



# SMART SIGNALS

MDOT SHA Office of Traffic and Safety



STATE HIGHWAY  
ADMINISTRATION

# Agenda

- Existing systems and Challenges
- Why Smart Signals?
- Debunking the Myths of Smart Signals
- Implementation Results
- Smart Signal Operations
- Conclusion



# Existing Systems and Challenges

- MDOT SHA maintains 3000+ signals statewide
- Controllers - Econolite ASC/3 or Econolite Cobalt
- Detection – Video camera, non-invasive micro loop probes, inductive loop, radar-based detection, thermal detection
- Communication – Telephone Service with Dial-Up Modems and Ethernet Based High Speed Data Communications with Cellular Modems
- Old ATMS (Aries) over 20 years old.

# Existing Systems and Challenges

- Outdated communication and ATMS
- Cannot adapt to fluctuations in traffic and non-recurrent congestion events such as temporary work zones, special event, crash etc.
- Existing system cannot respond to early onset of peak period or extended peak periods.
- No way to monitor system performance to prioritize timing reviews.

# Why Smart Signals?

To utilize cutting edge technology to effectively modernize and manage our system

## SMART SIGNALS

- Adaptive Signal Control Technology
- Upgraded Communication
- Signal Performance Measures
- SPaT Challenge

# Traditional Signal Systems **vs.** Smart Signal Systems

## TRADITIONAL SIGNAL SYSTEMS



Requires  
Engineers to  
Study & Retime



Pre-Programmed  
Static Signal  
Timing & Phasing

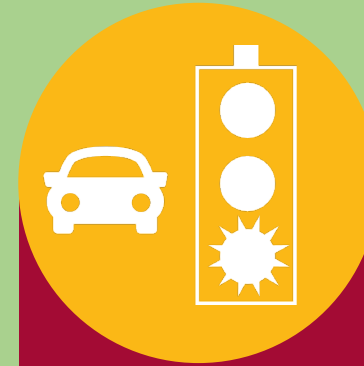


Delays  
Increase as  
Volumes Change

## SMART SIGNAL SYSTEMS



Real-Time  
Updating &  
Adapting to  
Traffic

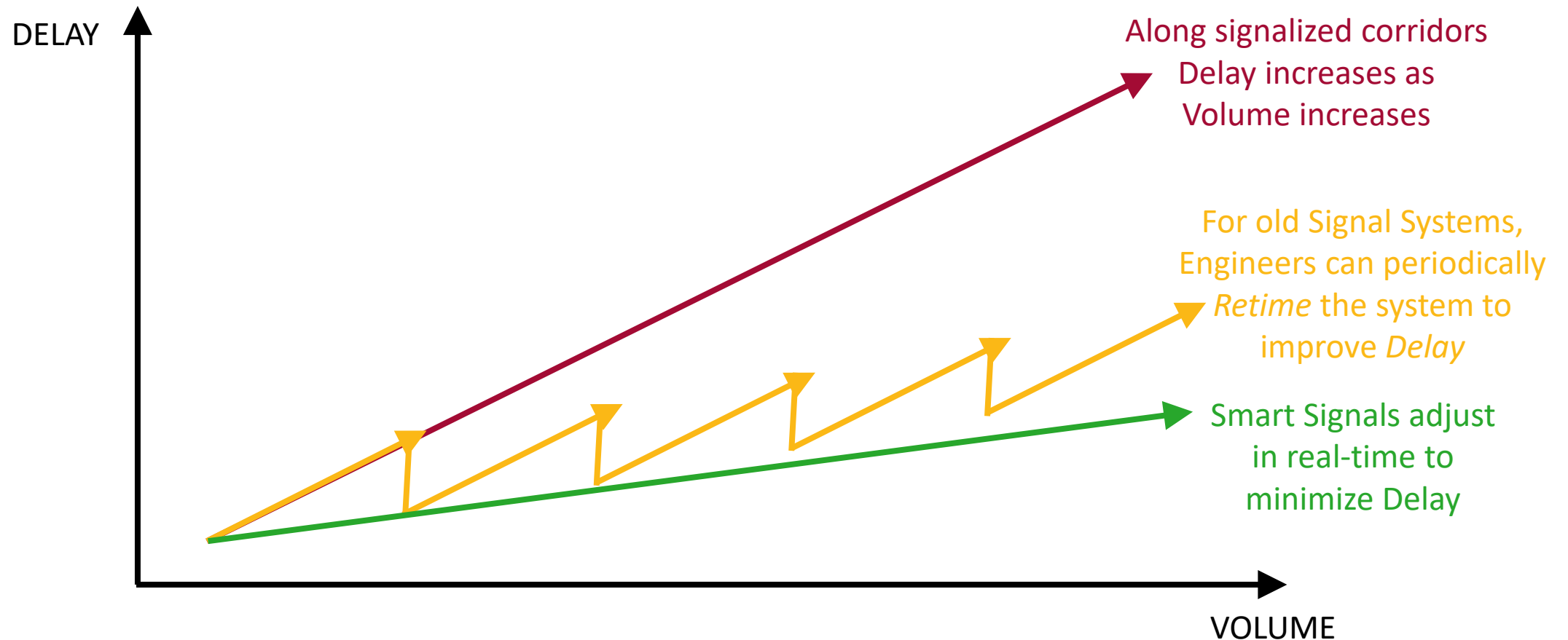


Constantly  
Adjusting Signal  
Timing & Phasing



Delays are  
Managed  
Continuously

# Delay Increases as Volumes Increase



# Benefits to SMART SIGNALS



Motorist Cost Savings



Agency Cost Savings



Improves the Environment & Reduces Fuel Emissions

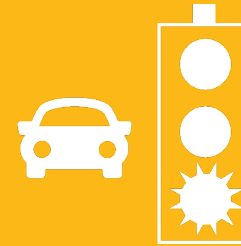


Reduce Complaints & Frustrations

Up To  
**15%**  
Crash Reduction

Improves Safety

**10%-50%** Delay Reduction



Reduce Travel Time



Reacts to Unforeseen Congestion



Continually Adjusting



# WHAT ARE **SMART SIGNALS?**

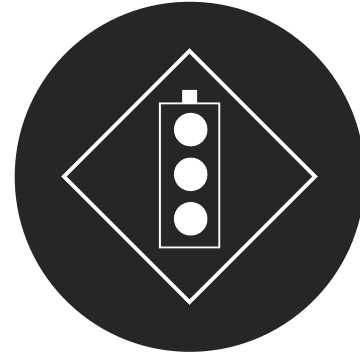


# Debunking Myths:

**MYTHS**  
debunked!



1. Everyone Gets Green All the Time.  
*(Traffic Will Still Have to Stop But Delay Is Minimized )*



3. All Corridors Should be Smart Signal Corridors.  
*(Smart Signals are Most Cost Effective Along Congested Corridors With Highly Variable Traffic Volumes)*



2. You Are Saving Hours of Commute Time **Per** Day.  
*(You're Saving Minutes Per Day—Annual Time & Money Savings Are Significant)*



4. Smart Signals Are Ideal For Urban Downtown Areas.  
*(Smart Signals Are Not Recommended For Corridors With High Pedestrian Volumes)*

# Implementation Results: Update

- Studies of 5 Corridors Completed
- Conducting Studies of 20 Corridors with Over 180+ Signals

Signal System	No. of Signals in System
US 1/MD 175 Jessup	16
MD 24/US 1 Bus Bel Air	14
MD 2 Brooklyn Park	4
MD 139 Towson	3
US 40 Catonsville	11

# Case Study: MD 139 (Towson)

Average Reduction in  
Corridor Travel Time (sec/veh)  
3 Hour Period



AM Peak

**7** secs.



Midday Peak

**8** secs.



PM Peak

**0.5** secs.

Average Reduction In  
Total Delay  
3 Hour Period



AM Peak

**1.5** hrs.



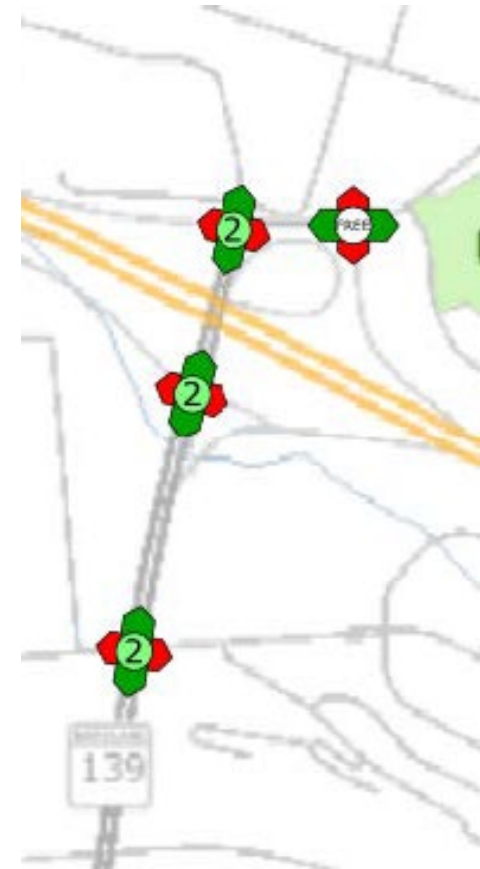
Midday Peak

**1** hrs.



PM Peak

**1.5** hrs.



# Data Conclusions: MD 139 (Towson)



**6 gallons**

Per day

**That's Equivalent to:**



**2,190 Gallons per year**



**438 Home Depot Buckets per year**



**27 Bathtubs per year**



**\$114,000**

Total Annual Savings

# Case Study: MD 2 (Brooklyn Park)

Average Reduction in  
Corridor Travel Time (sec/veh)  
3 Hour Period



AM Peak

**17**secs.



Midday Peak

**10**secs.



PM Peak

**28**secs.

Average Reduction In  
Total Delay  
3 Hour Period



AM Peak

**3.5**hrs.



Midday Peak

**2.6**hrs.



PM Peak

**12.3**hrs.



# Data Conclusions: MD 2 (Brooklyn Park)



**20 gallons**

Per day

**That's Equivalent to:**



**7,300 Gallons per year**



**1,460 Home Depot Buckets per year**



**91 Bathtubs per year**



**\$337,000**

Total Annual Savings

# Implementation Summary:

## US 40, US 1, MD 24, MD 2, & MD 139,



**\$470k**

Annual Savings

**US 40**



**\$970k**

Annual Savings

**US 1**



**\$582k**

Annual Savings

**MD 24**



**\$337k**

Annual Savings

**MD 2**



**\$114k**

Annual Savings

**MD 139**

# Upcoming SMART SIGNAL Corridors

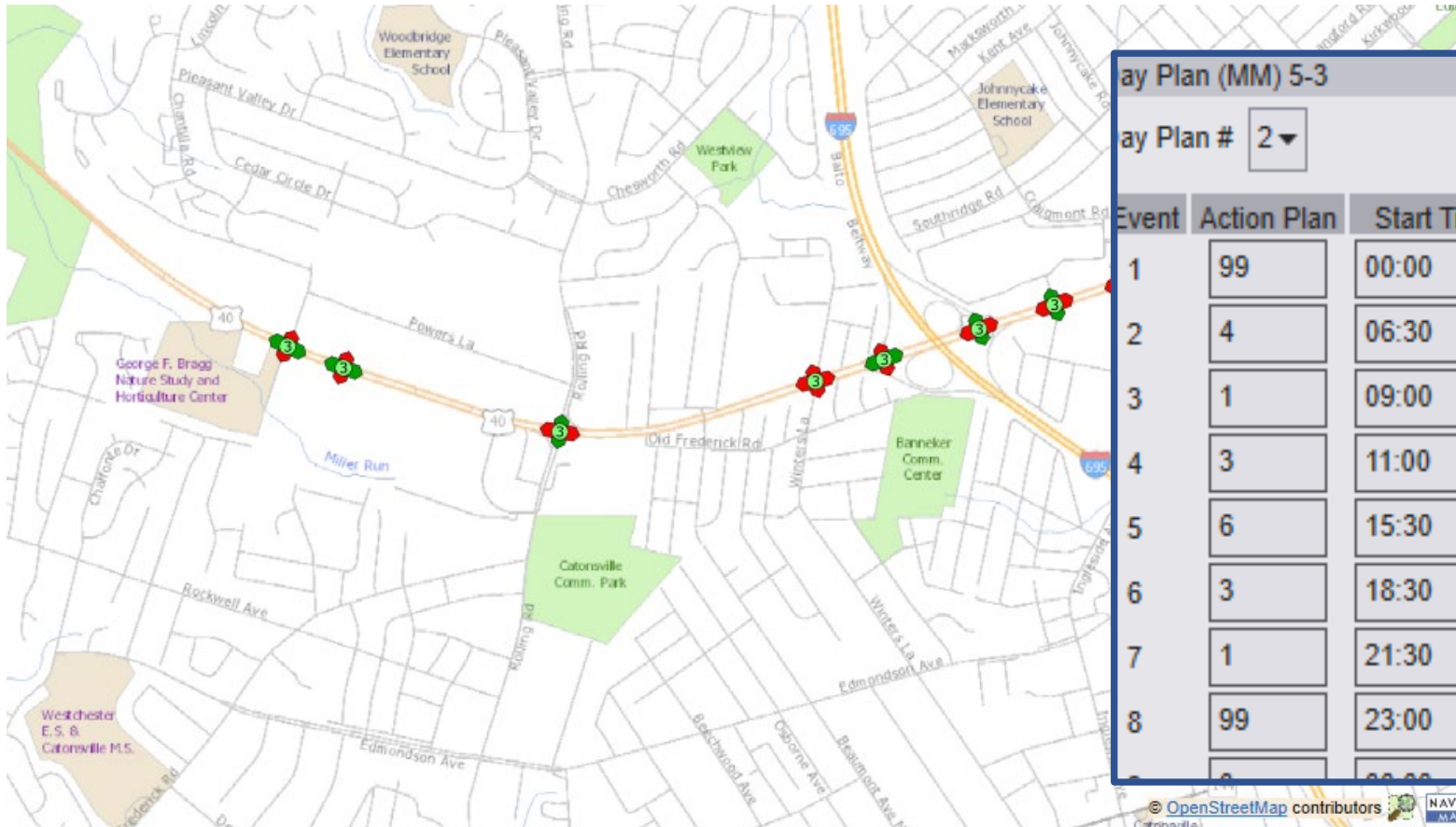
## CORRIDORS ADAPTIVE READY

Signal System	No. of Signals in System
US 301 Bowie	6
MD 2 Annapolis Harbor	4
MD 3 Crofton	12
MD 22 Aberdeen	8
US 13 Business North Salisbury	5
MD 202 Landover	5

## CORRIDORS IN CONSTRUCTION

Signal System	No. of Signals in System
US 301 Waldorf	20
MD 198 West Laurel	2
MD 108 Olney	11
US 40 Ellicott City East	5
MD 140 Westminster	13
MD 450 Parole	10
MD 2 Severna Park	11
MD 2 Glen Burnie North	10

# Smart Signal Operations



Day Plan (MM) 5-3

Day Plan #

Event	Action Plan	Start Time
1	99	00:00
2	4	06:30
3	1	09:00
4	3	11:00
5	6	15:30
6	3	18:30
7	1	21:30
8	99	23:00

Schedule (MM) 5-4

Schedule Number

Day Plan No

Clear All Date Fields

Select All ☐ Months ☐ DOW ☐ DO

Month

JAN	FEB	MAR	APR	MAY	JUN
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
JUL	AUG	SEP	OCT	NOV	DEC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Day (DOW)

SUN	MON	TUE	WED	THU	FRI	SAT
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# Smart Signal Operations

The screenshot shows a traffic signal control interface. On the left is an aerial map of an intersection with signal heads labeled 23, 44, 31, and 4. On the right is a control panel with columns for Mode / Pattern, Coordination, Time, Preempt, and Alarms. A large yellow callout box with a speaker icon contains the text: **Most Importantly...Smart Signals Mean No More**. The interface also shows a status bar at the bottom with text like 'Unit control is in timebase mode' and 'Ring 1: Yellow Change'.

Mode / Pattern	Coordination	Time	Preempt	Alarms
Desired NONP	Actual Prog-Adj	Last 14:54:25		

Unit control is in timebase mode

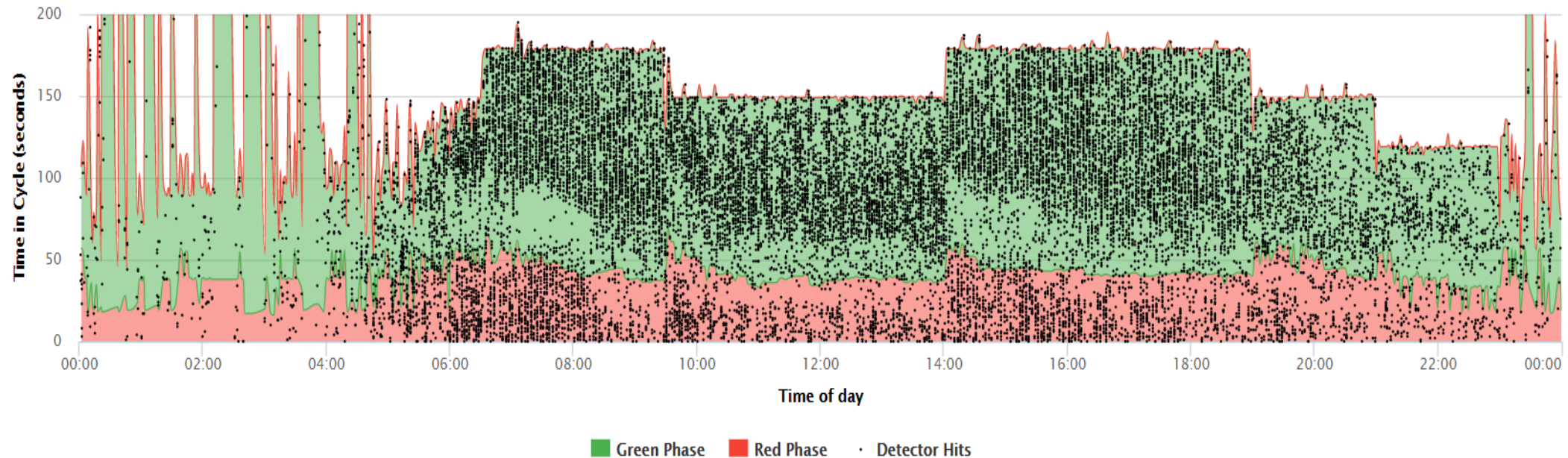
Ring 1: Yellow Change  
Ring 2: Extension

Comms 100.0%

# How Smart are Smart Signals?

US 301 @ Mitchellville, Crain Highway (SB) – Thru

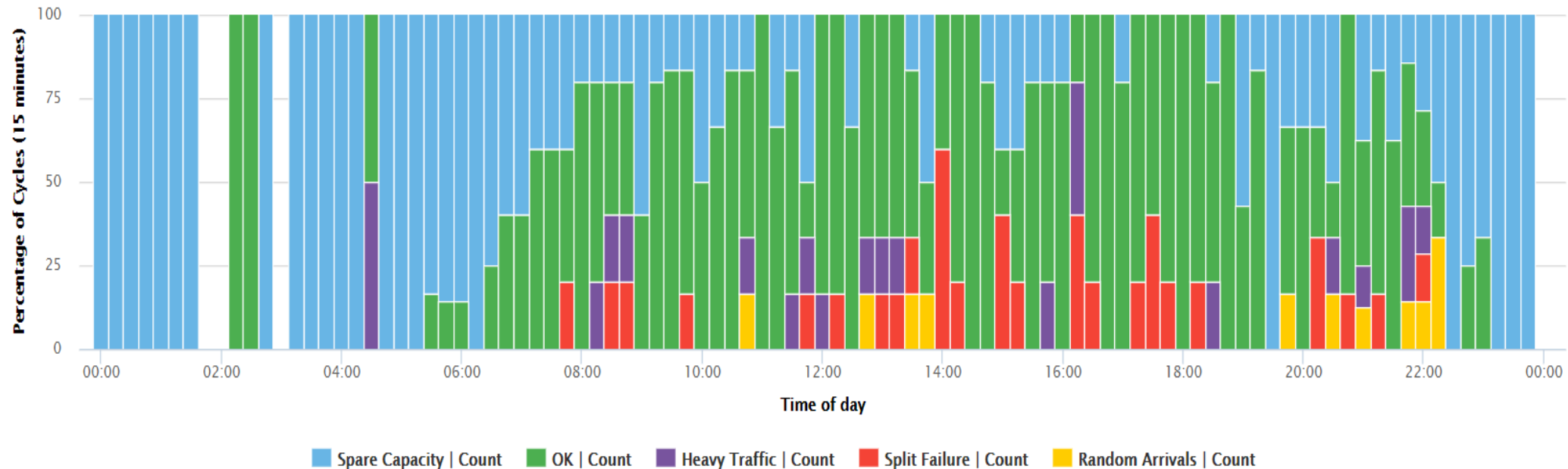
Purdue Coordination Diagram | Thu, May 16th, 2019



# Hmmm...What Else?

## US 301 @ Heritage Blvd/Ball Park, Heritage Boulevard (WB) – Thru

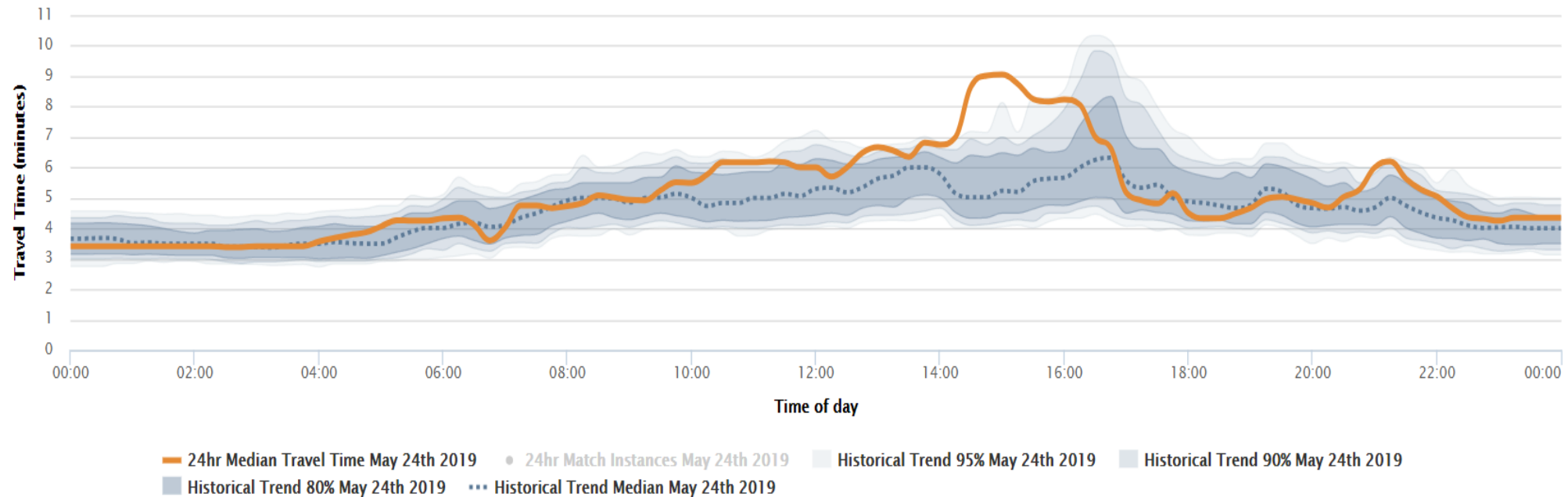
Split Trend | Wed, May 22nd, 2019



# Stop! I am not a traffic engineer

...(but I do love MD beaches)

Travel Time from US 301 @ Harbour Way/Governor's Bridge to US 301 @ Pointer Ridge Drive





# THANK YOU

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