb ramp to curb ramp (measured at 60 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

Where:

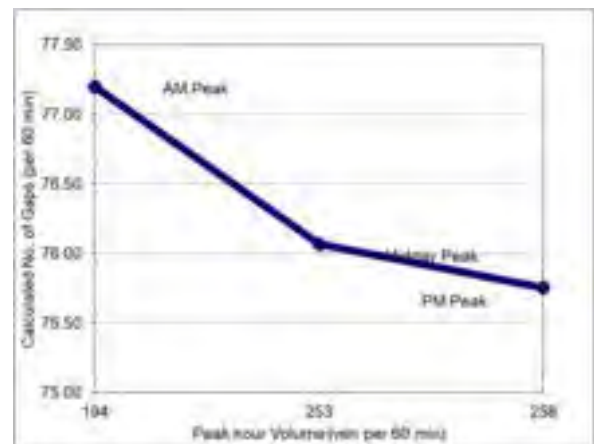
- λ = Total bidirectional volume at Shafor Blvd @ Aberdeen Ave
- t = Crossing Time = $\frac{60 \text{ ft}}{3.5 \frac{\text{ft}}{\text{s}}} =$

17.1 seconds

The resulting number of gaps for each peak hour volume are shown in **Figure 18A**.

The gap analysis shows the calculated number of gaps to cross Shafor Boulevard is over 75 at this intersection during peak hours. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). With acceptable headway available to cross the major street at this location, *warrants #4 and #5 are NOT satisfied based on gap analysis.*

FIGURE 18A: GAP ANALYSIS (60 FT CROSSING DISTANCE)



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/4/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/22/2022
Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Shafor

Major Street Approach Direction:
N-Bound
S-Bound

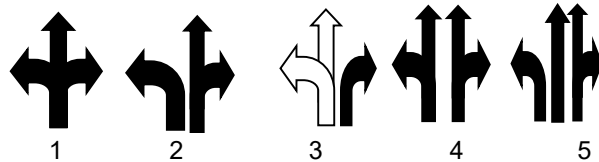
Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 25 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Aberdeen

Minor Street Approach Configuration:
1 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> <tr><td style="text-align: center;">5:45 PM</td></tr> </table>	Peak Hour	4:45 PM	5:45 PM
Peak Hour						
4:45 PM						
5:45 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:00 PM</td></tr> <tr><td style="text-align: center;">4:00 PM</td></tr> </table>	Peak Hour	3:00 PM	4:00 PM
Peak Hour						
3:00 PM						
4:00 PM						
Warrant 5, School Crossing	Yes	No	N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
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8:15 AM	127	34																
8:30 AM	69	11																
8:45 AM	38	8																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Shafor and Aberdeen

10:00 AM	0	0																	
10:15 AM	21	6																	
10:30 AM	62	16																	
10:45 AM	114	19																	
11:00 AM	147	22																	
11:15 AM	165	18																	
11:30 AM	154	12																	
11:45 AM	148	14																	
12:00 PM	159	14																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

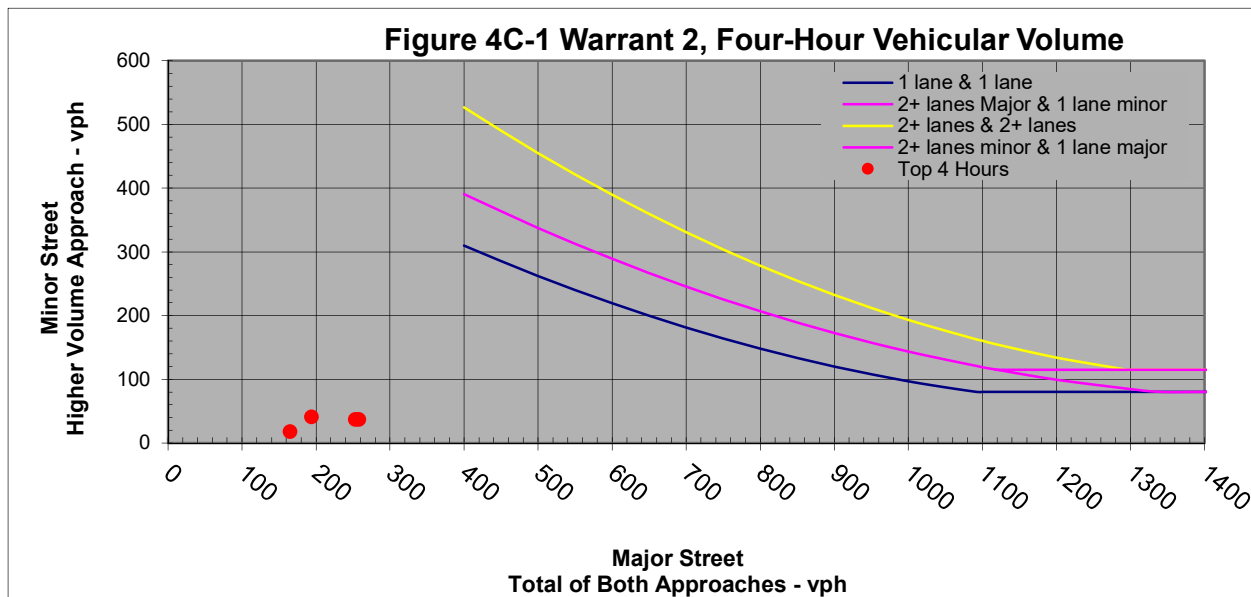
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

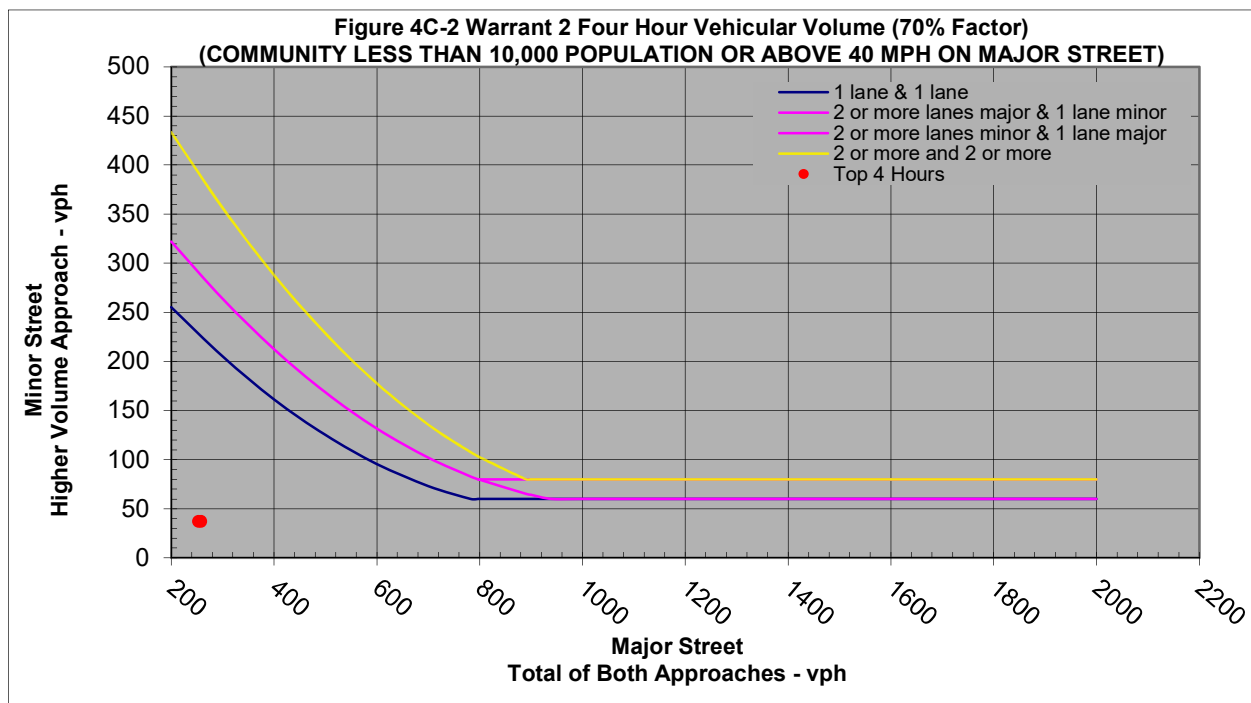
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - Shafor		Minor - Aberdeen					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	1	5	1	0	6	1		
6:30 AM	15	11	4	0	26	4		
6:45 AM	22	20	6	2	42	6		
7:00 AM	42	41	11	5	83	11		
7:15 AM	69	75	16	12	144	16		
7:30 AM	73	109	20	35	182	35		
7:45 AM	83	114	21	36	197	36		
8:00 AM	89	105	20	41	194	41		
8:15 AM	61	66	14	34	127	34		
8:30 AM	43	26	7	11	69	11		
8:45 AM	26	12	4	8	38	8		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	12	9	0	6	21	6		
10:30 AM	32	30	1	16	62	16		
10:45 AM	59	55	4	19	114	19		
11:00 AM	75	72	5	22	147	22		
11:15 AM	85	80	7	18	165	18		
11:30 AM	78	76	9	12	154	12		
11:45 AM	81	67	9	14	148	14		
12:00 PM	86	73	13	14	159	14		
12:15 PM	64	56	11	12	120	12		
12:30 PM	51	39	8	8	90	8		
12:45 PM	21	23	5	3	44	5		
1:00 PM	0	0	0	0	0	0		
1:15 PM	16	13	1	1	29	1		
1:30 PM	29	21	4	3	50	4		
1:45 PM	50	39	5	9	89	9		
2:00 PM	73	55	8	13	128	13		
2:15 PM	100	67	10	30	167	30		
2:30 PM	124	98	10	33	222	33		
2:45 PM	124	115	12	39	239	39		
3:00 PM	124	129	13	37	253	37		
3:15 PM	108	136	12	30	244	30		
3:30 PM	105	122	15	31	227	31		
3:45 PM	112	111	17	25	223	25		
4:00 PM	124	109	15	29	233	29		
4:15 PM	132	108	14	28	240	28		
4:30 PM	126	120	10	31	246	31		
4:45 PM	134	124	10	37	258	37		
5:00 PM	126	123	13	39	249	39		
5:15 PM	91	92	12	29	183	29		
5:30 PM	63	55	10	20	118	20		
5:45 PM	27	27	5	8	54	8		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	258	37
2nd Highest Hour	3:00 PM	4:00 PM	253	37
3rd Highest Hour	8:00 AM	9:00 AM	194	41
4th Highest Hour	11:15 AM	12:15 PM	165	18

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:45 PM	5:45 PM	258	37
2nd Highest Hour	3:00 PM	4:00 PM	253	37
3rd Highest Hour	8:00 AM	9:00 AM	194	41
4th Highest Hour	11:15 AM	12:15 PM	165	18



Are the requirements for Warrant 2 met?: No

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	4:45 PM
Minor Street:	1 Lane	Peak Hour End Time
		5:45 PM

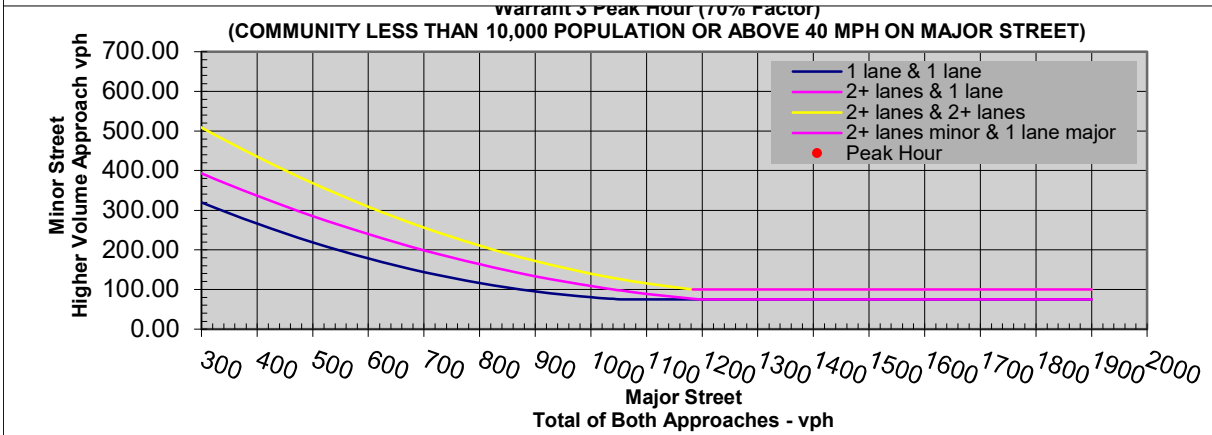
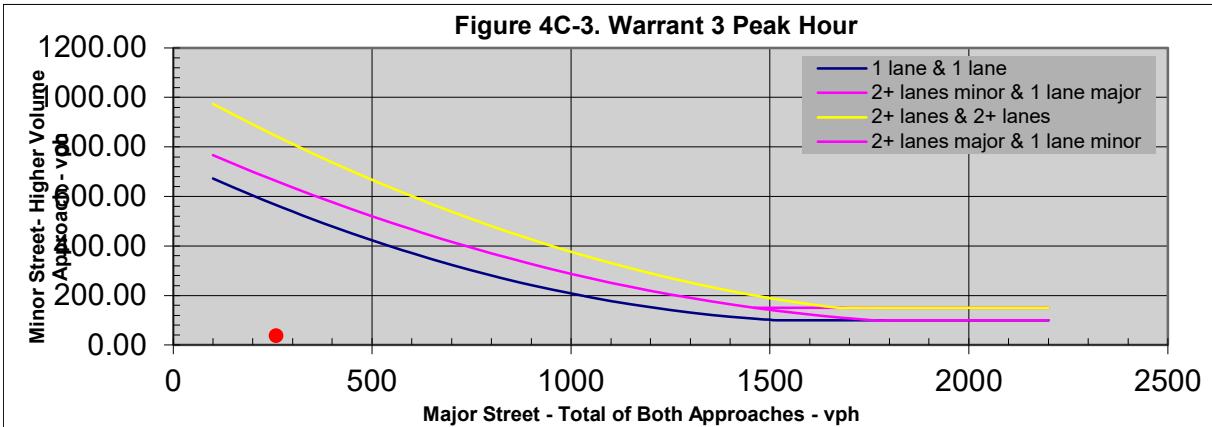
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Shafor and Aberdeen

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	6	1	7	7
6:30 AM	26	4	30	30
6:45 AM	42	6	48	50
7:00 AM	83	11	94	99
7:15 AM	144	16	160	172
7:30 AM	182	35	217	237
7:45 AM	197	36	233	254
8:00 AM	194	41	235	255
8:15 AM	127	34	161	175
8:30 AM	69	11	80	87
8:45 AM	38	8	46	50
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	21	6	27	27
10:30 AM	62	16	78	79
10:45 AM	114	19	133	137
11:00 AM	147	22	169	174
11:15 AM	165	18	183	190
11:30 AM	154	12	166	175
11:45 AM	148	14	162	171
12:00 PM	159	14	173	186
12:15 PM	120	12	132	143
12:30 PM	90	8	98	106
12:45 PM	44	5	49	52
1:00 PM	0	0	0	0
1:15 PM	29	1	30	31
1:30 PM	50	4	54	57
1:45 PM	89	9	98	103
2:00 PM	128	13	141	149
2:15 PM	167	30	197	207
2:30 PM	222	33	255	265
2:45 PM	239	39	278	290
3:00 PM	253	37	290	303
3:15 PM	244	30	274	286
3:30 PM	227	31	258	273
3:45 PM	223	25	248	265
4:00 PM	233	29	262	277
4:15 PM	240	28	268	282
4:30 PM	246	31	277	287
4:45 PM	258	37	295	305
5:00 PM	249	39	288	301
5:15 PM	183	29	212	224
5:30 PM	118	20	138	148
5:45 PM	54	8	62	67
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
258	37	565	344

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	6	1
6:30 AM	26	3
6:45 AM	42	8
7:00 AM	83	13
7:15 AM	144	23
7:30 AM	182	134
7:45 AM	197	137
8:00 AM	194	135
8:15 AM	127	124
8:30 AM	69	11
8:45 AM	38	3
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	21	0
10:30 AM	62	13
10:45 AM	114	18
11:00 AM	147	19
11:15 AM	165	26
11:30 AM	154	15
11:45 AM	148	13
12:00 PM	159	16
12:15 PM	120	9
12:30 PM	90	7
12:45 PM	44	4
1:00 PM	0	0
1:15 PM	29	1
1:30 PM	50	3
1:45 PM	89	4
2:00 PM	128	11
2:15 PM	167	110
2:30 PM	222	128
2:45 PM	239	143
3:00 PM	253	137
3:15 PM	244	39
3:30 PM	227	24
3:45 PM	223	8
4:00 PM	233	10
4:15 PM	240	14
4:30 PM	246	12
4:45 PM	258	20
5:00 PM	249	22
5:15 PM	183	16
5:30 PM	118	13
5:45 PM	54	5
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No
**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	3:00 PM	4:00 PM	253	137
2nd Highest Hour	7:45 AM	8:45 AM	197	137
3rd Highest Hour	4:45 PM	5:45 PM	258	20
4th Highest Hour	11:15 AM	12:15 PM	165	26

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	3:00 PM	4:00 PM	253	137
2nd Highest Hour	7:45 AM	8:45 AM	197	137
3rd Highest Hour	4:45 PM	5:45 PM	258	20
4th Highest Hour	11:15 AM	12:15 PM	165	26

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
3:00 PM	4:00 PM	253	137

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

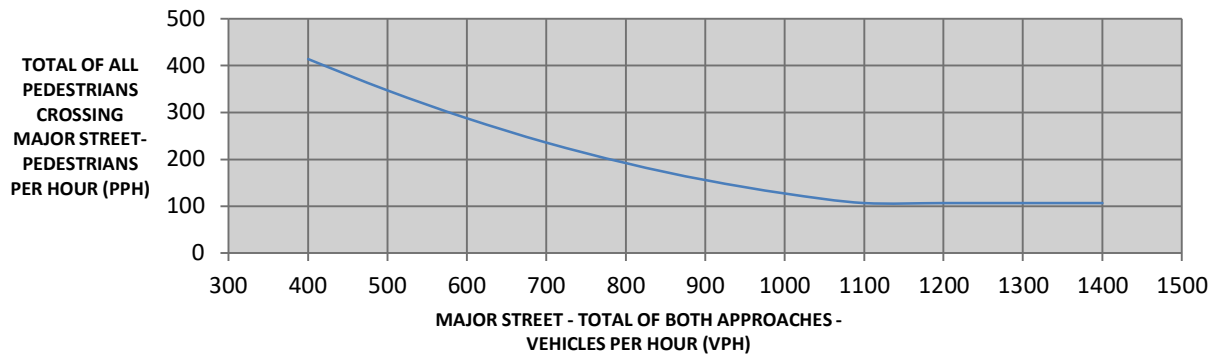


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)

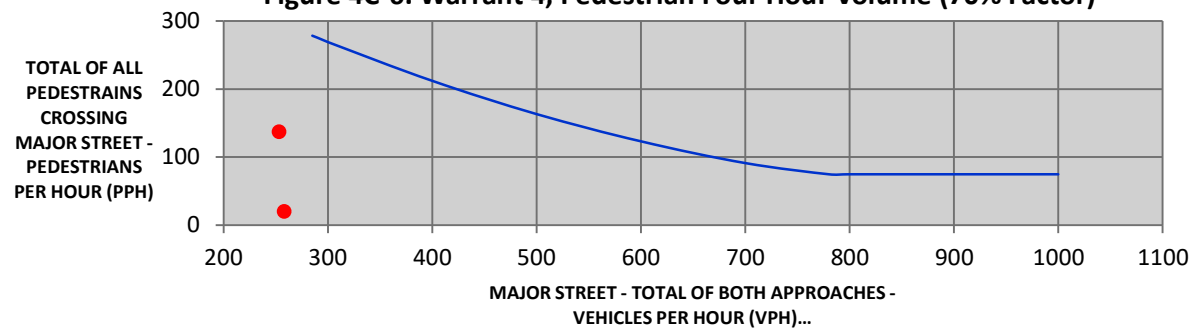


Figure 4C-7. Warrant 4, Pedestrian Peak Hour

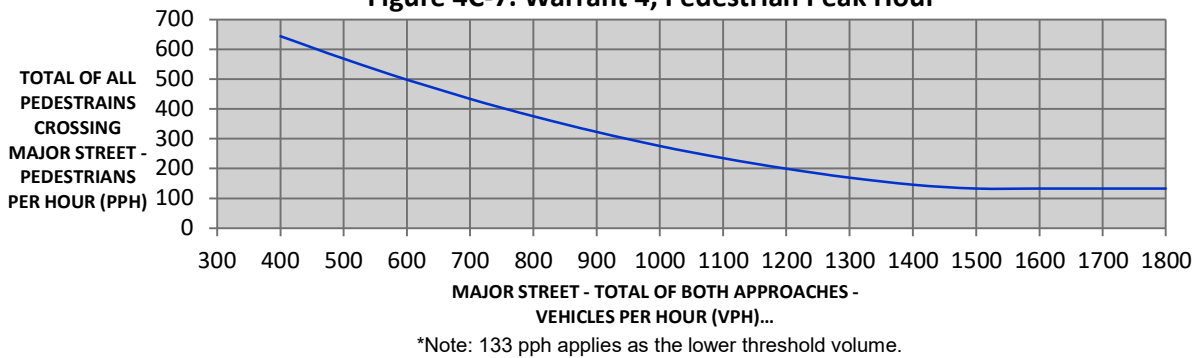
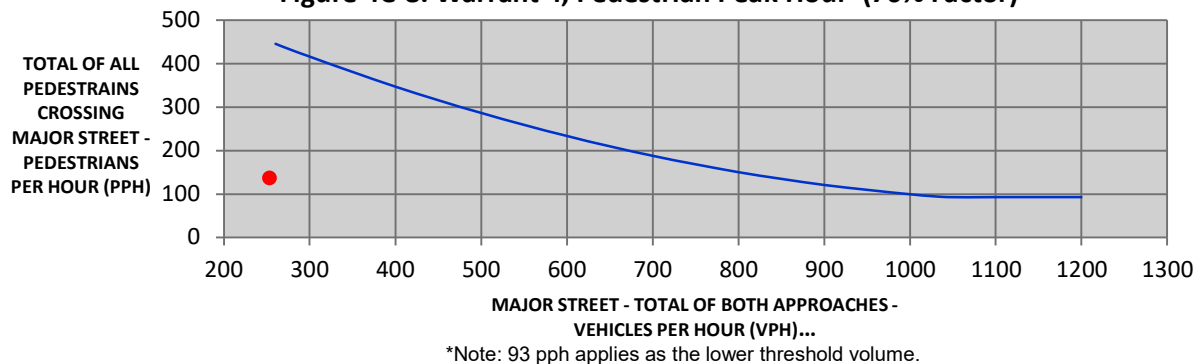


Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



OMUTCD WARRANT 5, SCHOOL CROSSING

Do school children (elementary through high school students) cross the major street?

Has consideration been given to implement other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing?

Is the distance to the nearest traffic control signal along the major street less than 300 feet?

If the distance to the nearest traffic control signal along the major street is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic?

Minimum of 20 schoolchildren during the highest crossing hour?

Has a traffic engineering study been conducted to determine the adequacy and frequency of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street?

Pedestrian Gap Acceptance Engineering and Traffic Study Evaluation

Data Collection Date:

Day of the Week:

Study Period	Study Duration (min)	Crossing 1 (Stage 1)		Crossing 1 (Stage 2)		Crossing 2 (Stage 1)		Crossing 2 (Stage 2)	
		Total Adequate Gaps	Met?	Road A	Met?	Total Adequate Gaps	Met?	Total Adequate Gaps	Met?
1			N/A		N/A		N/A		N/A
2			N/A		N/A		N/A		N/A
3			N/A		N/A		N/A		N/A
4			N/A		N/A		N/A		N/A
5			N/A		N/A		N/A		N/A
Summary:		Not Met		Not Met		Not Met		Not Met	

Estimation of Expected Gaps if No Study was Done.

Crossing Width: feet Length of Time period for which the volume applies: Sec.

Required Gap time: sec. Two way vehicular volume across the crossing path over time period:

Expected number of gaps per the length of time which are equal to or greater than the required gap time

Are the requirements for Warrant 5 met?:

OMUTCD WARRANT 6, COORDINATED SIGNAL SYSTEM

On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

**Warrant 6 should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

Are the requirements for Warrant 6 met?:

Checking OMTUCD Section **4C.05** states that warrant #4 thresholds may be reduced to 70% for an existing traffic signal. The results of the signal warrant #4 analyses using 70% criteria are shown in **Figure 18B** and **Figure 18C**. The thresholds for warrant #4 are not met. Warrant #4 would not be expected to meet if the 11% COVID adjustment factor was applied. *Warrant #4 is NOT satisfied based on OMTUCD Section 4C.05.*

FIGURE 18B: SHAFOR BLVD AT ABERDEEN AVENUE WARRANT #4 (PED. 4 HOUR VOLUME AT 70%)

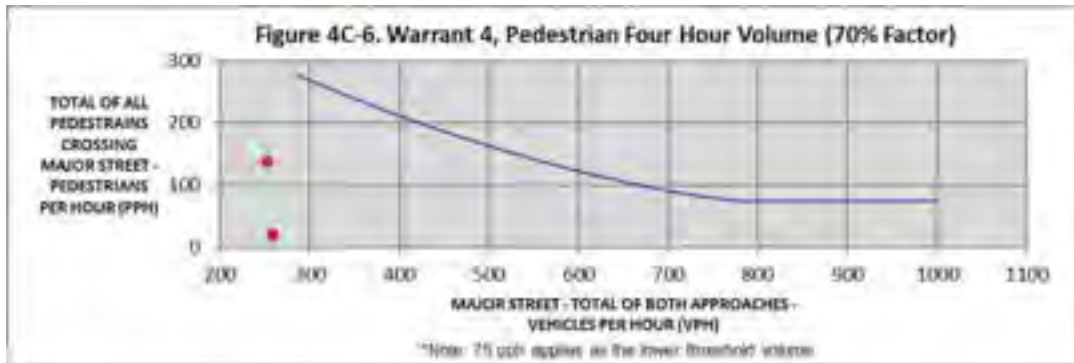


FIGURE 18C: SHAFOR BLVD AT ABERDEEN AVENUE WARRANT #4 (PK HR AT 70%)



The existing traffic signal at the Shafor Boulevard & Aberdeen Avenue intersection **is not warranted** as it does not meet volume-based warrants and the available headway provides enough gaps for pedestrian crossings over Shafor Boulevard during peak hours.

SHAFOR BOULEVARD AT TELFORD AVENUE

This four-leg intersection is analyzed assuming 1 lane on the major street approach (Shafor Boulevard) and 1 through lane on the minor street approach (Telford Avenue), resulting in the following:

Warrant #1. No hours of the TMC period exceeded the warrant #1 thresholds shown in OMUTCD Table 4C-1 for condition A, B, and combo warrant (evaluated at 80%). *Warrant #1 is NOT satisfied.*

Warrant #2. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 60 vehicles when evaluating warrant #2 at 70% criteria. The highest observed minor side street volume is 34 vehicles. *Warrant #2 is NOT satisfied.*

Warrant #3. The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 349 vehicles when evaluating warrant #3 at 70% criteria. The highest observed minor side street volume is 18 vehicles. *Warrant #3 is NOT satisfied.*

Warrants #4 and #5. A total of 618 pedestrians were observed crossing Shafor Boulevard at Telford during the 8-hour data collection periods. Due to the intersection being located on the property corner of Edwin D Smith Elementary School, a gap analysis was performed at the intersection to understand the impact of pedestrian crossings without the existing signal.

Gap analysis was performed using a Poisson Distribution methodology to determine if an acceptable number of gaps are available to cross Shafor Boulevard at the AM, midday, and PM peak hours. Acceptable numbers of gaps to accommodate pedestrians are assumed to be one per minute (60 gaps per hour). The available number of gaps is dependent on total bidirectional volume on Shafor Boulevard, crossing distance from curb ramp to curb ramp (measured at 60 ft), and walking speed (3.5 ft/s was assumed). The available gaps during peak hours were calculated using the following equation:

$$\text{No. of Gaps} = \lambda \times e^{-(\lambda t)}$$

Where:

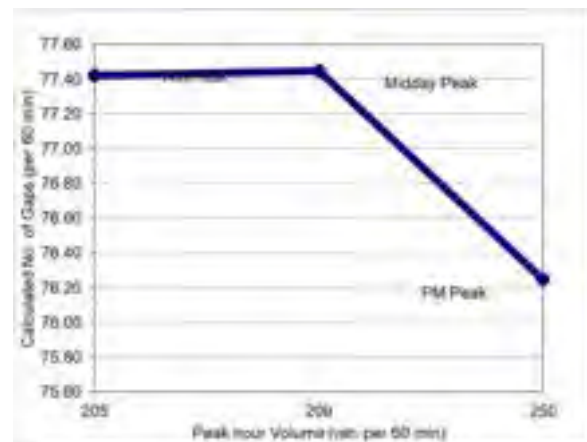
- λ = Total bidirectional volume at Shafor Blvd @ Telford Ave
- t = Crossing Time = $\frac{60 \text{ ft}}{3.5 \frac{\text{ft}}{\text{s}}}$ =

17.1 seconds

The resulting number of gaps for each peak hour volume are shown in **Figure 19A**.

The gap analysis shows the calculated number of gaps to cross Shafor Boulevard is over 75 at this intersection during peak hours. The acceptable number of gaps is 60 per hour (i.e., one opportunity to cross every minute). With acceptable headway available to cross the major street at this location, *warrants #4 and #5 are NOT satisfied based on gap analysis.*

FIGURE 19A: GAP ANALYSIS (60 FT CROSSING DISTANCE)



STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/11/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 9/27/2022
 Day of the Week: Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Shafor

Major Street Approach Direction: N-Bound
S-Bound

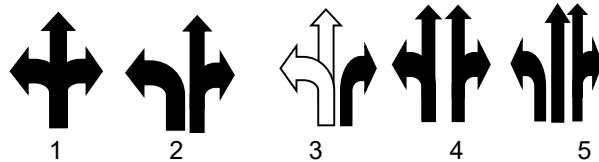
Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 25 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Telford

Minor Street Approach Configuration: 1 E-Bound
1 W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">5:00 PM</td></tr> <tr><td style="text-align: center;">6:00 PM</td></tr> </table>	Peak Hour	5:00 PM	6:00 PM
Peak Hour						
5:00 PM						
6:00 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">7:45 AM</td></tr> <tr><td style="text-align: center;">8:45 AM</td></tr> </table>	Peak Hour	7:45 AM	8:45 AM
Peak Hour						
7:45 AM						
8:45 AM						
Warrant 5, School Crossing	Yes	No	N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? Yes

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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6:15 AM	10	1																
6:30 AM	25	2																
6:45 AM	40	5																
7:00 AM	84	10																
7:15 AM	132	18																
7:30 AM	189	31																
7:45 AM	205	34																
8:00 AM	189	34																
8:15 AM	131	25																
8:30 AM	59	11																
8:45 AM	28	5																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Shafor and Telford

10:00 AM	0	0																	
10:15 AM	30	5																	
10:30 AM	73	9																	
10:45 AM	136	11																	
11:00 AM	170	12																	
11:15 AM	169	10																	
11:30 AM	171	9																	
11:45 AM	152	13																	
12:00 PM	148	16																	
12:15 PM	119	13																	
12:30 PM	74	10																	
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1:00 PM	0	0																	
1:15 PM	23	1																	
1:30 PM	49	6																	
1:45 PM	72	13																	
2:00 PM	110	19																	
2:15 PM	126	30																	
2:30 PM	171	28																	
2:45 PM	206	23																	
3:00 PM	209	19																	
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6:00 PM	0	0																	
6:15 PM	0	0																	
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9:00 PM	0	0																	
9:15 PM	0	0																	
9:30 PM	0	0																	
9:45 PM	0	0																	
HOURS MET			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

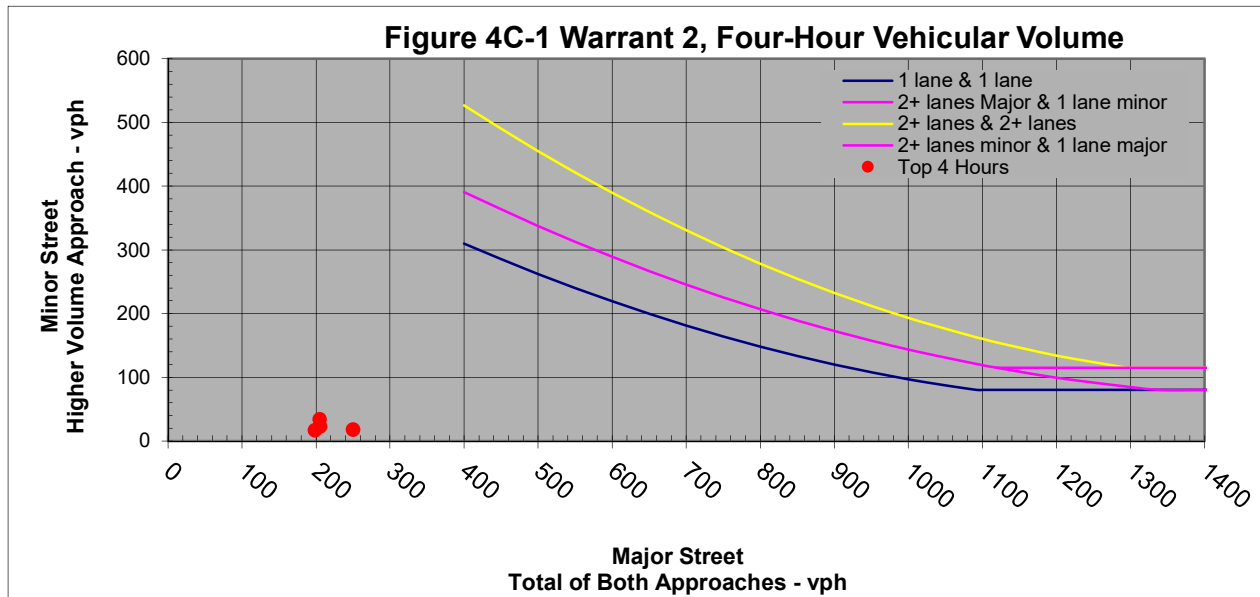
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

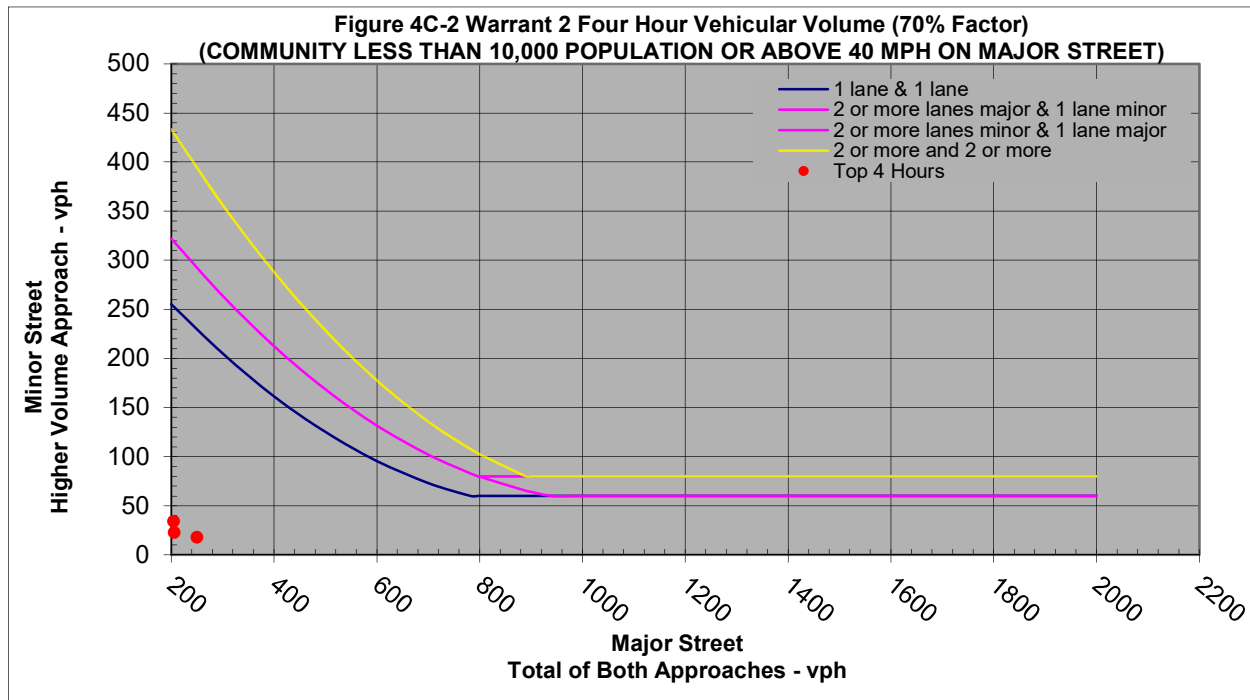
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - Shafor		Minor - Telford					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	6	4	1	1	10	1		
6:30 AM	13	12	2	1	25	2		
6:45 AM	17	23	5	4	40	5		
7:00 AM	40	44	10	5	84	10		
7:15 AM	59	73	18	6	132	18		
7:30 AM	80	109	31	8	189	31		
7:45 AM	91	114	34	10	205	34		
8:00 AM	80	109	34	9	189	34		
8:15 AM	55	76	25	7	131	25		
8:30 AM	27	32	11	5	59	11		
8:45 AM	12	16	5	0	28	5		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	20	10	5	1	30	5		
10:30 AM	49	24	9	4	73	9		
10:45 AM	79	57	11	9	136	11		
11:00 AM	96	74	12	9	170	12		
11:15 AM	86	83	10	10	169	10		
11:30 AM	72	99	9	9	171	9		
11:45 AM	66	86	13	6	152	13		
12:00 PM	68	80	16	8	148	16		
12:15 PM	58	61	13	6	119	13		
12:30 PM	43	31	10	4	74	10		
12:45 PM	19	11	4	2	30	4		
1:00 PM	0	0	0	0	0	0		
1:15 PM	17	6	1	0	23	1		
1:30 PM	34	15	6	5	49	6		
1:45 PM	43	29	13	9	72	13		
2:00 PM	61	49	19	13	110	19		
2:15 PM	70	56	30	16	126	30		
2:30 PM	84	87	28	16	171	28		
2:45 PM	95	111	23	18	206	23		
3:00 PM	98	111	19	17	209	19		
3:15 PM	98	116	9	18	214	18		
3:30 PM	93	100	6	17	193	17		
3:45 PM	97	89	6	15	186	15		
4:00 PM	109	90	9	17	199	17		
4:15 PM	116	98	10	17	214	17		
4:30 PM	126	108	17	16	234	17		
4:45 PM	133	112	17	15	245	17		
5:00 PM	130	120	18	13	250	18		
5:15 PM	97	94	15	9	191	15		
5:30 PM	61	60	8	6	121	8		
5:45 PM	30	29	6	3	59	6		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	5:00 PM	6:00 PM	250	18
2nd Highest Hour	7:45 AM	8:45 AM	205	34
3rd Highest Hour	2:45 PM	3:45 PM	206	23
4th Highest Hour	4:00 PM	5:00 PM	199	17

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	5:00 PM	6:00 PM	250	18
2nd Highest Hour	7:45 AM	8:45 AM	205	34
3rd Highest Hour	2:45 PM	3:45 PM	206	23
4th Highest Hour	4:00 PM	5:00 PM	199	17



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	5:00 PM
Minor Street:	1 Lane	Peak Hour End Time
		6:00 PM

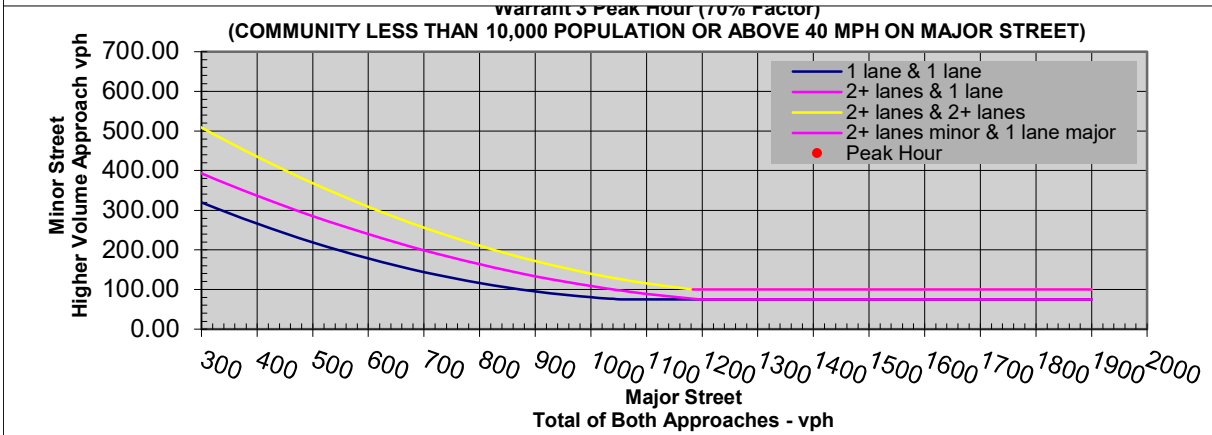
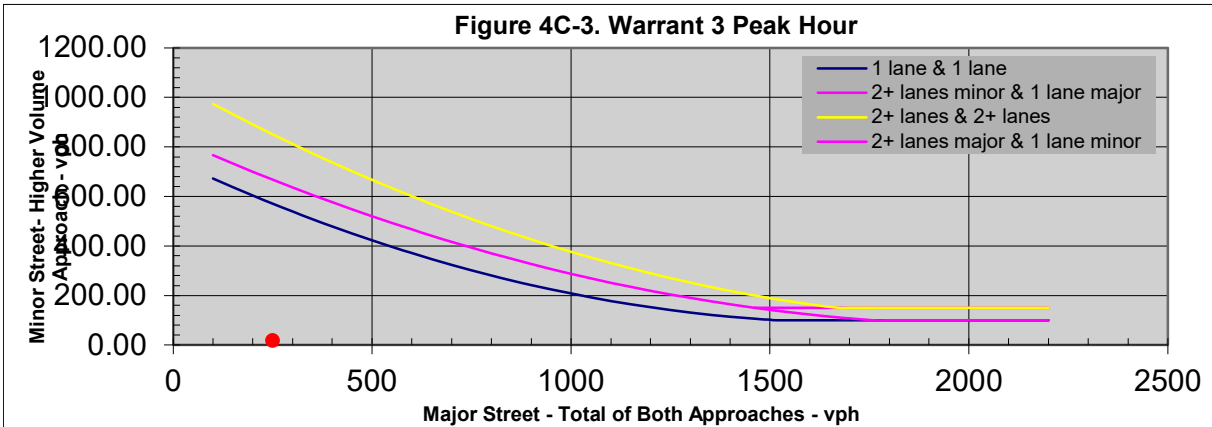
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
---	-----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Shafor and Telford

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	10	1	11	12
6:30 AM	25	2	27	28
6:45 AM	40	5	45	49
7:00 AM	84	10	94	99
7:15 AM	132	18	150	156
7:30 AM	189	31	220	228
7:45 AM	205	34	239	249
8:00 AM	189	34	223	232
8:15 AM	131	25	156	163
8:30 AM	59	11	70	75
8:45 AM	28	5	33	33
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	30	5	35	36
10:30 AM	73	9	82	86
10:45 AM	136	11	147	156
11:00 AM	170	12	182	191
11:15 AM	169	10	179	189
11:30 AM	171	9	180	189
11:45 AM	152	13	165	171
12:00 PM	148	16	164	172
12:15 PM	119	13	132	138
12:30 PM	74	10	84	88
12:45 PM	30	4	34	36
1:00 PM	0	0	0	0
1:15 PM	23	1	24	24
1:30 PM	49	6	55	60
1:45 PM	72	13	85	94
2:00 PM	110	19	129	142
2:15 PM	126	30	156	172
2:30 PM	171	28	199	215
2:45 PM	206	23	229	247
3:00 PM	209	19	228	245
3:15 PM	214	18	232	241
3:30 PM	193	17	210	216
3:45 PM	186	15	201	207
4:00 PM	199	17	216	225
4:15 PM	214	17	231	241
4:30 PM	234	17	251	267
4:45 PM	245	17	262	277
5:00 PM	250	18	268	281
5:15 PM	191	15	206	215
5:30 PM	121	8	129	135
5:45 PM	59	6	65	68
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
250	18	570	349

OMUTCD WARRANT 4, PEDESTRIAN VOLUME

Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Total of All Pedestrians Crossing Major Street Pedestrians Per Hour (PPH)
6:00 AM	0	0
6:15 AM	10	0
6:30 AM	25	0
6:45 AM	40	2
7:00 AM	84	7
7:15 AM	132	34
7:30 AM	189	231
7:45 AM	205	250
8:00 AM	189	249
8:15 AM	131	222
8:30 AM	59	25
8:45 AM	28	4
9:00 AM	0	0
9:15 AM	0	0
9:30 AM	0	0
9:45 AM	0	0
10:00 AM	0	0
10:15 AM	30	1
10:30 AM	73	27
10:45 AM	136	51
11:00 AM	170	52
11:15 AM	169	53
11:30 AM	171	31
11:45 AM	152	28
12:00 PM	148	29
12:15 PM	119	27
12:30 PM	74	23
12:45 PM	30	2
1:00 PM	0	0
1:15 PM	23	1
1:30 PM	49	3
1:45 PM	72	5
2:00 PM	110	21
2:15 PM	126	146
2:30 PM	171	195
2:45 PM	206	211
3:00 PM	209	200
3:15 PM	214	79
3:30 PM	193	40
3:45 PM	186	40
4:00 PM	199	38
4:15 PM	214	35
4:30 PM	234	37
4:45 PM	245	23
5:00 PM	250	22
5:15 PM	191	20
5:30 PM	121	6
5:45 PM	59	2
6:00 PM	0	0
6:15 PM	0	0
6:30 PM	0	0
6:45 PM	0	0
7:00 PM	0	0
7:15 PM	0	0
7:30 PM	0	0
7:45 PM	0	0
8:00 PM	0	0

Built-up Isolated Community With Less Than 10,000 Population or Above 35 MPH on Major Street? Yes

15th Percentile Pedestrian Crossing Speed Less than 3.5 f/s?* No
**If applicable, attach all supporting calculations, documentation, and findings.*

If 15th Percentile Pedestrian Crossing Speed is Less than 3.5 f/s, Reduce Criterion by (up to 50%):

Is the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross less than 300 feet?

If the distance to the nearest traffic control signal or STOP sign controlling the major street that pedestrians desire to cross is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic? If applicable, attach supporting justification.

Does the intersection meet the 4-Hour Volume? No

Does the intersection meet the Peak Hour? No

Are the Requirements for Warrant 4 Satisfied? No

Top Hours for Figure 4C-5	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:45 AM	8:45 AM	205	250
2nd Highest Hour	2:45 PM	3:45 PM	206	211
3rd Highest Hour	4:30 PM	5:30 PM	234	37
4th Highest Hour	11:15 AM	12:15 PM	169	53

Top Hours for Figure 4C-6	Start Time	End Time	Vehicles	Pedestrians
Top Hour	7:45 AM	8:45 AM	205	250
2nd Highest Hour	2:45 PM	3:45 PM	206	211
3rd Highest Hour	4:30 PM	5:30 PM	234	37
4th Highest Hour	11:15 AM	12:15 PM	169	53

Peak Hour Used for Graphs 4C-7 & 4C-8			
Top Hour			
Start Time	End Time	Vehicles	Pedestrians
7:45 AM	8:45 AM	205	250

Number of Hours That Met the 4-Hour Criteria 4C-5 0

Number of Hours That Met the 4-Hour Criteria 4C-6 0

Figure 4C-5. Warrant 4, Pedestrians Four-Hour Volume

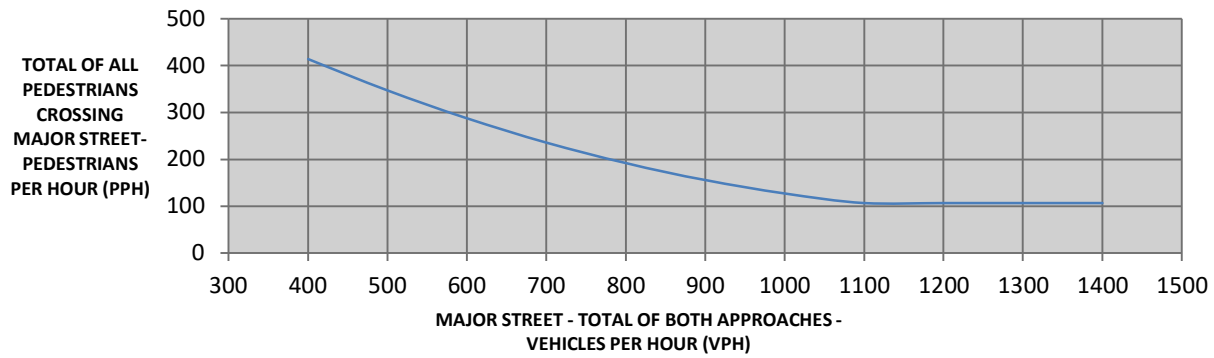


Figure 4C-6. Warrant 4, Pedestrian Four Hour Volume (70% Factor)

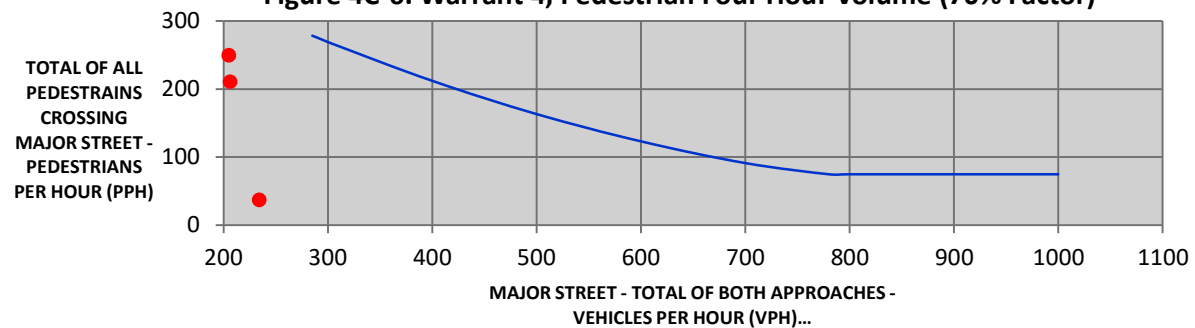


Figure 4C-7. Warrant 4, Pedestrian Peak Hour

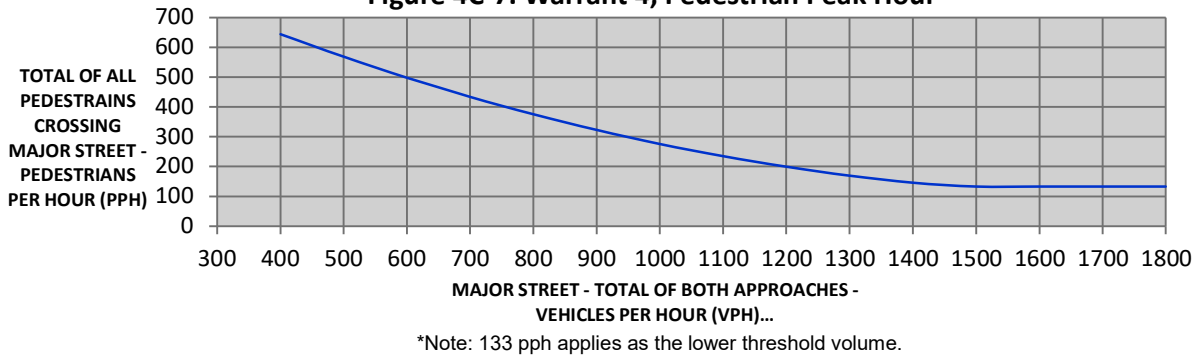
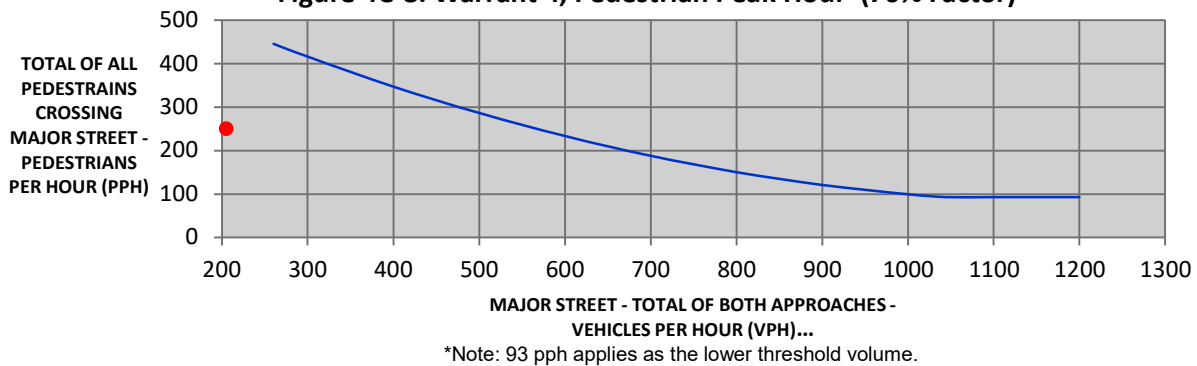


Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



OMUTCD WARRANT 5, SCHOOL CROSSING

Do school children (elementary through high school students) cross the major street?

Has consideration been given to implement other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing?

Is the distance to the nearest traffic control signal along the major street less than 300 feet?

If the distance to the nearest traffic control signal along the major street is less than 300 feet, will the proposed traffic control signal restrict the progressive movement of traffic?

Minimum of 20 schoolchildren during the highest crossing hour?

Has a traffic engineering study been conducted to determine the adequacy and frequency of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street?

Pedestrian Gap Acceptance Engineering and Traffic Study Evaluation

Data Collection Date:

Day of the Week:

Study Period	Study Duration (min)	Crossing 1 (Stage 1)		Crossing 1 (Stage 2)		Crossing 2 (Stage 1)		Crossing 2 (Stage 2)	
		Total Adequate Gaps	Met?	Road A	Met?	Total Adequate Gaps	Met?	Total Adequate Gaps	Met?
1			N/A		N/A		N/A		N/A
2			N/A		N/A		N/A		N/A
3			N/A		N/A		N/A		N/A
4			N/A		N/A		N/A		N/A
5			N/A		N/A		N/A		N/A
Summary:			Not Met		Not Met		Not Met		Not Met

Estimation of Expected Gaps if No Study was Done.

Crossing Width: feet Length of Time period for which the volume applies: Sec.

Required Gap time: sec. Two way vehicular volume across the crossing path over time period:

Expected number of gaps per the length of time which are equal to or greater than the required gap time

Are the requirements for Warrant 5 met?:

OMUTCD WARRANT 6, COORDINATED SIGNAL SYSTEM

On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

**Warrant 6 should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

Are the requirements for Warrant 6 met?:

Checking OMTUCD Section **4C.05** states that warrant #4 thresholds may be reduced to 70% for an existing traffic signal. The results of the signal warrant #4 analyses using 70% criteria are shown in **Figure 19B** and **Figure 20C**. The thresholds for warrant #4 are not met. Warrant #4 would not be expected to meet if the 11% COVID adjustment factor was applied. *Warrant #4 is NOT satisfied based on OMTUCD Section 4C.05.*

FIGURE 19B: SHAFOR BLVD AT TELFORD AVENUE WARRANT #4 (PED. 4 HOUR VOLUME AT 70%)



FIGURE 19C: SHAFOR BLVD AT TELFORD AVENUE WARRANT #4 (PK HR AT 70%)



The existing traffic signal at the Shafor Boulevard & Telford Avenue intersection **is not warranted** as it does not meet volume based warrants and the available headway provides enough gaps for pedestrian crossings over Shafor Boulevard during peak hours.

STUDY AND ANALYSIS INFORMATION

Municipality:	City of Oakwood	Traffic Volumes Obtained By:	Crawford, Murphy & Tilly
County:	Montgomery	Analysis Date:	10/20/2022
ODOT Engineering District:	7	Agency/ Company Name Performing Warrant Analysis:	Crawford, Murphy & Tilly
Google map link:	Map		

Analysis Information

Data Collection Date: 10/12/2022
 Day of the Week: Wednesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Existing Traffic Signal at intersection: Yes

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: Harmon

Major Street Approach Direction: N-Bound
S-Bound

Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

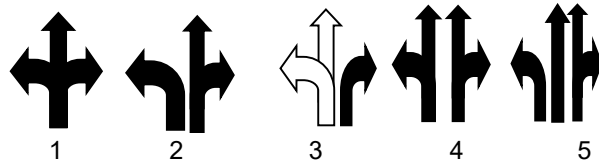
Speed Limit or 85th Percentile Speed on the Major Street*: 25 MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Dixon

Minor Street Approach Configuration:

1	E-Bound
1	W-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant					
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">8:00 AM</td></tr> <tr><td style="text-align: center;">9:00 AM</td></tr> </table>	Peak Hour	8:00 AM	9:00 AM
Peak Hour						
8:00 AM						
9:00 AM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	No		If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">7:45 AM</td></tr> <tr><td style="text-align: center;">8:45 AM</td></tr> </table>	Peak Hour	7:45 AM	8:45 AM
Peak Hour						
7:45 AM						
8:45 AM						
Warrant 5, School Crossing	No		N/A			
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No		If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.			
Warrant 8, Roadway Network	No		(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9			
Multi-Way Stop Warrant	No		May be used as an interim measure if traffic signal warrants are satisfied.			

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion:

Notes:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? No

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		80%		80%		56%		56%	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
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7:15 AM	34	19																
7:30 AM	115	60																
7:45 AM	124	65																
8:00 AM	127	66																
8:15 AM	110	55																
8:30 AM	24	12																
8:45 AM	12	4																
9:00 AM	0	0																
9:15 AM	0	0																
9:30 AM	0	0																
9:45 AM	0	0																

Signal Warrant Harmon and Dixon

10:00 AM	0	0																		
10:15 AM	5	3																		
10:30 AM	20	4																		
10:45 AM	31	11																		
11:00 AM	42	17																		
11:15 AM	45	17																		
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12:00 PM	33	23																		
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9:00 PM	0	0																		
9:15 PM	0	0																		
9:30 PM	0	0																		
9:45 PM	0	0																		
HOURS MET			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WARRANT SATISFIED?			NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A	NO	N/A

Warrant Met: **No**

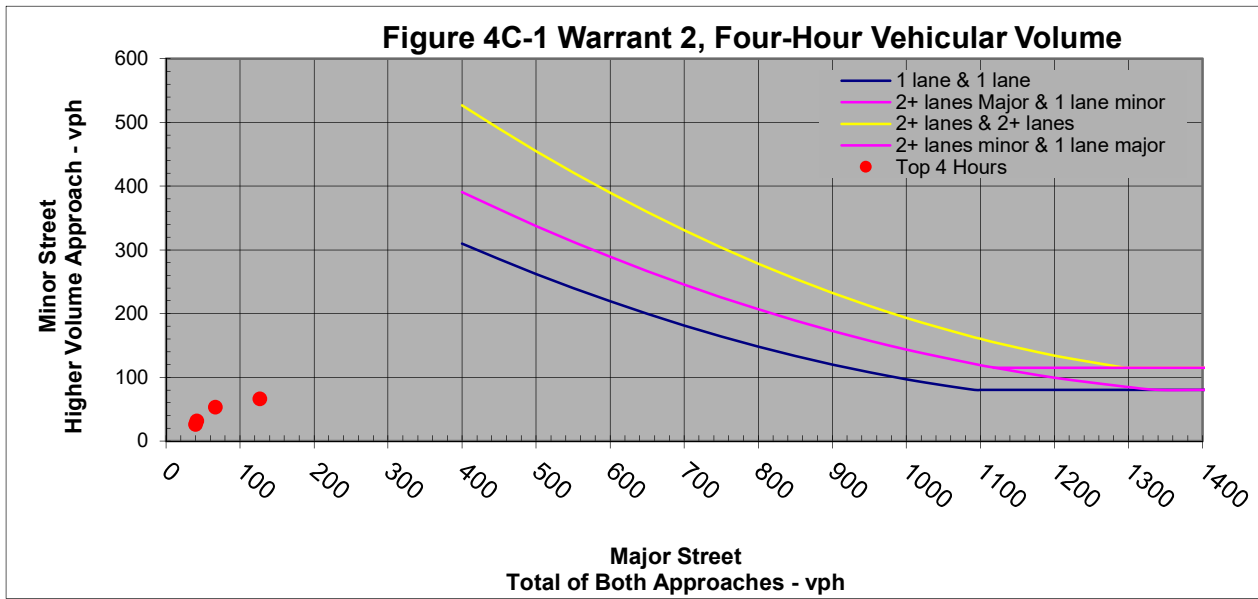
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	Total Number of Unique Hours Met on Figure 4C-1	0
Major street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street: 1 Lane		

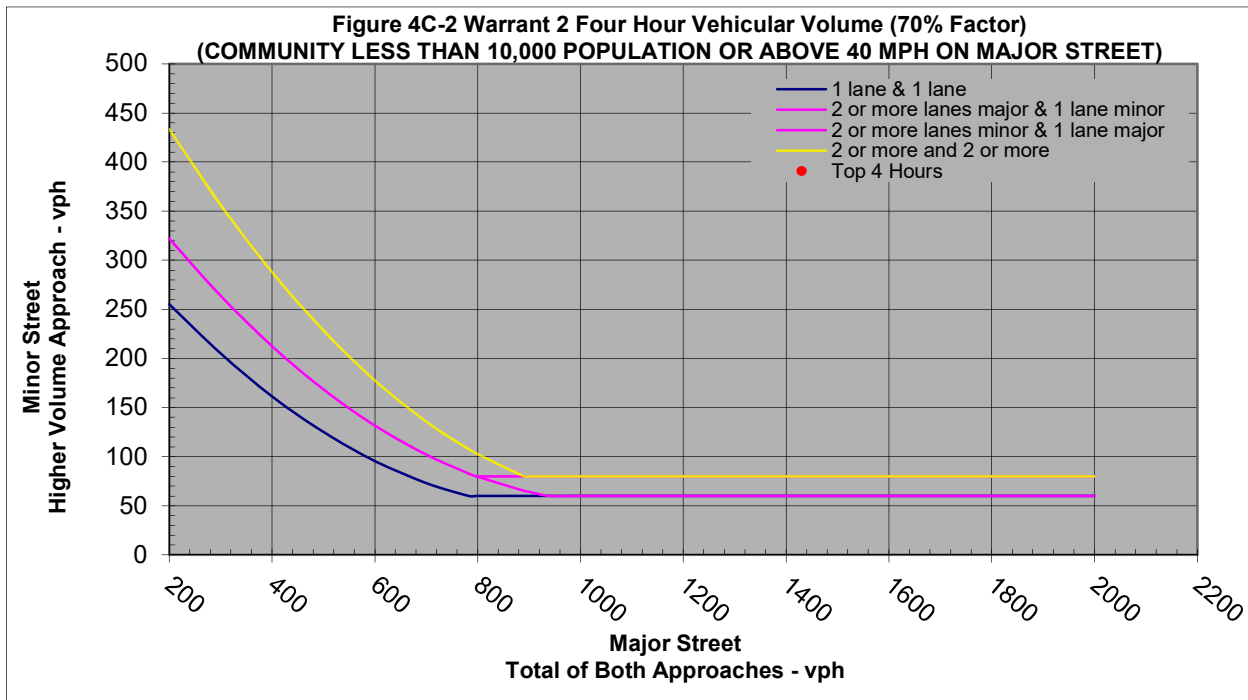
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **No**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - Harmon		Minor - Dixon					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	2	0	1	1	2	1		
6:30 AM	5	2	3	2	7	3		
6:45 AM	8	2	6	3	10	6		
7:00 AM	15	4	9	5	19	9		
7:15 AM	24	10	19	8	34	19		
7:30 AM	46	69	60	7	115	60		
7:45 AM	50	74	65	7	124	65		
8:00 AM	49	78	66	7	127	66		
8:15 AM	38	72	55	3	110	55		
8:30 AM	13	11	12	3	24	12		
8:45 AM	6	6	4	2	12	4		
9:00 AM	0	0	0	0	0	0		
9:15 AM	0	0	0	0	0	0		
9:30 AM	0	0	0	0	0	0		
9:45 AM	0	0	0	0	0	0		
10:00 AM	0	0	0	0	0	0		
10:15 AM	3	2	3	0	5	3		
10:30 AM	13	7	4	3	20	4		
10:45 AM	15	16	11	9	31	11		
11:00 AM	22	20	17	10	42	17		
11:15 AM	25	20	17	11	45	17		
11:30 AM	19	18	26	10	37	26		
11:45 AM	21	15	26	7	36	26		
12:00 PM	17	16	23	7	33	23		
12:15 PM	11	14	20	6	25	20		
12:30 PM	7	11	10	4	18	10		
12:45 PM	3	5	3	1	8	3		
1:00 PM	0	0	0	0	0	0		
1:15 PM	2	4	4	5	6	5		
1:30 PM	4	7	8	10	11	10		
1:45 PM	11	8	17	12	19	17		
2:00 PM	20	9	34	13	29	34		
2:15 PM	32	13	50	11	45	50		
2:30 PM	45	22	53	8	67	53		
2:45 PM	44	26	47	10	70	47		
3:00 PM	39	27	35	16	66	35		
3:15 PM	30	22	25	19	52	25		
3:30 PM	19	21	26	21	40	26		
3:45 PM	19	20	25	23	39	25		
4:00 PM	24	20	25	21	44	25		
4:15 PM	23	24	26	19	47	26		
4:30 PM	26	17	27	22	43	27		
4:45 PM	26	16	31	19	42	31		
5:00 PM	21	17	30	18	38	30		
5:15 PM	17	10	19	14	27	19		
5:30 PM	10	6	10	7	16	10		
5:45 PM	4	3	4	4	7	4		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		



Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	8:00 AM	9:00 AM	127	66
2nd Highest Hour	2:30 PM	3:30 PM	67	53
3rd Highest Hour	4:45 PM	5:45 PM	42	31
4th Highest Hour	3:30 PM	4:30 PM	40	26

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	8:00 AM	9:00 AM	127	66
2nd Highest Hour	2:30 PM	3:30 PM	67	53
3rd Highest Hour	4:45 PM	5:45 PM	42	31
4th Highest Hour	3:30 PM	4:30 PM	40	26



Are the requirements for Warrant 2 met?:

OMUTCD WARRANT 3, PEAK HOUR		
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time
Major Street:	1 Lane	8:00 AM
Minor Street:	1 Lane	Peak Hour End Time
		9:00 AM

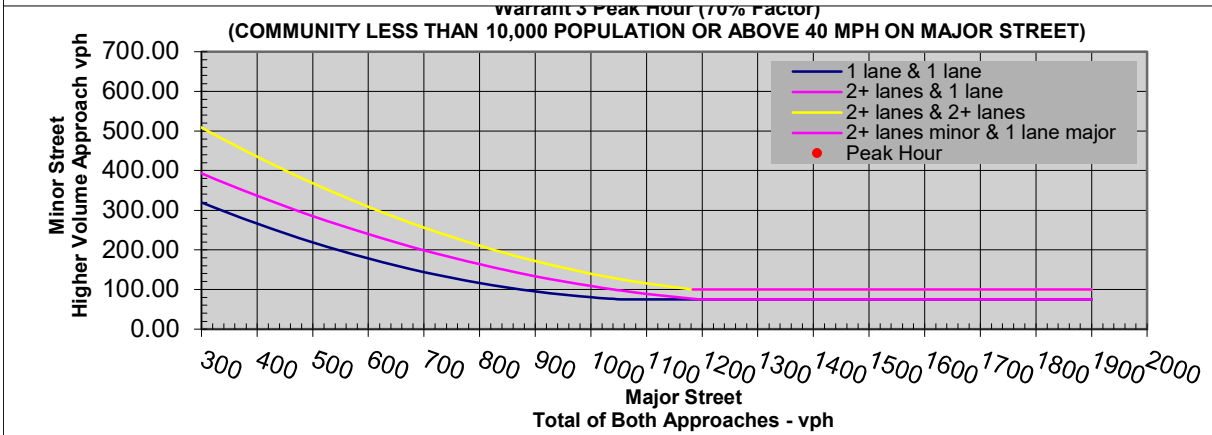
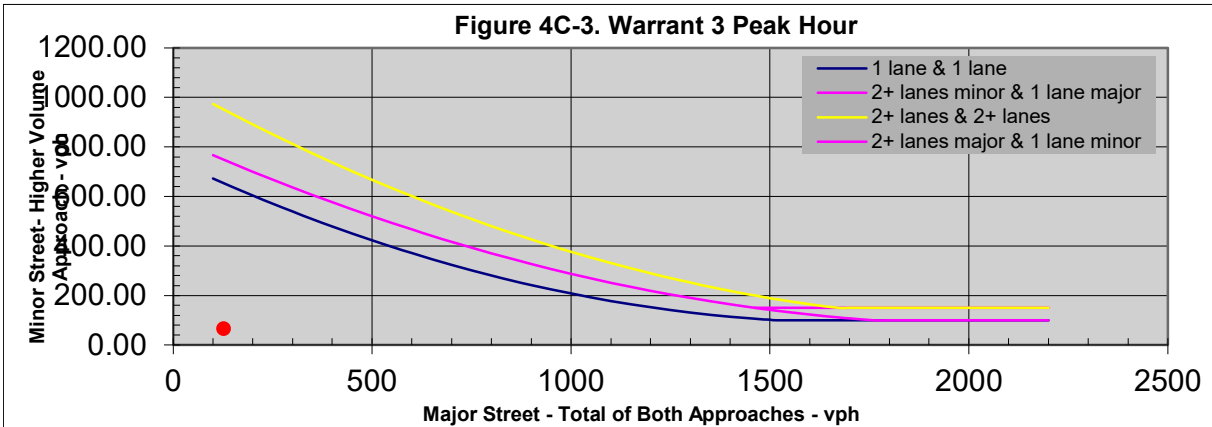
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?	No
---	----

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*	
Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?	
Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?	No
Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?	No

**If applicable, attach all supporting calculations and documentation.*

Are the requirements for Warrant 3 met?: **No**



Signal Warrant Harmon and Dixon

Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	0	0	0	0
6:15 AM	2	1	3	4
6:30 AM	7	3	10	12
6:45 AM	10	6	16	19
7:00 AM	19	9	28	33
7:15 AM	34	19	53	61
7:30 AM	115	60	175	182
7:45 AM	124	65	189	196
8:00 AM	127	66	193	200
8:15 AM	110	55	165	168
8:30 AM	24	12	36	39
8:45 AM	12	4	16	18
9:00 AM	0	0	0	0
9:15 AM	0	0	0	0
9:30 AM	0	0	0	0
9:45 AM	0	0	0	0
10:00 AM	0	0	0	0
10:15 AM	5	3	8	8
10:30 AM	20	4	24	27
10:45 AM	31	11	42	51
11:00 AM	42	17	59	69
11:15 AM	45	17	62	73
11:30 AM	37	26	63	73
11:45 AM	36	26	62	69
12:00 PM	33	23	56	63
12:15 PM	25	20	45	51
12:30 PM	18	10	28	32
12:45 PM	8	3	11	12
1:00 PM	0	0	0	0
1:15 PM	6	5	11	15
1:30 PM	11	10	21	29
1:45 PM	19	17	36	48
2:00 PM	29	34	63	76
2:15 PM	45	50	95	106
2:30 PM	67	53	120	128
2:45 PM	70	47	117	127
3:00 PM	66	35	101	117
3:15 PM	52	25	77	96
3:30 PM	40	26	66	87
3:45 PM	39	25	64	87
4:00 PM	44	25	69	90
4:15 PM	47	26	73	92
4:30 PM	43	27	70	92
4:45 PM	42	31	73	92
5:00 PM	38	30	68	86
5:15 PM	27	19	46	60
5:30 PM	16	10	26	33
5:45 PM	7	4	11	15
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
127	66	653	428

TRAFFIC SIGNAL EVALUATION – OAKWOOD, OH

APPENDIX E: CAPACITY ANALYSIS



Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/06/2023

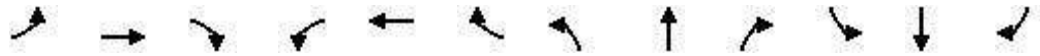


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↔		↖	↕↔		↖	↕↔	
Traffic Volume (vph)	18	5	20	13	5	78	10	808	8	58	363	9
Future Volume (vph)	18	5	20	13	5	78	10	808	8	58	363	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		170	0		0	205		0	150		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.891			0.999				0.996
Flt Protected		0.962			0.993		0.950			0.950		
Satd. Flow (prot)	0	1792	1583	0	1632	0	1787	3571	0	1752	3491	0
Flt Permitted		0.569			0.954		0.472			0.311		
Satd. Flow (perm)	0	1060	1583	0	1568	0	888	3571	0	574	3491	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35				35
Link Distance (ft)		306			419			825				530
Travel Time (s)		8.3			11.4			16.1				10.3
Peak Hour Factor	0.72	0.72	0.72	0.73	0.73	0.73	0.89	0.89	0.89	0.85	0.85	0.85
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	1%	1%	1%	3%	3%	3%
Adj. Flow (vph)	25	7	28	18	7	107	11	908	9	68	427	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	28	0	132	0	11	917	0	68	438	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA	pm+ov	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	7	4	5		8		5	2				6

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	5	8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0		7.0	20.0		20.0	20.0	
Minimum Split (s)	13.0	33.0	13.0	33.0	33.0		13.0	26.0		26.0	26.0	
Total Split (s)	13.0	60.0	16.0	47.0	47.0		16.0	90.0		74.0	74.0	
Total Split (%)	8.7%	40.0%	10.7%	31.3%	31.3%		10.7%	60.0%		49.3%	49.3%	
Maximum Green (s)	7.0	54.0	10.0	41.0	41.0		10.0	84.0		68.0	68.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead		Lead	Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)		7.0		7.0	7.0			7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0			10.0		10.0	10.0	
Pedestrian Calls (#/hr)		1		1	1			2		0	0	
Act Effct Green (s)		18.4	31.4		18.4		119.6	119.6		111.8	111.8	
Actuated g/C Ratio		0.12	0.21		0.12		0.80	0.80		0.75	0.75	
v/c Ratio		0.25	0.08		0.69		0.01	0.32		0.16	0.17	
Control Delay		61.7	45.6		80.3		1.0	1.2		8.8	6.9	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		61.7	45.6		80.3		1.0	1.2		8.8	6.9	
LOS		E	D		F		A	A		A	A	
Approach Delay		54.2			80.3			1.2			7.2	
Approach LOS		D			F			A			A	

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 102 (68%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow

Natural Cycle: 85

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 11.4

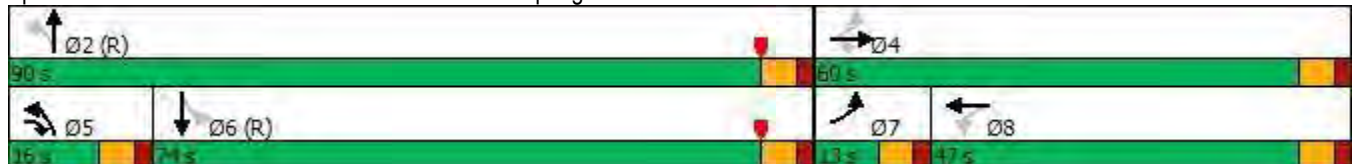
Intersection LOS: B

Intersection Capacity Utilization 66.7%

ICU Level of Service C























Analysis Period (min) 15

Splits and Phases: 1: Far Hills Ave & Old River Trl/Springhouse Rd



Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/06/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	57	49	1	55	16	108	811	5	8	300	90
Future Volume (vph)	43	57	49	1	55	16	108	811	5	8	300	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	195		195	0		0	155		0	330		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	50			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.967			0.999				0.965
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1845	1568	1787	1819	0	1787	3571	0	1736	3350	0
Flt Permitted	0.596			0.712			0.461			0.278		
Satd. Flow (perm)	1099	1845	1568	1339	1819	0	867	3571	0	508	3350	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			25			35				35
Link Distance (ft)		1055			352			1457				825
Travel Time (s)		20.6			9.6			28.4				16.1
Peak Hour Factor	0.83	0.83	0.83	0.69	0.69	0.69	0.82	0.82	0.82	0.84	0.84	0.84
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Adj. Flow (vph)	52	69	59	1	80	23	132	989	6	10	357	107
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	69	59	1	103	0	132	995	0	10	464	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA	pm+ov	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4	5		8		5	2		1	6	

Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/06/2023

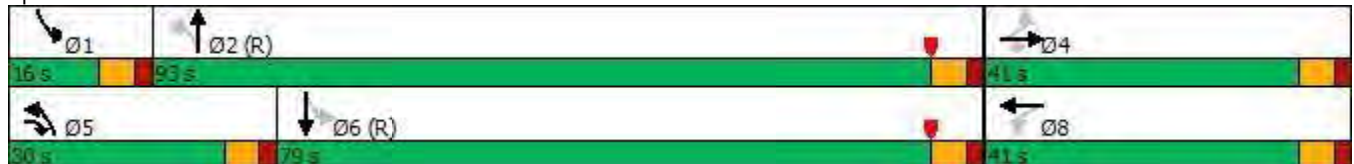


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	5	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0		7.0	20.0		7.0	20.0	
Minimum Split (s)	33.0	33.0	22.5	33.0	33.0		22.5	26.0		13.0	26.0	
Total Split (s)	41.0	41.0	30.0	41.0	41.0		30.0	93.0		16.0	79.0	
Total Split (%)	27.3%	27.3%	20.0%	27.3%	27.3%		20.0%	62.0%		10.7%	52.7%	
Maximum Green (s)	35.0	35.0	24.0	35.0	35.0		24.0	87.0		10.0	73.0	
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)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0			10.0			10.0	
Pedestrian Calls (#/hr)	2	2		1	1			2			3	
Act Effct Green (s)	15.7	15.7	29.8	15.7	15.7		120.8	117.1		115.2	108.2	
Actuated g/C Ratio	0.10	0.10	0.20	0.10	0.10		0.81	0.78		0.77	0.72	
v/c Ratio	0.45	0.36	0.19	0.01	0.54		0.18	0.36		0.02	0.19	
Control Delay	73.6	65.6	49.1	55.0	72.9		1.5	2.2		2.9	4.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	73.6	65.6	49.1	55.0	72.9		1.5	2.2		2.9	4.8	
LOS	E	E	D	D	E		A	A		A	A	
Approach Delay		62.5				72.7		2.1			4.7	
Approach LOS		E				E		A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 110 (73%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.54
 Intersection Signal Delay: 12.4
 Intersection Capacity Utilization 52.5%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service A

















Splits and Phases: 2: Far Hills Ave & Shantz Ave



Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023

												
Lane Group	NBL	NBT	NBR	NBR2	SBL	SBT	SBR	SEL2	SEL	SET	SER	SER2
Lane Configurations												
Traffic Volume (vph)	21	19	5	10	132	10	1	2	7	315	12	3
Future Volume (vph)	21	19	5	10	132	10	1	2	7	315	12	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0		230		0		0		0	
Storage Lanes	0		0		1		0		0		0	
Taper Length (ft)	25				50				25			
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95	0.95	0.95	0.95
Frt		0.964				0.998				0.993		
Flt Protected		0.981			0.950	0.959				0.999		
Satd. Flow (prot)	0	1762	0	0	1649	1661	0	0	0	3411	0	0
Flt Permitted		0.981			0.950	0.959				0.914		
Satd. Flow (perm)	0	1762	0	0	1649	1661	0	0	0	3120	0	0
Right Turn on Red				No								Yes
Satd. Flow (RTOR)										1		
Link Speed (mph)		25				25				35		
Link Distance (ft)		1058				666				1457		
Travel Time (s)		28.9				18.2				28.4		
Peak Hour Factor	0.48	0.48	0.48	0.48	0.73	0.73	0.73	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	2%	4%	4%	4%	5%	5%	5%	5%	5%
Adj. Flow (vph)	44	40	10	21	181	14	1	2	8	362	14	3
Shared Lane Traffic (%)					46%							
Lane Group Flow (vph)	0	115	0	0	98	98	0	0	0	389	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Right	Left	Left	Right	Left	Left	Left	Right	Right
Median Width(ft)		12				12				12		
Link Offset(ft)		0				0				0		
Crosswalk Width(ft)		16				16				16		
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	9	15		9	15	15		9	9
Number of Detectors	1	2			1	2		1	1	2		
Detector Template	Left	Thru			Left	Thru		Left	Left	Thru		
Leading Detector (ft)	20	100			20	100		20	20	100		
Trailing Detector (ft)	0	0			0	0		0	0	0		
Detector 1 Position(ft)	0	0			0	0		0	0	0		
Detector 1 Size(ft)	20	6			20	6		20	20	6		
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex		
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0		0.0	0.0	0.0		
Detector 1 Queue (s)	0.0	0.0			0.0	0.0		0.0	0.0	0.0		
Detector 1 Delay (s)	0.0	0.0			0.0	0.0		0.0	0.0	0.0		
Detector 2 Position(ft)		94				94				94		
Detector 2 Size(ft)		6				6				6		
Detector 2 Type		Cl+Ex				Cl+Ex				Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)		0.0				0.0				0.0		
Turn Type	Split	NA			Split	NA		Perm	Perm	NA		
Protected Phases	10	10			12	12				6		

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023



Lane Group	NWL2	NWL	NWT	NWR	NWR2	NEL2	NEL	NET	NER	SWL2	SWL	SWT
Lane Configurations			⇄					⇄				⇄
Traffic Volume (vph)	2	2	827	277	6	4	9	6	14	12	1	6
Future Volume (vph)	2	2	827	277	6	4	9	6	14	12	1	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0		0			0		0		0	
Storage Lanes		0		0			0		0		0	
Taper Length (ft)		25					25				25	
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.962					0.942				0.975
Flt Protected								0.981				0.973
Satd. Flow (prot)	0	0	3438	0	0	0	0	1721	0	0	0	1767
Flt Permitted			0.954					0.887				0.831
Satd. Flow (perm)	0	0	3280	0	0	0	0	1556	0	0	0	1509
Right Turn on Red								Yes				
Satd. Flow (RTOR)												1
Link Speed (mph)			35					25				25
Link Distance (ft)			1682					574				605
Travel Time (s)			32.8					15.7				16.5
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.73	0.73	0.73	0.73	0.54	0.54	0.54
Heavy Vehicles (%)	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	2	2	844	283	6	5	12	8	19	22	2	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	1137	0	0	0	0	44	0	0	0	43
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Right	Left	Left	Left	Right	Left	Left	Left
Median Width(ft)			12					0				0
Link Offset(ft)			0					0				0
Crosswalk Width(ft)			16					16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15	15		9	9	15	15		9	15	15	
Number of Detectors	1	1	2			1	1	2		1	1	2
Detector Template	Left	Left	Thru			Left	Left	Thru		Left	Left	Thru
Leading Detector (ft)	20	20	100			20	20	100		20	20	100
Trailing Detector (ft)	0	0	0			0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0			0	0	0		0	0	0
Detector 1 Size(ft)	20	20	6			20	20	6		20	20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)			94					94				94
Detector 2 Size(ft)			6					6				6
Detector 2 Type			Cl+Ex					Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)			0.0					0.0				0.0
Turn Type	Perm	Perm	NA			Perm	Perm	NA		Perm	Perm	NA
Protected Phases			2					4				8

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023



Lane Group	SWR	SWR2
Lane Configurations		
Traffic Volume (vph)	3	1
Future Volume (vph)	3	1
Ideal Flow (vphpl)	1900	1900
Storage Length (ft)	0	
Storage Lanes	0	
Taper Length (ft)		
Lane Util. Factor	1.00	1.00
Frt		
Flt Protected		
Satd. Flow (prot)	0	0
Flt Permitted		
Satd. Flow (perm)	0	0
Right Turn on Red		Yes
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor	0.54	0.54
Heavy Vehicles (%)	2%	2%
Adj. Flow (vph)	6	2
Shared Lane Traffic (%)		
Lane Group Flow (vph)	0	0
Enter Blocked Intersection	No	No
Lane Alignment	Right	Right
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor	1.00	1.00
Turning Speed (mph)	9	9
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Detector 2 Position(ft)		
Detector 2 Size(ft)		
Detector 2 Type		
Detector 2 Channel		
Detector 2 Extend (s)		
Turn Type		
Protected Phases		

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023

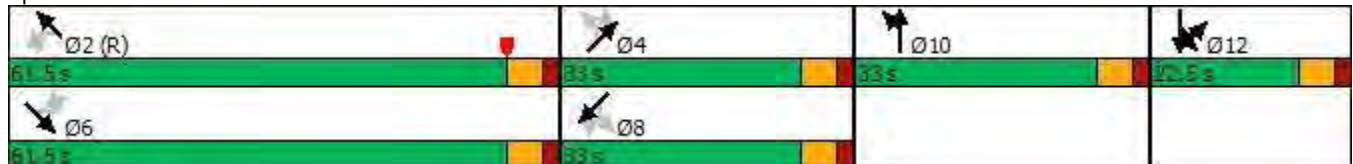


Lane Group	NBL	NBT	NBR	NBR2	SBL	SBT	SBR	SEL2	SEL	SET	SER	SER2
Permitted Phases								6	6			
Detector Phase	10	10			12	12		6	6	6		
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0		20.0	20.0	20.0		
Minimum Split (s)	33.0	33.0			22.5	22.5		26.0	26.0	26.0		
Total Split (s)	33.0	33.0			22.5	22.5		61.5	61.5	61.5		
Total Split (%)	22.0%	22.0%			15.0%	15.0%		41.0%	41.0%	41.0%		
Maximum Green (s)	27.0	27.0			16.5	16.5		55.5	55.5	55.5		
Yellow Time (s)	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		
Lost Time Adjust (s)		0.0			0.0	0.0					0.0	
Total Lost Time (s)		6.0			6.0	6.0					6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0	3.0		
Recall Mode	None	None			None	None		Max	Max	Max		
Walk Time (s)	7.0	7.0						7.0	7.0	7.0		
Flash Dont Walk (s)	20.0	20.0						10.0	10.0	10.0		
Pedestrian Calls (#/hr)	5	5						18	18	18		
Act Effct Green (s)		16.5			13.8	13.8					75.3	
Actuated g/C Ratio		0.11			0.09	0.09					0.50	
v/c Ratio		0.60			0.65	0.64					0.25	
Control Delay		75.1			84.9	84.5					19.6	
Queue Delay		0.0			0.0	0.0					0.0	
Total Delay		75.1			84.9	84.5					19.6	
LOS		E			F	F					B	
Approach Delay		75.1				84.7					19.6	
Approach LOS		E				F					B	

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 58 (39%), Referenced to phase 2:NWTL, Start of Yellow
 Natural Cycle: 135
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69
 Intersection Signal Delay: 32.7
 Intersection Capacity Utilization 67.9%
 Analysis Period (min) 15
 Intersection LOS: C
 ICU Level of Service C

Splits and Phases: 3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave



Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023



Lane Group	NWL2	NWL	NWT	NWR	NWR2	NEL2	NEL	NET	NER	SWL2	SWL	SWT
Permitted Phases	2	2				4	4			8	8	
Detector Phase	2	2	2			4	4	4		8	8	8
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0			10.0	10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	26.0	26.0	26.0			33.0	33.0	33.0		22.5	22.5	22.5
Total Split (s)	61.5	61.5	61.5			33.0	33.0	33.0		33.0	33.0	33.0
Total Split (%)	41.0%	41.0%	41.0%			22.0%	22.0%	22.0%		22.0%	22.0%	22.0%
Maximum Green (s)	55.5	55.5	55.5			27.0	27.0	27.0		27.0	27.0	27.0
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)			0.0					0.0				0.0
Total Lost Time (s)			6.0					6.0				6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max			None	None	None		None	None	None
Walk Time (s)	7.0	7.0	7.0			7.0	7.0	7.0				
Flash Dont Walk (s)	10.0	10.0	10.0			20.0	20.0	20.0				
Pedestrian Calls (#/hr)	20	20	20			57	57	57				
Act Effct Green (s)			75.3					23.6				23.6
Actuated g/C Ratio			0.50					0.16				0.16
v/c Ratio			0.69					0.18				0.18
Control Delay			22.4					54.3				53.0
Queue Delay			0.0					0.0				0.0
Total Delay			22.4					54.3				53.0
LOS			C					D				D
Approach Delay			22.4					54.3				53.0
Approach LOS			C					D				D
Intersection Summary												

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023



Lane Group	SWR	SWR2
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)		
Minimum Split (s)		
Total Split (s)		
Total Split (%)		
Maximum Green (s)		
Yellow Time (s)		
All-Red Time (s)		
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Vehicle Extension (s)		
Recall Mode		
Walk Time (s)		
Flash Dont Walk (s)		
Pedestrian Calls (#/hr)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/06/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	88	175	929	52	77	376
Future Volume (vph)	88	175	929	52	77	376
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115	0		0	90	
Storage Lanes	1	1		0	1	
Taper Length (ft)	50				50	
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.95
Frt		0.850	0.992			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1599	3546	0	1752	3505
Flt Permitted	0.950				0.187	
Satd. Flow (perm)	1787	1599	3546	0	345	3505
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	739		822			1682
Travel Time (s)	20.2		16.0			32.8
Peak Hour Factor	0.85	0.85	0.90	0.90	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	1%	3%	3%
Adj. Flow (vph)	104	206	1032	58	85	413
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	206	1090	0	85	413
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pm+ov	NA		pm+pt	NA
Protected Phases	8	1	2		1	6

Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/06/2023

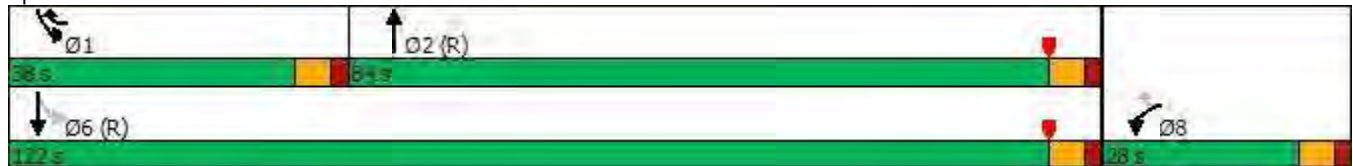


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases		8			6	
Detector Phase	8	1	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	7.0	20.0		7.0	20.0
Minimum Split (s)	22.5	33.0	26.0		33.0	26.0
Total Split (s)	28.0	38.0	84.0		38.0	122.0
Total Split (%)	18.7%	25.3%	56.0%		25.3%	81.3%
Maximum Green (s)	22.0	32.0	78.0		32.0	116.0
Yellow Time (s)	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0
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		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)		7.0	7.0		7.0	
Flash Dont Walk (s)		20.0	10.0		20.0	
Pedestrian Calls (#/hr)		137	28		137	
Act Effct Green (s)	14.3	47.3	90.7		123.7	123.7
Actuated g/C Ratio	0.10	0.32	0.60		0.82	0.82
v/c Ratio	0.62	0.41	0.51		0.16	0.14
Control Delay	80.1	42.6	9.0		4.6	3.0
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	80.1	42.6	9.0		4.6	3.0
LOS	F	D	A		A	A
Approach Delay	55.2		9.0			3.3
Approach LOS	E		A			A

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 66 (44%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.62
 Intersection Signal Delay: 15.0
 Intersection Capacity Utilization 56.5%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 4: Far Hills Ave & Patterson Rd



Lanes, Volumes, Timings

5: Far Hills Ave & Park Ave

01/06/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	51	52	1018	385	24
Future Volume (vph)	31	51	52	1018	385	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	66	120			0
Storage Lanes	1	1	1			0
Taper Length (ft)	25		50			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.850			0.991	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1787	3574	3507	0
Flt Permitted	0.950		0.477			
Satd. Flow (perm)	1770	1583	897	3574	3507	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	721			826	822	
Travel Time (s)	19.7			16.1	16.0	
Peak Hour Factor	0.54	0.54	0.94	0.94	0.85	0.85
Heavy Vehicles (%)	2%	2%	1%	1%	2%	2%
Adj. Flow (vph)	57	94	55	1083	453	28
Shared Lane Traffic (%)						
Lane Group Flow (vph)	57	94	55	1083	481	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (ft)	20	20	20	100	100	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	20	20	20	6	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	

Lanes, Volumes, Timings

5: Far Hills Ave & Park Ave

01/06/2023

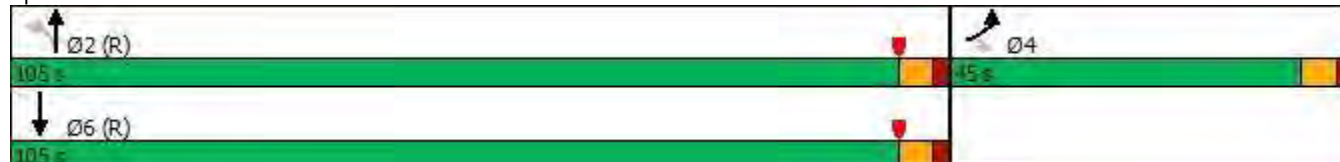


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0	20.0	20.0	
Minimum Split (s)	33.0	33.0	26.0	26.0	26.0	
Total Split (s)	45.0	45.0	105.0	105.0	105.0	
Total Split (%)	30.0%	30.0%	70.0%	70.0%	70.0%	
Maximum Green (s)	39.0	39.0	99.0	99.0	99.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
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?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	C-Max	C-Max	C-Max	
Walk Time (s)	7.0	7.0			7.0	
Flash Dont Walk (s)	20.0	20.0			10.0	
Pedestrian Calls (#/hr)	2	2			77	
Act Effct Green (s)	16.0	16.0	122.0	122.0	122.0	
Actuated g/C Ratio	0.11	0.11	0.81	0.81	0.81	
v/c Ratio	0.30	0.56	0.08	0.37	0.17	
Control Delay	63.8	74.9	1.4	1.4	2.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	63.8	74.9	1.4	1.4	2.4	
LOS	E	E	A	A	A	
Approach Delay	70.7			1.4	2.4	
Approach LOS	E			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 66 (44%), Referenced to phase 2:NBTL and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.56
 Intersection Signal Delay: 7.6
 Intersection Capacity Utilization 56.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service B

Splits and Phases: 5: Far Hills Ave & Park Ave



Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/06/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	9	19	2	976	373	9
Future Volume (vph)	9	19	2	976	373	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Flt	0.908				0.996	
Flt Protected	0.984					
Satd. Flow (prot)	1587	0	0	3574	3525	0
Flt Permitted	0.984			0.955		
Satd. Flow (perm)	1587	0	0	3413	3525	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	632			1805	826	
Travel Time (s)	17.2			35.2	16.1	
Peak Hour Factor	0.50	0.50	0.82	0.82	0.92	0.92
Heavy Vehicles (%)	7%	7%	1%	1%	2%	2%
Adj. Flow (vph)	18	38	2	1190	405	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	56	0	0	1192	415	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1		1	2	2	
Detector Template	Left		Left	Thru	Thru	
Leading Detector (ft)	20		20	100	100	
Trailing Detector (ft)	0		0	0	0	
Detector 1 Position(ft)	0		0	0	0	
Detector 1 Size(ft)	20		20	6	6	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Detector Phase	4		2	2	6	
Switch Phase						

Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/06/2023

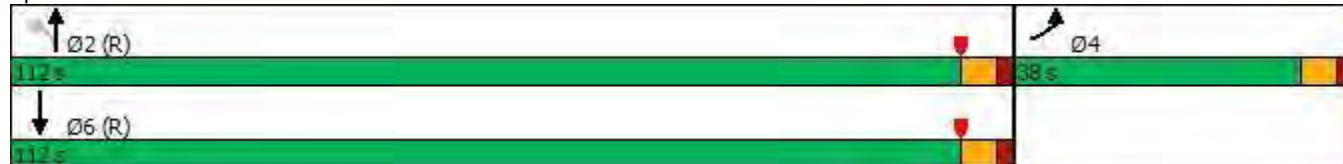


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Minimum Initial (s)	10.0		20.0	20.0	20.0	
Minimum Split (s)	33.0		26.0	26.0	26.0	
Total Split (s)	38.0		112.0	112.0	112.0	
Total Split (%)	25.3%		74.7%	74.7%	74.7%	
Maximum Green (s)	32.0		106.0	106.0	106.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	6.0			6.0	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	None		C-Max	C-Max	C-Max	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	20.0				10.0	
Pedestrian Calls (#/hr)	0				72	
Act Effct Green (s)	11.6			130.8	130.8	
Actuated g/C Ratio	0.08			0.87	0.87	
v/c Ratio	0.46			0.40	0.14	
Control Delay	77.7			1.0	2.2	
Queue Delay	0.0			0.0	0.0	
Total Delay	77.7			1.0	2.2	
LOS	E			A	A	
Approach Delay	77.7			1.0	2.2	
Approach LOS	E			A	A	

Intersection Summary

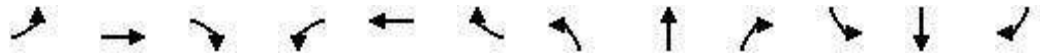
Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	82 (55%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.46
Intersection Signal Delay:	3.9
Intersection LOS:	A
Intersection Capacity Utilization:	46.7%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 6: Far Hills Ave & Harman Ave



Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕			↕	
Traffic Volume (vph)	16	4	6	10	2	10	6	966	18	24	389	8
Future Volume (vph)	16	4	6	10	2	10	6	966	18	24	389	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Fr _t		0.970			0.939			0.997			0.997	
Fl _t Protected		0.970			0.978						0.997	
Satd. Flow (prot)	0	1753	0	0	1711	0	0	3529	0	0	3518	0
Fl _t Permitted		0.845			0.893			0.952			0.829	
Satd. Flow (perm)	0	1527	0	0	1562	0	0	3359	0	0	2925	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		727			626			1977			1805	
Travel Time (s)		19.8			17.1			38.5			35.2	
Peak Hour Factor	0.72	0.72	0.72	0.69	0.69	0.69	0.85	0.85	0.85	0.94	0.94	0.94
Adj. Flow (vph)	22	6	8	14	3	14	7	1136	21	26	414	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	36	0	0	31	0	0	1164	0	0	449	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		20.0	20.0		20.0	20.0	

Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/06/2023

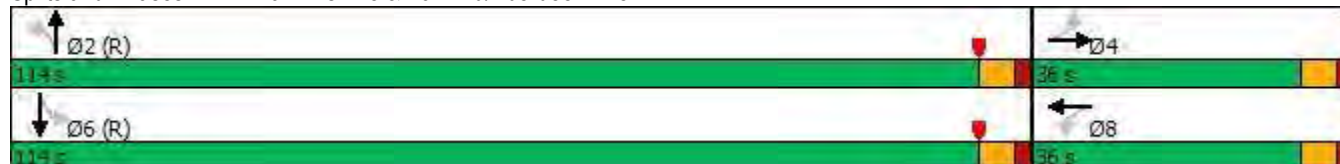


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	33.0	33.0		22.5	22.5		26.0	26.0		26.0	26.0	
Total Split (s)	36.0	36.0		36.0	36.0		114.0	114.0		114.0	114.0	
Total Split (%)	24.0%	24.0%		24.0%	24.0%		76.0%	76.0%		76.0%	76.0%	
Maximum Green (s)	30.0	30.0		30.0	30.0		108.0	108.0		108.0	108.0	
Yellow Time (s)	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	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0					7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0					10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	60	60					32	32		0	0	
Act Effct Green (s)		30.0			30.0			108.0			108.0	
Actuated g/C Ratio		0.20			0.20			0.72			0.72	
v/c Ratio		0.12			0.10			0.48			0.21	
Control Delay		50.5			50.1			2.5			2.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		50.5			50.1			2.5			2.0	
LOS		D			D			A			A	
Approach Delay		50.5			50.1			2.5			2.0	
Approach LOS		D			D			A			A	

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	22 (15%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.48
Intersection Signal Delay:	4.3
Intersection LOS:	A
Intersection Capacity Utilization:	49.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 21: Far Hills Ave & Park Rd/Aberdeen Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	SBL2	SBL
Lane Configurations		↕					↕		↕	↑↑	↕	
Traffic Volume (vph)	36	13	4	5	4	2	9	6	20	900	5	7
Future Volume (vph)	36	13	4	5	4	2	9	6	20	900	5	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0				0		145			85
Storage Lanes	0		0				0		1			1
Taper Length (ft)	25						25		50			50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95
Frt		0.979					0.962					
Flt Protected		0.970					0.986		0.950		0.950	
Satd. Flow (prot)	0	1718	0	0	0	0	1716	0	1787	3574	1770	0
Flt Permitted		0.792					0.912		0.450		0.239	
Satd. Flow (perm)	0	1403	0	0	0	0	1588	0	847	3574	445	0
Right Turn on Red				No				No				
Satd. Flow (RTOR)												
Link Speed (mph)		25					25			35		
Link Distance (ft)		382					543			736		
Travel Time (s)		10.4					14.8			14.3		
Peak Hour Factor	0.69	0.69	0.69	0.69	0.66	0.66	0.66	0.66	0.89	0.89	0.93	0.93
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	1%	1%	2%	2%
Adj. Flow (vph)	52	19	6	7	6	3	14	9	22	1011	5	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	84	0	0	0	0	32	0	22	1011	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Right	Left	Left	Left	Right	Left	Left	Left	Left
Median Width(ft)		0					0			12		
Link Offset(ft)		0					0			0		
Crosswalk Width(ft)		16					16			16		
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	9	15	15		9	15		15	15
Number of Detectors	1	2			1	1	2		1	2	1	1
Detector Template	Left	Thru			Left	Left	Thru		Left	Thru	Left	Left
Leading Detector (ft)	20	100			20	20	100		20	100	20	20
Trailing Detector (ft)	0	0			0	0	0		0	0	0	0
Detector 1 Position(ft)	0	0			0	0	0		0	0	0	0
Detector 1 Size(ft)	20	6			20	20	6		20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94					94			94		
Detector 2 Size(ft)		6					6			6		
Detector 2 Type		Cl+Ex					Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)		0.0					0.0			0.0		
Turn Type	Perm	NA			Perm	Perm	NA		Perm	NA	Perm	Perm
Protected Phases		4					8			2		

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	SBT	SBR	NWR	NWR2
Lane Configurations	↑↑		↔	
Traffic Volume (vph)	478	18	8	9
Future Volume (vph)	478	18	8	9
Ideal Flow (vphpl)	1900	1900	1900	1900
Storage Length (ft)		0	0	
Storage Lanes		0	1	
Taper Length (ft)				
Lane Util. Factor	0.95	0.95	1.00	1.00
Frt	0.995		0.865	
Flt Protected	0.999			
Satd. Flow (prot)	3518	0	1565	0
Flt Permitted	0.937			
Satd. Flow (perm)	3300	0	1565	0
Right Turn on Red		No		No
Satd. Flow (RTOR)				
Link Speed (mph)	35			
Link Distance (ft)	1977			
Travel Time (s)	38.5			
Peak Hour Factor	0.93	0.93	0.38	0.38
Heavy Vehicles (%)	2%	2%	5%	5%
Adj. Flow (vph)	514	19	21	24
Shared Lane Traffic (%)				
Lane Group Flow (vph)	541	0	45	0
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	Right	Right	Right
Median Width(ft)	12			
Link Offset(ft)	0			
Crosswalk Width(ft)	16			
Two way Left Turn Lane				
Headway Factor	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	9	9
Number of Detectors	2		1	
Detector Template	Thru		Right	
Leading Detector (ft)	100		20	
Trailing Detector (ft)	0		0	
Detector 1 Position(ft)	0		0	
Detector 1 Size(ft)	6		20	
Detector 1 Type	Cl+Ex		Cl+Ex	
Detector 1 Channel				
Detector 1 Extend (s)	0.0		0.0	
Detector 1 Queue (s)	0.0		0.0	
Detector 1 Delay (s)	0.0		0.0	
Detector 2 Position(ft)	94			
Detector 2 Size(ft)	6			
Detector 2 Type	Cl+Ex			
Detector 2 Channel				
Detector 2 Extend (s)	0.0			
Turn Type	NA		Perm	
Protected Phases	6			

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023

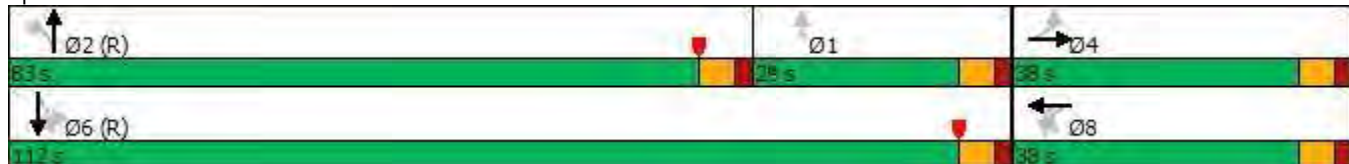


Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	SBL2	SBL
Permitted Phases	4				8	8			2		6	6
Detector Phase	4	4			8	8	8		2	2	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	10.0		20.0	20.0	20.0	20.0
Minimum Split (s)	33.0	33.0			22.5	22.5	22.5		26.0	26.0	26.0	26.0
Total Split (s)	38.0	38.0			38.0	38.0	38.0		83.0	83.0	112.0	112.0
Total Split (%)	25.3%	25.3%			25.3%	25.3%	25.3%		55.3%	55.3%	74.7%	74.7%
Maximum Green (s)	32.0	32.0			32.0	32.0	32.0		77.0	77.0	106.0	106.0
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)		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	Lead		
Lead-Lag Optimize?									Yes	Yes		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0	3.0
Recall Mode	None	None			None	None	None		C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0							7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0							10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	12	12							18	18	8	8
Act Effct Green (s)		18.0					18.0		91.0	91.0	120.0	
Actuated g/C Ratio		0.12					0.12		0.61	0.61	0.80	
v/c Ratio		0.50					0.17		0.04	0.47	0.01	
Control Delay		70.0					57.6		7.8	10.7	5.6	
Queue Delay		0.0					0.0		0.0	0.1	0.0	
Total Delay		70.0					57.6		7.8	10.7	5.6	
LOS		E					E		A	B	A	
Approach Delay		70.0					57.6			10.7		
Approach LOS		E					E			B		

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 130 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.50
 Intersection Signal Delay: 14.3
 Intersection Capacity Utilization 64.9%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	SBT	SBR	NWR	NWR2
Permitted Phases			1	
Detector Phase	6		1	
Switch Phase				
Minimum Initial (s)	20.0		20.0	
Minimum Split (s)	26.0		26.0	
Total Split (s)	112.0		29.0	
Total Split (%)	74.7%		19.3%	
Maximum Green (s)	106.0		23.0	
Yellow Time (s)	4.0		4.0	
All-Red Time (s)	2.0		2.0	
Lost Time Adjust (s)	0.0		0.0	
Total Lost Time (s)	6.0		6.0	
Lead/Lag			Lag	
Lead-Lag Optimize?			Yes	
Vehicle Extension (s)	3.0		3.0	
Recall Mode	C-Max		Max	
Walk Time (s)	7.0			
Flash Dont Walk (s)	10.0			
Pedestrian Calls (#/hr)	8			
Act Effct Green (s)	120.0		23.0	
Actuated g/C Ratio	0.80		0.15	
v/c Ratio	0.20		0.19	
Control Delay	6.6		57.8	
Queue Delay	0.0		0.0	
Total Delay	6.6		57.8	
LOS	A		E	
Approach Delay	6.6			
Approach LOS	A			
Intersection Summary				

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/06/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕			↘
Traffic Volume (vph)	0	0	894	0	0	495
Future Volume (vph)	0	0	894	0	0	495
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt						
Flt Protected						
Satd. Flow (prot)	0	1863	3574	0	0	3539
Flt Permitted						
Satd. Flow (perm)	0	1863	3574	0	0	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	404		1004			736
Travel Time (s)	11.0		19.6			14.3
Peak Hour Factor	0.92	0.92	0.84	0.84	0.89	0.89
Heavy Vehicles (%)	2%	2%	1%	1%	2%	2%
Adj. Flow (vph)	0	0	1064	0	0	556
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	1064	0	0	556
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors		1	2			2
Detector Template		Right	Thru			Thru
Leading Detector (ft)		20	100			100
Trailing Detector (ft)		0	0			0
Detector 1 Position(ft)		0	0			0
Detector 1 Size(ft)		20	6			6
Detector 1 Type		Cl+Ex	Cl+Ex			Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)		0.0	0.0			0.0
Detector 1 Queue (s)		0.0	0.0			0.0
Detector 1 Delay (s)		0.0	0.0			0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type		Perm	NA			NA
Protected Phases			2			6
Permitted Phases		8				
Detector Phase		8	2			6
Switch Phase						

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/06/2023

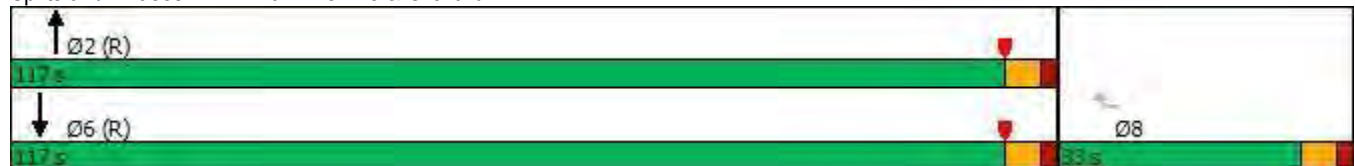


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)		10.0	20.0			20.0
Minimum Split (s)		33.0	26.0			26.0
Total Split (s)		33.0	117.0			117.0
Total Split (%)		22.0%	78.0%			78.0%
Maximum Green (s)		27.0	111.0			111.0
Yellow Time (s)		4.0	4.0			4.0
All-Red Time (s)		2.0	2.0			2.0
Lost Time Adjust (s)		0.0	0.0			0.0
Total Lost Time (s)		6.0	6.0			6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Max			C-Max
Walk Time (s)		7.0				
Flash Dont Walk (s)		20.0				
Pedestrian Calls (#/hr)		25				
Act Effct Green (s)			126.6			126.6
Actuated g/C Ratio			0.84			0.84
v/c Ratio			0.35			0.19
Control Delay			4.5			3.2
Queue Delay			0.0			0.0
Total Delay			4.5			3.2
LOS			A			A
Approach Delay			4.5			3.2
Approach LOS			A			A

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	130 (87%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.35
Intersection Signal Delay:	4.1
Intersection LOS:	A
Intersection Capacity Utilization:	29.7%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 27: Far Hills Ave & Orchard



Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↔		↖	↕↔		↖	↕↔	
Traffic Volume (vph)	0	2	4	44	1	26	3	858	20	27	451	8
Future Volume (vph)	0	2	4	44	1	26	3	858	20	27	451	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		20	0		0	75		0	75		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.951			0.997			0.997	
Flt Protected				0.970			0.950			0.950		
Satd. Flow (prot)	0	1863	1583	0	1593	0	1770	3529	0	1770	3529	0
Flt Permitted				0.808			0.456			0.254		
Satd. Flow (perm)	0	1863	1583	0	1327	0	849	3529	0	473	3529	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		181			322			464			1004	
Travel Time (s)		4.9			8.8			9.0			19.6	
Peak Hour Factor	0.50	0.50	0.50	0.68	0.68	0.68	0.83	0.83	0.83	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	10%	10%	10%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	0	4	8	65	1	38	4	1034	24	31	518	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	8	0	104	0	4	1058	0	31	527	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type		NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/06/2023

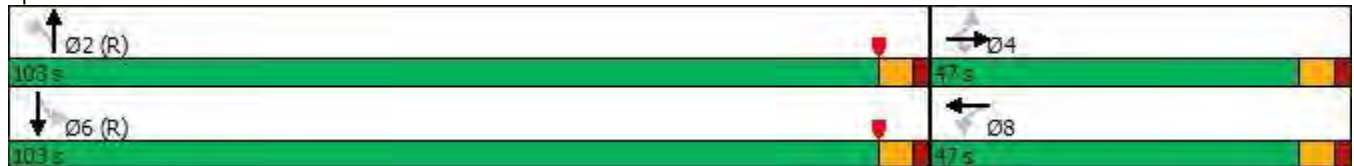


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	22.5	22.5	22.5	33.0	33.0		26.0	26.0		26.0	26.0	
Total Split (s)	47.0	47.0	47.0	47.0	47.0		103.0	103.0		103.0	103.0	
Total Split (%)	31.3%	31.3%	31.3%	31.3%	31.3%		68.7%	68.7%		68.7%	68.7%	
Maximum Green (s)	41.0	41.0	41.0	41.0	41.0		97.0	97.0		97.0	97.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				20.0	20.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)				4	4		8	8		3	3	
Act Effct Green (s)		17.6	17.6		17.6		120.4	120.4		120.4	120.4	
Actuated g/C Ratio		0.12	0.12		0.12		0.80	0.80		0.80	0.80	
v/c Ratio		0.02	0.04		0.67		0.01	0.37		0.08	0.19	
Control Delay		54.0	55.0		82.7		4.3	5.1		0.9	1.0	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		54.0	55.0		82.7		4.3	5.1		0.9	1.0	
LOS		D	D		F		A	A		A	A	
Approach Delay		54.7			82.7			5.1			1.0	
Approach LOS		D			F			A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 148 (99%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.67
 Intersection Signal Delay: 8.8
 Intersection Capacity Utilization 48.3%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 30: Far Hills Ave & East Ave



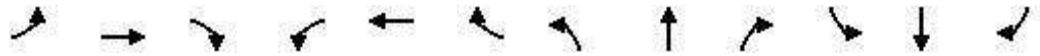
Network Totals

Number of Intersections	10
Total Delay (hr)	48
Stops (#)	5292
Average Speed (mph)	23
Total Travel Time (hr)	142
Distance Traveled (mi)	3250
Fuel Consumed (gal)	196
Fuel Economy (mpg)	16.6
Unserviced Vehicles (#)	0
Vehicles in dilemma zone (#)	313
Performance Index	62.4

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	6	45	14	13	60	91	509	16	115	920	20
Future Volume (vph)	8	6	45	14	13	60	91	509	16	115	920	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		170	0		0	205		0	150		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.908			0.995				0.997
Flt Protected		0.971			0.992		0.950			0.950		
Satd. Flow (prot)	0	1809	1583	0	1694	0	1770	3522	0	1787	3564	0
Flt Permitted		0.860			0.949		0.221			0.415		
Satd. Flow (perm)	0	1602	1583	0	1621	0	412	3522	0	781	3564	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35				35
Link Distance (ft)		306			419			825				530
Travel Time (s)		8.3			11.4			16.1				10.3
Peak Hour Factor	0.82	0.82	0.82	0.95	0.95	0.95	0.84	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	10	7	55	15	14	63	108	606	19	126	1011	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	55	0	92	0	108	625	0	126	1033	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA	pm+ov	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	7	4	5		8		5	2				6

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/06/2023

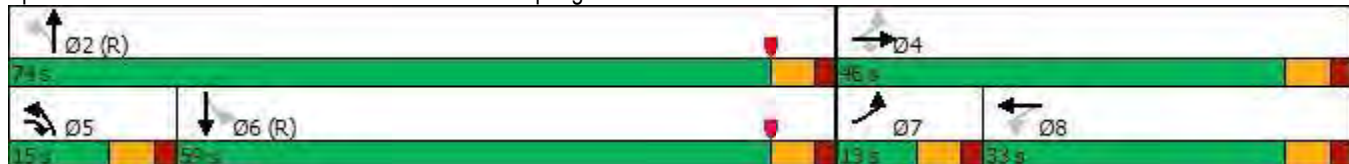


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	5	8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0		7.0	20.0		20.0	20.0	
Minimum Split (s)	13.0	33.0	13.0	33.0	33.0		13.0	26.0		26.0	26.0	
Total Split (s)	13.0	46.0	15.0	33.0	33.0		15.0	74.0		59.0	59.0	
Total Split (%)	10.8%	38.3%	12.5%	27.5%	27.5%		12.5%	61.7%		49.2%	49.2%	
Maximum Green (s)	7.0	40.0	9.0	27.0	27.0		9.0	68.0		53.0	53.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead		Lead	Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)		7.0		7.0	7.0			7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0			10.0		10.0	10.0	
Pedestrian Calls (#/hr)		2		0	0			0		3	3	
Act Effct Green (s)		14.6	28.2		14.6		93.4	93.4		79.8	79.8	
Actuated g/C Ratio		0.12	0.24		0.12		0.78	0.78		0.66	0.66	
v/c Ratio		0.09	0.15		0.47		0.27	0.23		0.24	0.44	
Control Delay		43.9	34.8		55.0		7.4	6.0		11.2	11.2	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		43.9	34.8		55.0		7.4	6.0		11.2	11.2	
LOS		D	C		E		A	A		B	B	
Approach Delay		37.0			55.0			6.2			11.2	
Approach LOS		D			E			A			B	

Intersection Summary























Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	56 (47%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.47
Intersection Signal Delay:	12.2
Intersection LOS:	B
Intersection Capacity Utilization:	60.1%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Far Hills Ave & Old River Trl/Springhouse Rd



Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/06/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	96	120	5	77	12	55	530	10	21	780	68
Future Volume (vph)	96	96	120	5	77	12	55	530	10	21	780	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	195		195	0		0	155		0	330		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	50			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.980			0.997				0.988
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1787	1844	0	1770	3529	0	1787	3531	0
Flt Permitted	0.659			0.627			0.250			0.358		
Satd. Flow (perm)	1240	1881	1599	1180	1844	0	466	3529	0	673	3531	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			25			35				35
Link Distance (ft)		1055			352			1457				825
Travel Time (s)		20.6			9.6			28.4				16.1
Peak Hour Factor	0.80	0.80	0.80	0.81	0.81	0.81	0.72	0.72	0.72	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	120	120	150	6	95	15	76	736	14	24	876	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	120	120	150	6	110	0	76	750	0	24	952	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	pm+ov	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4	5		8		5	2		1	6	

Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/06/2023

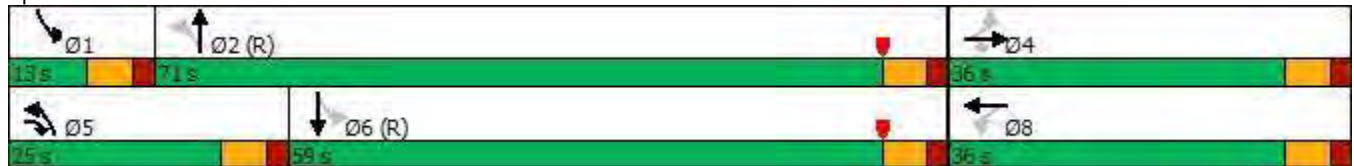


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	5	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0		7.0	20.0		7.0	20.0	
Minimum Split (s)	33.0	33.0	22.5	33.0	33.0		22.5	26.0		13.0	26.0	
Total Split (s)	36.0	36.0	25.0	36.0	36.0		25.0	71.0		13.0	59.0	
Total Split (%)	30.0%	30.0%	20.8%	30.0%	30.0%		20.8%	59.2%		10.8%	49.2%	
Maximum Green (s)	30.0	30.0	19.0	30.0	30.0		19.0	65.0		7.0	53.0	
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)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0			10.0			10.0	
Pedestrian Calls (#/hr)	1	1		1	1			1			1	
Act Effct Green (s)	17.3	17.3	30.7	17.3	17.3		87.5	82.9		84.3	77.3	
Actuated g/C Ratio	0.14	0.14	0.26	0.14	0.14		0.73	0.69		0.70	0.64	
v/c Ratio	0.67	0.44	0.37	0.04	0.42		0.18	0.31		0.04	0.42	
Control Delay	65.8	50.5	37.9	40.2	49.8		8.5	10.4		1.8	4.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	65.8	50.5	37.9	40.2	49.8		8.5	10.4		1.8	4.5	
LOS	E	D	D	D	D		A	B		A	A	
Approach Delay		50.4				49.3		10.3			4.5	
Approach LOS		D				D		B			A	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 72 (60%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.67
 Intersection Signal Delay: 16.5 Intersection LOS: B
 Intersection Capacity Utilization 56.5% ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 2: Far Hills Ave & Shantz Ave



Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

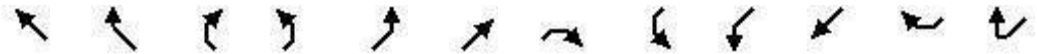
01/06/2023

Lane Group	NBL	NBT	NBR2	SBL2	SBL	SBT	SBR	SEL	SET	SER	SER2	NWL
Lane Configurations												
Traffic Volume (vph)	7	9	3	4	403	10	11	11	1115	5	11	4
Future Volume (vph)	7	9	3	4	403	10	11	11	1115	5	11	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0				230		0	0		0		0
Storage Lanes	0				1		0	0		0		0
Taper Length (ft)	25				50			25				25
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95	0.95	0.95	0.95
Frt		0.980				0.992			0.998			
Flt Protected		0.982			0.950	0.957						
Satd. Flow (prot)	0	1576	0	0	1698	1697	0	0	3567	0	0	0
Flt Permitted		0.982			0.950	0.957			0.942			
Satd. Flow (perm)	0	1576	0	0	1698	1697	0	0	3360	0	0	0
Right Turn on Red			No								Yes	
Satd. Flow (RTOR)									1			
Link Speed (mph)		25				25			35			
Link Distance (ft)		1058				666			1457			
Travel Time (s)		28.9				18.2			28.4			
Peak Hour Factor	0.72	0.72	0.72	0.56	0.56	0.56	0.56	0.92	0.92	0.92	0.92	0.91
Heavy Vehicles (%)	16%	16%	16%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	10	13	4	7	720	18	20	12	1212	5	12	4
Shared Lane Traffic (%)					48%							
Lane Group Flow (vph)	0	27	0	0	381	384	0	0	1241	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Left	Right	Left	Left	Right	Right	Left
Median Width(ft)		12				12			12			
Link Offset(ft)		0				0			0			
Crosswalk Width(ft)		16				16			16			
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15	15		9	15		9	9	15
Number of Detectors	1	2		1	1	2		1	2			1
Detector Template	Left	Thru		Left	Left	Thru		Left	Thru			Left
Leading Detector (ft)	20	100		20	20	100		20	100			20
Trailing Detector (ft)	0	0		0	0	0		0	0			0
Detector 1 Position(ft)	0	0		0	0	0		0	0			0
Detector 1 Size(ft)	20	6		20	20	6		20	6			20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex			Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0			0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0			0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0			0.0
Detector 2 Position(ft)		94				94			94			
Detector 2 Size(ft)		6				6			6			
Detector 2 Type		Cl+Ex				Cl+Ex			Cl+Ex			
Detector 2 Channel												
Detector 2 Extend (s)		0.0				0.0			0.0			
Turn Type	Split	NA		Split	Split	NA		Perm	NA			Perm
Protected Phases	10	10		12	12	12			6			

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023















Lane Group	NWT	NWR	NWR2	NEL2	NEL	NET	NER	SWL2	SWL	SWT	SWR	SWR2
Lane Configurations	↔↔					↔				↔		
Traffic Volume (vph)	571	234	4	5	12	4	18	2	1	5	13	4
Future Volume (vph)	571	234	4	5	12	4	18	2	1	5	13	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0			0		0		0		0	
Storage Lanes		0			0		0		0		0	
Taper Length (ft)					25				25			
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.956					0.937				0.905		
Flt Protected						0.978				0.995		
Satd. Flow (prot)	3417	0	0	0	0	1707	0	0	0	1677	0	0
Flt Permitted	0.949					0.862				0.975		
Satd. Flow (perm)	3243	0	0	0	0	1505	0	0	0	1644	0	0
Right Turn on Red			Yes									Yes
Satd. Flow (RTOR)										5		
Link Speed (mph)	35					25				25		
Link Distance (ft)	1682					574				605		
Travel Time (s)	32.8					15.7				16.5		
Peak Hour Factor	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	627	257	4	6	13	4	20	2	1	6	16	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	892	0	0	0	0	43	0	0	0	30	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Right	Left	Left	Left	Right	Left	Left	Left	Right	Right
Median Width(ft)	12					0				0		
Link Offset(ft)	0					0				0		
Crosswalk Width(ft)	16					16				16		
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)		9	9	15	15		9	15	15		9	9
Number of Detectors	2			1	1	2		1	1	2		
Detector Template	Thru			Left	Left	Thru		Left	Left	Thru		
Leading Detector (ft)	100			20	20	100		20	20	100		
Trailing Detector (ft)	0			0	0	0		0	0	0		
Detector 1 Position(ft)	0			0	0	0		0	0	0		
Detector 1 Size(ft)	6			20	20	6		20	20	6		
Detector 1 Type	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex		
Detector 1 Channel												
Detector 1 Extend (s)	0.0			0.0	0.0	0.0		0.0	0.0	0.0		
Detector 1 Queue (s)	0.0			0.0	0.0	0.0		0.0	0.0	0.0		
Detector 1 Delay (s)	0.0			0.0	0.0	0.0		0.0	0.0	0.0		
Detector 2 Position(ft)	94					94				94		
Detector 2 Size(ft)	6					6				6		
Detector 2 Type	Cl+Ex					Cl+Ex				Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0					0.0				0.0		
Turn Type	NA			Perm	Perm	NA		Perm	Perm	NA		
Protected Phases	2					4				8		

Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023

												
Lane Group	NBL	NBT	NBR2	SBL2	SBL	SBT	SBR	SEL	SET	SER	SER2	NWL
Permitted Phases								6				2
Detector Phase	10	10		12	12	12		6	6			2
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0		20.0	20.0			20.0
Minimum Split (s)	33.0	33.0		22.5	22.5	22.5		26.0	26.0			26.0
Total Split (s)	33.0	33.0		23.0	23.0	23.0		31.0	31.0			31.0
Total Split (%)	27.5%	27.5%		19.2%	19.2%	19.2%		25.8%	25.8%			25.8%
Maximum Green (s)	27.0	27.0		17.0	17.0	17.0		25.0	25.0			25.0
Yellow Time (s)	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
Lost Time Adjust (s)		0.0			0.0	0.0			0.0			
Total Lost Time (s)		6.0			6.0	6.0			6.0			
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0			3.0
Recall Mode	None	None		None	None	None		Max	Max			C-Max
Walk Time (s)	7.0	7.0						7.0	7.0			7.0
Flash Dont Walk (s)	10.0	10.0						10.0	10.0			10.0
Pedestrian Calls (#/hr)	7	7						0	0			6
Act Effct Green (s)		11.4			17.0	17.0			60.4			
Actuated g/C Ratio		0.10			0.14	0.14			0.50			
v/c Ratio		0.18			1.59	1.60			0.73			
Control Delay		51.7			317.7	322.9			26.0			
Queue Delay		0.0			0.0	0.0			0.0			
Total Delay		51.7			317.7	322.9			26.0			
LOS		D			F	F			C			
Approach Delay		51.7				320.3			26.0			
Approach LOS		D				F			C			

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 60 (50%), Referenced to phase 2:NWTL, Start of Yellow
 Natural Cycle: 145
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.60
 Intersection Signal Delay: 101.7 Intersection LOS: F
 Intersection Capacity Utilization 80.9% ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave



Lanes, Volumes, Timings

3: W Thruston Blvd/E Thruston Blvd & Oakwood Ave & Far Hills Ave

01/06/2023














Lane Group	NWT	NWR	NWR2	NEL2	NEL	NET	NER	SWL2	SWL	SWT	SWR	SWR2
Permitted Phases				4	4			8	8			
Detector Phase	2			4	4	4		8	8	8		
Switch Phase												
Minimum Initial (s)	20.0			10.0	10.0	10.0		10.0	10.0	10.0		
Minimum Split (s)	26.0			33.0	33.0	33.0		22.5	22.5	22.5		
Total Split (s)	31.0			33.0	33.0	33.0		33.0	33.0	33.0		
Total Split (%)	25.8%			27.5%	27.5%	27.5%		27.5%	27.5%	27.5%		
Maximum Green (s)	25.0			27.0	27.0	27.0		27.0	27.0	27.0		
Yellow Time (s)	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		
Lost Time Adjust (s)	0.0					0.0				0.0		
Total Lost Time (s)	6.0					6.0				6.0		
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			3.0	3.0	3.0		3.0	3.0	3.0		
Recall Mode	C-Max			None	None	None		None	None	None		
Walk Time (s)	7.0			7.0	7.0	7.0						
Flash Dont Walk (s)	10.0			20.0	20.0	20.0						
Pedestrian Calls (#/hr)	6			13	13	13						
Act Effct Green (s)	60.4					16.8				16.8		
Actuated g/C Ratio	0.50					0.14				0.14		
v/c Ratio	0.55					0.20				0.13		
Control Delay	26.0					44.4				36.6		
Queue Delay	0.0					0.0				0.0		
Total Delay	26.0					44.4				36.6		
LOS	C					D				D		
Approach Delay	26.0					44.4				36.6		
Approach LOS	C					D				D		

Intersection Summary

Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/06/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	61	109	638	96	206	957
Future Volume (vph)	61	109	638	96	206	957
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115	0		0	90	
Storage Lanes	1	1		0	1	
Taper Length (ft)	50				50	
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.95
Frt		0.850	0.980			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1599	3468	0	1787	3574
Flt Permitted	0.950				0.266	
Satd. Flow (perm)	1787	1599	3468	0	500	3574
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	739		822			1682
Travel Time (s)	20.2		16.0			32.8
Peak Hour Factor	0.80	0.80	0.82	0.82	0.88	0.88
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Adj. Flow (vph)	76	136	778	117	234	1088
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	136	895	0	234	1088
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pm+ov	NA		pm+pt	NA
Protected Phases	8	1	2		1	6

Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/06/2023

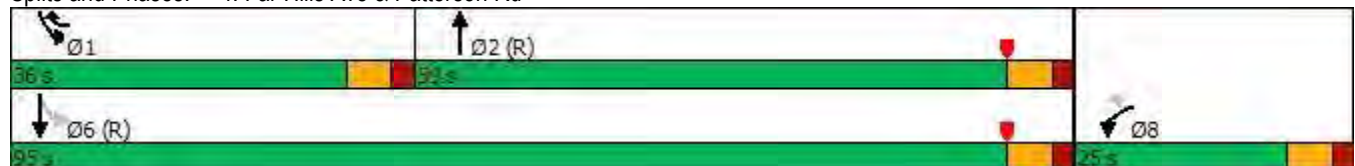


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases		8			6	
Detector Phase	8	1	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	7.0	20.0		7.0	20.0
Minimum Split (s)	22.5	33.0	26.0		33.0	26.0
Total Split (s)	25.0	36.0	59.0		36.0	95.0
Total Split (%)	20.8%	30.0%	49.2%		30.0%	79.2%
Maximum Green (s)	19.0	30.0	53.0		30.0	89.0
Yellow Time (s)	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0
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		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)		7.0	7.0		7.0	
Flash Dont Walk (s)		20.0	10.0		20.0	
Pedestrian Calls (#/hr)		9	3		9	
Act Effct Green (s)	11.4	26.8	81.2		99.8	101.0
Actuated g/C Ratio	0.10	0.22	0.68		0.83	0.84
v/c Ratio	0.45	0.38	0.38		0.42	0.36
Control Delay	59.6	39.6	2.8		3.2	3.4
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	59.6	39.6	2.8		3.2	3.4
LOS	E	D	A		A	A
Approach Delay	46.7		2.8			3.4
Approach LOS	D		A			A

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 12 (10%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.45
 Intersection Signal Delay: 6.9
 Intersection Capacity Utilization 55.4%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service B

Splits and Phases: 4: Far Hills Ave & Patterson Rd



Lanes, Volumes, Timings
5: Far Hills Ave & Park Ave

01/06/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	21	16	24	690	1096	10
Future Volume (vph)	21	16	24	690	1096	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	66	120			0
Storage Lanes	1	1	1			0
Taper Length (ft)	25		50			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.850			0.999	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1787	3574	3571	0
Flt Permitted	0.950		0.204			
Satd. Flow (perm)	1770	1583	384	3574	3571	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	721			826	822	
Travel Time (s)	19.7			16.1	16.0	
Peak Hour Factor	0.66	0.66	0.91	0.91	0.88	0.88
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	32	24	26	758	1245	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	24	26	758	1256	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (ft)	20	20	20	100	100	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	20	20	20	6	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	

Lanes, Volumes, Timings

5: Far Hills Ave & Park Ave

01/06/2023

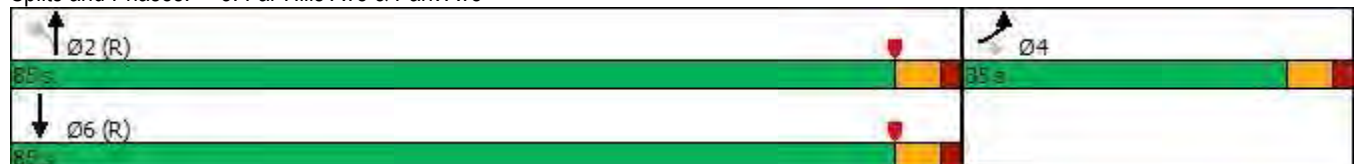


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0	20.0	20.0	
Minimum Split (s)	33.0	33.0	26.0	26.0	26.0	
Total Split (s)	35.0	35.0	85.0	85.0	85.0	
Total Split (%)	29.2%	29.2%	70.8%	70.8%	70.8%	
Maximum Green (s)	29.0	29.0	79.0	79.0	79.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
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?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	C-Max	C-Max	C-Max	
Walk Time (s)	7.0	7.0			7.0	
Flash Dont Walk (s)	20.0	20.0			10.0	
Pedestrian Calls (#/hr)	5	5			8	
Act Effct Green (s)	13.4	13.4	99.0	99.0	99.0	
Actuated g/C Ratio	0.11	0.11	0.82	0.82	0.82	
v/c Ratio	0.16	0.14	0.08	0.26	0.43	
Control Delay	47.3	46.8	2.5	1.7	2.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	47.3	46.8	2.5	1.7	2.4	
LOS	D	D	A	A	A	
Approach Delay	47.1			1.8	2.4	
Approach LOS	D			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 14 (12%), Referenced to phase 2:NBTL and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.43
 Intersection Signal Delay: 3.4
 Intersection Capacity Utilization 48.9%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 5: Far Hills Ave & Park Ave



Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/06/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	8	20	3	738	1261	7
Future Volume (vph)	8	20	3	738	1261	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Flt	0.902				0.999	
Flt Protected	0.986					
Satd. Flow (prot)	1657	0	0	3574	3571	0
Flt Permitted	0.986			0.951		
Satd. Flow (perm)	1657	0	0	3399	3571	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	632			1805	826	
Travel Time (s)	17.2			35.2	16.1	
Peak Hour Factor	0.78	0.78	0.92	0.92	0.90	0.90
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	10	26	3	802	1401	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	36	0	0	805	1409	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1		1	2	2	
Detector Template	Left		Left	Thru	Thru	
Leading Detector (ft)	20		20	100	100	
Trailing Detector (ft)	0		0	0	0	
Detector 1 Position(ft)	0		0	0	0	
Detector 1 Size(ft)	20		20	6	6	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Detector Phase	4		2	2	6	
Switch Phase						

Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/06/2023

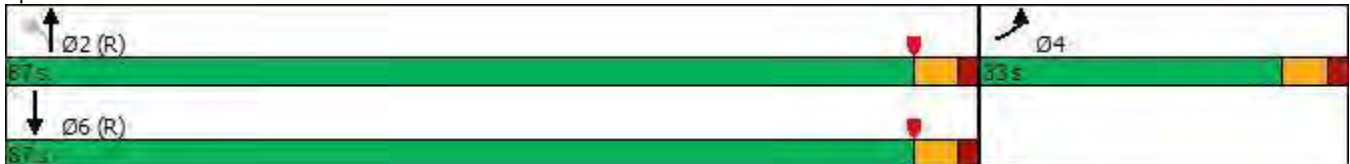


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Minimum Initial (s)	10.0		20.0	20.0	20.0	
Minimum Split (s)	33.0		26.0	26.0	26.0	
Total Split (s)	33.0		87.0	87.0	87.0	
Total Split (%)	27.5%		72.5%	72.5%	72.5%	
Maximum Green (s)	27.0		81.0	81.0	81.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	6.0			6.0	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	None		C-Max	C-Max	C-Max	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	20.0				10.0	
Pedestrian Calls (#/hr)	9				4	
Act Effct Green (s)	13.4			103.4	103.4	
Actuated g/C Ratio	0.11			0.86	0.86	
v/c Ratio	0.19			0.27	0.46	
Control Delay	48.2			3.4	1.1	
Queue Delay	0.0			0.0	0.0	
Total Delay	48.2			3.4	1.1	
LOS	D			A	A	
Approach Delay	48.2			3.4	1.1	
Approach LOS	D			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 22 (18%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.46
 Intersection Signal Delay: 2.7
 Intersection LOS: A
 Intersection Capacity Utilization 53.4%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 6: Far Hills Ave & Harman Ave



Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕			↕	
Traffic Volume (vph)	13	1	11	6	1	4	9	714	15	6	1190	11
Future Volume (vph)	13	1	11	6	1	4	9	714	15	6	1190	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Fr _t		0.941			0.949			0.997			0.999	
Fl _t Protected		0.974			0.973			0.999				
Satd. Flow (prot)	0	1707	0	0	1720	0	0	3560	0	0	3536	0
Fl _t Permitted		0.882			0.893			0.930			0.951	
Satd. Flow (perm)	0	1546	0	0	1579	0	0	3314	0	0	3362	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		727			626			1977			1805	
Travel Time (s)		19.8			17.1			38.5			35.2	
Peak Hour Factor	0.78	0.78	0.78	0.69	0.69	0.69	0.90	0.90	0.90	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Adj. Flow (vph)	17	1	14	9	1	6	10	793	17	7	1368	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	0	0	16	0	0	820	0	0	1388	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												

Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/06/2023

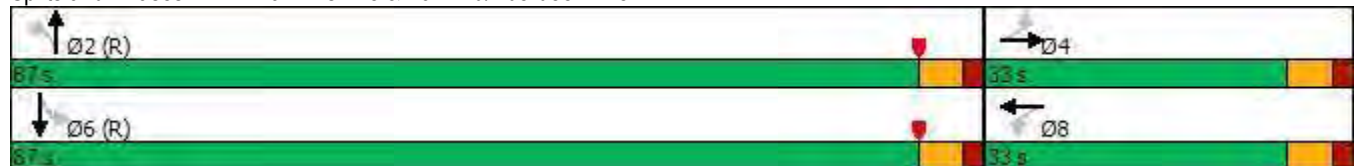


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	10.0	10.0		10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		22.5	22.5		26.0	26.0		26.0	26.0	
Total Split (s)	33.0	33.0		33.0	33.0		87.0	87.0		87.0	87.0	
Total Split (%)	27.5%	27.5%		27.5%	27.5%		72.5%	72.5%		72.5%	72.5%	
Maximum Green (s)	27.0	27.0		27.0	27.0		81.0	81.0		81.0	81.0	
Yellow Time (s)	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	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0					7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0					10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	12	12					0	0		13	13	
Act Effct Green (s)		27.0			27.0			81.0			81.0	
Actuated g/C Ratio		0.22			0.22			0.68			0.68	
v/c Ratio		0.09			0.05			0.37			0.61	
Control Delay		37.8			37.0			3.5			7.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		37.8			37.0			3.5			7.8	
LOS		D			D			A			A	
Approach Delay		37.8			37.0			3.5			7.8	
Approach LOS		D			D			A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 58 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.61
 Intersection Signal Delay: 6.9
 Intersection LOS: A
 Intersection Capacity Utilization 55.8%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 21: Far Hills Ave & Park Rd/Aberdeen Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2
Lane Configurations		↕					↕		↕	↑↑		↕
Traffic Volume (vph)	41	17	12	4	2	4	13	4	8	634	2	8
Future Volume (vph)	41	17	12	4	2	4	13	4	8	634	2	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0				0		145		0	
Storage Lanes	0		0				0		1		0	
Taper Length (ft)	25						25		50			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.970					0.977					
Flt Protected		0.973					0.987		0.950			0.950
Satd. Flow (prot)	0	1758	0	0	0	0	1621	0	1787	3574	0	1787
Flt Permitted		0.809					0.926		0.568			0.346
Satd. Flow (perm)	0	1462	0	0	0	0	1521	0	1069	3574	0	651
Right Turn on Red				No				No				
Satd. Flow (RTOR)												
Link Speed (mph)		25					25			35		
Link Distance (ft)		382					543			736		
Travel Time (s)		10.4					14.8			14.3		
Peak Hour Factor	0.77	0.77	0.77	0.77	0.64	0.64	0.64	0.64	0.93	0.93	0.93	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	13%	13%	13%	13%	1%	1%	1%	1%
Adj. Flow (vph)	53	22	16	5	3	6	20	6	9	682	2	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	96	0	0	0	0	35	0	9	684	0	9
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Right	Left	Left	Left	Right	Left	Left	Right	Left
Median Width(ft)		0					0			12		
Link Offset(ft)		0					0			0		
Crosswalk Width(ft)		16					16			16		
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	9	15	15		9	15		9	15
Number of Detectors	1	2			1	1	2		1	2		1
Detector Template	Left	Thru			Left	Left	Thru		Left	Thru		Left
Leading Detector (ft)	20	100			20	20	100		20	100		20
Trailing Detector (ft)	0	0			0	0	0		0	0		0
Detector 1 Position(ft)	0	0			0	0	0		0	0		0
Detector 1 Size(ft)	20	6			20	20	6		20	6		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 2 Position(ft)		94					94			94		
Detector 2 Size(ft)		6					6			6		
Detector 2 Type		Cl+Ex					Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)		0.0					0.0			0.0		
Turn Type	Perm	NA			Perm	Perm	NA		Perm	NA		Perm
Protected Phases		4					8			2		

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	SBT	SBR	NWR	NWR2
Lane Configurations	↑↑		↔	
Traffic Volume (vph)	262	10	50	25
Future Volume (vph)	262	10	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900
Storage Length (ft)		0	0	
Storage Lanes		0	1	
Taper Length (ft)				
Lane Util. Factor	0.95	0.95	1.00	1.00
Frt	0.995		0.865	
Flt Protected				
Satd. Flow (prot)	3556	0	1611	0
Flt Permitted				
Satd. Flow (perm)	3556	0	1611	0
Right Turn on Red		No		No
Satd. Flow (RTOR)				
Link Speed (mph)	35			
Link Distance (ft)	1977			
Travel Time (s)	38.5			
Peak Hour Factor	0.90	0.90	0.72	0.72
Heavy Vehicles (%)	1%	1%	2%	2%
Adj. Flow (vph)	291	11	69	35
Shared Lane Traffic (%)				
Lane Group Flow (vph)	302	0	104	0
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	Right	Right	Right
Median Width(ft)	12			
Link Offset(ft)	0			
Crosswalk Width(ft)	16			
Two way Left Turn Lane				
Headway Factor	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	9	9
Number of Detectors	2		1	
Detector Template	Thru		Right	
Leading Detector (ft)	100		20	
Trailing Detector (ft)	0		0	
Detector 1 Position(ft)	0		0	
Detector 1 Size(ft)	6		20	
Detector 1 Type	Cl+Ex		Cl+Ex	
Detector 1 Channel				
Detector 1 Extend (s)	0.0		0.0	
Detector 1 Queue (s)	0.0		0.0	
Detector 1 Delay (s)	0.0		0.0	
Detector 2 Position(ft)	94			
Detector 2 Size(ft)	6			
Detector 2 Type	Cl+Ex			
Detector 2 Channel				
Detector 2 Extend (s)	0.0			
Turn Type	NA		Perm	
Protected Phases	6			

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023

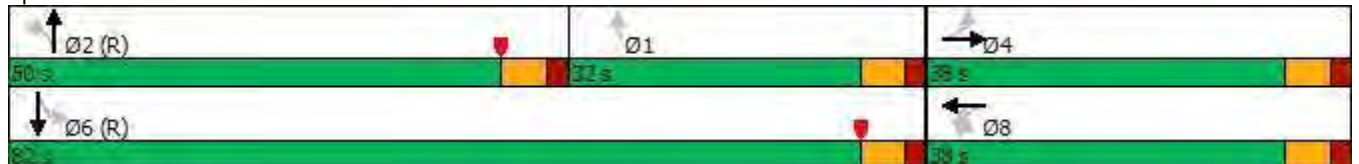


Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2
Permitted Phases	4				8	8			2			6
Detector Phase	4	4			8	8	8		2	2		6
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	10.0		20.0	20.0		20.0
Minimum Split (s)	33.0	33.0			22.5	22.5	22.5		26.0	26.0		26.0
Total Split (s)	38.0	38.0			38.0	38.0	38.0		50.0	50.0		82.0
Total Split (%)	31.7%	31.7%			31.7%	31.7%	31.7%		41.7%	41.7%		68.3%
Maximum Green (s)	32.0	32.0			32.0	32.0	32.0		44.0	44.0		76.0
Yellow Time (s)	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
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	Lead		
Lead-Lag Optimize?									Yes	Yes		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0		3.0
Recall Mode	None	None			None	None	None		C-Max	C-Max		C-Max
Walk Time (s)	7.0	7.0							7.0	7.0		7.0
Flash Dont Walk (s)	20.0	20.0							10.0	10.0		10.0
Pedestrian Calls (#/hr)	25	25							20	20		0
Act Effct Green (s)		20.4					20.4		55.6	55.6		87.6
Actuated g/C Ratio		0.17					0.17		0.46	0.46		0.73
v/c Ratio		0.39					0.14		0.02	0.41		0.02
Control Delay		46.7					39.9		13.6	17.0		7.2
Queue Delay		0.0					0.0		0.0	0.0		0.0
Total Delay		46.7					39.9		13.6	17.0		7.2
LOS		D					D		B	B		A
Approach Delay		46.7					39.9			17.0		
Approach LOS		D					D			B		

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	20 (17%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.41
Intersection Signal Delay:	19.2
Intersection LOS:	B
Intersection Capacity Utilization:	57.6%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/06/2023



Lane Group	SBT	SBR	NWR	NWR2
Permitted Phases			1	
Detector Phase	6		1	
Switch Phase				
Minimum Initial (s)	20.0		20.0	
Minimum Split (s)	26.0		26.0	
Total Split (s)	82.0		32.0	
Total Split (%)	68.3%		26.7%	
Maximum Green (s)	76.0		26.0	
Yellow Time (s)	4.0		4.0	
All-Red Time (s)	2.0		2.0	
Lost Time Adjust (s)	0.0		0.0	
Total Lost Time (s)	6.0		6.0	
Lead/Lag			Lag	
Lead-Lag Optimize?			Yes	
Vehicle Extension (s)	3.0		3.0	
Recall Mode	C-Max		Max	
Walk Time (s)	7.0			
Flash Dont Walk (s)	10.0			
Pedestrian Calls (#/hr)	0			
Act Effct Green (s)	87.6		26.0	
Actuated g/C Ratio	0.73		0.22	
v/c Ratio	0.12		0.30	
Control Delay	5.7		42.2	
Queue Delay	0.0		0.0	
Total Delay	5.7		42.2	
LOS	A		D	
Approach Delay	5.8			
Approach LOS	A			
Intersection Summary				

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/06/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕			↘
Traffic Volume (vph)	0	0	771	0	0	1023
Future Volume (vph)	0	0	771	0	0	1023
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Fr						
Flt Protected						
Satd. Flow (prot)	0	1863	3574	0	0	3574
Flt Permitted						
Satd. Flow (perm)	0	1863	3574	0	0	3574
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	404		1004			736
Travel Time (s)	11.0		19.6			14.3
Peak Hour Factor	0.92	0.92	0.93	0.93	0.89	0.89
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	0	0	829	0	0	1149
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	829	0	0	1149
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors		1	2			2
Detector Template		Right	Thru			Thru
Leading Detector (ft)		20	100			100
Trailing Detector (ft)		0	0			0
Detector 1 Position(ft)		0	0			0
Detector 1 Size(ft)		20	6			6
Detector 1 Type		Cl+Ex	Cl+Ex			Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)		0.0	0.0			0.0
Detector 1 Queue (s)		0.0	0.0			0.0
Detector 1 Delay (s)		0.0	0.0			0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type		Perm	NA			NA
Protected Phases			2			6
Permitted Phases		8				
Detector Phase		8	2			6
Switch Phase						

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/06/2023

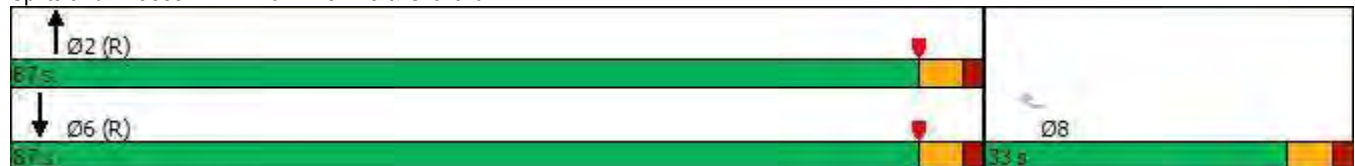


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)		10.0	20.0			20.0
Minimum Split (s)		33.0	26.0			26.0
Total Split (s)		33.0	87.0			87.0
Total Split (%)		27.5%	72.5%			72.5%
Maximum Green (s)		27.0	81.0			81.0
Yellow Time (s)		4.0	4.0			4.0
All-Red Time (s)		2.0	2.0			2.0
Lost Time Adjust (s)		0.0	0.0			0.0
Total Lost Time (s)		6.0	6.0			6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Max			C-Max
Walk Time (s)		7.0				
Flash Dont Walk (s)		20.0				
Pedestrian Calls (#/hr)		5				
Act Effct Green (s)			112.2			112.2
Actuated g/C Ratio			0.94			0.94
v/c Ratio			0.25			0.34
Control Delay			2.0			2.6
Queue Delay			0.0			0.0
Total Delay			2.0			2.6
LOS			A			A
Approach Delay			2.0			2.6
Approach LOS			A			A

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	6 (5%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.34
Intersection Signal Delay:	2.4
Intersection LOS:	A
Intersection Capacity Utilization:	33.3%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 27: Far Hills Ave & Orchard



Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/06/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↔		↖	↕		↗	↕	
Traffic Volume (vph)	14	11	27	59	10	38	40	735	45	71	999	36
Future Volume (vph)	14	11	27	59	10	38	40	735	45	71	999	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		20	0		0	75		0	75		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.952			0.991			0.995	
Flt Protected		0.973			0.973		0.950			0.950		
Satd. Flow (prot)	0	1812	1583	0	1725	0	1787	3542	0	1787	3556	0
Flt Permitted		0.806			0.811		0.238			0.319		
Satd. Flow (perm)	0	1501	1583	0	1438	0	448	3542	0	600	3556	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		181			322			464			1004	
Travel Time (s)		4.9			8.8			9.0			19.6	
Peak Hour Factor	0.77	0.77	0.77	0.72	0.72	0.72	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	18	14	35	82	14	53	43	799	49	75	1052	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	35	0	149	0	43	848	0	75	1090	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/06/2023

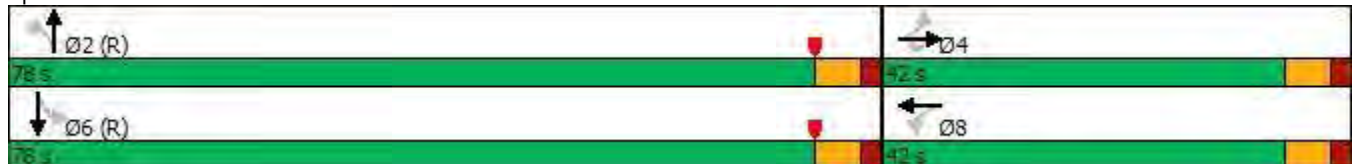


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	22.5	22.5	22.5	33.0	33.0		26.0	26.0		26.0	26.0	
Total Split (s)	42.0	42.0	42.0	42.0	42.0		78.0	78.0		78.0	78.0	
Total Split (%)	35.0%	35.0%	35.0%	35.0%	35.0%		65.0%	65.0%		65.0%	65.0%	
Maximum Green (s)	36.0	36.0	36.0	36.0	36.0		72.0	72.0		72.0	72.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				20.0	20.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)				2	2		0	0		5	5	
Act Effct Green (s)		18.2	18.2		18.2		89.8	89.8		89.8	89.8	
Actuated g/C Ratio		0.15	0.15		0.15		0.75	0.75		0.75	0.75	
v/c Ratio		0.14	0.15		0.69		0.13	0.32		0.17	0.41	
Control Delay		42.6	42.6		63.2		6.6	5.9		3.0	3.5	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		42.6	42.6		63.2		6.6	5.9		3.0	3.5	
LOS		D	D		E		A	A		A	A	
Approach Delay		42.6			63.2			6.0			3.5	
Approach LOS		D			E			A			A	

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	26 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.69
Intersection Signal Delay:	9.5
Intersection Capacity Utilization	73.2%
Analysis Period (min)	15
Intersection LOS:	A
ICU Level of Service	D

Splits and Phases: 30: Far Hills Ave & East Ave



Network Totals

Number of Intersections	10
Total Delay (hr)	90
Stops (#)	6533
Average Speed (mph)	19
Total Travel Time (hr)	205
Distance Traveled (mi)	3952
Fuel Consumed (gal)	263
Fuel Economy (mpg)	15.0
Unserved Vehicles (#)	159
Vehicles in dilemma zone (#)	389
Performance Index	108.3

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↔		↖	↕		↗	↕	
Traffic Volume (vph)	18	5	20	13	5	78	10	808	8	58	363	9
Future Volume (vph)	18	5	20	13	5	78	10	808	8	58	363	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		170	0		0	205		0	150		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.891			0.999				0.996
Flt Protected		0.962			0.993		0.950			0.950		
Satd. Flow (prot)	0	1792	1583	0	1632	0	1787	3571	0	1752	3491	0
Flt Permitted		0.689			0.955		0.459			0.311		
Satd. Flow (perm)	0	1283	1583	0	1570	0	863	3571	0	574	3491	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35				35
Link Distance (ft)		306			419			825				530
Travel Time (s)		8.3			11.4			16.1				10.3
Peak Hour Factor	0.72	0.72	0.72	0.73	0.73	0.73	0.89	0.89	0.89	0.85	0.85	0.85
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	1%	1%	1%	3%	3%	3%
Adj. Flow (vph)	25	7	28	18	7	107	11	908	9	68	427	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	28	0	132	0	11	917	0	68	438	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA	pm+ov	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	7	4	5		8		5	2				6

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	5	8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0		7.0	20.0		20.0	20.0	
Minimum Split (s)	13.0	33.0	13.0	33.0	33.0		13.0	26.0		26.0	26.0	
Total Split (s)	13.0	50.0	14.0	37.0	37.0		14.0	60.0		46.0	46.0	
Total Split (%)	11.8%	45.5%	12.7%	33.6%	33.6%		12.7%	54.5%		41.8%	41.8%	
Maximum Green (s)	7.0	44.0	8.0	31.0	31.0		8.0	54.0		40.0	40.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead		Lead	Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)		7.0		7.0	7.0			7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0			10.0		10.0	10.0	
Pedestrian Calls (#/hr)		1		1	1			2		0	0	
Act Effct Green (s)		16.1	29.1		16.1		81.9	81.9		74.1	74.1	
Actuated g/C Ratio		0.15	0.26		0.15		0.74	0.74		0.67	0.67	
v/c Ratio		0.17	0.07		0.58		0.02	0.34		0.18	0.19	
Control Delay		40.1	27.8		52.4		3.1	3.2		11.6	8.7	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		40.1	27.8		52.4		3.1	3.2		11.6	8.7	
LOS		D	C		D		A	A		B	A	
Approach Delay		34.4			52.4			3.2			9.1	
Approach LOS		C			D			A			A	

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 68 (62%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow

Natural Cycle: 85

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.58

Intersection Signal Delay: 10.2

Intersection LOS: B

Intersection Capacity Utilization 66.7%

ICU Level of Service C























Analysis Period (min) 15

Splits and Phases: 1: Far Hills Ave & Old River Trl/Springhouse Rd



Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/07/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	57	49	1	55	16	108	811	5	8	300	90
Future Volume (vph)	43	57	49	1	55	16	108	811	5	8	300	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	195		195	0		0	155		0	330		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	50			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.967			0.999				0.965
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1845	1568	1787	1819	0	1787	3571	0	1736	3350	0
Flt Permitted	0.690			0.712			0.445			0.283		
Satd. Flow (perm)	1273	1845	1568	1339	1819	0	837	3571	0	517	3350	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			25			35				35
Link Distance (ft)		1055			352			1457				825
Travel Time (s)		20.6			9.6			28.4				16.1
Peak Hour Factor	0.83	0.83	0.83	0.69	0.69	0.69	0.82	0.82	0.82	0.84	0.84	0.84
Heavy Vehicles (%)	3%	3%	3%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Adj. Flow (vph)	52	69	59	1	80	23	132	989	6	10	357	107
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	69	59	1	103	0	132	995	0	10	464	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA	pm+ov	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4	5		8		5	2		1	6	

Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/07/2023

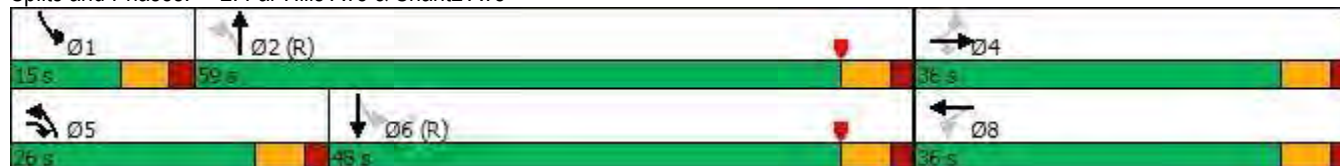


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	5	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0		7.0	20.0		7.0	20.0	
Minimum Split (s)	33.0	33.0	22.5	33.0	33.0		22.5	26.0		13.0	26.0	
Total Split (s)	36.0	36.0	26.0	36.0	36.0		26.0	59.0		15.0	48.0	
Total Split (%)	32.7%	32.7%	23.6%	32.7%	32.7%		23.6%	53.6%		13.6%	43.6%	
Maximum Green (s)	30.0	30.0	20.0	30.0	30.0		20.0	53.0		9.0	42.0	
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)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0			10.0			10.0	
Pedestrian Calls (#/hr)	2	2		1	1			2			3	
Act Effct Green (s)	14.4	14.4	28.4	14.4	14.4		83.2	81.0		76.6	69.6	
Actuated g/C Ratio	0.13	0.13	0.26	0.13	0.13		0.76	0.74		0.70	0.63	
v/c Ratio	0.31	0.29	0.15	0.01	0.43		0.19	0.38		0.02	0.22	
Control Delay	45.8	44.0	29.7	36.0	48.0		1.5	2.5		3.0	5.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	45.8	44.0	29.7	36.0	48.0		1.5	2.5		3.0	5.3	
LOS	D	D	C	D	D		A	A		A	A	
Approach Delay		39.8			47.9			2.4			5.3	
Approach LOS		D			D			A			A	

Intersection Summary












Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 78 (71%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.43
 Intersection Signal Delay: 9.2
 Intersection Capacity Utilization 52.5%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 2: Far Hills Ave & Shantz Ave



Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/07/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	88	175	929	52	77	376
Future Volume (vph)	88	175	929	52	77	376
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115	0		0	90	
Storage Lanes	1	1		0	1	
Taper Length (ft)	50				50	
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.95
Frt		0.850	0.992			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1599	3546	0	1752	3505
Flt Permitted	0.950				0.142	
Satd. Flow (perm)	1787	1599	3546	0	262	3505
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	739		822			1682
Travel Time (s)	20.2		16.0			32.8
Peak Hour Factor	0.85	0.85	0.90	0.90	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	1%	3%	3%
Adj. Flow (vph)	104	206	1032	58	85	413
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	206	1090	0	85	413
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pm+ov	NA		pm+pt	NA
Protected Phases	8	1	2		1	6

Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/07/2023

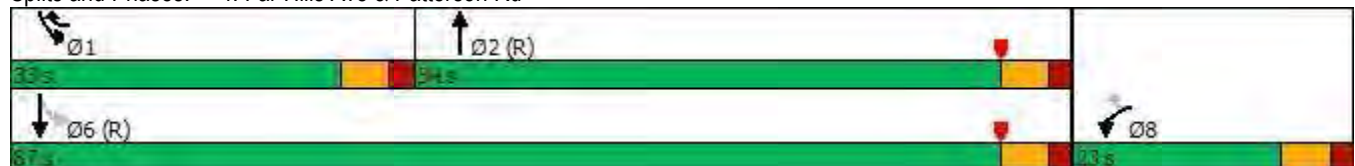


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases		8			6	
Detector Phase	8	1	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	7.0	20.0		7.0	20.0
Minimum Split (s)	22.5	33.0	26.0		33.0	26.0
Total Split (s)	23.0	33.0	54.0		33.0	87.0
Total Split (%)	20.9%	30.0%	49.1%		30.0%	79.1%
Maximum Green (s)	17.0	27.0	48.0		27.0	81.0
Yellow Time (s)	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0
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		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)		7.0	7.0		7.0	
Flash Dont Walk (s)		20.0	10.0		20.0	
Pedestrian Calls (#/hr)		137	28		137	
Act Effct Green (s)	12.3	45.3	52.7		85.7	85.7
Actuated g/C Ratio	0.11	0.41	0.48		0.78	0.78
v/c Ratio	0.52	0.31	0.64		0.15	0.15
Control Delay	55.1	22.9	9.4		7.6	2.7
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	55.1	22.9	9.4		7.6	2.7
LOS	E	C	A		A	A
Approach Delay	33.7		9.4			3.5
Approach LOS	C		A			A

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.64
 Intersection Signal Delay: 11.9
 Intersection Capacity Utilization 56.5%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 4: Far Hills Ave & Patterson Rd



Lanes, Volumes, Timings
5: Far Hills Ave & Park Ave

01/07/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	31	51	52	1018	385	24
Future Volume (vph)	31	51	52	1018	385	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	66	120			0
Storage Lanes	1	1	1			0
Taper Length (ft)	25		50			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.850			0.991	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1787	3574	3507	0
Flt Permitted	0.950		0.477			
Satd. Flow (perm)	1770	1583	897	3574	3507	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	721			826	822	
Travel Time (s)	19.7			16.1	16.0	
Peak Hour Factor	0.54	0.54	0.94	0.94	0.85	0.85
Heavy Vehicles (%)	2%	2%	1%	1%	2%	2%
Adj. Flow (vph)	57	94	55	1083	453	28
Shared Lane Traffic (%)						
Lane Group Flow (vph)	57	94	55	1083	481	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (ft)	20	20	20	100	100	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	20	20	20	6	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	

Lanes, Volumes, Timings
5: Far Hills Ave & Park Ave

01/07/2023

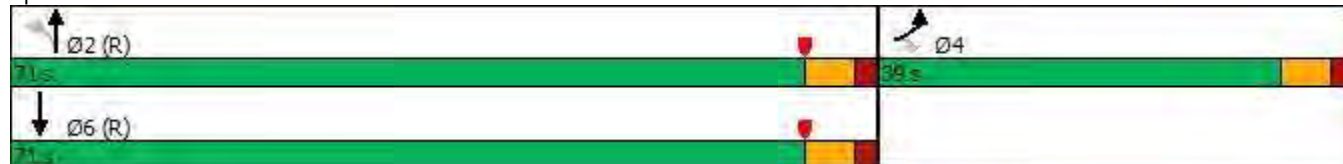


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0	20.0	20.0	
Minimum Split (s)	33.0	33.0	26.0	26.0	26.0	
Total Split (s)	39.0	39.0	71.0	71.0	71.0	
Total Split (%)	35.5%	35.5%	64.5%	64.5%	64.5%	
Maximum Green (s)	33.0	33.0	65.0	65.0	65.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
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?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	C-Max	C-Max	C-Max	
Walk Time (s)	7.0	7.0			7.0	
Flash Dont Walk (s)	20.0	20.0			10.0	
Pedestrian Calls (#/hr)	2	2			77	
Act Effct Green (s)	14.6	14.6	83.4	83.4	83.4	
Actuated g/C Ratio	0.13	0.13	0.76	0.76	0.76	
v/c Ratio	0.24	0.45	0.08	0.40	0.18	
Control Delay	42.8	49.1	1.9	2.5	4.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	42.8	49.1	1.9	2.5	4.4	
LOS	D	D	A	A	A	
Approach Delay	46.7			2.5	4.4	
Approach LOS	D			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 10 (9%), Referenced to phase 2:NBTL and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.45
 Intersection Signal Delay: 6.8
 Intersection Capacity Utilization 56.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service B

Splits and Phases: 5: Far Hills Ave & Park Ave



Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/07/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	9	19	2	976	373	9
Future Volume (vph)	9	19	2	976	373	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Frt	0.908				0.996	
Flt Protected	0.984					
Satd. Flow (prot)	1587	0	0	3574	3525	0
Flt Permitted	0.984			0.955		
Satd. Flow (perm)	1587	0	0	3413	3525	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	632			1805	826	
Travel Time (s)	17.2			35.2	16.1	
Peak Hour Factor	0.50	0.50	0.82	0.82	0.92	0.92
Heavy Vehicles (%)	7%	7%	1%	1%	2%	2%
Adj. Flow (vph)	18	38	2	1190	405	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	56	0	0	1192	415	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1		1	2	2	
Detector Template	Left		Left	Thru	Thru	
Leading Detector (ft)	20		20	100	100	
Trailing Detector (ft)	0		0	0	0	
Detector 1 Position(ft)	0		0	0	0	
Detector 1 Size(ft)	20		20	6	6	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Detector Phase	4		2	2	6	
Switch Phase						

Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/07/2023

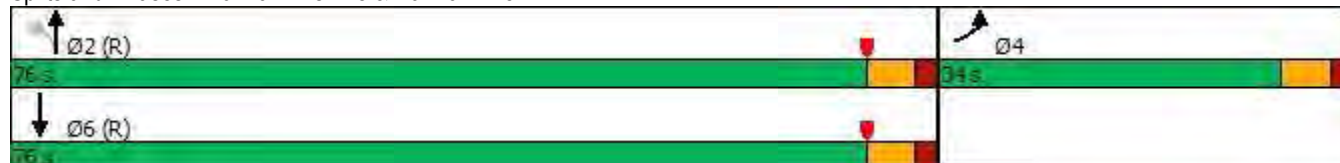


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Minimum Initial (s)	10.0		20.0	20.0	20.0	
Minimum Split (s)	33.0		26.0	26.0	26.0	
Total Split (s)	34.0		76.0	76.0	76.0	
Total Split (%)	30.9%		69.1%	69.1%	69.1%	
Maximum Green (s)	28.0		70.0	70.0	70.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	6.0			6.0	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	None		C-Max	C-Max	C-Max	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	20.0				10.0	
Pedestrian Calls (#/hr)	0				72	
Act Effct Green (s)	10.7			91.7	91.7	
Actuated g/C Ratio	0.10			0.83	0.83	
v/c Ratio	0.36			0.42	0.14	
Control Delay	53.0			0.9	0.6	
Queue Delay	0.0			0.0	0.0	
Total Delay	53.0			0.9	0.6	
LOS	D			A	A	
Approach Delay	53.0			0.9	0.6	
Approach LOS	D			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 78 (71%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.42
 Intersection Signal Delay: 2.6
 Intersection LOS: A
 Intersection Capacity Utilization 46.7%
 ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 6: Far Hills Ave & Harman Ave



Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕			↕	
Traffic Volume (vph)	16	4	6	10	2	10	6	966	18	24	389	8
Future Volume (vph)	16	4	6	10	2	10	6	966	18	24	389	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Fr _t		0.970			0.939			0.997			0.997	
Fl _t Protected		0.970			0.978						0.997	
Satd. Flow (prot)	0	1753	0	0	1711	0	0	3529	0	0	3518	0
Fl _t Permitted		0.856			0.901			0.952			0.844	
Satd. Flow (perm)	0	1547	0	0	1576	0	0	3359	0	0	2978	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		727			626			1977			1805	
Travel Time (s)		19.8			17.1			38.5			35.2	
Peak Hour Factor	0.72	0.72	0.72	0.69	0.69	0.69	0.85	0.85	0.85	0.94	0.94	0.94
Adj. Flow (vph)	22	6	8	14	3	14	7	1136	21	26	414	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	36	0	0	31	0	0	1164	0	0	449	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		20.0	20.0		20.0	20.0	

Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/07/2023

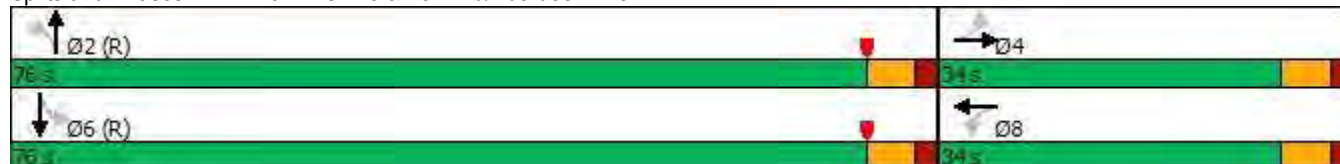


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	33.0	33.0		22.5	22.5		26.0	26.0		26.0	26.0	
Total Split (s)	34.0	34.0		34.0	34.0		76.0	76.0		76.0	76.0	
Total Split (%)	30.9%	30.9%		30.9%	30.9%		69.1%	69.1%		69.1%	69.1%	
Maximum Green (s)	28.0	28.0		28.0	28.0		70.0	70.0		70.0	70.0	
Yellow Time (s)	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	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0					7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0					10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	60	60					32	32		0	0	
Act Effct Green (s)		28.0			28.0			70.0			70.0	
Actuated g/C Ratio		0.25			0.25			0.64			0.64	
v/c Ratio		0.09			0.08			0.54			0.24	
Control Delay		32.2			32.0			3.3			8.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		32.2			32.0			3.3			8.1	
LOS		C			C			A			A	
Approach Delay		32.2			32.0			3.3			8.1	
Approach LOS		C			C			A			A	

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	44 (40%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	5.7
Intersection LOS:	A
Intersection Capacity Utilization:	49.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 21: Far Hills Ave & Park Rd/Aberdeen Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	SBL2	SBL
Lane Configurations		↕					↕		↕	↑↑	↕	
Traffic Volume (vph)	36	13	4	5	4	2	9	6	20	900	5	7
Future Volume (vph)	36	13	4	5	4	2	9	6	20	900	5	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0					0	145			85
Storage Lanes	0		0					0	1			1
Taper Length (ft)	25						25		50			50
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95
Frt		0.979					0.962					
Flt Protected		0.970					0.986		0.950		0.950	
Satd. Flow (prot)	0	1718	0	0	0	0	1716	0	1787	3574	1770	0
Flt Permitted		0.792					0.913		0.450		0.233	
Satd. Flow (perm)	0	1403	0	0	0	0	1589	0	847	3574	434	0
Right Turn on Red				No				No				
Satd. Flow (RTOR)												
Link Speed (mph)		25					25		35			
Link Distance (ft)		382					543		736			
Travel Time (s)		10.4					14.8		14.3			
Peak Hour Factor	0.69	0.69	0.69	0.69	0.66	0.66	0.66	0.66	0.89	0.89	0.93	0.93
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	1%	1%	2%	2%
Adj. Flow (vph)	52	19	6	7	6	3	14	9	22	1011	5	8
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	84	0	0	0	0	32	0	22	1011	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Right	Left	Left	Left	Right	Left	Left	Left	Left
Median Width(ft)		0					0		12			
Link Offset(ft)		0					0		0			
Crosswalk Width(ft)		16					16		16			
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	9	15	15		9	15		15	15
Number of Detectors	1	2			1	1	2		1	2	1	1
Detector Template	Left	Thru			Left	Left	Thru		Left	Thru	Left	Left
Leading Detector (ft)	20	100			20	20	100		20	100	20	20
Trailing Detector (ft)	0	0			0	0	0		0	0	0	0
Detector 1 Position(ft)	0	0			0	0	0		0	0	0	0
Detector 1 Size(ft)	20	6			20	20	6		20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94					94		94			
Detector 2 Size(ft)		6					6		6			
Detector 2 Type		Cl+Ex					Cl+Ex		Cl+Ex			
Detector 2 Channel												
Detector 2 Extend (s)		0.0					0.0		0.0			
Turn Type	Perm	NA			Perm	Perm	NA		Perm	NA	Perm	Perm
Protected Phases		4					8		2			

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	SBT	SBR	NWR	NWR2
Lane Configurations	↑↑		↵	
Traffic Volume (vph)	478	18	8	9
Future Volume (vph)	478	18	8	9
Ideal Flow (vphpl)	1900	1900	1900	1900
Storage Length (ft)		0	0	
Storage Lanes		0	1	
Taper Length (ft)				
Lane Util. Factor	0.95	0.95	1.00	1.00
Frt	0.995		0.865	
Flt Protected	0.999			
Satd. Flow (prot)	3518	0	1565	0
Flt Permitted	0.939			
Satd. Flow (perm)	3307	0	1565	0
Right Turn on Red		No		No
Satd. Flow (RTOR)				
Link Speed (mph)	35			
Link Distance (ft)	1977			
Travel Time (s)	38.5			
Peak Hour Factor	0.93	0.93	0.38	0.38
Heavy Vehicles (%)	2%	2%	5%	5%
Adj. Flow (vph)	514	19	21	24
Shared Lane Traffic (%)				
Lane Group Flow (vph)	541	0	45	0
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	Right	Right	Right
Median Width(ft)	12			
Link Offset(ft)	0			
Crosswalk Width(ft)	16			
Two way Left Turn Lane				
Headway Factor	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	9	9
Number of Detectors	2		1	
Detector Template	Thru		Right	
Leading Detector (ft)	100		20	
Trailing Detector (ft)	0		0	
Detector 1 Position(ft)	0		0	
Detector 1 Size(ft)	6		20	
Detector 1 Type	Cl+Ex		Cl+Ex	
Detector 1 Channel				
Detector 1 Extend (s)	0.0		0.0	
Detector 1 Queue (s)	0.0		0.0	
Detector 1 Delay (s)	0.0		0.0	
Detector 2 Position(ft)	94			
Detector 2 Size(ft)	6			
Detector 2 Type	Cl+Ex			
Detector 2 Channel				
Detector 2 Extend (s)	0.0			
Turn Type	NA		Perm	
Protected Phases	6			

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023

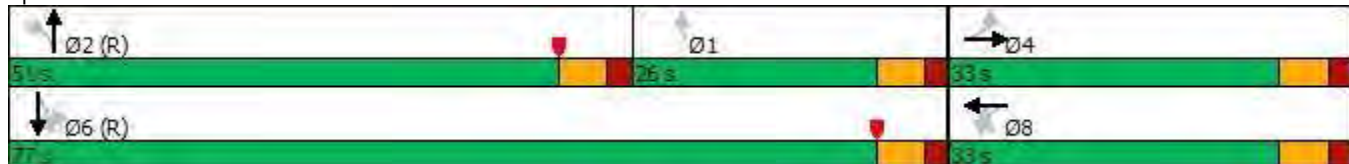


Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	SBL2	SBL
Permitted Phases	4				8	8			2		6	6
Detector Phase	4	4			8	8	8		2	2	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	10.0		20.0	20.0	20.0	20.0
Minimum Split (s)	33.0	33.0			22.5	22.5	22.5		26.0	26.0	26.0	26.0
Total Split (s)	33.0	33.0			33.0	33.0	33.0		51.0	51.0	77.0	77.0
Total Split (%)	30.0%	30.0%			30.0%	30.0%	30.0%		46.4%	46.4%	70.0%	70.0%
Maximum Green (s)	27.0	27.0			27.0	27.0	27.0		45.0	45.0	71.0	71.0
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)		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	Lead		
Lead-Lag Optimize?									Yes	Yes		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0	3.0	3.0
Recall Mode	None	None			None	None	None		C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0							7.0	7.0	7.0	7.0
Flash Dont Walk (s)	20.0	20.0							10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	12	12							18	18	8	8
Act Effct Green (s)		14.5					14.5		60.7	60.7	87.9	
Actuated g/C Ratio		0.13					0.13		0.55	0.55	0.80	
v/c Ratio		0.45					0.15		0.05	0.51	0.01	
Control Delay		50.1					40.8		5.3	8.1	8.2	
Queue Delay		0.0					0.0		0.0	0.0	0.0	
Total Delay		50.1					40.8		5.3	8.1	8.2	
LOS		D					D		A	A	A	
Approach Delay		50.1					40.8			8.0		
Approach LOS		D					D			A		

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	6 (5%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.51
Intersection Signal Delay:	10.6
Intersection LOS:	B
Intersection Capacity Utilization:	64.9%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	SBT	SBR	NWR	NWR2
Permitted Phases			1	
Detector Phase	6		1	
Switch Phase				
Minimum Initial (s)	20.0		20.0	
Minimum Split (s)	26.0		26.0	
Total Split (s)	77.0		26.0	
Total Split (%)	70.0%		23.6%	
Maximum Green (s)	71.0		20.0	
Yellow Time (s)	4.0		4.0	
All-Red Time (s)	2.0		2.0	
Lost Time Adjust (s)	0.0		0.0	
Total Lost Time (s)	6.0		6.0	
Lead/Lag			Lag	
Lead-Lag Optimize?			Yes	
Vehicle Extension (s)	3.0		3.0	
Recall Mode	C-Max		Max	
Walk Time (s)	7.0			
Flash Dont Walk (s)	10.0			
Pedestrian Calls (#/hr)	8			
Act Effct Green (s)	87.9		20.0	
Actuated g/C Ratio	0.80		0.18	
v/c Ratio	0.20		0.16	
Control Delay	5.2		39.7	
Queue Delay	0.0		0.0	
Total Delay	5.2		39.7	
LOS	A		D	
Approach Delay	5.2			
Approach LOS	A			
Intersection Summary				

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/07/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕			↘
Traffic Volume (vph)	0	0	894	0	0	495
Future Volume (vph)	0	0	894	0	0	495
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt						
Flt Protected						
Satd. Flow (prot)	0	1863	3574	0	0	3539
Flt Permitted						
Satd. Flow (perm)	0	1863	3574	0	0	3539
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	404		1004			736
Travel Time (s)	11.0		19.6			14.3
Peak Hour Factor	0.92	0.92	0.84	0.84	0.89	0.89
Heavy Vehicles (%)	2%	2%	1%	1%	2%	2%
Adj. Flow (vph)	0	0	1064	0	0	556
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	1064	0	0	556
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors		1	2			2
Detector Template		Right	Thru			Thru
Leading Detector (ft)		20	100			100
Trailing Detector (ft)		0	0			0
Detector 1 Position(ft)		0	0			0
Detector 1 Size(ft)		20	6			6
Detector 1 Type		Cl+Ex	Cl+Ex			Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)		0.0	0.0			0.0
Detector 1 Queue (s)		0.0	0.0			0.0
Detector 1 Delay (s)		0.0	0.0			0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type		Perm	NA			NA
Protected Phases			2			6
Permitted Phases		8				
Detector Phase		8	2			6
Switch Phase						

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/07/2023

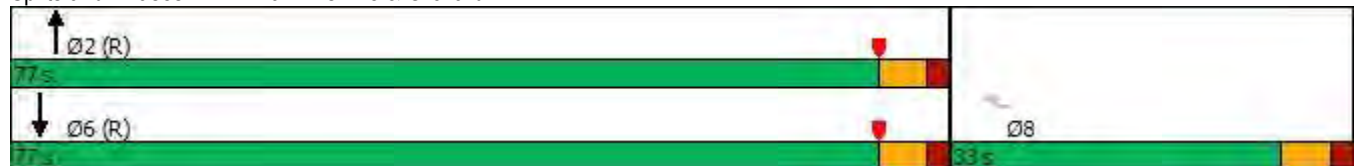


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)		10.0	20.0			20.0
Minimum Split (s)		33.0	26.0			26.0
Total Split (s)		33.0	77.0			77.0
Total Split (%)		30.0%	70.0%			70.0%
Maximum Green (s)		27.0	71.0			71.0
Yellow Time (s)		4.0	4.0			4.0
All-Red Time (s)		2.0	2.0			2.0
Lost Time Adjust (s)		0.0	0.0			0.0
Total Lost Time (s)		6.0	6.0			6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Max			C-Max
Walk Time (s)		7.0				
Flash Dont Walk (s)		20.0				
Pedestrian Calls (#/hr)		25				
Act Effct Green (s)			86.6			86.6
Actuated g/C Ratio			0.79			0.79
v/c Ratio			0.38			0.20
Control Delay			6.0			3.5
Queue Delay			0.0			0.0
Total Delay			6.0			3.5
LOS			A			A
Approach Delay			6.0			3.5
Approach LOS			A			A

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 102 (93%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.38
 Intersection Signal Delay: 5.2
 Intersection Capacity Utilization 29.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 27: Far Hills Ave & Orchard



Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

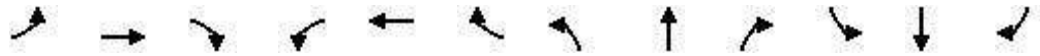
01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↔		↖	↕↔		↖	↕↔	
Traffic Volume (vph)	0	2	4	44	1	26	3	858	20	27	451	8
Future Volume (vph)	0	2	4	44	1	26	3	858	20	27	451	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		20	0		0	75		0	75		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.951			0.997			0.997	
Flt Protected					0.970		0.950			0.950		
Satd. Flow (prot)	0	1863	1583	0	1593	0	1770	3529	0	1770	3529	0
Flt Permitted					0.808		0.456			0.249		
Satd. Flow (perm)	0	1863	1583	0	1327	0	849	3529	0	464	3529	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		181			322			464			1004	
Travel Time (s)		4.9			8.8			9.0			19.6	
Peak Hour Factor	0.50	0.50	0.50	0.68	0.68	0.68	0.83	0.83	0.83	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	10%	10%	10%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	0	4	8	65	1	38	4	1034	24	31	518	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	8	0	104	0	4	1058	0	31	527	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type		NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/07/2023

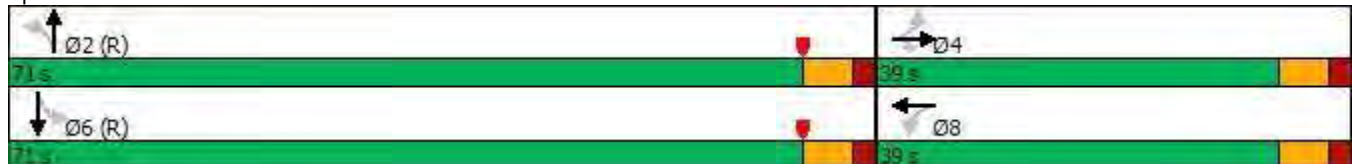


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	22.5	22.5	22.5	33.0	33.0		26.0	26.0		26.0	26.0	
Total Split (s)	39.0	39.0	39.0	39.0	39.0		71.0	71.0		71.0	71.0	
Total Split (%)	35.5%	35.5%	35.5%	35.5%	35.5%		64.5%	64.5%		64.5%	64.5%	
Maximum Green (s)	33.0	33.0	33.0	33.0	33.0		65.0	65.0		65.0	65.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				20.0	20.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)				4	4		8	8		3	3	
Act Effct Green (s)		15.7	15.7		15.7		82.3	82.3		82.3	82.3	
Actuated g/C Ratio		0.14	0.14		0.14		0.75	0.75		0.75	0.75	
v/c Ratio		0.02	0.04		0.55		0.01	0.40		0.09	0.20	
Control Delay		35.5	36.2		53.4		5.7	6.2		0.9	0.7	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		35.5	36.2		53.4		5.7	6.2		0.9	0.7	
LOS		D	D		D		A	A		A	A	
Approach Delay		36.0			53.4			6.2			0.7	
Approach LOS		D			D			A			A	

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	8 (7%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.55
Intersection Signal Delay:	7.5
Intersection LOS:	A
Intersection Capacity Utilization:	48.3%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 30: Far Hills Ave & East Ave



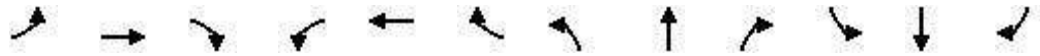
Network Totals

Number of Intersections	9
Total Delay (hr)	27
Stops (#)	3895
Average Speed (mph)	27
Total Travel Time (hr)	119
Distance Traveled (mi)	3186
Fuel Consumed (gal)	169
Fuel Economy (mpg)	18.9
Unserviced Vehicles (#)	0
Vehicles in dilemma zone (#)	349
Performance Index	37.8

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	6	45	14	13	60	91	509	16	115	920	20
Future Volume (vph)	8	6	45	14	13	60	91	509	16	115	920	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		170	0		0	205		0	150		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.908			0.995			0.997	
Flt Protected		0.971			0.992		0.950			0.950		
Satd. Flow (prot)	0	1809	1583	0	1694	0	1770	3522	0	1787	3564	0
Flt Permitted		0.859			0.945		0.220			0.415		
Satd. Flow (perm)	0	1600	1583	0	1614	0	410	3522	0	781	3564	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		306			419			825			530	
Travel Time (s)		8.3			11.4			16.1			10.3	
Peak Hour Factor	0.82	0.82	0.82	0.95	0.95	0.95	0.84	0.84	0.84	0.91	0.91	0.91
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	10	7	55	15	14	63	108	606	19	126	1011	22
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	55	0	92	0	108	625	0	126	1033	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	pm+ov	Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	7	4	5		8		5	2			6	

Lanes, Volumes, Timings

1: Far Hills Ave & Old River Trl/Springhouse Rd

01/07/2023

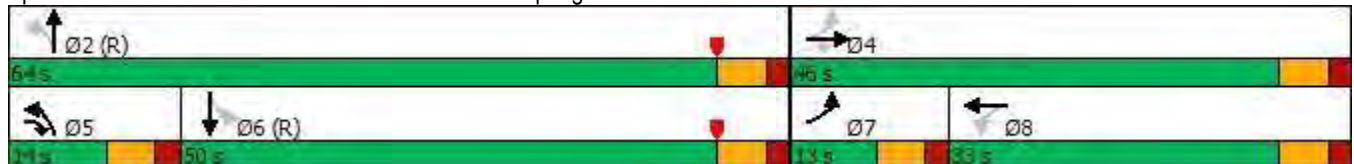


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	5	8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0		7.0	20.0		20.0	20.0	
Minimum Split (s)	13.0	33.0	13.0	33.0	33.0		13.0	26.0		26.0	26.0	
Total Split (s)	13.0	46.0	14.0	33.0	33.0		14.0	64.0		50.0	50.0	
Total Split (%)	11.8%	41.8%	12.7%	30.0%	30.0%		12.7%	58.2%		45.5%	45.5%	
Maximum Green (s)	7.0	40.0	8.0	27.0	27.0		8.0	58.0		44.0	44.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag	Lead		Lead	Lag	Lag		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes		Yes	Yes	Yes		Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)		7.0		7.0	7.0			7.0		7.0	7.0	
Flash Dont Walk (s)		20.0		20.0	20.0			10.0		10.0	10.0	
Pedestrian Calls (#/hr)		2		0	0			0		3	3	
Act Effct Green (s)		14.4	24.5		14.4		86.8	88.0		73.5	73.5	
Actuated g/C Ratio		0.13	0.22		0.13		0.79	0.80		0.67	0.67	
v/c Ratio		0.08	0.16		0.44		0.26	0.22		0.24	0.43	
Control Delay		39.1	30.6		48.8		5.8	3.9		11.5	11.1	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		39.1	30.6		48.8		5.8	3.9		11.5	11.1	
LOS		D	C		D		A	A		B	B	
Approach Delay		32.6			48.8			4.2			11.1	
Approach LOS		C			D			A			B	

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	48 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.44
Intersection Signal Delay:	11.1
Intersection LOS:	B
Intersection Capacity Utilization:	60.1%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 1: Far Hills Ave & Old River Trl/Springhouse Rd



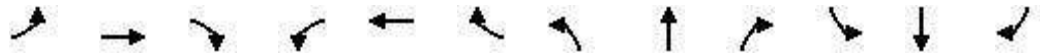
Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/07/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	96	120	5	77	12	55	530	10	21	780	68
Future Volume (vph)	96	96	120	5	77	12	55	530	10	21	780	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	195		195	0		0	155		0	330		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	50			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.980			0.997				0.988
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1787	1881	1599	1787	1844	0	1770	3529	0	1787	3531	0
Flt Permitted	0.683			0.653			0.239			0.367		
Satd. Flow (perm)	1285	1881	1599	1228	1844	0	445	3529	0	690	3531	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			25			35				35
Link Distance (ft)		1055			352			1457				825
Travel Time (s)		20.6			9.6			28.4				16.1
Peak Hour Factor	0.80	0.80	0.80	0.81	0.81	0.81	0.72	0.72	0.72	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	120	120	150	6	95	15	76	736	14	24	876	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	120	120	150	6	110	0	76	750	0	24	952	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA	pm+ov	Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4	5		8		5	2		1	6	

Lanes, Volumes, Timings
2: Far Hills Ave & Shantz Ave

01/07/2023

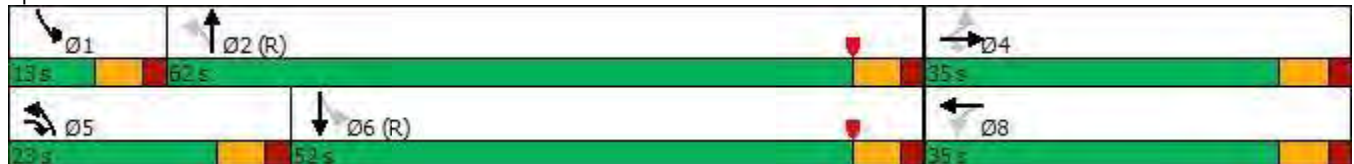


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	5	8	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	7.0	10.0	10.0		7.0	20.0		7.0	20.0	
Minimum Split (s)	33.0	33.0	22.5	33.0	33.0		22.5	26.0		13.0	26.0	
Total Split (s)	35.0	35.0	23.0	35.0	35.0		23.0	62.0		13.0	52.0	
Total Split (%)	31.8%	31.8%	20.9%	31.8%	31.8%		20.9%	56.4%		11.8%	47.3%	
Maximum Green (s)	29.0	29.0	17.0	29.0	29.0		17.0	56.0		7.0	46.0	
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)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	
Flash Dont Walk (s)	20.0	20.0		20.0	20.0			10.0			10.0	
Pedestrian Calls (#/hr)	1	1		1	1			1			1	
Act Effct Green (s)	16.7	16.7	30.2	16.7	16.7		79.3	76.1		74.8	67.8	
Actuated g/C Ratio	0.15	0.15	0.27	0.15	0.15		0.72	0.69		0.68	0.62	
v/c Ratio	0.62	0.42	0.34	0.03	0.39		0.19	0.31		0.04	0.44	
Control Delay	55.8	45.0	32.7	35.4	44.4		4.0	4.4		4.1	7.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	55.8	45.0	32.7	35.4	44.4		4.0	4.4		4.1	7.1	
LOS	E	D	C	D	D		A	A		A	A	
Approach Delay		43.6			43.9			4.3			7.1	
Approach LOS		D			D			A			A	

Intersection Summary












Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	48 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.62
Intersection Signal Delay:	14.1
Intersection LOS:	B
Intersection Capacity Utilization:	56.5%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 2: Far Hills Ave & Shantz Ave



Lanes, Volumes, Timings
4: Far Hills Ave & Patterson Rd

01/07/2023

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	61	109	638	96	206	957
Future Volume (vph)	61	109	638	96	206	957
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	115	0		0	90	
Storage Lanes	1	1		0	1	
Taper Length (ft)	50				50	
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.95
Frt		0.850	0.980			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1599	3468	0	1787	3574
Flt Permitted	0.950				0.260	
Satd. Flow (perm)	1787	1599	3468	0	489	3574
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	739		822			1682
Travel Time (s)	20.2		16.0			32.8
Peak Hour Factor	0.80	0.80	0.82	0.82	0.88	0.88
Heavy Vehicles (%)	1%	1%	2%	2%	1%	1%
Adj. Flow (vph)	76	136	778	117	234	1088
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	136	895	0	234	1088
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pm+ov	NA		pm+pt	NA
Protected Phases	8	1	2		1	6

Lanes, Volumes, Timings

4: Far Hills Ave & Patterson Rd

01/07/2023

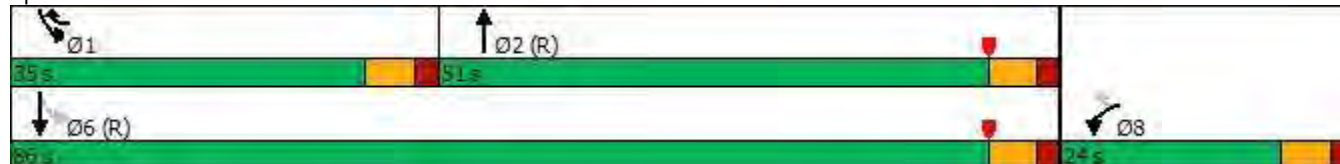


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases		8			6	
Detector Phase	8	1	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	7.0	20.0		7.0	20.0
Minimum Split (s)	22.5	33.0	26.0		33.0	26.0
Total Split (s)	24.0	35.0	51.0		35.0	86.0
Total Split (%)	21.8%	31.8%	46.4%		31.8%	78.2%
Maximum Green (s)	18.0	29.0	45.0		29.0	80.0
Yellow Time (s)	4.0	4.0	4.0		4.0	4.0
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0
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		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)		7.0	7.0		7.0	
Flash Dont Walk (s)		20.0	10.0		20.0	
Pedestrian Calls (#/hr)		9	3		9	
Act Effct Green (s)	11.1	26.4	71.6		90.1	91.3
Actuated g/C Ratio	0.10	0.24	0.65		0.82	0.83
v/c Ratio	0.42	0.36	0.40		0.43	0.37
Control Delay	53.5	34.2	3.3		6.9	2.6
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	53.5	34.2	3.3		6.9	2.6
LOS	D	C	A		A	A
Approach Delay	41.1		3.3			3.3
Approach LOS	D		A			A

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 98 (89%), Referenced to phase 2:NBT and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.43
 Intersection Signal Delay: 6.6
 Intersection Capacity Utilization 55.4%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service B

Splits and Phases: 4: Far Hills Ave & Patterson Rd



Lanes, Volumes, Timings
5: Far Hills Ave & Park Ave

01/07/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	21	16	24	690	1096	10
Future Volume (vph)	21	16	24	690	1096	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	66	120			0
Storage Lanes	1	1	1			0
Taper Length (ft)	25		50			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95
Frt		0.850			0.999	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1787	3574	3571	0
Flt Permitted	0.950		0.206			
Satd. Flow (perm)	1770	1583	388	3574	3571	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	721			826	822	
Travel Time (s)	19.7			16.1	16.0	
Peak Hour Factor	0.66	0.66	0.91	0.91	0.88	0.88
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	32	24	26	758	1245	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	24	26	758	1256	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	
Detector Template	Left	Right	Left	Thru	Thru	
Leading Detector (ft)	20	20	20	100	100	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	20	20	20	6	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	

Lanes, Volumes, Timings
5: Far Hills Ave & Park Ave

01/07/2023

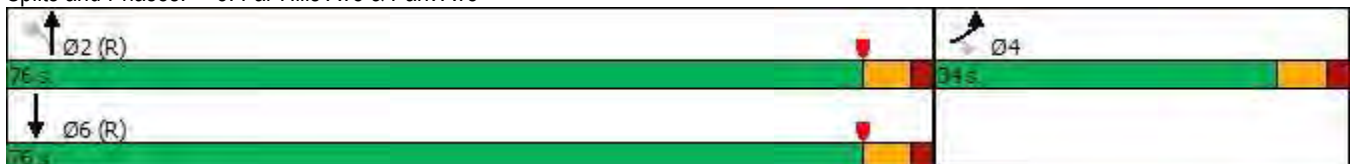


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0	20.0	20.0	
Minimum Split (s)	33.0	33.0	26.0	26.0	26.0	
Total Split (s)	34.0	34.0	76.0	76.0	76.0	
Total Split (%)	30.9%	30.9%	69.1%	69.1%	69.1%	
Maximum Green (s)	28.0	28.0	70.0	70.0	70.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	
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?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	C-Max	C-Max	C-Max	
Walk Time (s)	7.0	7.0			7.0	
Flash Dont Walk (s)	20.0	20.0			10.0	
Pedestrian Calls (#/hr)	5	5			8	
Act Effct Green (s)	13.4	13.4	93.4	93.4	93.4	
Actuated g/C Ratio	0.12	0.12	0.85	0.85	0.85	
v/c Ratio	0.15	0.12	0.08	0.25	0.41	
Control Delay	42.0	41.4	3.5	2.4	2.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	42.0	41.4	3.5	2.4	2.6	
LOS	D	D	A	A	A	
Approach Delay	41.7			2.4	2.6	
Approach LOS	D			A	A	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 4 (4%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.41
 Intersection Signal Delay: 3.5
 Intersection Capacity Utilization 48.9%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 5: Far Hills Ave & Park Ave



Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/07/2023



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	8	20	3	738	1261	7
Future Volume (vph)	8	20	3	738	1261	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Flt	0.902				0.999	
Flt Protected	0.986					
Satd. Flow (prot)	1657	0	0	3574	3571	0
Flt Permitted	0.986			0.951		
Satd. Flow (perm)	1657	0	0	3399	3571	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	25			35	35	
Link Distance (ft)	632			1805	826	
Travel Time (s)	17.2			35.2	16.1	
Peak Hour Factor	0.78	0.78	0.92	0.92	0.90	0.90
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	10	26	3	802	1401	8
Shared Lane Traffic (%)						
Lane Group Flow (vph)	36	0	0	805	1409	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1		1	2	2	
Detector Template	Left		Left	Thru	Thru	
Leading Detector (ft)	20		20	100	100	
Trailing Detector (ft)	0		0	0	0	
Detector 1 Position(ft)	0		0	0	0	
Detector 1 Size(ft)	20		20	6	6	
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Detector Phase	4		2	2	6	
Switch Phase						

Lanes, Volumes, Timings
6: Far Hills Ave & Harman Ave

01/07/2023

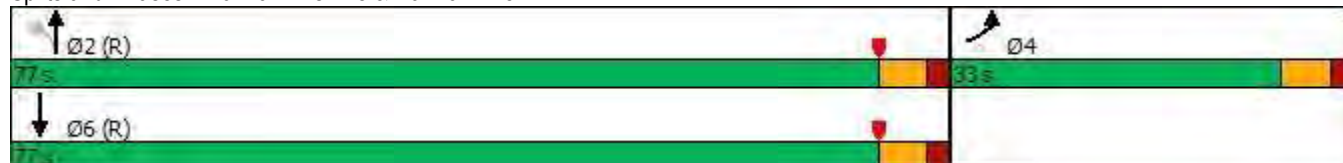


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Minimum Initial (s)	10.0		20.0	20.0	20.0	
Minimum Split (s)	33.0		26.0	26.0	26.0	
Total Split (s)	33.0		77.0	77.0	77.0	
Total Split (%)	30.0%		70.0%	70.0%	70.0%	
Maximum Green (s)	27.0		71.0	71.0	71.0	
Yellow Time (s)	4.0		4.0	4.0	4.0	
All-Red Time (s)	2.0		2.0	2.0	2.0	
Lost Time Adjust (s)	0.0			0.0	0.0	
Total Lost Time (s)	6.0			6.0	6.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Recall Mode	None		C-Max	C-Max	C-Max	
Walk Time (s)	7.0				7.0	
Flash Dont Walk (s)	20.0				10.0	
Pedestrian Calls (#/hr)	9				4	
Act Effect Green (s)	13.4			93.4	93.4	
Actuated g/C Ratio	0.12			0.85	0.85	
v/c Ratio	0.18			0.28	0.46	
Control Delay	42.7			3.4	4.1	
Queue Delay	0.0			0.0	0.0	
Total Delay	42.7			3.4	4.1	
LOS	D			A	A	
Approach Delay	42.7			3.4	4.1	
Approach LOS	D			A	A	

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	2 (2%), Referenced to phase 2:NBTL and 6:SBT, Start of Yellow
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.46
Intersection Signal Delay:	4.5
Intersection LOS:	A
Intersection Capacity Utilization:	53.4%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 6: Far Hills Ave & Harman Ave



Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕			↕	
Traffic Volume (vph)	13	1	11	6	1	4	9	714	15	6	1190	11
Future Volume (vph)	13	1	11	6	1	4	9	714	15	6	1190	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Fr _t		0.941			0.949			0.997			0.999	
Fl _t Protected		0.974			0.973			0.999				
Satd. Flow (prot)	0	1707	0	0	1720	0	0	3560	0	0	3536	0
Fl _t Permitted		0.885			0.896			0.931			0.951	
Satd. Flow (perm)	0	1551	0	0	1584	0	0	3318	0	0	3362	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35			35	
Link Distance (ft)		727			626			1977			1805	
Travel Time (s)		19.8			17.1			38.5			35.2	
Peak Hour Factor	0.78	0.78	0.78	0.69	0.69	0.69	0.90	0.90	0.90	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	2%	2%	2%
Adj. Flow (vph)	17	1	14	9	1	6	10	793	17	7	1368	13
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	0	0	16	0	0	820	0	0	1388	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												

Lanes, Volumes, Timings
 21: Far Hills Ave & Park Rd/Aberdeen Ave

01/07/2023

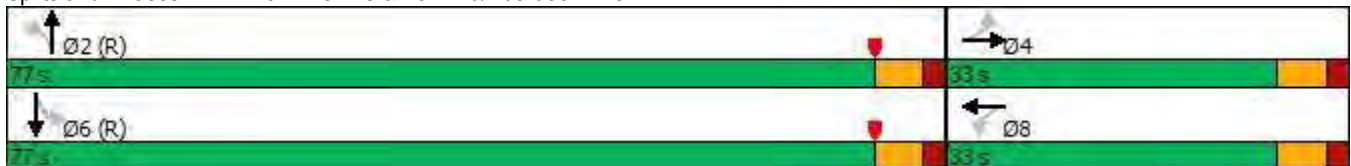


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	10.0	10.0		10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	33.0	33.0		22.5	22.5		26.0	26.0		26.0	26.0	
Total Split (s)	33.0	33.0		33.0	33.0		77.0	77.0		77.0	77.0	
Total Split (%)	30.0%	30.0%		30.0%	30.0%		70.0%	70.0%		70.0%	70.0%	
Maximum Green (s)	27.0	27.0		27.0	27.0		71.0	71.0		71.0	71.0	
Yellow Time (s)	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	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		Max	Max		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0					7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	20.0	20.0					10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	12	12					0	0		13	13	
Act Effct Green (s)		27.0			27.0			71.0			71.0	
Actuated g/C Ratio		0.25			0.25			0.65			0.65	
v/c Ratio		0.08			0.04			0.38			0.64	
Control Delay		32.8			32.2			3.9			8.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		32.8			32.2			3.9			8.1	
LOS		C			C			A			A	
Approach Delay		32.8			32.2			3.9			8.1	
Approach LOS		C			C			A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 30 (27%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.64
 Intersection Signal Delay: 7.1
 Intersection LOS: A
 Intersection Capacity Utilization 55.8%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 21: Far Hills Ave & Park Rd/Aberdeen Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2
Lane Configurations		↕					↕		↕	↑↑		↕
Traffic Volume (vph)	41	17	12	4	2	4	13	4	8	634	2	8
Future Volume (vph)	41	17	12	4	2	4	13	4	8	634	2	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0				0		145		0	
Storage Lanes	0		0				0		1		0	
Taper Length (ft)	25						25		50			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.970					0.977					
Flt Protected		0.973					0.987		0.950			0.950
Satd. Flow (prot)	0	1758	0	0	0	0	1621	0	1787	3574	0	1787
Flt Permitted		0.809					0.923		0.568			0.347
Satd. Flow (perm)	0	1462	0	0	0	0	1516	0	1069	3574	0	653
Right Turn on Red				No				No				
Satd. Flow (RTOR)												
Link Speed (mph)		25					25			35		
Link Distance (ft)		382					543			736		
Travel Time (s)		10.4					14.8			14.3		
Peak Hour Factor	0.77	0.77	0.77	0.77	0.64	0.64	0.64	0.64	0.93	0.93	0.93	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	13%	13%	13%	13%	1%	1%	1%	1%
Adj. Flow (vph)	53	22	16	5	3	6	20	6	9	682	2	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	96	0	0	0	0	35	0	9	684	0	9
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Right	Left	Left	Left	Right	Left	Left	Right	Left
Median Width(ft)		0					0			12		
Link Offset(ft)		0					0			0		
Crosswalk Width(ft)		16					16			16		
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	9	15	15		9	15		9	15
Number of Detectors	1	2			1	1	2		1	2		1
Detector Template	Left	Thru			Left	Left	Thru		Left	Thru		Left
Leading Detector (ft)	20	100			20	20	100		20	100		20
Trailing Detector (ft)	0	0			0	0	0		0	0		0
Detector 1 Position(ft)	0	0			0	0	0		0	0		0
Detector 1 Size(ft)	20	6			20	20	6		20	6		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0		0.0	0.0		0.0
Detector 2 Position(ft)		94					94			94		
Detector 2 Size(ft)		6					6			6		
Detector 2 Type		Cl+Ex					Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)		0.0					0.0			0.0		
Turn Type	Perm	NA			Perm	Perm	NA		Perm	NA		Perm
Protected Phases		4					8			2		

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	SBT	SBR	NWR	NWR2
Lane Configurations	↑↑		↵	
Traffic Volume (vph)	262	10	50	25
Future Volume (vph)	262	10	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900
Storage Length (ft)		0	0	
Storage Lanes		0	1	
Taper Length (ft)				
Lane Util. Factor	0.95	0.95	1.00	1.00
Frt	0.995		0.865	
Flt Protected				
Satd. Flow (prot)	3556	0	1611	0
Flt Permitted				
Satd. Flow (perm)	3556	0	1611	0
Right Turn on Red		No		No
Satd. Flow (RTOR)				
Link Speed (mph)	35			
Link Distance (ft)	1977			
Travel Time (s)	38.5			
Peak Hour Factor	0.90	0.90	0.72	0.72
Heavy Vehicles (%)	1%	1%	2%	2%
Adj. Flow (vph)	291	11	69	35
Shared Lane Traffic (%)				
Lane Group Flow (vph)	302	0	104	0
Enter Blocked Intersection	No	No	No	No
Lane Alignment	Left	Right	Right	Right
Median Width(ft)	12			
Link Offset(ft)	0			
Crosswalk Width(ft)	16			
Two way Left Turn Lane				
Headway Factor	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	9	9
Number of Detectors	2		1	
Detector Template	Thru		Right	
Leading Detector (ft)	100		20	
Trailing Detector (ft)	0		0	
Detector 1 Position(ft)	0		0	
Detector 1 Size(ft)	6		20	
Detector 1 Type	Cl+Ex		Cl+Ex	
Detector 1 Channel				
Detector 1 Extend (s)	0.0		0.0	
Detector 1 Queue (s)	0.0		0.0	
Detector 1 Delay (s)	0.0		0.0	
Detector 2 Position(ft)	94			
Detector 2 Size(ft)	6			
Detector 2 Type	Cl+Ex			
Detector 2 Channel				
Detector 2 Extend (s)	0.0			
Turn Type	NA		Perm	
Protected Phases	6			

Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023

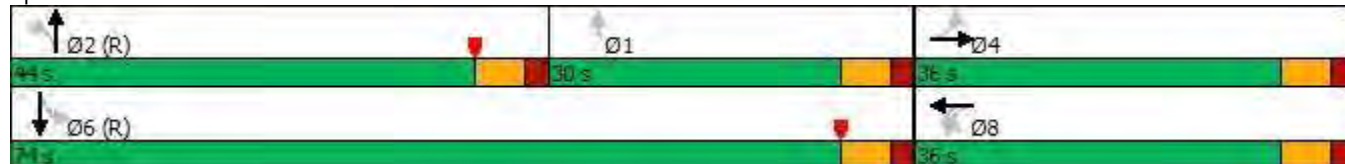


Lane Group	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2
Permitted Phases	4				8	8			2			6
Detector Phase	4	4			8	8	8		2	2		6
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	10.0		20.0	20.0		20.0
Minimum Split (s)	33.0	33.0			22.5	22.5	22.5		26.0	26.0		26.0
Total Split (s)	36.0	36.0			36.0	36.0	36.0		44.0	44.0		74.0
Total Split (%)	32.7%	32.7%			32.7%	32.7%	32.7%		40.0%	40.0%		67.3%
Maximum Green (s)	30.0	30.0			30.0	30.0	30.0		38.0	38.0		68.0
Yellow Time (s)	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
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	Lead		
Lead-Lag Optimize?									Yes	Yes		
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0		3.0	3.0		3.0
Recall Mode	None	None			None	None	None		C-Max	C-Max		C-Max
Walk Time (s)	7.0	7.0							7.0	7.0		7.0
Flash Dont Walk (s)	20.0	20.0							10.0	10.0		10.0
Pedestrian Calls (#/hr)	25	25							20	20		0
Act Effct Green (s)		20.2					20.2		51.0	51.0		82.2
Actuated g/C Ratio		0.18					0.18		0.46	0.46		0.75
v/c Ratio		0.36					0.13		0.02	0.41		0.02
Control Delay		40.6					34.8		14.2	16.4		13.0
Queue Delay		0.0					0.0		0.0	0.0		0.0
Total Delay		40.6					34.8		14.2	16.4		13.0
LOS		D					C		B	B		B
Approach Delay		40.6					34.8			16.3		
Approach LOS		D					C			B		

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 102 (93%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.41
 Intersection Signal Delay: 19.0
 Intersection Capacity Utilization 57.6%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service B

Splits and Phases: 26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave



Lanes, Volumes, Timings

26: Far Hills Ave & Peach Orchard Rd/Peach Orchard Ave

01/07/2023



Lane Group	SBT	SBR	NWR	NWR2
Permitted Phases			1	
Detector Phase	6		1	
Switch Phase				
Minimum Initial (s)	20.0		20.0	
Minimum Split (s)	26.0		26.0	
Total Split (s)	74.0		30.0	
Total Split (%)	67.3%		27.3%	
Maximum Green (s)	68.0		24.0	
Yellow Time (s)	4.0		4.0	
All-Red Time (s)	2.0		2.0	
Lost Time Adjust (s)	0.0		0.0	
Total Lost Time (s)	6.0		6.0	
Lead/Lag			Lag	
Lead-Lag Optimize?			Yes	
Vehicle Extension (s)	3.0		3.0	
Recall Mode	C-Max		Max	
Walk Time (s)	7.0			
Flash Dont Walk (s)	10.0			
Pedestrian Calls (#/hr)	0			
Act Effct Green (s)	82.2		24.0	
Actuated g/C Ratio	0.75		0.22	
v/c Ratio	0.11		0.30	
Control Delay	9.7		38.7	
Queue Delay	0.0		0.0	
Total Delay	9.7		38.7	
LOS	A		D	
Approach Delay	9.8			
Approach LOS	A			
Intersection Summary				

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/07/2023



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↗	↕			↘
Traffic Volume (vph)	0	0	771	0	0	1023
Future Volume (vph)	0	0	771	0	0	1023
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt						
Flt Protected						
Satd. Flow (prot)	0	1863	3574	0	0	3574
Flt Permitted						
Satd. Flow (perm)	0	1863	3574	0	0	3574
Right Turn on Red		No		No		
Satd. Flow (RTOR)						
Link Speed (mph)	25		35			35
Link Distance (ft)	404		1004			736
Travel Time (s)	11.0		19.6			14.3
Peak Hour Factor	0.92	0.92	0.93	0.93	0.89	0.89
Heavy Vehicles (%)	2%	2%	1%	1%	1%	1%
Adj. Flow (vph)	0	0	829	0	0	1149
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	829	0	0	1149
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors		1	2			2
Detector Template		Right	Thru			Thru
Leading Detector (ft)		20	100			100
Trailing Detector (ft)		0	0			0
Detector 1 Position(ft)		0	0			0
Detector 1 Size(ft)		20	6			6
Detector 1 Type		Cl+Ex	Cl+Ex			Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)		0.0	0.0			0.0
Detector 1 Queue (s)		0.0	0.0			0.0
Detector 1 Delay (s)		0.0	0.0			0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type		Perm	NA			NA
Protected Phases			2			6
Permitted Phases		8				
Detector Phase		8	2			6
Switch Phase						

Lanes, Volumes, Timings
27: Far Hills Ave & Orchard

01/07/2023

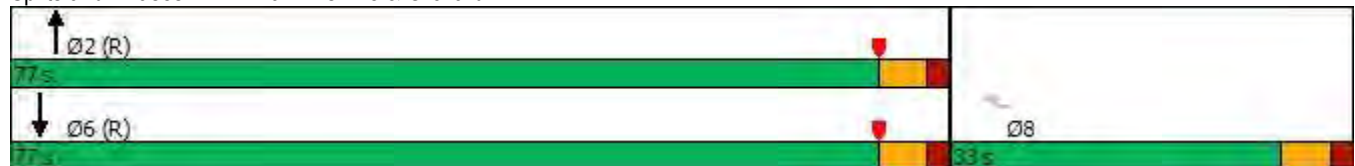


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)		10.0	20.0			20.0
Minimum Split (s)		33.0	26.0			26.0
Total Split (s)		33.0	77.0			77.0
Total Split (%)		30.0%	70.0%			70.0%
Maximum Green (s)		27.0	71.0			71.0
Yellow Time (s)		4.0	4.0			4.0
All-Red Time (s)		2.0	2.0			2.0
Lost Time Adjust (s)		0.0	0.0			0.0
Total Lost Time (s)		6.0	6.0			6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Max			C-Max
Walk Time (s)		7.0				
Flash Dont Walk (s)		20.0				
Pedestrian Calls (#/hr)		5				
Act Effct Green (s)			102.2			102.2
Actuated g/C Ratio			0.93			0.93
v/c Ratio			0.25			0.35
Control Delay			2.2			2.4
Queue Delay			0.0			0.0
Total Delay			2.2			2.4
LOS			A			A
Approach Delay			2.2			2.4
Approach LOS			A			A

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	90 (82%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow
Natural Cycle:	60
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.35
Intersection Signal Delay:	2.3
Intersection LOS:	A
Intersection Capacity Utilization:	33.3%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 27: Far Hills Ave & Orchard



Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

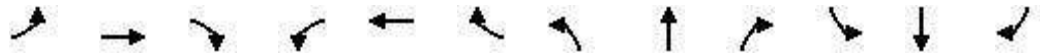
01/07/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↔		↖	↕		↗	↕	
Traffic Volume (vph)	14	11	27	59	10	38	40	735	45	71	999	36
Future Volume (vph)	14	11	27	59	10	38	40	735	45	71	999	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		20	0		0	75		0	75		0
Storage Lanes	0		1	0		0	1		0	1		0
Taper Length (ft)	25			25			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt			0.850		0.952			0.991				0.995
Flt Protected		0.973			0.973		0.950			0.950		
Satd. Flow (prot)	0	1812	1583	0	1725	0	1787	3542	0	1787	3556	0
Flt Permitted		0.815			0.811		0.237			0.318		
Satd. Flow (perm)	0	1518	1583	0	1438	0	446	3542	0	598	3556	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		25			25			35				35
Link Distance (ft)		181			322			464				1004
Travel Time (s)		4.9			8.8			9.0				19.6
Peak Hour Factor	0.77	0.77	0.77	0.72	0.72	0.72	0.92	0.92	0.92	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Adj. Flow (vph)	18	14	35	82	14	53	43	799	49	75	1052	38
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	35	0	149	0	43	848	0	75	1090	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway 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
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2				6

Lanes, Volumes, Timings
30: Far Hills Ave & East Ave

01/07/2023

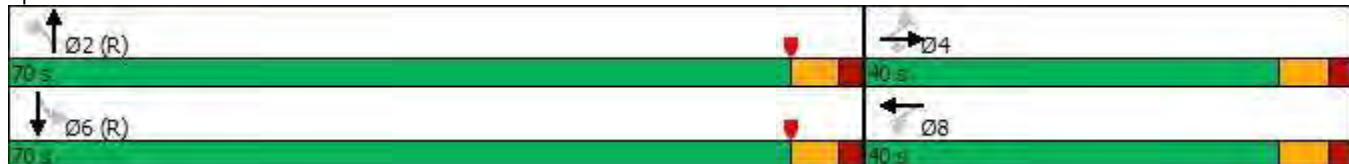


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8			2			6		
Detector Phase	4	4	4	8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0		20.0	20.0		20.0	20.0	
Minimum Split (s)	22.5	22.5	22.5	33.0	33.0		26.0	26.0		26.0	26.0	
Total Split (s)	40.0	40.0	40.0	40.0	40.0		70.0	70.0		70.0	70.0	
Total Split (%)	36.4%	36.4%	36.4%	36.4%	36.4%		63.6%	63.6%		63.6%	63.6%	
Maximum Green (s)	34.0	34.0	34.0	34.0	34.0		64.0	64.0		64.0	64.0	
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)		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0	6.0		6.0		6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				20.0	20.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)				2	2		0	0		5	5	
Act Effct Green (s)		17.4	17.4		17.4		80.6	80.6		80.6	80.6	
Actuated g/C Ratio		0.16	0.16		0.16		0.73	0.73		0.73	0.73	
v/c Ratio		0.13	0.14		0.66		0.13	0.33		0.17	0.42	
Control Delay		37.9	38.0		56.0		7.1	6.2		2.9	3.2	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		37.9	38.0		56.0		7.1	6.2		2.9	3.2	
LOS		D	D		E		A	A		A	A	
Approach Delay		38.0			56.0			6.3			3.2	
Approach LOS		D			E			A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Yellow
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.66
 Intersection Signal Delay: 8.9
 Intersection Capacity Utilization 73.2%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 30: Far Hills Ave & East Ave



Network Totals

Number of Intersections	9
Total Delay (hr)	36
Stops (#)	4526
Average Speed (mph)	26
Total Travel Time (hr)	146
Distance Traveled (mi)	3824
Fuel Consumed (gal)	204
Fuel Economy (mpg)	18.7
Unserviced Vehicles (#)	0
Vehicles in dilemma zone (#)	452
Performance Index	48.7

Intersection						
Intersection Delay, s/veh	13.4					
Intersection LOS	B					
Approach	EB		WB		SE	
Entry Lanes	2		1		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	368		1246		155	
Demand Flow Rate, veh/h	386		1271		161	
Vehicles Circulating, veh/h	161		0		951	
Vehicles Exiting, veh/h	951		547		0	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	20		0		0	
Ped Cap Adj	0.980		1.000		1.000	
Approach Delay, s/veh	5.8		16.3		8.4	
Approach LOS	A		C		A	
Lane	Left	Right	Left	Bypass	Left	Right
Designated Moves	LT	TR	T	R	L	LTR
Assumed Moves	LT	TR	T	R	L	LTR
RT Channelized	Free					
Lane Util	0.469	0.531	1.000		0.528	0.472
Critical Headway, s	4.293	4.113	4.113		4.293	4.113
Entry Flow, veh/h	181	205	951	320	85	76
Cap Entry Lane, veh/h	1001	1010	1130	1938	554	581
Entry HV Adj Factor	0.955	0.950	0.980	0.980	0.966	0.959
Flow Entry, veh/h	173	195	932	314	82	73
Cap Entry, veh/h	937	940	1108	1900	535	557
V/C Ratio	0.184	0.207	0.842	0.165	0.154	0.131
Control Delay, s/veh	5.6	5.9	21.8	0.0	8.7	8.1
LOS	A	A	C	A	A	A
95th %tile Queue, veh	1	1	11	1	1	0

Intersection						
Intersection Delay, s/veh	8.8					
Intersection LOS	A					
Approach	EB		WB		NB	SB
Entry Lanes	2		2		1	1
Conflicting Circle Lanes	2		2		2	2
Adj Approach Flow, veh/h	549		1211		36	25
Demand Flow Rate, veh/h	576		1223		36	25
Vehicles Circulating, veh/h	0		31		562	1216
Vehicles Exiting, veh/h	1241		567		14	38
Follow-Up Headway, s	3.186		3.186		3.186	3.186
Ped Vol Crossing Leg, #/h	18		1		0	57
Ped Cap Adj	0.979		0.999		1.000	1.000
Approach Delay, s/veh	5.9		10.2		5.2	8.1
Approach LOS	A		B		A	A
Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	R
Assumed Moves	LT	TR	LT	TR	LTR	R
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Critical Headway, s	4.293	4.113	4.293	4.113	4.113	4.113
Entry Flow, veh/h	271	305	575	648	36	25
Cap Entry Lane, veh/h	1130	1130	1104	1106	762	482
Entry HV Adj Factor	0.952	0.954	0.990	0.990	1.000	1.000
Flow Entry, veh/h	258	291	569	642	36	25
Cap Entry, veh/h	1053	1055	1092	1094	762	482
V/C Ratio	0.245	0.276	0.521	0.587	0.047	0.052
Control Delay, s/veh	5.7	6.1	9.4	10.8	5.2	8.1
LOS	A	A	A	B	A	A
95th %tile Queue, veh	1	1	3	4	0	0

Network Totals

Number of Intersections	3
Total Delay (hr)	0
Stops (#)	3358
Average Speed (mph)	25
Total Travel Time (hr)	10
Distance Traveled (mi)	247
Fuel Consumed (gal)	24
Fuel Economy (mpg)	10.2
Unserviced Vehicles (#)	0
Vehicles in dilemma zone (#)	0
Performance Index	9.5

Intersection						
Intersection Delay, s/veh	15.3					
Intersection LOS	C					
Approach	EB		WB		SE	
Entry Lanes	2		1		2	
Conflicting Circle Lanes	2		2		2	
Adj Approach Flow, veh/h	1245		928		465	
Demand Flow Rate, veh/h	1257		938		470	
Vehicles Circulating, veh/h	470		0		660	
Vehicles Exiting, veh/h	660		1727		0	
Follow-Up Headway, s	3.186		3.186		3.186	
Ped Vol Crossing Leg, #/h	5		0		0	
Ped Cap Adj	0.997		1.000		1.000	
Approach Delay, s/veh	23.3		7.4		9.5	
Approach LOS	C		A		A	
Lane	Left	Right	Left	Bypass	Left	Right
Designated Moves	LT	TR	T	R	L	LTR
Assumed Moves	LT	TR	T	R	L	LTR
RT Channelized	Free					
Lane Util	0.470	0.530	1.000		0.530	0.470
Critical Headway, s	4.293	4.113	4.113		4.293	4.113
Entry Flow, veh/h	591	666	660	278	249	221
Cap Entry Lane, veh/h	794	813	1130	1919	689	712
Entry HV Adj Factor	0.990	0.990	0.990	0.990	0.990	0.989
Flow Entry, veh/h	585	660	653	275	246	219
Cap Entry, veh/h	783	803	1119	1900	682	704
V/C Ratio	0.747	0.822	0.584	0.145	0.362	0.310
Control Delay, s/veh	20.6	25.7	10.6	0.0	10.0	9.0
LOS	C	D	B	A	B	A
95th %tile Queue, veh	7	9	4	1	2	1

Intersection						
Intersection Delay, s/veh	14.2					
Intersection LOS	B					
Approach	EB		WB		NB	SB
Entry Lanes	2		2		1	1
Conflicting Circle Lanes	2		2		2	2
Adj Approach Flow, veh/h	1724		883		33	27
Demand Flow Rate, veh/h	1741		892		33	27
Vehicles Circulating, veh/h	0		33		1707	888
Vehicles Exiting, veh/h	915		1707		34	37
Follow-Up Headway, s	3.186		3.186		3.186	3.186
Ped Vol Crossing Leg, #/h	4		2		6	0
Ped Cap Adj	0.995		0.998		1.000	1.000
Approach Delay, s/veh	17.7		7.6		12.2	6.4
Approach LOS	C		A		B	A
Lane	Left	Right	Left	Right	Left	Left
Designated Moves	LT	TR	LT	TR	LTR	R
Assumed Moves	LT	TR	LT	TR	LTR	R
RT Channelized						
Lane Util	0.470	0.530	0.470	0.530	1.000	1.000
Critical Headway, s	4.293	4.113	4.293	4.113	4.113	4.113
Entry Flow, veh/h	818	923	419	473	33	27
Cap Entry Lane, veh/h	1130	1130	1102	1104	342	607
Entry HV Adj Factor	0.991	0.990	0.991	0.990	0.992	1.000
Flow Entry, veh/h	810	914	415	468	33	27
Cap Entry, veh/h	1114	1114	1090	1090	339	607
V/C Ratio	0.727	0.821	0.381	0.429	0.096	0.044
Control Delay, s/veh	14.9	20.1	7.2	7.9	12.2	6.4
LOS	B	C	A	A	B	A
95th %tile Queue, veh	7	10	2	2	0	0

Network Totals

Number of Intersections	3
Total Delay (hr)	0
Stops (#)	4899
Average Speed (mph)	25
Total Travel Time (hr)	15
Distance Traveled (mi)	365
Fuel Consumed (gal)	35
Fuel Economy (mpg)	10.3
Unserviced Vehicles (#)	0
Vehicles in dilemma zone (#)	0
Performance Index	13.7

TRAFFIC SIGNAL EVALUATION – OAKWOOD, OH

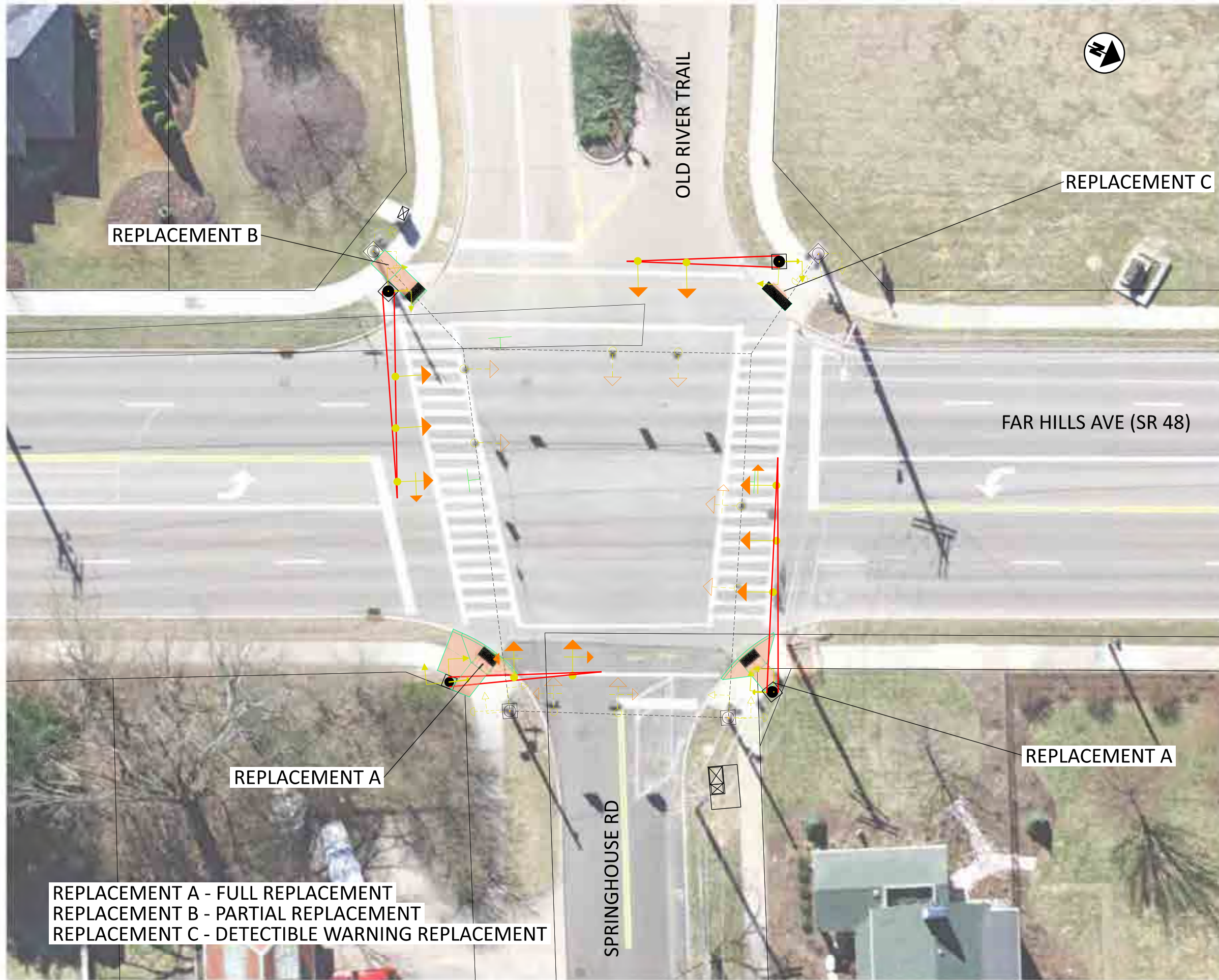
APPENDIX F: NOT USED



TRAFFIC SIGNAL EVALUATION – OAKWOOD, OH

APPENDIX G: CONCEPT PLANS



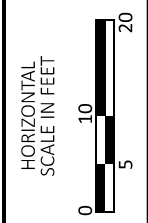
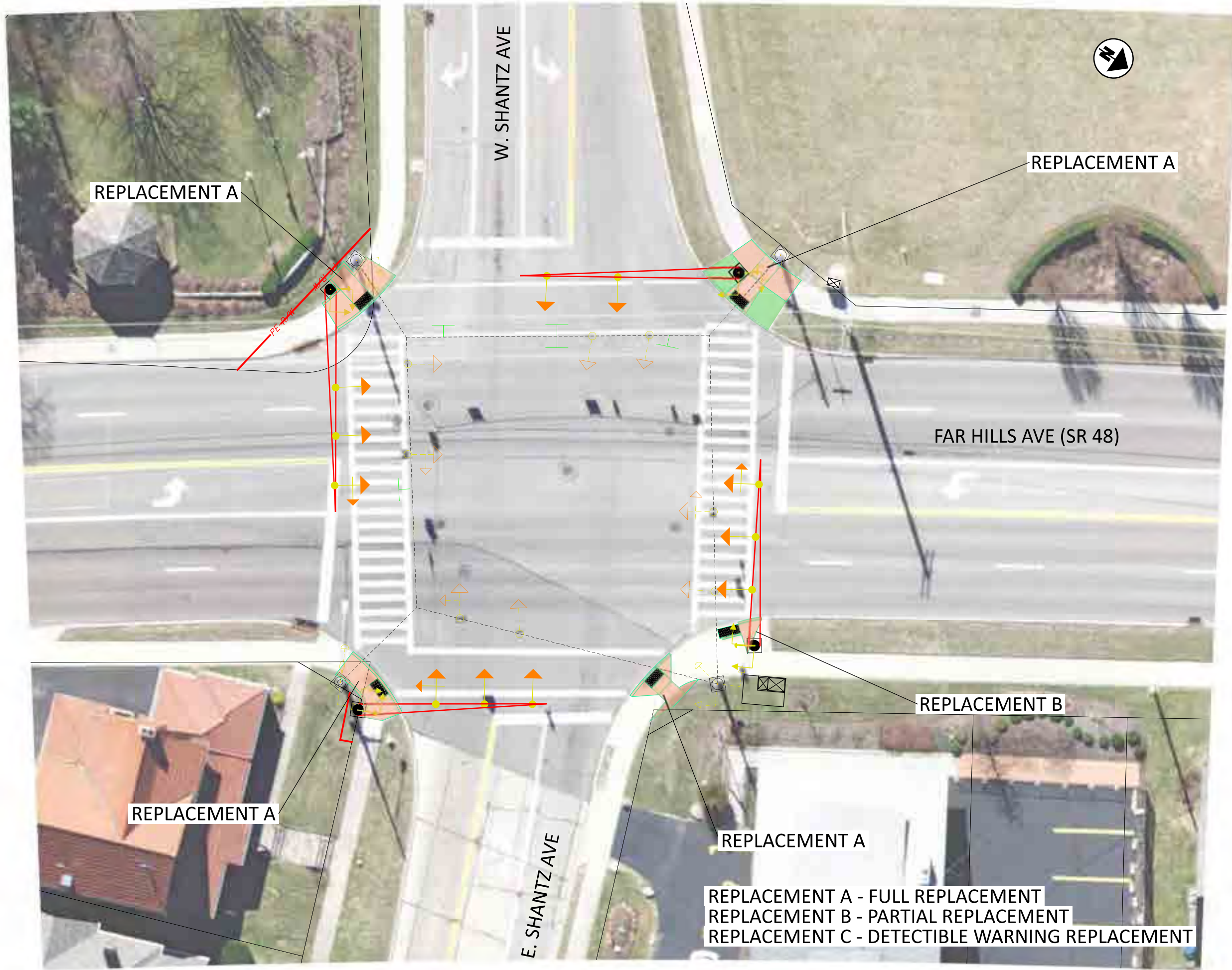


REPLACEMENT A - FULL REPLACEMENT
 REPLACEMENT B - PARTIAL REPLACEMENT
 REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT

FAR HILLS AVE & SPRINGHOUSE RD/OLD RIVER TRL
 SIGNAL CONCEPT PLAN

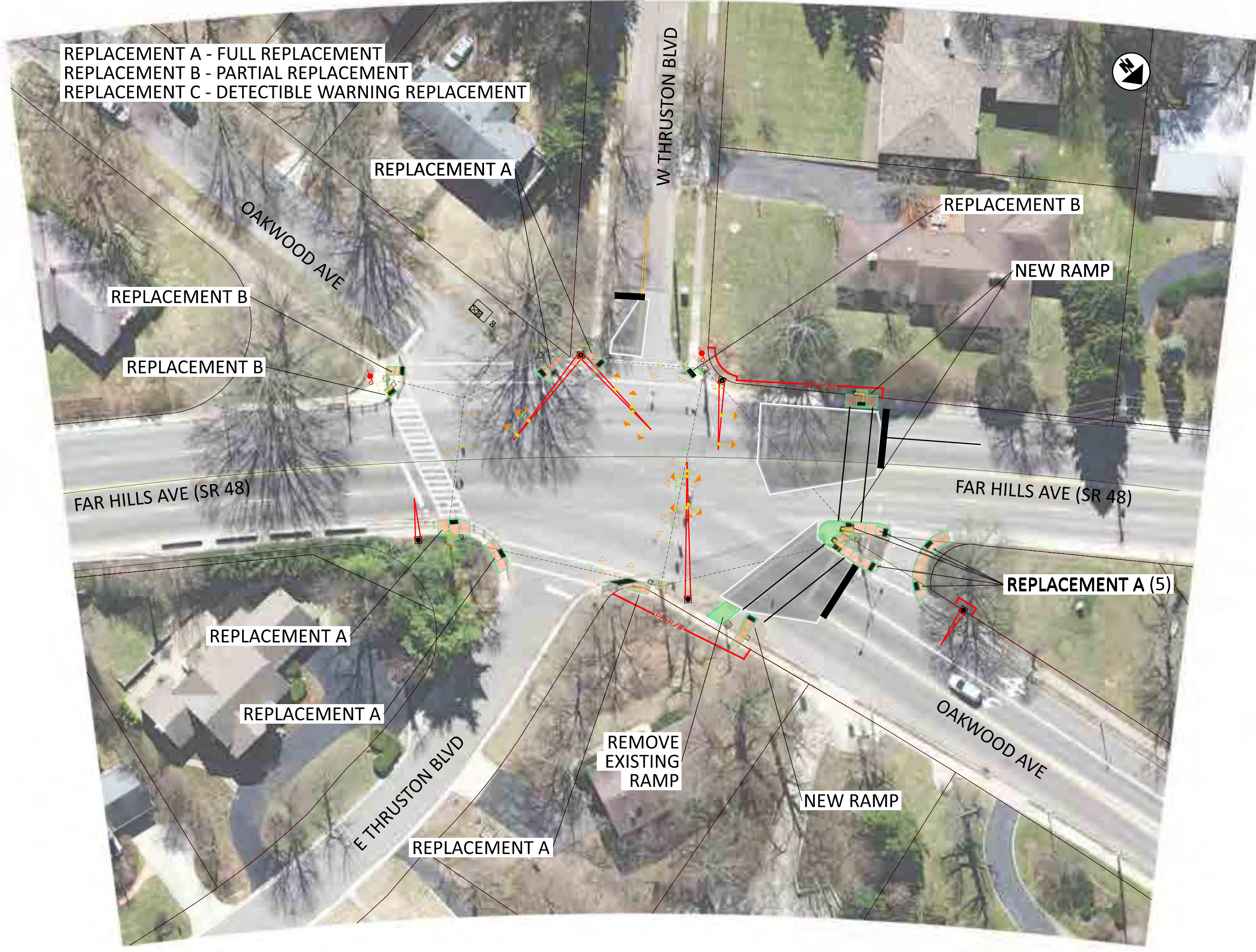


DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
TOTAL	P.0
	0



FAR HILLS AVE & SHANTZ AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY	
 CMT CIVIL, INC. 84 REMOND'S BOULEVARD BRIARCLIFF, OHIO 45006 www.cmteng.com	
DESIGNER	
RTM	
REVIEWER	
SAK	01-06-23
PROJECT ID	
460700	
SHEET	TOTAL
P.0	0

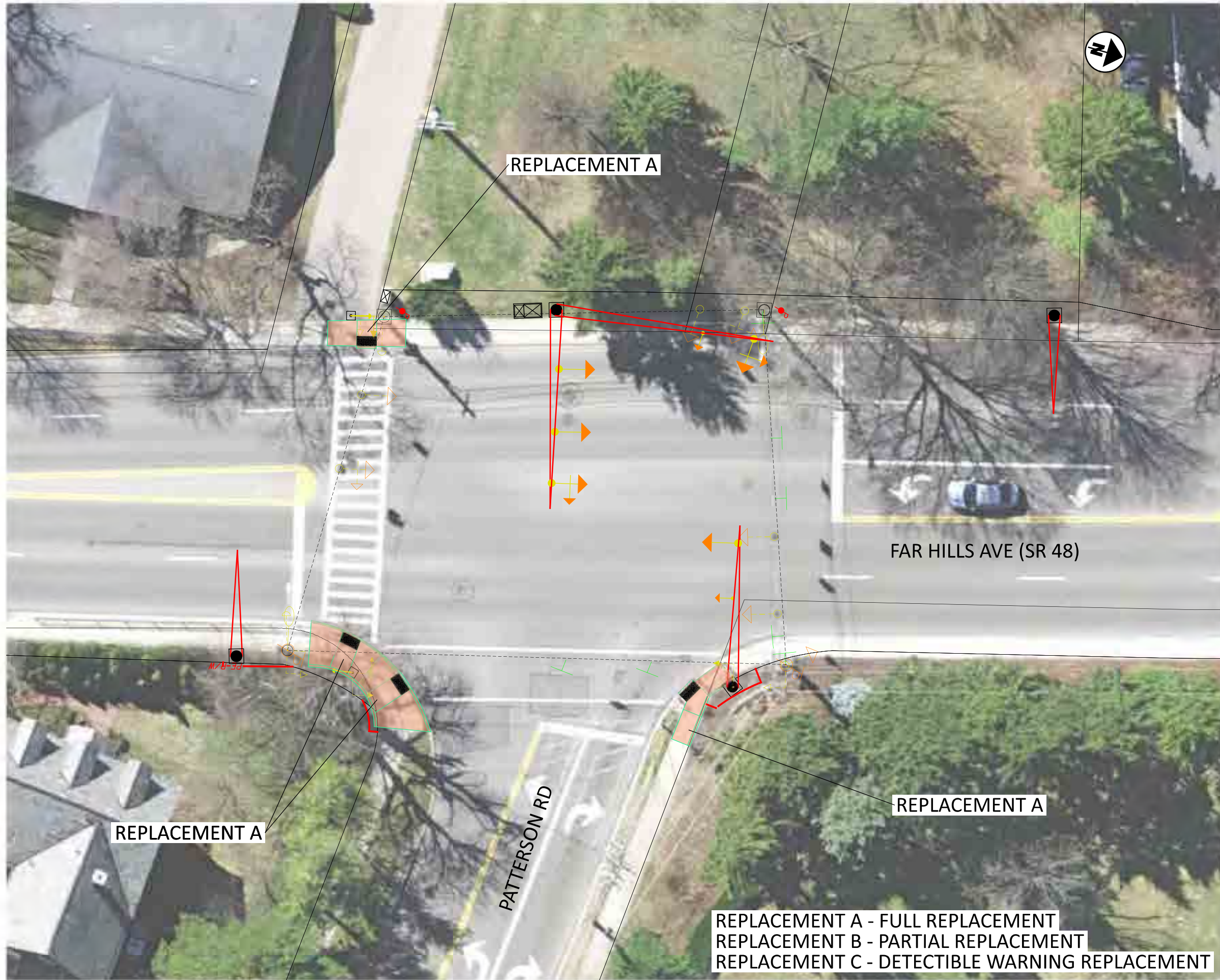


FAR HILLS AVE & OAKWOOD AVE/THRUSTON BLVD
SIGNAL CONCEPT PLAN

DESIGN AGENCY

 CMT
 CONSULTING & ENGINEERING
 84 REMOND'S BOULEVARD
 BIRMGHAM, ALABAMA 35202
 PH: (205) 987-2100
 WWW.CMTENG.COM

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
	460700
SHEET	TOTAL
P.0	0



REPLACEMENT A - FULL REPLACEMENT
 REPLACEMENT B - PARTIAL REPLACEMENT
 REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT

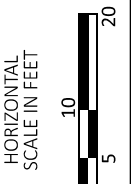
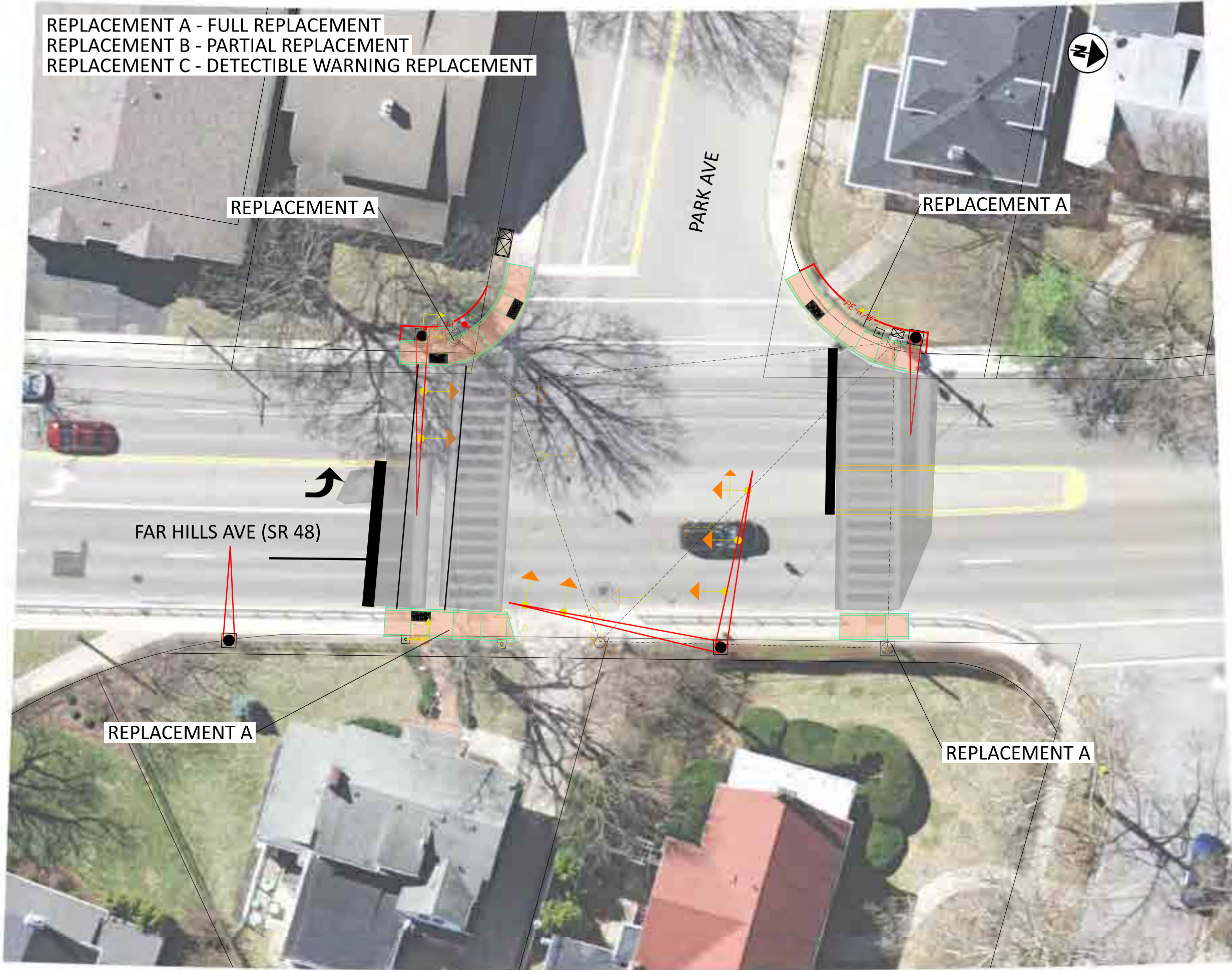


FAR HILLS AVE & PATTERSON RD
 SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING
 84 REMOND'S BOULEVARD
 SUITE 200
 RICHMOND, VA 23261
 WWW.CMTENG.COM

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
TOTAL	P.0
	0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT

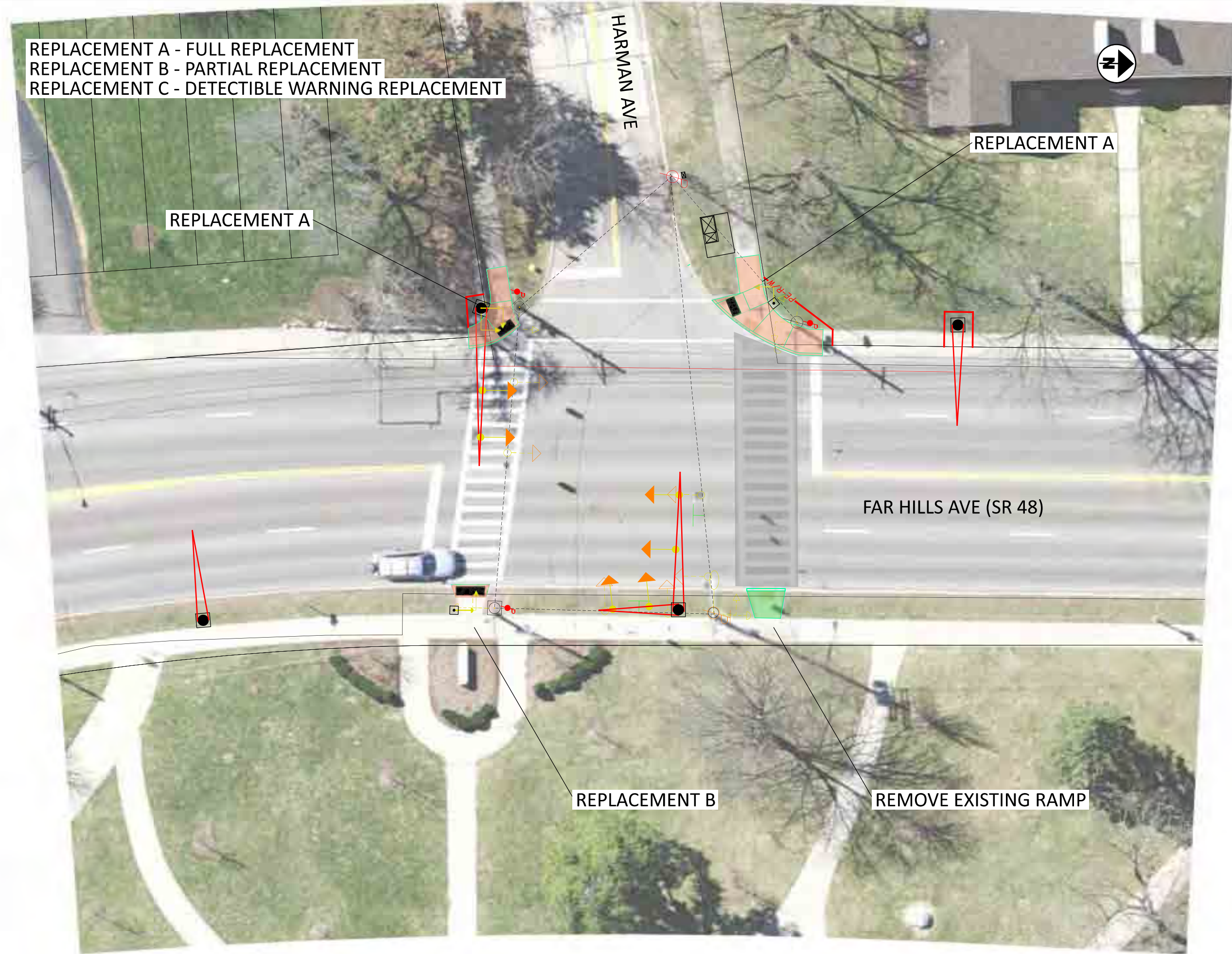


FAR HILLS AVE & PARK AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING, INC.
 84 REMOND'S BOULEVARD
 BIRMGHAM, AL 35202-2183
 www.cmteng.com

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	0
TOTAL	P.O. 0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT

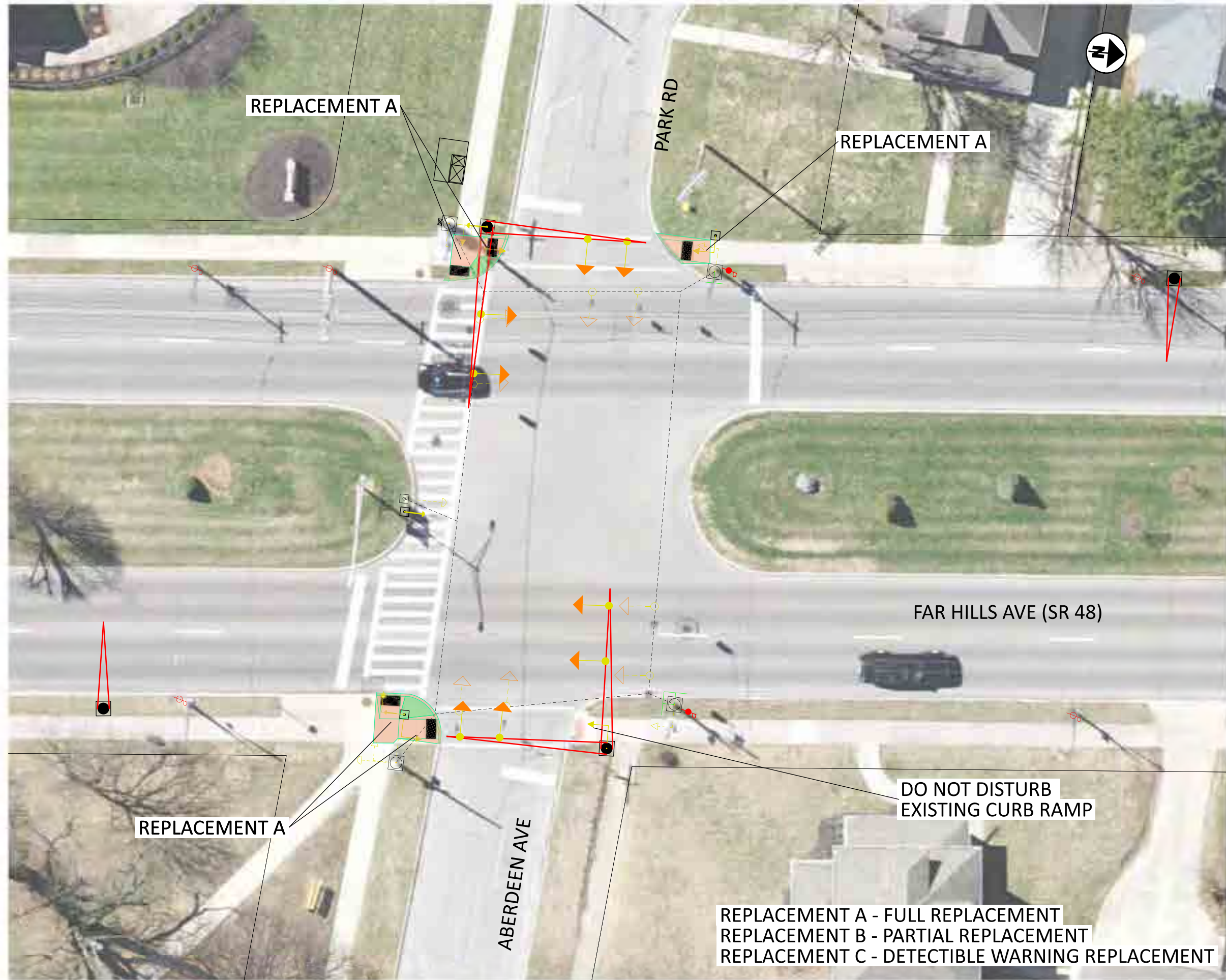


FAR HILLS AVE & HARMAN AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY

CMT
 CONSULTING & ENGINEERING
 84 REMONDY BOULEVARD
 BIRMINGHAM, AL 35202-2183
 www.cmteng.com

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
TOTAL	P.0
	0



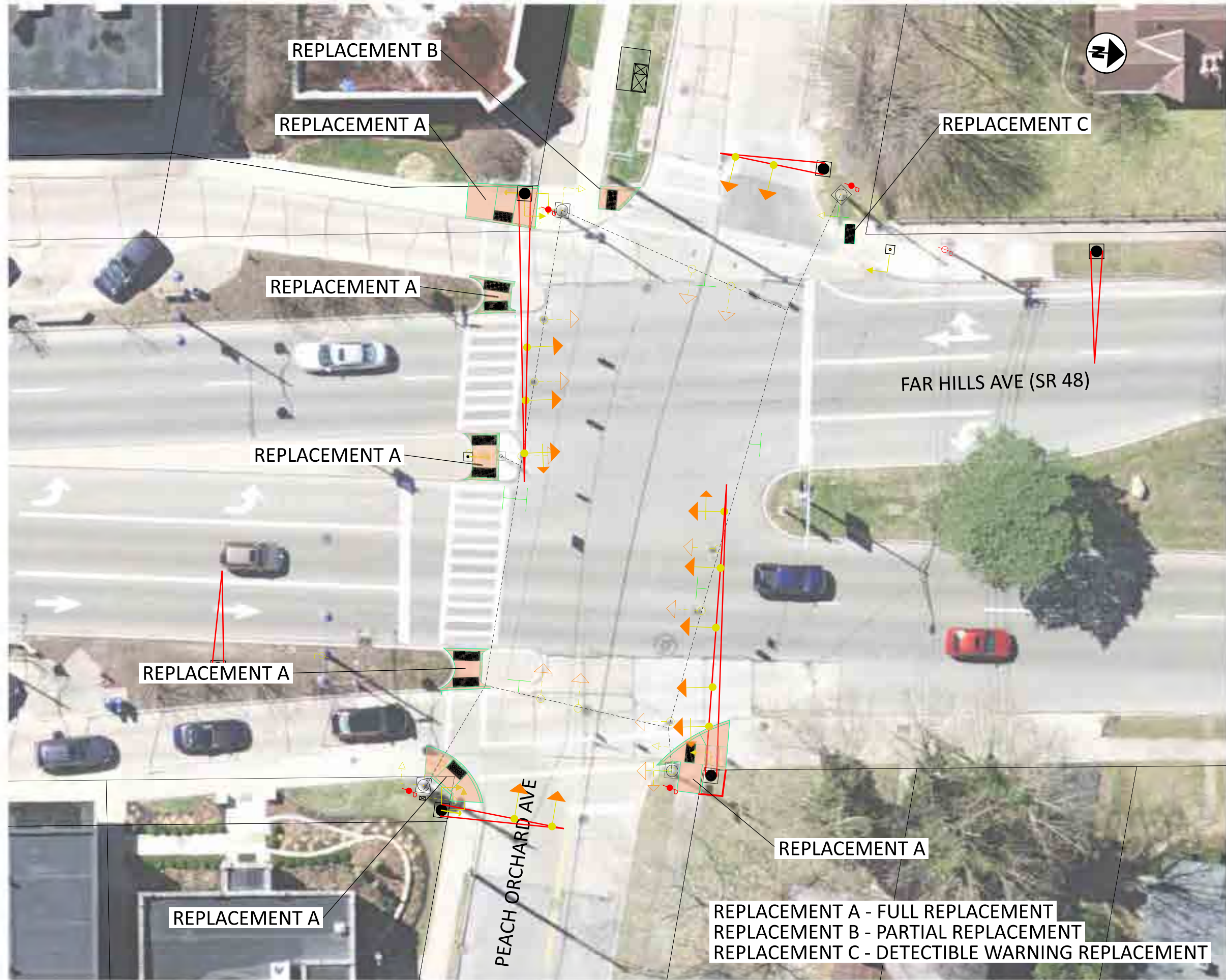
REPLACEMENT A - FULL REPLACEMENT
 REPLACEMENT B - PARTIAL REPLACEMENT
 REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT



FAR HILLS AVE & ABERDEEN AVE/PARK RD
 SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING, INC.
 84 REMONDY BOULEVARD
 BIRMINGHAM, AL 35202-3703
 www.cmteng.com

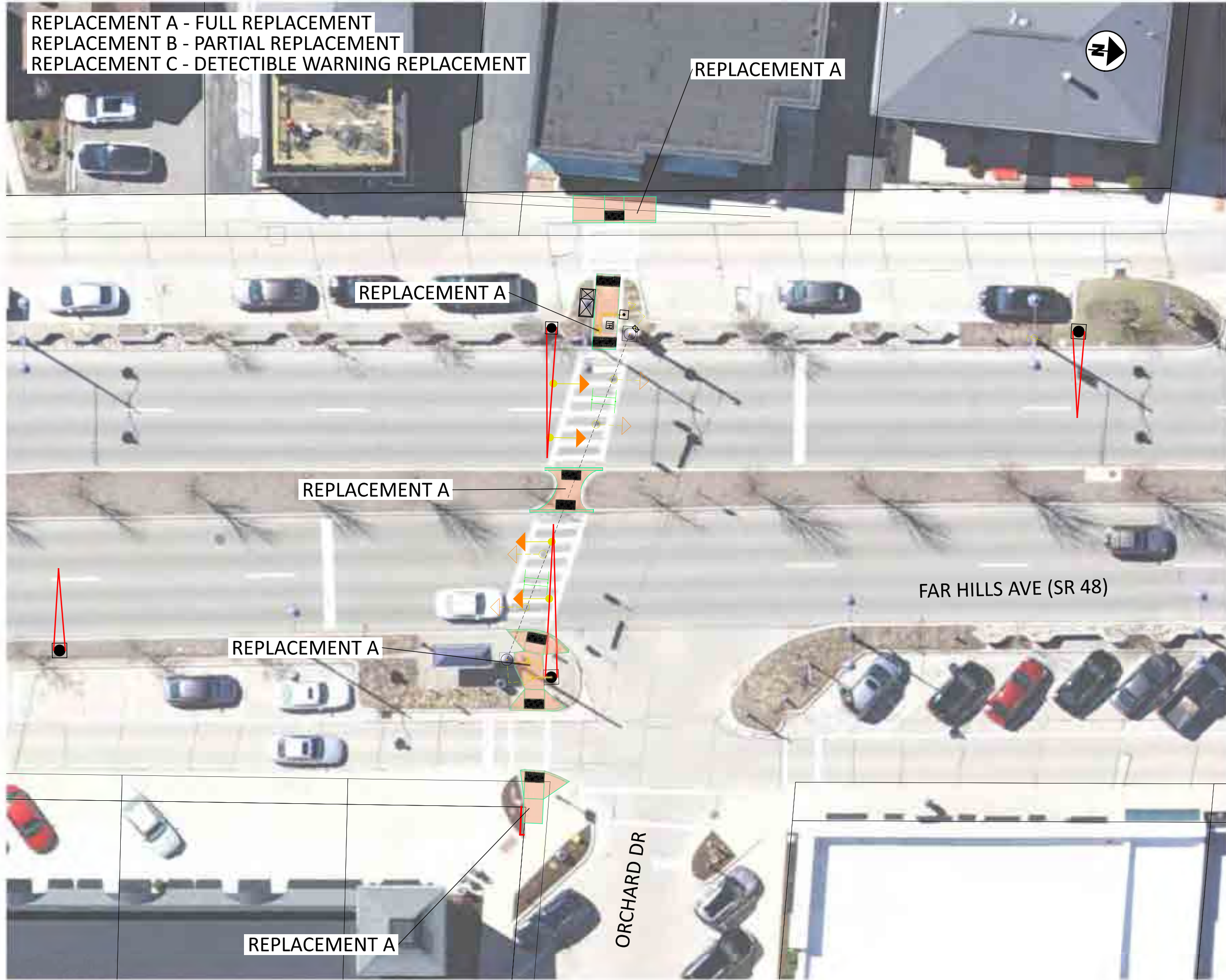
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REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL 0



FAR HILLS AVE & PEACH ORCHARD AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING, INC.
 84 REMOND'S BOULEVARD
 BIRMINGHAM, AL 35202-2100
 PH: (205) 707-2100
 WWW.CMTENGR.COM

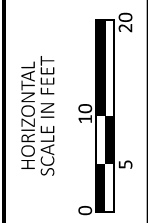
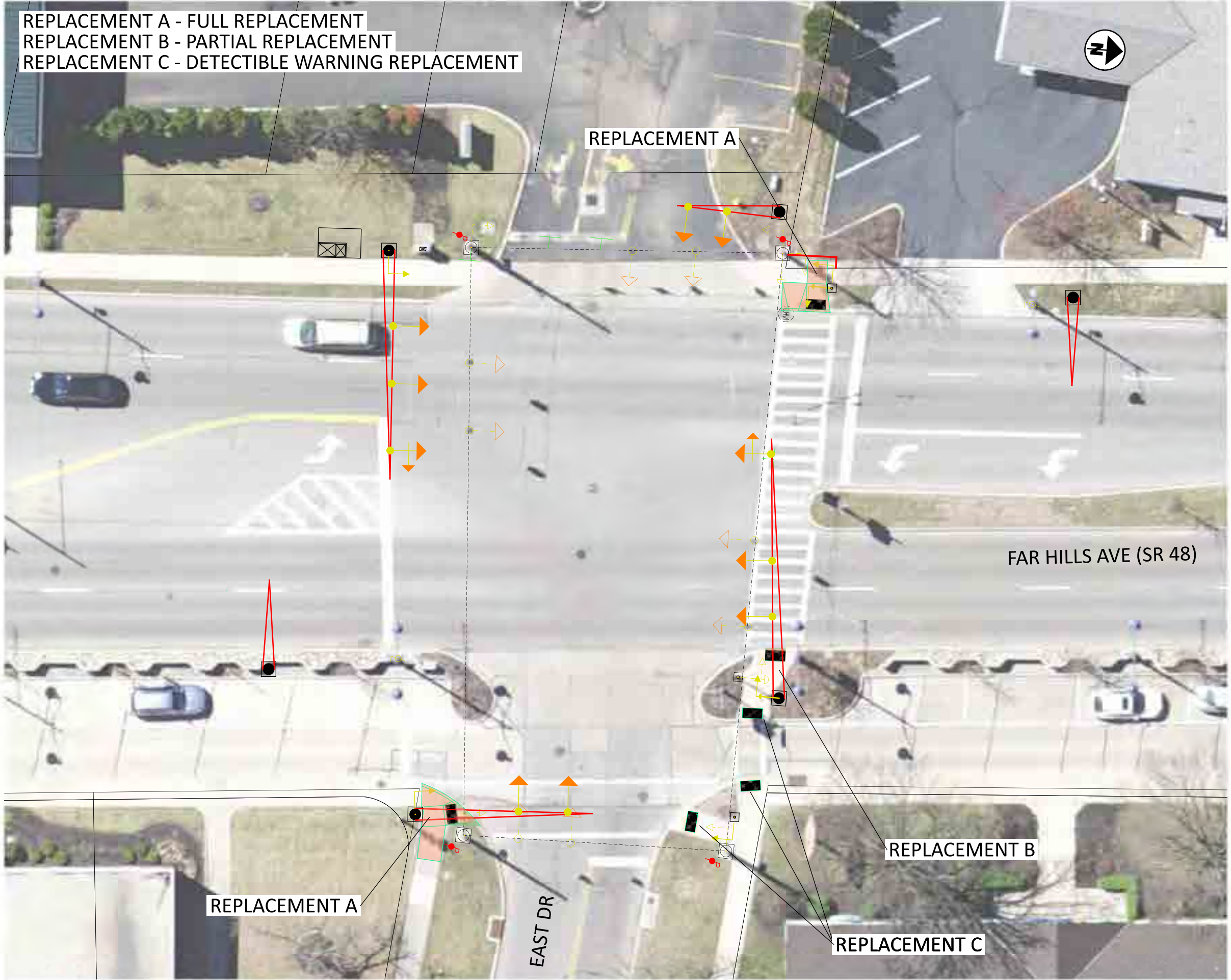
DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL 0



FAR HILLS AVE & ORCHARD DR
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
CMT INC.
24 REMONDY BOULEVARD
BIRMINGHAM, AL 35202-2130
www.cmteng.com

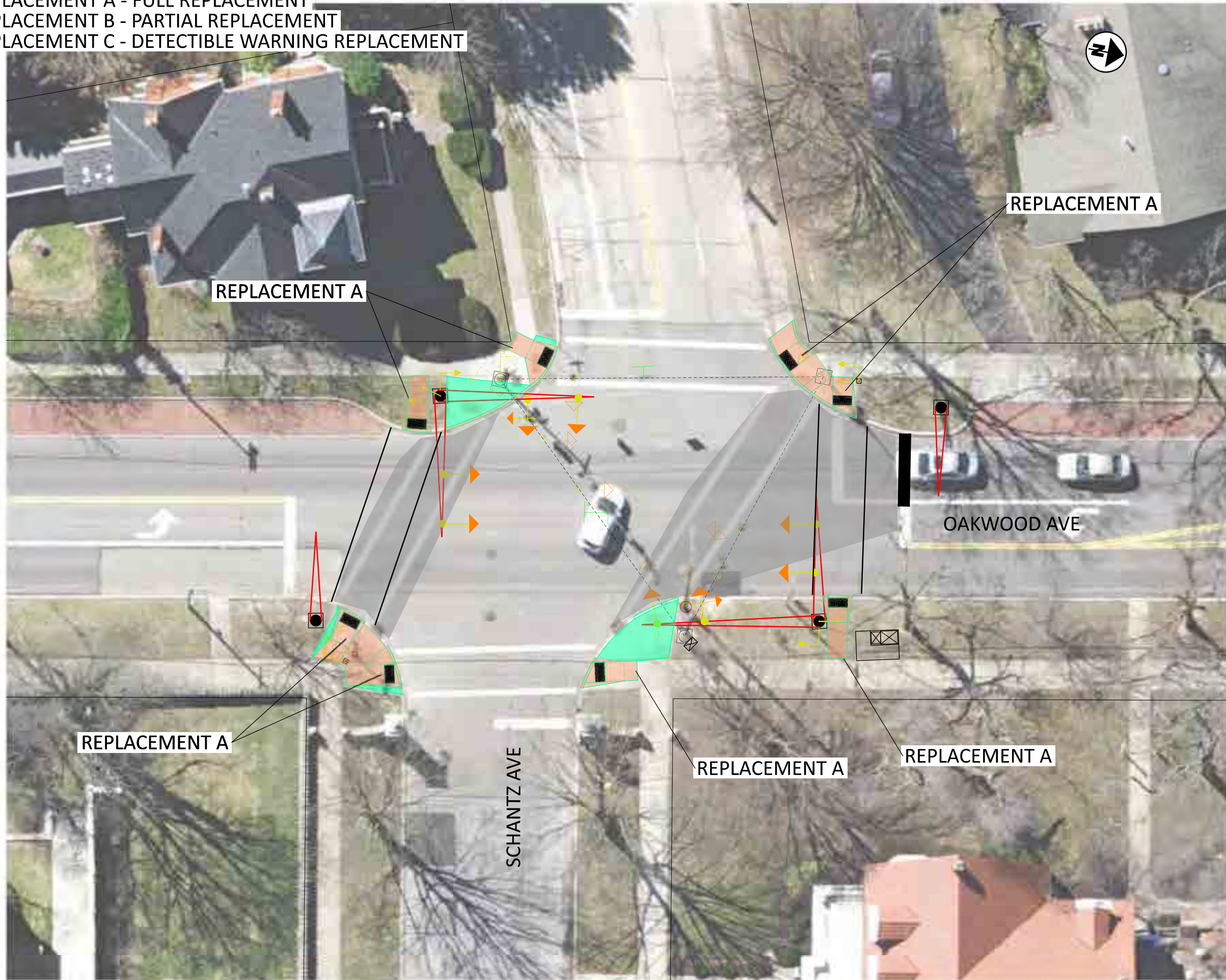
DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL 0



FAR HILLS AVE & EAST DR
 SIGNAL CONCEPT PLAN

DESIGN AGENCY	
 CMT CONSULTING & ENGINEERING 84 REMONDY BOULEVARD BIRMINGHAM, AL 35202-2183 www.cmtengr.com	
DESIGNER	
RTM	
REVIEWER	
SAK 01-06-23	
PROJECT ID	
460700	
SHEET	TOTAL
P.0	0

REPLACEMENT A - FULL REPLACEMENT
 REPLACEMENT B - PARTIAL REPLACEMENT
 REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT



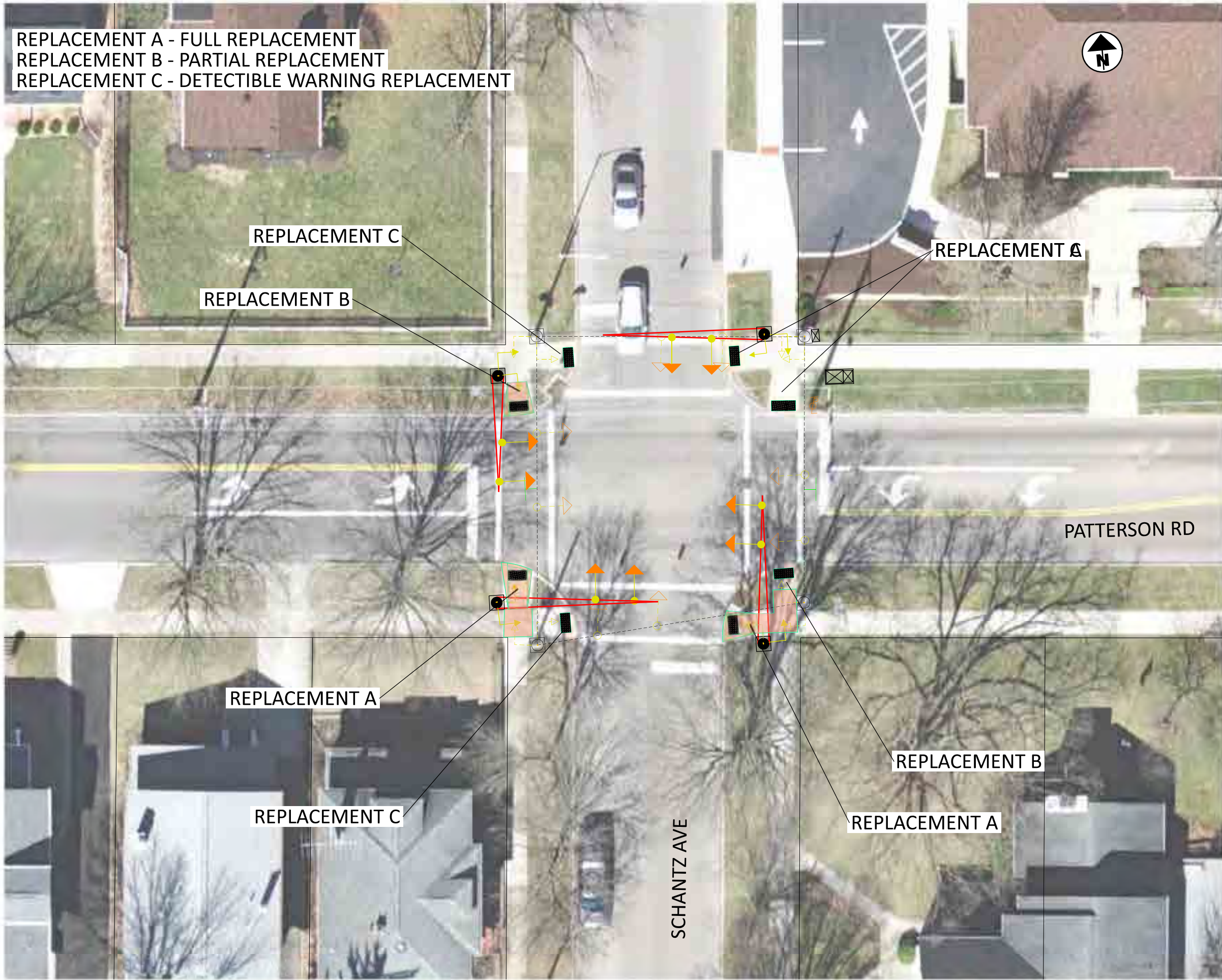
SCHANTZ AVE & OAKWOOD AVE
 SIGNAL CONCEPT PLAN

CTY-RTE-SECTION

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DESIGN AGENCY	CMT
DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
TOTAL	P.0
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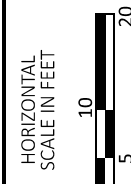
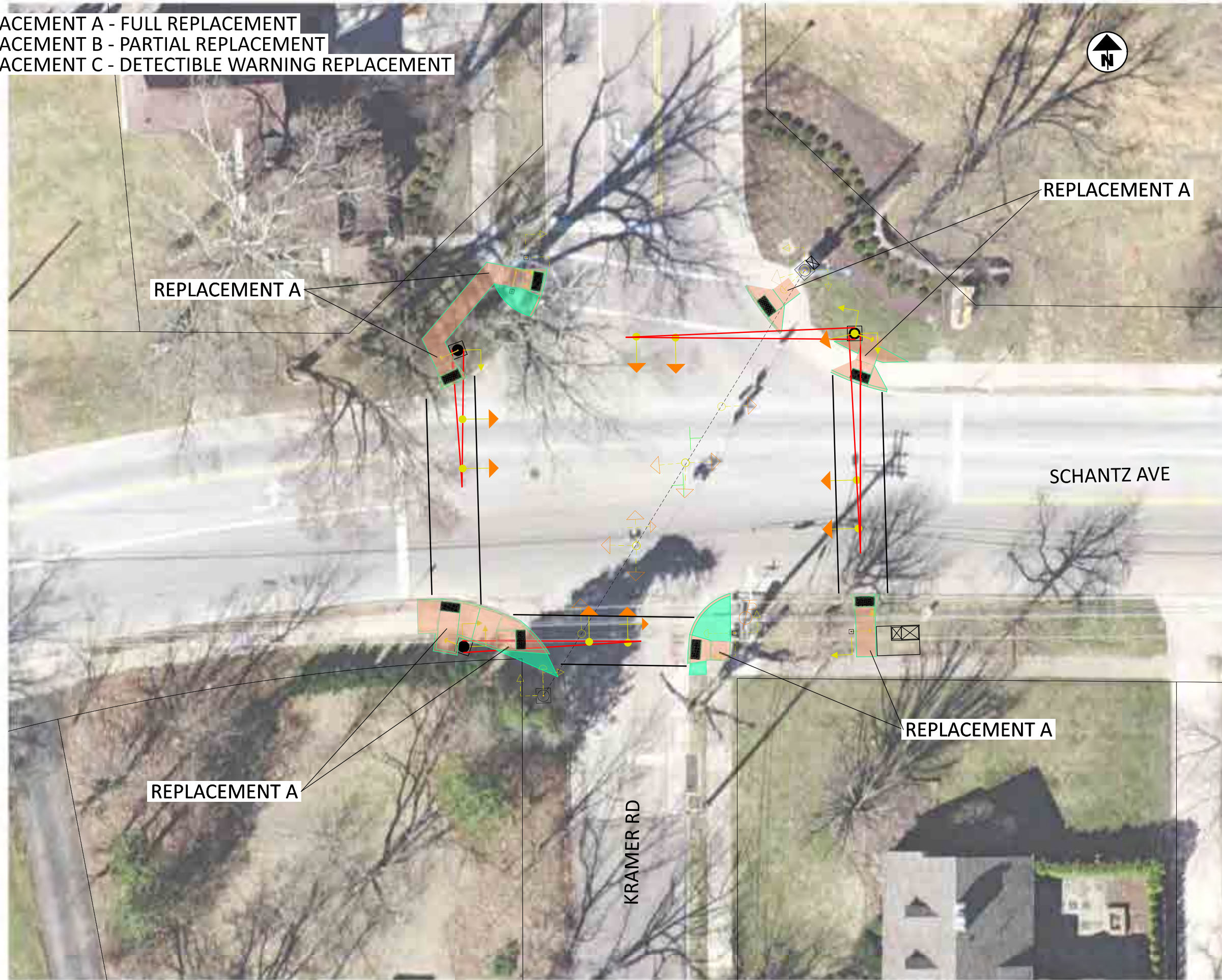


SCHANTZ AVE & PATTERSON RD
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING, INC.
 84 REMOND'S BOULEVARD
 BIRMGHAM, ALABAMA 35202-3183
 www.cmteng.com

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL 0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTABLE WARNING REPLACEMENT



SCHANTZ AVE & KRAMER RD
SIGNAL CONCEPT PLAN



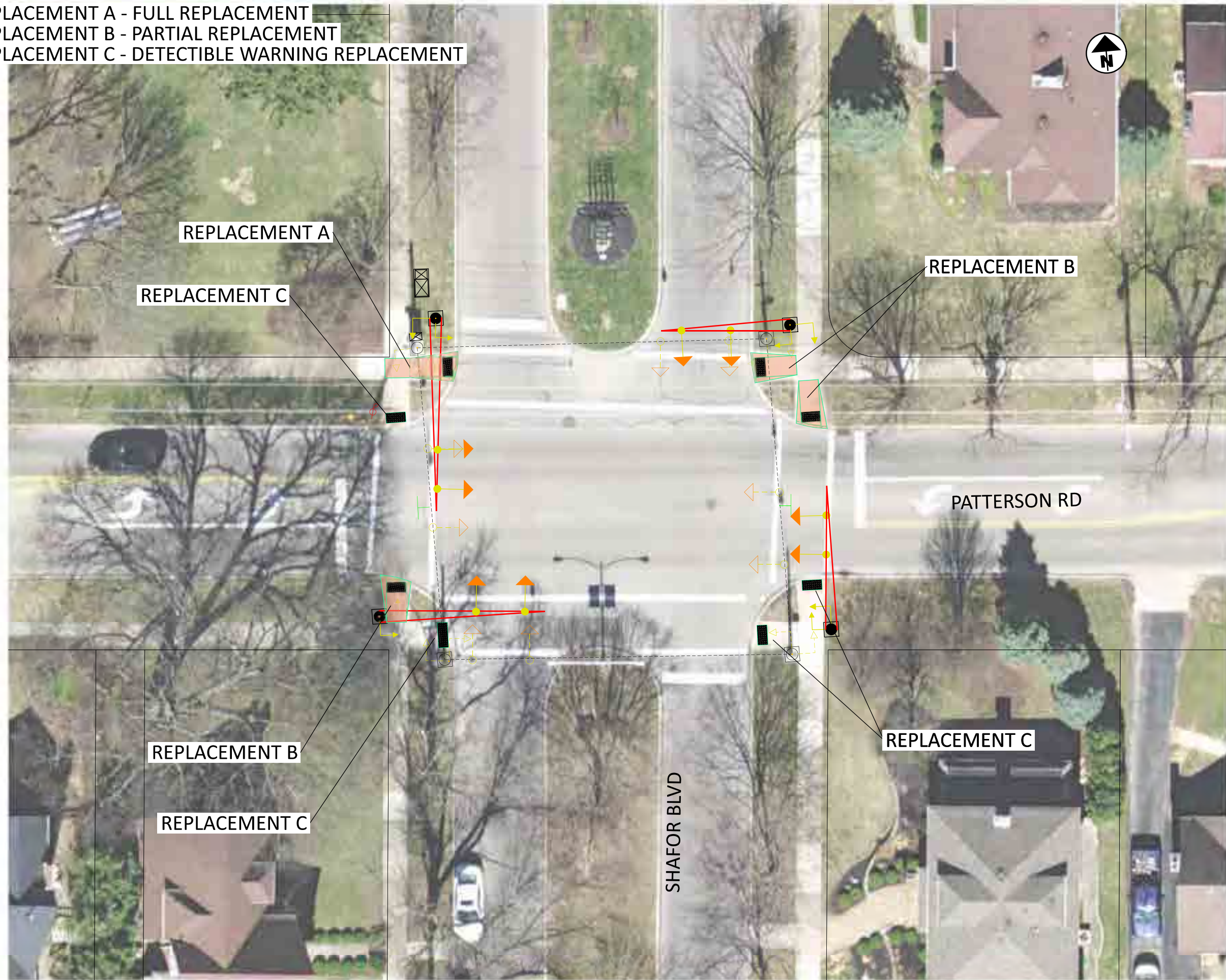
DESIGNER
SAK

REVIEWER
RTM 01-06-23

PROJECT ID
460700

SHEET	TOTAL
P.0	0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT



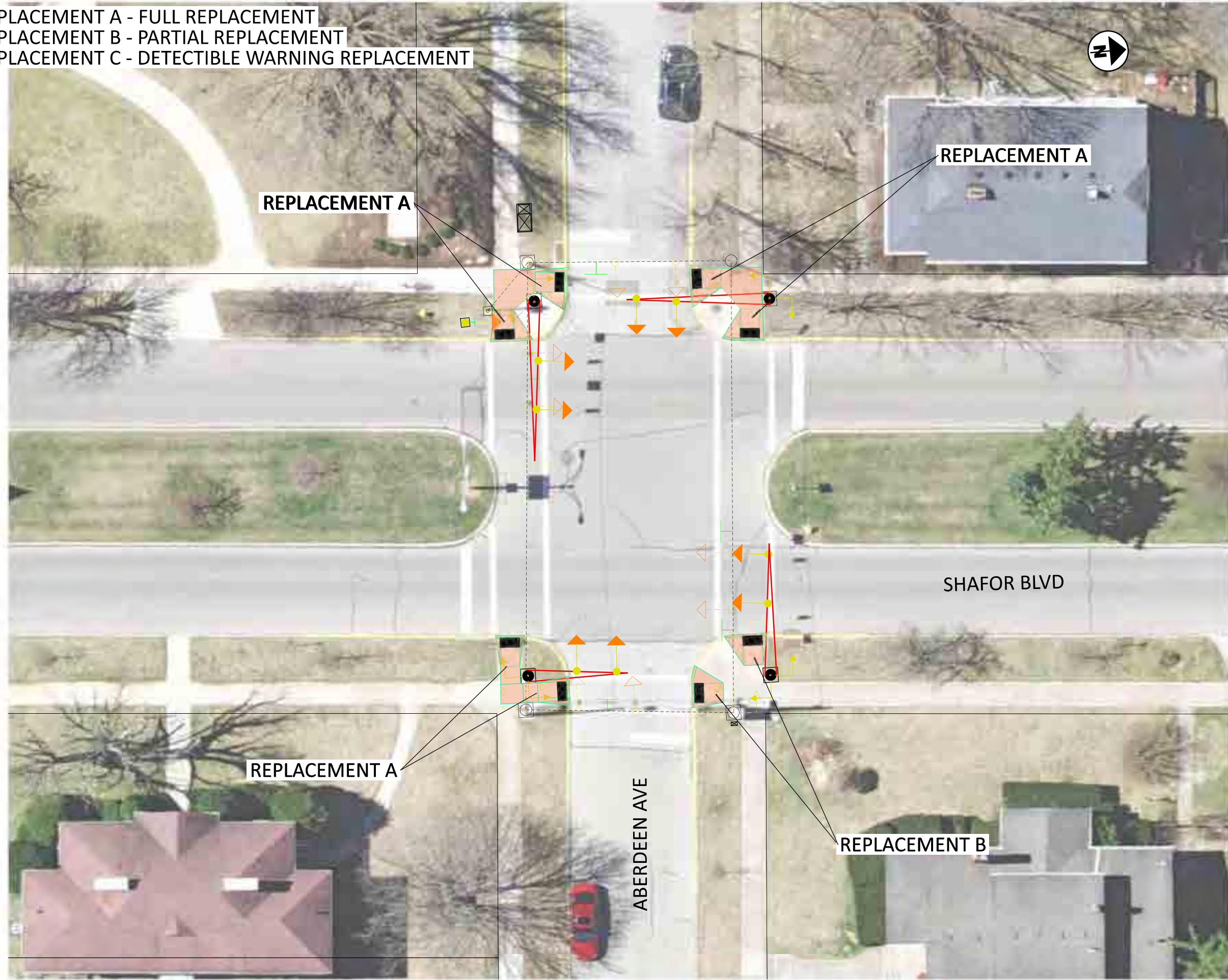
SHAFOR BLVD & PATTERSON RD
SIGNAL CONCEPT PLAN

DESIGN AGENCY

 CMT
 CONSULTING & ENGINEERING
 84 REMOND'S BOULEVARD
 BIRMGHAM, ALABAMA 35202
 WWW.CMTENGR.COM

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL 0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT



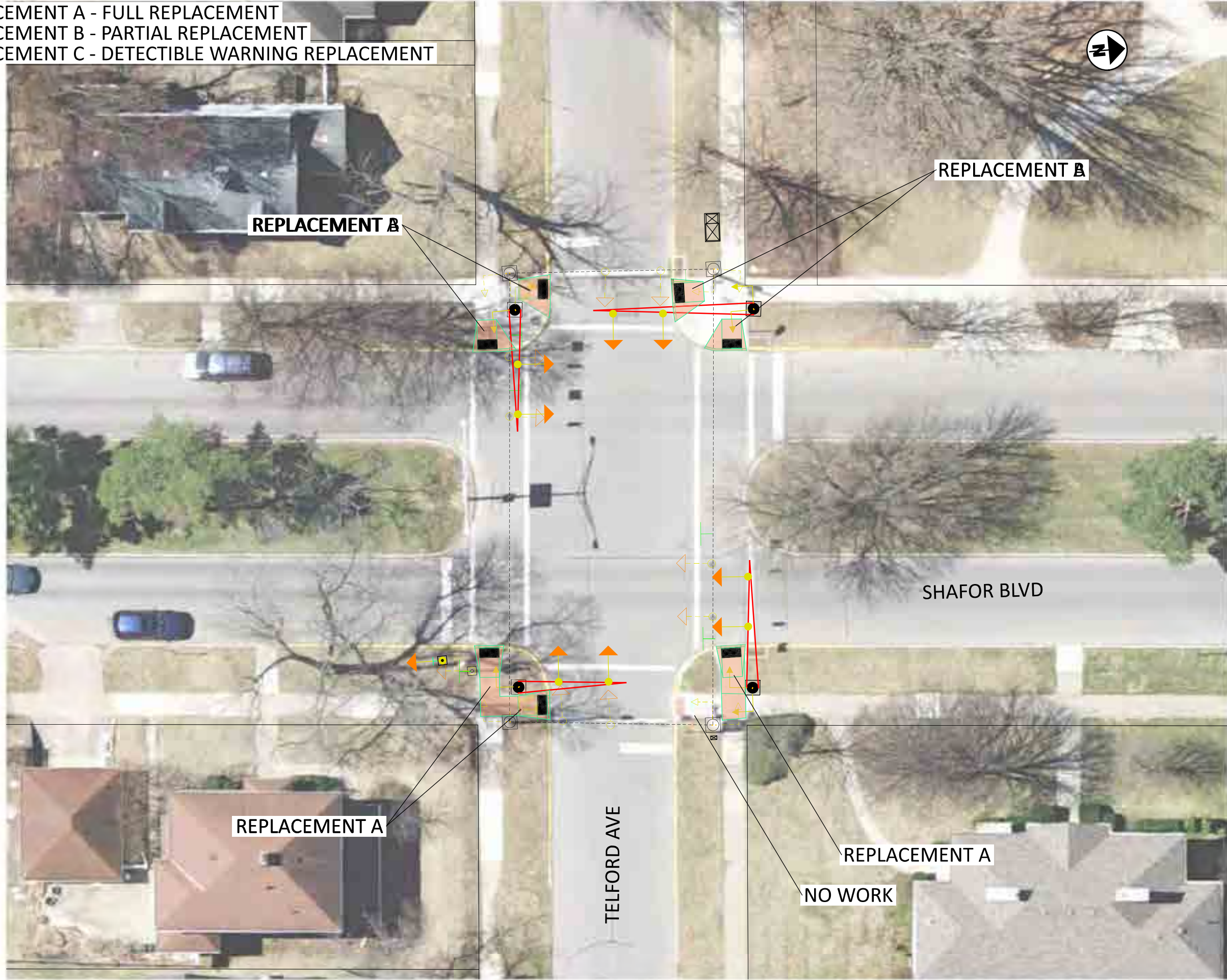
SHAFOR BLVD & ABERDEEN AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY

 CMT
 CONSULTING & ENGINEERING
 84 REMONDY BOULEVARD
 BIRMINGHAM, AL 35202-2100
 www.cmteng.com

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
TOTAL	P.0
	0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT

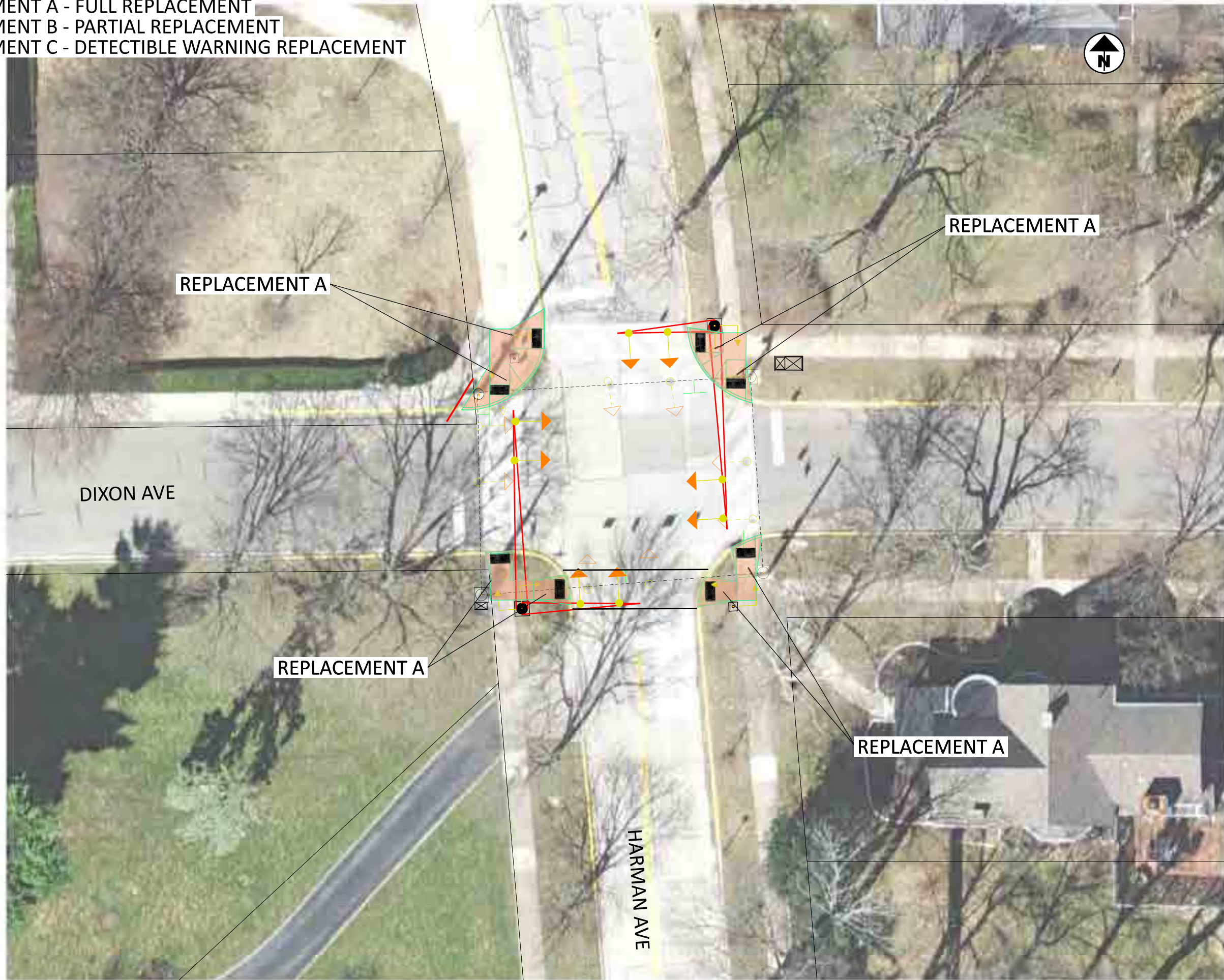


SHAFOR BLVD & TELFORD AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING
 84 REMONDY BOULEVARD
 BIRMGHAM, ALABAMA 35202
 PH: (205) 707-2700
 WWW.CMTENGR.COM

DESIGNER	RTM
REVIEWER	SAK
PROJECT ID	01-06-23
SHEET	460700
P.O.	TOTAL
	0

REPLACEMENT A - FULL REPLACEMENT
REPLACEMENT B - PARTIAL REPLACEMENT
REPLACEMENT C - DETECTIBLE WARNING REPLACEMENT



HARMAN AVE & DIXON AVE
SIGNAL CONCEPT PLAN

DESIGN AGENCY
CMT
 CONSULTING & ENGINEERING, INC.
 84 REMOND'S BOULEVARD
 BIRMGHAM, ALABAMA 35202
 WWW.CMTENGR.COM

DESIGNER
RTM

REVIEWER
SAK 01-06-23

PROJECT ID
460700

SHEET	TOTAL
P.0	0



EXISTING CONDITIONS



Schantz Park Historic District



Historic Structure



Right-of-Way and Property Lines



PROPERTY IMPACTS



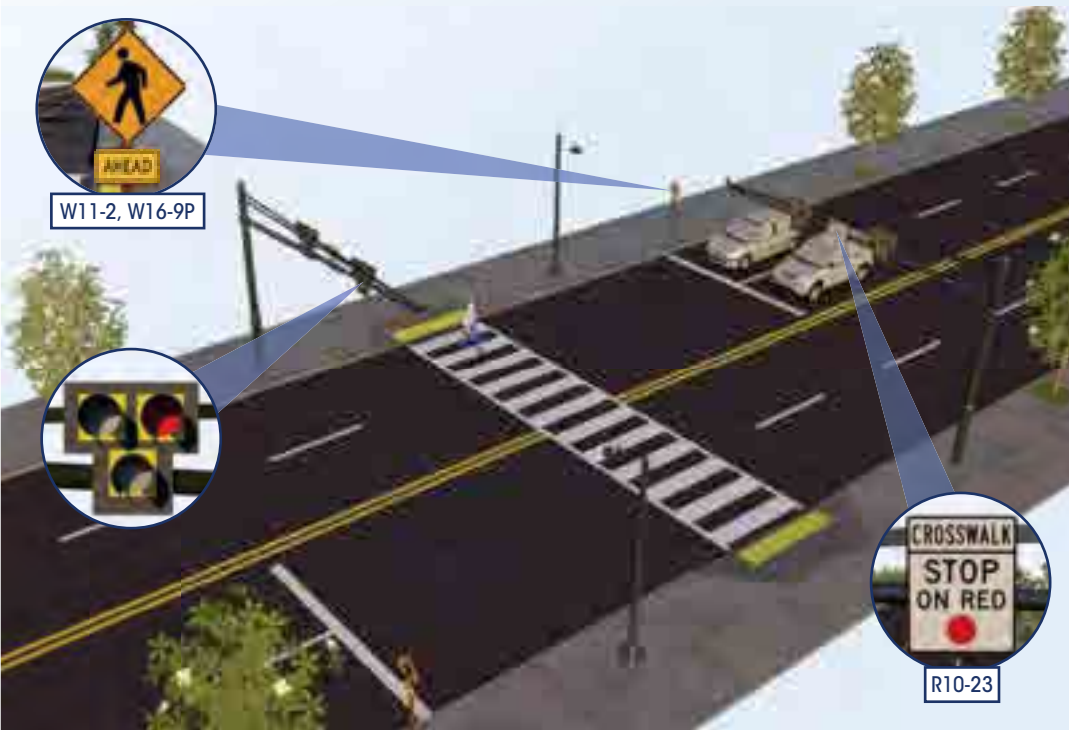
Property area shown in orange depicts additional right-of-way that may be required to construct the roundabout. Actual right-of-way requirements will be determined during the final design process.

— Right-of-Way and Property Lines

Pedestrian Hybrid Beacon (PHB)


**SAFE TRANSPORTATION
FOR EVERY PEDESTRIAN**


COUNTERMEASURE TECH SHEET



A Pedestrian Hybrid Beacon head consists of two red lenses above a single yellow lens. Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection. When activated, the beacon displays a sequence of flashing and solid lights that indicate the pedestrian walk interval and when it is safe for drivers to proceed (see figure on back page).

The PHB is often considered for installation at locations where pedestrians need to cross and vehicle speeds or volumes are high, but traffic signal warrants are not met. These devices have been successfully used at school crossings, parks, senior centers, and other pedestrian crossings on multilane streets. PHBs are typically installed at the side of the road or on mast arms over midblock pedestrian crossings.

 High speeds and multiple lanes of traffic create challenges for pedestrians crossing at unsignalized locations.

 PHBs can warn and control traffic at unsignalized locations and assist pedestrians in crossing a street or highway at a marked crosswalk.

PHBs can reduce pedestrian crashes by **55%**



FEATURES:

- Beacons stop all lanes of traffic, which can reduce pedestrian crashes.

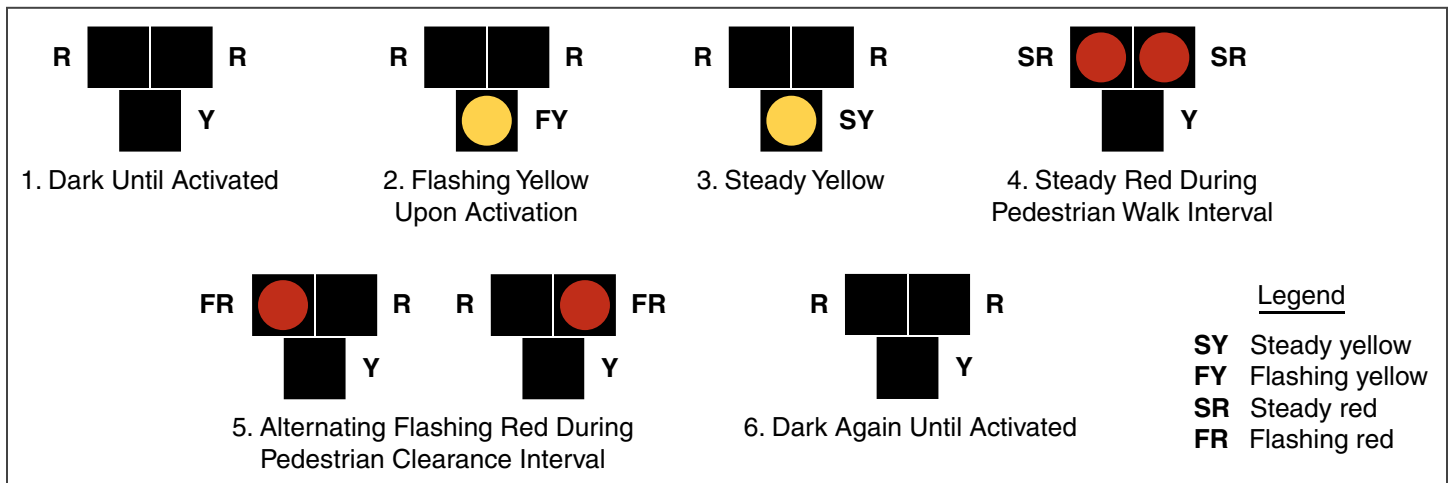
OFTEN USED WITH:

- High-visibility crosswalk markings
- Raised islands
- Advance STOP or YIELD signs and markings

Pedestrian Hybrid Beacon (PHB)

EDC-4 STEP: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon from FHWA's *Manual on Uniform Traffic Control Devices*, 2009 Edition, p. 511



When a pedestrian activates a PHB, a flashing yellow light is followed by a solid yellow light, alerting drivers to slow. A solid red light requires drivers to stop while pedestrians have the right-of-way to cross the street. When the pedestrian signals display a flashing DON'T WALK indication, the overhead beacon flashes red, and drivers may proceed if the crosswalk is clear.



References

- Zegeer, C., R. Srinivasan, B. Lan, D. Carter, S. Smith, C. Sundstrom, N.J. Thirsk, J. Zegeer, C. Lyon, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.
- Federal Highway Administration. (2013). "Pedestrian Hybrid Beacon" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System. Available: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=53
- Bushell, M., Poole, B., Zegeer, C., & Rodriguez, D. (2013). Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public. *Pedestrian and Bicycle Information Center*.

Rectangular Rapid-Flashing Beacon (RRFB)

SAFE TRANSPORTATION
FOR EVERY PEDESTRIAN


COUNTERMEASURE TECH SHEET



RRFBs are pedestrian-actuated conspicuity enhancements used in combination with a pedestrian, school, or trail crossing warning sign to improve safety at uncontrolled, marked crosswalks. The device includes two rectangular-shaped yellow indications, each with an LED-array-based light source, that flash with high frequency when activated.

The RRFB is a treatment option at many types of established pedestrian crossings. Research indicates RRFBs can result in motorist yielding rates as high as 98 percent at marked crosswalks. However, yielding rates as low as 19 percent have also been noted. Compliance rates varied most per the city location, posted speed limit, crossing distance, and whether the road was one- or two-way. RRFBs are particularly effective at multilane crossings with speed limits less than 40 mph. Consider the Pedestrian Hybrid Beacon (PHB) instead for roadways with higher speeds. FHWA's *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (HSA-17-072) provides specific conditions where practitioners should strongly consider the PHB instead of the RRFB.

 Multiple lanes of traffic create challenges for pedestrians crossing at unsignalized locations.

 RRFBs can make crosswalks and/or pedestrians more visible at a marked crosswalk.

RRFBs can reduce pedestrian crashes by

47%



FEATURES:

- Enhanced warning improves motorist yielding

OFTEN USED WITH:

- Crosswalk visibility enhancements
- Pedestrian refuge island
- Advance STOP or YIELD markings and signs

Rectangular Rapid-Flashing Beacon (RRFB)

EDC-4 STEP: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

SB Far Hills Avenue @ south Xwalk



CONSIDERATIONS

FHWA has issued interim approval for the use of the RRFB (IA-21). State and local agencies must request and receive permission to use this interim approval before they can use the RRFB. IA-21 does not provide guidance or criteria based on number of lanes, speed, or traffic volumes.

RRFBs are placed on both ends of a crosswalk. If the crosswalk contains a pedestrian refuge island or other type of median, an RRFB should be placed to the right of the crosswalk and on the median (instead of the left side of the crosswalk).

RRFBs typically draw power from standalone solar panel units, but may also be wired to a traditional power source. IA-21 provides conditions for the use of accessible pedestrian features with the RRFB assembly. When RRFBs are not in common use in a community, consider conducting an outreach effort to educate the public and law enforcement officers on their purpose and use.

COST

The cost associated with RRFB installation ranges from \$4,500 to \$52,000 each, with the average cost estimated at \$22,250. These costs include the complete system installation with labor and materials.

References

MUTCD section 2B.12 In-Street and Overhead Pedestrian Crossing Signs (R1-6, R1-6a, R1-9, and R1-9a).

Fitzpatrick, K., M. Brewer, R. Avelar, and T. Lindheimer. "Will You Stop for Me? Roadway Design and Traffic Control Device Influences on Drivers Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid-Flashing Beacon." Report No. TTI-CTS-0010. Texas A&M Transportation Institute, College Station, Texas. June 2016. <https://static.tti.tamu.edu/tti.tamu.edu/documents/TTI-CTS-0010.pdf>

Federal Highway Administration. (2018). MUTCD – Interim Approval for Optional Use of Pedestrian-Actuated Rectangular Rapid-Flashing Beacons at Uncontrolled Marked Crosswalks (IA-21). U.S. Department of Transportation, Washington, DC.

Federal Highway Administration. (2013). "Rectangular Rapid Flash Beacon" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System. Available: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54

Bushell, M., Poole, B., Zegeer, C., & Rodriguez, D. (2013). Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public. Pedestrian and Bicycle Information Center.



ROUNABOUT SHAPES

Dublin, OH
SR 161 at Riverside Dr



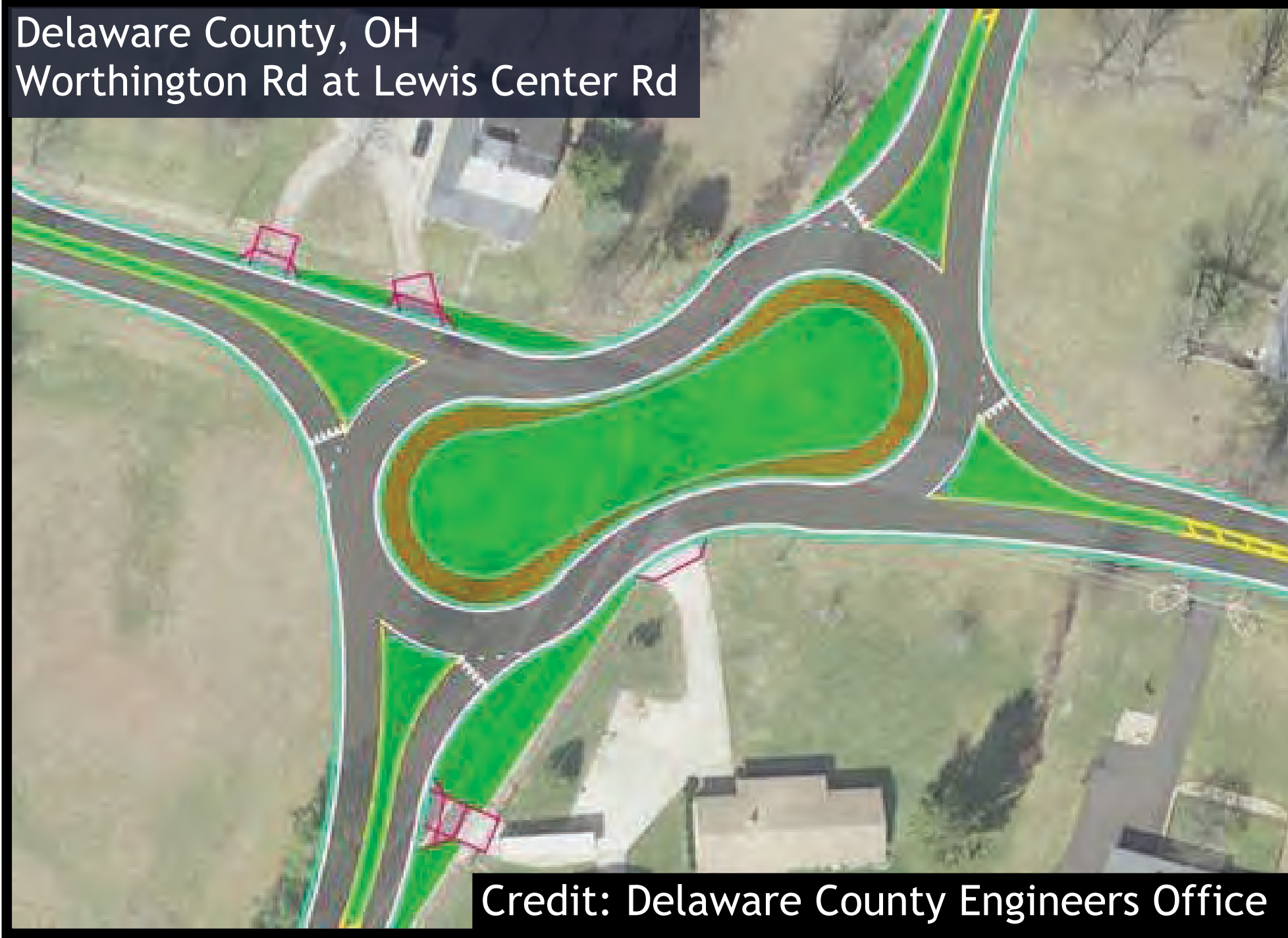
Credit: Doral Chenoweth - The Columbus Dispatch

ODOT District 6, OH
SR 61 at SR 656



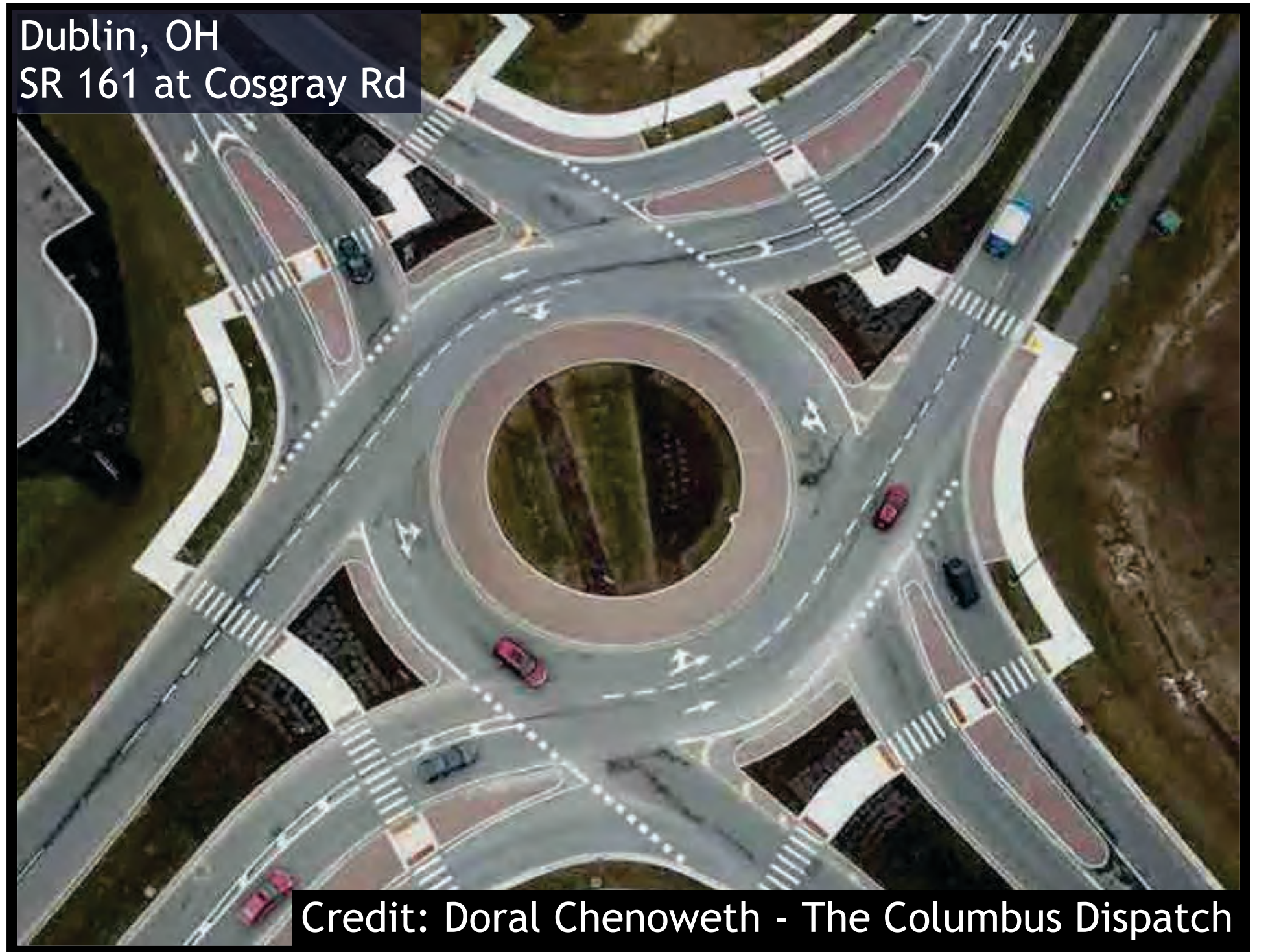
Credit: Google Maps

Delaware County, OH
Worthington Rd at Lewis Center Rd



Credit: Delaware County Engineers Office

Dublin, OH
SR 161 at Cosgray Rd



Credit: Doral Chenoweth - The Columbus Dispatch

Troy, OH
Dorset Rd at Mckaig Ave



Credit: Google Maps

Hilliard, OH
Main St at Cemetery Rd / Scioto Darby Rd



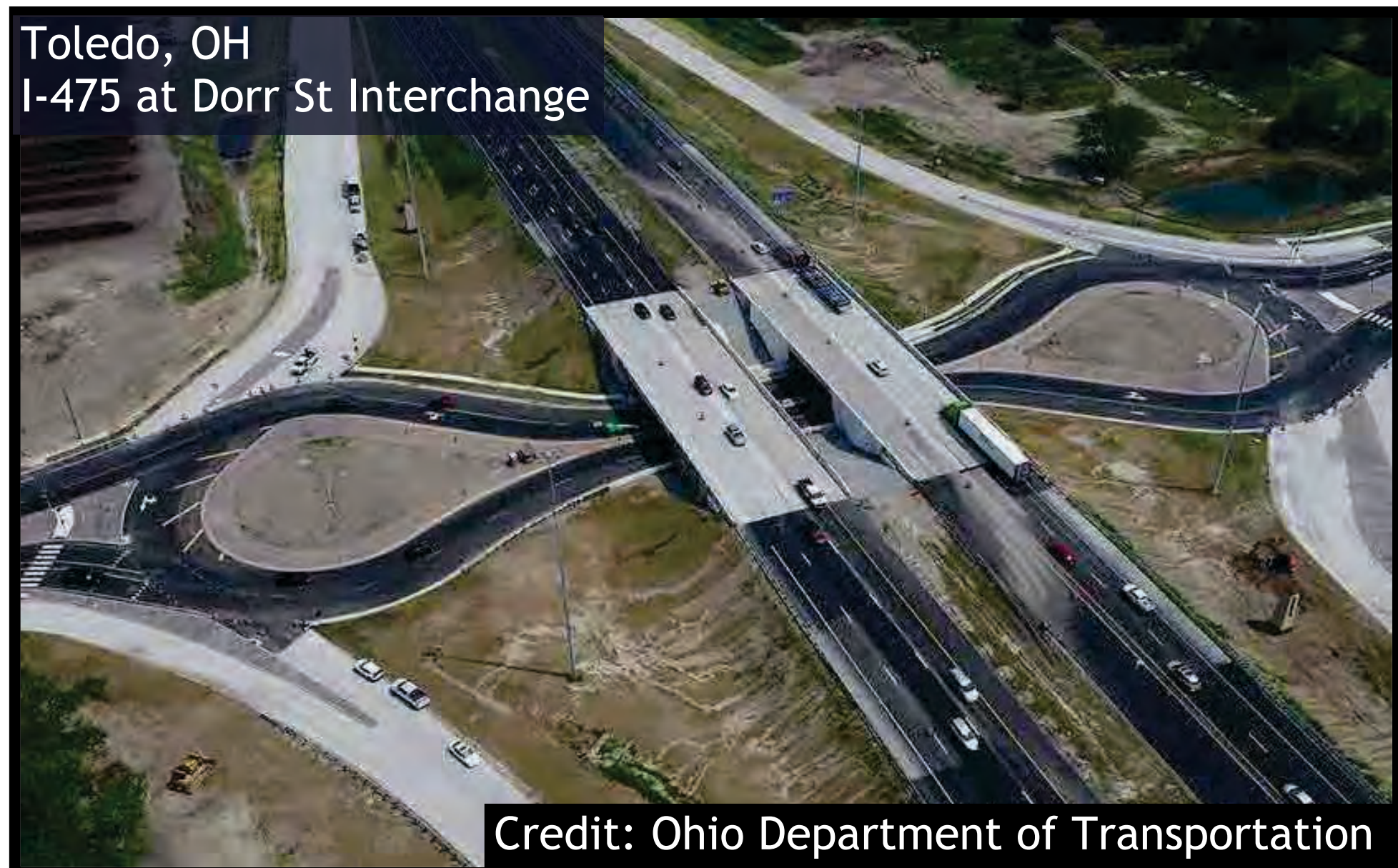
Credit: Google Maps

Jacksonville, FL
University Blvd at Merrill Rd



Credit: The Jacksonville Free Press

Toledo, OH
I-475 at Dorr St Interchange



Credit: Ohio Department of Transportation

OHIO HISTORIC INVENTORY 0000

Ohio Historic Preservation Office
Ohio Historical Center
Columbus, Ohio 43211


1. No. <i>MCT-1112-24</i> <i>11324-038870</i>	4. Present Name(s) <p style="text-align: center;">Oakwood Avenue</p>
2. County Montgomery	5. Other Name(s)
3. Location of Negatives Regional Office 5HA	

6. Specific Location <i>414 Oakwood Avenue</i>	16. Thematic Category D	26. No. of Stories <i>2</i>
7. City or Town If Rural, Township & Vicinity Oakwood	17. Date(s) or Period c. 1920	29. Basement? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
8. Site Plan with North Arrow 	18. Style or Design Georgian Revival	30. Foundation ^{Mat} rock face stone
9. Coordinates Dayton South Lat. _____ Long. _____ U.T.M. Reference <i>16 741800 4927280</i>	19. Architect or Engineer	31. Wall Construction brick
10. Site <input type="checkbox"/> Building <input checked="" type="checkbox"/> Structure <input type="checkbox"/> Object <input type="checkbox"/>	20. Contractor or Builder	32. Roof Type & Material flat
11. On National Register? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	21. Original Use, if apparent residence	33. No. of Bays Front <i>9</i> Side <i>2</i>
12. Is It Eligible? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	22. Present Use residence	34. Wall Treatment stretcher bond
13. Part of Estab. Hist. Dist.? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	23. Ownership Public <input type="checkbox"/> Private <input checked="" type="checkbox"/>	35. Plan Shape <i>rectangle</i>
14. District Potent? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	24. Owner's Name & Address, if known	36. Changes (Explain in #42) Addition <input type="checkbox"/> Altered <input type="checkbox"/> Moved <input type="checkbox"/>
15. Name of Established District <i>Schwartz Park</i>	25. Open to Public? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	37. Condition Interior _____ Exterior <i>excellent</i>
26. Local Contact Person or Organization Montgomery Co. Historical Soc.	27. Other Surveys in Which Included <i>NATIONAL REGISTER</i>	38. Preservation Underway? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
42. Further Description of Important Features Central section of bldg. projects flanked by 2 recessed wings. High foundation, smooth stone water table. Double leaf central entry flanked by multi-lit sidelights, elliptical fanlight off a doric portico with full entablature-the doric columns are fluted, the frieze line is nicely sculptured all in advancing central pavillion. Bays are 8/8 DHS, stone lug sills, blinds, flat brick arches. 2nd story	39. Endangered? By What? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	40. Visible from Public Road? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
43. History and Significance bays have bracketed lug sills. The cornice line of the wings is boxed; wide eaves paneled, characterize the roof line of central section. Wooden belt course separates 2nd story and attic story. 7 decorative very horizontal attic bays. Left side exterior brick chimney. Outstanding representation of Georgian Revival as indicative to the city of	41. Distance from and Frontage on Road <i>220' back 400' wide</i>	
44. Description of Environment and Outbuildings Oakwood. Good use of classical detail enhances the architectural significance of the home. High atop a hill overlooking Oakwood and Dayton. Spacious shaded grounds. Winding path framed by brick pillars and brick steps lead to central entry.	45. Sources of Information	46. Prepared by Carolyn L. Beauregard
	47. Organization Regional Office 5HA	48. Date 5/78
	49. Revision Date(s)	

11324-038870 Montgomery 414 Oakwood Avenue

OHIO HISTORIC INVENTORY

Ohio Historic Preservation Office
Ohio Historical Center
Columbus, Ohio 43211

<p>1. No. <u>MOT-958-24</u> <u>11324-001410</u></p> <p>2. County <u>Montgomery</u></p> <p>3. Location of Negatives <u>Regional Office SHA</u></p>	<p>4. Present Name(s) <u>501 Oakwood Avenue</u></p> <p>5. Other Name(s)</p>														
<p>6. Specific Location <u>501 Oakwood Avenue</u></p>	<p>16. Thematic Category <u>D</u></p> <p>17. Date(s) or Period <u>1930's</u></p>	<p>28. No. of Stories <u>2</u></p> <p>29. Basement? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>30. Foundation Material <u>concrete</u></p> <p>31. Wall Construction <u>frame</u></p> <p>32. Roof Type & Material <u>gable, asphalt</u></p> <p>33. No. of Bays Front <u>8</u> Side <u>3</u></p> <p>34. Wall Treatment <u>Weatherboard</u></p> <p>35. Plan Shape <u>rectangular</u></p>													
<p>7. City or Town If Rural, Township & Vicinity <u>Oakwood</u></p> <p>8. Site Plan with North Arrow</p> 	<p>18. Style or Design <u>Colonial</u></p> <p>19. Architect or Engineer</p> <p>20. Contractor or Builder</p> <p>21. Original Use, if apparent <u>residence</u></p> <p>22. Present Use <u>residence</u></p> <p>23. Ownership Public <input type="checkbox"/> Private <input checked="" type="checkbox"/></p> <p>24. Owner's Name & Address, if known</p>	<p>36. Changes (Explain in #42) Addition <input type="checkbox"/> Altered <input type="checkbox"/> Moved <input type="checkbox"/></p> <p>37. Condition Interior _____ Exterior <u>excellent</u></p> <p>38. Preservation Underway? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>39. Endangered? By What? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>40. Visible from Public Road? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>41. Distance from and Frontage on Road</p>													
<p>9. Coordinates <u>Dayton South</u></p> <p>Lat. _____ Long. _____</p> <p>U.T.M. Reference</p> <table border="1" style="width:100%; text-align: center;"> <tr> <td>16</td><td>7</td><td>4</td><td>1</td><td>8</td><td>0</td><td>0</td> <td>4</td><td>4</td><td>0</td><td>1</td><td>0</td><td>0</td> </tr> </table> <p>Zone Easting Northing</p> <p>10. Site Building <input checked="" type="checkbox"/> Structure Object <input type="checkbox"/></p> <p>11. On National Register? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>12. Is It Eligible? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>13. Part of Estab. Hist. Dist.? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>14. District Potent?? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>15. Name of Established District</p>	16	7	4	1	8	0	0	4	4	0	1	0	0	<p>25. Open to Public? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>26. Local Contact Person or Organization <u>Montgomery Co. Historical Society</u></p> <p>27. Other Surveys in Which Included</p>	<p>42. Further Description of Important Features <u>Bricked entry surrounded by engaged pilasters. 6/6 Dfs bays with wood trim, blinds. This residence is in 2 sections - right section projects, left, a bit recessed. 2 chimneys - right and left sides.</u></p>
16	7	4	1	8	0	0	4	4	0	1	0	0			
<p>43. History and Significance <u>Large residence possessing a strong horizontal facade. A good contributor to the diversity of architectural styles making up the city of Oakwood.</u></p>	<p>44. Description of Environment and Outbuildings <u>Good corner location. Well shaded, well treed.</u></p>														
<p>45. Sources of Information</p>	<p>46. Prepared by <u>Carolyn L. Brannigan</u></p> <p>47. Organization <u>Regional Office SHA</u></p> <p>48. Date <u>8/78</u> 49. Revision Date(s)</p>														

1. No. 11324-001410
 County Montgomery
 2. Present Name(s) 501 Oakwood Avenue
 3. Other Name(s)

