Leveraging Cloud-based Technology for Optimizing Signal Timing & Real-Time Adaptive Control

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The Importance of Measurement

- How well is the signal operating?
  - ✓ How do you know?
- Historically we've lacked rich data
  - ✓ Volume and Occupancy
  - ✓ Floating car studies
- Good data was expensive and time consuming to obtain
- Limited tools for analysis to turn that data into useable information
- Lack of tools to pinpoint sources of problems

Role of SPM

Traffic Adaptive

Traffic Responsive

Coordinated

Fully Actuated

Semi Actuated

Fixed Time

SPM Analytics

“SPMs can be used to manage and optimize all modes of operation, can outperform adaptive control, and is much cheaper and simpler.”

Mark Taylor, UDOT

Detection Requirements

No Detection

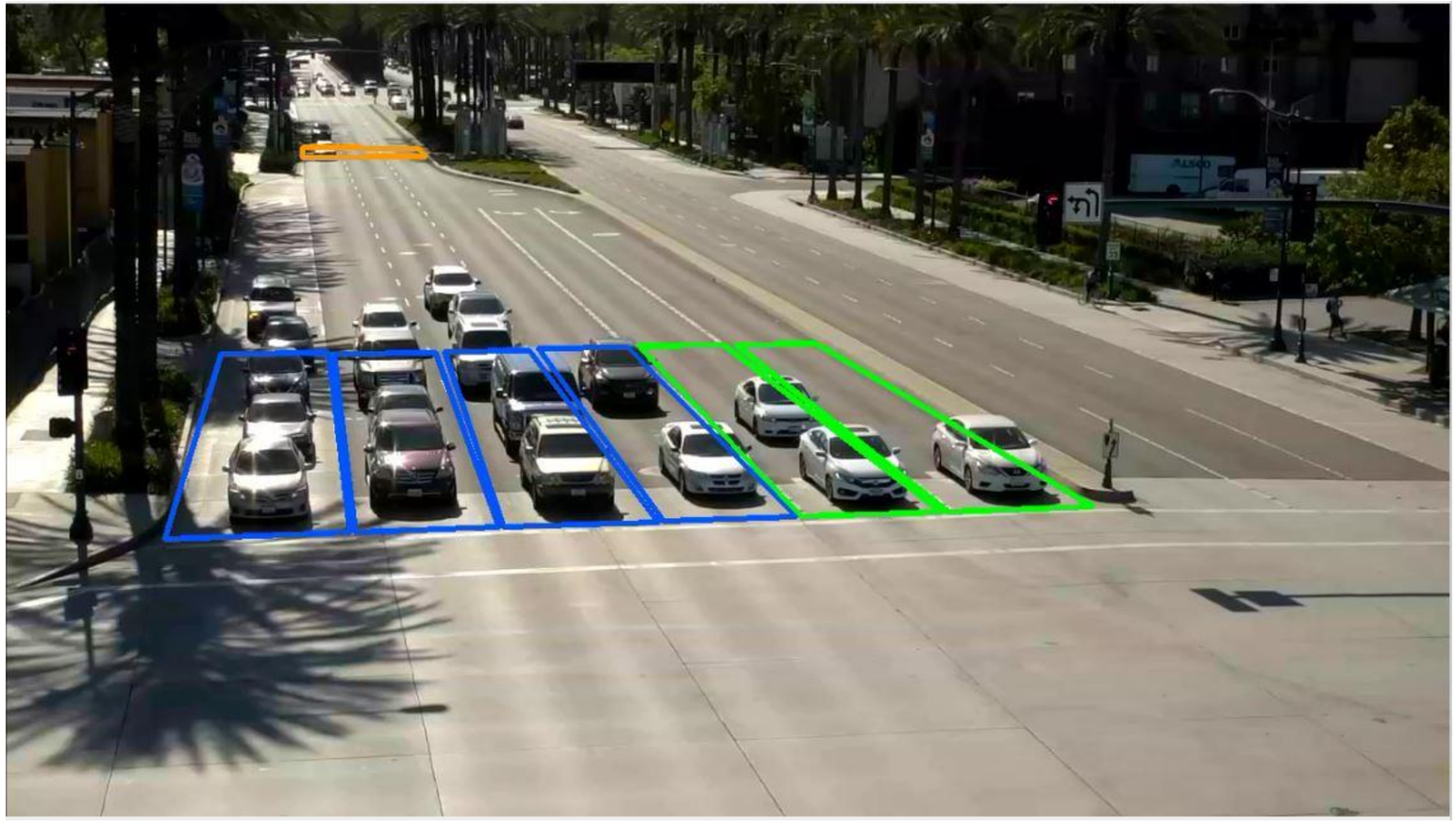
- Cycle Length
- Green Times
- Percent Ped Calls
- Split Monitor
- Phase Terminations

Stop Bar

- ROR/GOR
- Split Failures

Advanced

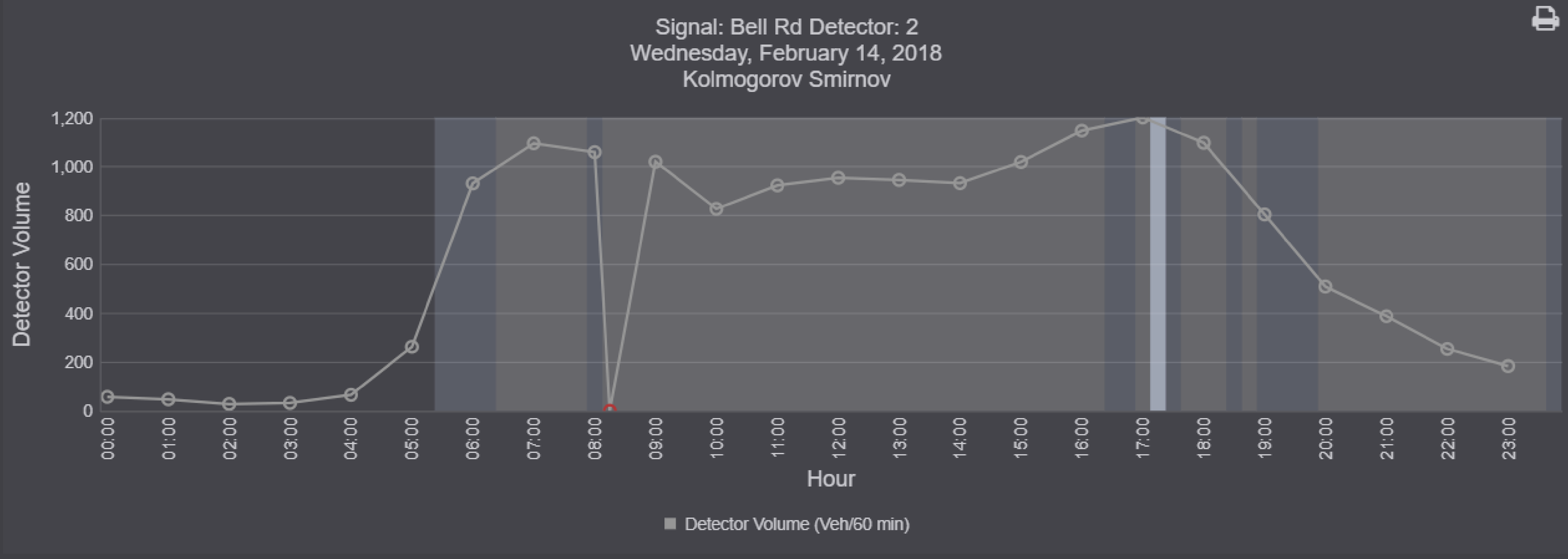
- Purdue Coordination Diagram
- Arrivals on Green
- Flow Rates
- Approach Delay
- Volume/Capacity



Charts

Kolmogorov Smirnov | Standard Deviation

Date	Detector	Name	P-Value
2/14/2018 8:25:03 AM	2		0



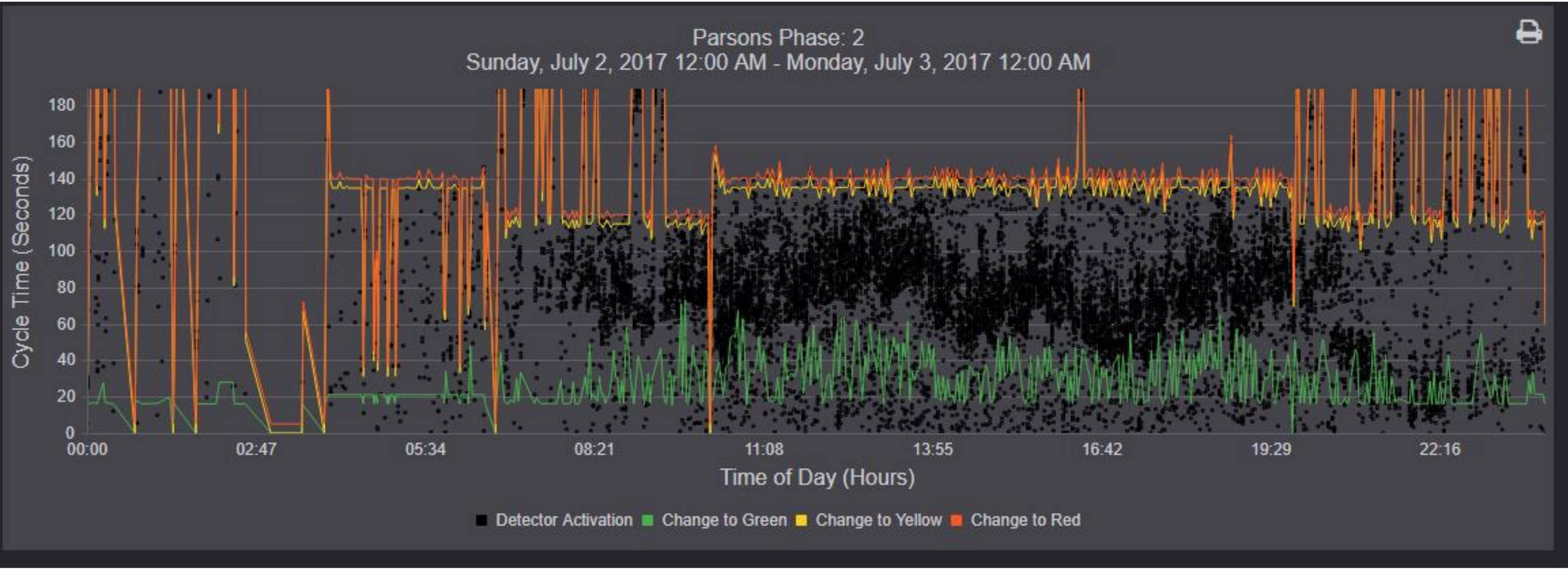
Controller Compatibility

- Econolite Cobalt: Any Version
- Econolite ASC/3 NEMA, v. 2.50+ and OS 1.14.03+
- Econolite 2070 with 1C CPU Module V. 32.50+

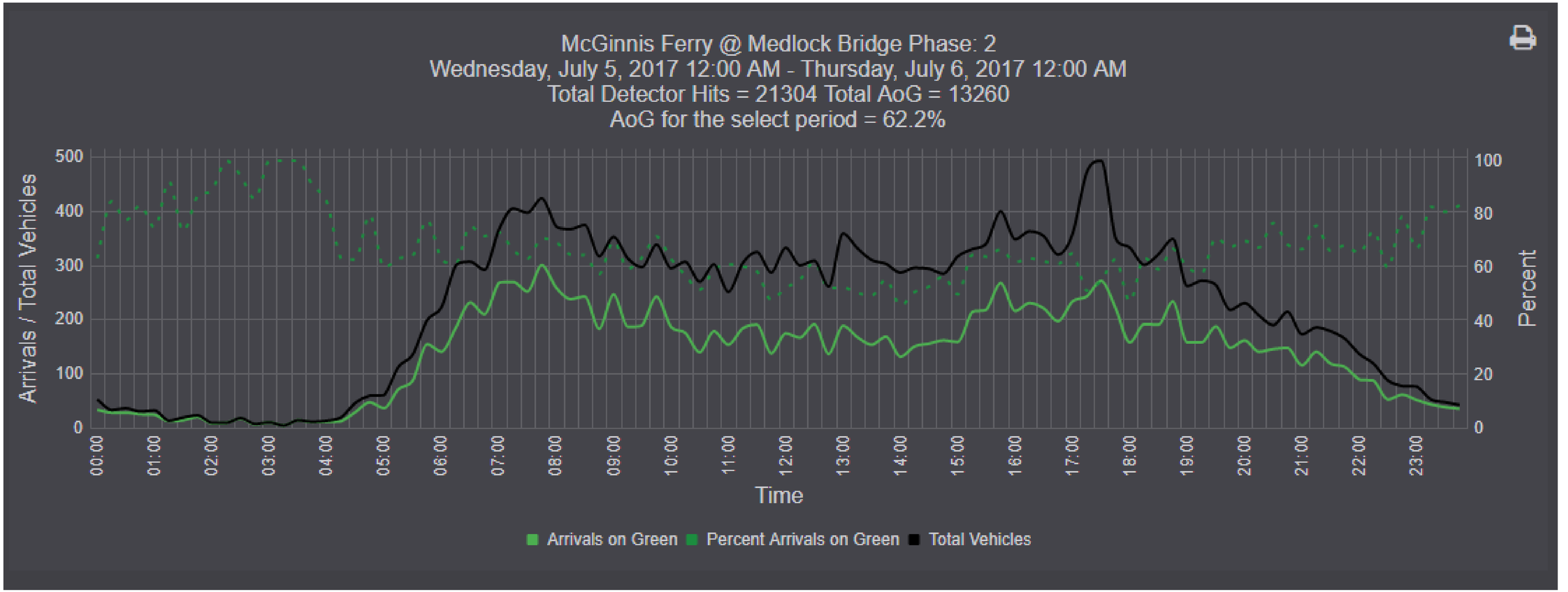
Possible with vendor provided translation utility:

- Intelight Maxtime ver. 1.7.0+
- Peek ATC Greenwave ver. 03.05.0528+
- Trafficware 980ATC ver. 76.10+
- Siemens M50 Linux and M60 ATC
  - ECOM Ver. 3.52+
  - NTCIP Ver. 4.53+
- McCain ATX Omni eX 1.6+
- D4 ver. L-20+

Purdue Coordination Diagram



Arrivals on Green

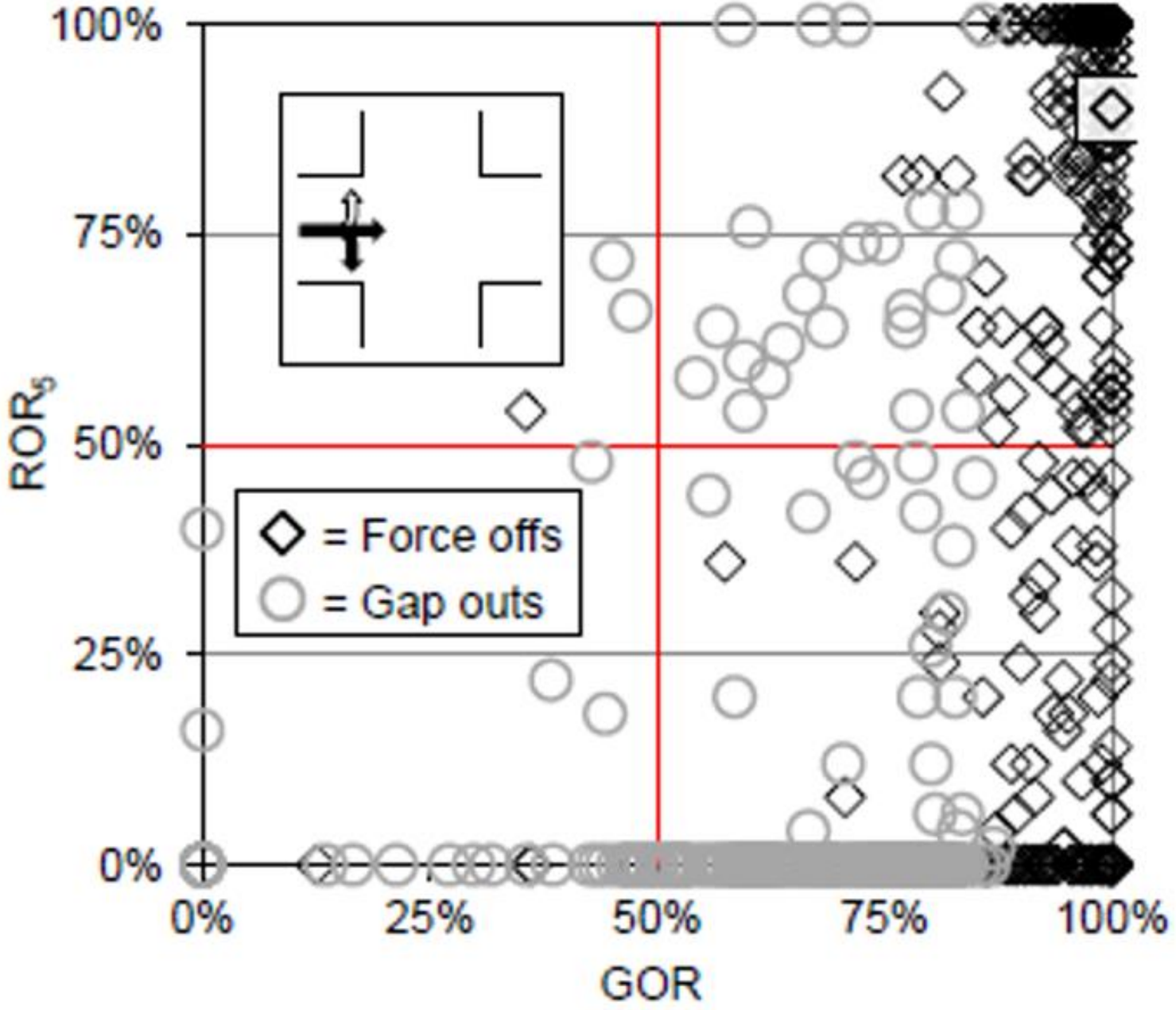


Select Date Ranges - Yesterday / (5/31/2017 to 6/28/2017)

Select signal...

Select Columns

Corridor		Arrivals on Green (avg/day)	Delay (secs/veh)	Delay (secs/hour)	Flow Rate	Volume (avg/day)	Ped Delay (avg/day)	Ped Delay (secs/actuation)	Ped Actuations (avg#/day)	Ped Transitions (avg#/day)	Percent Peds (avg%)	Total Ped Cycles (avg#/day)	Preempts (avg#/day)	Preer Durat (av secs/c
Default Corridor	Range 1	-	-	-	-	-	-	-	-	-	-	-	-	
	Range 2	-	-	-	-	-	-	-	-	-	-	-	-	
McGinnis Ferry	Range 1	111597.0	2.1	15184.5	154.6	175781.0	3906.1	56.6	69.0	18.0	1.4	33.0	-	
	Range 2	77443.4	3.5	19564.9	122.3	134744.0	2496.7	62.7	39.8	21.6	0.5	19.2	-	
Old Alabama Rd	Range 1	87747.0	4.0	23864.5	62.8	143554.0	5840.3	47.9	122.0	56.0	0.7	106.0	2.0	8
	Range 2	114591.8	3.7	28793.2	75.6	187547.4	7261.4	45.3	160.4	83.6	1.6	135.6	7.2	20
Medlock Bridge Road	Range 1	198411.0	2.0	27630.0	102.8	339997.0	16485.8	54.1	305.0	164.0	0.6	58.0	6.0	28
	Range 2	162272.8	2.5	32195.2	106.3	304173.0	18438.1	62.4	295.4	213.6	0.6	61.8	7.6	30


100%
75%
50%
25%
0%
ROR5
= Force offs
= Gap outs
0%
25%
50%
75%
100%
GOR

Optimizations

Corridor Details

Pattern Optimizer

						Average Delay		
Corridor	Enabled	Latest Run	Analysis Period	Latest Action	Green Time / Direction	Initial	Predicted	Outcome
Jones Bridge Road	No	--	--	⊘				
McGinnis Ferry	No	May 06, 2018 09:00 PM	Apr 29, 2018 - May 05, 2018	⊘				
Medlock Bridge Optimization	No	Jun 12, 2018 11:47 AM	Jun 11, 2018 - Jun 12, 2018	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:20 0:00:13	0:00:15 ↓25% 0:00:12 ↓8%	-- --
Medlock Bridge Optimization South	Yes	Sep 15, 2019 09:00 PM	Sep 08, 2019 - Sep 14, 2019	Sep 15, 2019 09:00 PM				
Medlock Bridge Road	No	May 06, 2018 09:00 PM	Apr 29, 2018 - May 05, 2018	⊘				
Old Alabama Rd	No	May 06, 2018 09:00 PM	Apr 29, 2018 - May 05, 2018	⊘				
Single Intersection Test	No	--	--	⊘				

Pattern Optimizer - Medlock Bridge Optimization

Optimization > Plans > Jun 12, 2018 11:47 AM

Plan Generated On: Jun 12, 2018 11:47 AM

Analysis Period: Jun 11, 2018 - Jun 12, 2018

Configured: O, C, S View Details

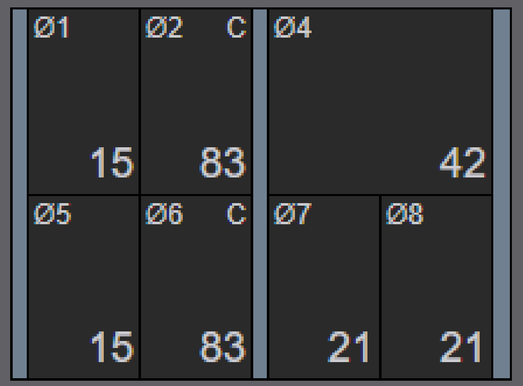
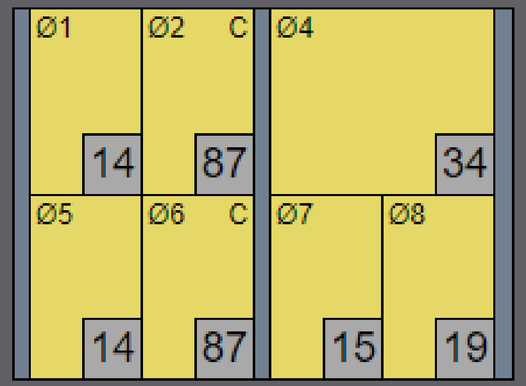
All Patterns

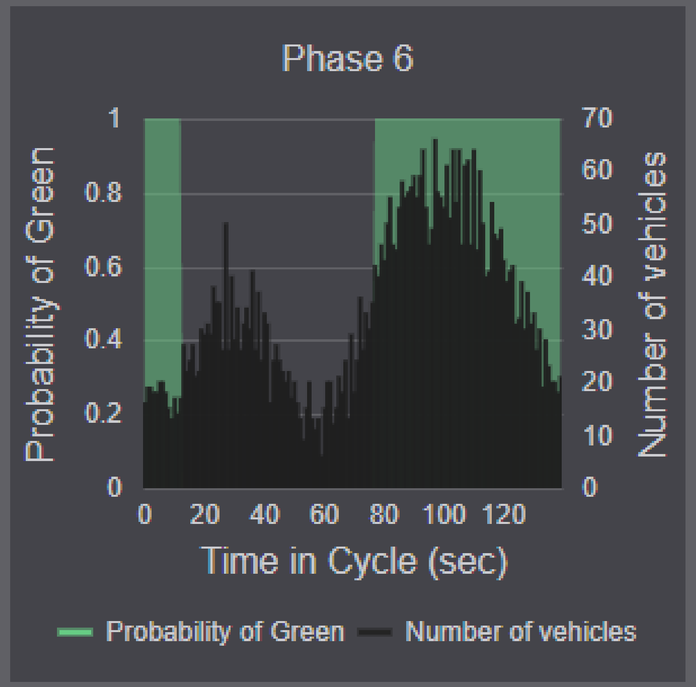
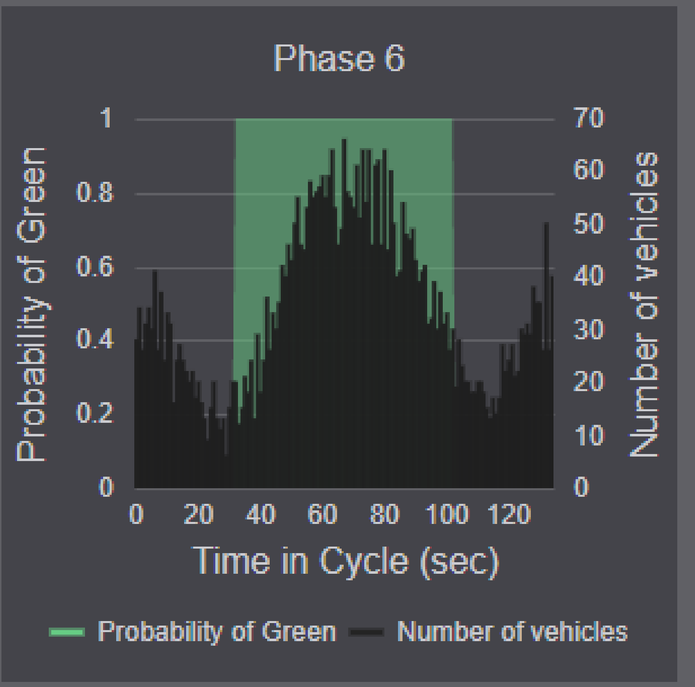
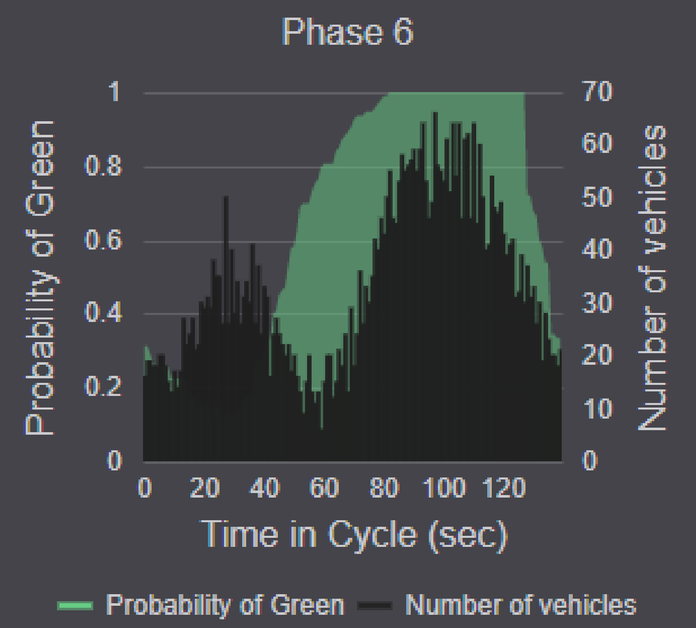
			Average Delay	
Pattern	**Latest Action**	**Green Time / Direction**	**Initial**	**Predicted**
Pattern 22	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:11 0:00:10	0:00:11 0% 0:00:06 ↓ 40%
Pattern 25	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:14 0:00:15	0:00:12 ↓ 14% 0:00:13 ↓ 13%
Pattern 27	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:24 0:00:09	0:00:17 ↓ 29% 0:00:08 ↓ 11%
Pattern 28	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:47 0:00:25	0:00:19 ↓ 60% 0:00:36 ↑ 44%
Pattern 29	Jun 12, 2018 11:47 AM	Programmed / Southbound Programmed / Northbound	0:00:26 0:00:14	0:00:21 ↓ 19% 0:00:18 ↑ 29%

Signal Details

Average Delay

Green Time / Direction	Initial	Predicted
Wilson Rd Pattern: 25		
Programmed /	--	--
Programmed /	0:00:17	0:00:14 ↓18%
Actual /	--	--
Actual /	0:00:01	--

Setting	Initial	Recommended
Offset	77	32
Cycle Length	140	135
Sequence/Splits		

Programmed Green Time		
Actual Green Time		--

Edaptive!

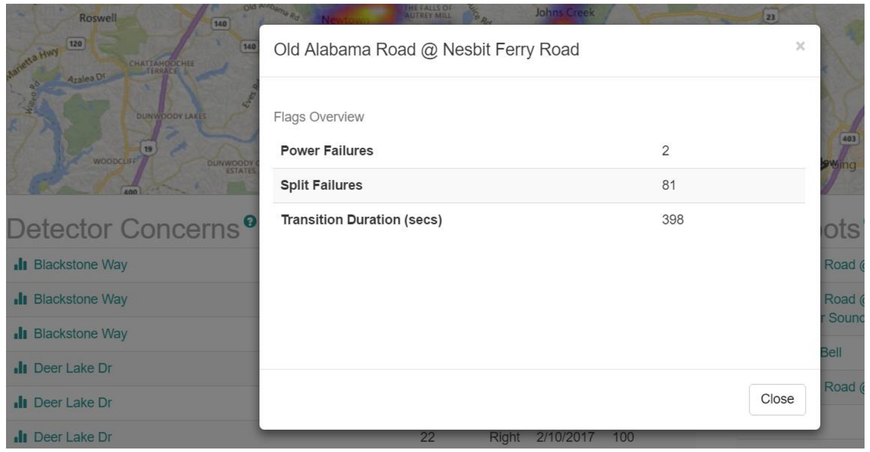
- Can we optimize cycle by cycle? YES!
- Requirements: Network; Detection; Hi-res controller
- Release real-time control to SPM system…
- …but, retain understanding of how system trying to operate

Evolution of Optimization

Reactive

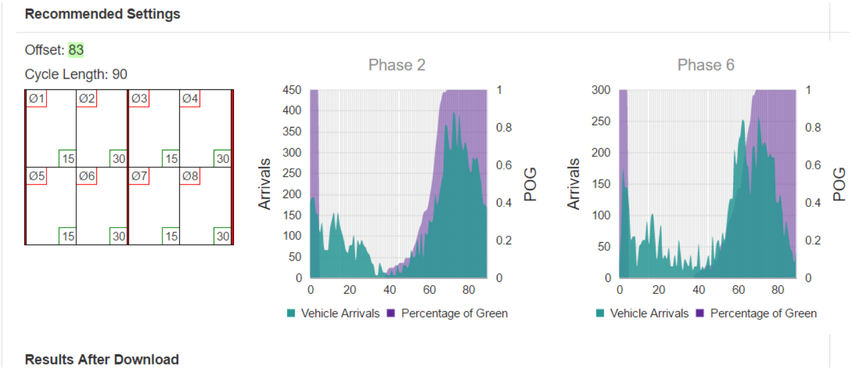
“I had to wait 5 minutes for the light to change!”

Proactive



There are abnormally high spilt failures at Old Alabama and Nesbit Ferry road

Automated Recommendations



Update phase 2&6 split times to 22 seconds and 4&8 to 15 seconds to reduce split failures

Key Takeaways

- Don’t invest in any controller that is not hi-res capable!
- SPM = Hi-resolution Controller Data
- SPM optimizations → Different than traditional adaptive
- Edaptive: SPM technology; optimizes; arterial

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