MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

ITEM # 2

Smart Signals

SPOTS/Traffic Signals Subcommittee

December 7, 2017

Smart Signals

- **$50 Million for Smart Signals**
  - Adaptive Signal Control
  - Enhanced detection
  - Upgraded Communications
  - ATMS
  - Performance Monitoring

WBAL NEWSRADIO 1090

NOW STREAMING
WBAL News Now with Bryan Nehman

Home Shows News Weather Traffic Sports Ravens Orioles

Hogan Announces $50M To Deploy Smart Traffic Signals

Print

Wednesday, October 25 2017
Associated Press

Maryland is getting smarter traffic signals.

Gov. Larry Hogan announced Wednesday a $50 million plan to deploy a system that uses real-time traffic conditions and computer software to adjust the timing of traffic signals.

The Hogan administration says it will ease congestion for about 700,000 drivers a day on 14 major corridors. Three of them are in Anne Arundel County, two are in Baltimore County and three are in Charles County. Harford and Prince George's counties will each get smart signals in two corridors. Howard and Montgomery counties will get signals in one corridor each.

The governor says it's the second phase of his traffic-relief plan. Last month, he announced a $9 billion plan to add four lanes to I-270, I-495 and the Baltimore-Washington Parkway.

MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Outline

- Current and Upcoming Adaptive Deployments
- Design and Equipment
- Programming and Activation
- Before/After Studies
- Future

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Adaptive Deployments

US 1/MD 175 Jessup

- Fall 2015
- 15 signals
- Centracs Adaptive

MD 24/US 1 Bus Bel Air

- Spring 2016
- 13 Signals
- Centracs Adaptive

MD 2 Brooklyn Park

- Spring 2017
- 4 Signals
- SynchroGreen

MD 139 Towson

- Summer 2017
- 3 signals
- Centracs Adaptive

US 301 Bowie

- Summer 2017
- 4 Signals
- Centracs Adaptive

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Upcoming Deployments

MD 2 Annapolis Harbor

- 4 signals

MD 3 Crofton

- 10 Signals

US 40 Catonsville

- 11 signals

MD 202 Landover

- 4 signals

MD 22 Aberdeen

- 11 signals

US 301 Waldorf

- 24 signals

Target Late 2018

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Adaptive Criteria

- Volume (20 pts)
- Capacity/LOS (15 pts)
- Weekend Shopping (10 pts)
- Incident Detour (5 pts)
- Seasonal (5 pts)
- Special Events (3 pts)
- Homeland Security (3 pts)
- Pedestrians (-12 pts)

- Volume and Capacity measured
- Qualitative analysis for other criteria
- Did not consider signal infrastructure

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Design

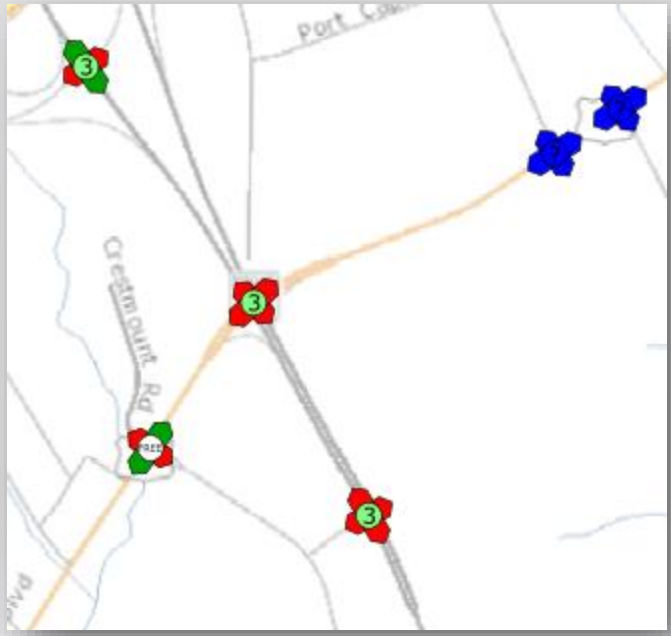
Communication

- Sprint 3G/4G cellular
- Patton ethernet switches
- Use existing twisted pair copper

ATMS

- Econolite Centracs
- Real time monitoring
- Split/cycle reports

180 signals currently upgraded



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Design

Adaptive requires good detection!

- Survey existing detection

Typical SHA Conditions:

- Video (multiple generations) for side streets and lefts
- Loops or micro-loops for mainline advance detection
- Mostly mast arm

Adaptive Requirements:

- Stopbar detection on all approaches
- Advance detection on mainline

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Design

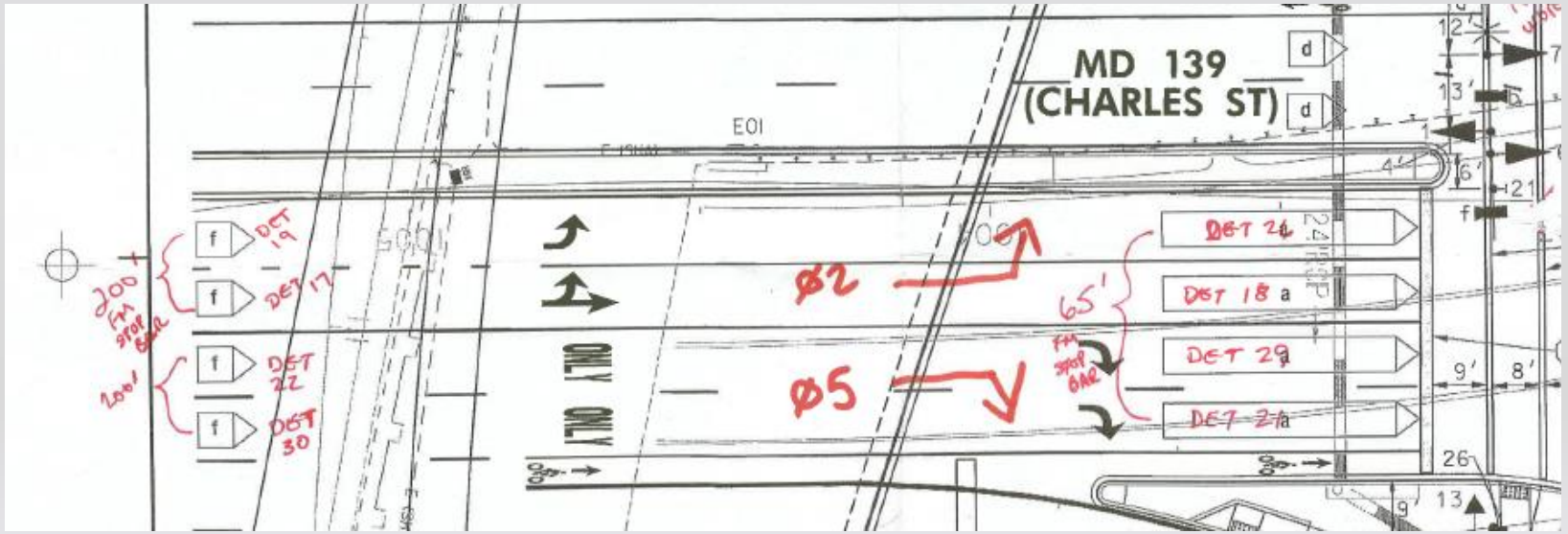
- Mast or Span?
- Can existing left turn cameras be used for mainline stopbar?
- Can cameras be added or do all need to be replaced?
- Are there sampling cameras?

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Programming

Detailed Survey of Detection Zones

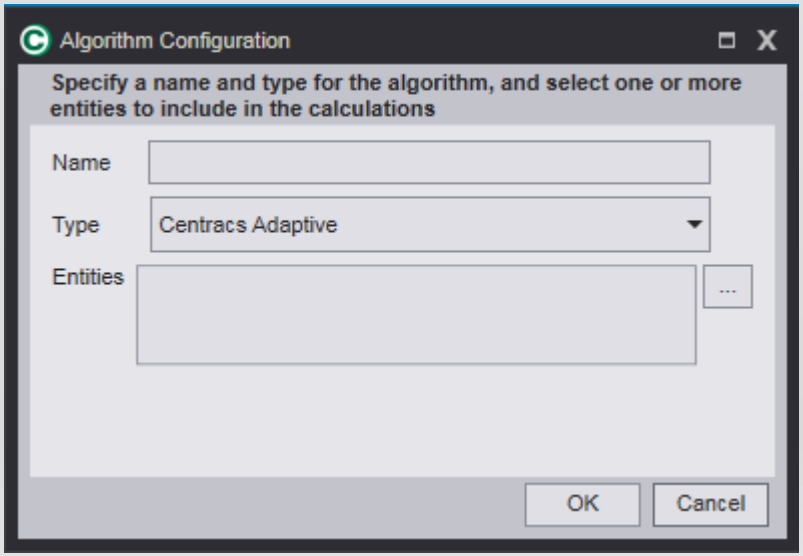
- Position and size of the zone
- Detector number, lane, phase



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Programming

1. Convert coordination patterns from percent to seconds
2. Create the algorithm

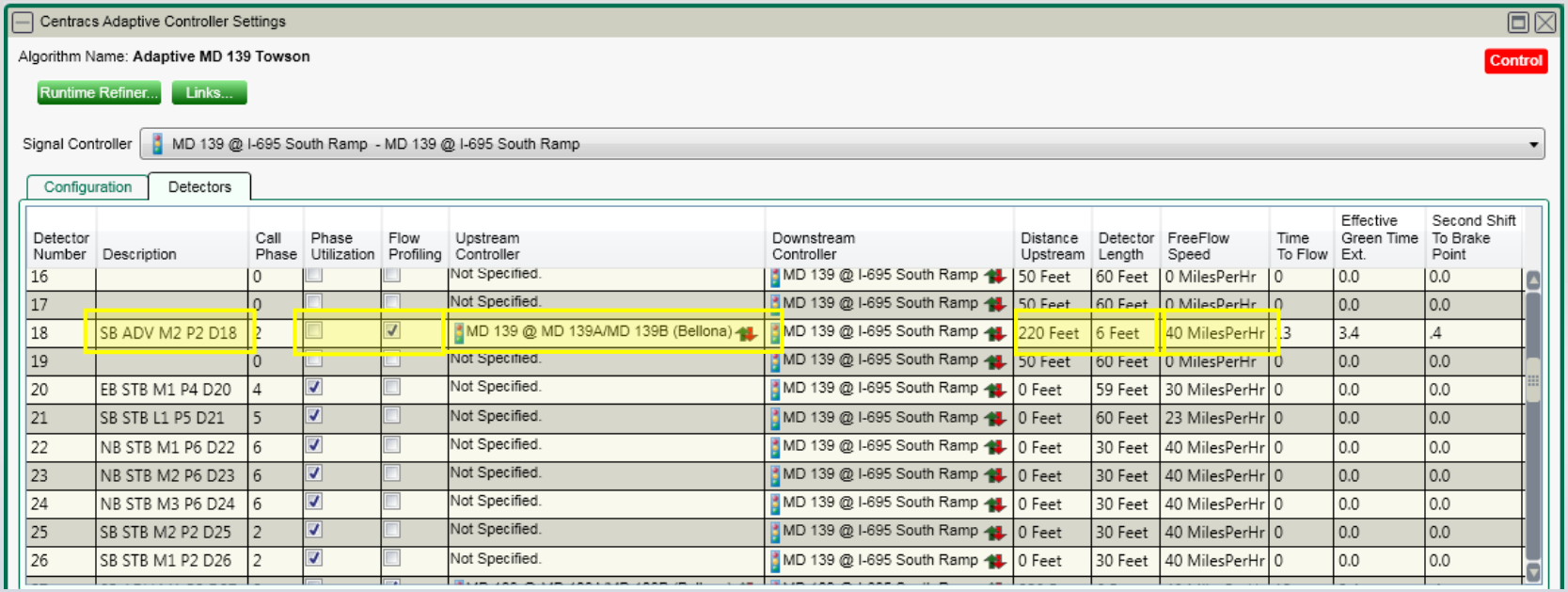


MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Programming

Program Detectors

1. Name the Detector – ex. SB ADV M2 P2 D18
2. Offset or Split
3. Select the Upstream controller
4. Size and location of Detector
5. Free Flow speed

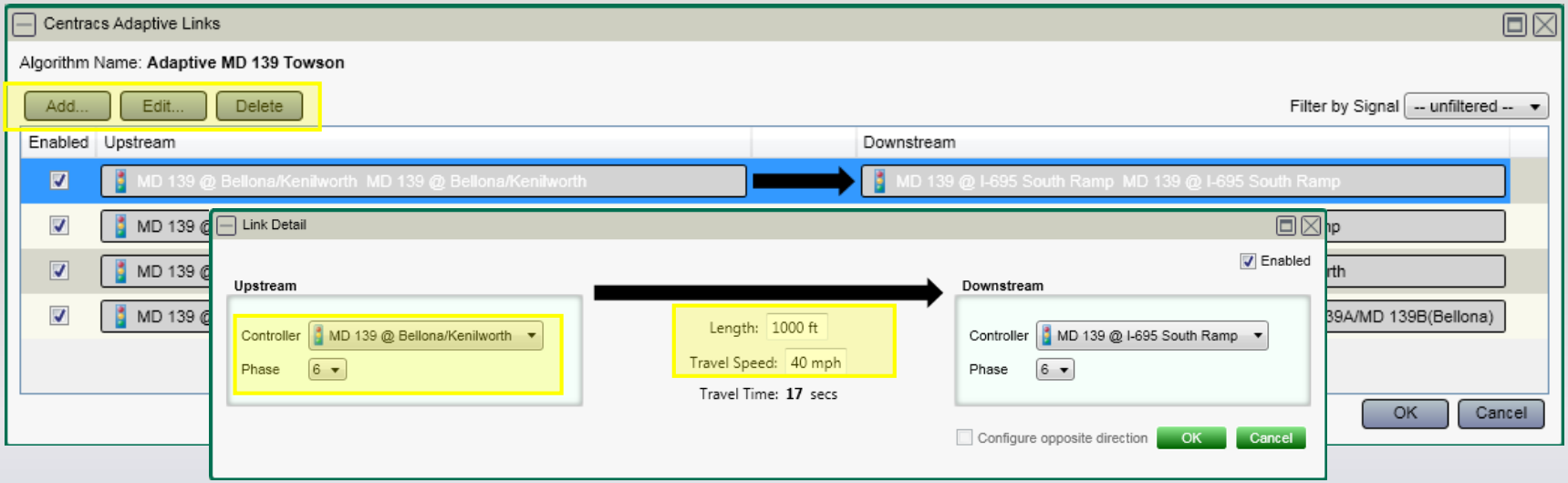


Detector Number	Description	Call Phase	Phase Utilization	Flow Profiling	Upstream Controller	Downstream Controller	Distance Upstream	Detector Length	FreeFlow Speed	Time To Flow	Effective Green Time Ext.	Second Shift To Brake Point
16		0			Not Specified.	MD 139 @ I-695 South Ramp	50 Feet	60 Feet	0 MilesPerHr	0	0.0	0.0
17		0			Not Specified.	MD 139 @ I-695 South Ramp	50 Feet	60 Feet	0 MilesPerHr	0	0.0	0.0
18	SB ADV M2 P2 D18	2		✓	MD 139 @ MD 139A/MD 139B (Bellona)	MD 139 @ I-695 South Ramp	220 Feet	6 Feet	40 MilesPerHr	3	3.4	.4
19		0			Not Specified.	MD 139 @ I-695 South Ramp	50 Feet	60 Feet	0 MilesPerHr	0	0.0	0.0
20	EB STB M1 P4 D20	4	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	59 Feet	30 MilesPerHr	0	0.0	0.0
21	SB STB L1 P5 D21	5	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	60 Feet	23 MilesPerHr	0	0.0	0.0
22	NB STB M1 P6 D22	6	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	30 Feet	40 MilesPerHr	0	0.0	0.0
23	NB STB M2 P6 D23	6	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	30 Feet	40 MilesPerHr	0	0.0	0.0
24	NB STB M3 P6 D24	6	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	30 Feet	40 MilesPerHr	0	0.0	0.0
25	SB STB M2 P2 D25	2	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	30 Feet	40 MilesPerHr	0	0.0	0.0
26	SB STB M1 P2 D26	2	✓		Not Specified.	MD 139 @ I-695 South Ramp	0 Feet	30 Feet	40 MilesPerHr	0	0.0	0.0

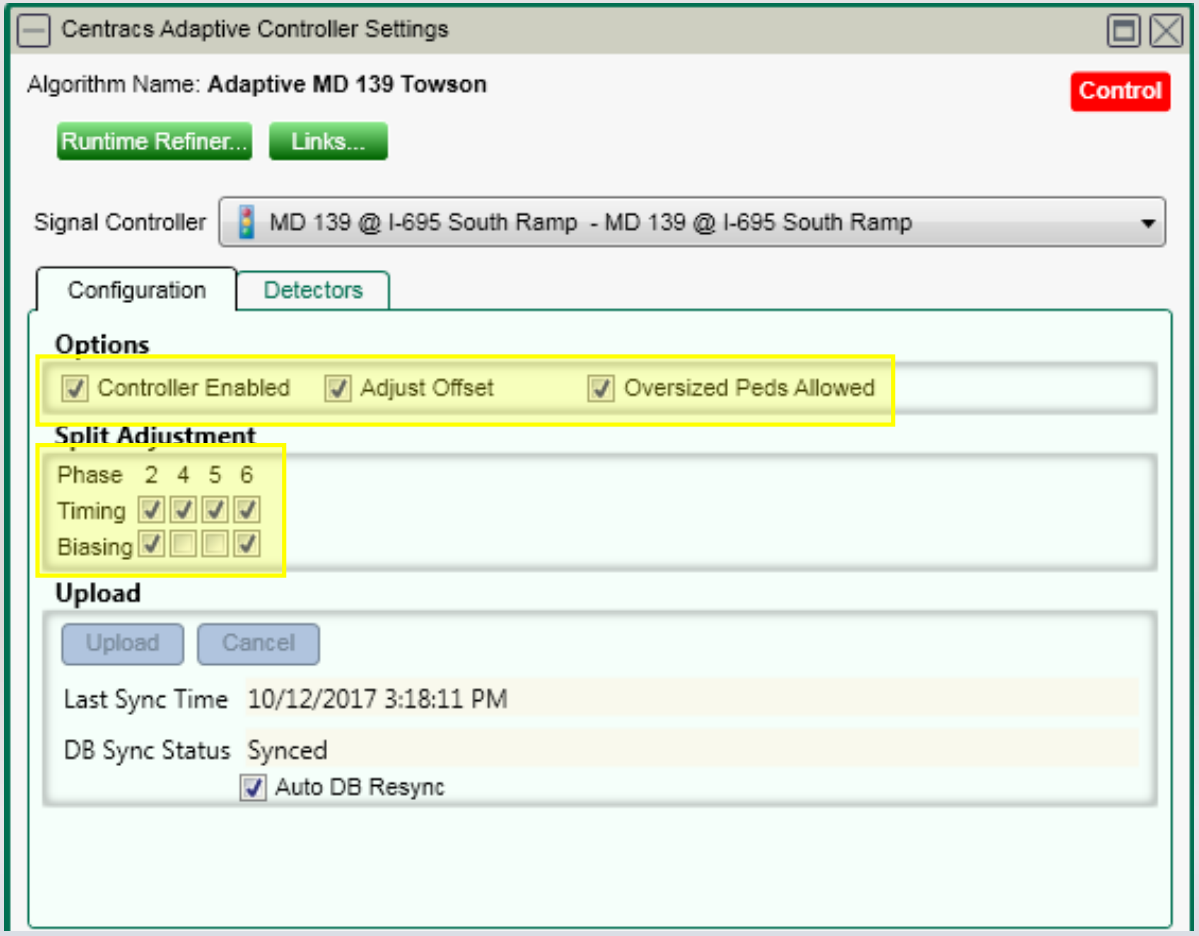
Programming

Add Links

1. Select controllers and enter associated phases
2. Enter length and speed

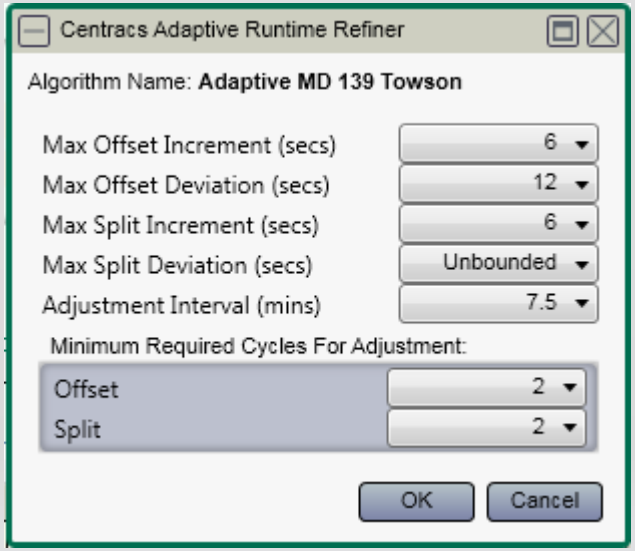


Programming – Intersection Settings



Programming – System Settings

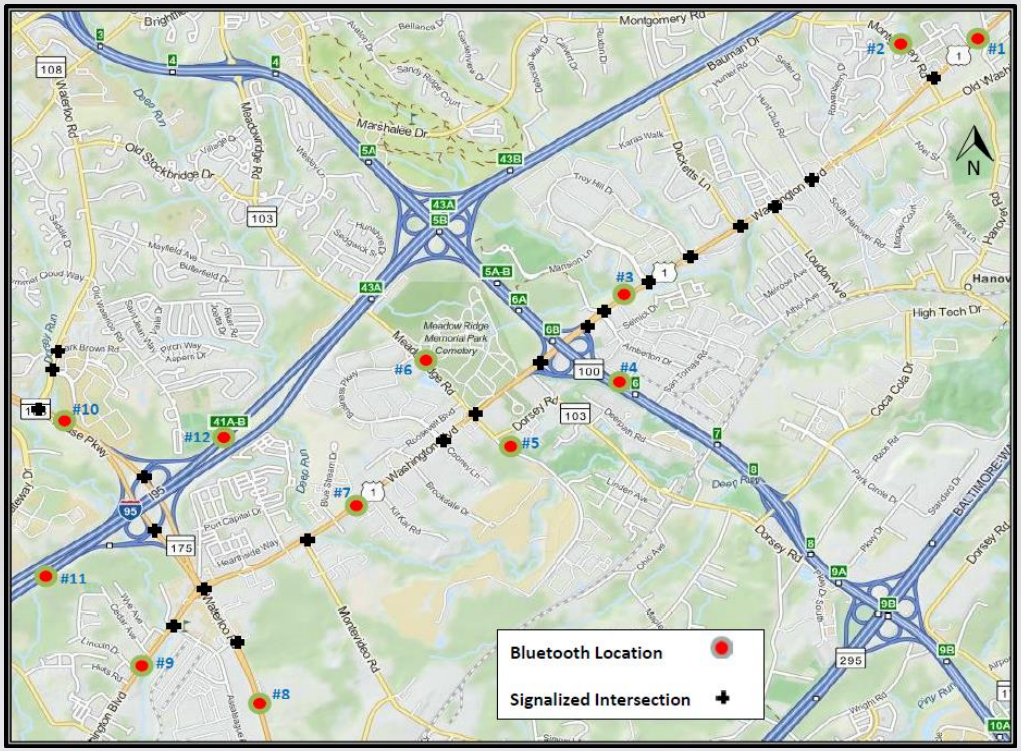
- Set incremental adaptive changes
- Set maximum adaptive changes
- Number of cycles for adjustment must fit into the adjustment interval
- Run the system in Analysis mode



Studies

US 1/MD 175 Jessup
(Centracs Adaptive)

- 12 Bluetooth Readers
- Mainline and major side-street movements
- Inrix
- 3 percent reduction in system travel times
- 4 percent reduction is mainline travel time



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Studies

MD 24/US 1 Bus Bel Air (Centracs Adaptive)

- 3 Bluetooth Readers
- >10% reduction in travel time for several segments
- Strong results in midday and on weekends

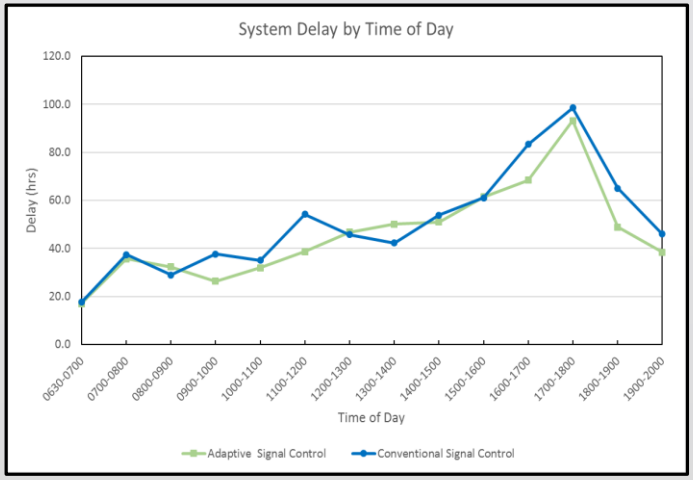
MD 24 Average Travel Time between MD 924 and Boulton Street

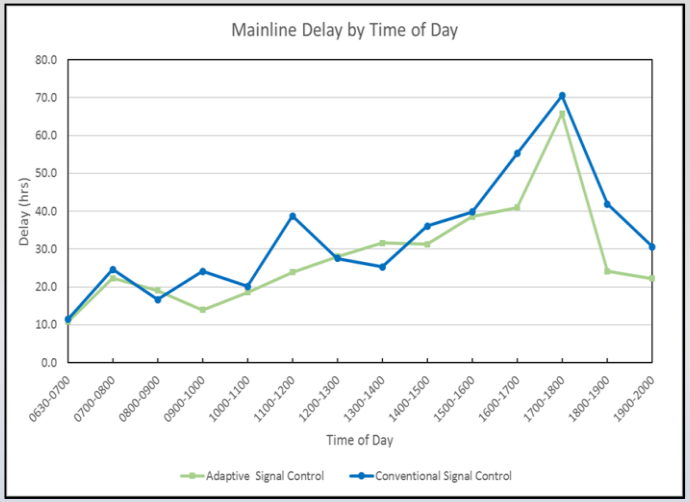
		MD 24 Northbound									MD 24 Southbound								
		MD 924 to Ring Factory Rd			Ring Factory Rd to Boulton St			Overall MD 924 to Boulton St			Boulton St to Ring Factory Rd			Ring Factory Rd to MD 924			Overall Boulton St to MD 924		
		Travel Time (minutes)		%	Travel Time (minutes)		%	Travel Time (minutes)		%	Travel Time (minutes)		%	Travel Time (minutes)		%	Travel Time (minutes)		%
Peak Period		Before	After		Before	After		Before	After		Before	After		Before	After		Before	After	
Weekdays	AM Peak	4.5	4.3	4.7%	5.3	4.8	10.3%	10.3	9.5	8.2%	4.2	4.1	0.9%	4.3	4.6	-5.7%	8.5	8.9	-4.3%
	Midday Peak	4.7	4.4	6.1%	5.2	4.6	13.2%	10.2	9.1	12.2%	5.0	5.1	-1.8%	4.8	4.4	8.6%	9.9	9.7	1.8%
	PM Peak	6.6	5.9	11.8%	6.0	5.7	6.1%	12.5	11.6	8.1%	6.2	6.1	0.4%	5.1	4.6	11.8%	11.8	11.2	5.3%
Weekend Peak		5.8	5.1	11.9%	5.0	4.7	6.1%	10.8	10.4	3.5%	5.8	5.4	6.4%	4.7	4.3	9.0%	11.3	10.1	11.3%

Studies

MD 2 Brooklyn Park
(SynchroGreen)

- Combined GPS Travel Time runs, controller split/cycle reports and TM counts
- 9.5 % reduction in system delay
- 15.5 % reduction in mainline delay





MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Studies

Conclusions

- No study is perfect
- Match the study to the corridor
- Try to capture side street performance
- Prefer delay, try to capture weekends, smaller time intervals

Studies show adaptive is working

- Centracs Adaptive – simple, inexpensive, limited by cycle
- SynchroGreen – effective, more expensive, more complex

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Future

Performance Monitoring

- How do we know the adaptive is working?
- When do we need to change base timings?
- Travel time, arrivals, etc.

Adaptive on most SHA corridors

Adaptive Changes

- Eos Adaptive – cycle and improved split calculations
- Multimodal
- Update existing adaptive systems

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION