



March 22, 2017

Mr. Barry Perkel, Director of Real Estate  
Frey Street Lodging Associates, LLC  
8333 Greenway Boulevard, Suite 200  
Middleton, WI 53562

Re: Frey Street Traffic Study–Supplemental Traffic Analysis Summary

Dear Mr. Perkel:

As requested by City of Madison Traffic Engineering (TE) staff, this is a summary of supplemental motor vehicle traffic modeling in the Hill Farms and Hilldale Mall area. This analysis is in support of the approvals process for the proposed Frey Street redevelopment project (site) at the corner of Frey Street and Sawyer Terrace, near the Target Store at Hilldale Mall. This analysis also considers forecasted motor vehicle traffic generated from the ongoing redevelopment of the Hill Farms State Office Building site (HFSOB) located just west of the Frey Street site.

TE staff requested this planning level review of the larger transportation system near the site to support development of its site review comments. The intersections summarized here include:

- University Avenue and the proposed new HFSOB entrance on University Avenue located between the eastbound Old Middleton Road on-ramp and the intersection of University Avenue and Segoe Road.
- University Avenue and Segoe Road.
- University Avenue and Hilldale Way.
- Segoe Road and Frey Street.

Two PM peak-hour traffic volume scenarios are included:

- 2018 Total Traffic (including HFSOB redevelopment traffic and Frey Street site traffic).
- 2030 Total Traffic (including HFSOB redevelopment traffic and Frey Street site traffic).

Summary of Findings: The supplemental planning-level traffic analysis summarized here indicates operations are expected to be marginally acceptable in 2018 after full redevelopment of the HFSOB and Frey Street sites. In terms of the subject Frey Street site's contribution to traffic volumes in the area, the incremental impact on traffic operations compared to the existing background and HFSOB site volumes is inconsequential. Based on the forecasted 2018 PM peak-hour total traffic volumes at University Avenue and Segoe Road, the Frey Street site volumes represent approximately 5 percent of the traffic on Segoe Road and 1 percent of the traffic on University Avenue.

## 1. Traffic Volumes Development

2030 Total Traffic volumes were developed based on the forecasted trips from the HFSOB Site Access Location Evaluation (SALE) completed by others in 2015. The SALE considered the proposed University Avenue and Hill Farms intersection as well as the University Avenue and Segoe Road intersection. The other two requested study intersections were not included in the SALE. The study team





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a. 2018 PM Peak Hour Total Traffic

Delay and LOS based on Synchro output indicates operations will generally be acceptable (LOS D or better) at the four study intersections in 2018 after completion of the HFSOB redevelopment and Frey Street site projects. The exception is at University Avenue and Segoe Road where the westbound left-turn (WBL) and northbound left and through movements (NBL, NBT) operate at LOS E and are near capacity.

Some locations have notable predicted queue lengths from Synchro. Some of these are expected to experience volumes that will exceed capacity during the heaviest portion of the PM peak hour<sup>1</sup>. These include:

- (1) University Avenue and Hill Farms entrance:
  - (a) NBL has queues exceeding 350 feet with a peak volume to capacity ratio ( $v/c$ )  $> 1.0$ .
  - (b) Eastbound through (EBT) has queues exceeding 600 feet.
- (2) University Avenue and Segoe Road:
  - (a) NBT and NBL has queues exceeding 300 feet with a peak  $v/c > 1.0$ .
  - (b) EBT has queues exceeding 700 feet with a peak  $v/c > 1.0$ .
  - (c) WBL has queues exceeding 350 feet with a peak  $v/c > 1.0$ .
- (3) University Avenue and Hilldale Way: The westbound through (WBT) has queues exceeding 550 feet.

Observation of SimTraffic microsimulation indicates lane utilization characteristics may result in additional congestion and queuing. Specifically, the share of westbound University Avenue traffic destined for the Old Middleton Road off-ramp (1,338 vehicles making up 43 percent of westbound traffic) results in poor lane utilization that exacerbates westbound congestion.

b. 2030 PM Peak Hour Total Traffic

Delay and LOS based on Synchro output indicates operations will deteriorate to some degree by 2030 if no additional modifications are made to the transportation system. Most movements remain at acceptable levels (LOS D or better) at the four study intersections. At University Avenue and Hill Farms entrance the EBT and NBL operate at LOS E. At University Avenue and Segoe Road the WBL and EBT drop to LOS F.

Some locations have notable predicted queue lengths from Synchro. Some of these are expected to experience volumes that will exceed capacity during the heaviest portion of the PM peak hour. These include:

- (1) University Avenue and Hill Farms entrance:
  - (a) NBL has queues exceeding 500 feet with a peak  $v/c > 1.0$ .
  - (b) EBT has queues exceeding 700 feet with a peak  $v/c > 1.0$ .
- (2) University Avenue and Segoe Road:
  - (a) NBT and NBL has queues exceeding 250 feet with a peak  $v/c > 1.0$ .
  - (b) EBT has queues exceeding 800 feet with a peak  $v/c > 1.0$ .
  - (c) WBL has queues exceeding 300 feet with a peak  $v/c > 1.0$ .

<sup>1</sup> Synchro predicts the volume to capacity ratio, or  $v/c$ , will be over 1.0 during the peak 15 minutes as indicated by a # symbol in the operations results.

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- (d) WBT has queues exceeding 850 feet with a peak  $v/c > 1.0$ .
- (3) University Avenue and Hilldale Way: The WBT has queues exceeding 850 feet with a  $v/c > 1.0$ .

Observation of SimTraffic microsimulation indicates lane utilization characteristics may result in additional congestion and queuing. Specifically, the share of westbound University Avenue traffic destined for the Old Middleton Road off-ramp (1,520 vehicles making up 43 percent of westbound traffic) results in poor lane utilization that exacerbates westbound congestion.

#### 4. Discussion of Possible Modifications

Following is a discussion of possible modifications that could be considered to improve motor vehicle traffic operations. These are based on previous studies as well as the planning level traffic operations analysis documented in this letter.

##### a. Modifications that may fit within the existing geometric footprint

- (1) University Avenue and Hill Farms entrance

There were none.

- (2) University Avenue and Segoe Road

There were none.

- (3) University Avenue and Hilldale Way

Install a partial signal allowing right-in/right-out/left-in movements and providing for a two-stage pedestrian crossing with a raised central refuge island.

- (4) Segoe Road and Frey Street

There were none.

- (5) Additional Modifications

The following additional modifications could be considered to improve motor vehicle routing options to/from the east, west, and south.

- (a) Implement adaptive signal control on University Avenue to improve the operations during the shoulders of the peak traffic volume periods and accommodate seasonal and non-recurring volume changes.
- (b) Provide all-way stop control at the intersection of Sheboygan Road and Eau Claire Avenue.
- (c) Provide all-way stop control at the HFSOB driveway(s) with Sheboygan Avenue to facilitate the southbound left-turn movements.
- (d) Add a protected NBL signal phase at the intersection of Midvale Boulevard and Regent Street.

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b. Modifications that likely require geometric alterations

(1) University Avenue and Hill Farms entrance

Maximize the northbound left-turn bay storage.

(2) University Avenue and Segoe Road

Provide a triple northbound left-turn configuration consisting of one exclusive northbound left-turn bay, one exclusive northbound left-turn lane, and one shared northbound left/through/right lane. Providing appropriate turning space for trucks may require geometric modifications to the intersection.

Provide dual westbound left-turn lanes.

Provide a dual lane westbound off-ramp to Old Middleton Road so two westbound through lanes are available for traffic destined to Old Middleton Road at the Segoe Road stop bar. This will improve lane utilization and reduce the westbound queuing. This likely would require construction of retaining walls along the westbound off-ramp.

(3) University Avenue and Hilldale Way

Install a partial signal allowing right-in/right-out/left-in movements and providing for a two-stage pedestrian crossing with a raised central refuge island. Maximize the westbound left-turn bay storage.

(4) Segoe Road and Frey Street

There were none.

(5) Additional Modifications

The following additional modifications could be considered to improve motor vehicle routing options to/from the east, west, and south.

(a) Add motor vehicle capacity to the intersection of Whitney Way and Old Middleton Road.

(b) Provide a westbound u-turn option from the Old Middleton road westbound off-ramp to travel back eastbound and enter the HFSOB site via the proposed right-in/right-out on the Old Middleton Road on-ramp with the goal of drawing some traffic away from the WBL from University Avenue to Segoe Road.

(c) Signalize the intersection of Segoe Road and Sheboygan Avenue.

5. Conclusions

The supplemental planning level traffic analysis summarized here indicates operations are expected to be marginally acceptable in 2018 after full redevelopment of the HFSOB and Frey Street sites. In terms of the subject Frey Street site's contribution to traffic volumes in the area, the incremental impact on traffic operations compared to the existing background and HFSOB site volumes is inconsequential.

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Based on the forecasted 2018 PM peak-hour total traffic volumes at University Avenue and Segoe Road, the Frey Street site volumes represent approximately 5 percent of the traffic on Segoe Road and 1 percent of the traffic on University Avenue.

Please let me know if you have questions about this supplemental traffic analysis, or need additional information.

Sincerely,

STRAND ASSOCIATES, INC.®

A handwritten signature in blue ink, appearing to read "J. S. Held", is written over the company name.

Jeffrey S. Held, P.E., PTOE

Enclosures

**APPENDIX  
TRAFFIC VOLUMES AND OPERATIONS OUTPUT**

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**Apply 2017 Turn Percentages to Volume Imbalances**

To Old Midd.:

1520

0	0	0	0	0	0	22	27	24	0	3,342	0	3,342	92	69	0	0
2303	5038	0	1,950	1,930	0	6769	University/Segoe	0	0	3,342	0	3,342	2527	6413	University/Hilldale	60
180	Univ/HFSOB	1850	+/-	2,493	2366	2958	2030 HFSOB	384	2958	+/-	0	2,781	162	2030 HFSOB	3273	63
	415	0	2,493	2,493	127	384	470	0	391	2,781	0	2,781	162	0	0	167

538	861
0	+/-
538	861

4	423	111
0	1808	294
0	Segoe/Frey	0
218	2030 HFSOB	129
0	567	62

Apply Frey Street Site Traffic 2030

Frey Site Inbound 60  
 Frey Site Outbound 83

To Old Midd.:

1520

43%

0	0	0	0
0	5105	0	0
2324	Univ/HFSOB	1896	46
180	2030 Total	100	
415	0	190	

0	22	27	24
1,976	6840	0	0
20	University/Segoe	2958	
+/-	2030 Total	384	
1,996	516	0	395
2,514	46	4	
0			

3,342	0	3,342
+/-		
2,785	0	2,785

92	69	0	0
2531	6471	0	0
162	University/Hilldale	3273	
	2030 Total	96	33
0	0	0	188
			21

559	911
0	+/-
559	911

0	4	423	132
0	1890	344	50
218	Segoe/Frey	0	
	2030 Total	137	8
0	0	567	65
			3

3 inbound from Sawyer Terrace  
 4 outbound to Mall/south



**2018 OPERATIONS WITH NO MODIFICATIONS**

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Timings

4: SEGOE ROAD & University Ave

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Configurations	↑↑↑	↘	↑↑↑	↘	↖	↗	↖	↗
Traffic Volume (vph)	2082	338	2603	460	0	348	24	19
Future Volume (vph)	2082	338	2603	460	0	348	24	19
Lane Group Flow (vph)	2283	348	2684	237	237	359	47	20
Turn Type	NA	pm+pt	NA	Split	NA	pm+ov	NA	Perm
Protected Phases	6	5	2	4	4	5	8	
Permitted Phases		2				4		8
Detector Phase	6	5	2	4	4	5	8	8
Switch Phase								
Minimum Initial (s)	15.0	8.0	15.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	42.0	12.0	42.0	23.0	23.0	12.0	14.0	14.0
Total Split (s)	56.0	22.0	78.0	23.0	23.0	22.0	14.0	14.0
Total Split (%)	48.7%	19.1%	67.8%	20.0%	20.0%	19.1%	12.2%	12.2%
Yellow Time (s)	4.0	3.5	4.0	4.0	4.0	3.5	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	2.0	2.0	0.5	2.0	2.0
Lost Time Adjust (s)	-2.0	0.0	-2.0	-2.0	-2.0	0.0	-2.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	6.0
Lead/Lag	Lead	Lag				Lag		
Lead-Lag Optimize?								
Recall Mode	C-Min	None	C-Min	None	None	None	None	None
Act Effct Green (s)	55.1	77.1	77.1	18.7	18.7	40.7	10.0	8.0
Actuated g/C Ratio	0.48	0.67	0.67	0.16	0.16	0.35	0.09	0.07
v/c Ratio	0.95	1.01	0.79	0.87	0.87	0.57	0.30	0.08
Control Delay	21.5	75.9	11.5	76.8	76.8	24.3	54.6	0.7
Queue Delay	1.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
Total Delay	22.5	75.9	11.5	76.8	76.8	26.1	54.6	0.7
LOS	C	E	B	E	E	C	D	A
Approach Delay	22.5		18.9		54.9		38.5	
Approach LOS	C		B		D		D	
Queue Length 50th (ft)	~140	~205	250	181	181	146	33	0
Queue Length 95th (ft)	#723	m#351	332	#328	#328	244	72	0
Internal Link Dist (ft)	185		900		124		129	
Turn Bay Length (ft)		350		100				
Base Capacity (vph)	2412	343	3408	277	277	631	158	242
Starvation Cap Reductn	35	0	0	0	0	140	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	1.01	0.79	0.86	0.86	0.73	0.30	0.08

Intersection Summary

Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 4 (3%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.01	
Intersection Signal Delay: 25.3	Intersection LOS: C
Intersection Capacity Utilization 92.2%	ICU Level of Service F
Analysis Period (min) 15	

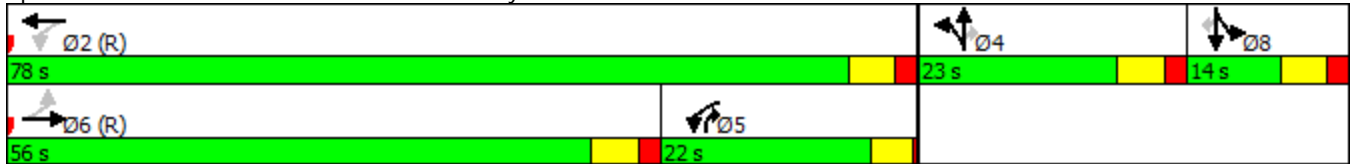
# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: SEGOE ROAD & University Ave



Timings  
5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017



Lane Group	EBL	EBT	WBL	WBT	NBR	SBR
Lane Configurations						
Traffic Volume (vph)	81	2228	88	2880	168	60
Future Volume (vph)	81	2228	88	2880	168	60
Lane Group Flow (vph)	84	2443	91	3024	173	62
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm
Protected Phases	1	6	5	2		
Permitted Phases	6		2		6	4
Detector Phase	1	6	5	2	6	4
Switch Phase						
Minimum Initial (s)	8.0	15.0	8.0	15.0	15.0	10.0
Minimum Split (s)	12.0	22.0	12.0	22.0	22.0	28.0
Total Split (s)	12.0	89.0	12.0	89.0	89.0	14.0
Total Split (%)	10.4%	77.4%	10.4%	77.4%	77.4%	12.2%
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	4.0
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?						
Recall Mode	None	C-Min	None	C-Min	C-Min	Min
Act Effct Green (s)	92.6	82.6	93.4	85.0	82.6	8.4
Actuated g/C Ratio	0.81	0.72	0.81	0.74	0.72	0.07
v/c Ratio	0.45	0.68	0.48	0.81	0.12	0.30
Control Delay	32.3	2.2	23.8	12.5	0.2	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.3	2.2	23.8	12.5	0.2	6.7
LOS	C	A	C	B	A	A
Approach Delay		3.2		12.8		
Approach LOS		A		B		
Queue Length 50th (ft)	25	24	12	495	0	0
Queue Length 95th (ft)	m33	m47	67	564	0	16
Internal Link Dist (ft)		900		472		
Turn Bay Length (ft)	230		75			
Base Capacity (vph)	188	3631	188	3747	1448	209
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.67	0.48	0.81	0.12	0.30

Intersection Summary

Cycle Length: 115  
 Actuated Cycle Length: 115  
 Offset: 12 (10%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green  
 Natural Cycle: 110  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.81  
 Intersection Signal Delay: 8.3  
 Intersection Capacity Utilization 75.2%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service D



Timings  
 5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
 Partial Signal

03/19/2017

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Hilldale Farms Entrance & University Ave

 Ø1	 Ø2 (R)	 Ø4
12 s	89 s	14 s
 Ø5	 Ø6 (R)	
12 s	89 s	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017



Lane Group	WBL	WBR	NBT	NBR	SBL
Lane Configurations					
Traffic Volume (vph)	122	309	499	58	118
Future Volume (vph)	122	309	499	58	118
Lane Group Flow (vph)	126	319	514	60	122
Turn Type	Prot	pm+ov	NA	Perm	D.P+P
Protected Phases	8	1	2		1
Permitted Phases		8		2	2
Detector Phase	8	1	2	2	1
Switch Phase					
Minimum Initial (s)	6.0	6.0	8.0	8.0	6.0
Minimum Split (s)	26.0	9.5	26.0	26.0	9.5
Total Split (s)	26.0	12.7	26.3	26.3	12.7
Total Split (%)	40.0%	19.5%	40.5%	40.5%	19.5%
Yellow Time (s)	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	2.0	0.0	2.0	2.0	0.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.5
Total Lost Time (s)	4.0	1.5	4.0	4.0	4.0
Lead/Lag		Lead	Lag	Lag	Lead
Lead-Lag Optimize?		Yes	Yes	Yes	Yes
Recall Mode	None	None	C-Min	C-Min	None
Act Effct Green (s)	13.2	24.0	35.5	35.5	42.2
Actuated g/C Ratio	0.20	0.37	0.55	0.55	0.65
v/c Ratio	0.35	0.47	0.27	0.07	0.19
Control Delay	23.4	8.2	10.7	4.9	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	8.2	10.7	4.9	5.9
LOS	C	A	B	A	A
Approach Delay	12.5		10.1		
Approach LOS	B		B		
Queue Length 50th (ft)	44	44	53	1	13
Queue Length 95th (ft)	70	63	121	23	44
Internal Link Dist (ft)	234		101		
Turn Bay Length (ft)		100		50	
Base Capacity (vph)	599	724	1933	890	686
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.44	0.27	0.07	0.18

### Intersection Summary

Cycle Length: 65	
Actuated Cycle Length: 65	
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.47	
Intersection Signal Delay: 10.6	Intersection LOS: B
Intersection Capacity Utilization 39.6%	ICU Level of Service A
Analysis Period (min) 15	

Timings

9: SEGOE ROAD & Frey Street

03/19/2017

Splits and Phases: 9: SEGOE ROAD & Frey Street



Timings  
26: Hill Farms & University

NOTE: HFSOB  
Partial Signal

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBR	Ø2
Lane Configurations	↑↑↑	↵	↑↑	↵	↶	
Traffic Volume (vph)	2048	88	1674	365	167	
Future Volume (vph)	2048	88	1674	365	167	
Lane Group Flow (vph)	2274	91	1726	376	172	
Turn Type	NA	pm+pt	NA	Prot	Perm	
Protected Phases	6	5	2 8!	8!		2
Permitted Phases		2 8!			8	
Detector Phase	6	5	2 8	8	8	
Switch Phase						
Minimum Initial (s)	15.0	8.0		10.0	10.0	15.0
Minimum Split (s)	27.0	12.0		22.0	22.0	22.0
Total Split (s)	65.0	12.0		38.0	38.0	77.0
Total Split (%)	56.5%	10.4%		33.0%	33.0%	67%
Yellow Time (s)	4.0	3.5		4.0	4.0	4.0
All-Red Time (s)	2.0	0.5		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	4.0		6.0	6.0	
Lead/Lag	Lead	Lag				
Lead-Lag Optimize?		Yes				
Recall Mode	C-Min	None		Min	Min	C-Max
Act Effct Green (s)	61.4	111.0	115.0	32.0	32.0	
Actuated g/C Ratio	0.53	0.97	1.00	0.28	0.28	
v/c Ratio	0.85	0.48	0.49	0.76	0.33	
Control Delay	27.4	21.5	0.3	49.6	15.6	
Queue Delay	0.7	0.0	0.0	0.0	0.0	
Total Delay	28.1	21.5	0.3	49.6	15.6	
LOS	C	C	A	D	B	
Approach Delay	28.1		1.4	39.0		
Approach LOS	C		A	D		
Queue Length 50th (ft)	528	9	0	255	38	
Queue Length 95th (ft)	604	m27	0	#379	98	
Internal Link Dist (ft)	416		205	231		
Turn Bay Length (ft)		150		100		
Base Capacity (vph)	2685	191	3539	492	515	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	157	0	0	0	2	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.90	0.48	0.49	0.76	0.34	

Intersection Summary

Cycle Length: 115  
 Actuated Cycle Length: 115  
 Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.85  
 Intersection Signal Delay: 18.9  
 Intersection Capacity Utilization 83.3%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service E

- # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.
- ! Phase conflict between lane groups.

Splits and Phases: 26: Hill Farms & University



**2030 OPERATIONS WITH NO MODIFICATIONS**

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Timings

4: SEGOE ROAD & University Ave

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBT	NBR	SBT	SBR
Lane Configurations	↑↑↑	↘	↑↑↑	↘	↖	↗	↖	↗
Traffic Volume (vph)	2366	384	2958	516	0	395	27	22
Future Volume (vph)	2366	384	2958	516	0	395	27	22
Lane Group Flow (vph)	2592	396	3049	266	266	407	53	23
Turn Type	NA	pm+pt	NA	Split	NA	Perm	NA	Perm
Protected Phases	6	5	2	4	4		8	
Permitted Phases		2				4		8
Detector Phase	6	5	2	4	4	4	8	8
Switch Phase								
Minimum Initial (s)	15.0	8.0	15.0	10.0	10.0	10.0	8.0	8.0
Minimum Split (s)	42.0	12.0	42.0	23.0	23.0	23.0	14.0	14.0
Total Split (s)	42.9	17.1	60.0	26.0	26.0	26.0	14.0	14.0
Total Split (%)	42.9%	17.1%	60.0%	26.0%	26.0%	26.0%	14.0%	14.0%
Yellow Time (s)	4.0	3.5	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	0.0	-2.0	-2.0	-2.0	0.0	-2.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag						
Lead-Lag Optimize?								
Recall Mode	C-Min	None	Min	None	None	None	None	None
Act Effct Green (s)	43.1	60.2	60.2	20.6	20.6	18.6	10.0	8.0
Actuated g/C Ratio	0.43	0.60	0.60	0.21	0.21	0.19	0.10	0.08
v/c Ratio	1.20	1.29	1.00	0.77	0.77	0.72	0.29	0.08
Control Delay	106.0	166.7	25.2	52.9	52.9	16.3	46.4	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	106.0	166.7	25.2	52.9	52.9	16.3	46.4	0.6
LOS	F	F	C	D	D	B	D	A
Approach Delay	106.0		41.4		37.1		32.5	
Approach LOS	F		D		D		C	
Queue Length 50th (ft)	~789	~276	~781	166	166	42	32	0
Queue Length 95th (ft)	m#819	m#312	#874	#280	#280	148	70	0
Internal Link Dist (ft)	185		900		124		129	
Turn Bay Length (ft)		350		100				
Base Capacity (vph)	2169	308	3060	369	369	580	182	277
Starvation Cap Reductn	1	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.20	1.29	1.00	0.72	0.72	0.70	0.29	0.08

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 50 (50%), Referenced to phase 6:EBTL, Start of Green	
Natural Cycle: 145	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.29	
Intersection Signal Delay: 64.5	Intersection LOS: E
Intersection Capacity Utilization 101.2%	ICU Level of Service G
Analysis Period (min) 15	

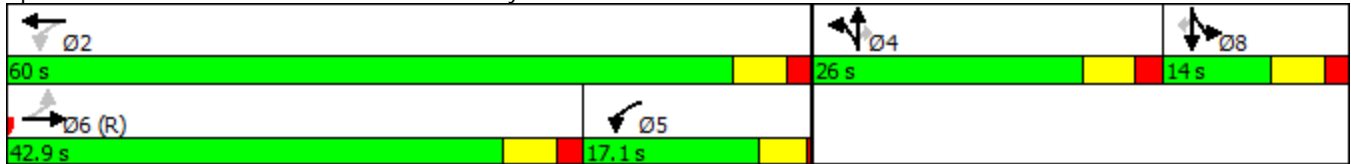
# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: SEGOE ROAD & University Ave





Timings  
5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017



Lane Group	EBL	EBT	WBL	WBT	NBR	SBR
Lane Configurations						
Traffic Volume (vph)	92	2531	96	3273	188	69
Future Volume (vph)	92	2531	96	3273	188	69
Lane Group Flow (vph)	95	2776	99	3374	194	71
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm
Protected Phases	1	6	5	2		
Permitted Phases	6		2		6	4
Detector Phase	1	6	5	2	6	4
Switch Phase						
Minimum Initial (s)	8.0	15.0	8.0	15.0	15.0	10.0
Minimum Split (s)	12.0	22.0	12.0	22.0	22.0	28.0
Total Split (s)	12.0	74.0	12.0	74.0	74.0	14.0
Total Split (%)	12.0%	74.0%	12.0%	74.0%	74.0%	14.0%
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	4.0
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?						
Recall Mode	None	C-Min	None	Min	C-Min	Min
Act Effect Green (s)	78.8	70.4	78.8	70.4	70.4	8.0
Actuated g/C Ratio	0.79	0.70	0.79	0.70	0.70	0.08
v/c Ratio	0.44	0.78	0.46	0.94	0.13	0.30
Control Delay	21.5	12.5	18.7	21.2	0.2	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	12.5	18.7	21.2	0.2	5.7
LOS	C	B	B	C	A	A
Approach Delay		12.8		21.2		
Approach LOS		B		C		
Queue Length 50th (ft)	28	203	9	664	0	0
Queue Length 95th (ft)	m23	m102	60	#890	0	14
Internal Link Dist (ft)		900		472		
Turn Bay Length (ft)	230		75			
Base Capacity (vph)	216	3542	216	3579	1439	235
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.78	0.46	0.94	0.13	0.30

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 39 (39%), Referenced to phase 6:EBTL, Start of Green	
Natural Cycle: 130	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 16.8	Intersection LOS: B
Intersection Capacity Utilization 81.6%	ICU Level of Service D
Analysis Period (min) 15	

Timings

5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017

- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Hilldale Farms Entrance & University Ave

 Ø1 12 s	 Ø2 74 s	 Ø4 14 s
 Ø5 12 s	 Ø6 (R) 74 s	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017



Lane Group	WBL	WBR	NBT	NBR	SBL
Lane Configurations	↶	↷	↕	↶	↷
Traffic Volume (vph)	137	344	567	65	132
Future Volume (vph)	137	344	567	65	132
Lane Group Flow (vph)	141	355	585	67	136
Turn Type	Prot	pm+ov	NA	Perm	D.P+P
Protected Phases	8	1	2		1
Permitted Phases		8		2	2
Detector Phase	8	1	2	2	1
Switch Phase					
Minimum Initial (s)	6.0	6.0	8.0	8.0	6.0
Minimum Split (s)	26.0	9.5	26.0	26.0	9.5
Total Split (s)	26.0	12.7	26.3	26.3	12.7
Total Split (%)	40.0%	19.5%	40.5%	40.5%	19.5%
Yellow Time (s)	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	2.0	0.0	2.0	2.0	0.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.5
Total Lost Time (s)	4.0	1.5	4.0	4.0	4.0
Lead/Lag		Lead	Lag	Lag	Lead
Lead-Lag Optimize?		Yes	Yes	Yes	Yes
Recall Mode	None	None	C-Min	C-Min	None
Act Effect Green (s)	13.6	25.1	34.4	34.4	41.9
Actuated g/C Ratio	0.21	0.39	0.53	0.53	0.64
v/c Ratio	0.38	0.52	0.31	0.08	0.23
Control Delay	23.7	11.2	11.4	5.5	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.7	11.2	11.4	5.5	6.2
LOS	C	B	B	A	A
Approach Delay	14.8		10.8		
Approach LOS	B		B		
Queue Length 50th (ft)	50	66	64	2	15
Queue Length 95th (ft)	77	87	137	26	49
Internal Link Dist (ft)	234		101		
Turn Bay Length (ft)		100		50	
Base Capacity (vph)	599	708	1874	864	626
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.24	0.50	0.31	0.08	0.22

### Intersection Summary

Cycle Length: 65	
Actuated Cycle Length: 65	
Offset: 0 (0%), Referenced to phase 2:NBSB and 6:, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.52	
Intersection Signal Delay: 11.9	Intersection LOS: B
Intersection Capacity Utilization 43.6%	ICU Level of Service A
Analysis Period (min) 15	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017

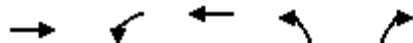
Splits and Phases: 9: SEGOE ROAD & Frey Street



Timings  
26: Hill Farms & University

NOTE: HFSOB  
Partial Signal

03/19/2017



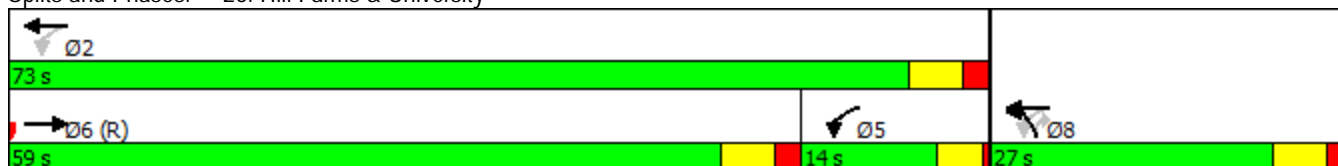
Lane Group	EBT	WBL	WBT	NBL	NBR	Ø2
Lane Configurations	↑↑↑	↙	↑↑	↙	↗	
Traffic Volume (vph)	2324	100	1896	415	190	
Future Volume (vph)	2324	100	1896	415	190	
Lane Group Flow (vph)	2582	103	1955	428	196	
Turn Type	NA	pm+pt	NA	Prot	Perm	
Protected Phases	6	5	2 8!	8!		2
Permitted Phases		2 8!			8	
Detector Phase	6	5	2 8	8	8	
Switch Phase						
Minimum Initial (s)	15.0	4.0		10.0	10.0	15.0
Minimum Split (s)	27.0	8.0		22.0	22.0	22.0
Total Split (s)	59.0	14.0		27.0	27.0	73.0
Total Split (%)	59.0%	14.0%		27.0%	27.0%	73%
Yellow Time (s)	4.0	3.5		4.0	4.0	4.0
All-Red Time (s)	2.0	0.5		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	4.0		6.0	6.0	
Lead/Lag	Lead	Lag				
Lead-Lag Optimize?		Yes				
Recall Mode	C-Min	None		Min	Min	None
Act Effct Green (s)	53.0	96.0	100.0	25.1	25.1	
Actuated g/C Ratio	0.53	0.96	1.00	0.25	0.25	
v/c Ratio	0.97	0.47	0.55	0.97	0.39	
Control Delay	34.9	17.4	0.2	75.0	12.9	
Queue Delay	43.3	0.0	0.0	0.0	0.1	
Total Delay	78.1	17.4	0.2	75.0	13.0	
LOS	E	B	A	E	B	
Approach Delay	78.1		1.1	55.5		
Approach LOS	E		A	E		
Queue Length 50th (ft)	553	12	0	~296	26	
Queue Length 95th (ft)	#705	m13	m0	#511	90	
Internal Link Dist (ft)	416		205	231		
Turn Bay Length (ft)		150		100		
Base Capacity (vph)	2665	254	3456	443	505	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	809	0	0	0	23	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	1.39	0.41	0.57	0.97	0.41	

Intersection Summary

Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 24 (24%), Referenced to phase 6:EBT, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.97  
 Intersection Signal Delay: 45.3  
 Intersection Capacity Utilization 90.8%  
 Analysis Period (min) 15  
 Intersection LOS: D  
 ICU Level of Service E

- ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.
- ! Phase conflict between lane groups.

Splits and Phases: 26: Hill Farms & University



**2018 OPERATIONS INCLUDING MODIFICATIONS**

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# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Configurations	↑↑↑	↘↘	↑↑↑	↘↘	↔	↔	↗
Traffic Volume (vph)	2082	338	2603	460	0	24	19
Future Volume (vph)	2082	338	2603	460	0	24	19
Lane Group Flow (vph)	2283	348	2684	237	596	47	20
Turn Type	NA	pm+pt	NA	Split	NA	NA	Perm
Protected Phases	6	5	2	4	4	8	
Permitted Phases		2					8
Detector Phase	6	5	2	4	4	8	8
Switch Phase							
Minimum Initial (s)	15.0	8.0	15.0	10.0	10.0	8.0	8.0
Minimum Split (s)	42.0	12.0	42.0	23.0	23.0	14.0	14.0
Total Split (s)	61.0	13.0	74.0	42.0	42.0	14.0	14.0
Total Split (%)	46.9%	10.0%	56.9%	32.3%	32.3%	10.8%	10.8%
Yellow Time (s)	4.0	3.5	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.0
Lead/Lag	Lead	Lag					
Lead-Lag Optimize?							
Recall Mode	C-Min	None	C-Min	None	None	None	None
Act Effct Green (s)	59.8	72.8	72.8	38.0	38.0	10.0	8.0
Actuated g/C Ratio	0.46	0.56	0.56	0.29	0.29	0.08	0.06
v/c Ratio	0.99	0.99	0.94	0.25	1.12	0.34	0.09
Control Delay	26.8	73.0	22.7	30.6	106.0	63.9	0.8
Queue Delay	4.1	0.0	0.0	0.0	0.4	0.0	0.0
Total Delay	30.8	73.0	22.7	30.6	106.3	63.9	0.8
LOS	C	E	C	C	F	E	A
Approach Delay	30.8		28.4		84.8	45.1	
Approach LOS	C		C		F	D	
Queue Length 50th (ft)	~754	~104	781	72	-552	38	0
Queue Length 95th (ft)	#831	m#170	#916	104	#818	79	0
Internal Link Dist (ft)	185		900		124	129	
Turn Bay Length (ft)		350		100			
Base Capacity (vph)	2316	351	2847	941	531	140	215
Starvation Cap Reductn	44	0	0	0	24	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.99	0.94	0.25	1.18	0.34	0.09

### Intersection Summary

Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 8 (6%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.12	
Intersection Signal Delay: 37.0	Intersection LOS: D
Intersection Capacity Utilization 95.1%	ICU Level of Service F
Analysis Period (min) 15	



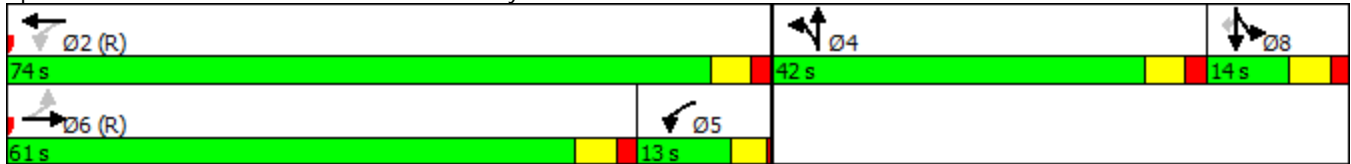
# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: SEGOE ROAD & University Ave



Timings  
5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017



Lane Group	EBL	EBT	WBL	WBT	NBR	SBR
Lane Configurations	↖	↗↗↗	↖	↖↖↖	↗	↘
Traffic Volume (vph)	81	2228	88	2880	168	60
Future Volume (vph)	81	2228	88	2880	168	60
Lane Group Flow (vph)	84	2443	91	3024	173	62
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm
Protected Phases	1	6	5	2		
Permitted Phases	6		2		6	4
Detector Phase	1	6	5	2	6	4
Switch Phase						
Minimum Initial (s)	8.0	15.0	8.0	15.0	15.0	10.0
Minimum Split (s)	12.0	22.0	12.0	22.0	22.0	28.0
Total Split (s)	12.0	89.0	13.0	90.0	89.0	28.0
Total Split (%)	9.2%	68.5%	10.0%	69.2%	68.5%	21.5%
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	4.0
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?						
Recall Mode	None	C-Min	None	C-Min	C-Min	Min
Act Effct Green (s)	103.2	93.2	104.0	93.6	93.2	12.4
Actuated g/C Ratio	0.79	0.72	0.80	0.72	0.72	0.10
v/c Ratio	0.50	0.68	0.53	0.83	0.12	0.26
Control Delay	31.5	3.3	30.5	16.1	0.2	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.5	3.3	30.5	16.1	0.2	5.2
LOS	C	A	C	B	A	A
Approach Delay		4.3		16.5		
Approach LOS		A		B		
Queue Length 50th (ft)	34	42	20	534	0	0
Queue Length 95th (ft)	m37	m83	85	847	0	14
Internal Link Dist (ft)		900		472		
Turn Bay Length (ft)	230		75			
Base Capacity (vph)	167	3608	181	3650	1446	353
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.68	0.50	0.83	0.12	0.18

Intersection Summary

Cycle Length: 130  
 Actuated Cycle Length: 130  
 Offset: 1 (1%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green  
 Natural Cycle: 110  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.83  
 Intersection Signal Delay: 10.6  
 Intersection Capacity Utilization 75.2%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service D

Timings  
 5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
 Partial Signal

03/19/2017

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Hilldale Farms Entrance & University Ave

 Ø1 12 s	 Ø2 (R) 90 s	 Ø4 28 s
 Ø5 13 s	 Ø6 (R) 89 s	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017



Lane Group	WBL	WBR	NBT	NBR	SBL
Lane Configurations					
Traffic Volume (vph)	122	309	499	58	118
Future Volume (vph)	122	309	499	58	118
Lane Group Flow (vph)	126	319	514	60	122
Turn Type	Prot	pm+ov	NA	Perm	D.P+P
Protected Phases	8	1	2		1
Permitted Phases		8		2	2
Detector Phase	8	1	2	2	1
Switch Phase					
Minimum Initial (s)	6.0	6.0	8.0	8.0	6.0
Minimum Split (s)	26.0	9.5	26.0	26.0	9.5
Total Split (s)	38.0	37.0	55.0	55.0	37.0
Total Split (%)	29.2%	28.5%	42.3%	42.3%	28.5%
Yellow Time (s)	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	2.0	0.0	2.0	2.0	0.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.5
Total Lost Time (s)	4.0	1.5	4.0	4.0	4.0
Lead/Lag		Lead	Lag	Lag	Lead
Lead-Lag Optimize?		Yes	Yes	Yes	Yes
Recall Mode	None	None	C-Min	C-Min	None
Act Effect Green (s)	16.6	30.5	94.0	94.0	101.4
Actuated g/C Ratio	0.13	0.23	0.72	0.72	0.78
v/c Ratio	0.56	0.61	0.20	0.05	0.17
Control Delay	63.1	21.3	6.6	3.9	4.8
Queue Delay	0.0	0.3	0.0	0.0	0.0
Total Delay	63.1	21.6	6.6	3.9	4.8
LOS	E	C	A	A	A
Approach Delay	33.3		6.3		
Approach LOS	C		A		
Queue Length 50th (ft)	101	87	66	6	18
Queue Length 95th (ft)	m159	172	107	23	m36
Internal Link Dist (ft)	234		101		
Turn Bay Length (ft)		100		50	
Base Capacity (vph)	462	794	2560	1153	916
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	139	175	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.49	0.22	0.05	0.13

### Intersection Summary

Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 31 (24%), Referenced to phase 2:NBSB, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.61	
Intersection Signal Delay: 16.7	Intersection LOS: B
Intersection Capacity Utilization 39.6%	ICU Level of Service A
Analysis Period (min) 15	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: SEGOE ROAD & Frey Street



Timings  
26: Hill Farms & University

NOTE: HFSOB  
Partial Signal

03/19/2017



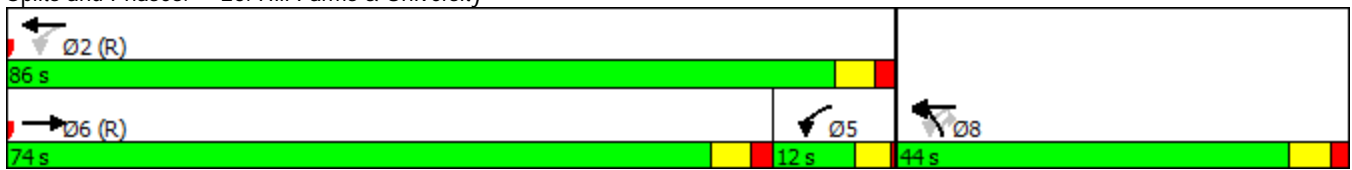
Lane Group	EBT	WBL	WBT	NBL	NBR	Ø2
Lane Configurations	↑↑↑	↖	↑↑	↖	↗	
Traffic Volume (vph)	2048	88	1674	365	167	
Future Volume (vph)	2048	88	1674	365	167	
Lane Group Flow (vph)	2274	91	1726	376	172	
Turn Type	NA	pm+pt	NA	Prot	Perm	
Protected Phases	6	5	2 8!	8!		2
Permitted Phases		2 8!			8	
Detector Phase	6	5	2 8	8	8	
Switch Phase						
Minimum Initial (s)	15.0	8.0		10.0	10.0	15.0
Minimum Split (s)	27.0	12.0		22.0	22.0	22.0
Total Split (s)	74.0	12.0		44.0	44.0	86.0
Total Split (%)	56.9%	9.2%		33.8%	33.8%	66%
Yellow Time (s)	4.0	3.5		4.0	4.0	4.0
All-Red Time (s)	2.0	0.5		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	4.0		6.0	6.0	
Lead/Lag	Lead	Lag				
Lead-Lag Optimize?		Yes				
Recall Mode	C-Min	None		Min	Min	C-Max
Act Effct Green (s)	68.4	126.0	130.0	37.6	37.6	
Actuated g/C Ratio	0.53	0.97	1.00	0.29	0.29	
v/c Ratio	0.86	0.51	0.49	0.73	0.33	
Control Delay	31.0	18.9	0.2	51.4	18.5	
Queue Delay	3.4	0.0	0.0	0.0	0.0	
Total Delay	34.4	18.9	0.2	51.4	18.5	
LOS	C	B	A	D	B	
Approach Delay	34.4		1.2	41.1		
Approach LOS	C		A	D		
Queue Length 50th (ft)	591	19	0	285	50	
Queue Length 95th (ft)	664	m24	m0	405	113	
Internal Link Dist (ft)	416		205	231		
Turn Bay Length (ft)		150		100		
Base Capacity (vph)	2645	177	3517	517	527	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	282	0	0	0	4	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.96	0.51	0.49	0.73	0.33	

Intersection Summary

Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 128 (98%), Referenced to phase 2:WBTL and 6:EBT, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 22.2	Intersection LOS: C
Intersection Capacity Utilization 83.3%	ICU Level of Service E
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.  
! Phase conflict between lane groups.

Splits and Phases: 26: Hill Farms & University



**2030 OPERATIONS INCLUDING MODIFICATIONS**

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# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Configurations	↑↑↑	↘↘	↑↑↑	↘↘	↔	↔	↗
Traffic Volume (vph)	2366	384	2958	516	0	27	22
Future Volume (vph)	2366	384	2958	516	0	27	22
Lane Group Flow (vph)	2592	396	3049	266	673	53	23
Turn Type	NA	pm+pt	NA	Split	NA	NA	Perm
Protected Phases	6	5	2	4	4	8	
Permitted Phases		2					8
Detector Phase	6	5	2	4	4	8	8
Switch Phase							
Minimum Initial (s)	15.0	8.0	15.0	10.0	10.0	8.0	8.0
Minimum Split (s)	42.0	12.0	42.0	23.0	23.0	14.0	14.0
Total Split (s)	63.0	12.0	75.0	41.0	41.0	14.0	14.0
Total Split (%)	48.5%	9.2%	57.7%	31.5%	31.5%	10.8%	10.8%
Yellow Time (s)	4.0	3.5	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	6.0
Lead/Lag	Lead	Lag					
Lead-Lag Optimize?							
Recall Mode	C-Min	None	Min	None	None	None	None
Act Effct Green (s)	61.8	73.8	73.8	37.0	37.0	10.0	8.0
Actuated g/C Ratio	0.48	0.57	0.57	0.28	0.28	0.08	0.06
v/c Ratio	1.08	1.22	1.06	0.29	1.29	0.38	0.11
Control Delay	58.2	145.8	49.5	30.2	173.1	65.4	1.0
Queue Delay	7.2	0.0	0.0	0.0	0.2	0.0	0.0
Total Delay	65.5	145.8	49.5	30.2	173.3	65.4	1.0
LOS	E	F	D	C	F	E	A
Approach Delay	65.5		60.6		132.8	45.9	
Approach LOS	E		E		F	D	
Queue Length 50th (ft)	~911	~160	~1052	82	~717	43	0
Queue Length 95th (ft)	#1003	m#193	#1132	110	#959	87	0
Internal Link Dist (ft)	185		900		124	129	
Turn Bay Length (ft)		350		100			
Base Capacity (vph)	2393	324	2886	916	520	140	215
Starvation Cap Reductn	51	0	0	0	13	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.11	1.22	1.06	0.29	1.33	0.38	0.11

### Intersection Summary

Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 15 (12%), Referenced to phase 6:EBTL, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.29	
Intersection Signal Delay: 71.8	Intersection LOS: E
Intersection Capacity Utilization 103.9%	ICU Level of Service G
Analysis Period (min) 15	

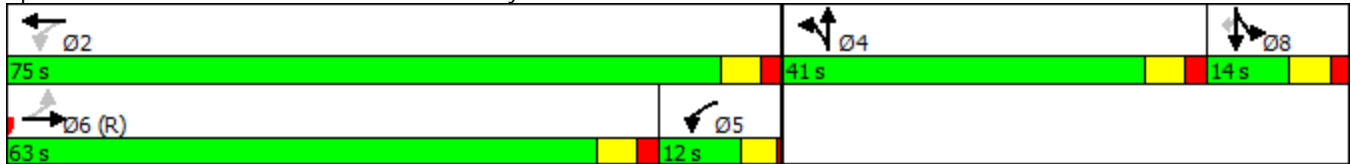
# Timings

## 4: SEGOE ROAD & University Ave

03/19/2017

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: SEGOE ROAD & University Ave



Timings  
5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017



Lane Group	EBL	EBT	WBL	WBT	NBR	SBR
Lane Configurations	↖	↗↗↗	↖	↗↗↗	↖	↗
Traffic Volume (vph)	92	2531	96	3273	188	69
Future Volume (vph)	92	2531	96	3273	188	69
Lane Group Flow (vph)	95	2776	99	3374	194	71
Turn Type	pm+pt	NA	pm+pt	NA	Perm	Perm
Protected Phases	1	6	5	2		
Permitted Phases	6		2		6	4
Detector Phase	1	6	5	2	6	4
Switch Phase						
Minimum Initial (s)	8.0	15.0	8.0	15.0	15.0	10.0
Minimum Split (s)	12.0	22.0	12.0	22.0	22.0	28.0
Total Split (s)	12.0	90.0	12.0	90.0	90.0	28.0
Total Split (%)	9.2%	69.2%	9.2%	69.2%	69.2%	21.5%
Yellow Time (s)	3.5	4.0	3.5	4.0	4.0	4.0
All-Red Time (s)	0.5	2.0	0.5	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?						
Recall Mode	None	C-Min	None	Min	C-Min	Min
Act Effct Green (s)	103.6	93.6	103.6	93.6	93.6	12.4
Actuated g/C Ratio	0.80	0.72	0.80	0.72	0.72	0.10
v/c Ratio	0.57	0.77	0.59	0.92	0.13	0.30
Control Delay	33.6	5.4	36.4	21.1	0.2	7.4
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	33.6	5.5	36.4	21.1	0.2	7.4
LOS	C	A	D	C	A	A
Approach Delay		6.4		21.6		
Approach LOS		A		C		
Queue Length 50th (ft)	41	71	27	715	0	0
Queue Length 95th (ft)	m37	m95	#103	#1183	0	25
Internal Link Dist (ft)		900		472		
Turn Bay Length (ft)	230		75			
Base Capacity (vph)	167	3622	167	3661	1447	351
Starvation Cap Reductn	0	142	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.80	0.59	0.92	0.13	0.20

Intersection Summary

Cycle Length: 130  
 Actuated Cycle Length: 130  
 Offset: 12 (9%), Referenced to phase 6:EBTL, Start of Green  
 Natural Cycle: 130  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.92  
 Intersection Signal Delay: 14.2  
 Intersection Capacity Utilization 81.6%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service D

Timings

5: Hilldale Farms Entrance & University Ave

NOTE: Hilldale Way  
Partial Signal

03/19/2017

- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Hilldale Farms Entrance & University Ave

 Ø1 12 s	 Ø2 90 s	 Ø4 28 s
 Ø5 12 s	 Ø6 (R) 90 s	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017



Lane Group	WBL	WBR	NBT	NBR	SBL
Lane Configurations					
Traffic Volume (vph)	137	344	567	65	132
Future Volume (vph)	137	344	567	65	132
Lane Group Flow (vph)	141	355	585	67	136
Turn Type	Prot	pm+ov	NA	Perm	D.P+P
Protected Phases	8	1	2		1
Permitted Phases		8		2	2
Detector Phase	8	1	2	2	1
Switch Phase					
Minimum Initial (s)	6.0	6.0	8.0	8.0	6.0
Minimum Split (s)	26.0	9.5	26.0	26.0	9.5
Total Split (s)	37.0	39.0	54.0	54.0	39.0
Total Split (%)	28.5%	30.0%	41.5%	41.5%	30.0%
Yellow Time (s)	4.0	3.5	4.0	4.0	3.5
All-Red Time (s)	2.0	0.0	2.0	2.0	0.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.5
Total Lost Time (s)	4.0	1.5	4.0	4.0	4.0
Lead/Lag		Lead	Lag	Lag	Lead
Lead-Lag Optimize?		Yes	Yes	Yes	Yes
Recall Mode	None	None	C-Min	C-Min	None
Act Effect Green (s)	17.7	31.9	92.6	92.6	100.3
Actuated g/C Ratio	0.14	0.25	0.71	0.71	0.77
v/c Ratio	0.59	0.71	0.23	0.06	0.21
Control Delay	62.9	33.6	7.3	4.5	4.9
Queue Delay	0.0	0.5	0.5	0.0	0.0
Total Delay	62.9	34.0	7.8	4.5	4.9
LOS	E	C	A	A	A
Approach Delay	42.2		7.4		
Approach LOS	D		A		
Queue Length 50th (ft)	113	162	79	8	22
Queue Length 95th (ft)	m172	m251	131	28	m23
Internal Link Dist (ft)	234		101		
Turn Bay Length (ft)		100		50	
Base Capacity (vph)	449	800	2521	1136	887
Starvation Cap Reductn	0	0	1418	0	0
Spillback Cap Reductn	0	149	220	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.55	0.53	0.06	0.15

### Intersection Summary

Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 32 (25%), Referenced to phase 2:NBSB and 6:, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 20.6	Intersection LOS: C
Intersection Capacity Utilization 43.6%	ICU Level of Service A
Analysis Period (min) 15	

# Timings

## 9: SEGOE ROAD & Frey Street

03/19/2017

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: SEGOE ROAD & Frey Street



Timings  
26: Hill Farms & University

NOTE: HFSOB  
Partial Signal

03/19/2017



Lane Group	EBT	WBL	WBT	NBL	NBR	Ø2
Lane Configurations	↑↑↑	↵	↑↑	↵	↶	
Traffic Volume (vph)	2324	100	1896	415	190	
Future Volume (vph)	2324	100	1896	415	190	
Lane Group Flow (vph)	2582	103	1955	428	196	
Turn Type	NA	pm+pt	NA	Prot	Perm	
Protected Phases	6	5	2 8!	8!		2
Permitted Phases		2 8!			8	
Detector Phase	6	5	2 8	8	8	
Switch Phase						
Minimum Initial (s)	15.0	4.0		10.0	10.0	15.0
Minimum Split (s)	27.0	8.0		22.0	22.0	22.0
Total Split (s)	77.0	10.0		43.0	43.0	87.0
Total Split (%)	59.2%	7.7%		33.1%	33.1%	67%
Yellow Time (s)	4.0	3.5		4.0	4.0	4.0
All-Red Time (s)	2.0	0.5		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.0	4.0		6.0	6.0	
Lead/Lag	Lead	Lag				
Lead-Lag Optimize?		Yes				
Recall Mode	C-Min	None		Min	Min	None
Act Effect Green (s)	71.0	126.0	130.0	37.0	37.0	
Actuated g/C Ratio	0.55	0.97	1.00	0.28	0.28	
v/c Ratio	0.94	0.73	0.55	0.85	0.40	
Control Delay	35.8	23.4	0.1	60.9	28.3	
Queue Delay	44.7	0.0	0.0	0.0	0.0	
Total Delay	80.5	23.4	0.1	60.9	28.4	
LOS	F	C	A	E	C	
Approach Delay	80.5		1.2	50.7		
Approach LOS	F		A	D		
Queue Length 50th (ft)	716	32	0	341	91	
Queue Length 95th (ft)	799	m33	m0	#515	163	
Internal Link Dist (ft)	416		205	231		
Turn Bay Length (ft)		150		200		
Base Capacity (vph)	2746	141	3539	503	493	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	470	0	0	0	5	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	1.13	0.73	0.55	0.85	0.40	

Intersection Summary

Cycle Length: 130  
 Actuated Cycle Length: 130  
 Offset: 0 (0%), Referenced to phase 6:EBT, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.94  
 Intersection Signal Delay: 46.0  
 Intersection Capacity Utilization 90.8%  
 Analysis Period (min) 15  
 Intersection LOS: D  
 ICU Level of Service E

- # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.
- ! Phase conflict between lane groups.

Splits and Phases: 26: Hill Farms & University

