Auburn Citywide Traffic Study

Signal System Report

PREPARED FOR:

City of Auburn

PREPARED BY:

SKIPPER CONSULTING INC

AUGUST 2020

Auburn Citywide Traffic Study
SIGNAL SYSTEM REPORT

City of Auburn

PREPARED BY:

SKIPPER CONSULTING, INC.
3644 Vann Road, Suite 100
Birmingham, Alabama 35235
205.655.8855

ALABAMA REGISTERED No. 20061 PROFESSIONAL ENGINEER RICHARD LYN CAUDLE

SIGNED: Richard Caudle

DATE: 8/4/20

AUGUST 2020

SKIPPER CONSULTING INC

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INTRODUCTION

Traffic Signal systems were implemented on eight roadways in the City of Auburn. The locations of the signal systems are listed below and are illustrated in Figure 1.

- South College Street, from the I-85 Northbound Ramps to Woodfield Drive (3 subsystems)
- Dean Road, from Annalue Drive to East Samford Avenue
- North Donahue Drive, from Bragg Avenue/MLK Drive to Magnolia Avenue
- East University Drive, from Gatewood Drive to Mall Parkway
- Gay Street, from Thach Avenue to Mitcham Avenue
- Moores Mill Road, from East University Drive to Grove Hill Road
- Opelika Road, from Mall Parkway to Gay Street (2 subsystems)
- Samford Avenue, from College Street to Gay Street

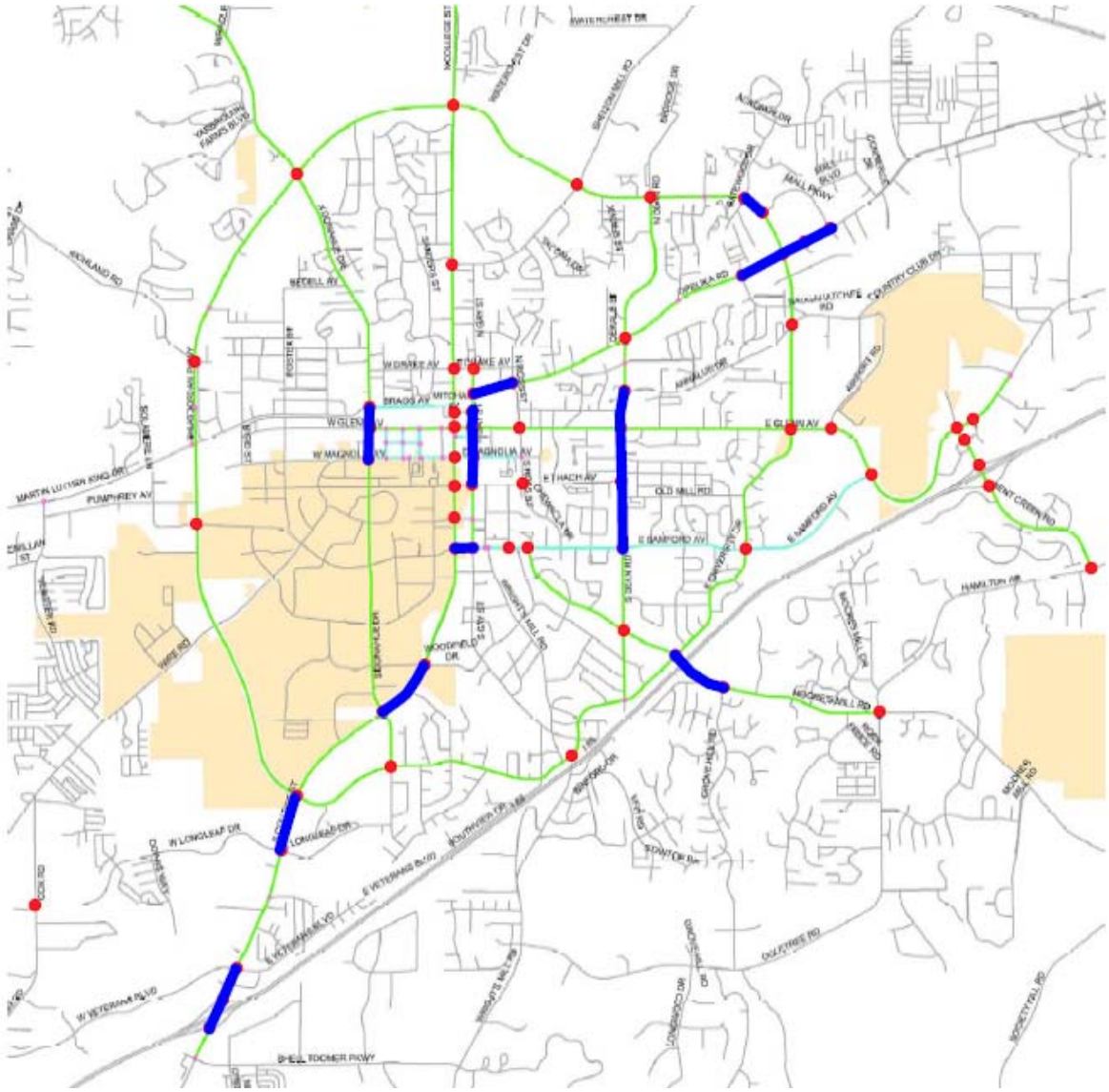


Figure 1. Signal System Location Map

SOUTH COLLEGE STREET

Three traffic signal subsystems were implemented on South College Street. The three subsystems are listed below, and the locations indicated in Figure 2.

- Subsystem 1
  - South College Street at I-85 Northbound Ramps
  - South College Street at I-85 Southbound Ramps
  - South College Street at Veterans Boulevard
- Subsystem 2
  - South College Street at Longleaf Drive
  - South College Street at East University Drive/Shug Jordan Parkway
- Subsystem 3
  - South College Street at Donahue Drive
  - South College Street at Woodfield Drive

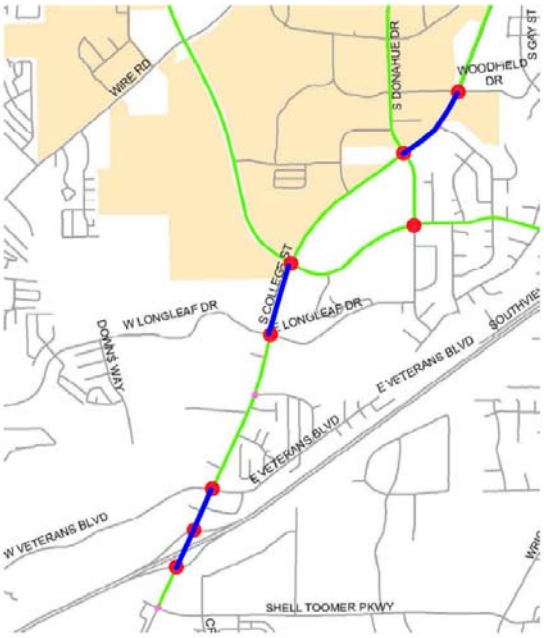


Figure 2. South College Street Signal System

Coordination timings for the South College Street signal system intersections are shown in Table 1. The time clock is shown in Table 2. Time-space diagrams are included in Appendix A.

Table 1
Coordination Timings
South College Street

College Street at I-85 NB Exit										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	0	70	0	0	30*	40	0	30	88
Midday (2-1-1)	110	0	80	0	0	35*	45	0	30	98
AM (3-1-1)	120	0	90	0	0	35*	55	0	30	107
PM (4-1-1)	130	0	95	0	0	40*	55	0	35	124
College Street at I-85 SB Exit										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	20	50	0	30	0	70	0	0	93
Midday (2-1-1)	110	20	60	0	30	0	80	0	0	92
AM (3-1-1)	120	25	65	0	30	0	90	0	0	111
PM (4-1-1)	130	20	80	0	30	0	100	0	0	117

* - lagging left turn
Offsets referenced to beginning of green
(†) – Coordinated Phase

Table 1 (continued)
Coordination Timings
South College Street

College Street at Veterans Boulevard										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	20	45	0	35	20	45	0	35	0
Midday (2-1-1)	110	20	55	0	35	20	55	0	35	0
AM (3-1-1)	120	20	65	0	35	20	65	0	35	0
PM (4-1-1)	130	20	75	0	35	20	75	0	35	0
College Street at Longleaf Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	120	20	45	20	35	20	45	20	35	2
Midday (2-1-1)	140	30	45	30	35	20	55	30	35	5
AM (3-1-1)	130	20	55	20	35	20	55	20	35	103
PM (4-1-1)	150	30	55	30	35	20	65	30	35	12
College Street at EUD/Shug Jordan Pkwy										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	120	20	45	20	35	25	40	20	35	0
Midday (2-1-1)	140	20	60	25	35	35	45	25	35	0
AM (3-1-1)	130	20	55	20	35	35	40	20	35	0
PM (4-1-1)	150	20	55	30	45	35	40	30	45	0
College Street at Donahue Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	20	45	0	35	30	35	0	35	0
Midday (2-1-1)	110	20	55	0	35	30	45	0	35	0
AM (3-1-1)	110	20	55	0	35	35	40	0	35	0
PM (4-1-1)	120	20	60	0	40	30	50	0	40	0
College Street at Woodfield Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	20	45	0	35	20	45	0	35	0
Midday (2-1-1)	110	20	55	0	35	20	55	0	35	108
AM (3-1-1)	110	20	55	0	35	20	55	0	35	4
PM (4-1-1)	120	20	65	0	35	20	65	0	35	115

* - lagging left turn
Offsets referenced to beginning of green
(†) – Coordinated Phase

Table 2
Time Clock
South College Street

Day of Week	Time	Dial-Split-Offset
Monday-Thursday	0000	004
	0545	311
	0845	111
	1115	211
	1530	411
	1830	111
	2115	004
Friday	0000	004
	0545	311
	0845	111
	1115	211
	1530	411
	1830	111
	2215	004
Saturday	0000	004
	0715	111
	0930	211
	1815	111
	2230	004
Sunday	0000	004
	0830	111
	1000	211
	1830	111
	2045	004

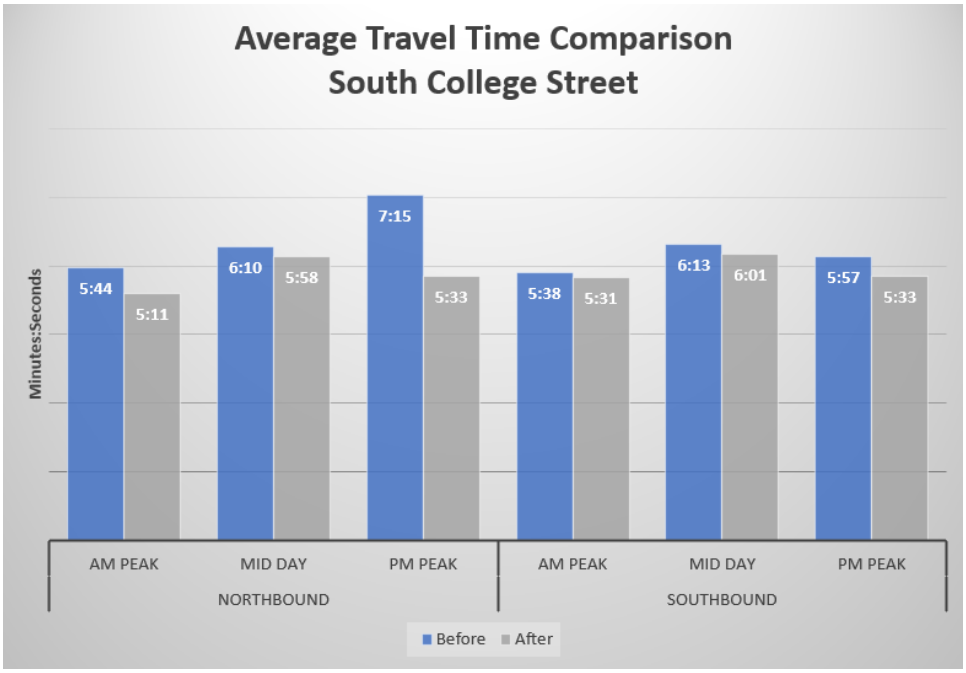
A comparison of before-and-after travel time runs on South College Street between the I-85 Southbound Ramps and Woodfield Drive is shown in Table 3. The overall improvement in travel speeds due to implementation of coordination is as follows:

- AM
  - Northbound +3.0 mph
  - Southbound +0.6 mph
- Midday
  - Northbound +0.9 mph
  - Southbound +0.9 mph
- PM
  - Northbound +1.7 mph
  - Southbound +2.0 mph

Table 3
Before-and-After Travel Time Runs
South College Street

Direction	Run #	AM Peak		Midday Peak		PM Peak	
		Before	After	Before	After	Before	After
Northbound	1	323	369	332	360	410	364
	2	317	305	354	358	441	429
	3	346	325	417	288	438	371
	4	365	330	344	412	451	429
	5	306	278	365	385	443	503
	6	402	257	406	347	426	328
	Average	*344*	*311*	*370*	*358*	*435*	*404*
Southbound	1	304	315	328	298	338	303
	2	402	281	315	327	365	268
	3	275	322	443	394	350	389
	4	311	403	363	353	387	293
	5	396	392	383	434	374	360
	6	340	278	437	332	379	389
	Average	*338*	*331*	*373*	*361*	*357*	*333*

Note: results are times in total seconds of travel time



Graphs of the before and after travel time runs for the a.m., midday, and p.m. peak periods are for each direction of traffic flow are included in Appendix A.

DEAN ROAD

A traffic signal system was implemented on Dean Road. The intersections included in the system are listed below and the locations indicated in Figure 3.

- Dean Road at Annalue Drive
- Dean Road at East Glenn Avenue
- Dean Road at East Thach Avenue
- Dean Road at East Samford Avenue

Coordination timings for the Dean Road signal system intersections are shown in Table 4. The time clock is shown in Table 5.

A comparison of before-and-after travel time runs on Dean Road between Annalue Drive and Samford Avenue is shown in Table 6. Time-space diagrams are included in Appendix B.

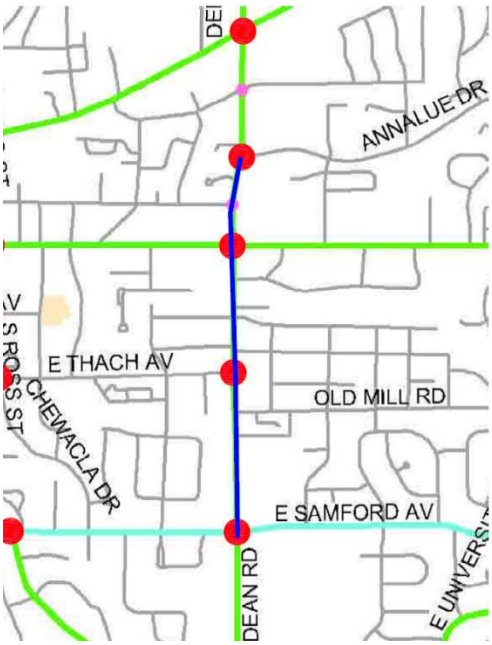


Figure 3. Dean Road Signal System

Table 4
Coordination Timings
Dean Road

Dean Road at Annalue Drive										
Plan	Cycle	1	2(†)	3	4	5	6	7	8	Offset
AM (1-1-1)	110	0	72	0	38					60
Midday (2-1-1)	60	0	36	0	24					40
PM (3-1-1)	60	0	36	0	24					33
Dean Road at East Glenn Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	14	40	13	43	19	35	19	37	9
Midday (2-1-1)	120	29	35	13	43	25	39	14	42	116
PM (3-1-1)	120	29	35	17	39	25	39	17	39	80
Dean Road at East Thach Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	12	55	0	20	0	67	0	23	14
Midday (2-1-1)	120	12	61	0	24	0	73	0	23	63
PM (3-1-1)	120	12	51	0	34	0	63	0	23	0

Offsets referenced to end of green
(†) – Coordinated Phase

Table 4 (continued)
Coordination Timings
Dean Road

Dean Road at Samford Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	15	40	15	40	13	42	15	40	106
Midday (2-1-1)	120	13	53	13	41	13	53	13	41	43
PM (3-1-1)	120	13	55	13	39	13	55	20	32	62

Offsets referenced to end of green
(†) – Coordinated Phase

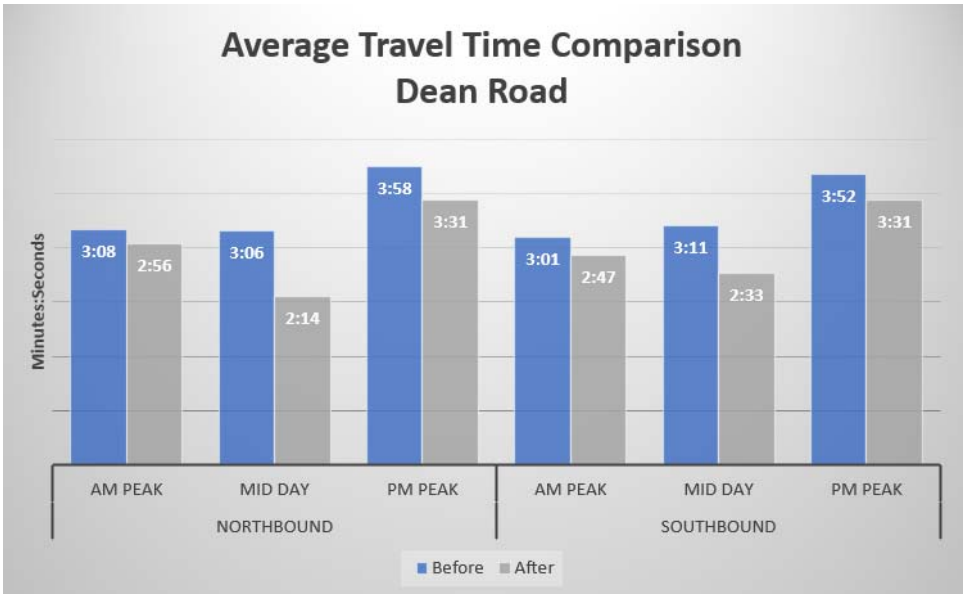
Table 5
Time Clock
Dean Road

Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	0700	111
	0900	004
	1100	211
	1500	311
	1800	004

Table 6
Before-and-After Travel Time Runs
Dean Road

Direction	Run #	AM Peak		Midday Peak		PM Peak	
		Before	After	Before	After	Before	After
Northbound	1	159	116	214	132	219	203
	2	238	209	127	150	190	157
	3	250	162	168	117	276	194
	4	182	205	217	131	228	181
	5	164	171	154	134	269	219
	6	137	195	237	140	244	230
	Average	*188*	*176*	*186*	*134*	*238*	*197*
Southbound	1	189	177	234	155	148	166
	2	241	131	143	132	234	206
	3	223	226	190	155	191	231
	4	171	202	206	164	235	210
	5	135	114	181	147	335	227
	6	130	149	192	167	249	227
	Average	*181*	*167*	*191*	*153*	*232*	*211*

Note: results are times in total seconds of travel time



The overall improvement in travel speeds due to implementation of coordination is as follows:

- AM
  - Northbound +1.4 mph
  - Southbound +1.7 mph
- Midday
  - Northbound +7.9 mph
  - Southbound +4.9 mph
- PM
  - Northbound +3.3 mph
  - Southbound +1.6 mph

Graphs of the before and after travel time runs for the a.m., midday, and p.m. peak periods are for each direction of traffic flow are included in Appendix B.

NORTH DONAHUE DRIVE

A traffic signal system was implemented on North Donahue Drive. The intersections included in the system are listed below and the locations indicated in Figure 4.

- North Donahue Drive at Bragg Avenue/MLK Drive
- North Donahue Drive at West Glenn Avenue
- North Donahue Drive at West Magnolia Avenue

Coordination timings for the Donahue Drive signal system intersections are shown in Table 7. The time clock is shown in Table 8. Time-space diagrams are included in Appendix C.

A comparison of before-and-after travel time runs on Donahue Drive between Bragg Avenue/MLK Drive and Magnolia Avenue is shown in Table 9.

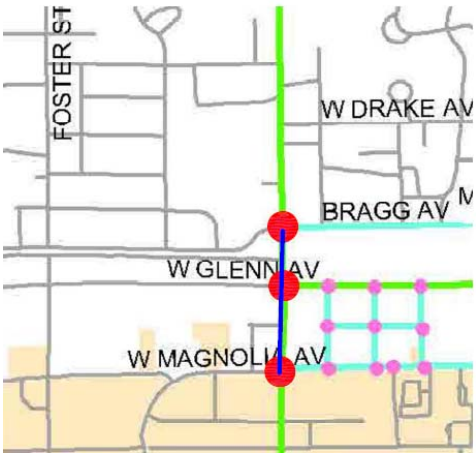


Figure 4. Donahue Drive Signal System

Table 7
Coordination Timings
Donahue Drive

Donahue Drive at Bragg Avenue/MLK Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	18	39	16	37	15	42	19	34	58
Off (2-1-1)	100	18	38	16	28	16	40	17	27	45
PM (3-1-1)	125	18	56	18	33	15	59	18	33	33
Midday (4-1-1)	105	18	43	16	28	16	45	17	27	42
Donahue Drive at West Glenn Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	15	49	16	30	21	43	22	24	57
Off (2-1-1)	100	16	40	16	28	18	38	20	24	45
PM (3-1-1)	125	18	54	16	37	18	54	29	24	19
Midday (4-1-1)	105	16	43	17	29	16	43	22	24	42
Donahue Drive at West Magnolia Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	18	41	18	33	15	44	16	35	0
Off (2-1-1)	100	15	33	17	35	15	33	17	35	0
PM (3-1-1)	125	16	46	20	43	16	46	28	35	0
Midday (4-1-1)	105	15	38	17	35	15	38	17	35	0

Offsets referenced to beginning of green
(†) – Coordinated Phase

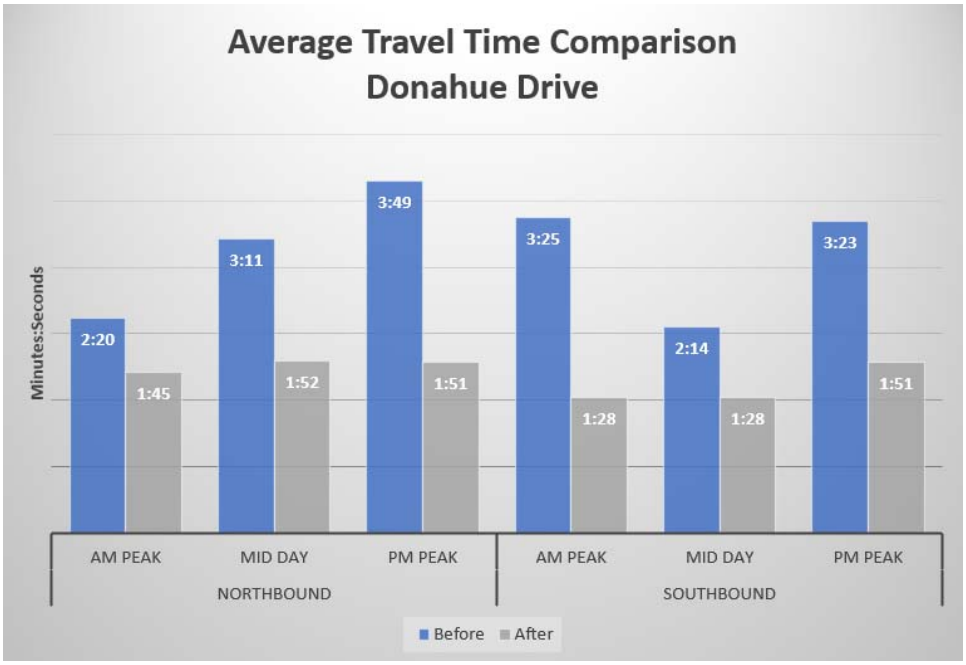
Table 8
Time Clock
Donahue Drive

Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	0630	111
	0900	211
	1045	411
	1430	311
	1900	004
Saturday	0000	004
	0845	211
	2200	004
Sunday	0000	004
	1015	211
	2100	004

Table 9
Before-and-After Travel Time Runs
Donahue Drive

Direction	Run #	AM Peak		Midday Peak		PM Peak	
		Before	After	Before	After	Before	After
Northbound	1	103	79	260	83	223	172
	2	149	104	170	149	269	129
	3	168	101	254	114	223	166
	4	99	93	180	73	155	146
	5	176	180	120	123	186	180
	6	143	76	159	128	317	198
	Average	*140*	*105*	*191*	*112*	*229*	*165*
Southbound	1	274	61	88	92	254	121
	2	254	61	147	78	219	101
	3	124	74	190	80	158	84
	4	149	70	87	78	70	105
	5	268	150	124	86	209	97
	6	162	109	165	112	305	159
	Average	*205*	*88*	*134*	*88*	*203*	*111*

Note: results are times in total seconds of travel time



The overall improvement in travel speeds due to implementation of coordination is as follows:

- AM
  - Northbound +3.6 mph
  - Southbound +9.8 mph
- Midday
  - Northbound +5.6 mph
  - Southbound +5.9 mph
- PM
  - Northbound +2.6 mph
  - Southbound +6.2 mph

Graphs of the before and after travel time runs for the a.m., midday, and p.m. peak periods are for each direction of traffic flow are included in Appendix C.

EAST UNIVERSITY DRIVE

A traffic signal system was implemented on East University Drive. The intersections included in the system are listed below and the locations indicated in Figure 5.

- East University Drive at Gatewood Drive
- East University Drive at Mall Parkway

Coordination timings for the East University Drive signal system intersections are shown in Table 10. The time clock is shown in Table 11. Time-space diagrams are included in Appendix D.

The time clock for weekdays (Monday-Thursday and Friday) change the system mode to FREE from 0740-0805 and 1450-1545 due to a peaking of side street traffic caused by traffic generated by Lee-Scott Academy. The system needs to operate in FREE because the side street demands up to 55 seconds of green time to handle school traffic on Gatewood Drive and service for Gatewood Drive cannot be delayed while the intersection of EUD/Gatewood Drive is serving coordinated phases on EUD.

Figure 5. East University Drive Signal System

Before-and-after travel time runs were not performed on East University Drive because the system is only two intersections. In such a case, travel time runs are meaningless because they are unduly influenced by the random delay at the beginning of the run due to the fact that the driver can arrive at any point in the cycle. Coordination is recommended due to the proximity of the two signals, such that a vehicle, when receiving main street green at the first signal, has a favored progression band to also receive a green indication at the second signal.

Table 10
Coordination Timings
East University Drive

East University Drive at Gatewood Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	20	35	20	25	16	39	25	20	0
Midday (2-1-1)	110	25	40	20	25	16	49	25	20	0
AM (3-1-1)	110	30	35	20	25	16	49	27	18	0
PM (4-1-1)	120	25	45	20	30	16	54	32	18	0
Saturday (4-2-1)	110	25	40	20	25	20	45	25	20	0
East University Drive at Mall Parkway										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	15	55	0	30	25	45	0	30	88
Midday (2-1-1)	110	15	60	0	35	25	50	0	35	100
AM (3-1-1)	110	20	60	0	30	25	55	0	30	108
PM (4-1-1)	120	15	70	0	35	25	60	0	35	107
Saturday (4-2-1)	110	20	50	0	40	25	45	0	40	105

Offsets referenced to beginning of green
(†) – Coordinated Phase

Table 11
Time Clock
East University Drive

Day of Week	Time	Dial-Split-Offset
Monday-Thursday	0000	004
	0615	111
	0700	311
	0740	004
	0805	311
	0830	111
	1045	211
	1450	004
	1545	411
	1745	111
	2130	004
Friday	0000	004
	0615	311
	0740	004
	0805	311
	0830	111
	1045	211
	1450	004
	1545	411
	1745	211
	1845	111
	2130	004
Saturday	0000	004
	0715	111
	1115	421
	1930	111
	2215	004
Sunday	0000	004
	0830	111
	1215	211
	1815	111
	2045	004

GAY STREET

A traffic signal system was implemented on Gay Street. The intersections included in the system are listed below and the locations indicated in Figure 6.

- Gay Street at Thach Avenue
- Gay Street at Magnolia Avenue
- Gay Street at Glenn Avenue
- Gay Street at Mitcham Avenue

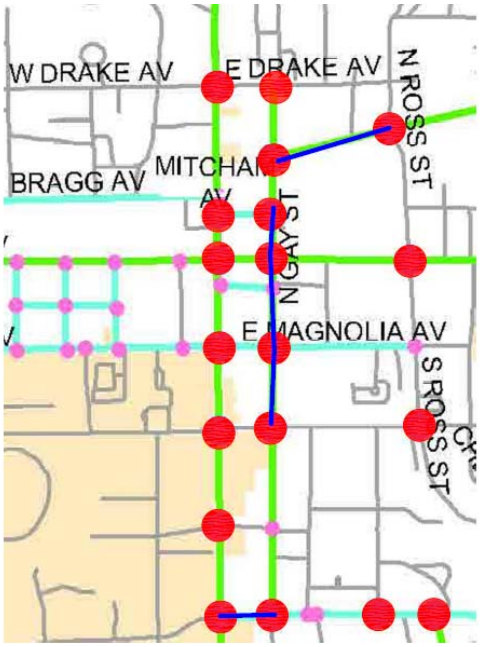


Figure 6. Gay Street Signal System

Coordination timings for the Gay Street signal system intersections are shown in Table 12. The time clock is shown in Table 13. Time-space diagrams are included in Appendix E.

Plans implemented for the Gay Street corridor include only midday and p.m. peak plans. An a.m. peak plan was also developed and implemented, but was subsequently disabled. During fine-tuning of the a.m. peak plan, it was determined that traffic inbound to the Auburn University campus from eastern areas of Auburn on Glenn Avenue, Magnolia Avenue, and Thach Avenue experienced significant delay since these roadways are the non-coordinated phase, and that traffic northbound and southbound on Gay Street is considerably lighter than these westbound movements.

Table 12
Coordination Timings
Gay Street

Gay Street at Thach Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Midday (2-1-1)	120	15	52	16	37	15	52	16	37	53
PM (3-1-1)	120	15	52	16	37	15	52	16	37	19
Gay Street at Magnolia Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Midday (2-1-1)	120	14	42	14	50	12	50	14	44	30
PM (3-1-1)	120	14	40	14	52	14	40	14	52	56
Gay Street at Glenn Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Midday (2-1-1)	120	14	44	14	48	14	44	14	48	105
PM (3-1-1)	120	14	44	14	48	14	44	14	48	37
Gay Street at Mitcham Avenue										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Midday (2-1-1)	120	0	60	0	60	12	48	34	26	117
PM (3-1-1)	120	0	60	0	60	12	48	34	26	57

Offsets referenced to end of green
(†) – Coordinated Phase

Table 13
Time Clock
Gay Street

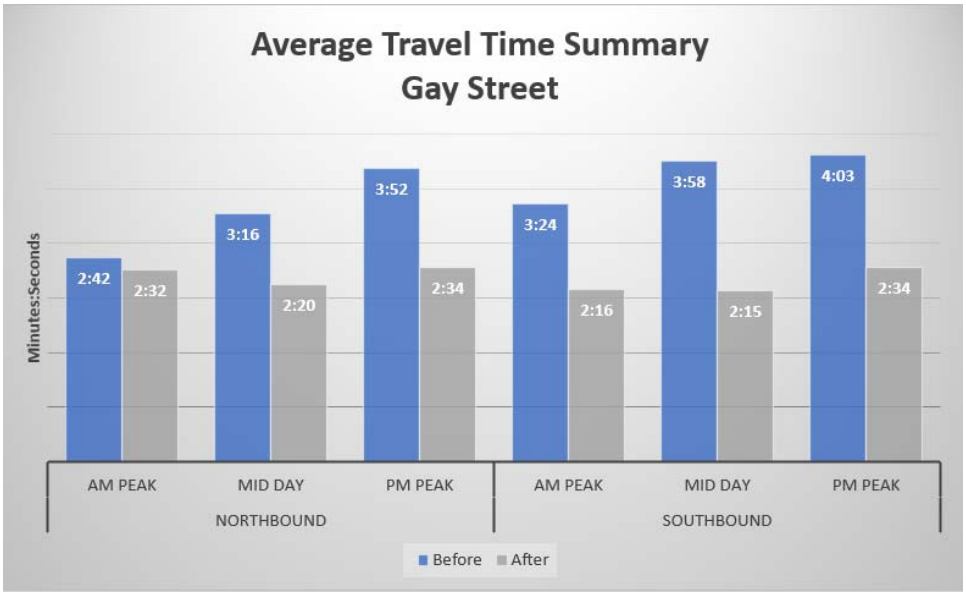
Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	1100	211
	1500	311
	1900	004

A comparison of before-and-after travel time runs on Gay Street between Thach Avenue and Mitcham Avenue is shown in Table 14.

Table 14
Before-and-After Travel Time Runs
Gay Street

Direction	Run #	AM Peak		Midday Peak		PM Peak	
		Before	After	Before	After	Before	After
Northbound	1	111	124	199	201	272	162
	2	168	120	298	153	170	159
	3	179	167	180	125	126	172
	4	166	237	123	116	302	235
	5	199	140	190	121	163	236
	6	149	125	183	124	360	174
	Average	*162*	*152*	*196*	*140*	*232*	*190*
Southbound	1	177	76	233	137	195	171
	2	127	155	182	129	185	135
	3	335	178	215	127	233	147
	4	233	101	282	156	296	139
	5	182	163	321	114	237	175
	6	172	143	192	144	310	158
	Average	*204*	*136*	*238*	*135*	*243*	*154*

Note: results are times in total seconds of travel time
Note: System is FREE during a.m. peak



The overall improvement in travel speeds due to implementation of coordination is as follows:

- AM
  - Northbound +1.0 mph
  - Southbound +6.2 mph
- Midday
  - Northbound +5.1 mph
  - Southbound +8.1 mph

- PM
  - Northbound +2.4 mph
  - Southbound +6.0 mph

Graphs of the before and after travel time runs for the a.m., midday, and p.m. peak periods are for each direction of traffic flow are included in Appendix E.

MOORES MILL ROAD

A traffic signal system was implemented on Moores Mill Road. The intersections included in the system are listed below and the locations indicated in Figure 7.

- Moores Mill Road at East University Drive
- Moores Mill Road at Grove Hill Road

Coordination timings for the Moores Mill Road signal system intersections are shown in Table 15. The time clock is shown in Table 16. Time-space diagrams are included in Appendix F.

Figure 7. Moores Mill Road Signal System

Before-and-after travel time runs were not performed on Moores Mill Road because the system was deactivated before after travel time runs could be performed. During fine-tuning of the coordination plans, it was determined that traffic on East University Drive experienced significant delay since this roadway is the non-coordinated roadway, but traffic volumes indicate that East University Drive is the major roadway.

Table 15
Coordination Timings
Moores Mill Road

Moores Mill Road at East University Drive										
Plan	Cycle	1	2	3	4(†)	5	6	7	8(†)	Offset
Off (1-1-1)	100	15	35	15	35	15	35	15	35	0
Midday (2-1-1)	110	20	40	15	35	15	35	18	32	0
AM (3-1-1)	120	20	35	20	45	15	40	20	45	0
PM (4-1-1)	130	20	55	15	40	15	60	25	30	0
Moores Mill Road at Grove Hill Road										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
Off (1-1-1)	100	15	60	0	0	0	75	0	25	80
Midday (2-1-1)	110	20	65	0	0	0	85	0	25	93
AM (3-1-1)	120	15	70	0	0	0	85	0	35	96
PM (4-1-1)	130	20	85	0	0	0	105	0	25	119

Offsets referenced to beginning of green
(†) – Coordinated Phase

Table 16
Time Clock
Moores Mill Road

Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	0615	311
	0830	111
	1115	211
	1430	411
	1845	111
	2100	211
Saturday	0000	004
	0800	111
	1000	211
	1800	111
	2100	004
Sunday	0000	004
	1000	111
	1130	211
	1800	004

OPELIKA ROAD

Two traffic signal subsystems were implemented on Opelika Road. The two subsystems are listed below, and the locations indicated in Figure 8.

- Subsystem 1
  - Opelika Road at Mall Parkway
  - Opelika Road at Ronald Lane
  - Opelika Road at East University Drive
  - Opelika Road at Saugahatchie Road
- Subsystem 2
  - Opelika Road at Ross Street
  - Opelika Road at Gay Street

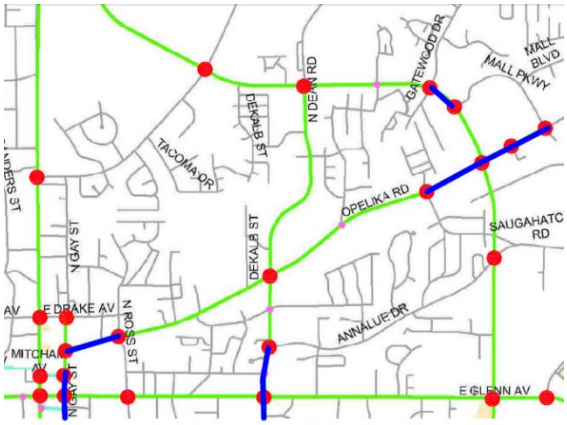


Figure 8. Opelika Road Signal System

Coordination timings for the Opelika Road signal system intersections are shown in Table 17. The time clock is shown in Table 18. Time-space diagrams are included in Appendix G.

Table 17
Coordination Timings
Opelika Road

Opelika Road at Mall Parkway										
Plan	Cycle	1	2	3	4	5	6	7	8	Offset
AM (1)	110	18	62(†)	0	30	18	62(†)	0	30	66
Off (55)	100	16	56	0	28	16	56	0	28	67
PM (37)	120	16	68	0	36	16	68	0	36	114
Opelika Road at Ronald Lane										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1)	110	17	62	0	31	17	62	0	31	67
Off (55)	100	17	52	0	31	17	52	0	31	65
PM (37)	120	18	68	0	34	17	69	0	34	114
Opelika Road at East University Drive										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1)	110	18	36	22	34	18	36	22	34	6
Off (55)	100	Free during off peak pattern								
PM (37)	120	20	41	20	35	20	41	24	35	75
Opelika Road at Saugahatchie Road										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1)	110	16	62	0	32	15	63	0	32	11
Off (55)	100	12	43	0	45	12	43	0	45	21
PM (37)	120	12	86	0	22	12	86	0	22	44

Offsets referenced to end of green
(†) – Coordinated Phase

Table 17 (continued)
Coordination Timings
Opelika Road

Opelika Road at Ross Street										
Plan	Cycle	1	2(†)	3	4	5	6(†)	7	8	Offset
AM (1-1-1)	110	10	58	11	31	13	55	16	26	86
PM (3-1-1)	120	10	58	11	41	10	58	23	29	41
Off (4-1-1)	100	10	53	11	26	10	53	12	25	60
Opelika Road at Gay Street										
Plan	Cycle	2	4	9(†)		6	8			Offset
AM (1-1-1)	55	12	22	21		12	22			26
PM (3-1-1)	60	17	22	21		17	22			48
Off (4-1-1)	100	41	22	37		41	22			30

Offsets referenced to end of green
(†) – Coordinated Phase

Table 18
Time Clock
Opelika Road

Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	0700	111
	0900	411
	1100	311
	1800	411
	1900	004

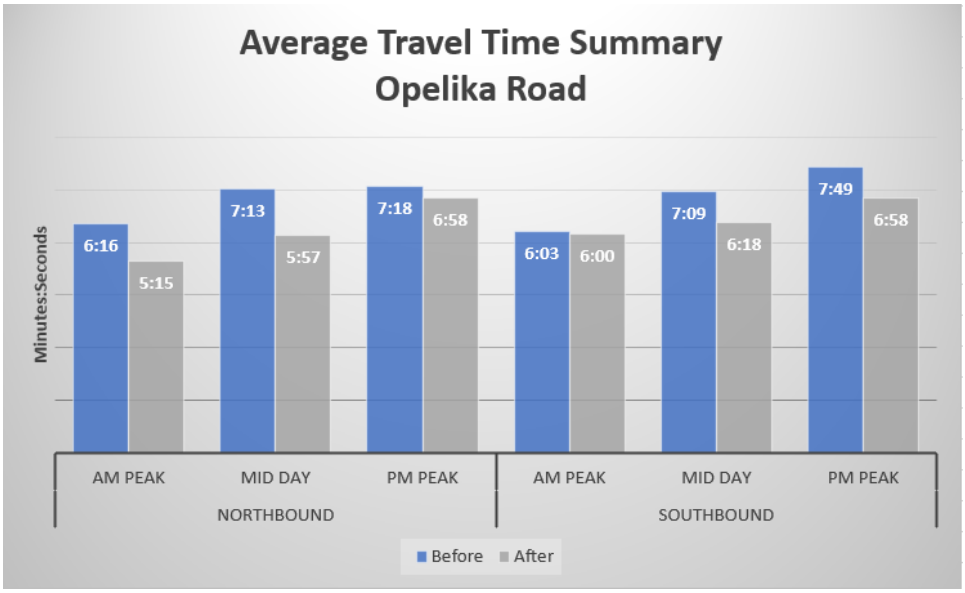
Note: The intersection of Opelika Road/EUD is placed in free operation on weekdays from 08:59-10:59 and 15:59-18:59

A comparison of before-and-after travel time runs on Opelika Road Mall Parkway and Gay Street is shown in Table 19.

Table 19
Before-and-After Travel Time Runs
Opelika Road

Direction	Run #	AM Peak		Midday Peak		PM Peak	
		Before	After	Before	After	Before	After
Eastbound	1	297	329	453	337	484	379
	2	374	296	354	368	502	452
	3	324	340	552	316	462	286
	4	341	338	342	354	381	438
	5	442	280	405	383	400	427
	6	479	307	489	384	400	482
	Average	*376*	*315*	*433*	*357*	*438*	*411*
Westbound	1	308	376	371	385	517	381
	2	387	368	462	382	348	415
	3	461	335	444	332	446	314
	4	330	355	435	412	410	494
	5	367	379	399	339	574	490
	6	322	344	462	415	521	416
	Average	*363*	*360*	*429*	*378*	*469*	*418*

Note: results are times in total seconds of travel time



The overall improvement in travel speeds due to implementation of coordination is as follows:

- AM
  - Eastbound +4.6 mph
  - Westbound +0.2 mph
- Midday
  - Eastbound +4.3 mph
  - Westbound +2.7 mph
- PM
  - Eastbound +1.3 mph
  - Westbound +2.3 mph

Graphs of the before and after travel time runs for the a.m., midday, and p.m. peak periods are for each direction of traffic flow are included in Appendix G.

SAMFORD AVENUE

A traffic signal system was implemented on Samford Avenue. The intersections included in the system are listed below and the locations indicated in Figure 9.

- Samford Avenue at College Street
- Samford Avenue at Gay Street

Figure 9. Samford Avenue Signal System

Coordination timings for the Samford Avenue signal system intersections are shown in Table 20. The time clock is shown in Table 21. Time-space diagrams are included in Appendix H.

Before-and-after travel time runs were not performed on Samford Avenue because the system is only two intersections and only runs for a short time during the p.m. peak period. In such a case, travel time runs are meaningless because they are unduly influenced by the random delay at the beginning of the run due to the fact that the driver can arrive at any point in the cycle. Coordination is recommended due to a long queue which backs up on the Auburn University campus each weekday afternoon. The cause of the queue was determined to be, in part, due to the lack of a green band of progression for vehicles eastbound on Samford Avenue from College Street through Gay Street.

Table 20
Coordination Timings
Samford Avenue

Samford Avenue at College Street										
Plan	Cycle	1	2	3	4(†)	5	6	7	8(†)	Offset
PM (4-1-1)	130	20	45	25	40	20	45	25	40	0
Samford Avenue at Gay Street										
Plan	Cycle	1	2	3	4(†)	5	6	7	8	Offset
PM (4-1-1)	130	0	60	0	70	0	60	0	0	6

Offsets referenced to beginning of green
(†) – Coordinated Phase

Table 21
Time Clock
Samford Avenue

Day of Week	Time	Dial-Split-Offset
Monday-Friday	0000	004
	1630	411
	1730	004
Saturday-Sunday	0000	004

LOCAL TIMING ADJUSTMENTS

Observations were conducted at all signalized intersections in the City of Auburn to determine locations where local timing adjustments were needed. The following is a listing all adjustments made:

- Bent Creek Road at I-85 Northbound Ramps
  - Increase southbound left turn maximum green time +5 seconds
- Dean Road at East University Drive
  - Increase northbound left turn maximum green time +5 seconds
- East University Drive at Moores Mill Road
  - Increase northbound left turn maximum green time +5 seconds
- East University Drive at Shelton Mill Road
  - Increase left turn maximum green time +5 seconds on both left turns on East University Drive
- Glenn Avenue at Ross Street
  - Increase westbound through maximum green time +10 seconds
- North Donahue Drive at Magnolia Avenue
  - Decrease minimum green time on all left turns to 6 seconds
  - Decrease phase 8 pedestrian clearance time to 20 seconds
- Shug Jordan Parkway at North Donahue Drive
  - Increase left turn maximum green times +5 seconds on both left turns on Shug Jordan Parkway
- Moores Mill Road at Hamilton Road/Ogletree Road
  - Set up maximum green 2 program for phase 2 (eastbound through) to increase green time from 4:00 p.m. to 5:30 p.m. weekdays from 55 to 65 seconds
- Samford Avenue at Moores Mill Road
  - Set main street to maximum recall and increased maximum green time to 35 seconds

TRAFFIC RESPONSIVE/ADAPTIVE RECOMMENDATIONS

As of the writing of this report, there are 66 traffic signals in the City of Auburn. Of these, 30 currently have coordination plans active, distributed as follows:

- South College Street – 7 signals in three subsystems
- Opelika Road – 6 signals in two subsystems
- Gay Street – 4 signals
- Dean Road – 4 signals
- East University Drive – 4 signals in two subsystems
- North Donahue Drive – 3 signals
- Samford Avenue – 2 signals

All coordinated traffic signals are currently controlled by time-of-day/day-of-week control. The purpose of this section of this report is to make recommendations for the upgrade to traffic responsive or adaptive control. Moreover, this section also makes recommendations for upgrade to Automated Traffic Signal Performance Measures (ATSPM) modified signal systems.

Traffic Responsive

Traffic responsive traffic signal coordination operation is a variant of time-of-day signal control which uses strategically-placed vehicle sensors to detect changes in traffic and select the most appropriate cycle length/split plan/offset combination from pre-programmed coordination plans based on traffic volumes and occupancies. The added flexibility over and above time-of-day operation is useful when variations in traffic flow occur at unanticipated times due to non-recurring events. Implementation of traffic responsive operation requires deployment of special detectors (using practically any available detection technology) in strategic locations on both the main street and side street to measure traffic volume and occupancy across a specific interval of time, typically 5 to 15 minutes, and then selecting a cycle length, split plan, and offset according to user-programmed threshold values.

The current traffic signal system software (Siemens TACTICS) used by the City of Auburn has traffic responsive routines built into the operating system. Implementing traffic responsive operation on any corridor with the existing coordination timings would involve four steps:

1. Using existing detection or adding detection at strategic locations to monitor main street and side street traffic volumes and occupancies. In general, these detection zones are usually upstream from the signalized intersection or in the departure lane from the signalized intersection.
2. Allowing the system to collect detector data over a period of time, typically two weeks
3. Developing and programming transfer thresholds for cycle length, split plan, and offsets
4. Fine-tuning results to produce expected operation

Based on knowledge of traffic flow in the City of Auburn, there are two sources of non-recurring traffic events which have a major impact on traffic flow on the coordinated signal corridors: 1) the variation in traffic between Auburn University being in session and not in session, and 2) game day traffic for Auburn University. The schedule for both of these events is known on a year-by-year basis, and programming can be implemented using the current TACTICS system to account for these changes. Therefore, in view of

this, and in deference to later recommendations in this report section, traffic responsive operation is not recommended for implementation for any of the coordinated signal systems in the City of Auburn.

Adaptive

Adaptive signal systems also build on time-of-day signal operation. However, instead of using averaged traffic flow over a period of time to pick from preprogrammed coordination timing plans, adaptive traffic signal systems use real-time data to make adjustments to the currently-running coordination plan, varying the cycle length, split times, or offset time as needed based on real-time traffic flow data. Implementation of adaptive timing requires extensive detection for nearly all traffic lanes at each signalized intersection plus a proprietary software package to implement adaptive programming. Currently in the State of Alabama, there are adaptive signal systems in approximately six cities. Software packages in use include SCATS, SCOOT, and ACS-LITE.

The added flexibility of an adaptive system over and above time-of-day operation is useful when variations in traffic flow occur at unanticipated times due to non-recurring events. Based on knowledge of traffic flow in the City of Auburn, there are two sources of non-recurring traffic events which have a major impact on traffic flow on the coordinated signal corridors: 1) the variation in traffic between Auburn University being in session and not in session, and 2) game day traffic for Auburn University. The schedule for both of these events is known on a year-by-year basis, and programming can be implemented using the current TACTICS system to account for these changes.

It is estimated that implementation of an adaptive signal system on any given corridor in the City of Auburn would require an investment of $50,000 to $75,000 per signalized intersection.

Therefore, in view of the cost to implement adaptive control technology, and in deference to later recommendations in this report section, adaptive traffic signal operation is not recommended for implementation for any of the coordinated signal systems in the City of Auburn.

ATSPM

The latest development in active management of coordinated signal corridors is Automated Traffic Signal Performance Measures (ATSPM). This technology has been receiving widespread attention over the past several years, including a 3,800 traffic signal implementation across the State of Georgia and a successful 55 traffic signal implementation in Tuscaloosa, Alabama. The technology behind the use of ATSPM for coordinated signal systems is high-resolution controller data, including detection events and controller events. Use of this data allows the user to view specific parameters and make informed decisions to fine-tune traffic signal timings. The typical specific parameters include, but are not limited to:

- Approach delay
- Approach volume
- Arrivals on red
- Purdue Coordination diagram
- Purdue split failure
- Pedestrian delay
- Preemption details
- Phase termination

- Speed
- Split monitor
- Turning movement counts
- Yellow and red actuations

The following presents the detection requirements for various ATSPM parameters:

METRIC	DETECTION NEEDED
Purdue Coordination Diagram	Setback count (350 ft – 400 ft)
Approach Volume	Setback count (350 ft – 400 ft)
Approach Speed	Setback count (350 ft – 400 ft) using radar
Purdue Phase Termination	No detection needed or used
Split Monitor	No detection needed or used
Turning Movement Counts	Stop bar (lane-by-lane) count
Approach Delay	Setback count (350 ft – 400 ft)
Arrivals on Red	Setback count (350 ft – 400 ft)

Signal performance metrics show real-time and a history of performance at signalized intersections. The various metrics will evaluate the quality of progression of traffic along the corridor, and displays any unused green time that may be available from various movements. This information informs the user of vehicle and pedestrian detector malfunctions, measures vehicle delay and lets the user know volumes, speeds and travel time of vehicles. The metrics are used to optimize mobility and manage traffic signal timing and maintenance to reduce congestion, save fuel costs and improve safety.

The traffic signal controller manufactures wrote a “data-logger” program that runs in the background of the traffic signal controller firmware. The Indiana Traffic Signal Hi Resolution Data Logger Enumerations encode events to a resolution to the nearest 100 milliseconds. The recorded enumerations will have events for “phase begin green”, “phase gap out”, “phase max out”, “phase begin yellow clearance”, “phase end yellow clearance”, “pedestrian begin walk”, “pedestrian begin clearance”, “detector off”, “detector on”, etc. For each event, a time-stamp is given, and the event is stored temporarily in the signal controller. Over 125 various enumerations are currently in use. Then, using an FTP connection from a remote server to the traffic signal controller, packets of the hi resolution data logger enumerations (with its 1/10th second resolution time-stamp) are retrieved and stored on a web server about every 10 to 15 minutes. Software was written in-house by Utah DOT that allows the user to graph and display the various data-logger enumerations and to show the results on the Signal Performance Metric website.

A central traffic management system is not used or needed for the ATSPM’s. It is all done through FTP connections from a web server through the network directly to the traffic signal controller which has the Indiana Traffic Signal High Resolution Data Logger Enumerations running in the background of the controller firmware. The ATSPM’s are independent of any central traffic management system.

Implementation of ATSPM’s for managing coordinated signal system timings involve ensuring each intersection is equipped with a high-resolution data-logging controller (such as a Siemens M60 controller), a communications path to the controller, and use of free software developed by the Utah Department of Transportation.

It is recommended that the City of Auburn plan for implementation of ATSPM technology for all of its coordinated signal corridors. The City already has the foundation for this system in place, including many

high-resolution controllers (some older controllers will need to be replaced), good detection, and communications to every signal. The most significant investment will include staffing and training in the use of ATSPM's. See the next section of this report for specific staffing recommendations.

SIGNAL MAINTENANCE RECOMMENDATIONS

At the time of the writing of this report, the City of Auburn maintains 66 traffic signals. The primary maintenance needs for traffic signals are personnel, operating and maintenance budget, and capital budget.

In 2012, the National Transportation Operations Coalition issued its period "National Traffic Signal Report Card" report. This report documented the results of surveys of 241 agencies across the United States and Canada. The survey included responses to questions involving both maintenance staff and maintenance budget. This report represents the latest and most comprehensive study for maintenance needs for traffic signals. The two tables from the 2012 NTOC National Traffic Signal Report Card are reproduced below.

Table 4: Average Number of Staff Performing Traffic Signal Work by System Size

Traffic Signals Managed	Non-technical Manager	Engineering Manager	Engineers	Other Professionals	Signal Technicians	Other Technicians	Administrative	Other Staff	Total
In House Staff (FTEs)									
Less than 50	0.2	0.4	0.4	0.3	1.0	0.4	0.2	0.1	3.1
50 to 150	0.3	0.7	0.7	0.2	2.3	0.5	0.3	0.1	5.2
150 to 450	0.5	0.9	1.4	0.6	5.5	1.1	0.7	0.6	11.4
450 to 1,000	0.6	1.4	2.8	2.4	13.8	2.7	0.9	0.6	25.2
More than 1,000	2.1	7.7	23.7	4.7	31.6	5.4	2.6	1.8	79.4
AVERAGE	**0.9**	**1.8**	**5.2**	**1.8**	**9.1**	**2.1**	**1.1**	**0.9**	**22.9**
Outsourced Staff (FTEs)									
Less than 50	0.1	0.1	0.4	0.1	0.7	0.2	0.1	0.0	1.7
50 to 150	0.1	0.1	0.3	0.1	0.4	0.1	0.0	0.1	1.2
150 to 450	0.1	0.1	0.3	0.1	1.3	0.2	0.1	0.0	2.2
450 to 1,000	0.4	0.1	0.1	0.2	1.8	1.1	0.1	0.1	3.9
More than 1,000	0.2	0.2	1.4	0.4	1.9	3.5	0.4	0.5	8.4
AVERAGE	**0.2**	**0.2**	**0.7**	**0.3**	**1.4**	**1.2**	**0.2**	**0.2**	**4.4**

Note: 9 agencies did not respond to this question.

Table 5: Source of Operating/Maintenance and Capital Funding by System Size and Agency Type

	Operating/Maintenance Project/Program (Average Funding $ by System Size)				Capital Project/Program (Average Funding $ by System Size)			
	Local	Regional	State	Federal	Local	Regional	State	Federal
Signal System Size								
Less than 50	$57,493	$7,000	$109,715	$2,909	$36,482	$3,636	$7,691	$14,345
50 to 150	$256,340	$6,284	$44,780	$4,311	$195,277	$8,041	$38,784	$89,797
150 to 450	$705,492	$16,652	$226,215	$147,315	$187,173	$3,041	$110,166	$103,148
450 to 1,000	$763,591	$456,500	$461,273	$431,864	$427,955	$300,682	$135,227	$294,547
More than 1,000	$3,061,972	$187,917	$4,031,281	$694,444	$2,499,583	$111,111	$1,572,083	$2,147,917
Agency Type								
City/Municipality	$1,147,757	$40,525	$83,591	$98,571	$763,022	$42,137	$35,765	$321,592
County	$504,605	$186,029	$111,647	$21,206	$385,005	$151,029	$37,340	$133,529
State/Province	$23,070	$4,825	$2,820,145	$485,614	$12,456	$4,298	$1,092,719	$789,386
Average, All Agencies	$858,981	$147,279	$1,202,978	$349,065	$711,663	$98,925	$521,303	$756,321

Note: 22 Agencies did not respond to this question.

The following sections of this report use the data from the two tables above to provide recommendations concerning the personnel and budgetary needs for maintenance of traffic signals in Auburn.

Personnel

The NTOC report states that more than half of the respondents did not outsource any personnel, so the following recommendations are based on in-house staff only. For the City of Auburn, the following would be the recommended level of personnel staffing dedicated to traffic signal operations.

- Managerial and professional personnel – 1-1/2 full-time equivalent staff
- Technical and administrative personnel – 2-1/2 full-time equivalent staff

Budget

The NTOC report provides an average response for both operating/maintenance and capital improvements annual budgets. For the City of Auburn, the following would be the recommended annual budget levels dedicated to traffic signal operations and new traffic signal project construction:

- Operating/Maintenance - $160,000
- Capital Improvements - $115,000

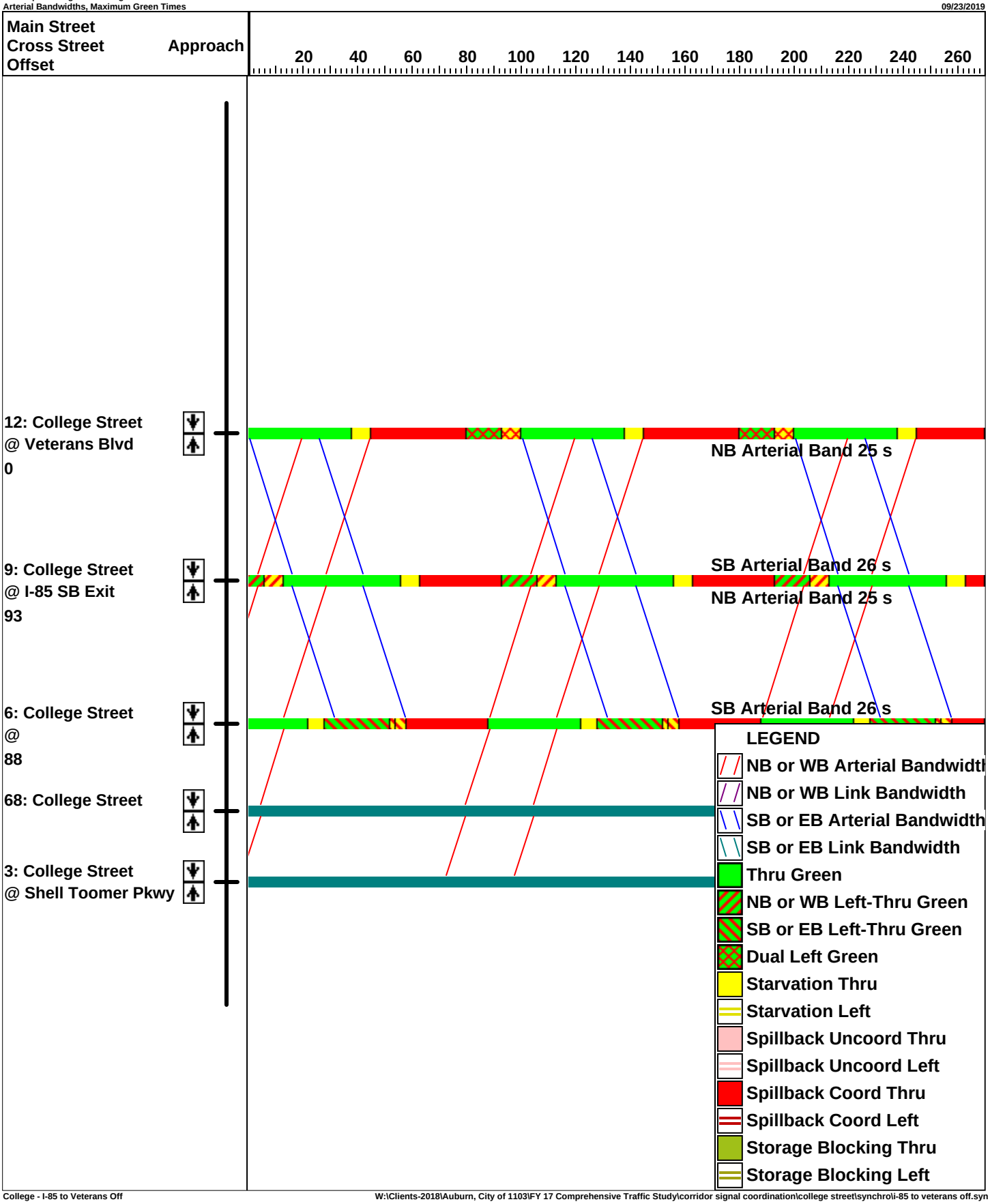
Appendix A

Time-Space Diagrams and Travel Time Graphs

South College Street

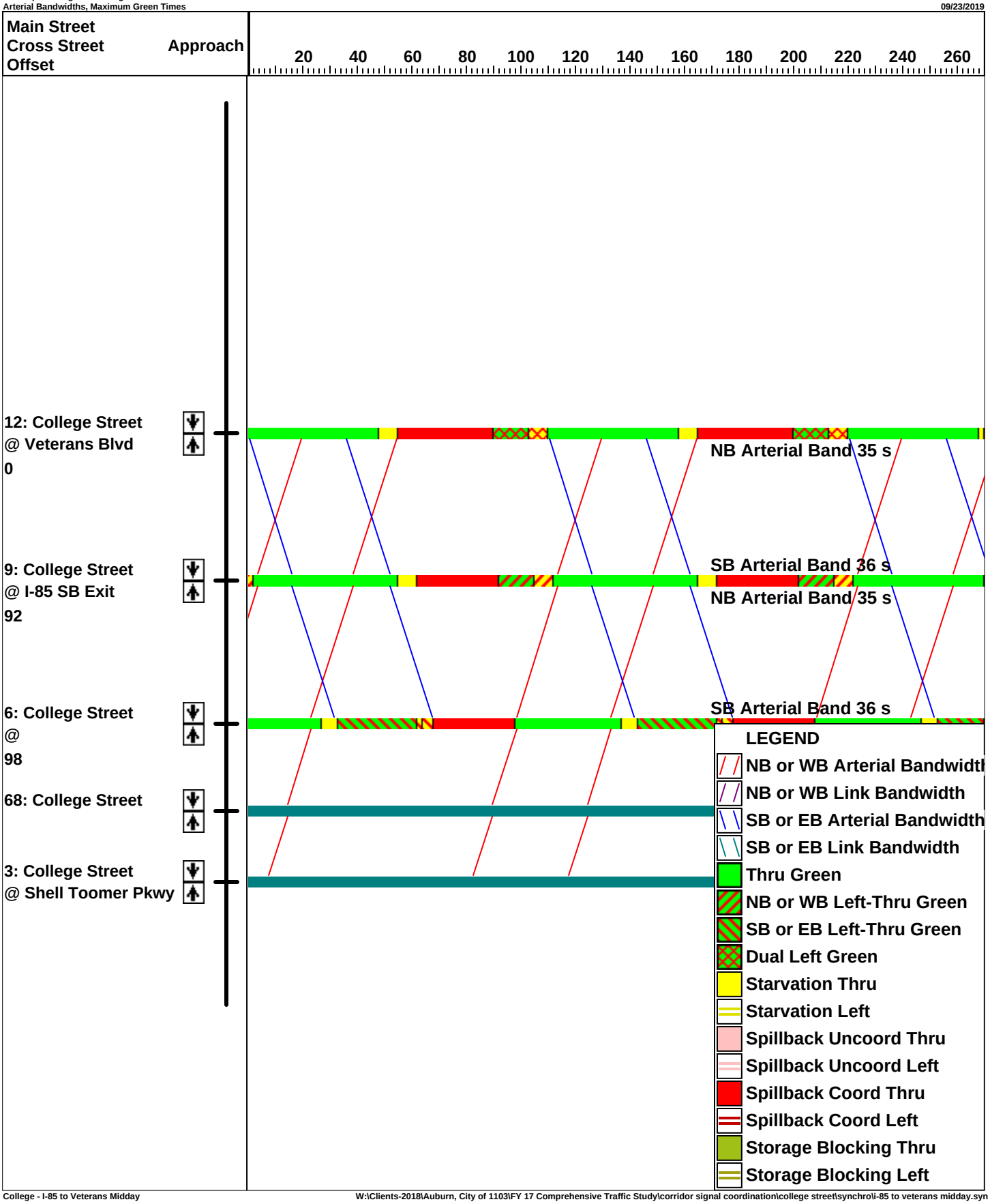
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

09/23/2019



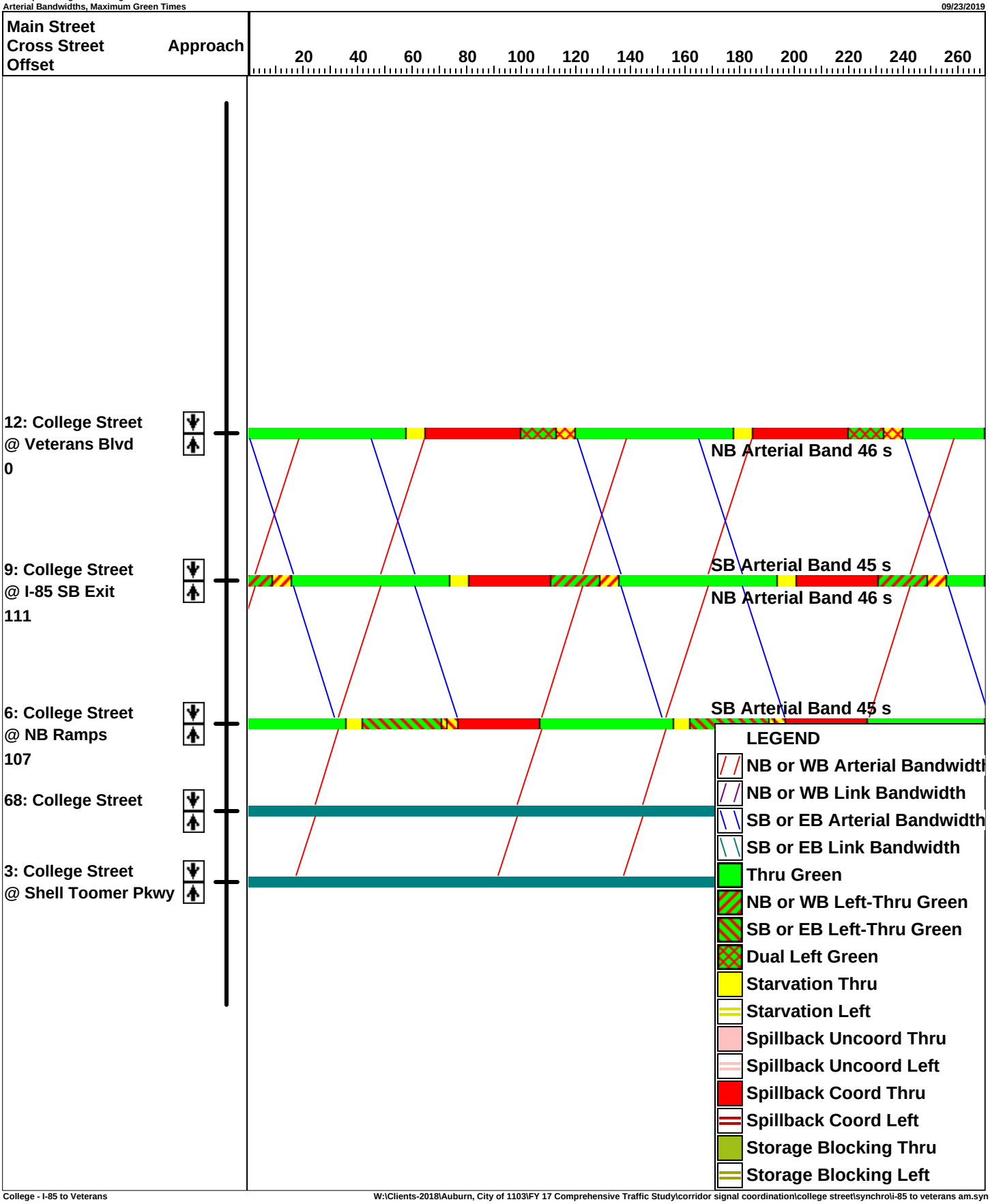
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

09/23/2019



Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

09/23/2019



College - I-85 to Veterans

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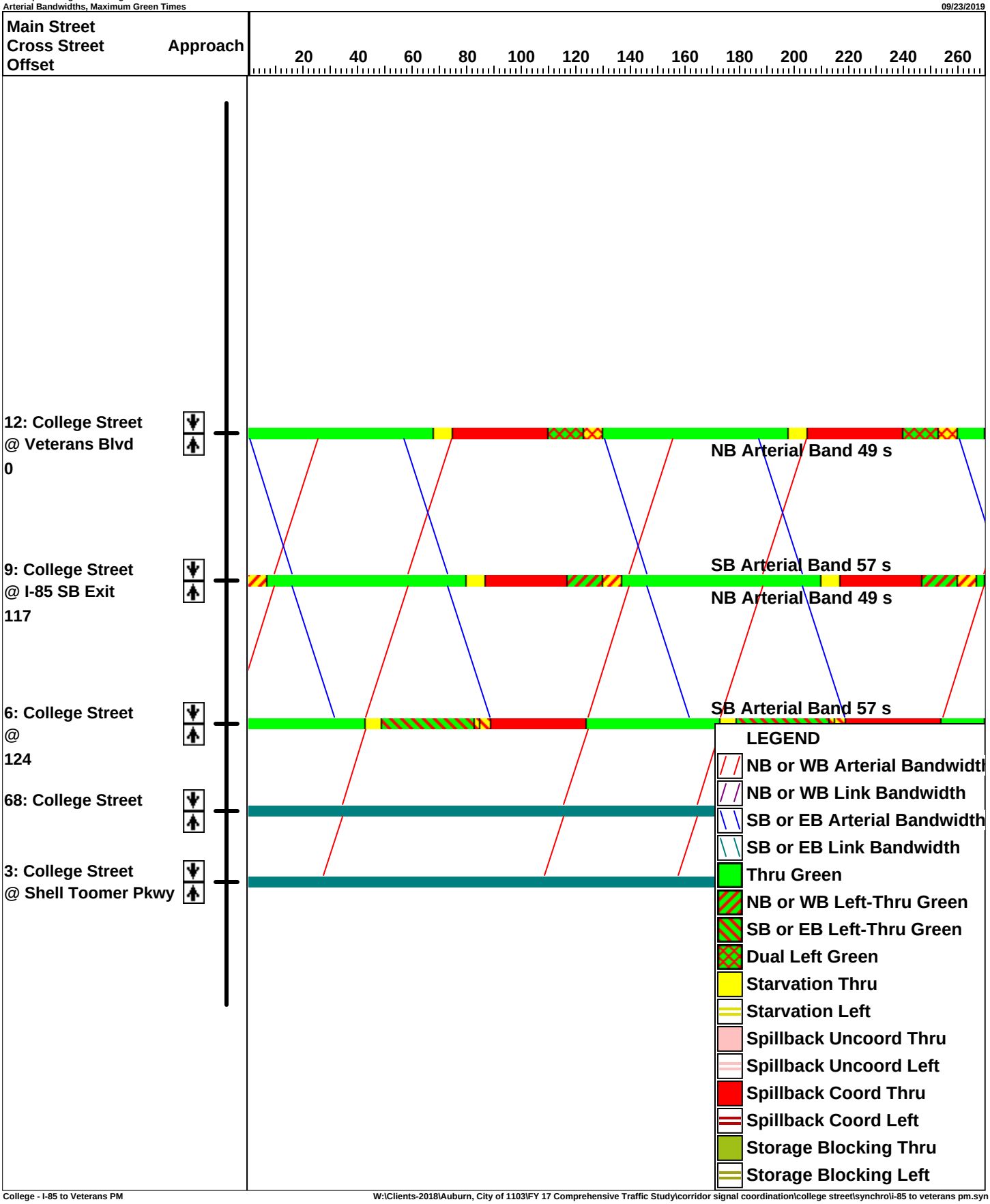
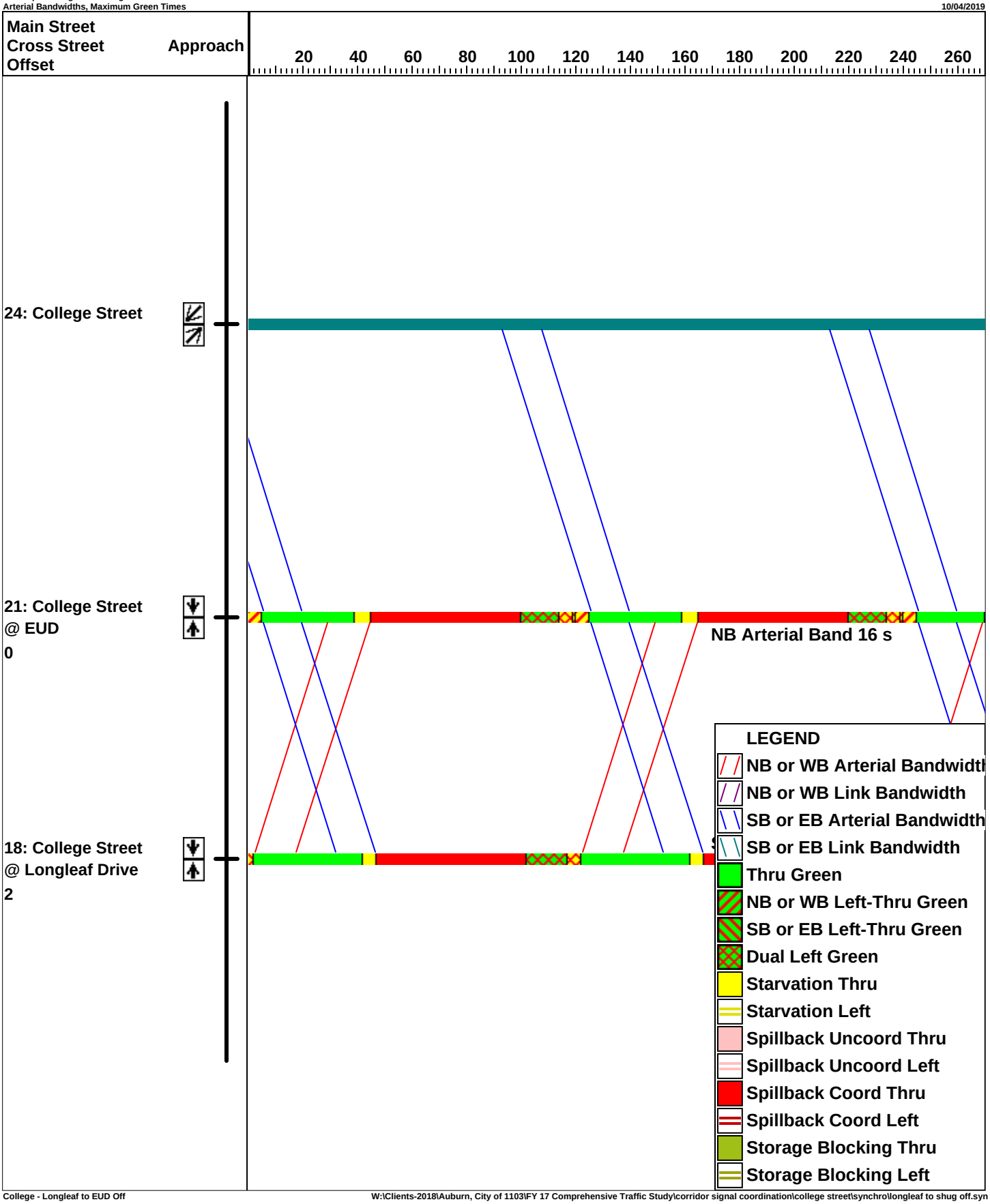
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

09/23/2019



Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019



College - Longleaf to EUD Off

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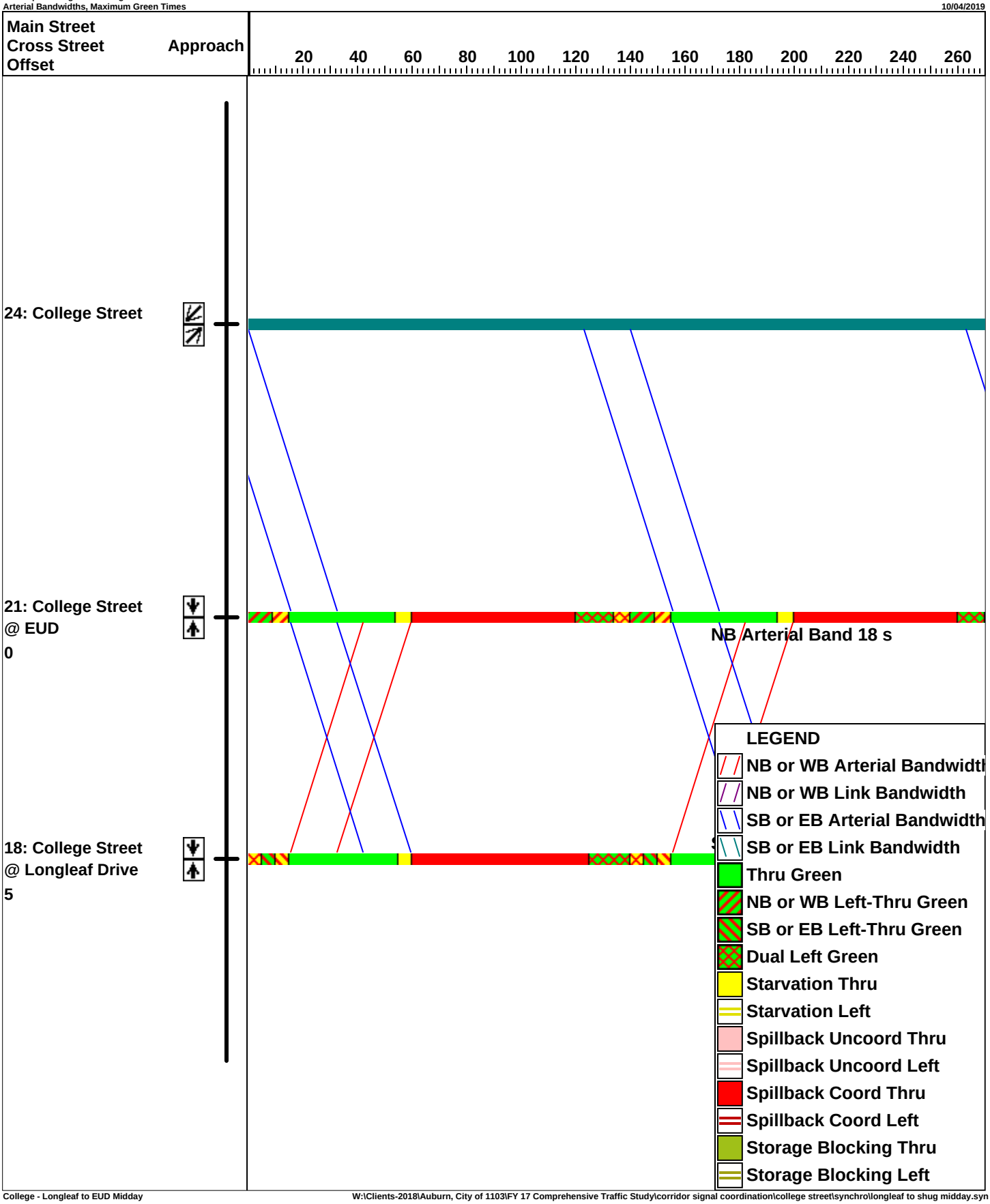
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019

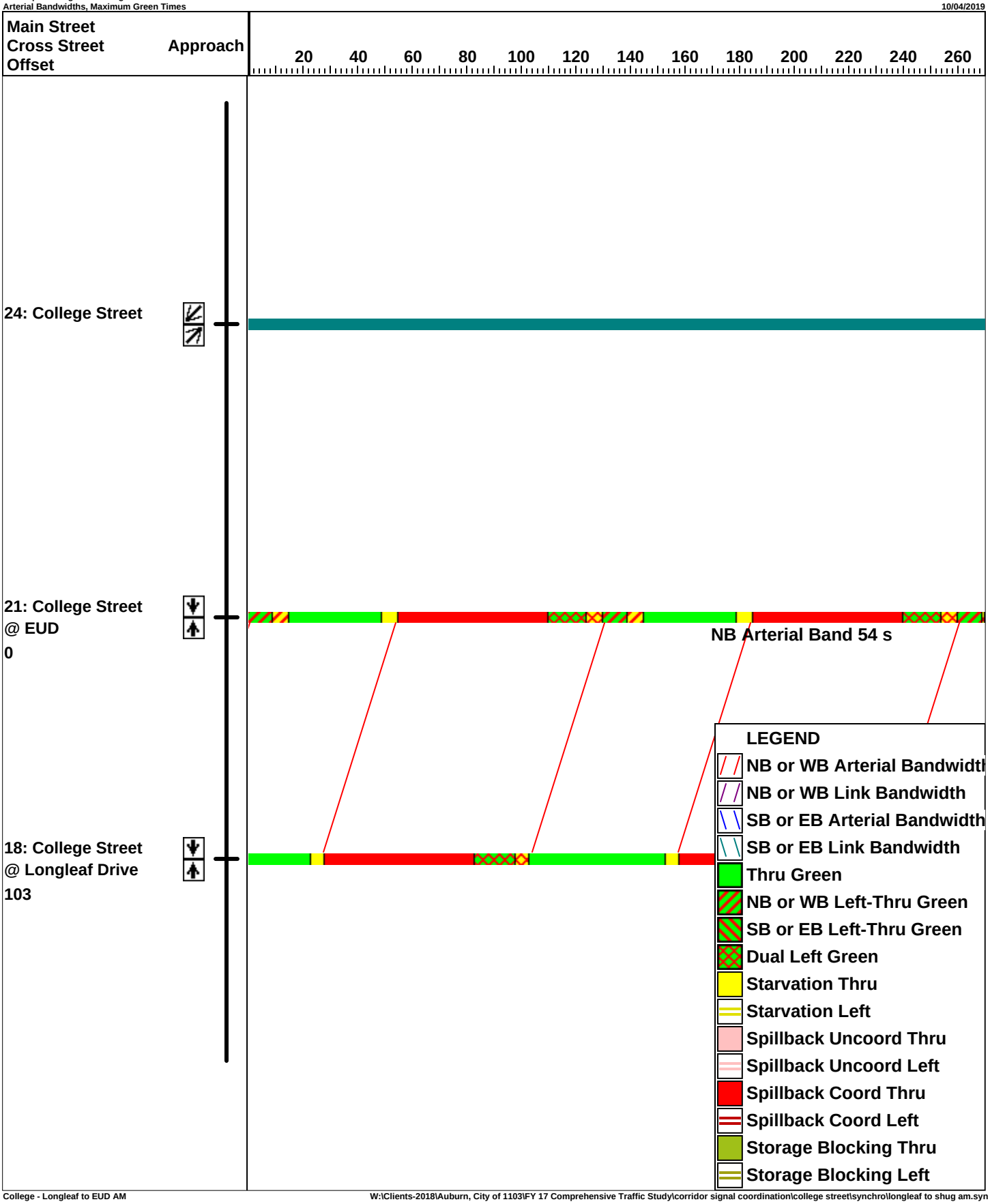


College - Longleaf to EUD Midday

W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\college street\synchro\longleaf to shug midday.syn

Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019

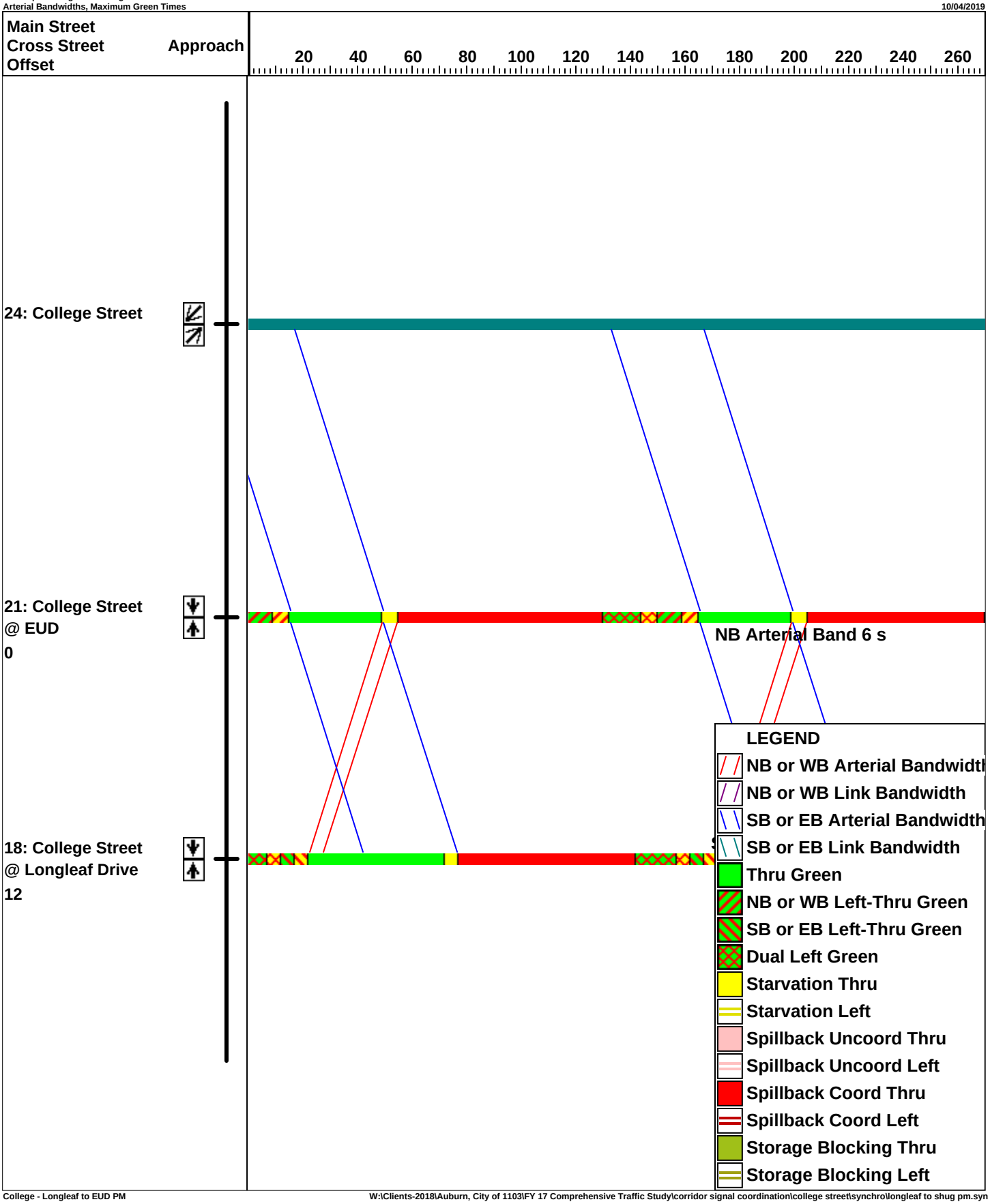


College - Longleaf to EUD AM

W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\college street\synchro\longleaf to shug am.syn

Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019

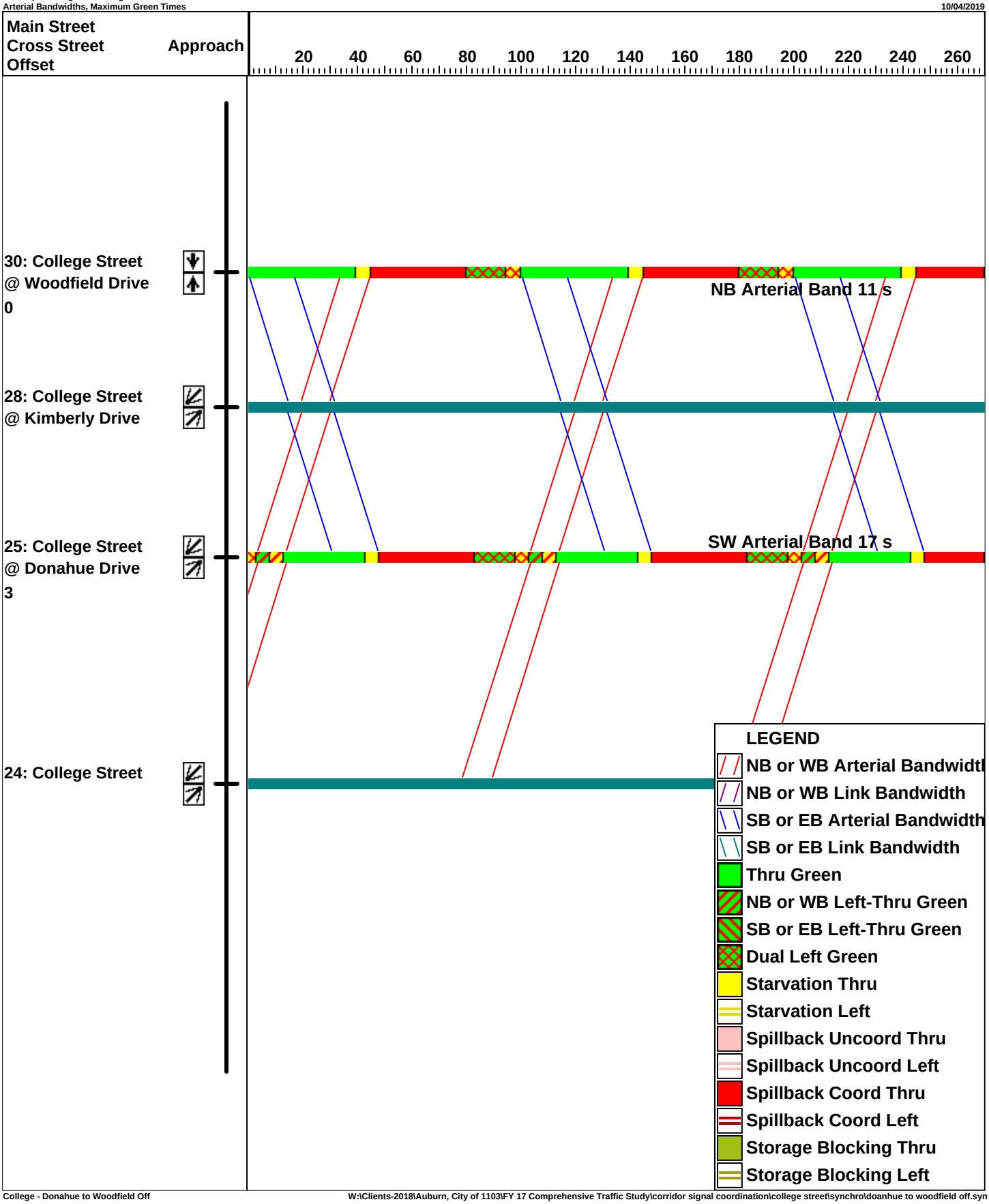


College - Longleaf to EUD PM

W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\college street\synchro\longleaf to shug pm.syn

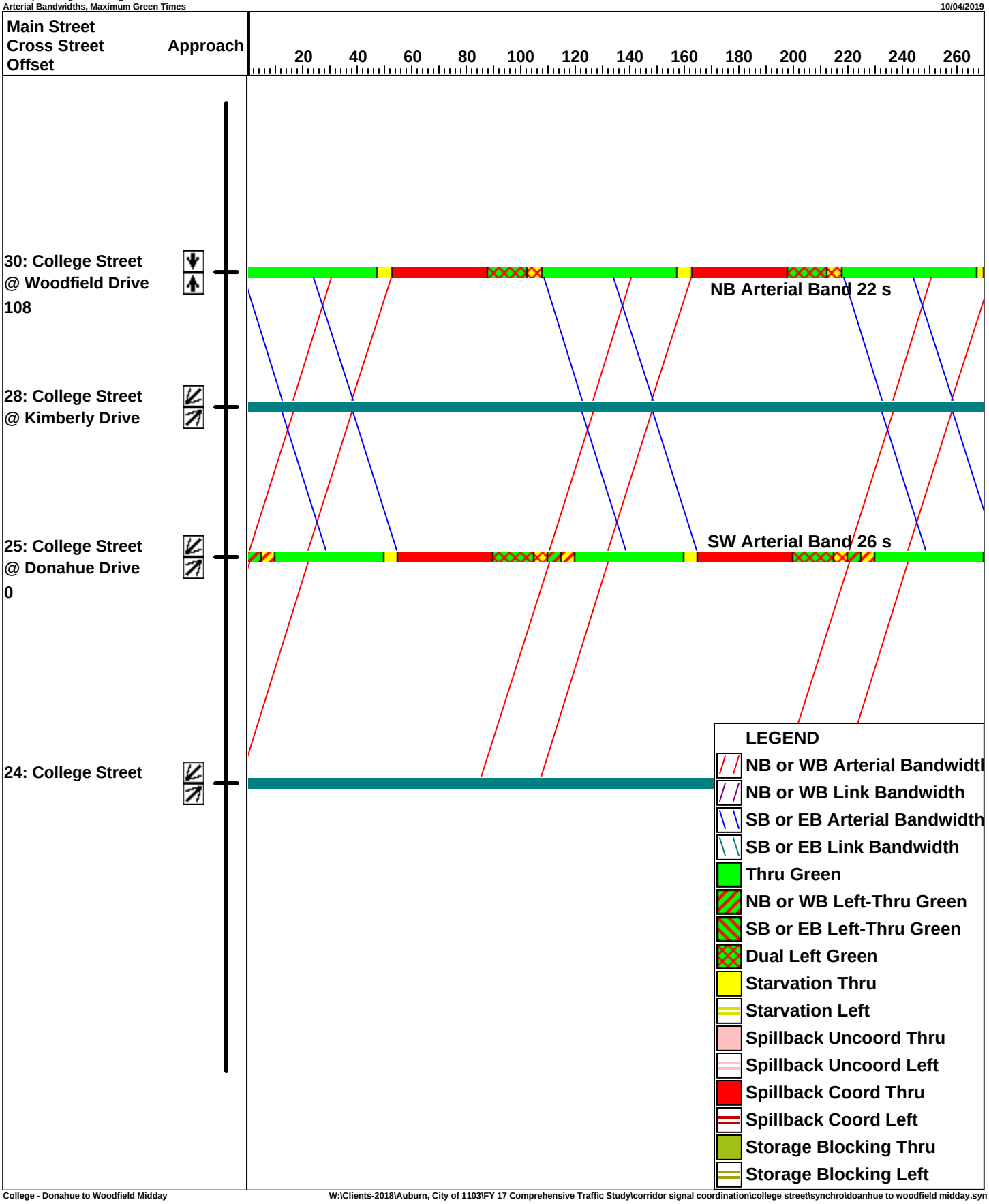
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019



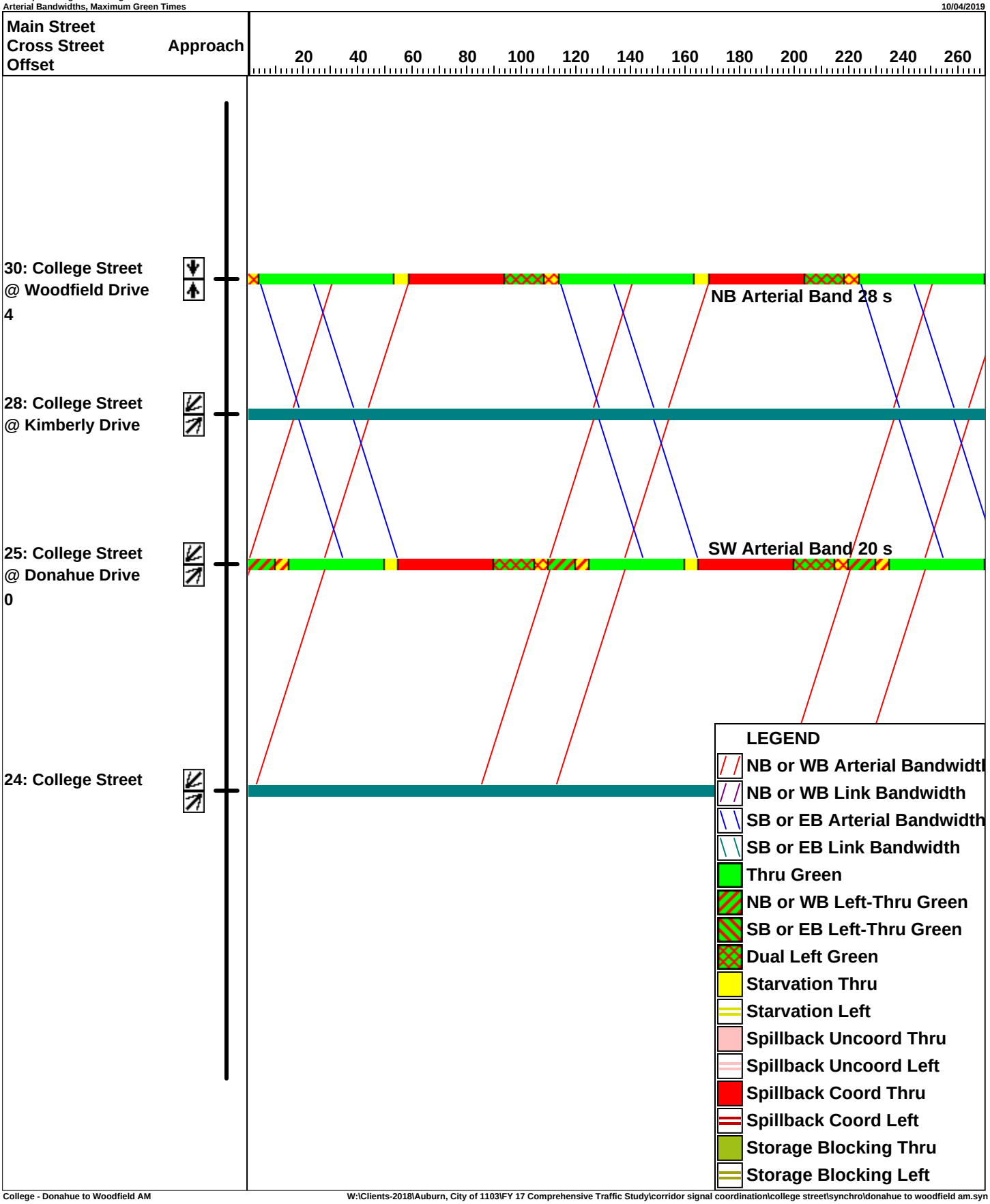
Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019



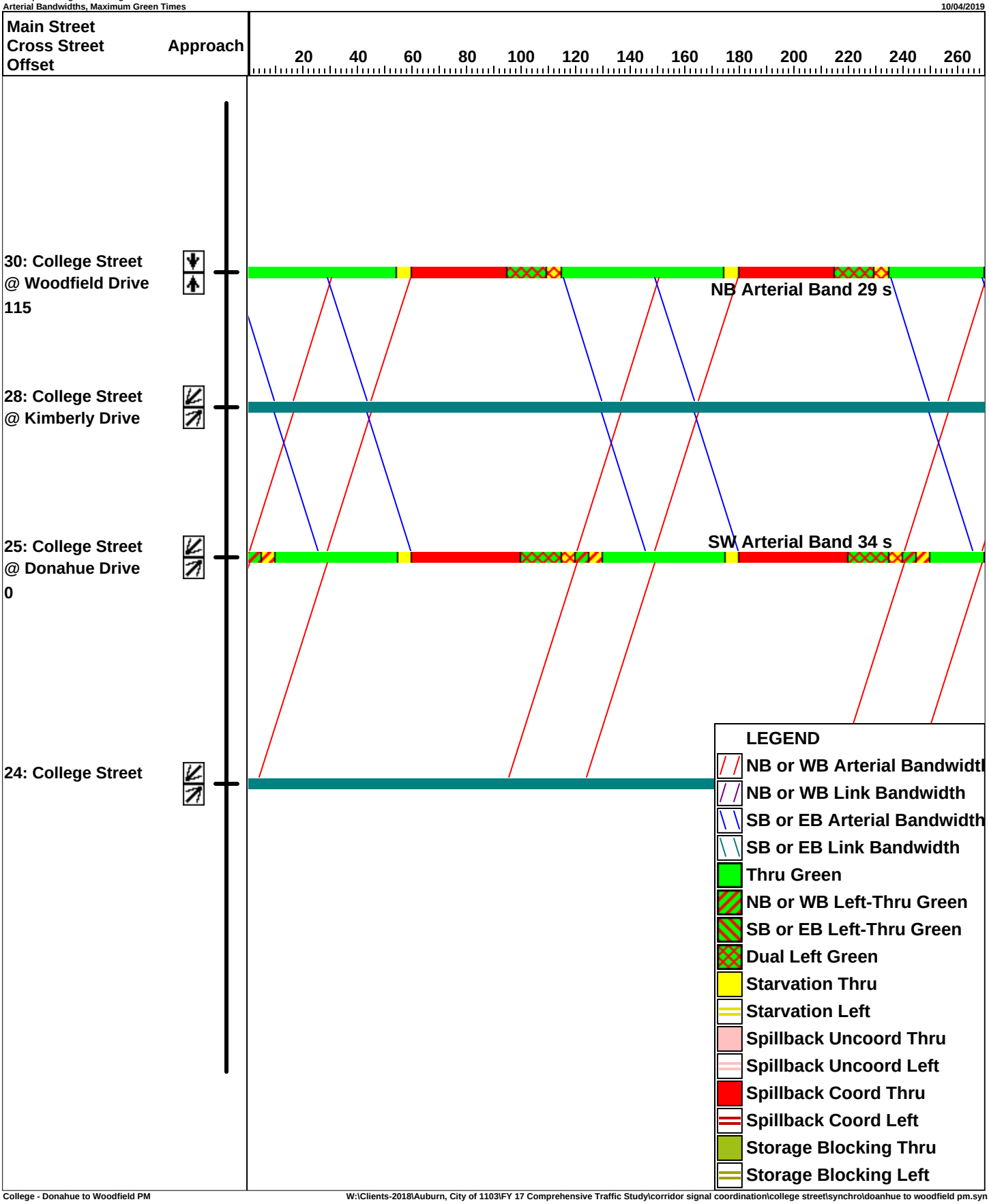
College - Donahue to Woodfield Midday

W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\college street\synchro\doanhue to woodfield midday.syn


Main Street
Cross Street
Offset
Approach
20
40
60
80
100
120
140
160
180
200
220
240
260
30: College Street
@ Woodfield Drive
4
28: College Street
@ Kimberly Drive
25: College Street
@ Donahue Drive
0
24: College Street
NB Arterial Band 28 s
SW Arterial Band 20 s
LEGEND
NB or WB Arterial Bandwidth
NB or WB Link Bandwidth
SB or EB Arterial Bandwidth
SB or EB Link Bandwidth
Thru Green
NB or WB Left-Thru Green
SB or EB Left-Thru Green
Dual Left Green
Starvation Thru
Starvation Left
Spillback Uncoord Thru
Spillback Uncoord Left
Spillback Coord Thru
Spillback Coord Left
Storage Blocking Thru
Storage Blocking Left

Time-Space Diagram - College Street
Arterial Bandwidths, Maximum Green Times

10/04/2019

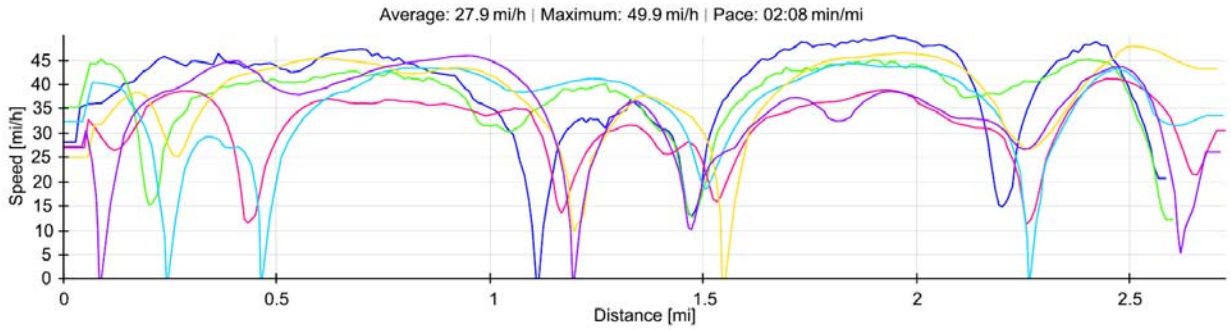


College - Donahue to Woodfield PM

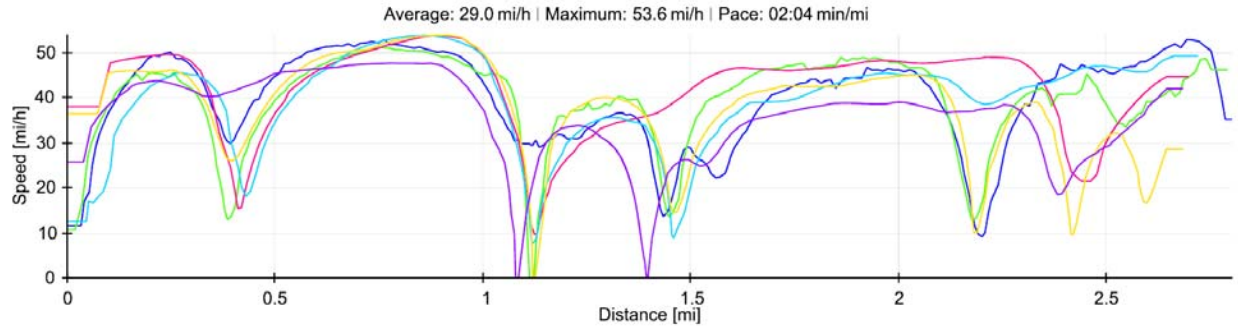
W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\college street\synchro\doanhue to woodfield pm.syn

College Street
Travel Time Graphs

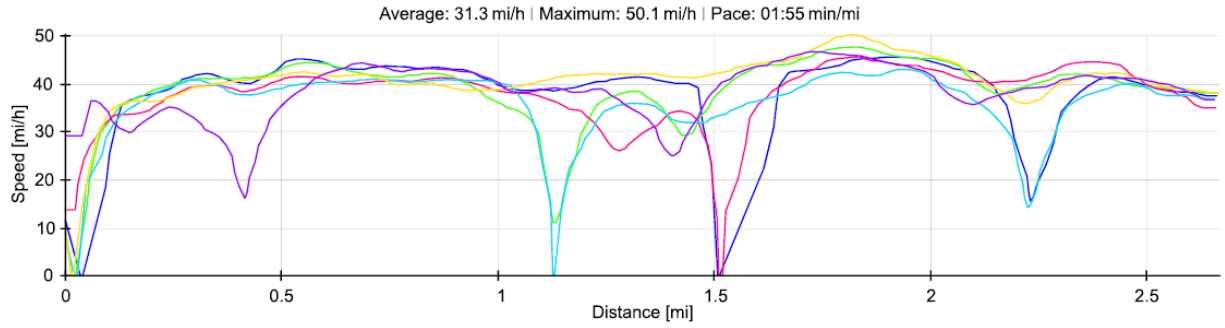
Before – AM - Northbound



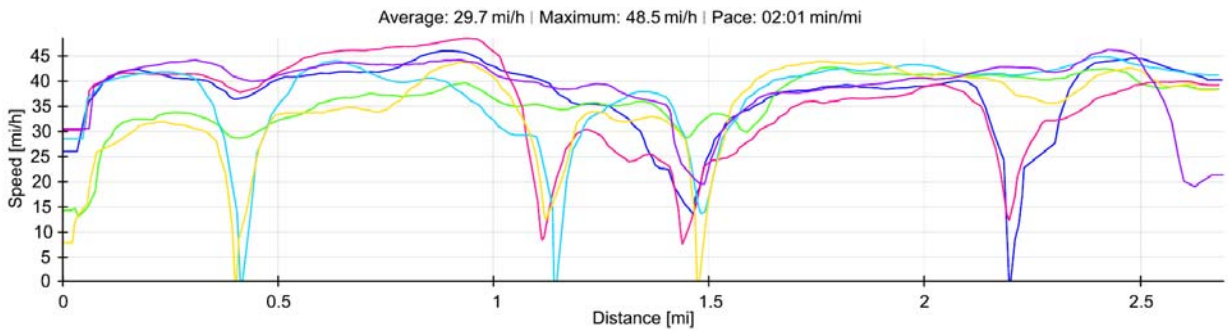
Before – AM – Southbound



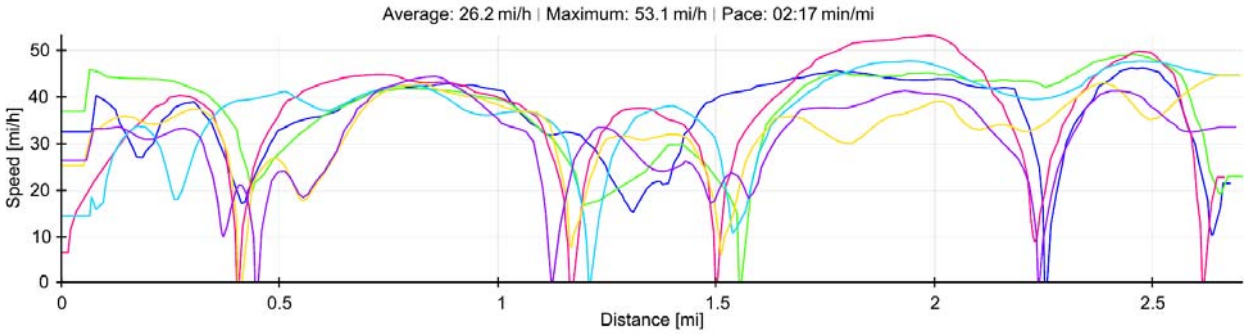
After – AM – Northbound



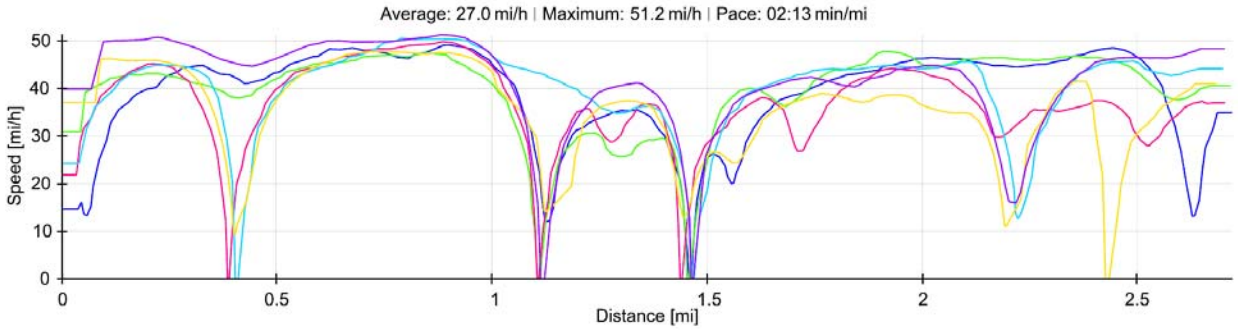
After – AM - Southbound



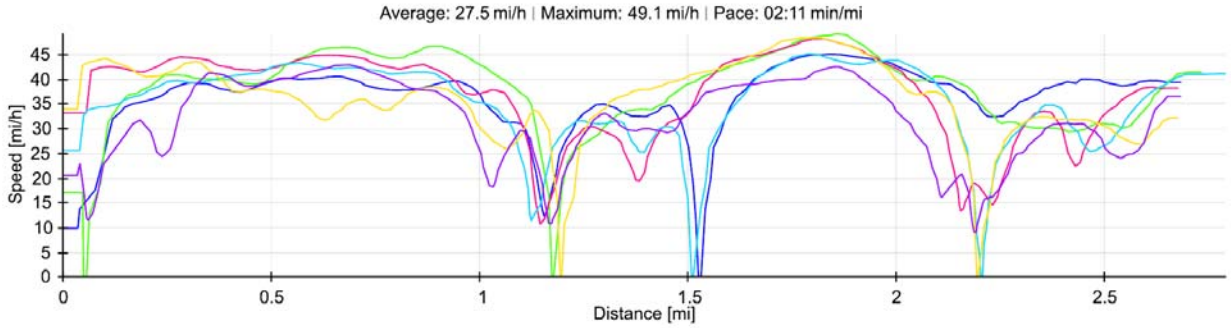
Before – Midday - Northbound



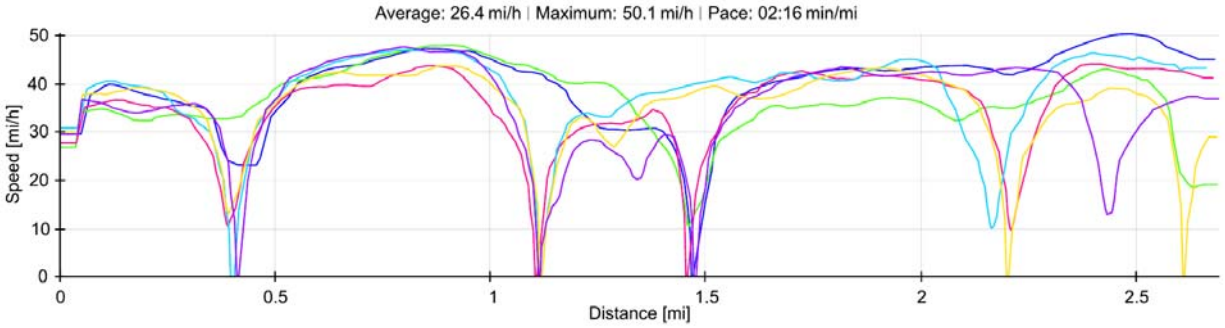
Before – Midday - Southbound



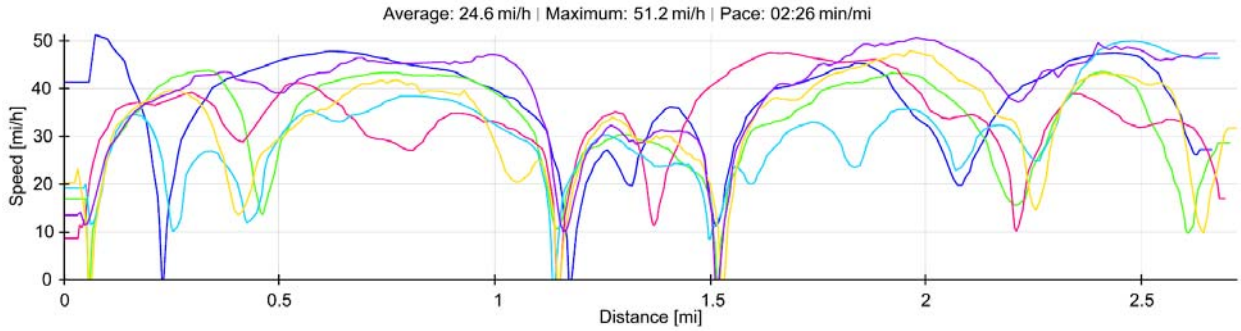
After – Midday – Northbound



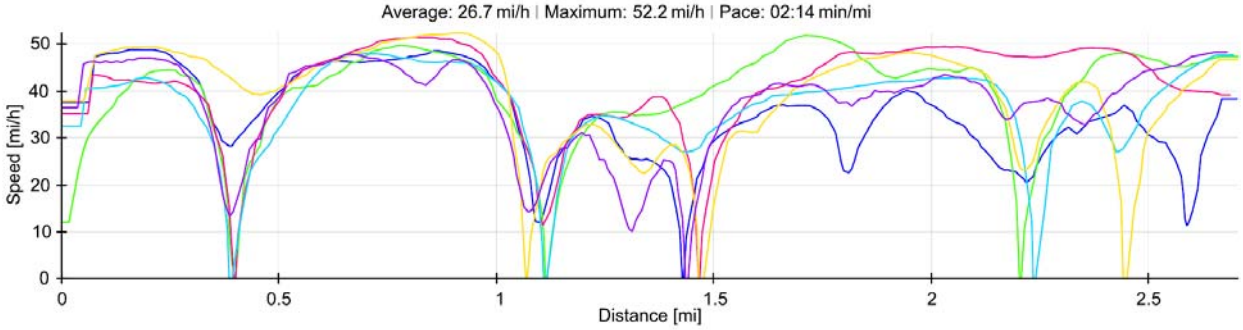
After – Midday – Southbound



Before – PM - Northbound



Before – PM - Southbound



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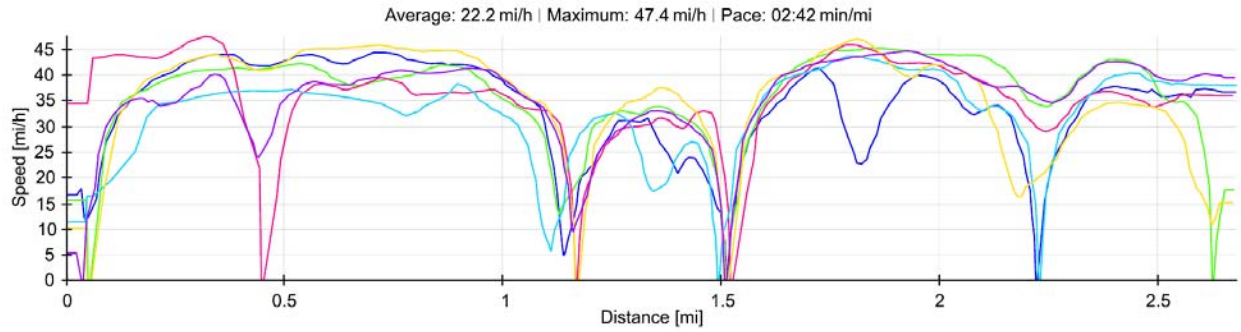
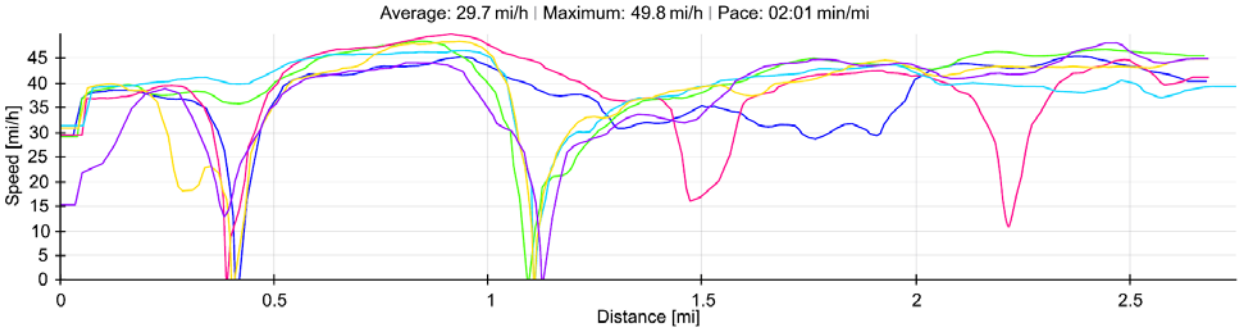


After – PM – Southbound



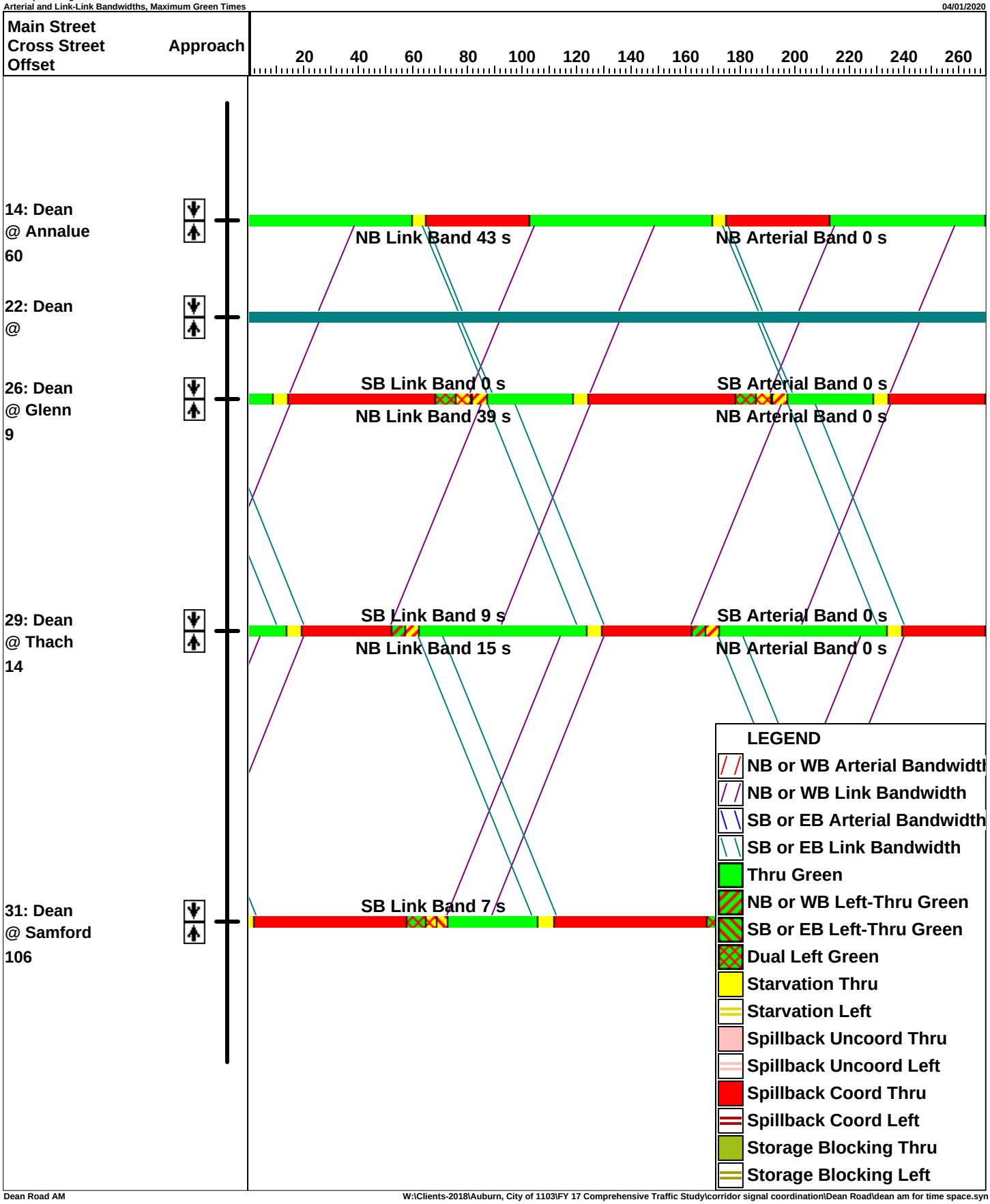
Appendix B

Time-Space Diagrams and Travel Time Graphs

Dean Road

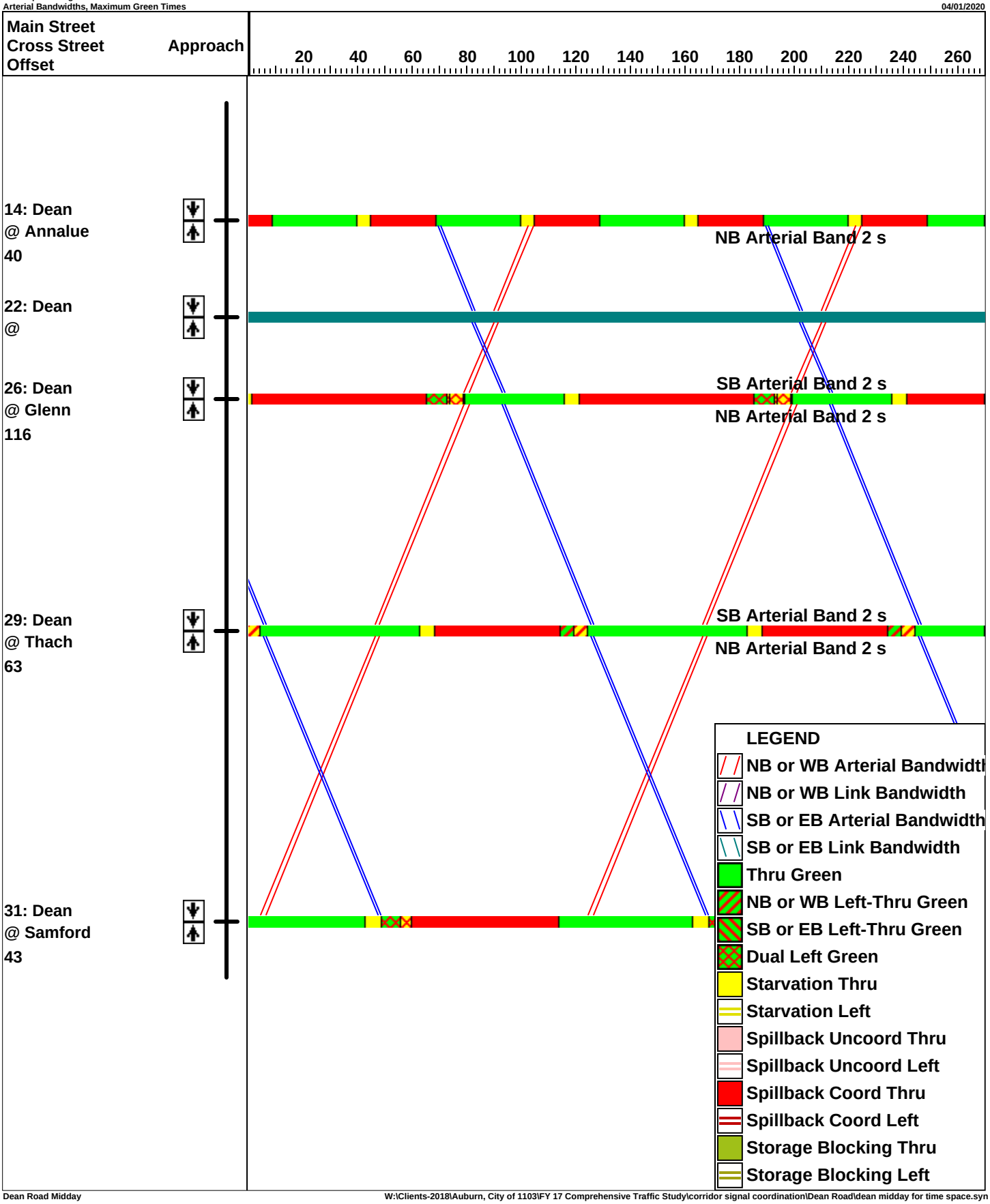
Time-Space Diagram - Dean
Arterial and Link-Link Bandwidths, Maximum Green Times

04/01/2020



Time-Space Diagram - Dean
Arterial Bandwidths, Maximum Green Times

04/01/2020

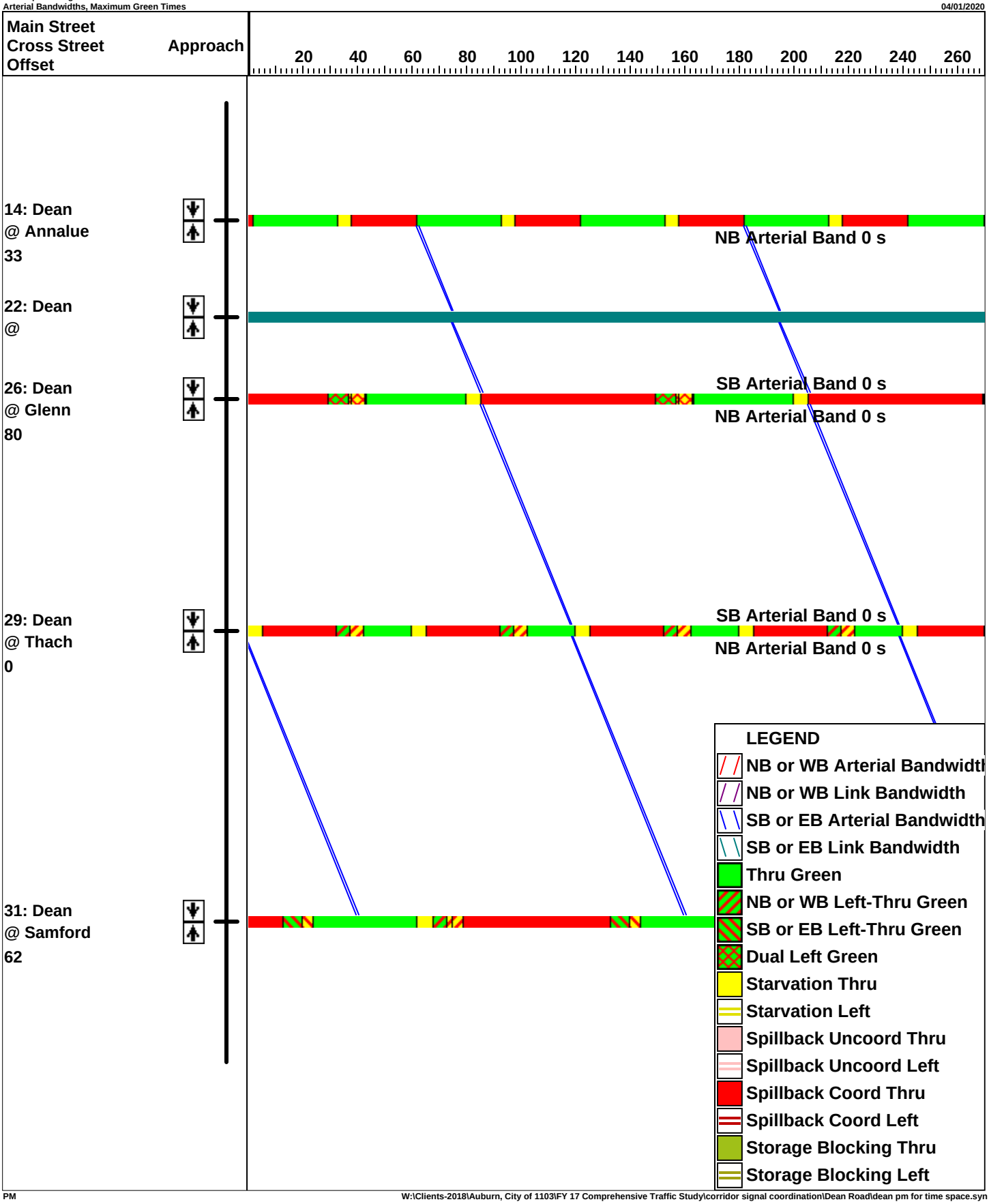


Dean Road Midday

W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\Dean Road\dean midday for time space.syn

Time-Space Diagram - Dean
Arterial Bandwidths, Maximum Green Times

04/01/2020

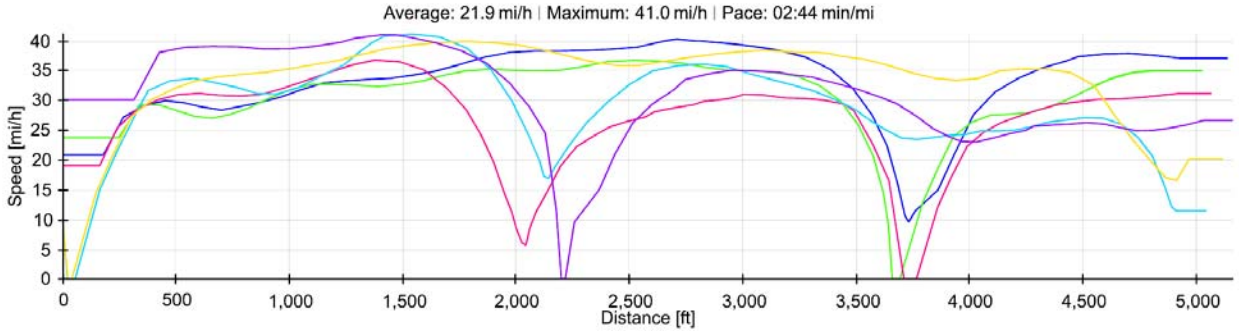


PM

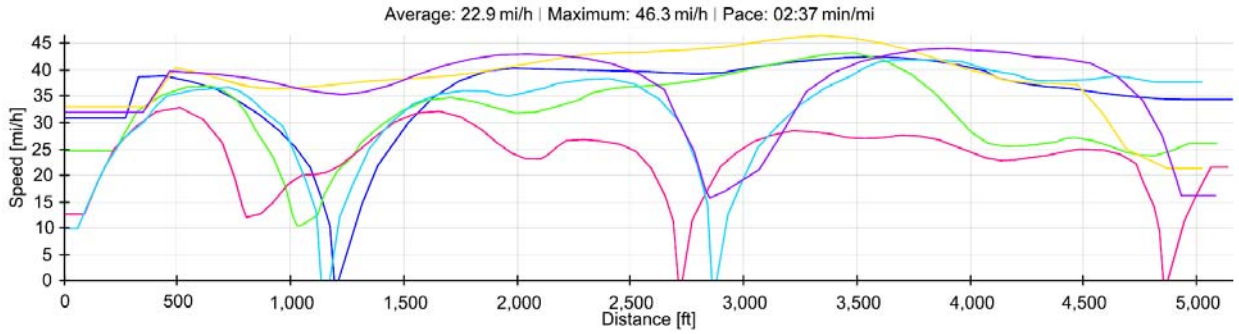
W:\Clients-2018\Auburn, City of 1103\FY 17 Comprehensive Traffic Study\corridor signal coordination\Dean Road\dean pm for time space.syn

Dean Road
Travel Time Graphs

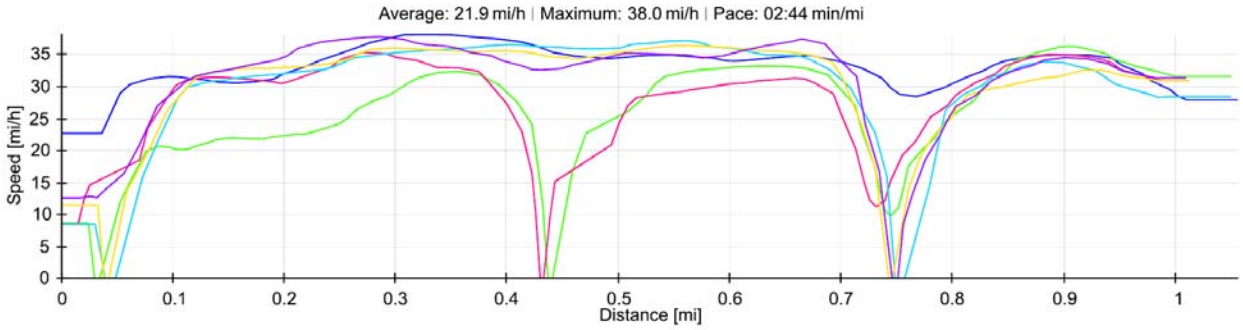
Before – AM - Northbound



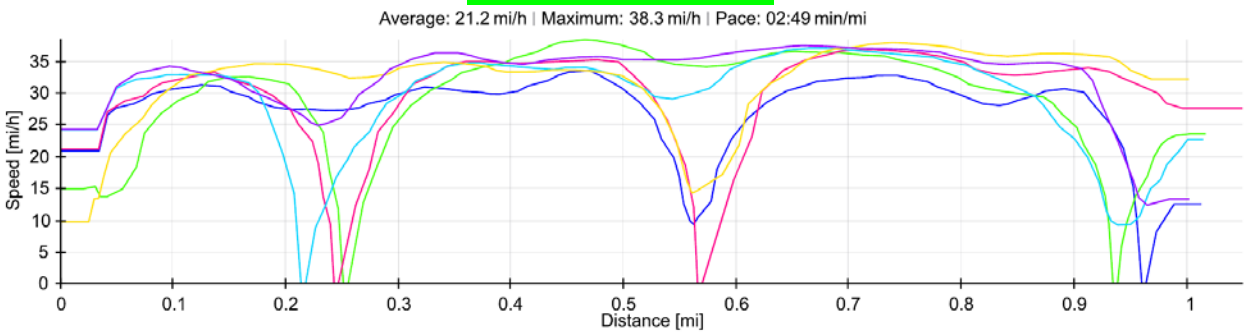
Before – AM – Southbound



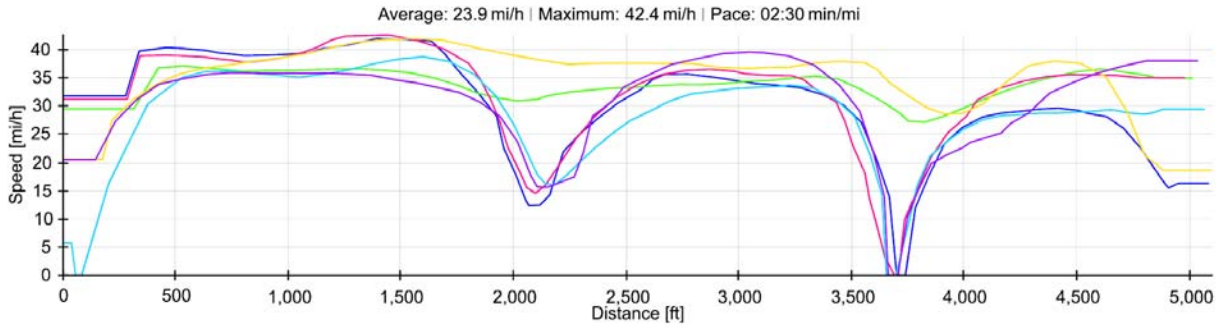
After – AM – Northbound



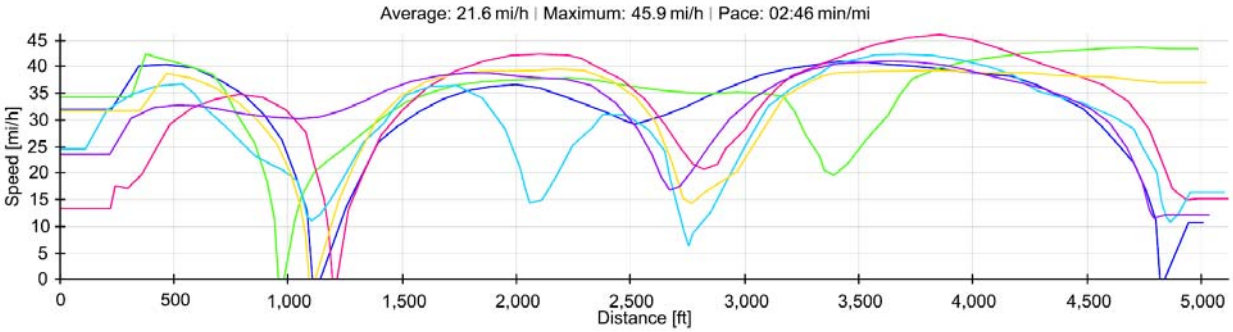
After – AM - Southbound



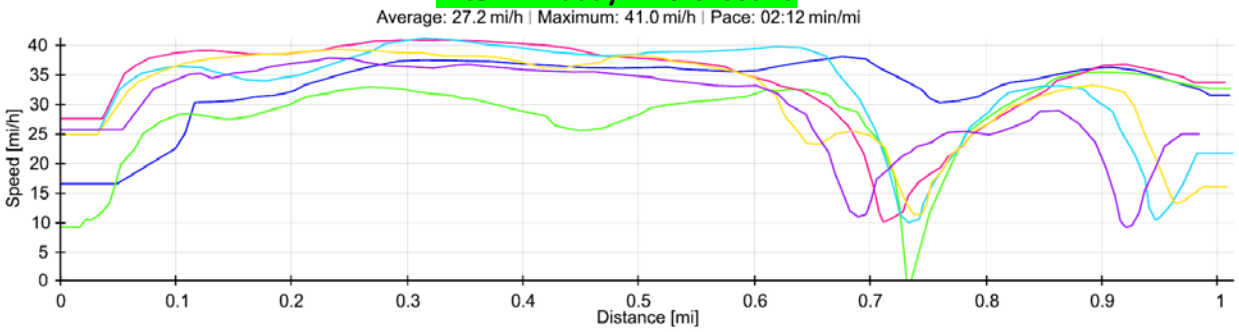
Before – Midday - Northbound



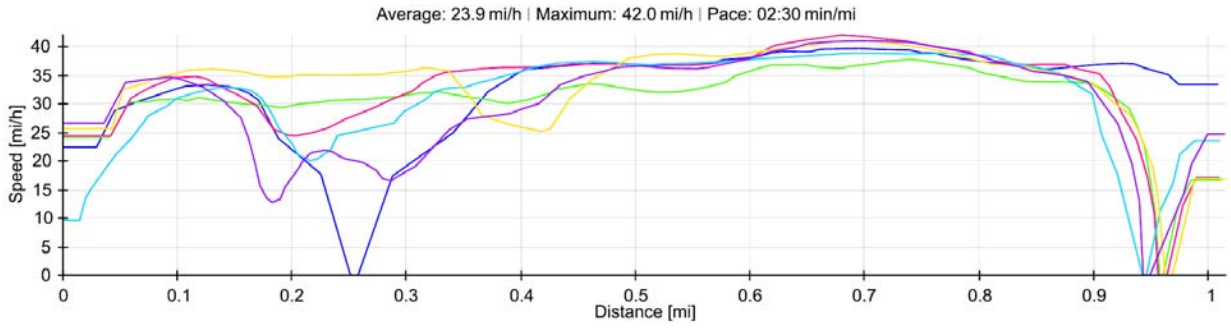
Before – Midday - Southbound



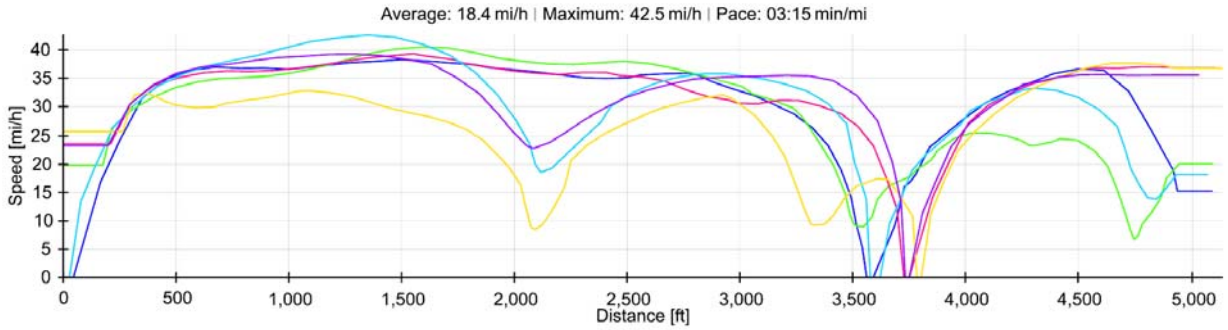
After – Midday – Northbound



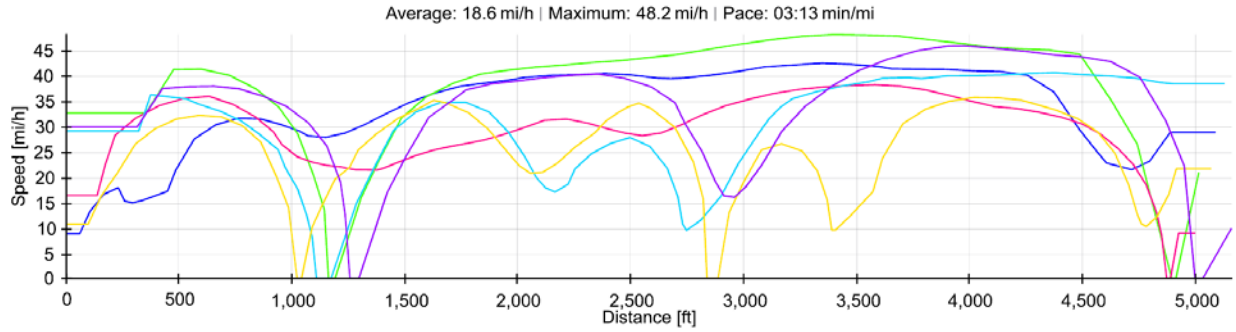
After – Midday – Southbound



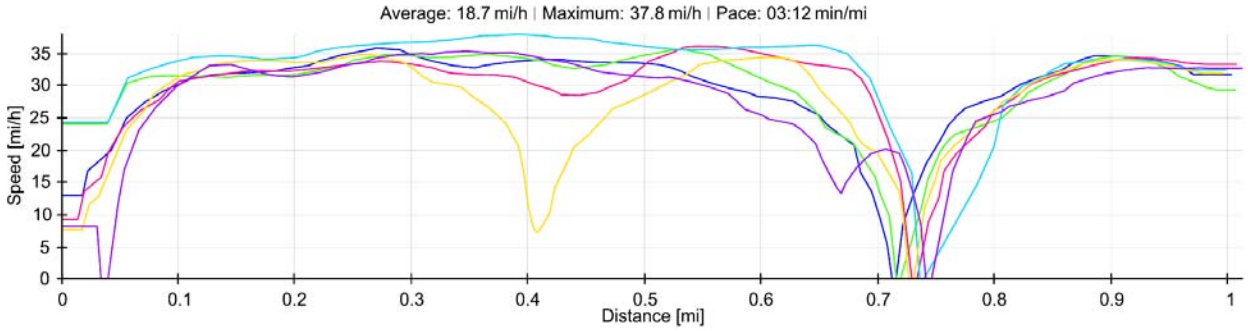
Before – PM - Northbound



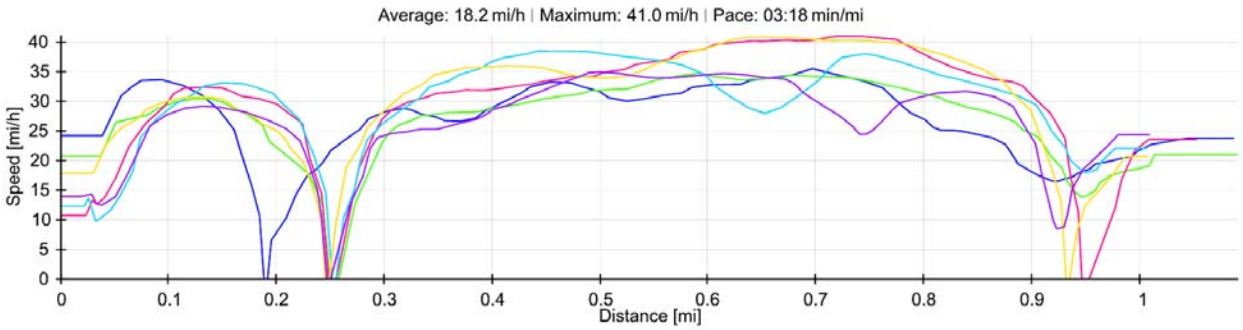
Before – PM - Southbound



After – PM – Northbound



After – PM – Southbound



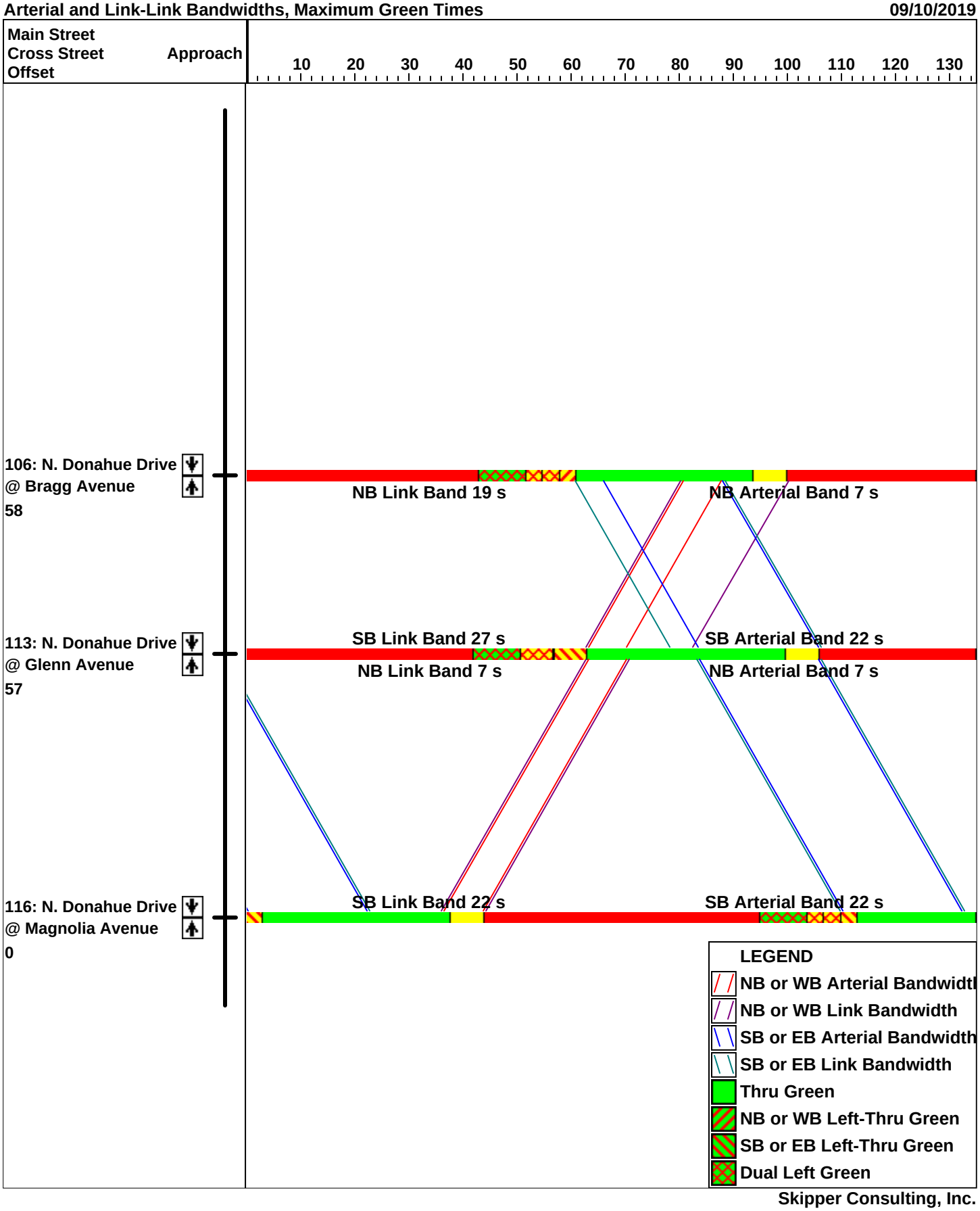
Appendix C

Time-Space Diagrams and Travel Time Graphs

North Donahue Drive

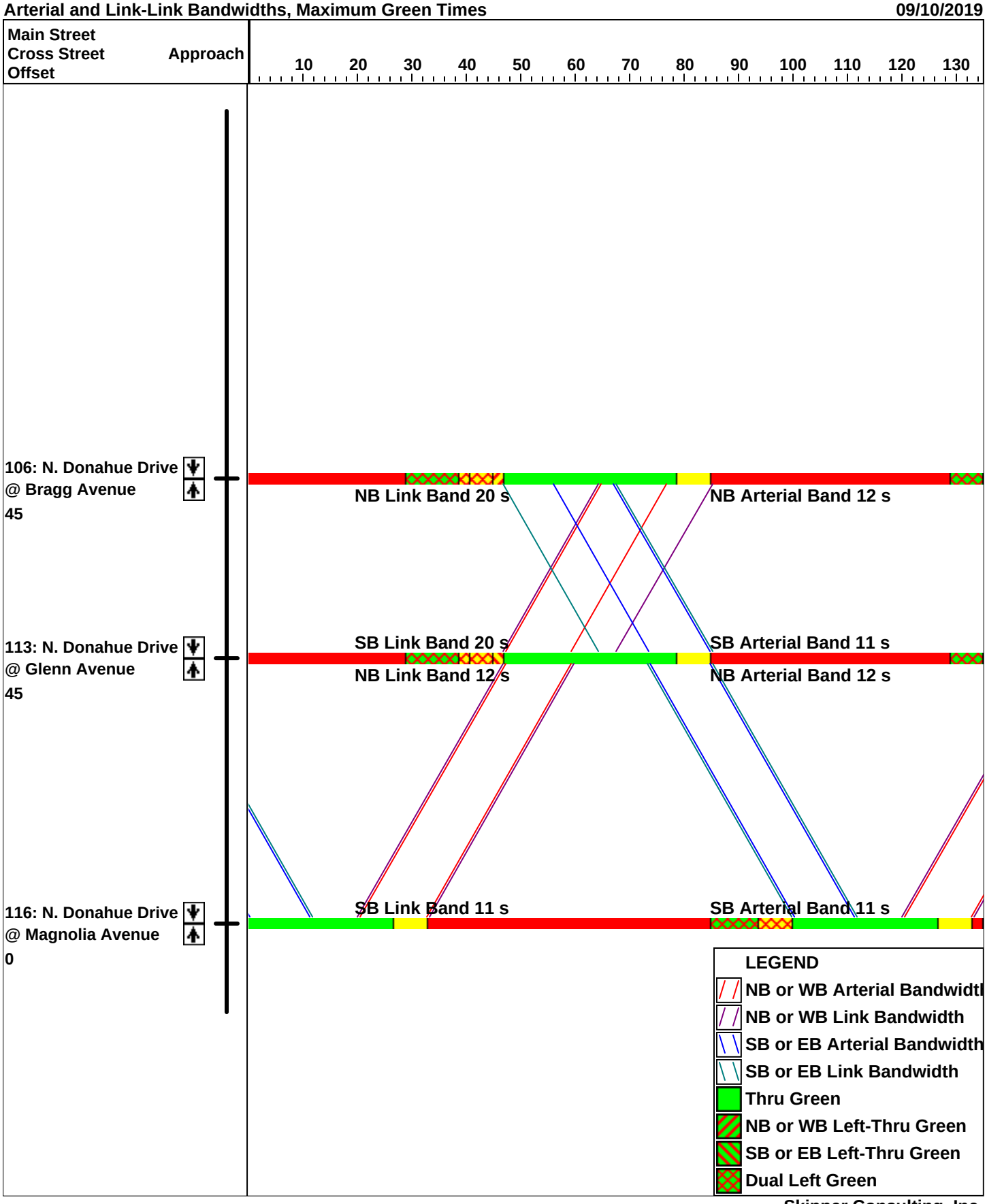
Time Space Diagram - Donahue Drive
Arterial and Link-Link Bandwidths, Maximum Green Times

AM Plan (1-1-1)
09/10/2019



Skipper Consulting, Inc.

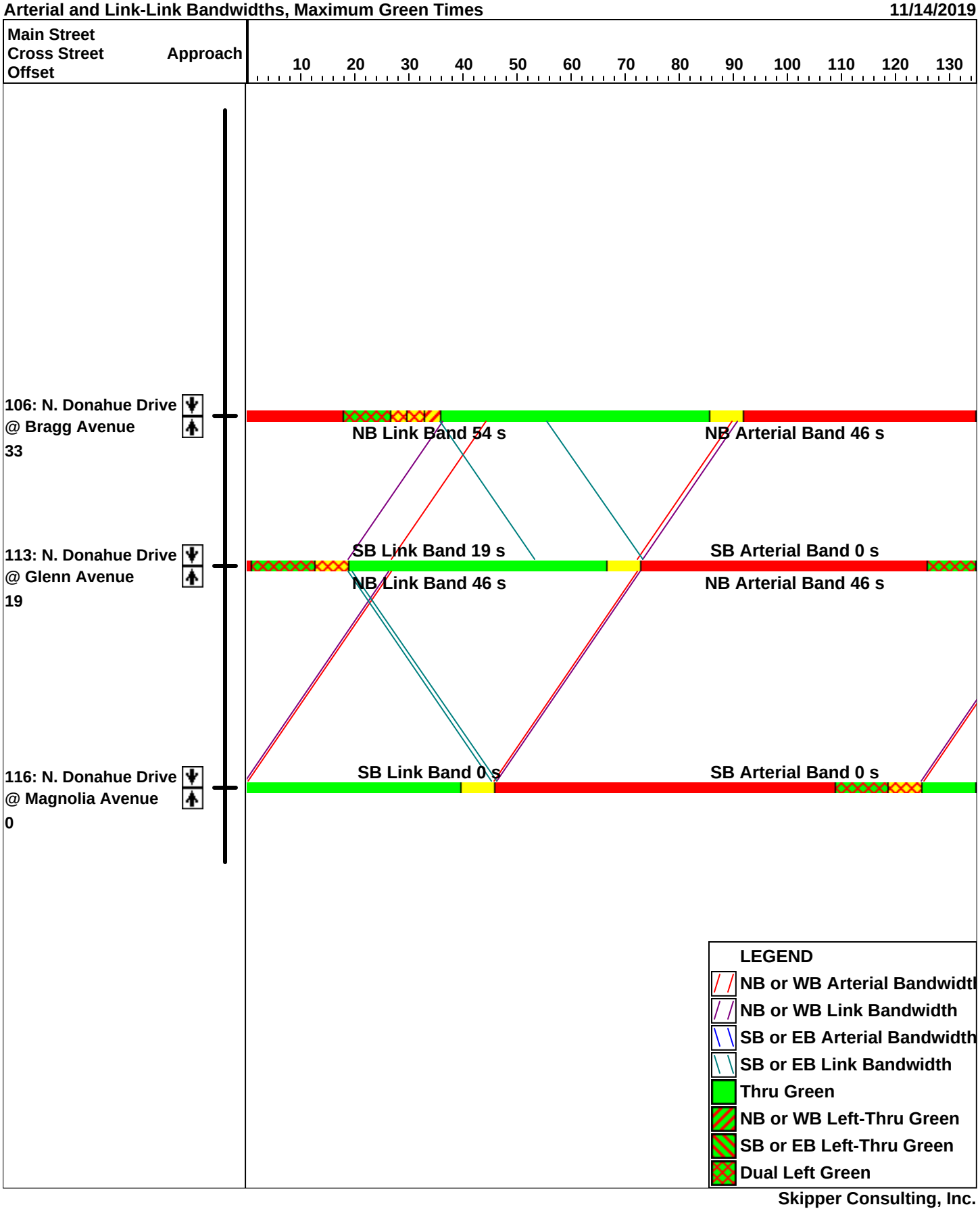
Time Space Diagram - Donahue Drive **Off Plan (2-1-1)**
Arterial and Link-Link Bandwidths, Maximum Green Times **09/10/2019**



Skipper Consulting, Inc.

Time Space Diagram - Donahue Drive
Arterial and Link-Link Bandwidths, Maximum Green Times

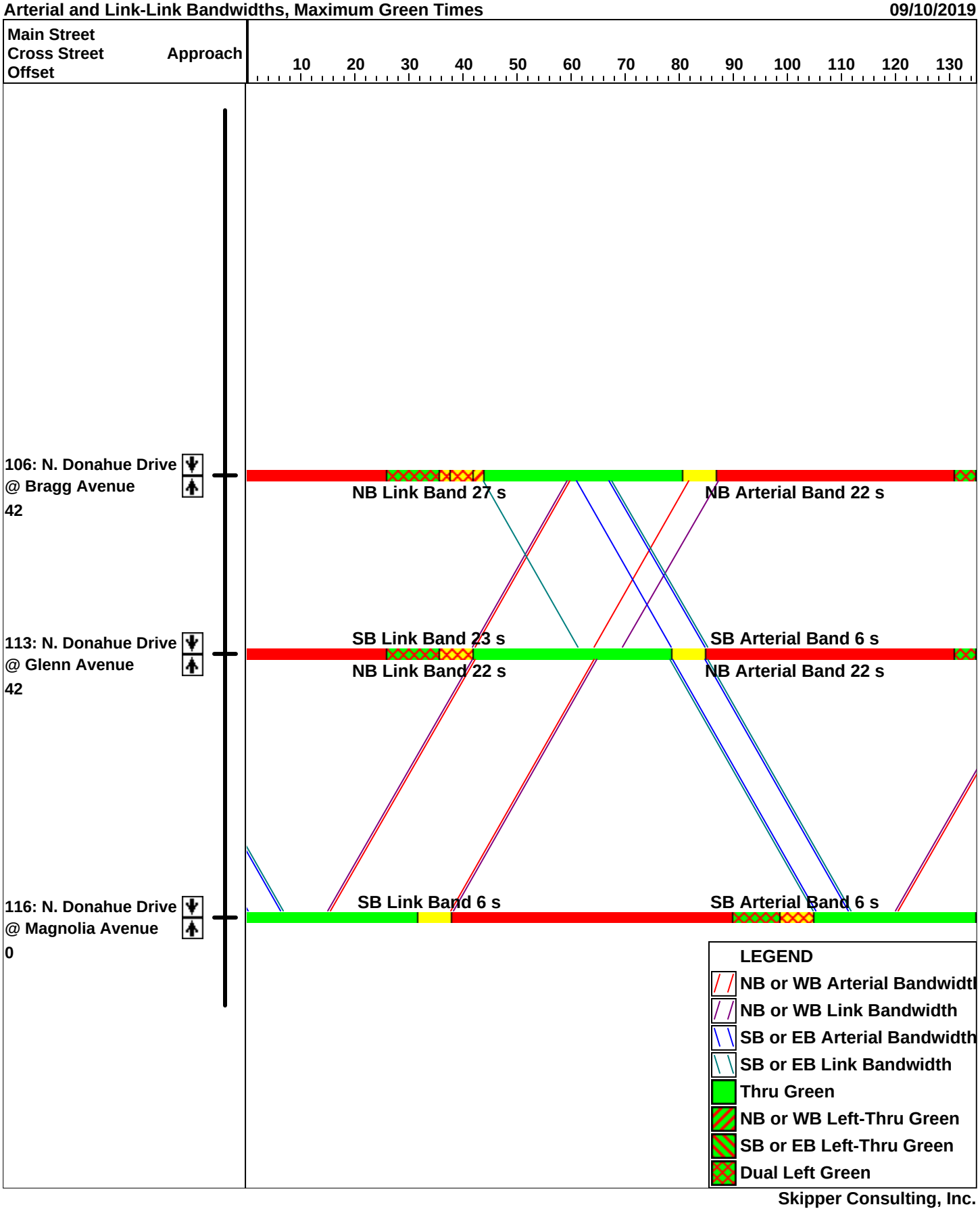
PM Plan (3-1-1)
11/14/2019



Skipper Consulting, Inc.

Time Space Diagram - Donahue Drive
Arterial and Link-Link Bandwidths, Maximum Green Times

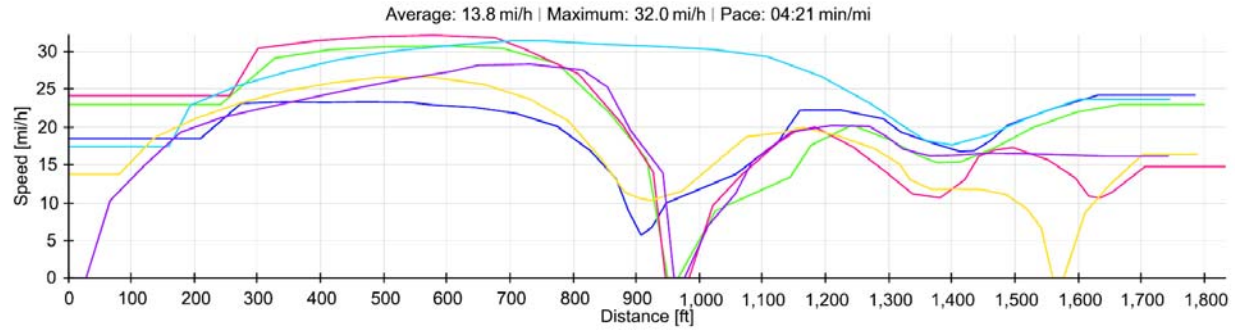
Midday Plan (4-1-1)
09/10/2019



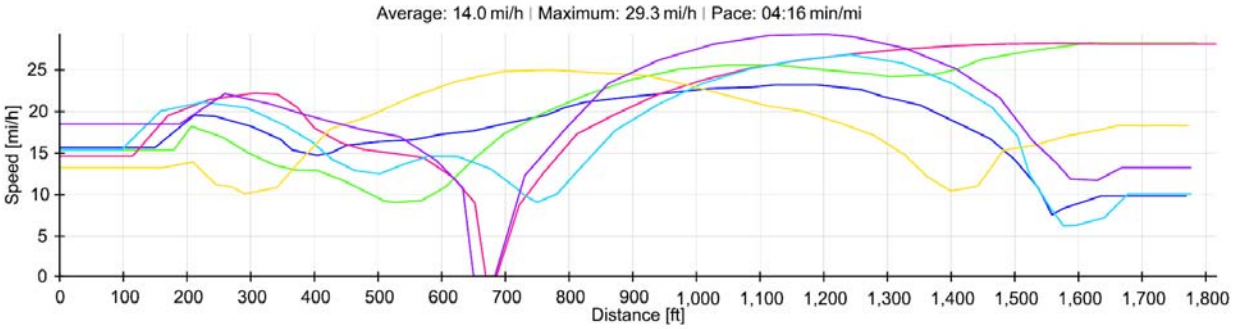
Skipper Consulting, Inc.

Donahue Drive
Travel Time Graphs

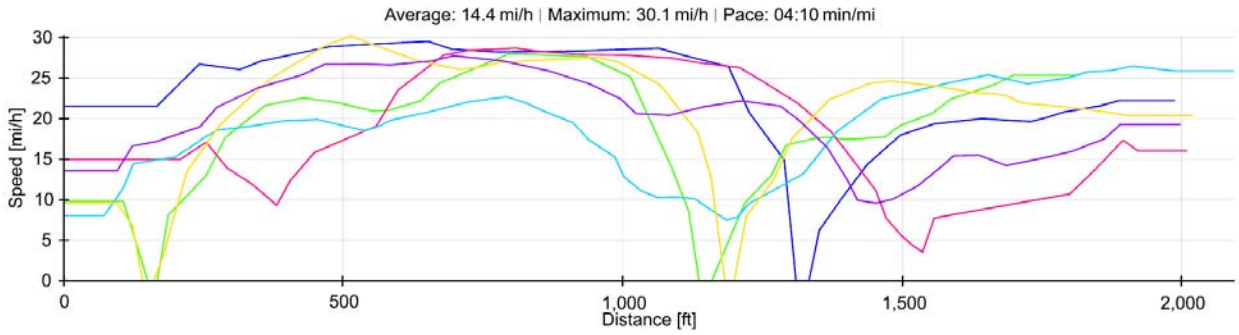
Before – AM - Northbound



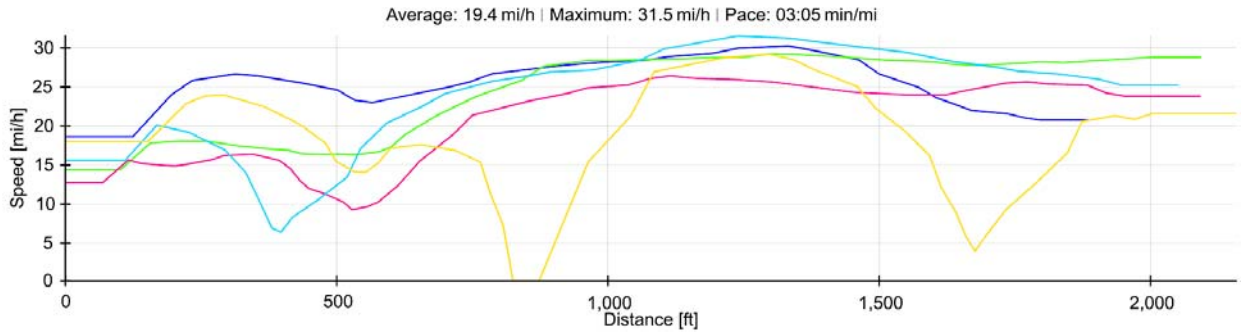
Before – AM – Southbound



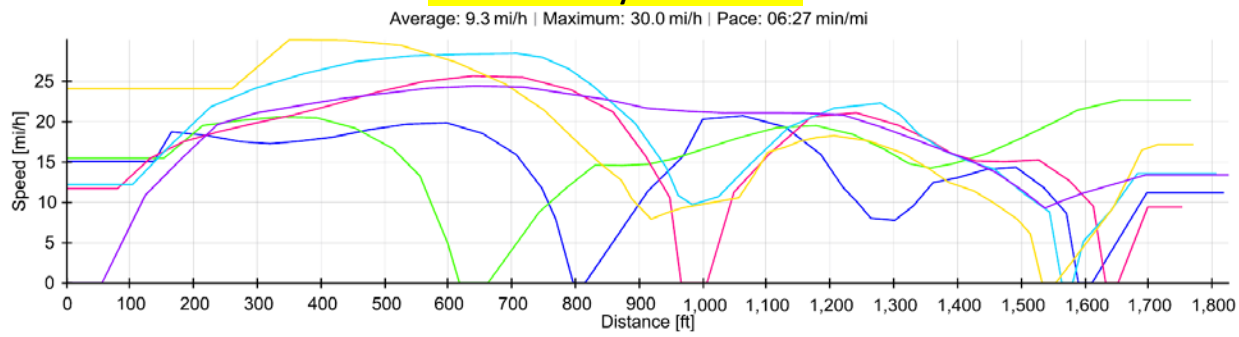
After – AM – Northbound



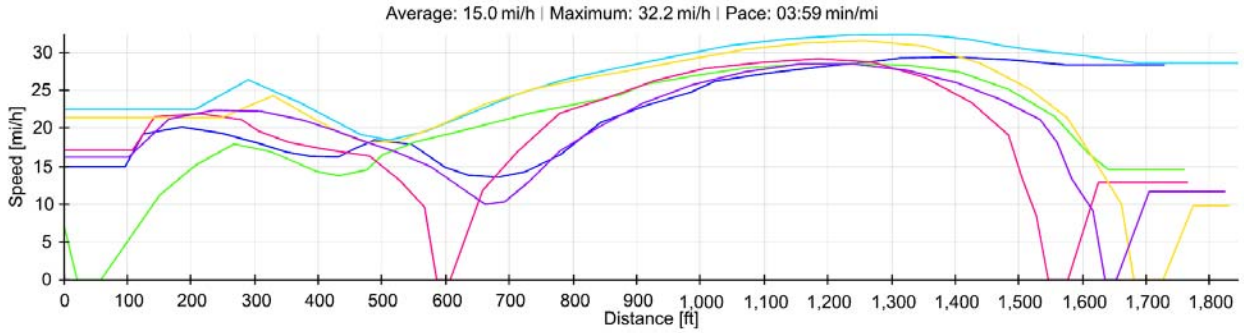
After – AM – Southbound



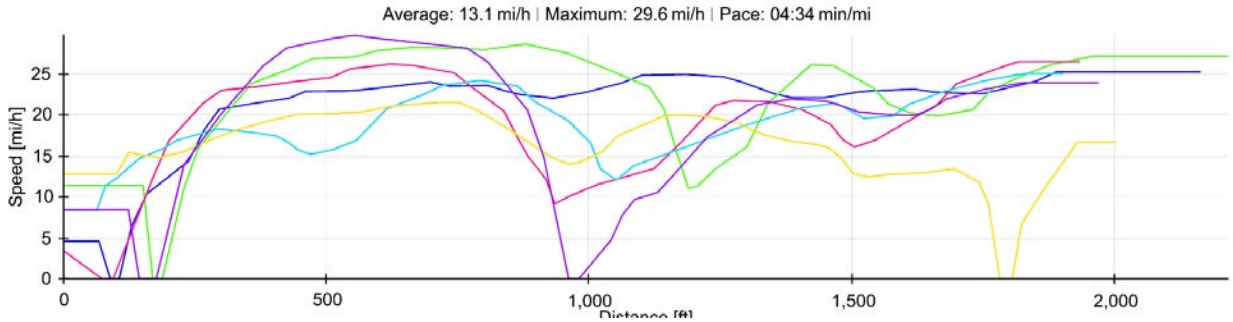
Before – Midday - Northbound



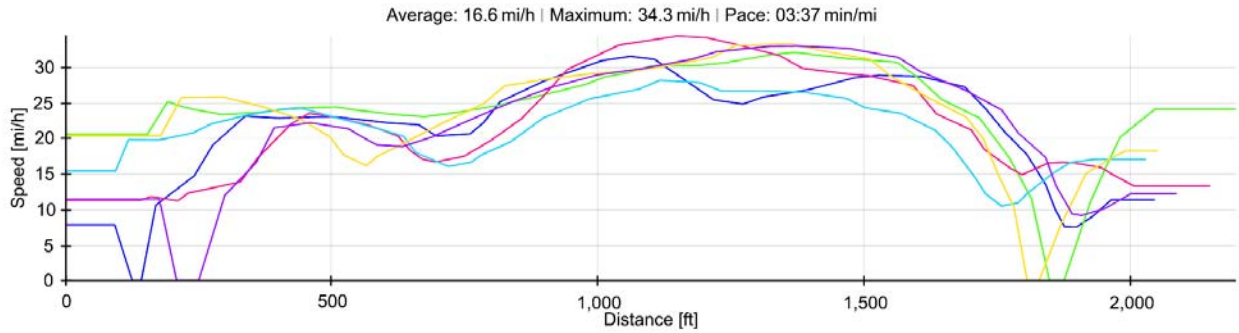
Before – Midday - Southbound



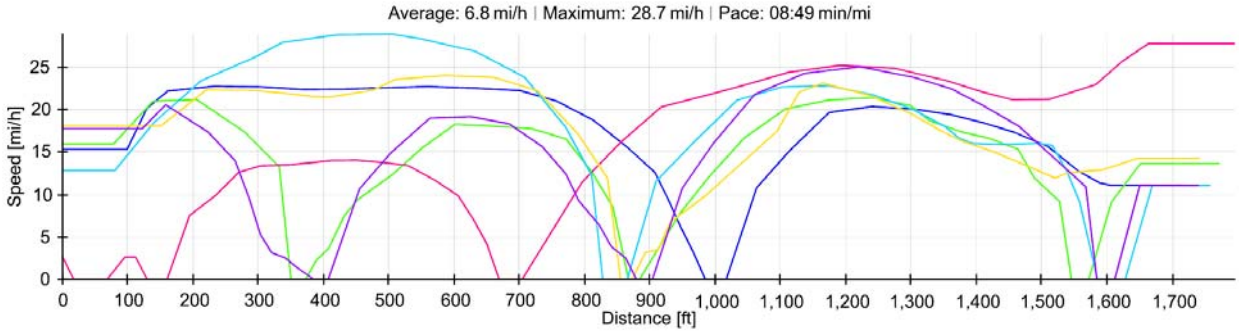
After – Midday – Northbound



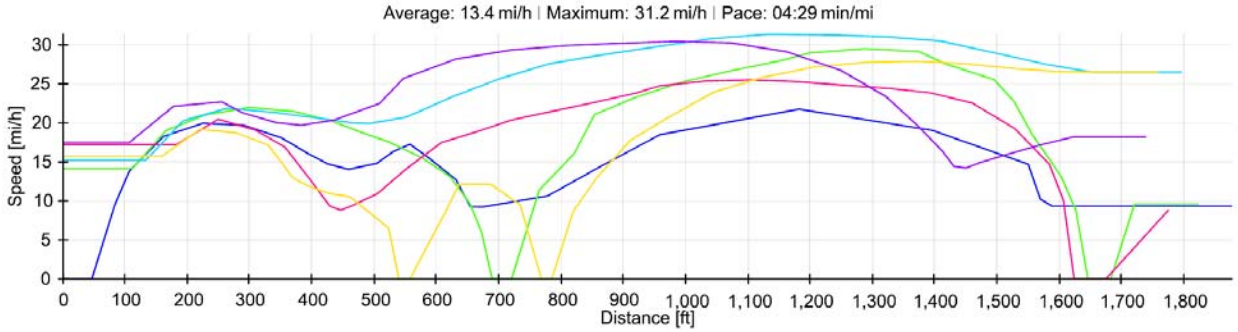
After – Midday – Southbound



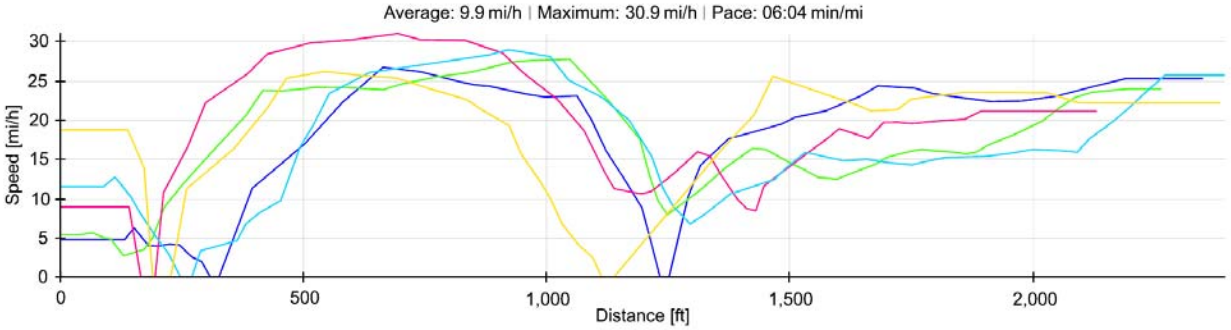
Before – PM - Northbound



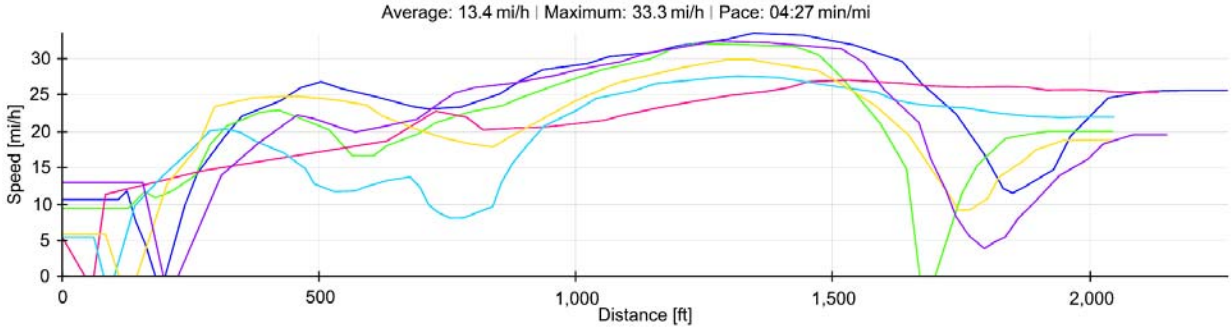
Before – PM - Southbound



After – PM – Northbound



After – PM – Southbound



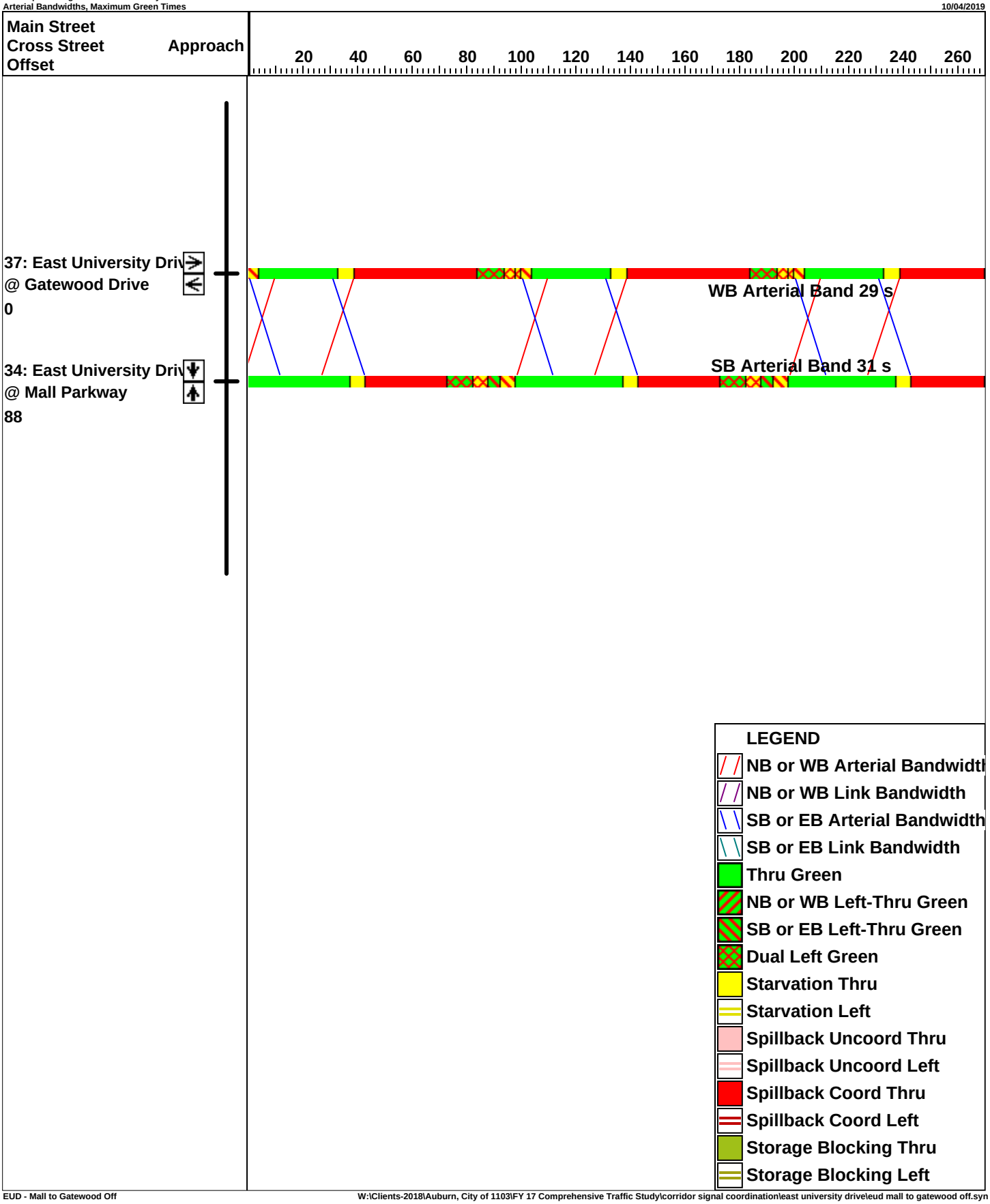
Appendix D

Time-Space Diagrams

East University Drive

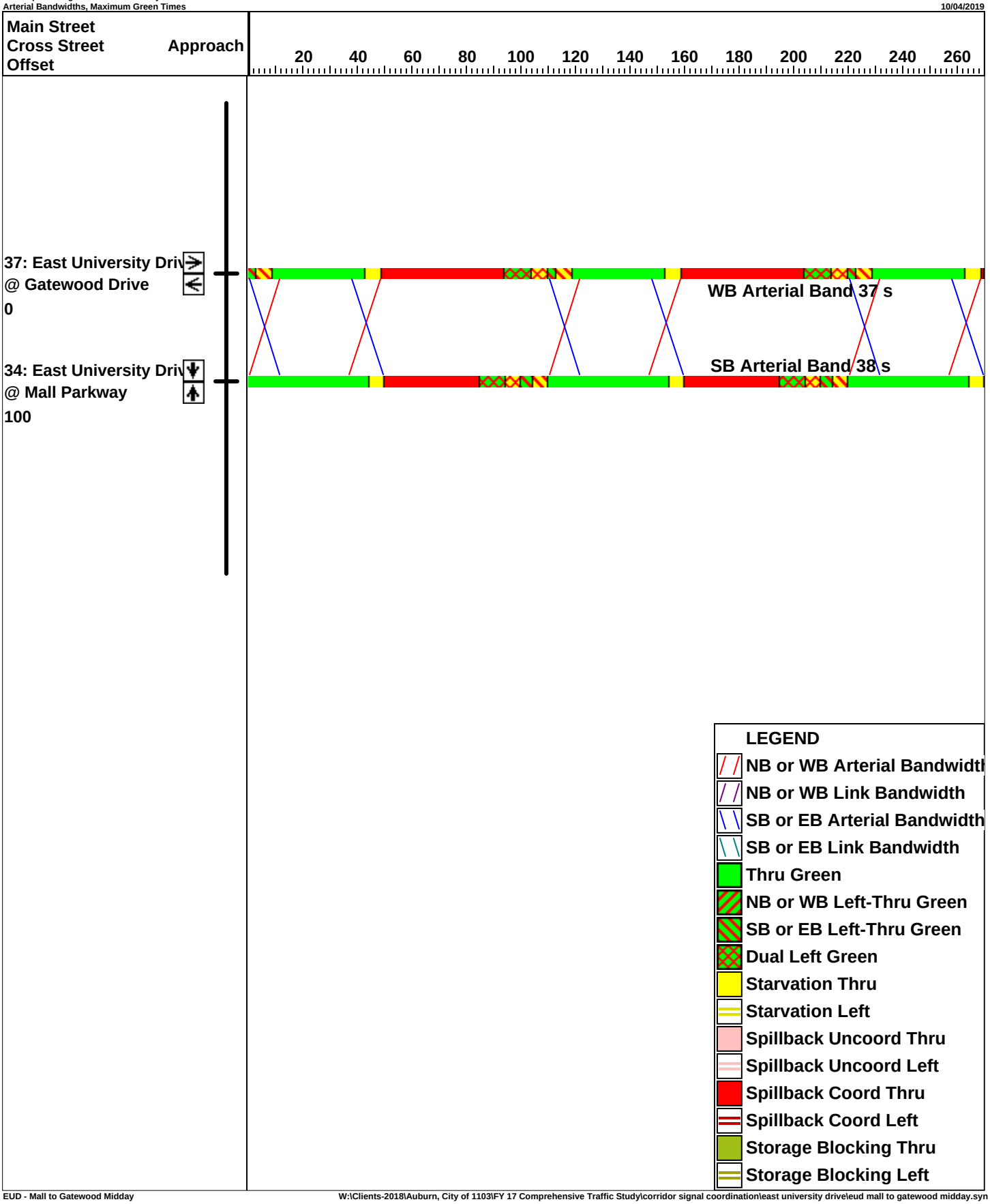
Time-Space Diagram - East University Drive
Arterial Bandwidths, Maximum Green Times

10/04/2019



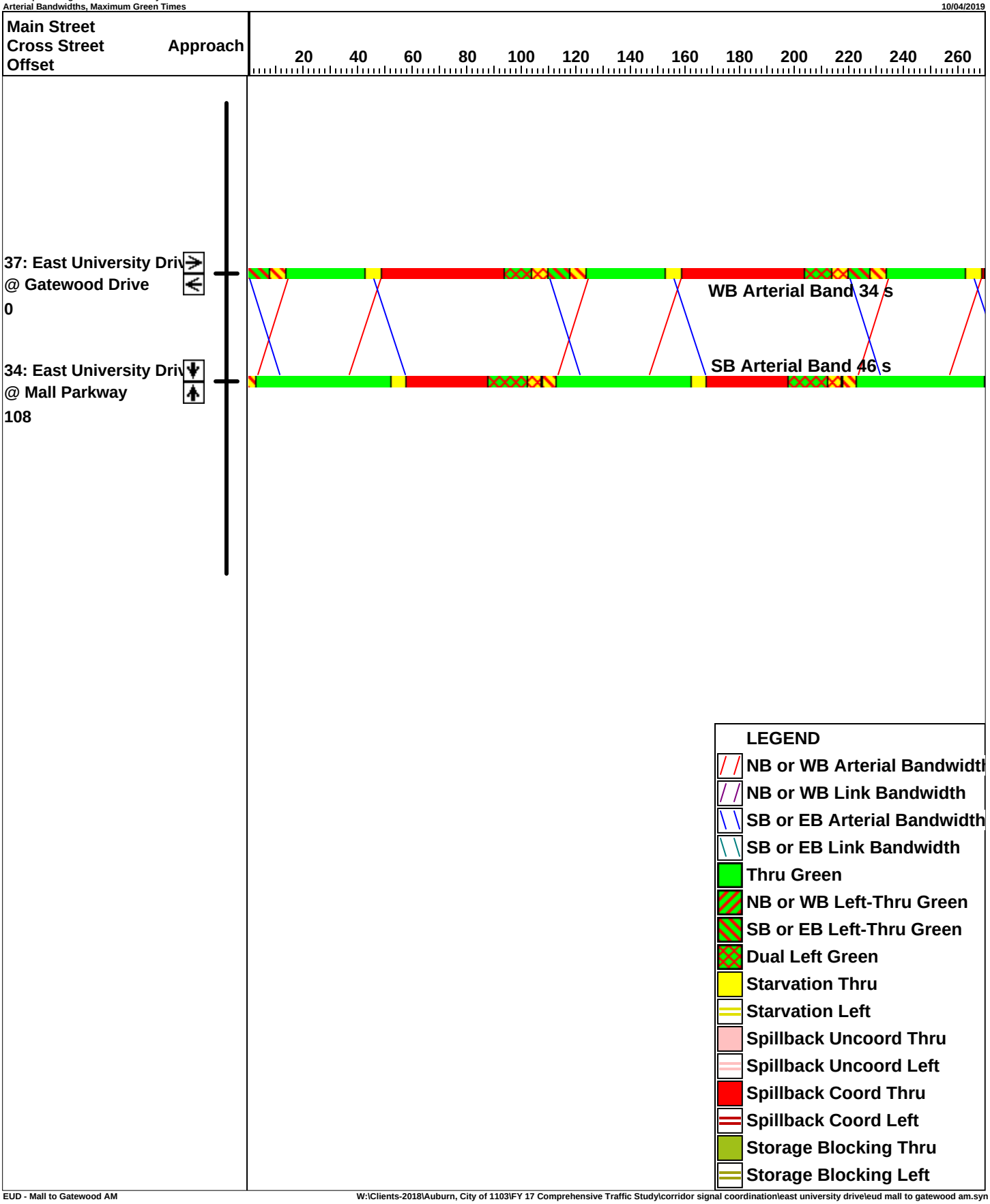
Time-Space Diagram - East University Drive
Arterial Bandwidths, Maximum Green Times

10/04/2019



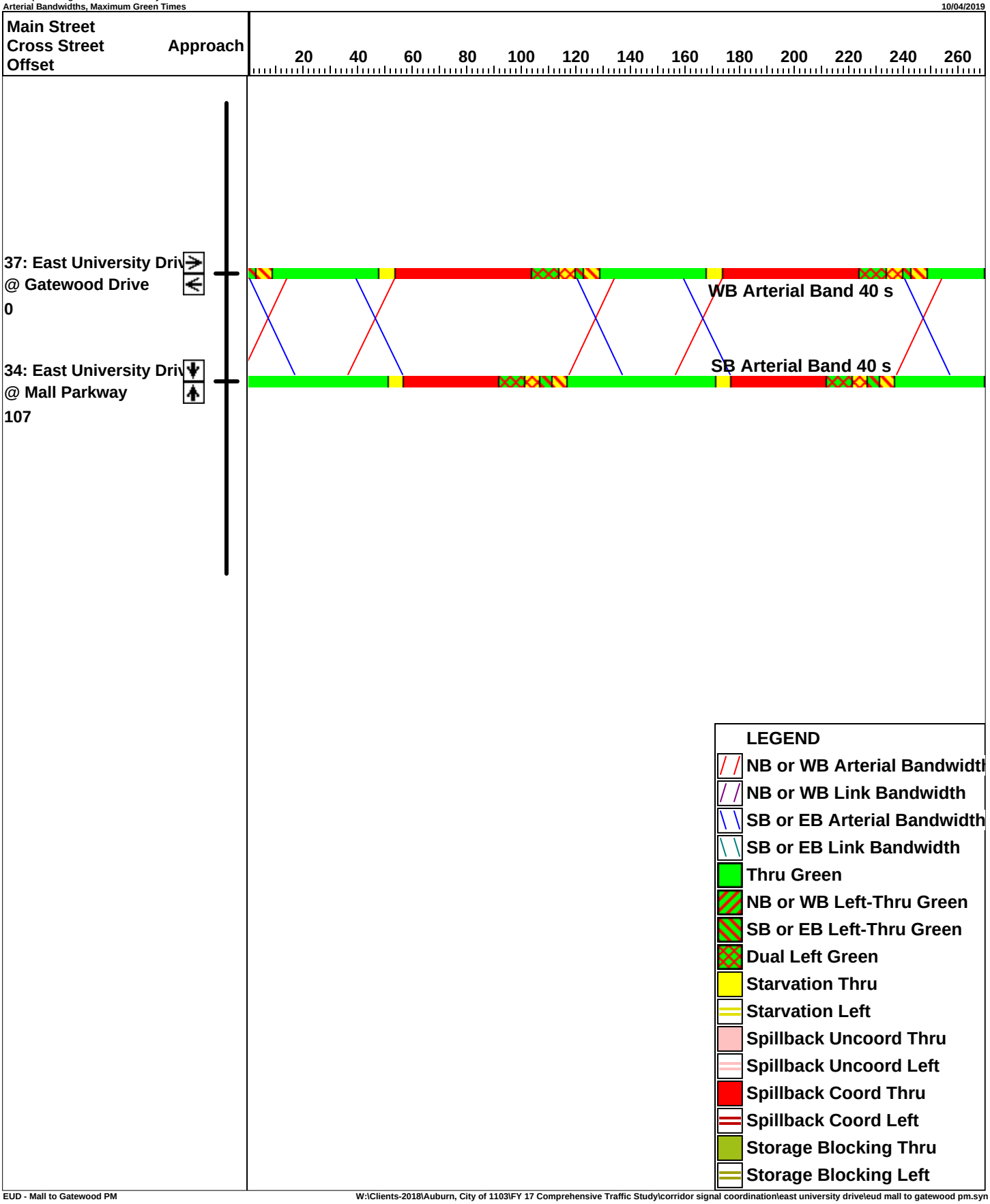
Time-Space Diagram - East University Drive
Arterial Bandwidths, Maximum Green Times

10/04/2019



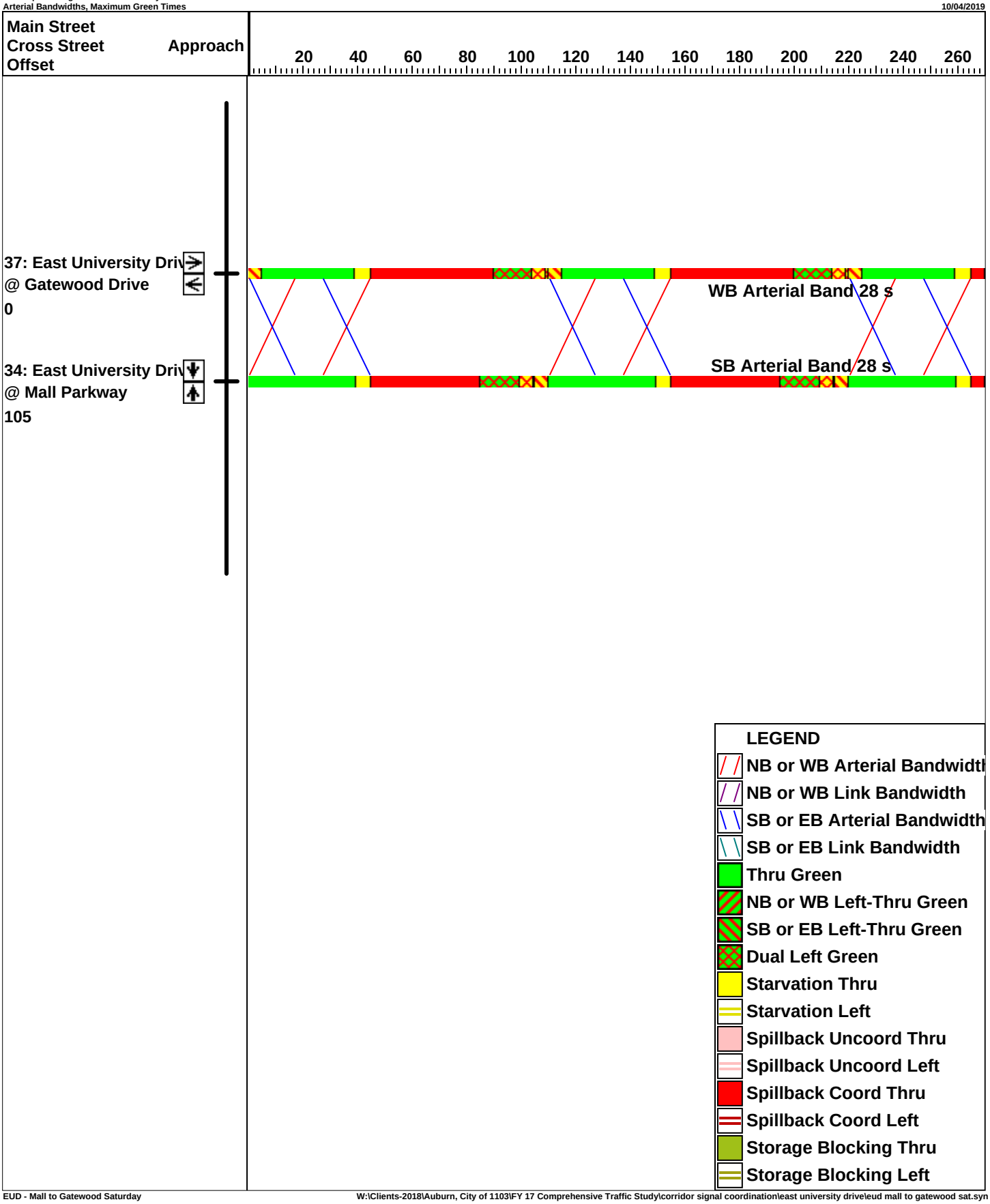
Time-Space Diagram - East University Drive
Arterial Bandwidths, Maximum Green Times

10/04/2019



Time-Space Diagram - East University Drive
Arterial Bandwidths, Maximum Green Times

10/04/2019

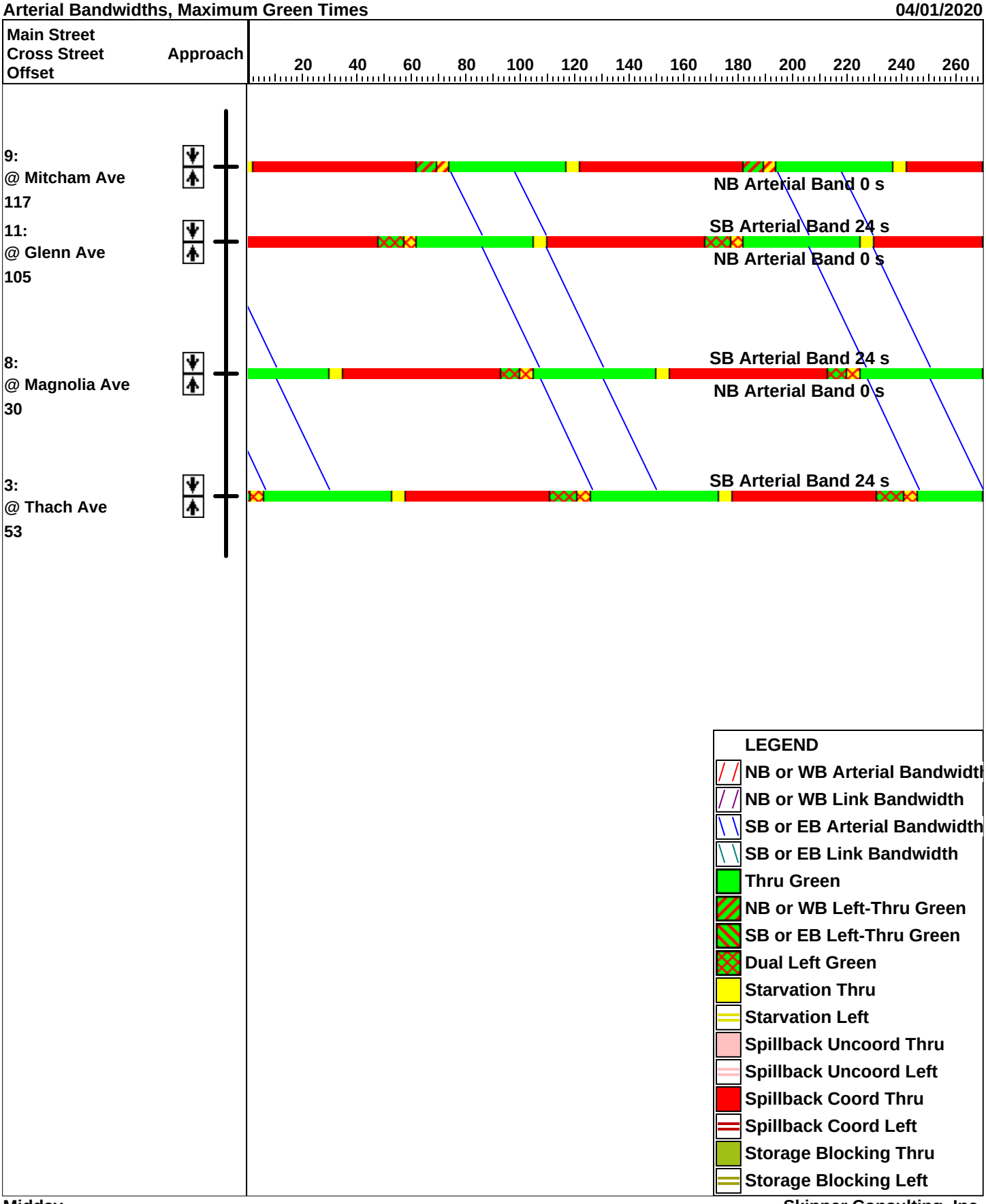


Appendix E

Time-Space Diagrams and Travel Time Graphs

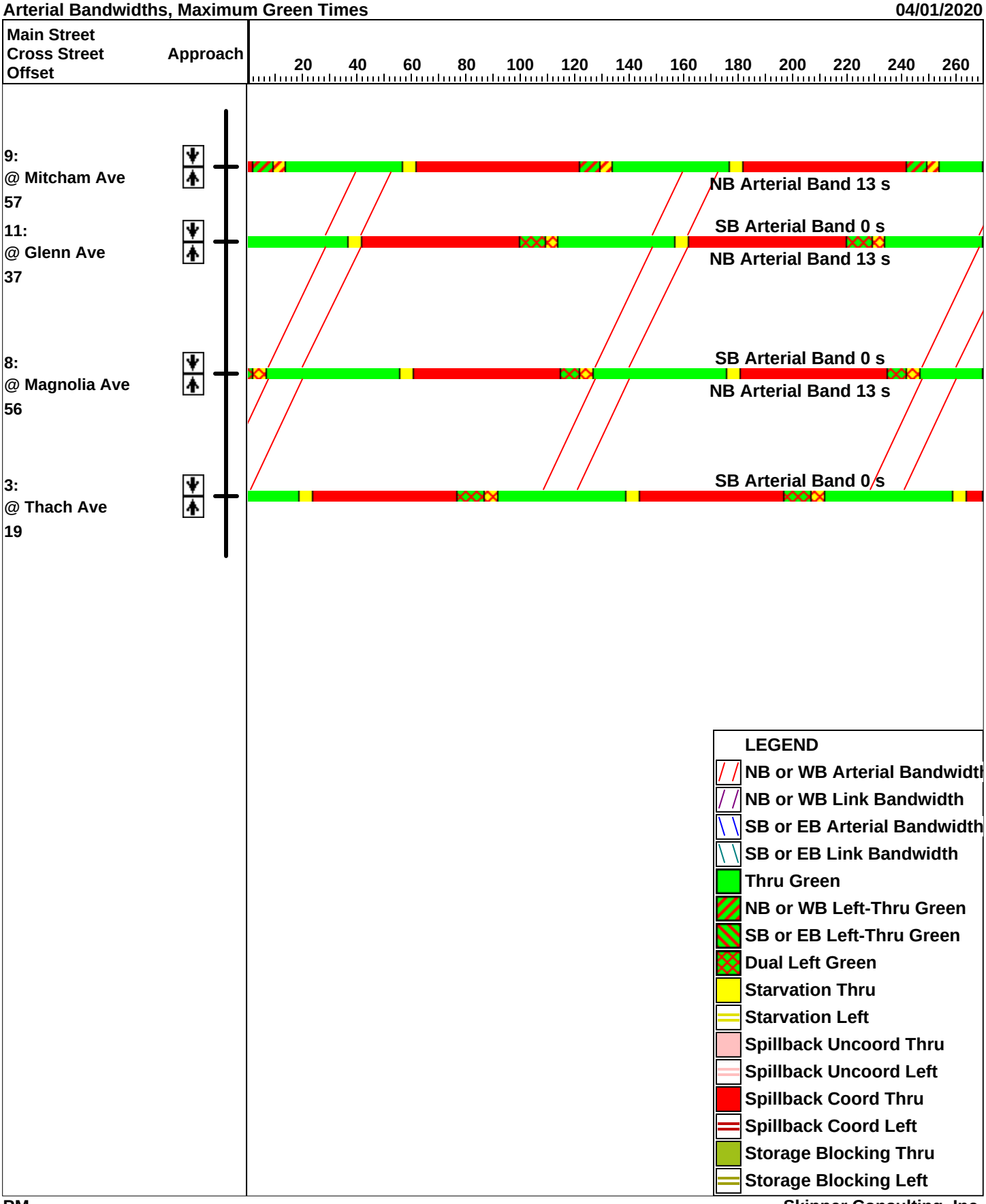
Gay Street

Gay Street
Arterial Bandwidths, Maximum Green Times 04/01/2020



Midday Skipper Consulting, Inc.

Gay Street
Arterial Bandwidths, Maximum Green Times 04/01/2020

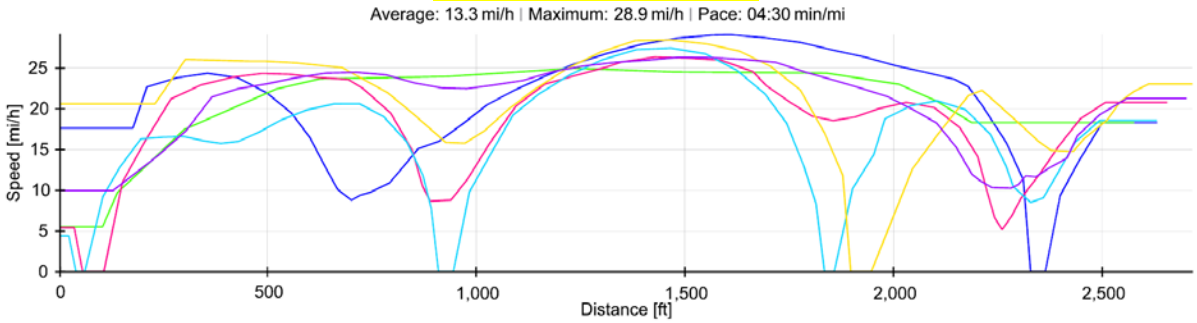


PM

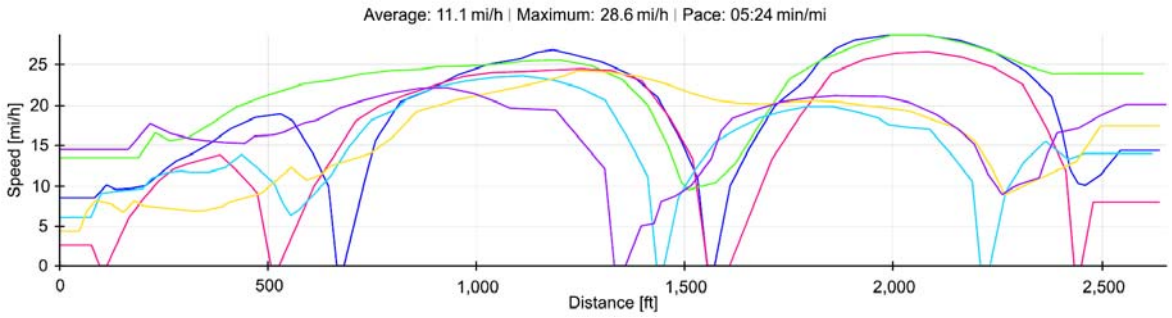
Skipper Consulting, Inc.

Gay Street
Travel Time Graphs

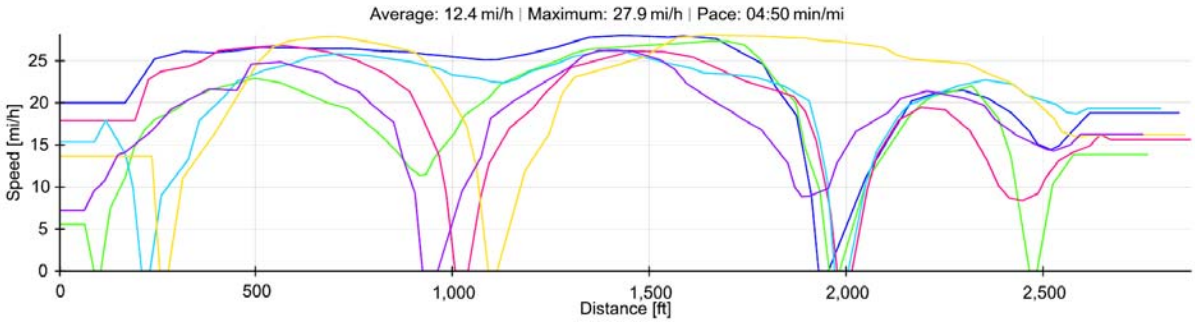
Before – AM - Northbound



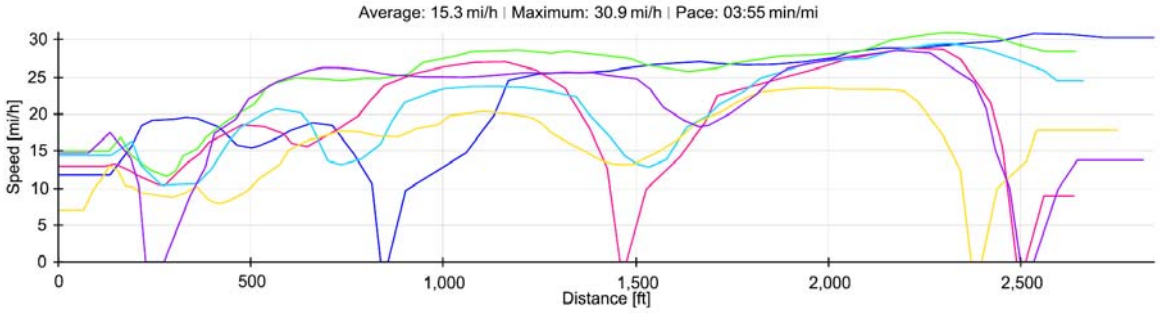
Before – AM – Southbound



After – AM – Northbound

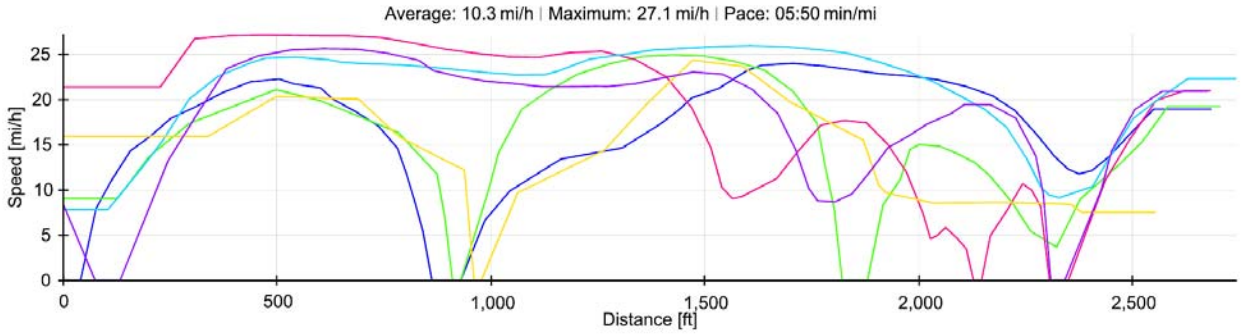


After – AM – Southbound

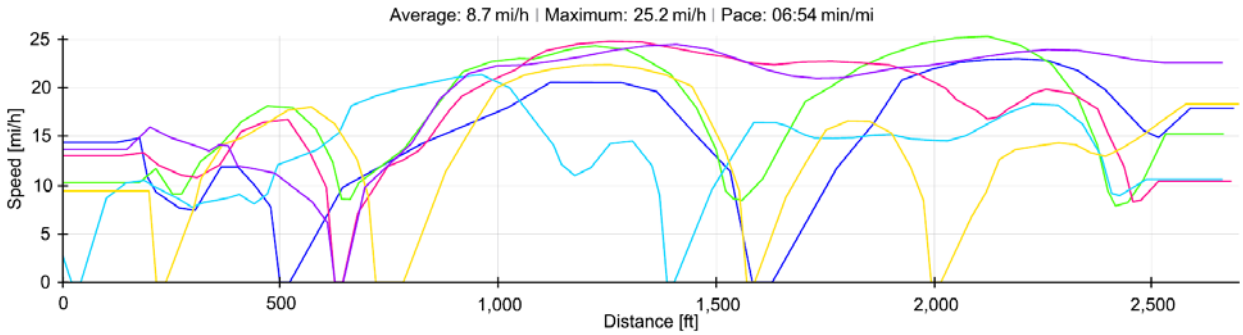


Note: Gay Street operates in FREE mode during the a.m. peak period

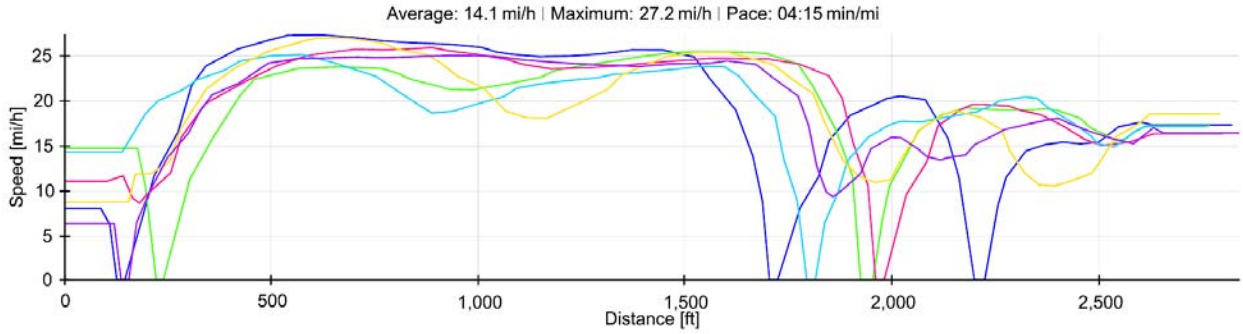
Before – Midday - Northbound



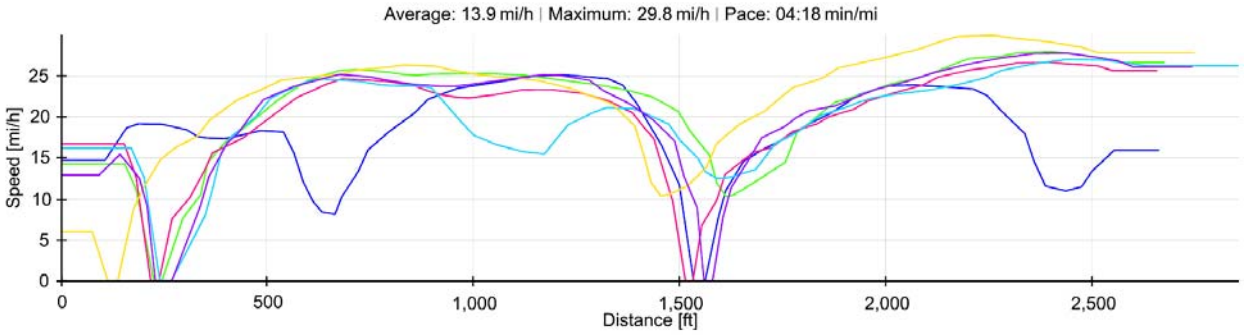
Before – Midday - Southbound



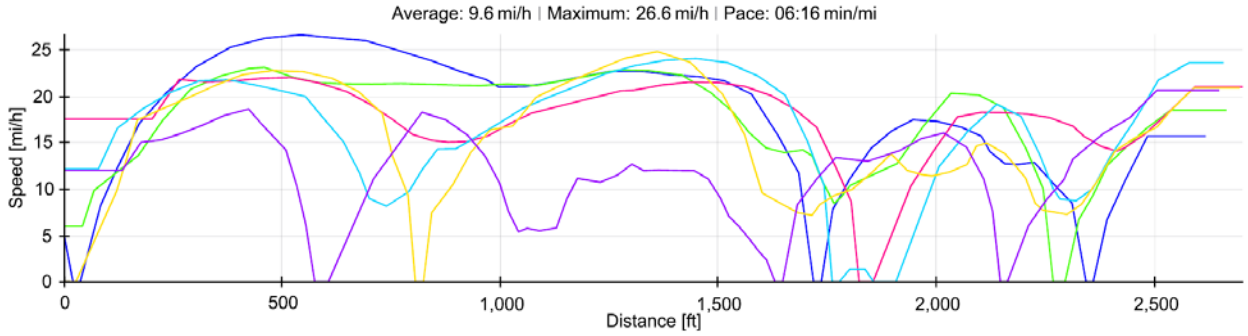
After – Midday – Northbound



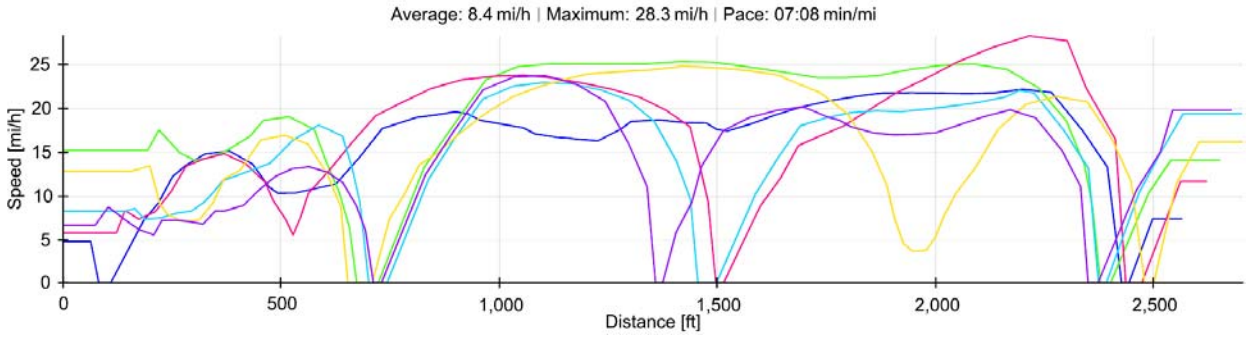
After – Midday – Southbound



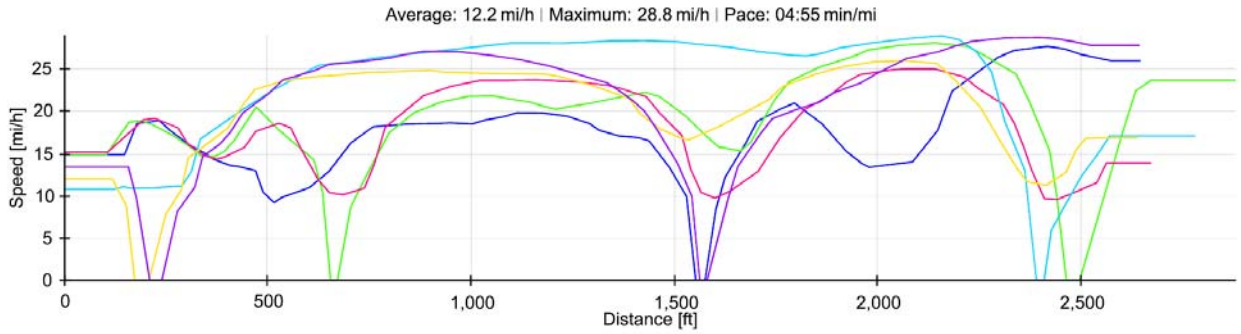
Before – PM - Northbound



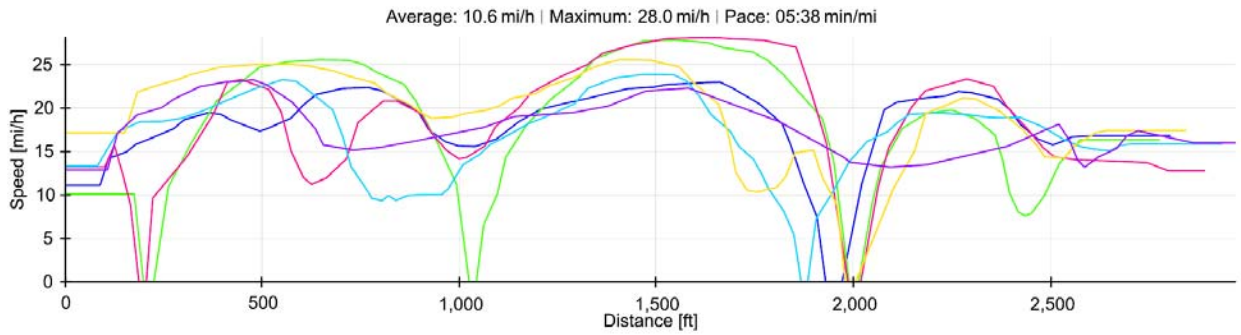
Before – PM - Southbound



After – PM – Northbound



After – PM – Southbound

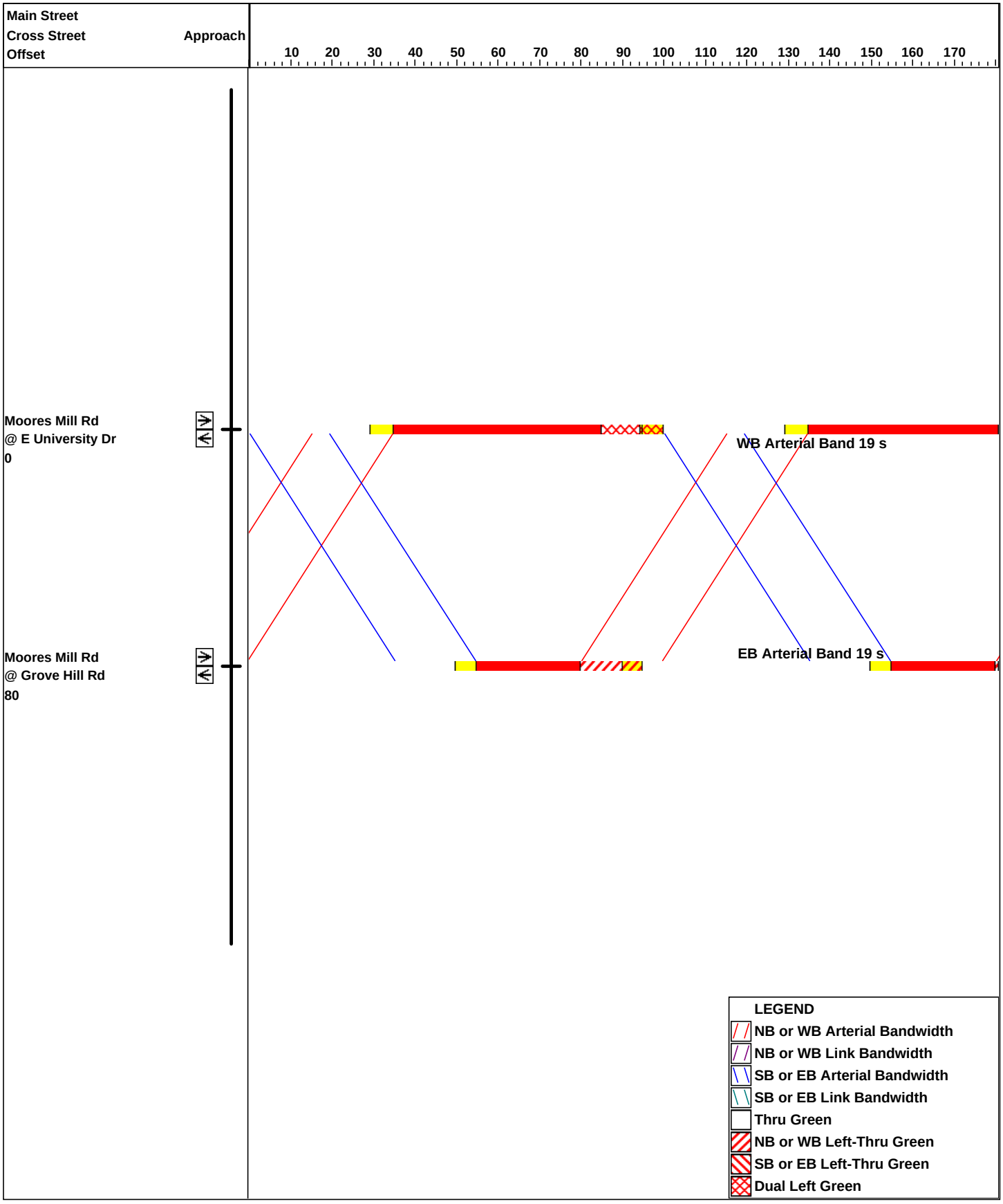


Appendix F

Time-Space Diagrams

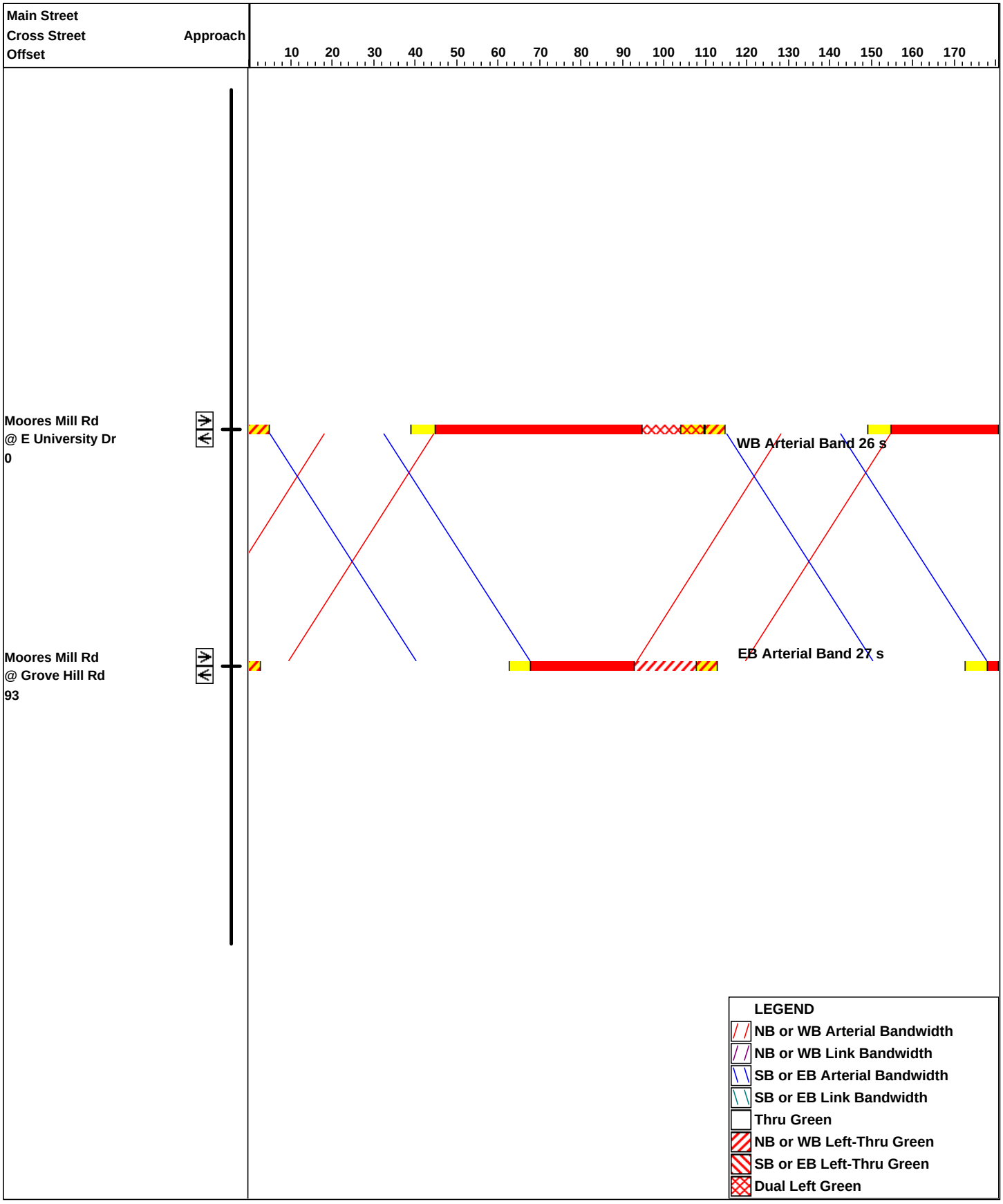
Moores Mill Road

Time-Space Diagram - Moores Mill Rd



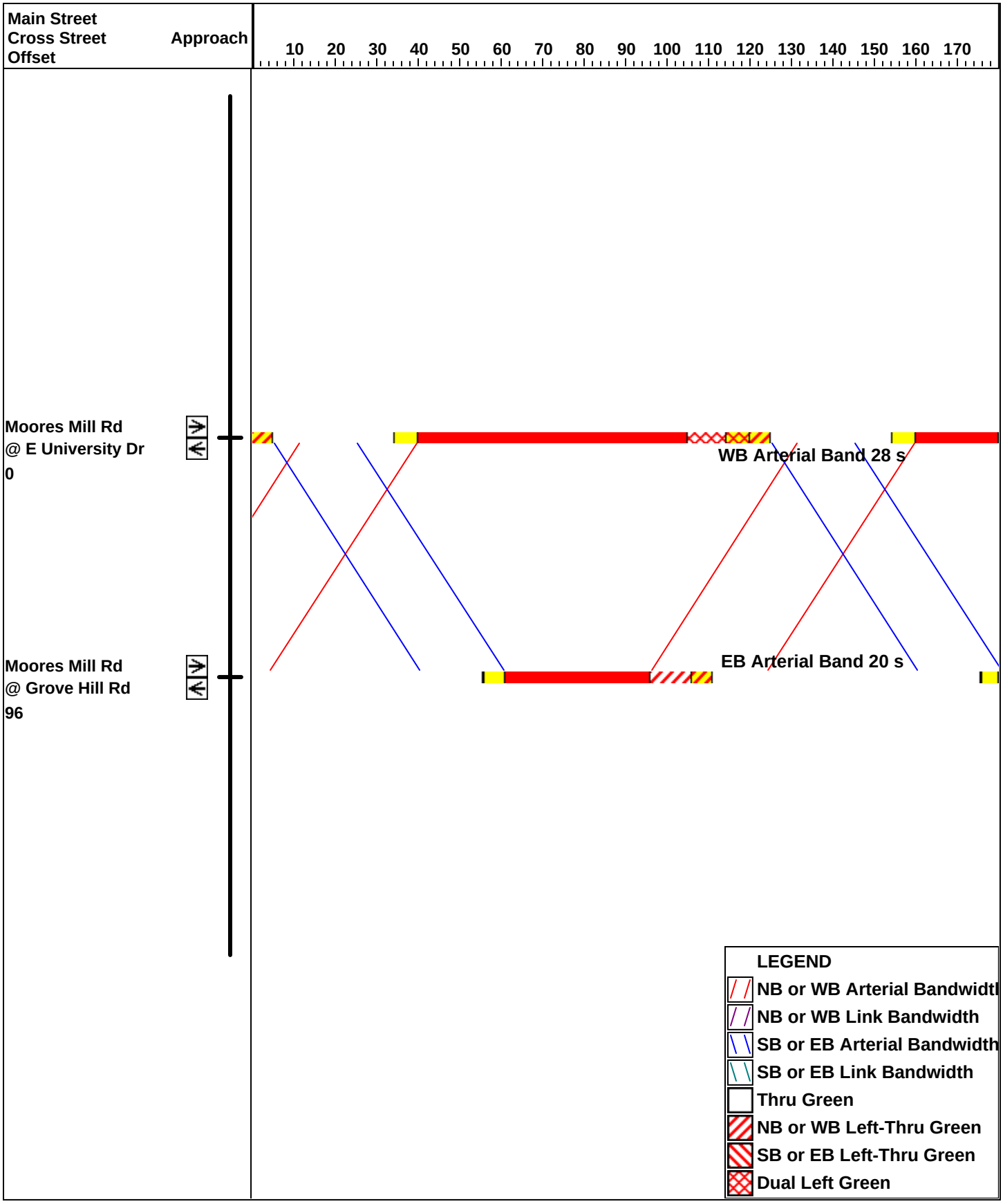
Moores Mill Road Off

Time-Space Diagram - Moores Mill Rd



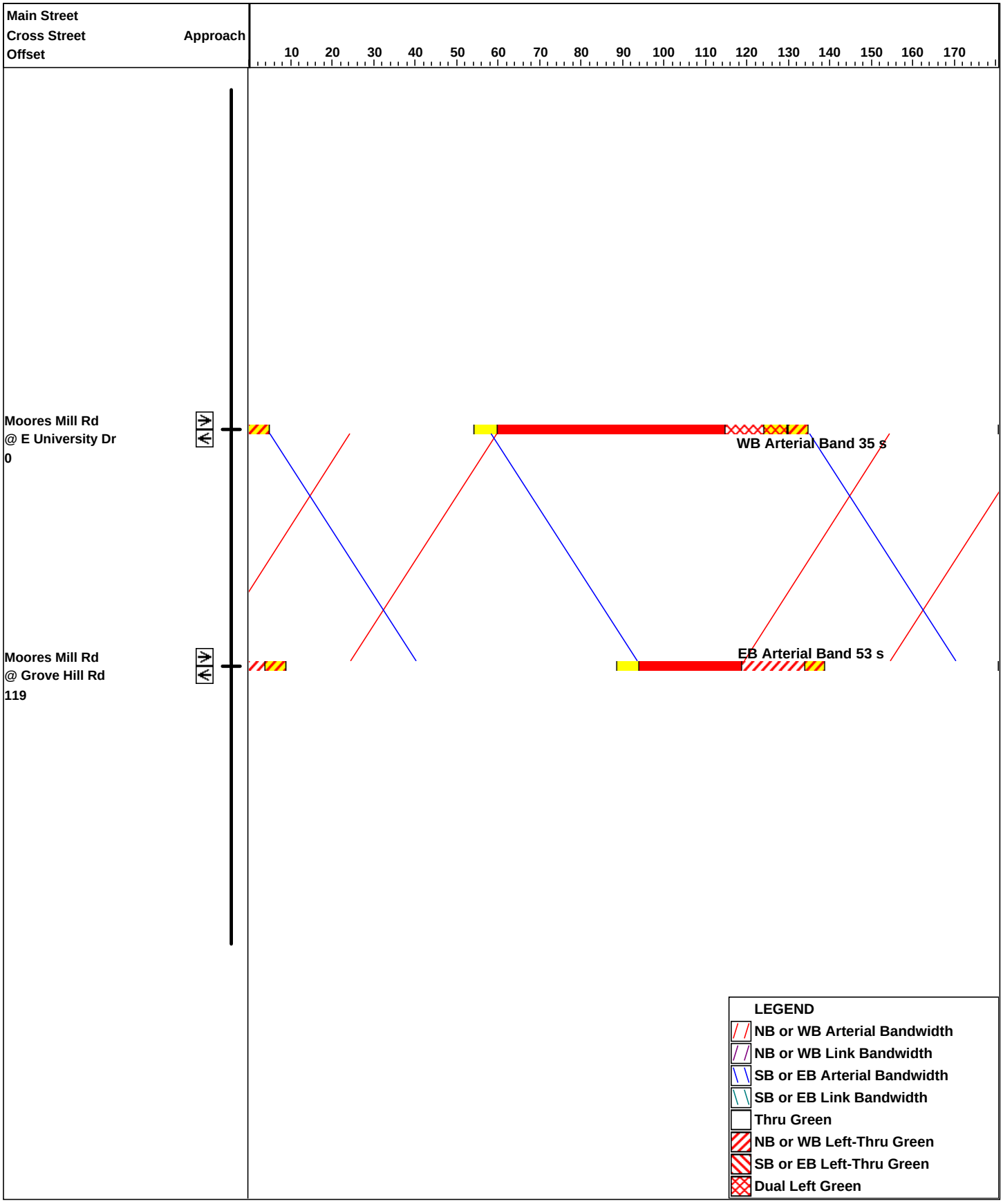
Moores Mill Road Midday

Time-Space Diagram - Moores Mill Rd



Moores Mill Road AM

Time-Space Diagram - Moores Mill Rd



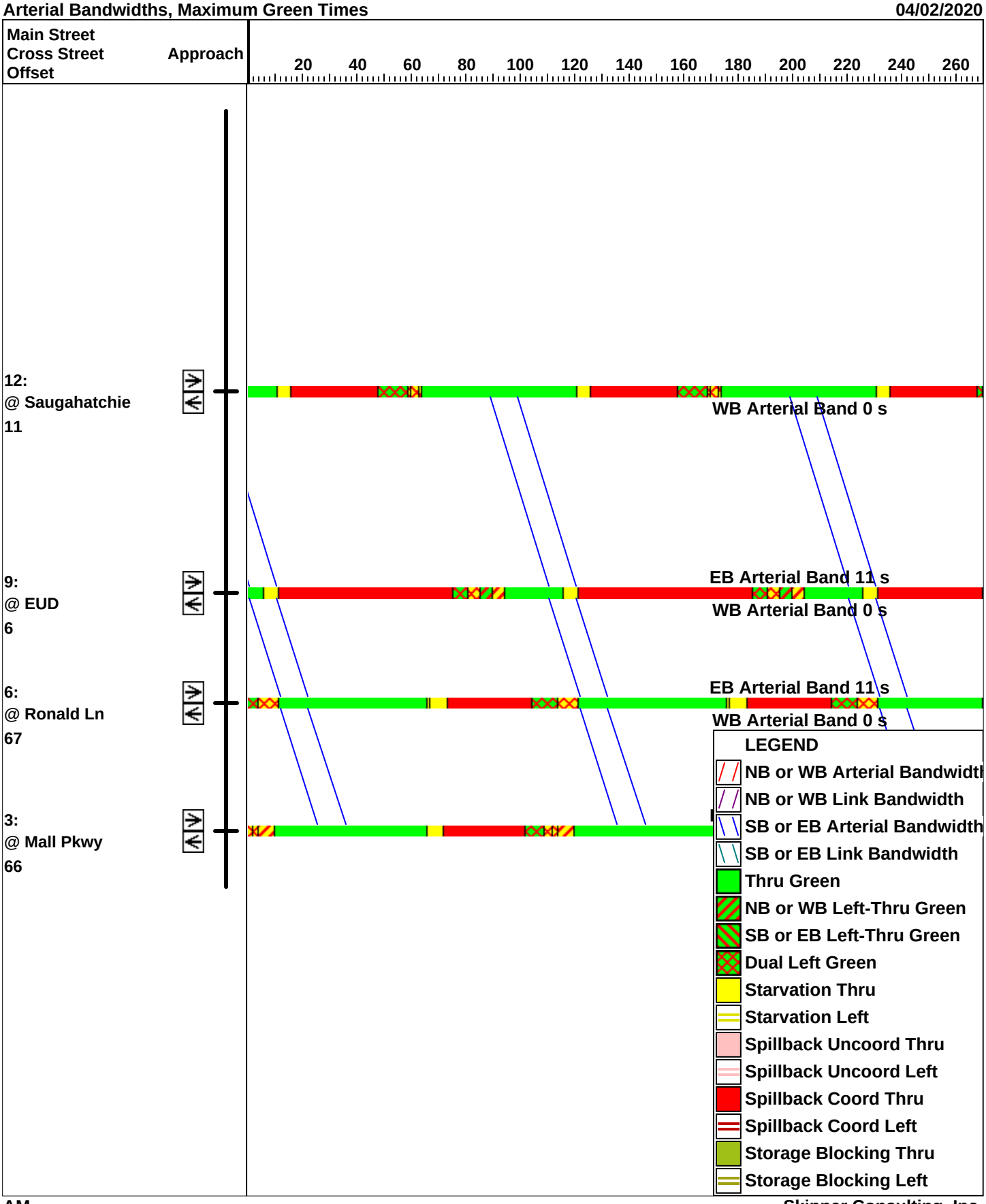
Moores Mill Road PM

Appendix G

Time-Space Diagrams and Travel Time Graphs

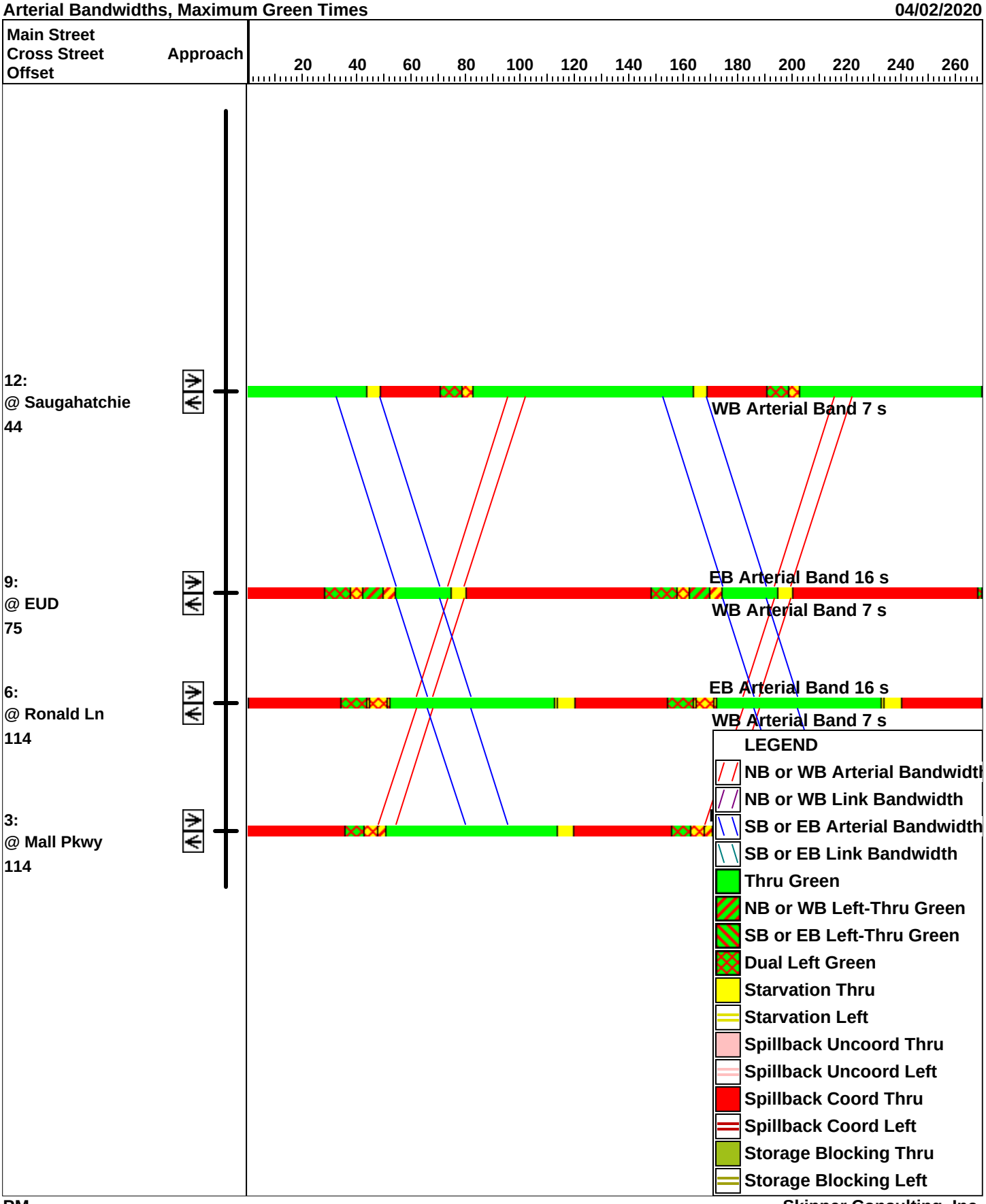
Opelika Road

Opelika Road Subsystem 1
Arterial Bandwidths, Maximum Green Times **04/02/2020**



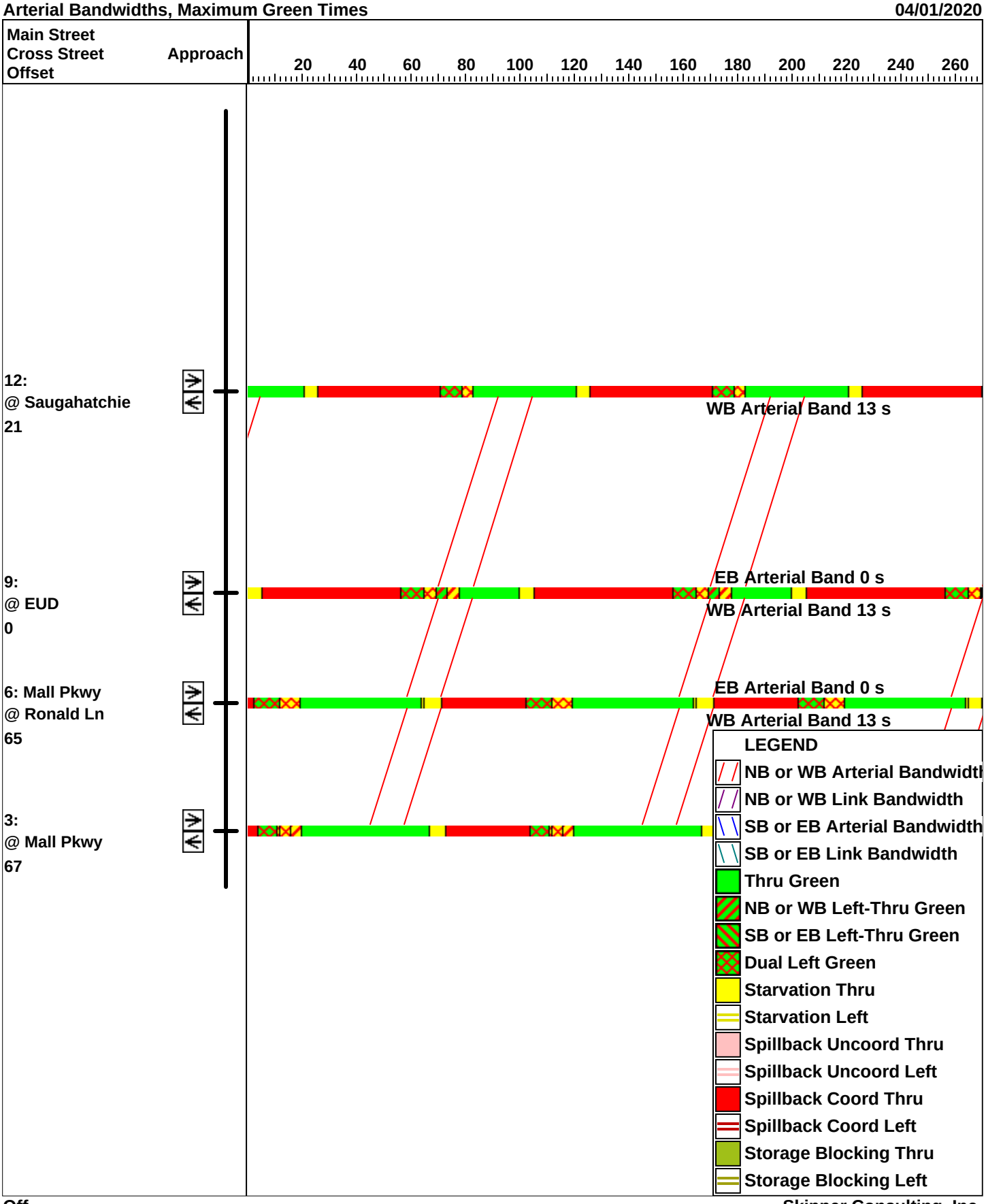
AM **Skipper Consulting, Inc.**

Opelika Road Subsystem 1
Arterial Bandwidths, Maximum Green Times **04/02/2020**



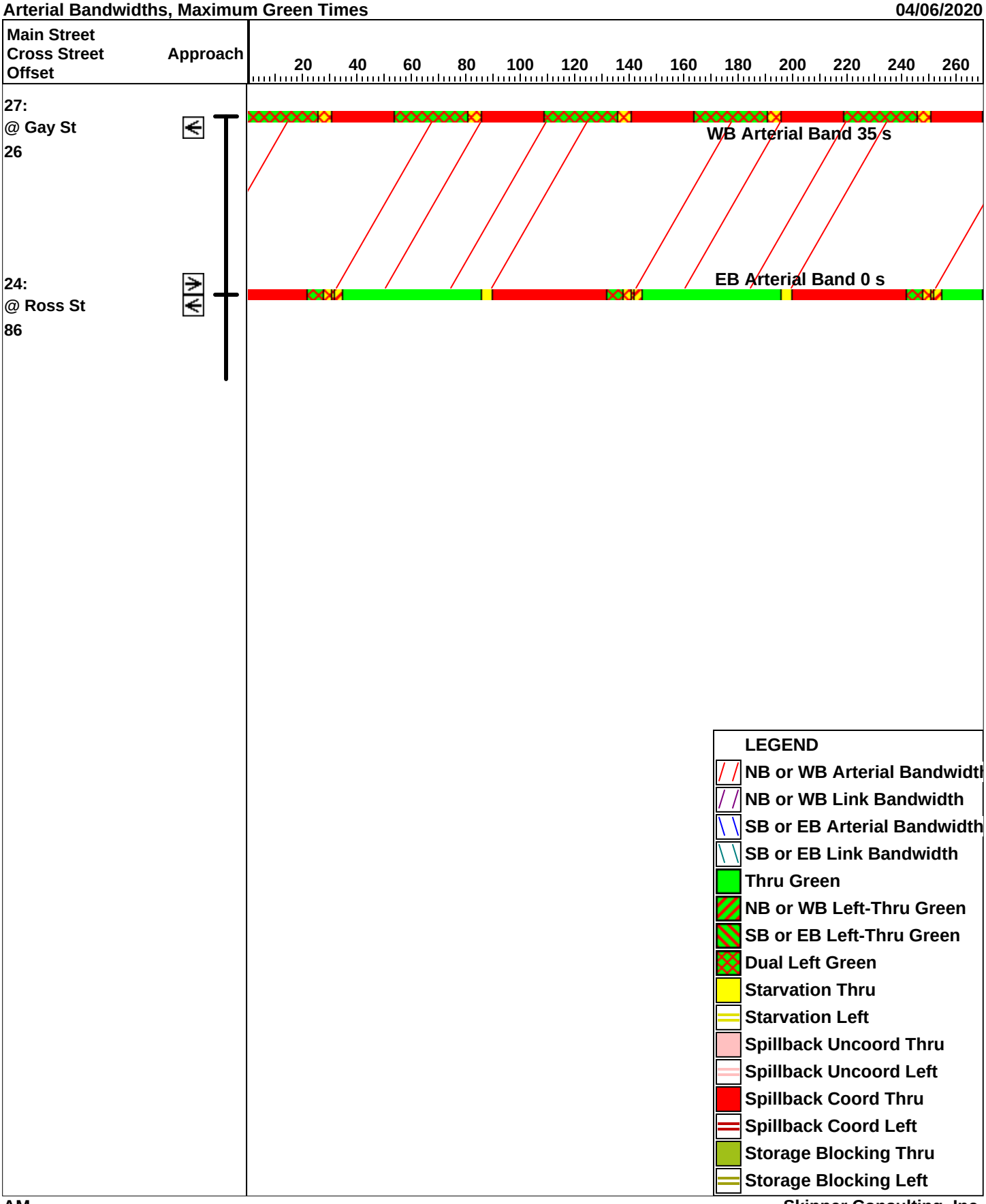
PM **Skipper Consulting, Inc.**

Opelika Road Subsystem 1
Arterial Bandwidths, Maximum Green Times **04/01/2020**



Off **Skipper Consulting, Inc.**

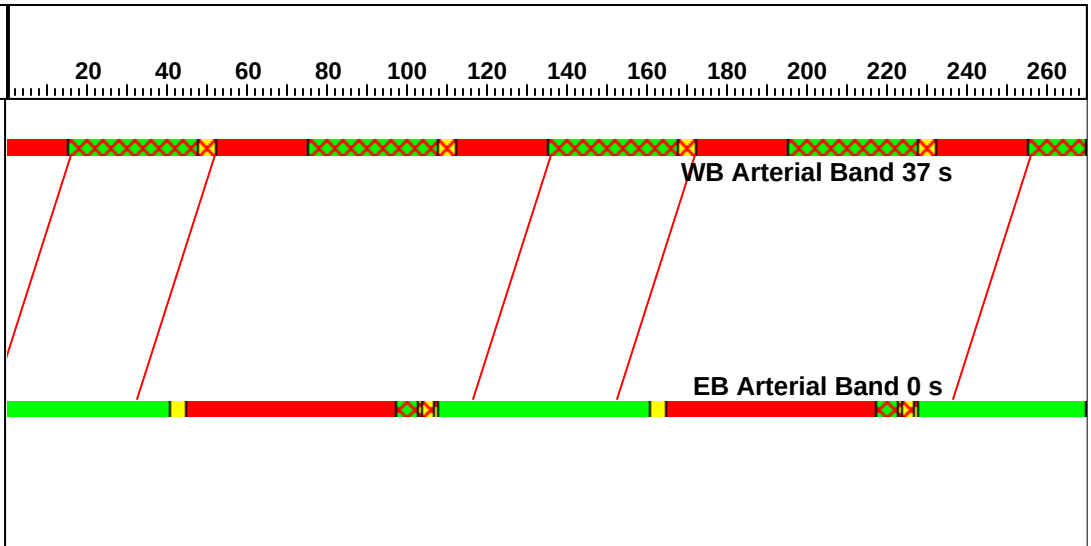
Opelika Road Subsystem 2
Arterial Bandwidths, Maximum Green Times **04/06/2020**



AM **Skipper Consulting, Inc.**

Arterial Bandwidths, Maximum Green Times 04/06/2020

Main Street Cross Street Offset	Approach
27: @ Gay St 48	
24: @ Ross St 41	

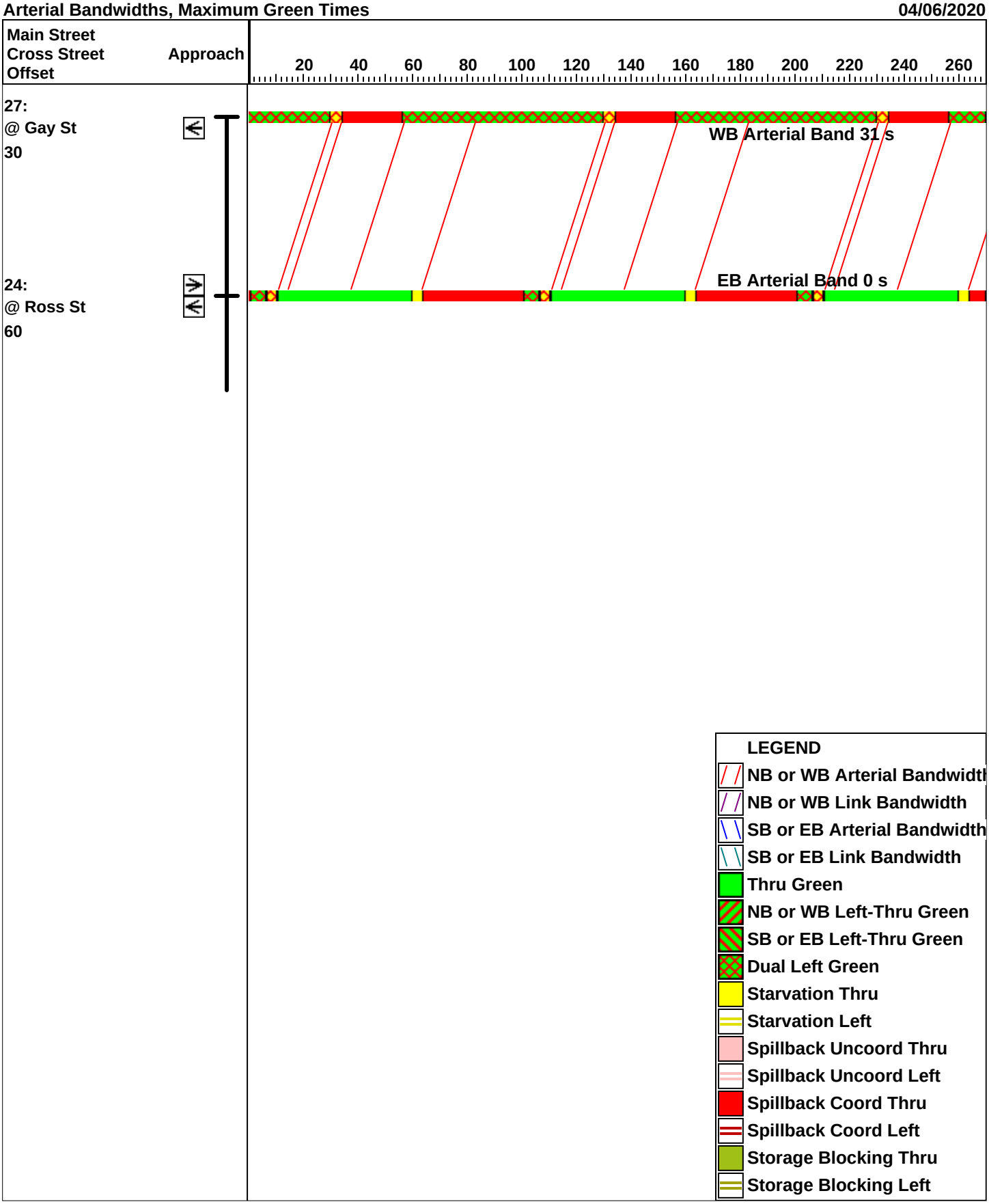


LEGEND
- NB or WB Arterial Bandwidth
- NB or WB Link Bandwidth
- SB or EB Arterial Bandwidth
- SB or EB Link Bandwidth
- Thru Green
- NB or WB Left-Thru Green
- SB or EB Left-Thru Green
- Dual Left Green
- Starvation Thru
- Starvation Left
- Spillback Uncoord Thru
- Spillback Uncoord Left
- Spillback Coord Thru
- Spillback Coord Left
- Storage Blocking Thru
- Storage Blocking Left

Baseline

Skipper Consulting, Inc.

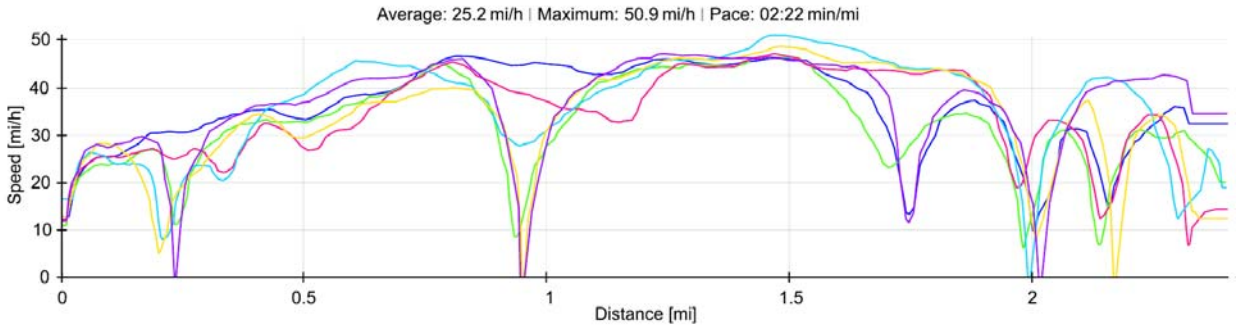
Opelika Road Subsystem 2
Arterial Bandwidths, Maximum Green Times **04/06/2020**



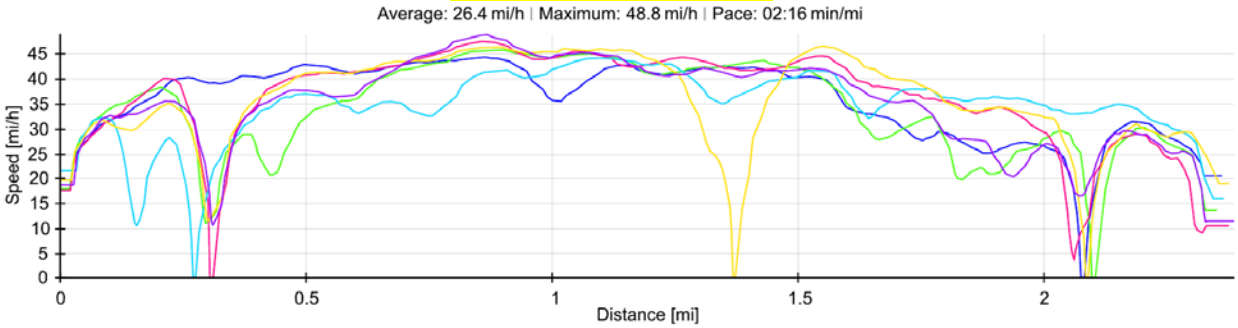
Off **Skipper Consulting, Inc.**

Opelika Road
Travel Time Graphs

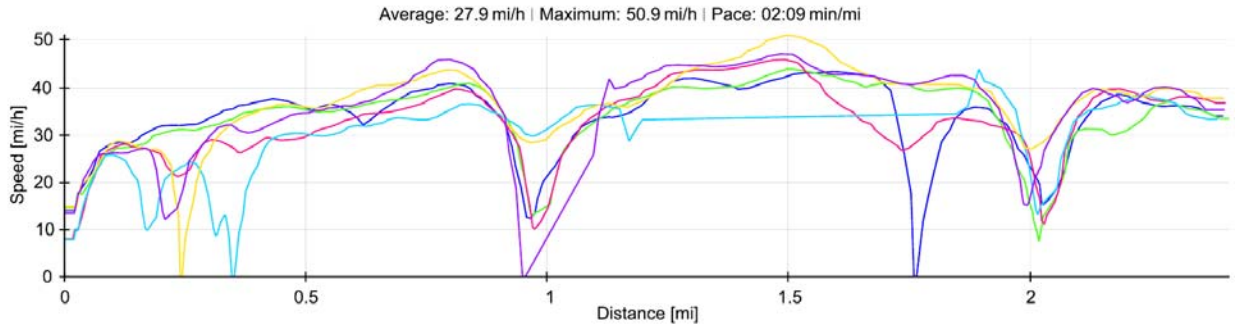
Before – AM - Eastbound



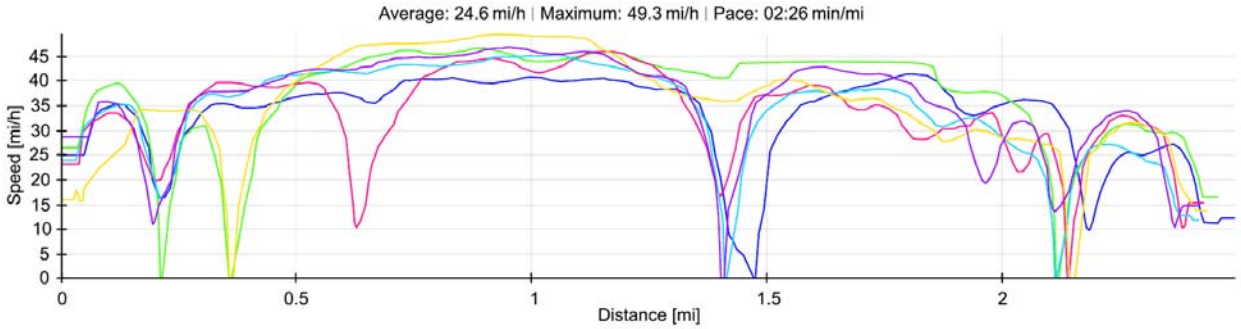
Before – AM – Westbound



After – AM – Eastbound

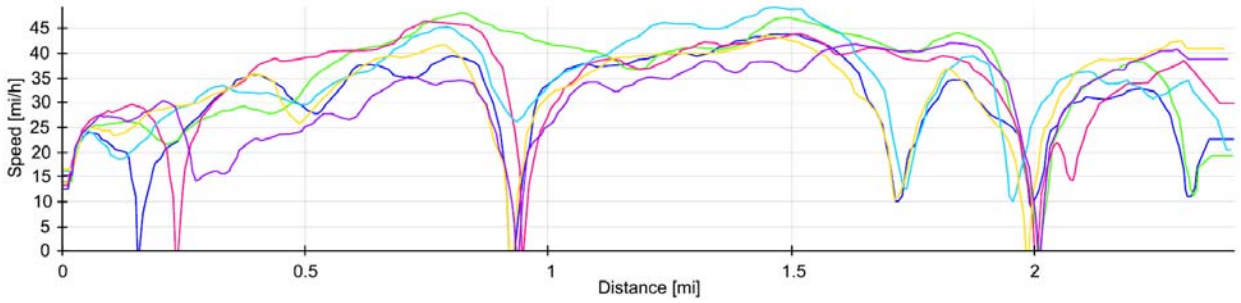


After – AM – Westbound



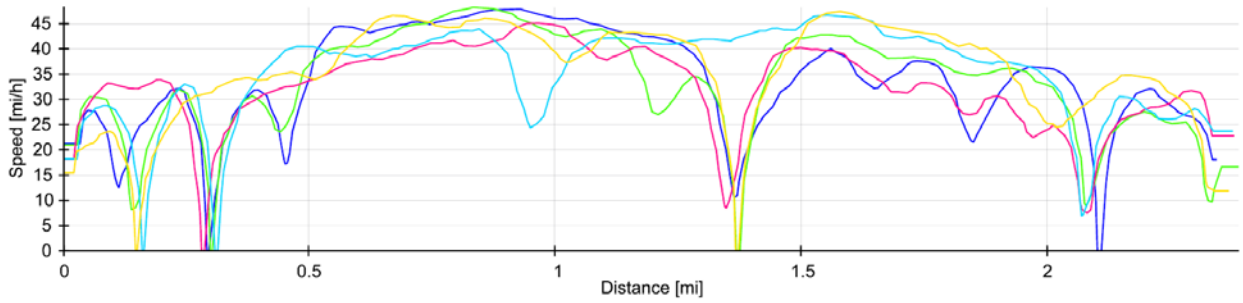
Before – Midday - Eastbound

Average: 23.5 mi/h | Maximum: 49.1 mi/h | Pace: 02:33 min/mi



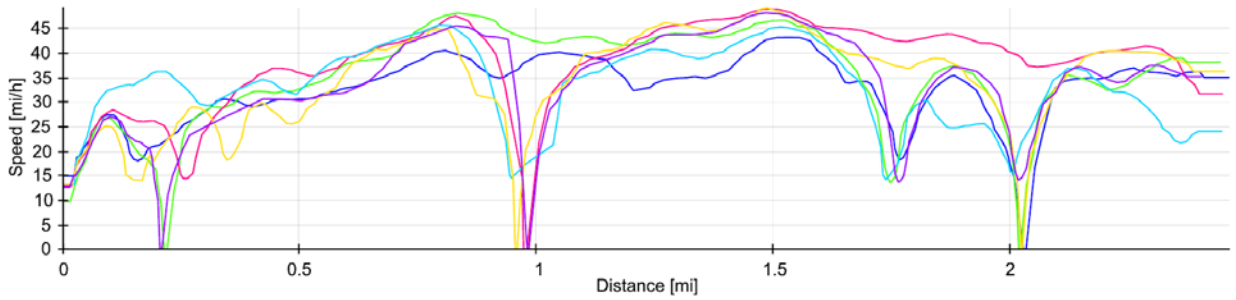
Before – Midday - Westbound

Average: 21.6 mi/h | Maximum: 48.0 mi/h | Pace: 02:46 min/mi



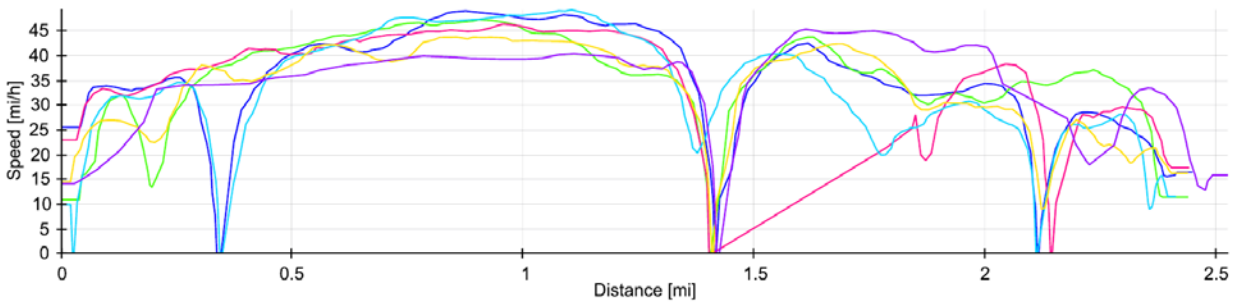
After – Midday – Eastbound

Average: 24.8 mi/h | Maximum: 49.1 mi/h | Pace: 02:25 min/mi

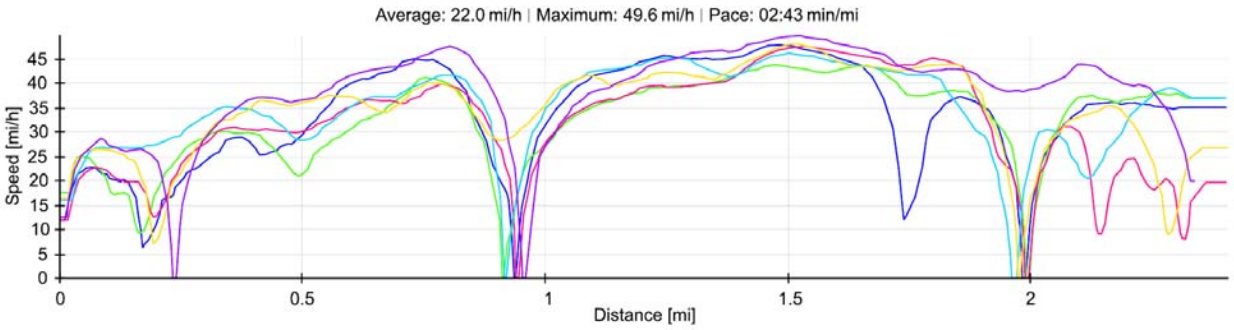


After – Midday – Westbound

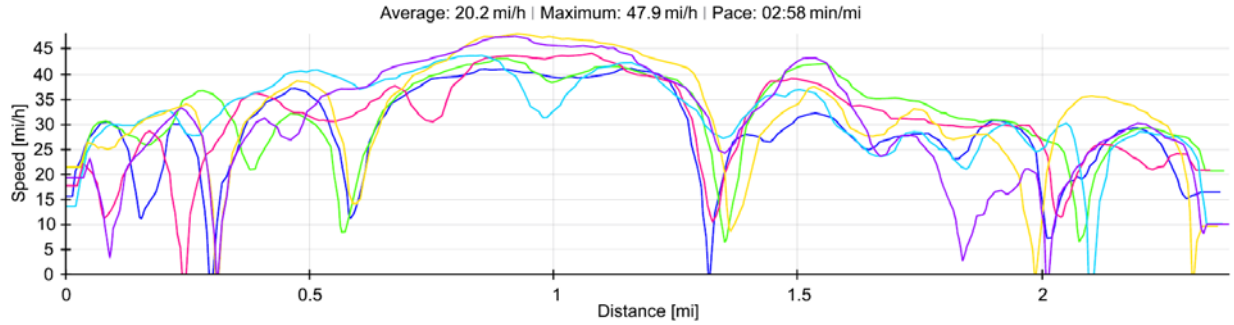
Average: 23.7 mi/h | Maximum: 49.1 mi/h | Pace: 02:31 min/mi



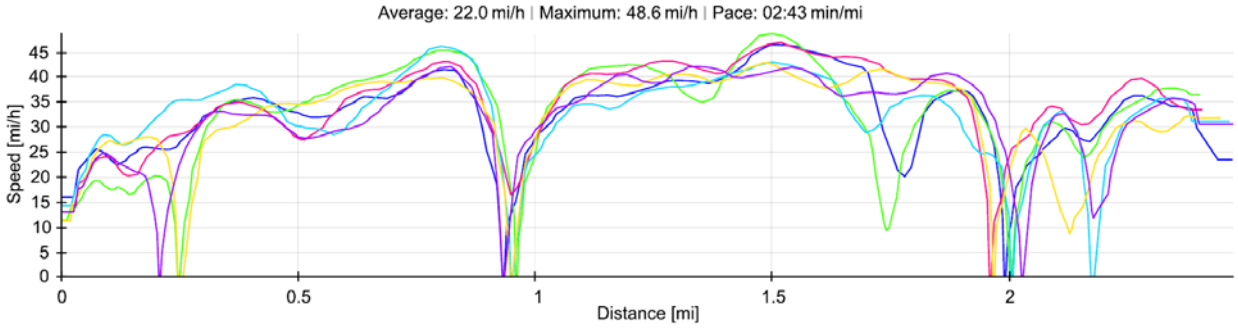
Before – PM - Eastbound



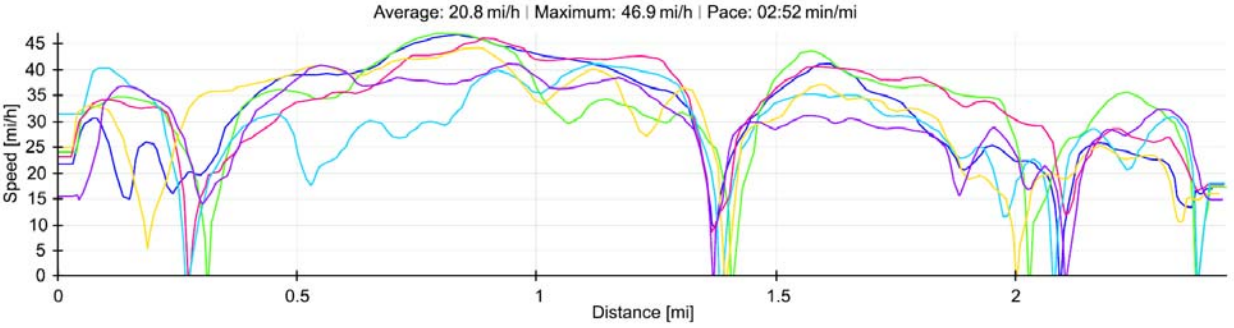
Before – PM - Westbound



After – PM – Eastbound



After – PM – Westbound



Appendix H

Time-Space Diagrams

Samford Avenue

Time-Space Diagram - Samford Ave
Arterial Bandwidths, Maximum Green Times

10/18/2019