

Case Studies of Automated Traffic Signal Performance Measures (ATSPM) Implementation in Florida

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FHWA's Every Day Counts

- FDOT participated in Federal Highway Administration's (FHWA) Every Day Counts 4 (EDC-4) Update
- FDOT initiated three ATSPM projects by 2018 (goal achieved by now)
- FHWA considers ATSPM as means to improve signal operations by providing continuous monitoring capability
- ATSPM can manage traffic signal maintenance and operations in support of an agency's safety, livability and mobility goals



every day counts
An Innovation Partnership with States

**Automated Traffic Signal
Performance Measures (ATSPMs)**



ATSPMs modernize traffic signal management by providing high-resolution data to actively manage performance and improve safety and customer service while cutting congestion and costs.

FDOT Traffic Signal Program Overview

	Level 1 Ad-Hoc, High Risk	Level 2 Established, Risk Acknowledged	Level 3 Measured, Managed Risk	Level 4 Managed, Low Risk
Business Processes			✓	
Systems & Technology			✓	
Performance Measures			✓	
Organization & Workforce			✓	
Culture			✓	
Collaboration			✓	

ATSPM Capability

FDOT and local agencies use ATSPM to support a wide range of performance metrics. Analytics provided by ATSPM include:

- Approach delay
- Approach speed
- Approach volume
- Arrivals on red/green
- Preemption details
- Phase termination
- Split failure
- Split monitor
- Coordination diagram
- Turning movement counts

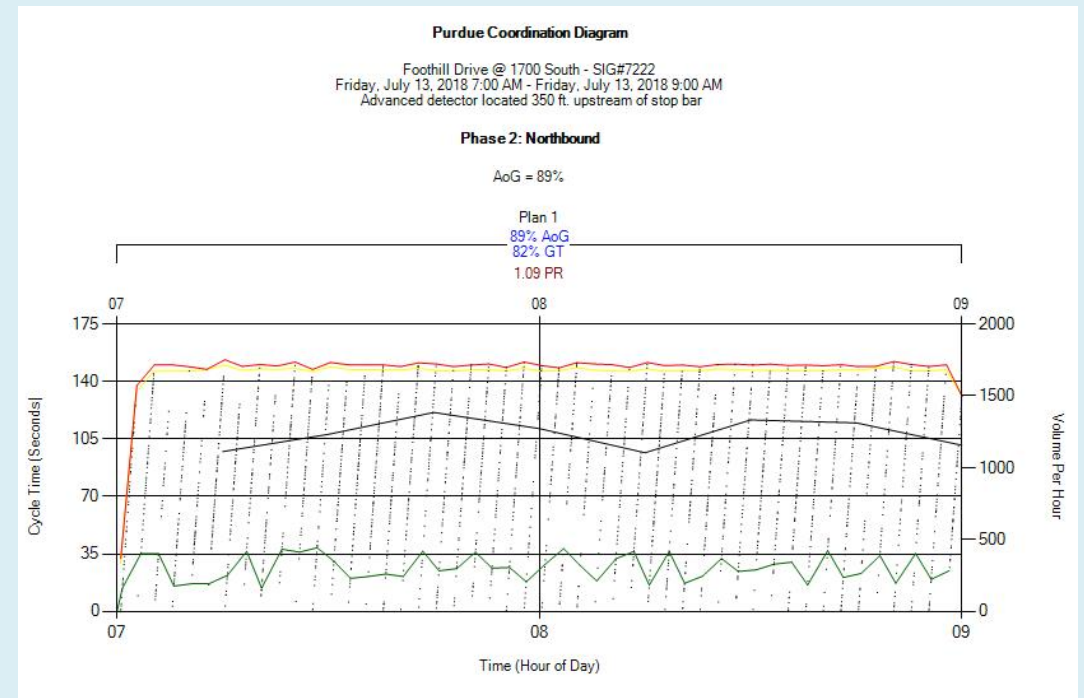
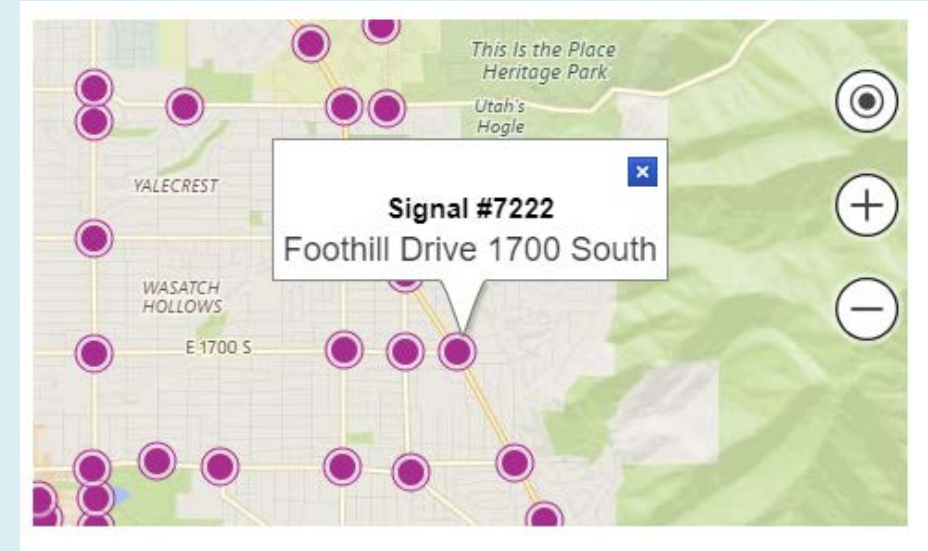
ATSPM Benefits

- Previously known as Purdue Performance Measures
- Benefits
 - Targeted Maintenance: provides the **actionable information** needed to deliver **high quality signal operations**.
 - Improved Operations: **active monitoring of signalized intersection performance** lets agencies address problems before they become complaints.
 - Increased Safety: a shift to **proactive operations** and maintenance practices can improve safety by reducing the traffic congestion that results from **poor and outdated signal timing**.

The screenshot displays the ATSPM (Automated Traffic Signal Performance Measures) web application. The header includes the ATSPM logo and the Utah Department of Transportation (UDOT) logo with the slogan "Amazing Utah Moving". A navigation bar contains links for Measures, Reports, Log Action Taken, Links, FAQ, Admin, and About, along with Register and Log in options. The main content area is titled "Signal" and is divided into two columns. The left column, "Signal Selection", features a "Signal ID" input field with a "Press Enter to select signal" prompt, a "Signal List" section, and a "Signal Map" section. The map shows a geographical area with several orange location pins. The right column, "Date Selection", includes a "Chart Selection" dropdown, a "Start Date" field set to 12:00, an "End Date" field set to 11:59, a "PM" dropdown, a "Reset Date" button, and a "Create Chart" button. A calendar for January 2017 is also visible, with the 16th highlighted.

ATSPM Overview

- An open-source software package with website and supporting application; shows real-time and historical performance at signalized intersections
- Measures vehicle delay, volume, speeds, progression, and more
- Stakeholders can identify bottlenecks, failing hardware, and safety issues on the fly using ATSPM data
- FDOT is participating in Federal Highway Administration's Every Day Counts-4 program, and has installed ATSPM at City of Tallahassee and District 7
- District 5 has multiple installations and development activities underway



City of Tallahassee (District 3)

- Initial installation: 22 signals on US 90 (Mahan Dr. / Tennessee St. corridor)
- Intersection and detector geometry along corridor configured to allow all relevant metric charts to be rendered
- City staff were trained enabling them to fine-tune their configuration and add more signals
- Expanded to about 40 signals
- Data consumption – a challenge; City moving to server virtualization



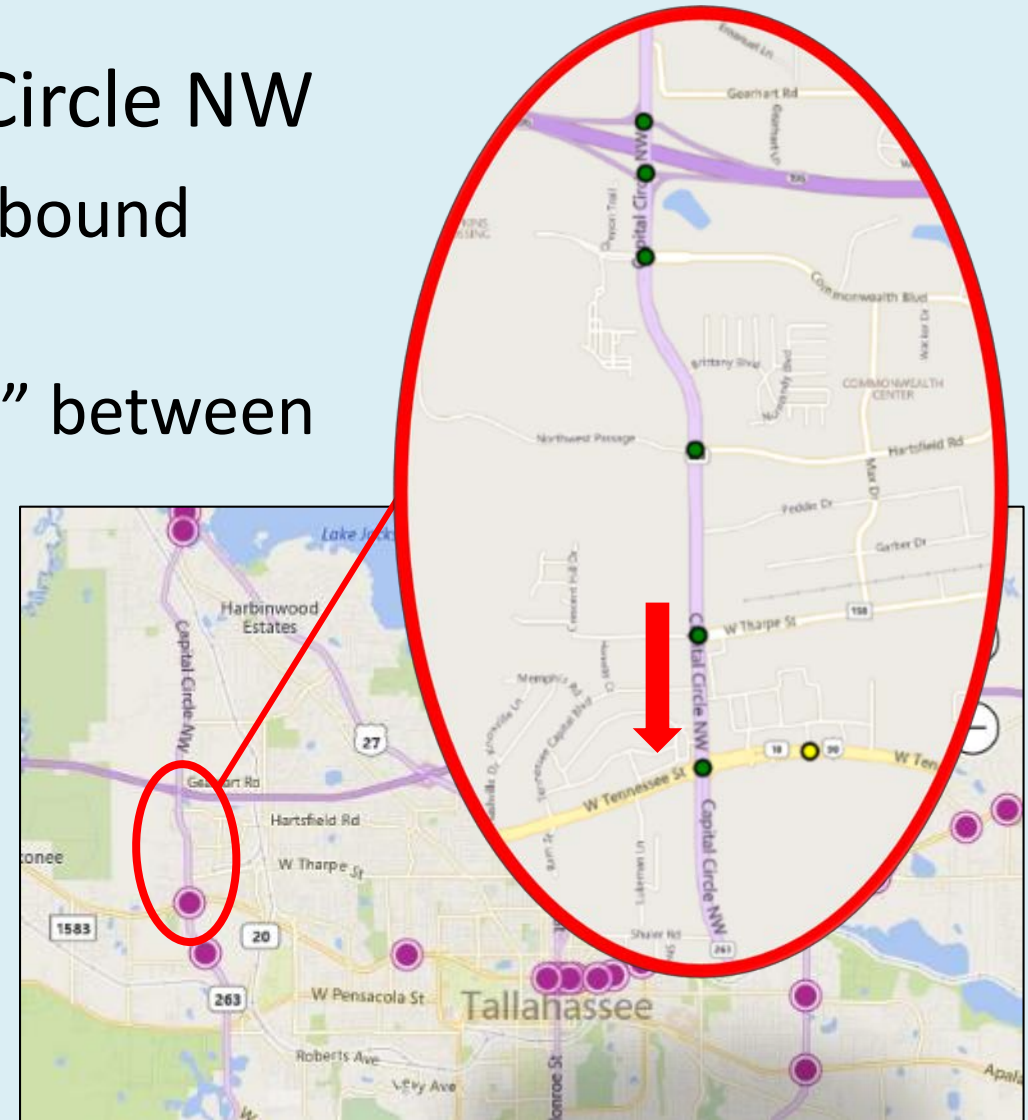
City of Tallahassee – ATSPM Benefits

- New signal installed along Capital Circle (SR 263) to address heavy directional volumes in AM/PM peak
 - Initially, ran coordinated during AM/PM peak, and free otherwise
- Delays observed for NBL/SBL vehicles
 - City engineers tried free operation during peak
 - Then looked at arrival on red/green ATSPM metric and determined that impact to NB/SB progression was not severely impacted; the change also reduced delay of turning vehicles and was kept



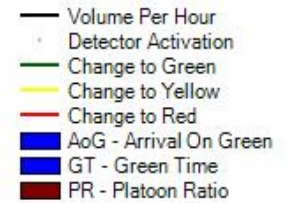
City of Tallahassee – ATSPM Benefits

- Tennessee Street (US 90) @ Capital Circle NW
 - Complaints of “poor progression southbound around 9:45”
 - Three signals programmed to run “free” between 9:30 and 11:45
 - Decision made to start mid-day coordinated pattern earlier



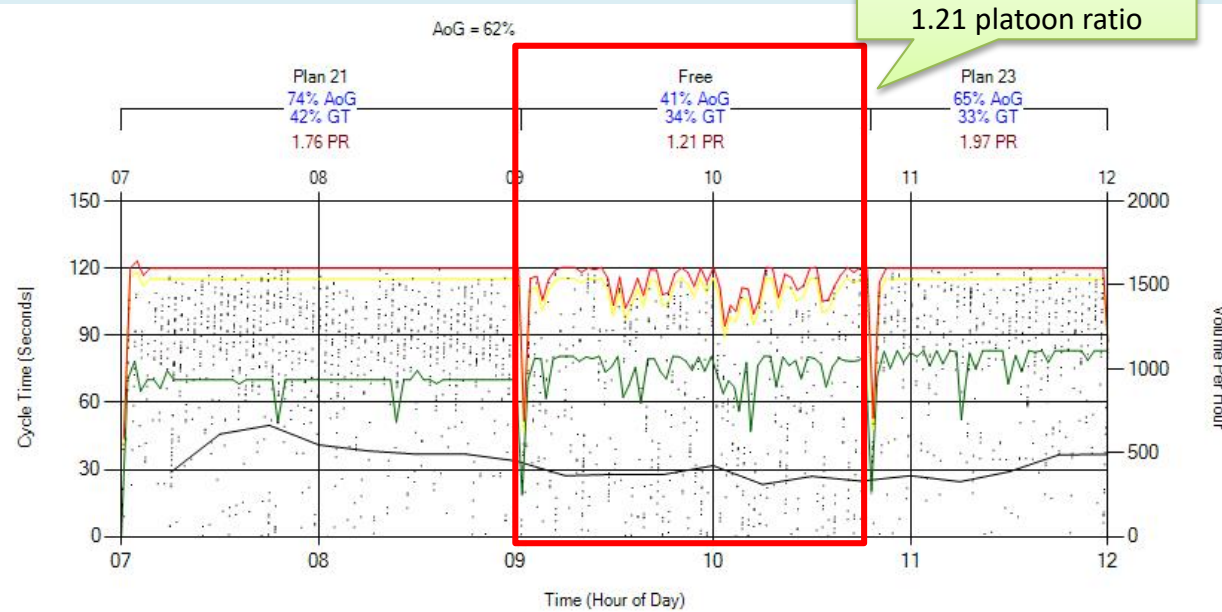
City of Tallahassee – ATSPM Benefits

- Tennessee Street (US 90) @ Capital Circle NW
Purdue Coordination Diagram



Before (7/17/18)

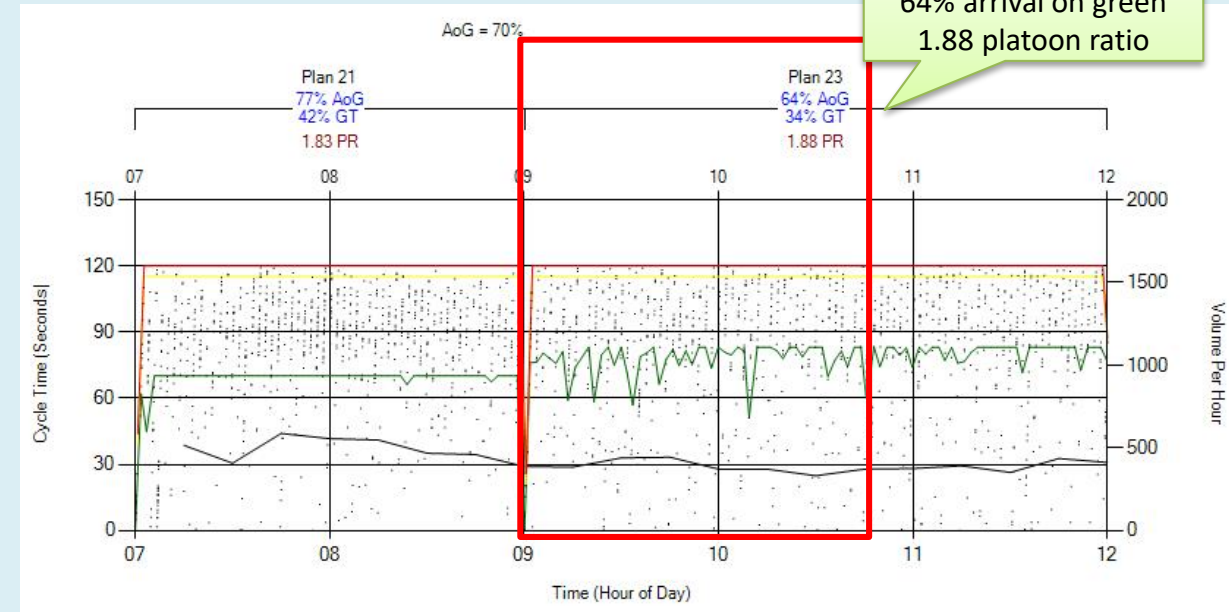
Free operation
41% arrival on green
1.21 platoon ratio



41% Arrival on Green

After (7/24/18)

Coordinated plan
64% arrival on green
1.88 platoon ratio

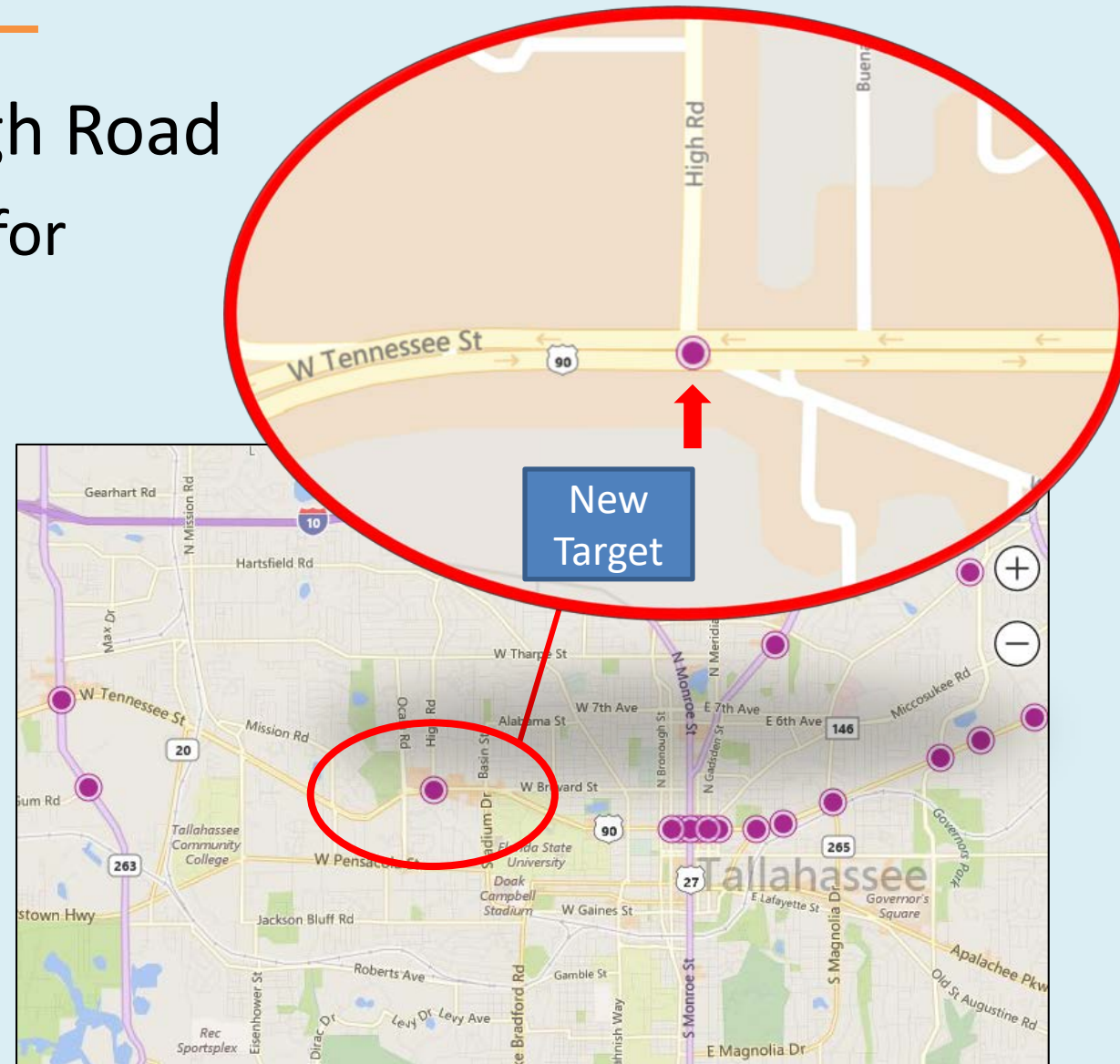


64% Arrival on Green

Tennessee Street (US 90) @ Capital Circle NW
(Southbound)

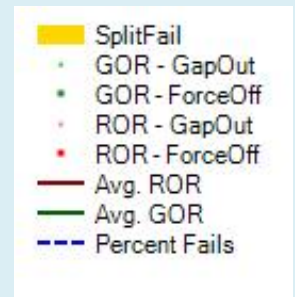
City of Tallahassee – ATSPM Benefits

- Tennessee Street (US 90) @ High Road
 - Complaints of “green too short” for NB approach
 - Target recently opened at shopping center on southside of intersection
 - Decision made to extend the NB green



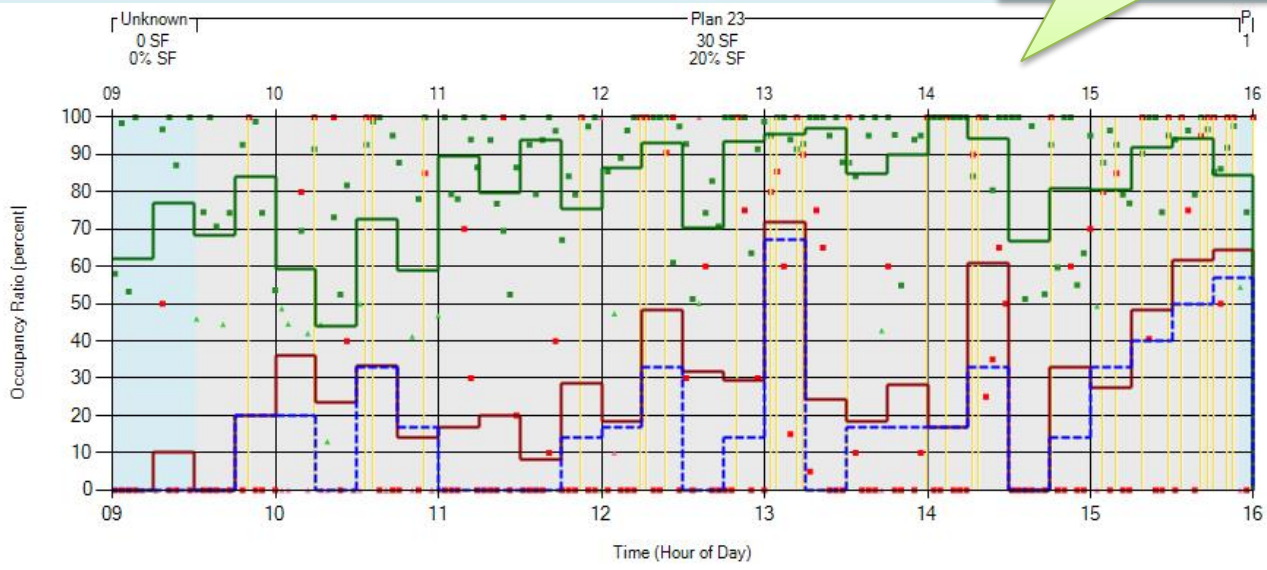
City of Tallahassee – ATSPM Benefits

- Tennessee Street (US 90) @ High Road
Purdue Split Failure



Before Timing Change (7/23/18)

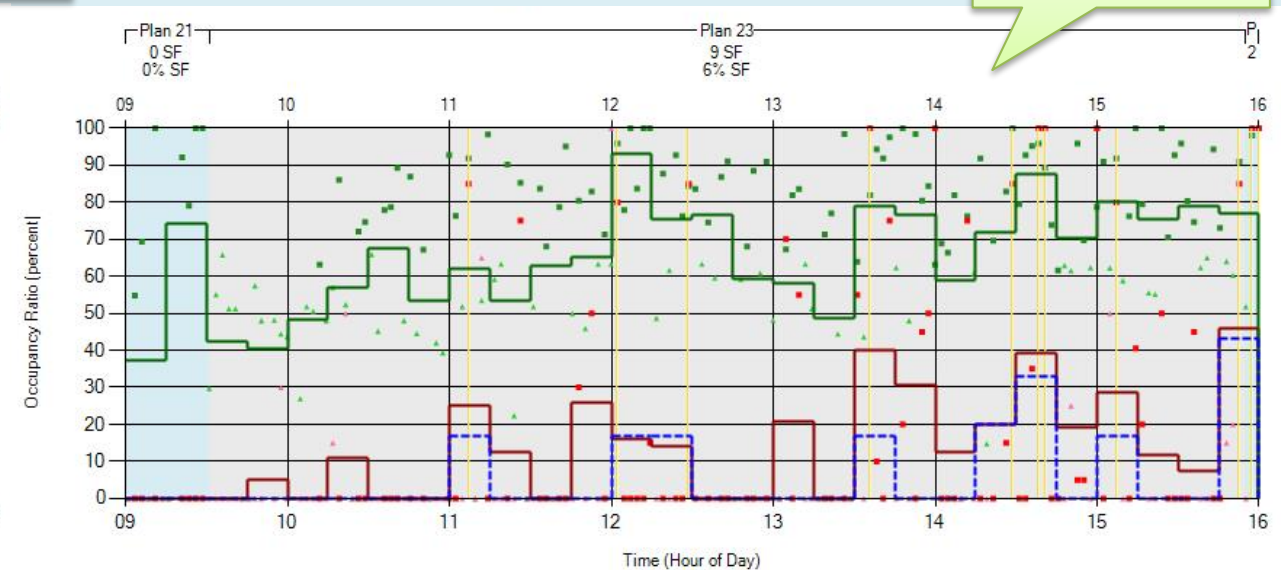
20% split failures



30 Split Failures (20%)

After Timing Change (7/24/18)

6% split failures



9 Split Failures (6%)

Tennessee Street @ High Road (Target)

(Phase 4 – Northbound)

City of Tallahassee – Benefits

- City traffic engineers noticed unusual, infrequent controller behavior at a few intersections under light conditions
 - Reviewed historical information from KITS Advanced Traffic Management System for times where this unusual transition was reported
 - Then reviewed corresponding ATSPM data to re-create what happened
- There was a narrow set of circumstances where the controller was accepting a “late” call, causing it to go into transition
 - Contacted controller manufacturer who corrected the behavior

District 7 – Tampa / Hillsborough County

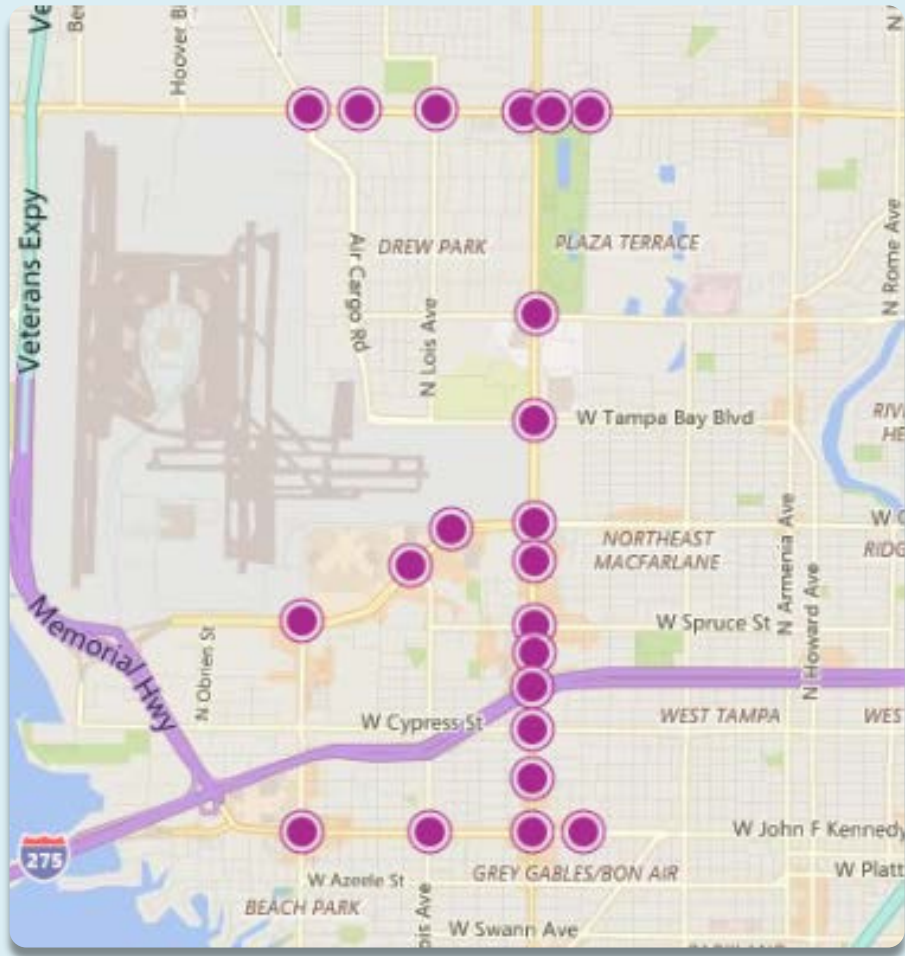
- Install ATSPM software on supplied servers
 - Dell PowerEdge servers utilizing virtualization
 - Database: 1TB HD, 12gb ram, 2 cores
 - Web / App: 500gb HD, 64gb ram, 6 cores
 - Coordination with FDOT, the City of Tampa, and Hillsborough County to verify equipment and communications capability
 - Add ten City of Tampa and five Hillsborough County intersections to the system; Tampa intersections active at start of installation

District 7: Installation Challenges

- .NET Framework
 - Server had Microsoft .NET Framework 4.7 already installed
 - Took a day to downgrade to 4.5.5
 - Server install problem free after .NET downgrade
 - Learned that ATSPM functions correctly on versions later than documented 4.5.2
- SNMP (Simple Network Management Protocol)
 - Econolite Controllers were set to SNMP port 501, not 161; hence, ATSPM's FTP application on server could not correctly toggle log setting on controller
 - Once the correct port was set in FTP application on server, SNMP communication to controller was enabled with full retrieval of log files

District 7: Insync Adaptive System

- After the successful ATSPM installation, Insync Adaptive system was installed along Fowler Avenue. There was not enough physical space in the existing cabinets to add another detector rack to accommodate both ATSPM and the InSync Adaptive systems.
- The ATSPM installation is currently being moved to other corridors.

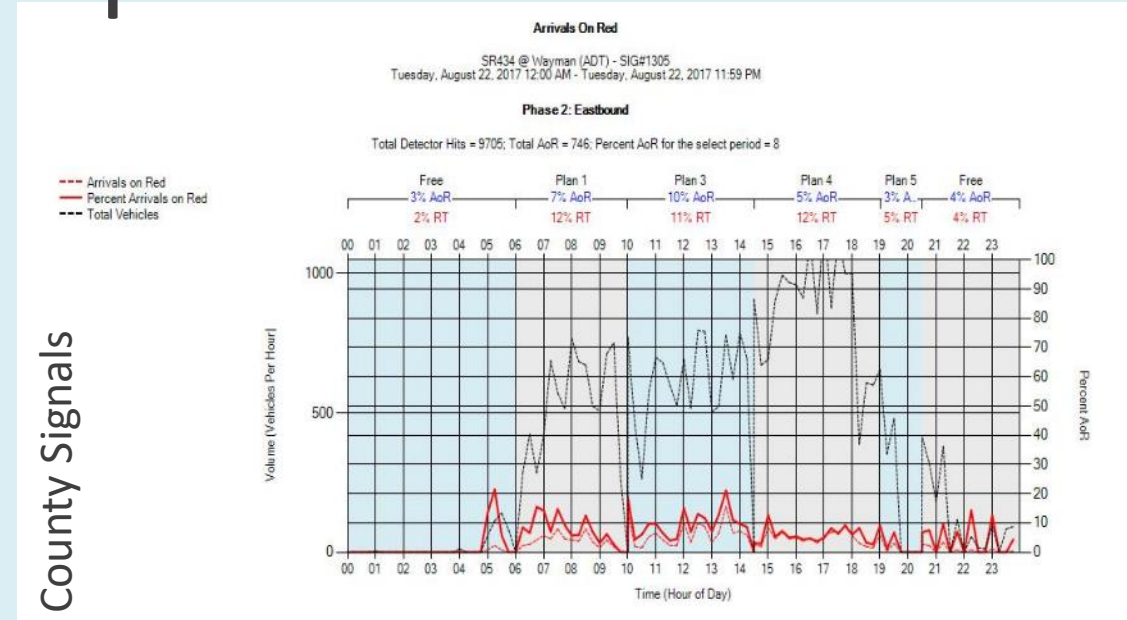


City of Tampa
added additional
intersections to
be brought online

Seminole County: ATSPM Implementation

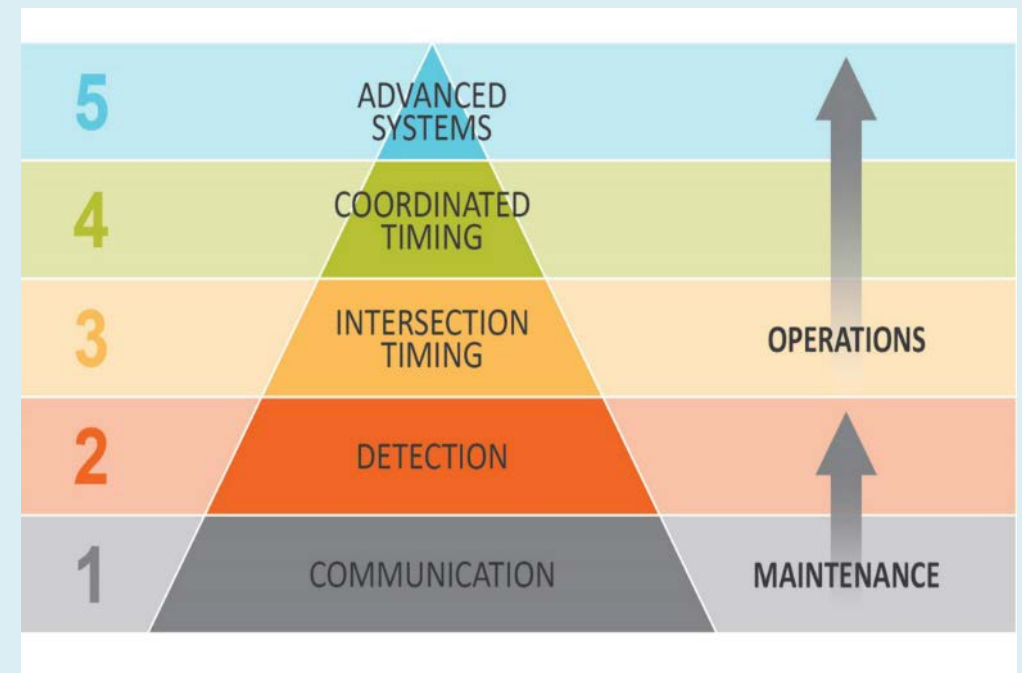
- Seminole County using Trafficware 980 ATC controllers
- Signal controllers configured to enable ATSPM
- Seminole County ATSPM implementation took less than two years from installation of first signal to last

D5/Seminole County Signals



Seminole County: Improved Signal Operation

- ATSPMs eliminated need to perform traffic counts and facilitated data-driven evaluations of signal performance
- County spent \$28,000 each year on tube counts before ATSPM, which is 70 percent of its data collection budget
- ATSPM enabled Seminole County to reduce need for counts and more strategically focus data collection dollars



Seminole County to District 5 Migration

- Seminole County, along with other local agencies, requested assistance with arterial management
- There was a need for data storage that the District could fill
- District 5 and Seminole County transitioned services to District 5 servers while adding on more agencies

District 5: Concerns

- Scalability, interoperability, and segmentation
 - Local agencies maintain signals on behalf of FDOT
 - Over 1600 state signals in District 5
 - Over 800 local signals in Orlando alone
 - Part of Advanced Transportation and Congestion Management Technologies Deployment grant committed to ATSPM on 1,000 signals
 - Currently at over 400 signals

District 5: Needs

- Allow local agencies to use their vendors' systems
- Need to upgrade non-ATC controllers
- Centralize and organize information for better decisions
- Prevent unneeded work on local agencies

District 5: Enhancements

- Local agencies were using SLDC Port Monitor for communication to ATMS
 - Orange County – Siemens M50 controller
 - Lake County – Naztec 980
- Vendor offered their own ATSPM tool; District 5 desired to integrate it into their system
- Developed an ingester to bring data from Vendor's cloud into District 5's system
- Allows for:
 - Non-ATC controllers to report ATSPM data without controller change-out
 - Cellular backhaul for devices without wired connection



District 5: ATSPM Enhancements

- Our local agencies have their own signal numbering conventions
- Many node numbers overlap between agencies
- Added a prefix to database signal ID based on agency
- No database structure changes made
- Allows them to maintain their numbering system and easily search data

District 5: ATSPM Enhancements

- Congestion issue decoding ATSPM raw files and storing ATSPM data with all signals and polling frequency
- Fix is to make decoding and storing run parallel
- Error checking added for data integrity
 - Check whether path elements have invalid or duplicate characters that could affect decoding and storage processes



District 5: Challenges and Future Enhancements

- Expand data gathering
 - Incorporate inventory tracking and Integrated Corridor Management operation needs into ATSPM
- Develop specific signal / controller wiring guidelines
 - Signal plans often incorrect or outdated, hindering ATSPM implementation
 - Standardization will minimize future data gathering efforts
- Develop specific video detection configuration
 - Allow for generation of ATSPM data and additional turning movement counts, including separation of shared lanes
- Improve processing efficiencies for scalability
 - Revised architecture

Questions?

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