THE EASTERN TRANSPORTATION COALITION

CONNECTING FOR SOLUTIONS

New Signal Technology, New Maintenance Needs Webinar

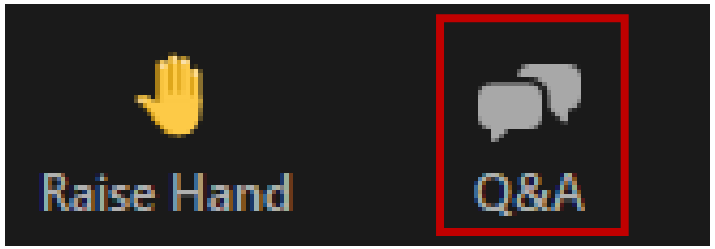
November 4, 2021

Welcome!

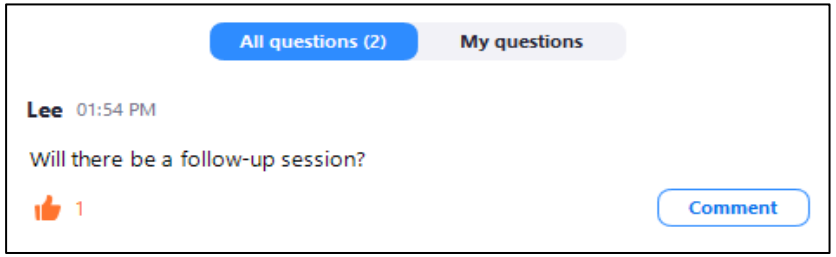
- We are using Zoom **Webinar**
- **AUDIO (Computer):** Use your computer speakers and microphone by clicking the “Join Audio” button in the bottom left of the screen. You will be muted.
- **Alternate Audio (Phone):** Call into the meeting by dialing the phone number based on your location (provided in the confirmation email) and enter the Meeting ID at the prompt. You will be muted.
- **This web meeting is being recorded.**
- **Questions** with the audio or web? Please contact Esther via email (ekleit@kmjinc.com)
- The **Chatbox** is not available to participants. Please use the **Q&A box** for questions to the presenters

Asking Questions in the Q&A Box

- Click on the Q&A icon at the bottom of your screen



- The questions in the Q&A box will be monitored and answered either between presentations or at the end of the meeting
- You can keep track of your questions in the “My Questions” tab in the Q&A box



Welcome

Ginna Reeder, Director, Innovation Program
The Eastern Transportation Coalition

Upcoming Coalition Events

RECENT

- ✓ **Traffic Data Marketplace - RFP Evaluation Meetings** - Aug, Sep, Oct 2021 *(member invite only)*
- ✓ **Meet the Work Zone Data Exchange (WZDx) Project** - **How to Get Better Work Zone Data Out to the Traveler** - September 9, 2021
- ✓ **RITIS User Group Web Meeting** – September 30, 2021
- ✓ **Coalition Mapping Workshop** - October 7, 2021 *(member invite only)*

UPCOMING

- ➢ **Rebuilding the Causes of Congestion Pie Chart with Real-World Data: TDADS Phase 2 Project** - November 10, 2021
- ➢ **WAZE Technical Bi-Annual Working Group** - November 18, 2021 *(member invite only)*

Overall Agenda

Topic/Vendor	Presenter
Welcome and Introductions	Ginna Reeder - The Eastern Transportation Coalition
New Signal Technology: Leveraging Data for Traffic Signal Performance	Stan Young, Chief Data Officer, The Eastern Transportation Coalition
Sustainable Signal Technology: A Virginia Experience	Michael Clements, Signal & Arterial Systems Program Manager, Virginia DOT
The Evolution of GDOT Traffic Signals: From Regional Traffic Operations to SigOps	Andrew Heath, State Traffic Engineer, Georgia DOT
Regional Traffic Operations (RTOP)	Brett Sellers, Emerging Technologies Engineer, Alabama DOT
Wrap Up	Ginna Reeder

Participants

Agencies				
Alabama DOT	Florida DOT	Middlesex County, NJ	NYMTC	SunGuide TMC
Atlanta Regional Commission	Florida International University	Montgomery County Planning Commission	Orange County, FL	Tennessee DOT
City of Alexandria, VA	Georgia DOT	MWCOG	PANYNJ	University of Maryland CATT
City of Sandy Springs, GA	Maine DOT	New Jersey DOT	Pennsylvania DOT	University of Maryland CATT Lab
Connecticut DOT	Manatee County	New Jersey Sports & Exposition Authority	Pennsylvania Turnpike Commission	US DOT
Delaware DOT	Maryland DOT	New York City DOT	Rhode Island DOT	Vermont AOT
District DOT	Maryland DOT-SHA	New York State DOT	Richmond Regional Planning Agency	Virginia DOT
DVRPC	Maryland Transportation Authority	North Carolina DOT	Southern Georgia Regional Commission	
Federal Highway Administration	Massachusetts DOT	North Florida TPO	Southwestern Pennsylvania Commission	

Signal Maintenance Technologies Survey Results

- 91% of respondents' states have installed new signals with new technologies that require additional skills or funds
  - *"… with tech changing so quickly and no funding source being designated/set aside for this, it is a constant challenge…"*
  - *"[We have] had numerous training sessions for staff/contractors on its new ATC software as well as the new controller software and central signal system software. A mixture of state and Federal funds were used for the transition to the new technology as well as the high-speed communications system supporting it."*
- 73% of respondents anticipate changes to their current signal maintenance program due to planned technology upgrades
  - *"The change in the signal controller cabinet from a pure electrical controller to more of an ITS based cabinet is changing the workforce requirements and this is a big need for our industry."*
  - *"the 'signal' technicians have transitioned to ITS technicians which requires more advanced knowledge, skills and abilities and changes to associated job classifications and associated qualifications."*

Introductions

Stan Young, PhD, PE
Chief Data Officer
The Eastern Transportation Coalition

Andrew Heath, PE
State Traffic Engineer
Georgia DOT

Michael Clements, PE
Signal & Arterial Systems Program Manager
Virginia DOT

Brett Sellers, PE
Emerging Technologies Engineer
Alabama DOT

New Signal Technology:
Leveraging Data for Traffic Signal Performance

Stan Young, PhD, PE, Chief Data Officer
The Eastern Transportation Coalition

It is the best of times ….

- ❑ Digital Mapping Companies
- ❑ Traffic information disseminated through industry
- ❑ More and better info for DOT's and travelers than we have ever had

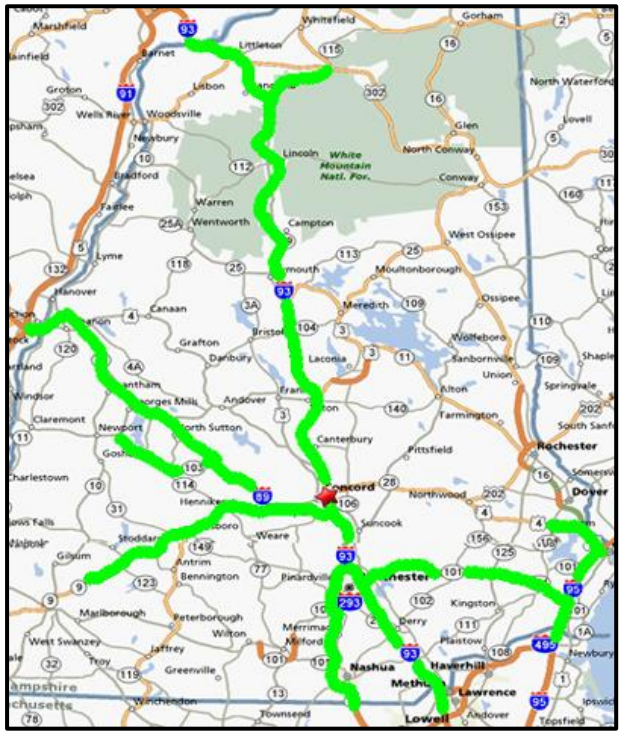
INRIX

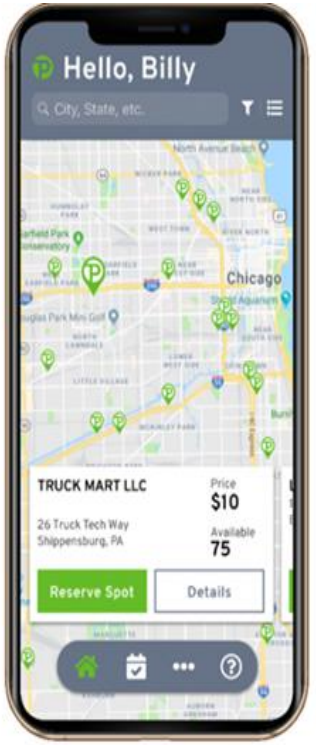
here

Google

WZDx
WORK ZONE DATA EXCHANGE

TOMTOM

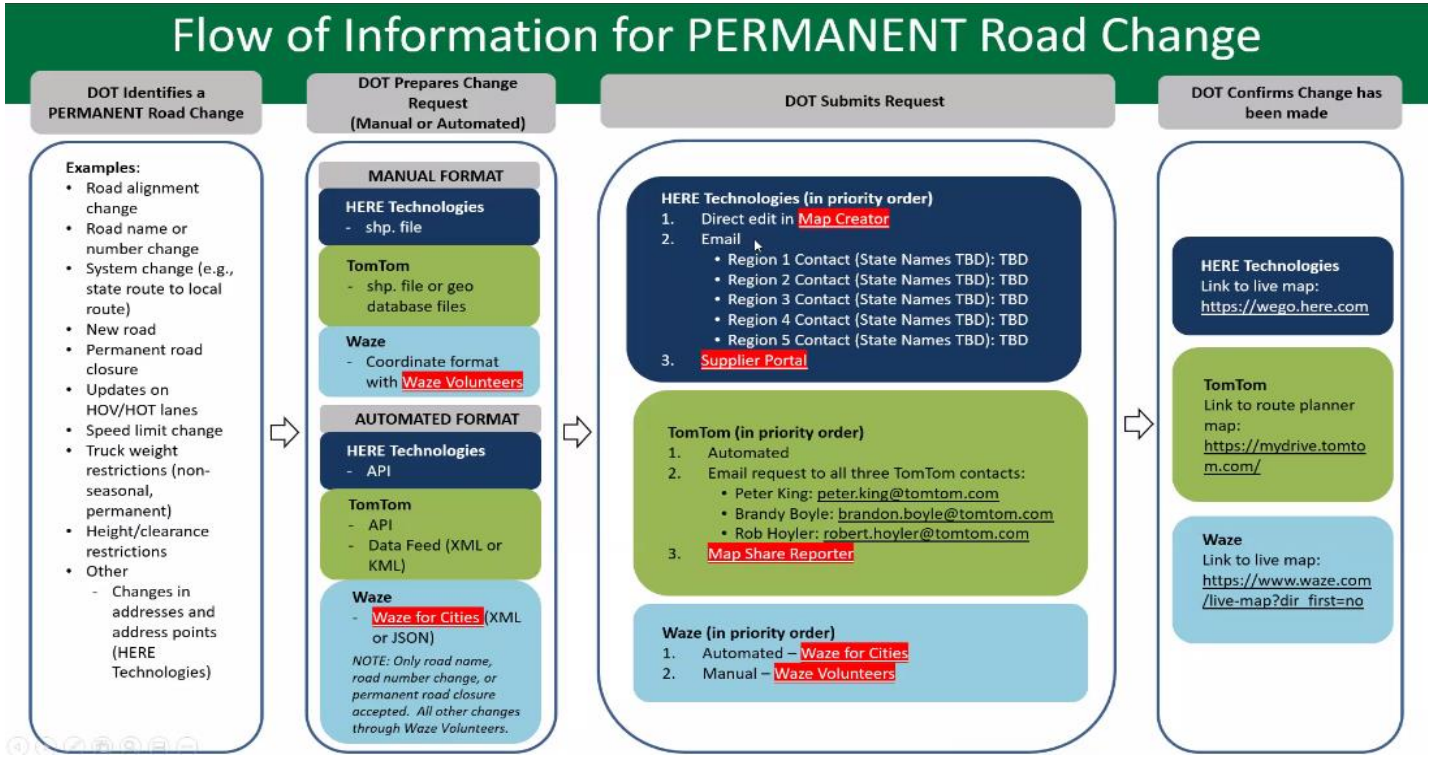




It is the ~~worst~~ (most challenging) of times ….

a. Just for permanent mapping changes – non-real time

Each maps change requires interaction with each Map Company tool to update changes



Source: Enterprise Pooled Fund Study

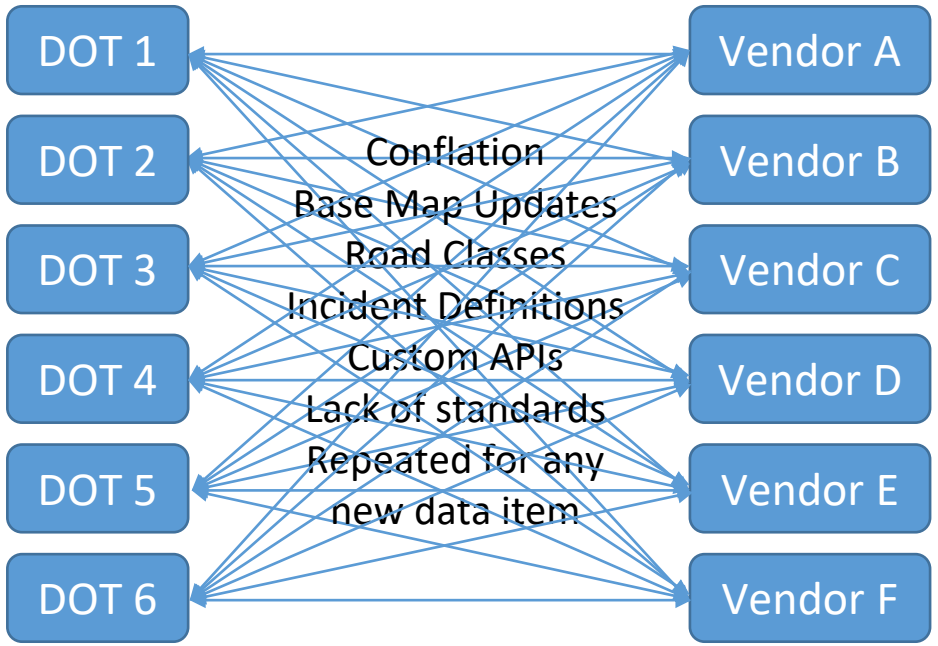
How about b. Work Zones (real-time) c. Incidents (real-time) d. Posted bridges e. ????

Each data set currently requires custom, vendor specific interaction

Common Digital Exchange Formats

- Our mission is to build effective common data exchange formats and sources so that all mapping companies have one location or portal to pick up the needed information- *“everyone drinking from the same fire hose”*

Today’s World



Complexity = Vendors X Data

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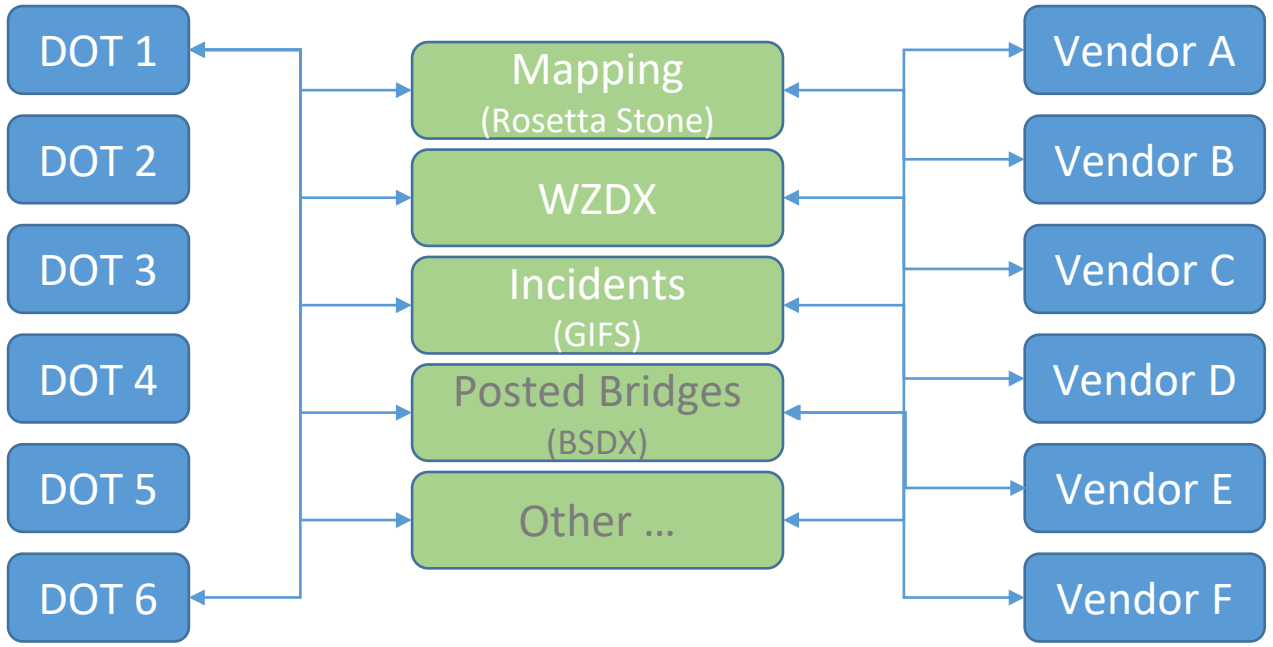
Tomorrow’s World



Complexity = # of Defined Data

Common Digital Exchange Formats

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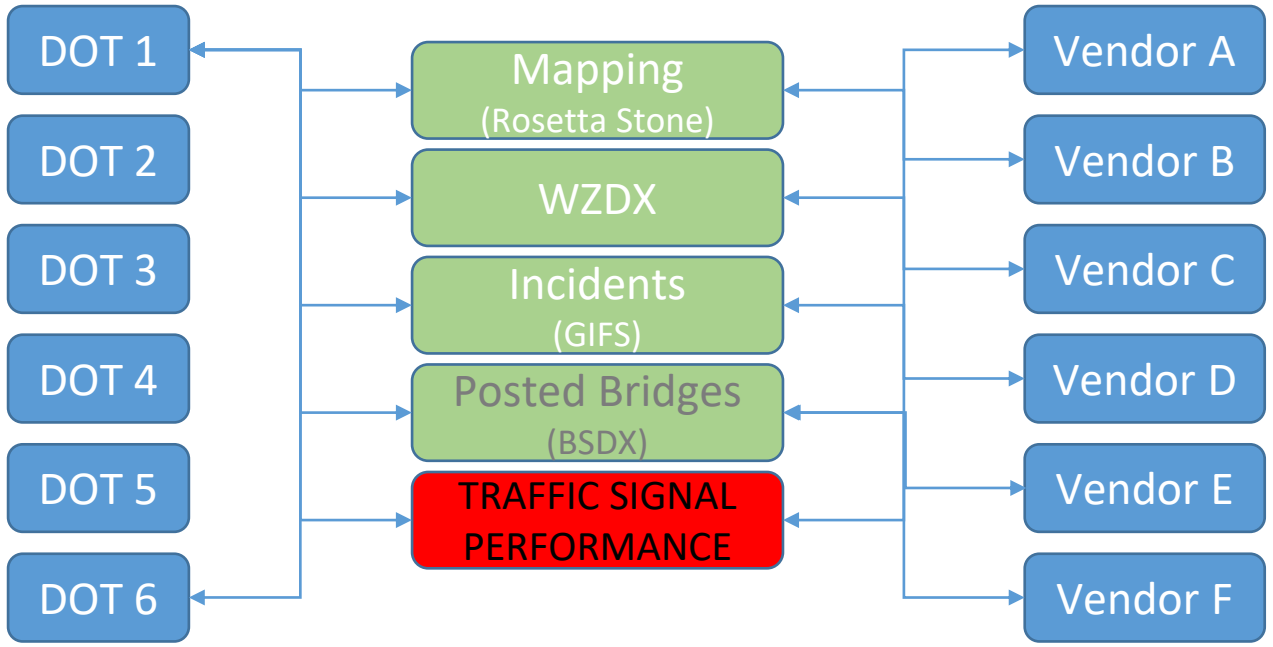
Tomorrow’s World



Complexity = # of Defined Data

Optimal Traffic Monitoring Guide

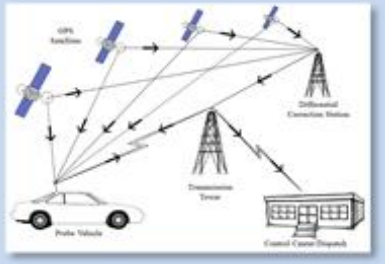
[Link]

Optimal Traffic Monitoring

Conventional Sensors

- Still needed and viable, and will be for the foreseeable future.
- Justified on critical portions of the roadway where ownership and direct control of the data stream trump the value proposition of probe data.
- Needed to continue to sample across a broad array of road classes and types as ground-truth sources for spot speed and counts.
- Data are owned by the agency and can be shared and used without being subject to licensing.

Commercial Probe Data



- Useful for any state DOT and sub-jurisdictions.
- High value proposition, scalability and usefulness for a variety of applications from planning to operations.
- Analytics options are robust and growing, and supported by a number of industry players.
- Key personnel within the DOT should be well-versed in its capabilities and limitations.
- **Useful Applications: Travel Time on Signs, Signal Performance Studies, Smart Work Zones**

Re-identification Data

- Bluetooth and WiFi
- Should be viewed as travel time sensors (as opposed to speed sensors). Such data is needed for travel time or O-D studies.
- Re-identification is typically used as ground truth for validating accuracy of sources of travel time data (such as commercial probe data).
- **Useful Applications: Travel Time on Signs, Travel Time Validation, Signal Performance Studies, Origin-Destination Studies, Smart Work Zones**

HRCD (High-Resolution Controller Data)

- HRCD and the corresponding Automated Traffic Signal Performance Measures (ATSPMs) are in the domain of traffic signal engineers.
- Signal upgrades should include consideration for acquisition and processing of HRCD and ASTPMs.
- **Useful Applications: Signal Performance Studies (ATSPMs)**

High-Resolution Controller Data

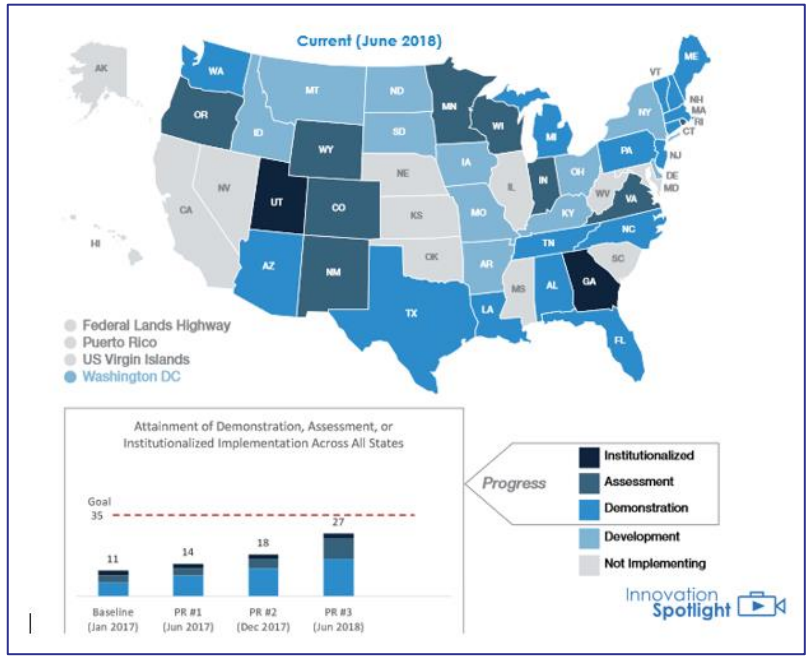
HRCD (High-Resolution Controller Data)

- HRCD and the corresponding Automated Traffic Signal Performance Measures (ATSPMs) are in the domain of traffic signal engineers.
- Signal upgrades should include consideration for acquisition and processing of HRCD and ASTPMs.
- **Useful Applications: Signal Performance Studies (ATSPMs)**

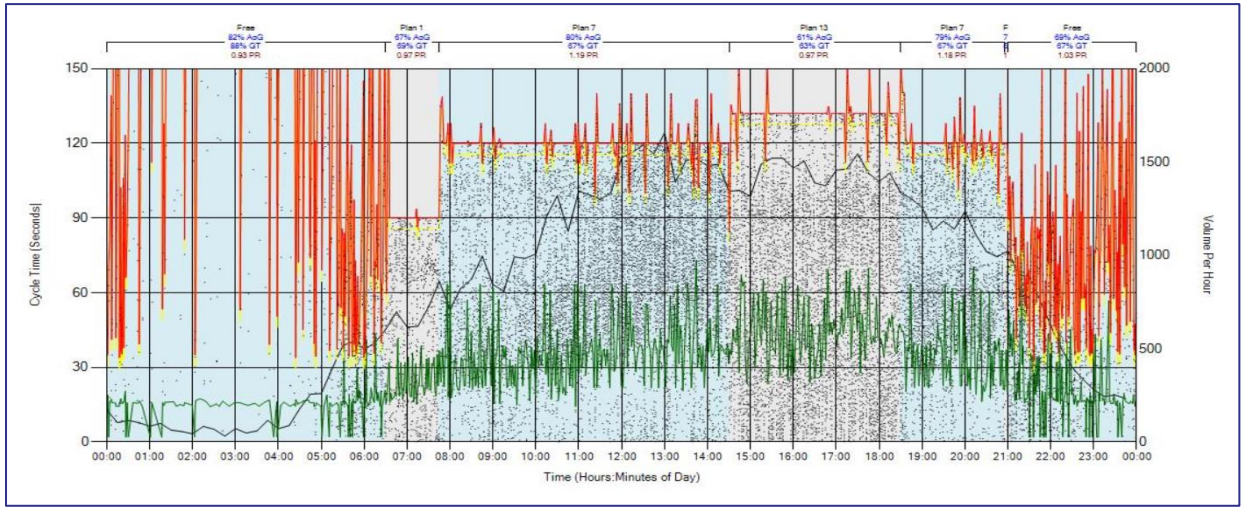
- Unleashes the data in the traffic signal cabinet
  - Signal Phase and Timing
  - All actuation and Sensor data
  - Enabled by low-cost communications, and server-side storage and processing
- Led to development of Automatic Traffic Signal Performance Measures (ATSPMs)
  - High quality, timely traffic signal assessment for management of critical corridors
  - Made data available for other applications
- Leading to ATSPMs from vehicle trajectory data

High-Resolution Controller Data

- Ushered in Automated Traffic Signal Performance Measures (ATSPMs)
  - Major signal controllers adopted & states getting on board

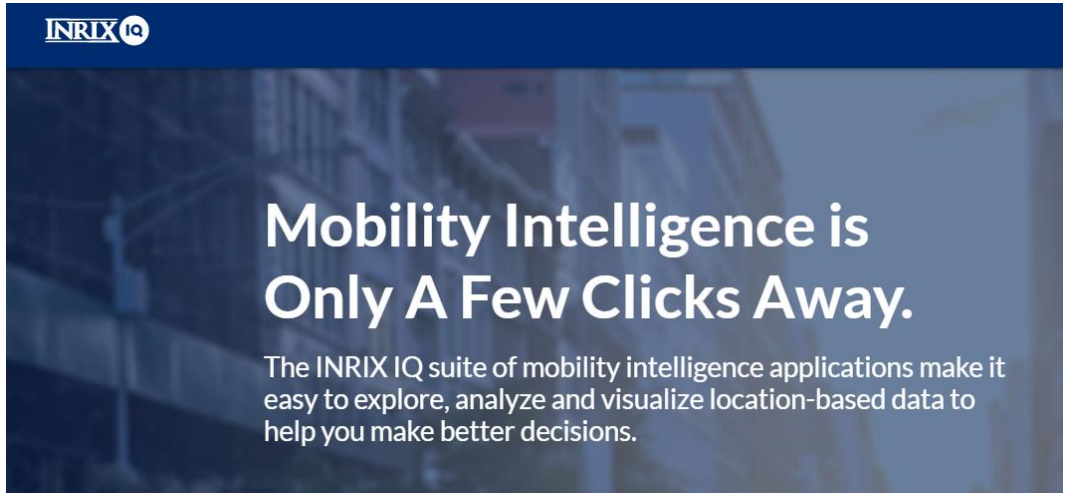


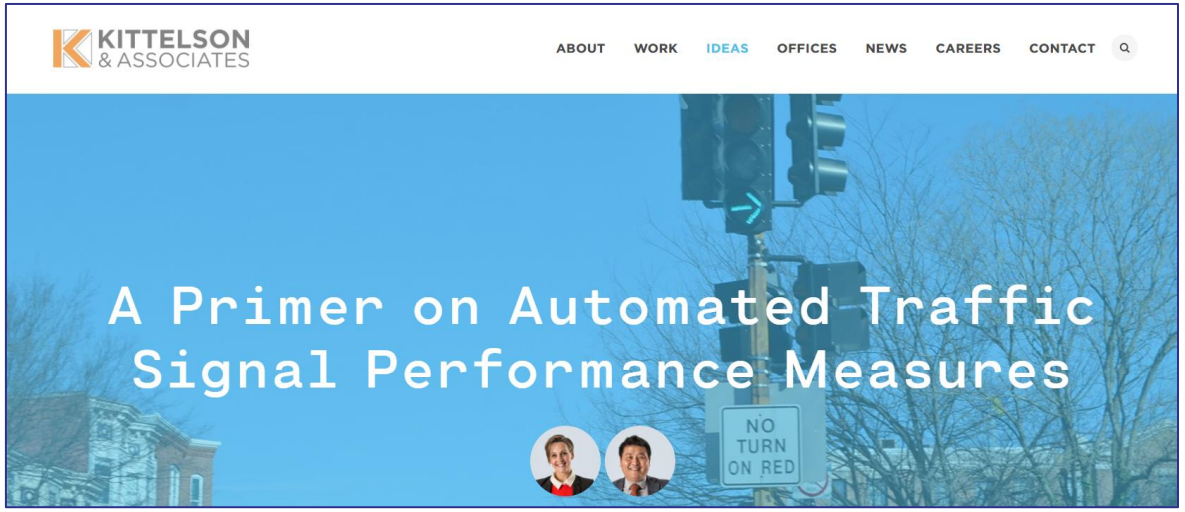
Adoption of Advanced Signal Metrics

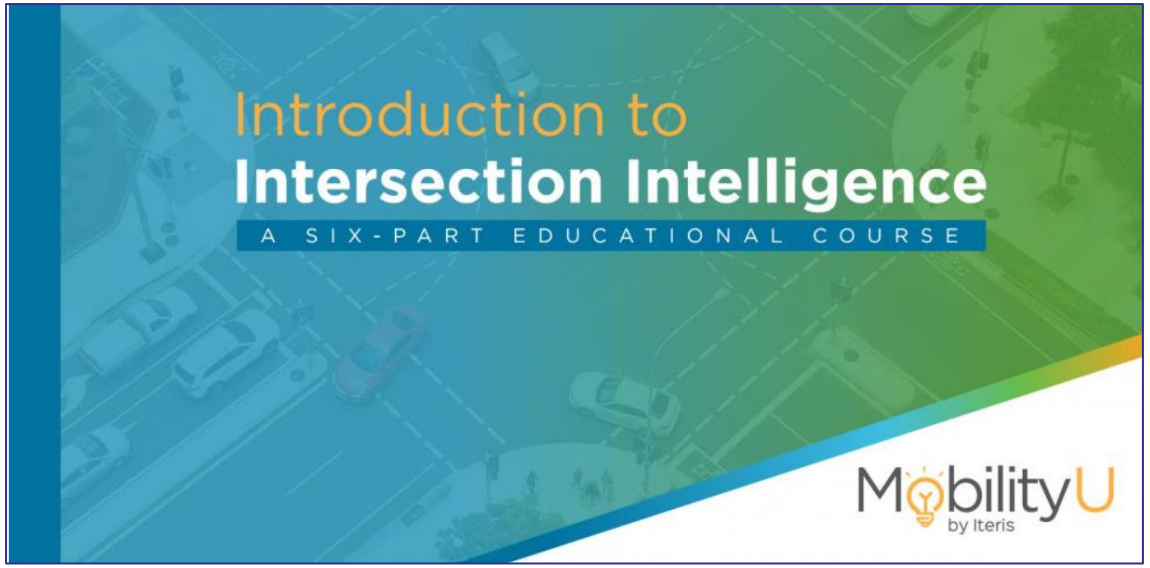


Purdue Coordination Diagram

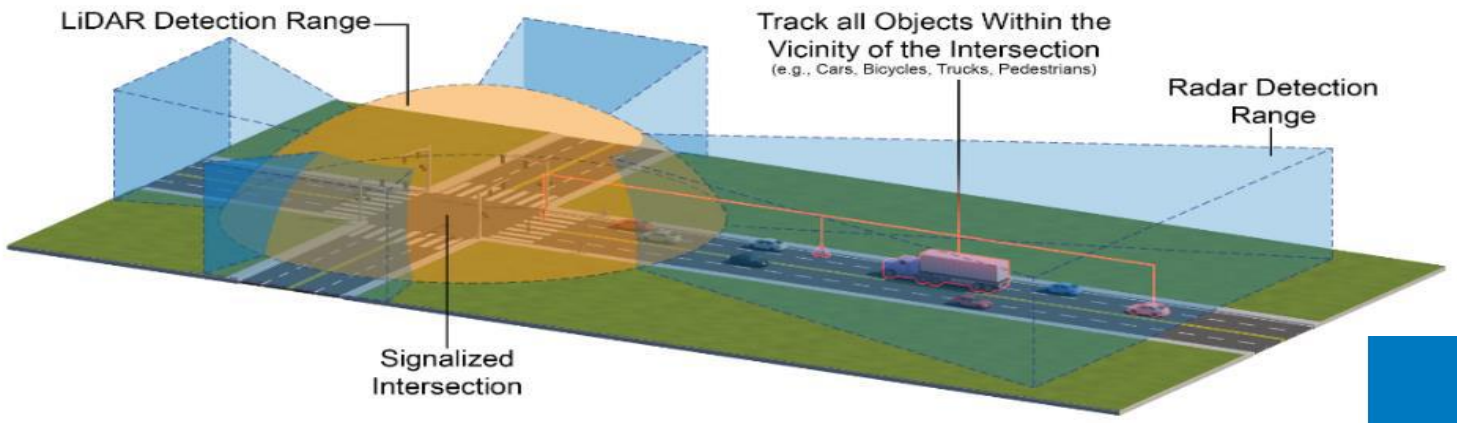
Market Adoption





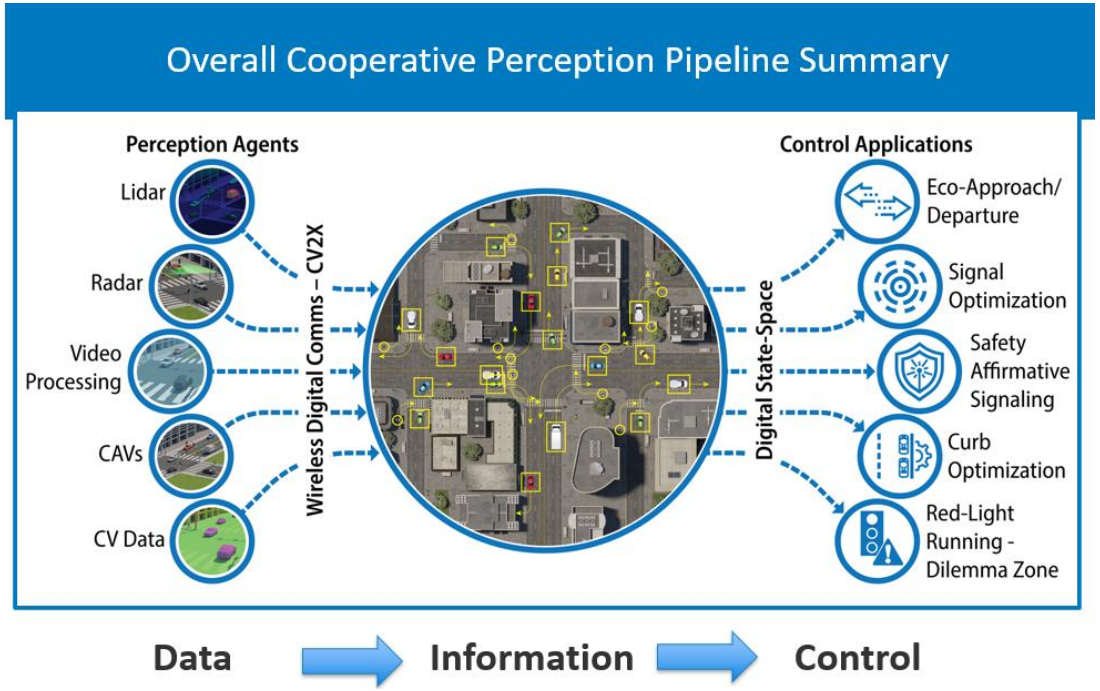


Intersection Control is Getting Even More Complex



- **AV & CV is not lessoning the criticality of traffic control, but greatly increasing the dependence on Intelligent Roadway Infrastructure**

- AV sensors (Radars, LiDARs, and Video) are being deployed in numbers pilots and proof of concepts
- Data fused and filtered at the roadside is communicating to vehicle, pedestrians, and micro-mobility
- Signals are called upon not only to coordinate traffic but to provide 'safety affirmative signaling'
- Enables not only safe passage of vehicles, but all road users and energy savings



Questions?

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The Eastern Transportation Coalition
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seyoung@tetcoalition.org

Sustainable Signal Technology: A Virginia Experience

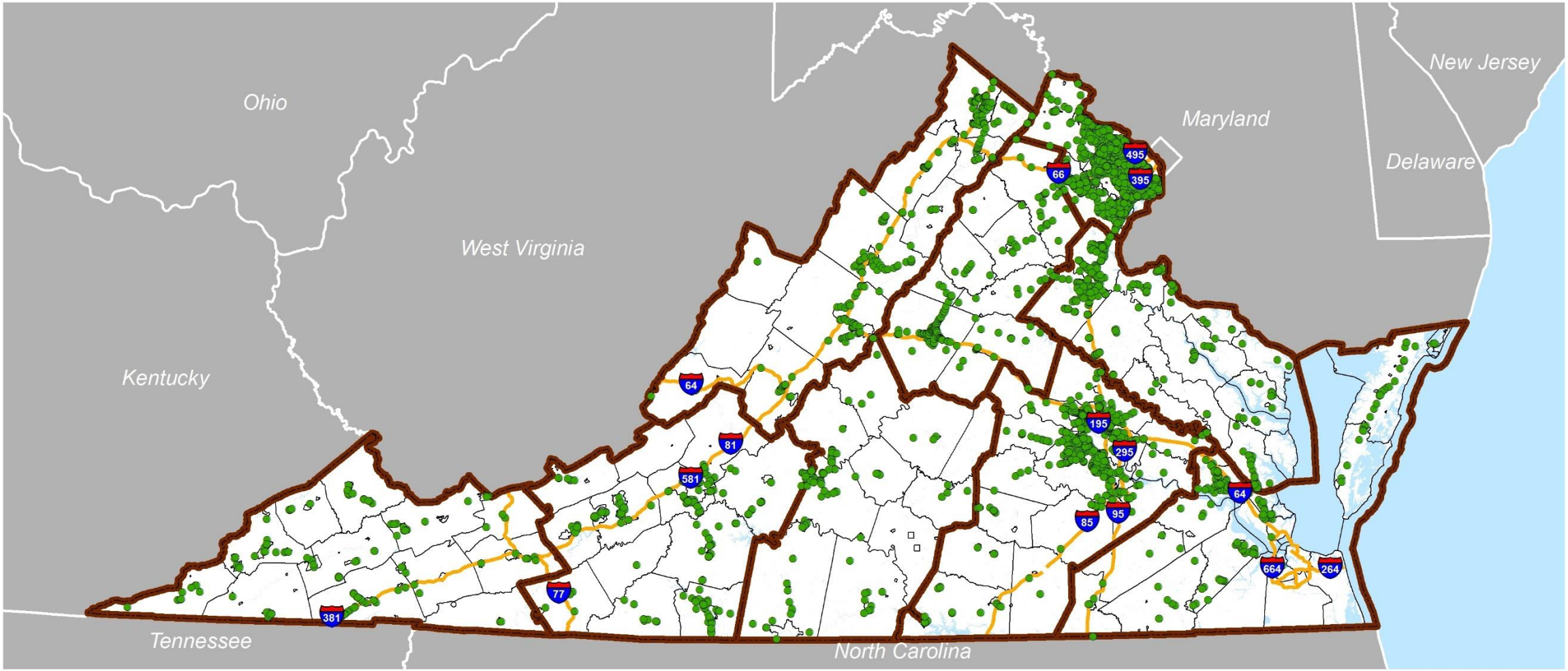
Michael Clements, PE, Signal & Arterial Systems Program Manager
Virginia DOT

SUSTAINABLE SIGNAL TECHNOLOGY:
A VIRGINIA EXPERIENCE

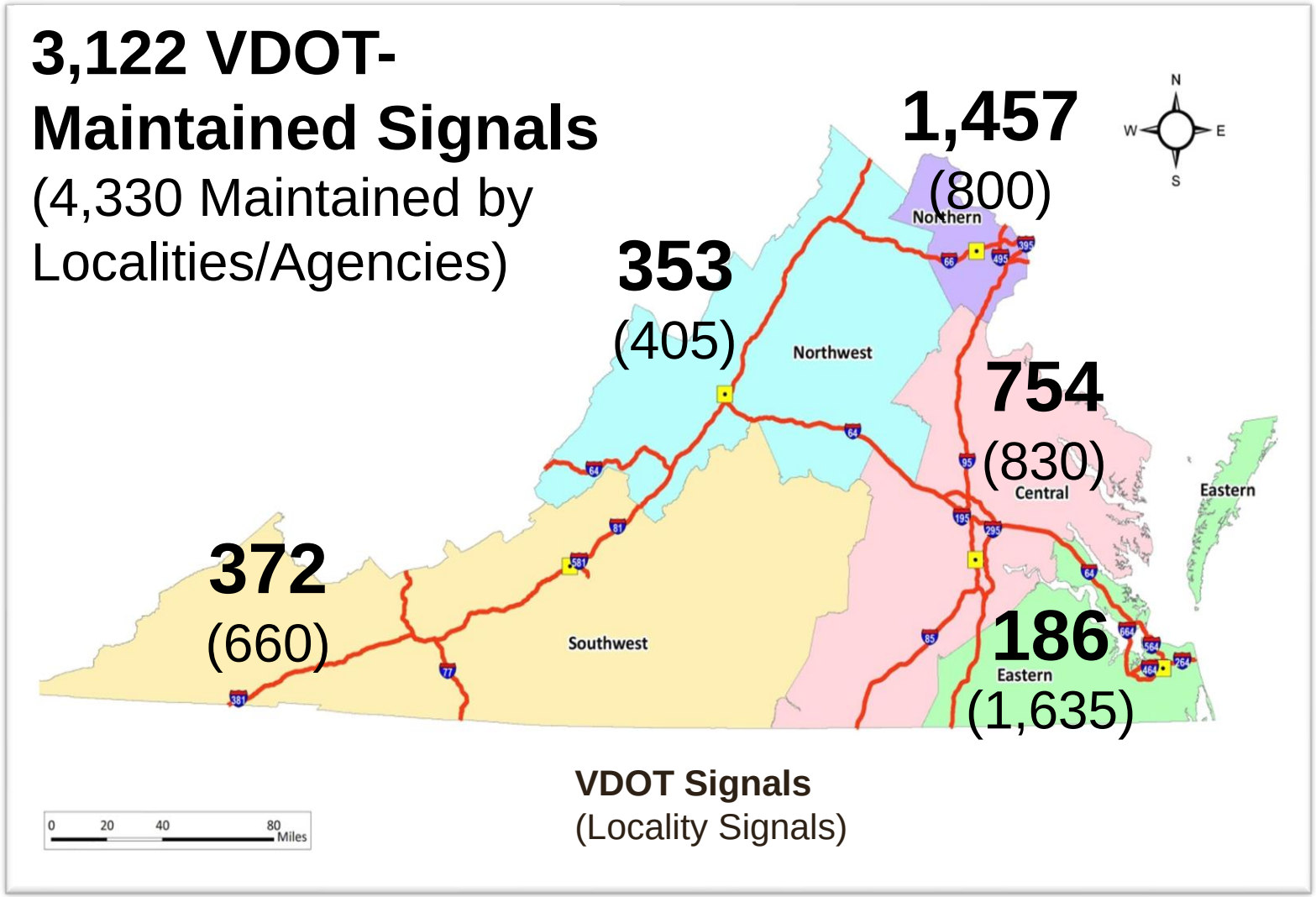
Michael Clements, P.E.

November 4, 2021

VDOT Traffic Signal Locations



Signals in Virginia

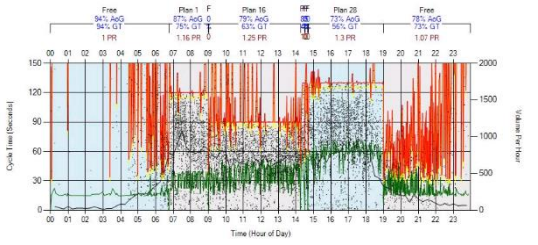


Technology Gap in Traffic Signal Systems

vs.

Signal & Arterial System Technology

Communications → **ATC** Controller Migration → **ATSPM** Performance Metrics → **CSS** Central Signal System



CYBERSECURITY

Transportation Communications Upgrades

Progress:

- $50 M in in needs identified
- Step 1: Upgrade all signals to high speed communications (75% complete)
- Step 2: Move away from leased lines and onto VDOT fiber and Resource Sharing Fiber
- New Resource Sharing agreements frequently

Traffic Signal Controller Upgrades

(back of ATC)

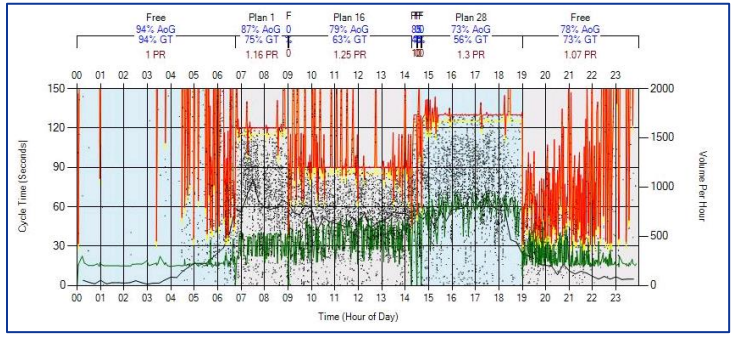
NEMA version

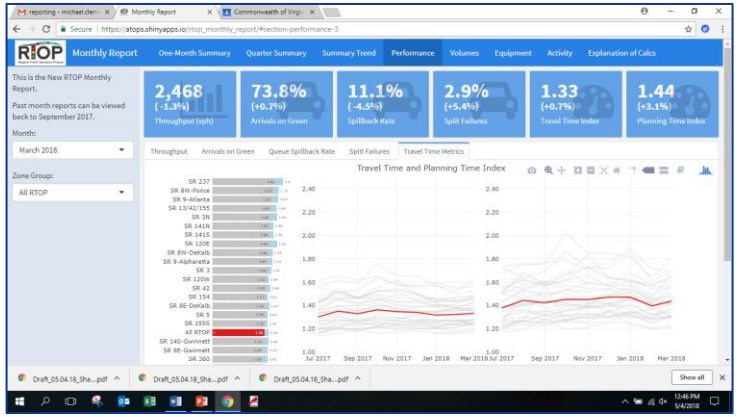
Advanced Transportation Controller (ATC):

- Open Architecture
- Modular
- Multi-Task / Application
- Can grow with technology
- Can be used with legacy signal cabinet environment
- 2,750 (88%) intersections operating with ATCs and the D4 firmware

Performance Metrics Technology

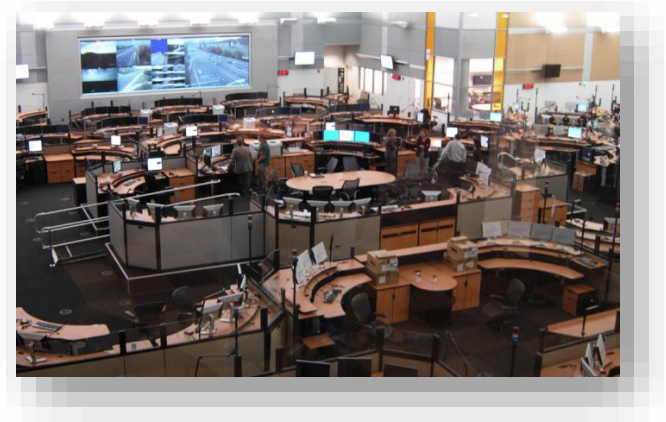
Progress:





- **Data driven support system**
  - Individual intersection performance
  - Proactive signal optimization & maintenance
- **Dashboard for reporting**
  - RTOP (SigOps) Pilot
  - Corridor level performance
- **120+ signals with ATSPM**
- **Moving to cloud-based storage**

Central Signal System (CSS)



Progress:

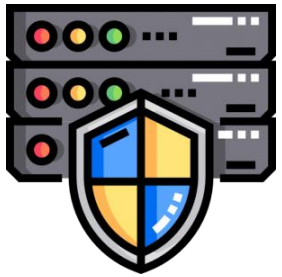
- Statewide Platform
- Remote management & control
- Monitoring status & health
- Real-time reporting
- Moving to cloud-based and away from on-premise servers
- 1,880 (60%) signals operating “live” in the KITS central signal system

Signals & Arterials Technology Advancements

SPaT Data

(Signal Phasing &Timing)

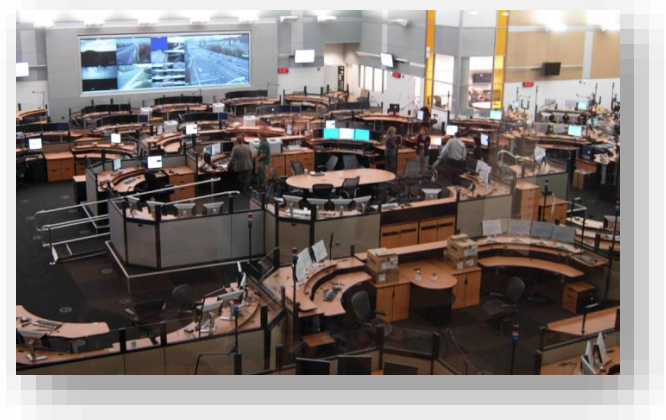
Cybersecurity



Progress:

- OT Security Standards/Policies
- Cabinet Hardening
- VPN & Encryption
- Identity Access Control
- Monitoring

Statewide Signal System Technology Upgrades



Benefits:

- Real-time Monitoring
- Real-time Response & Operations
- Real-time Data Management
  - Connected Vehicle Capabilities
  - Traveler Information Systems (TIS)
- Single Platform Statewide
- Interoperability with Localities

Locality Opportunities

- **Contract Availability for controllers/firmware/CSS**
  - Provides consistent & interoperable equipment
  - Reduces time for procurement
  - Benefits from VDOT negotiated pricing

- **Resource sharing opportunities**
  - Communications
  - Documented guidance & practices, training, technical knowledge, and lessons learned
- **Cross Jurisdiction Control (MOU development)**
- **Assistance with funding opportunities**

Maintenance

Current:

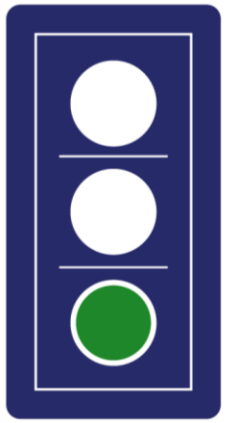
- Communications Maintenance (contract)
- ITS Maintenance (contract)
- Signal Maintenance (in-house / contract)

Future:

- Considering Universal Maintenance – communications/ITS/Signals (contract and in-house)
- Development of skillsets to maintain multiple technologies

QUESTIONS?

VDOT'S SIGNAL & ARTERIAL SYSTEMS PROGRAM



For More Information Contact:
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The Evolution of GDOT Traffic Signals: From Regional Traffic Operations to SigOps

Andrew Heath, PE, State Traffic Engineer
Georgia DOT

GDOT: From RTOP to SigOps

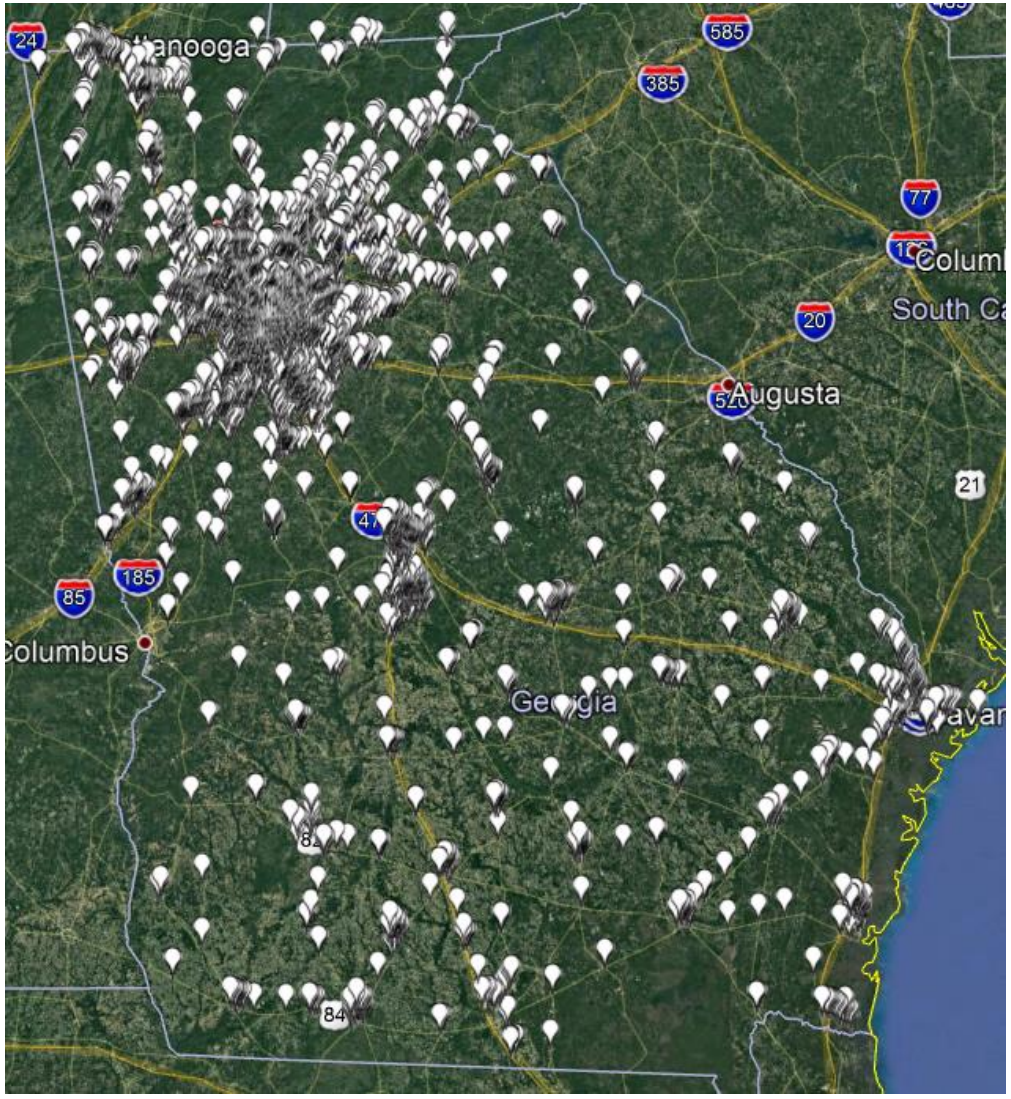
Andrew J. Heath, P.E., State Traffic Engineer

TETC Webinar

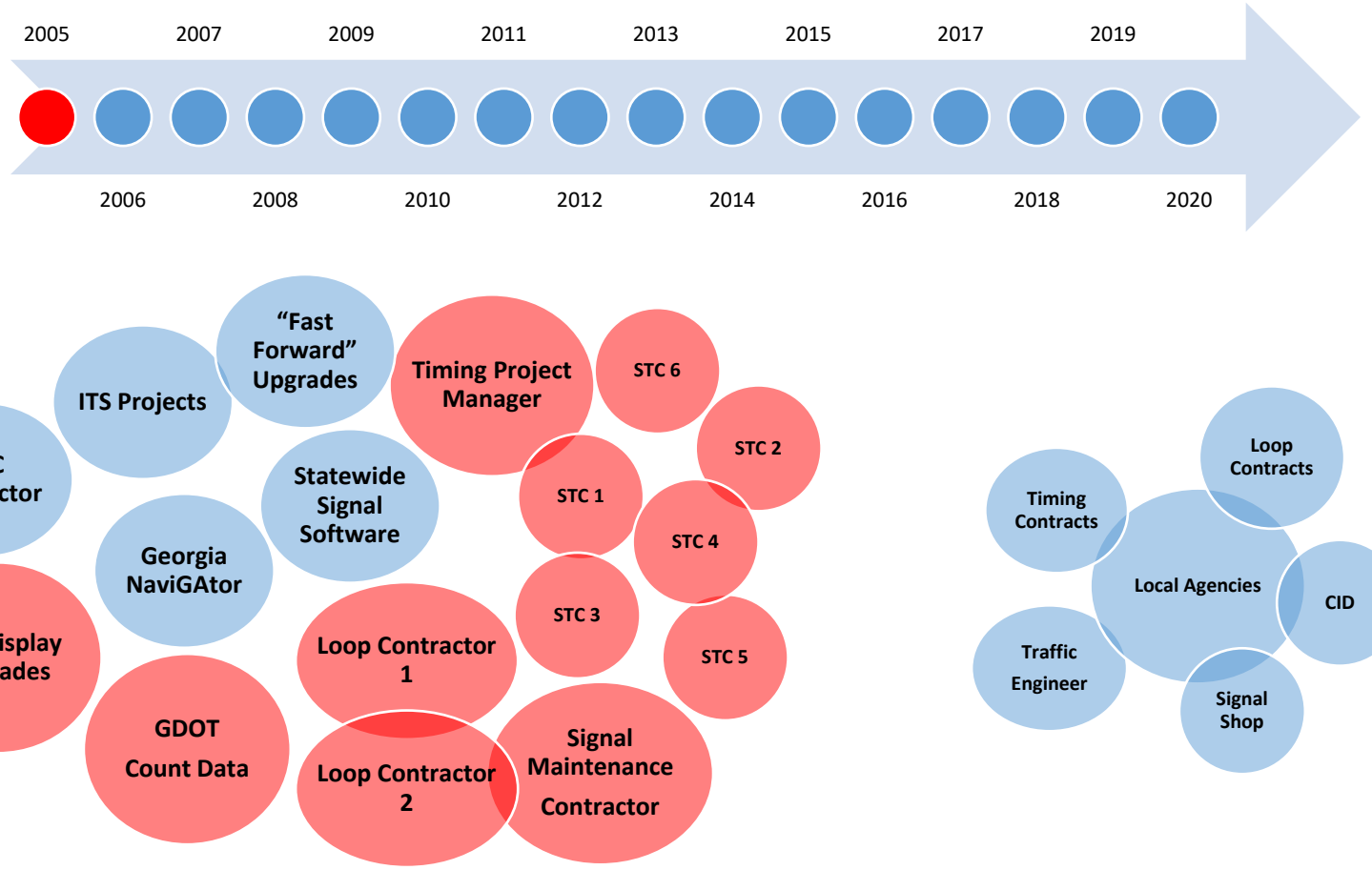
11/4/21

Traffic Signals in Georgia

- 9,000+ signals statewide
- 4,500 signals operated and maintained by GDOT
- Over 100 local agencies



16 Years Ago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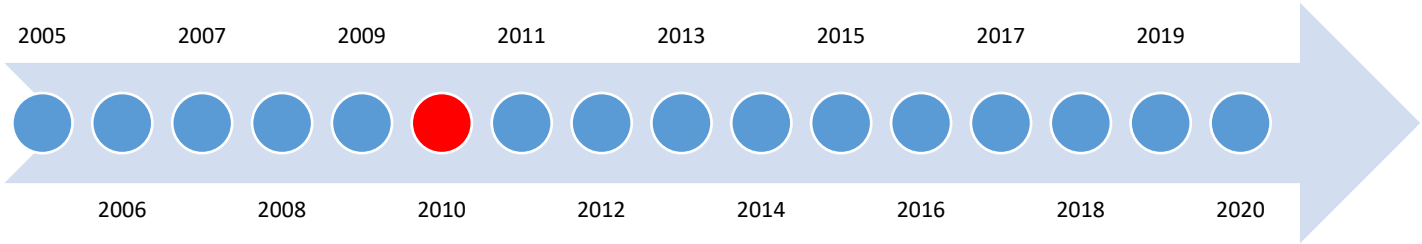
2020
"Fast Forward" Upgrades
Timing Project Manager
STC 6
ITS Projects
STC 2
ATC Contractor
Statewide Signal Software
STC 1
STC 4
Georgia NaviGAtor
STC 3
LED Display Upgrades
Loop Contractor 1
STC 5
GDOT Count Data
Loop Contractor 2
Signal Maintenance Contractor
Loop Contracts
Timing Contracts
Local Agencies
CID
Traffic Engineer
Signal Shop



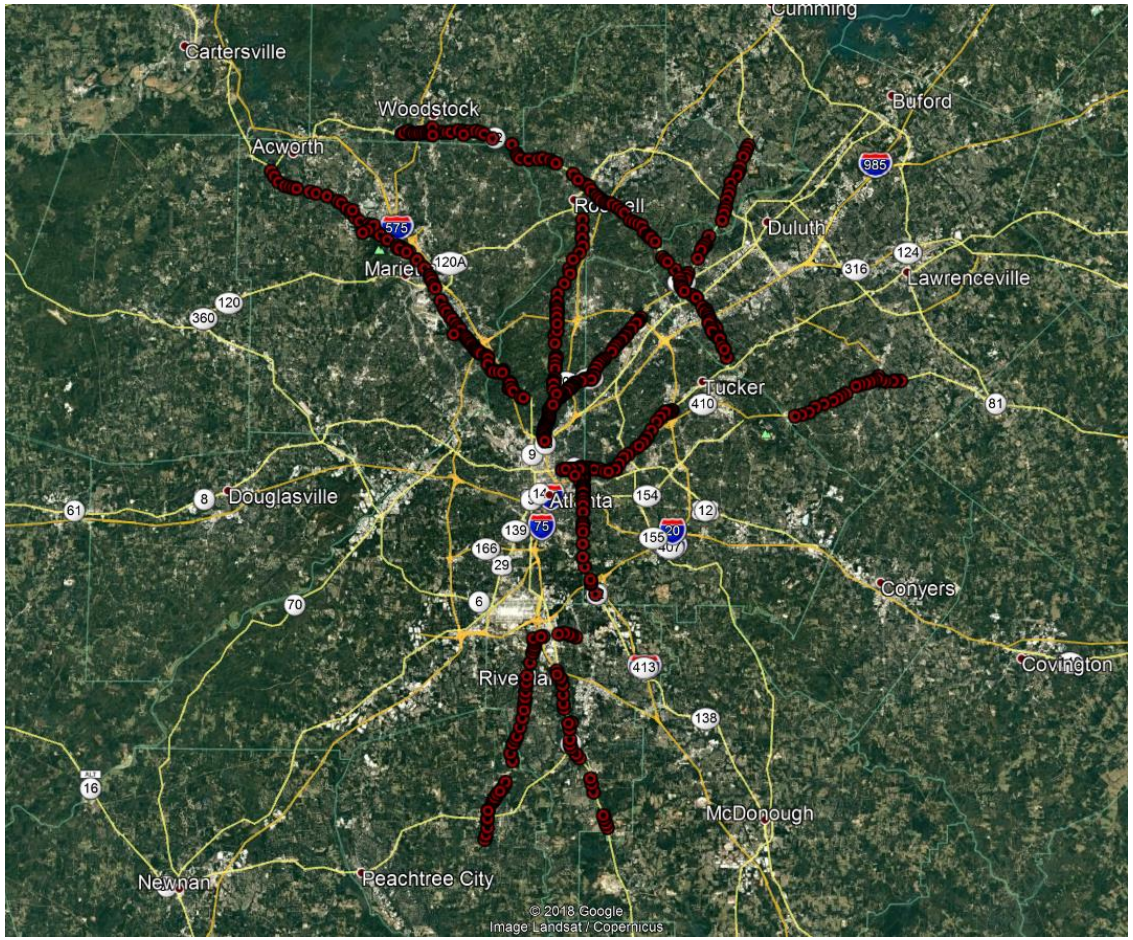
2010

RTOP Begins

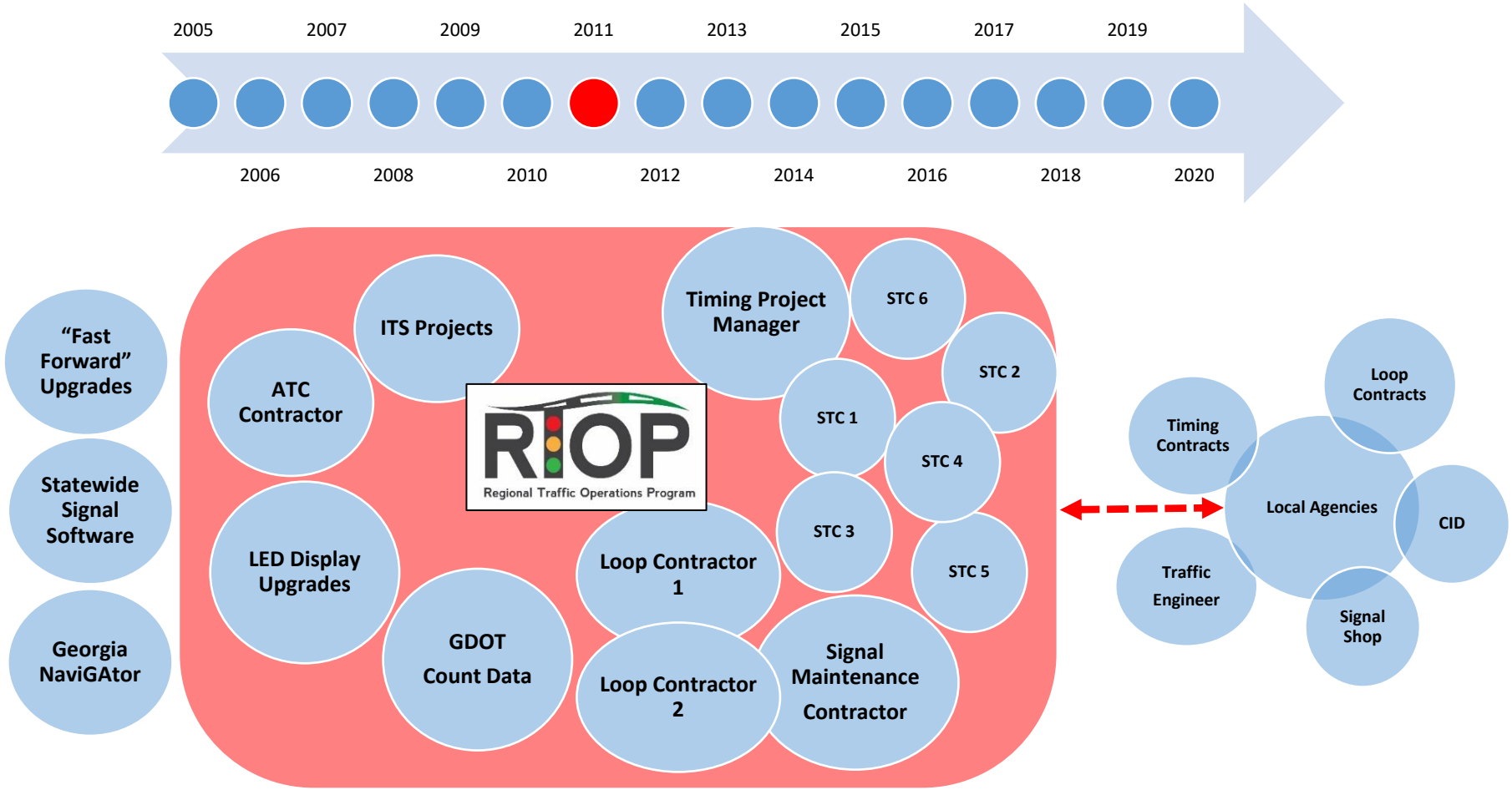
- RTOP1
- 10 corridors
- 396 intersections

Non RTOP:

- Statewide Retiming Contracts
- Metro Retiming Contracts



10 Years Ago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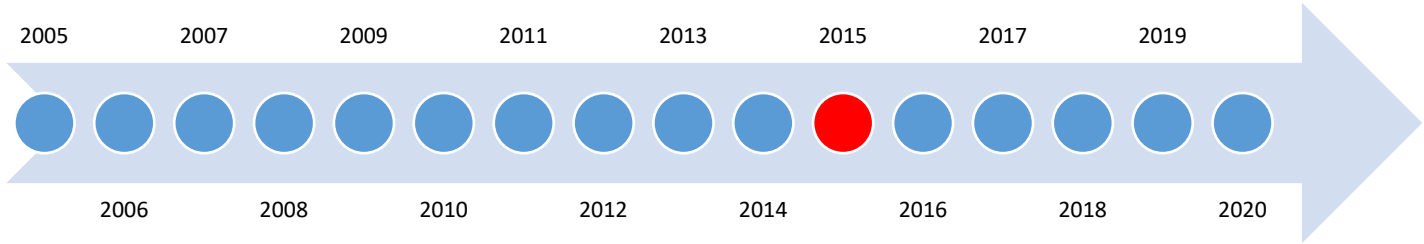


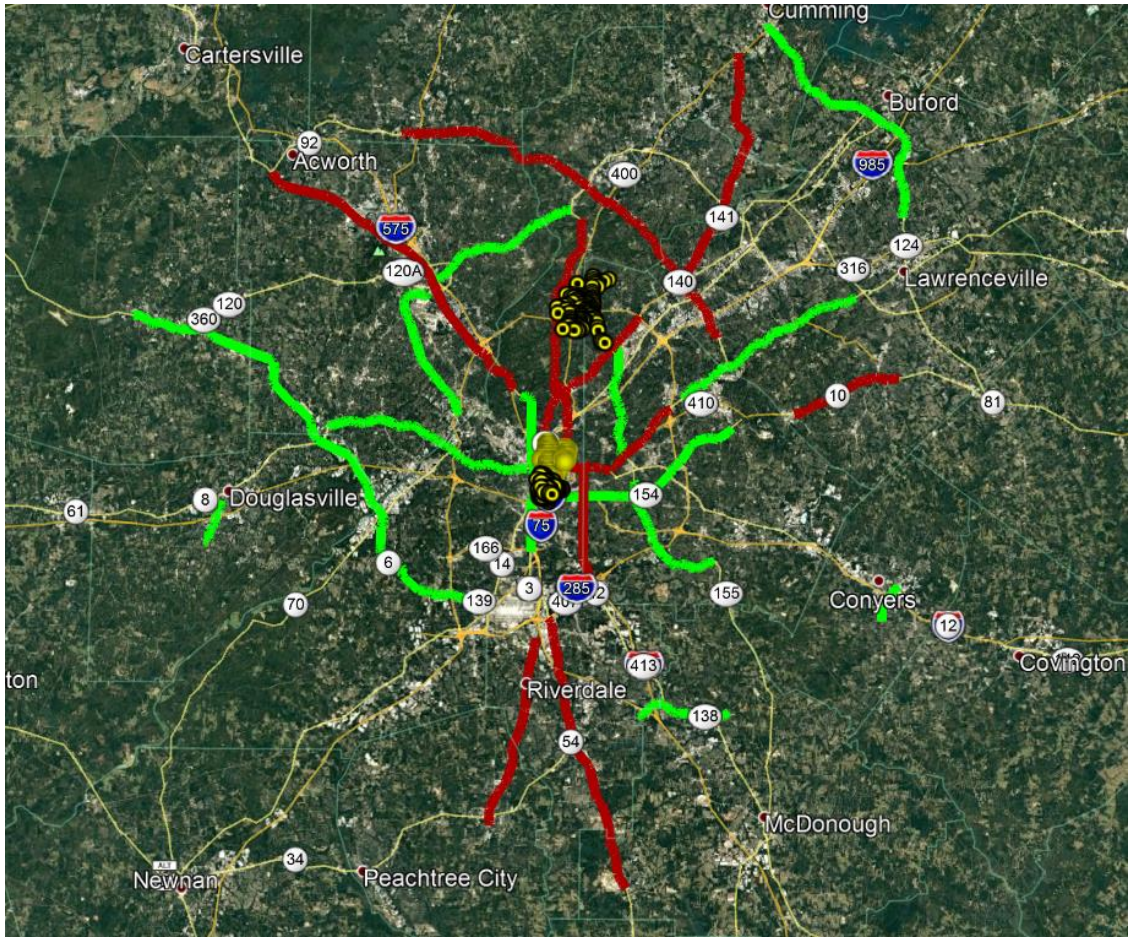
2015

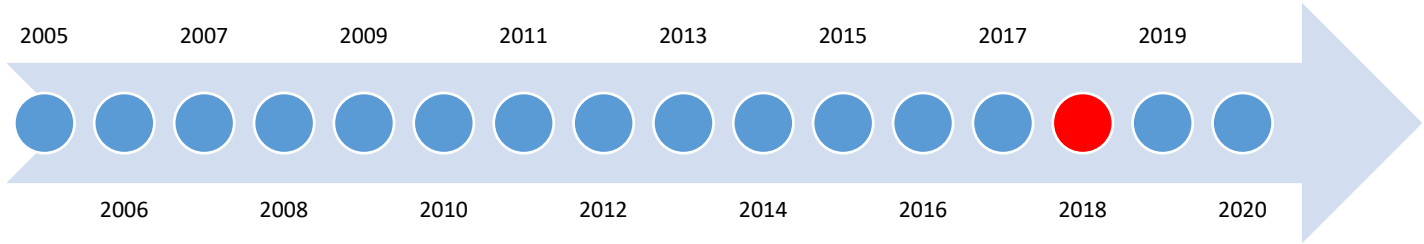
Expansion

- 1100+ intersections
  - RTOP 1 (red) – 604
  - RTOP 2 (2013) (green) – 495
  - DTOP - downtown
  - MTOP - midtown
  - PTOP - perimeter

Non-RTOP:

- Statewide Retiming Contracts
- Metro Retiming Contracts

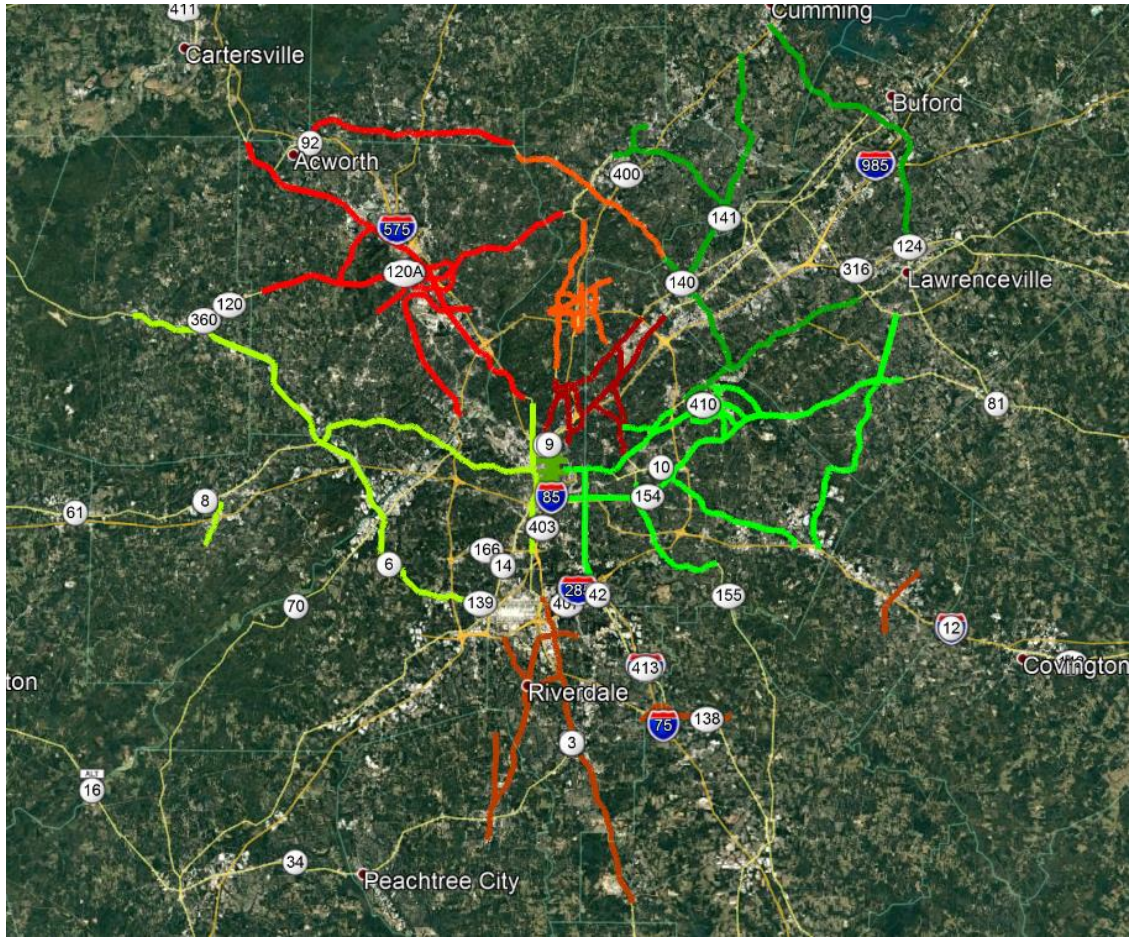


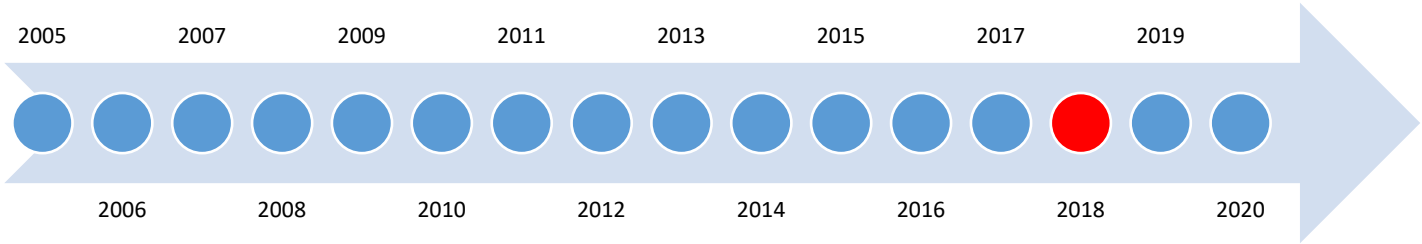


2018

Zones

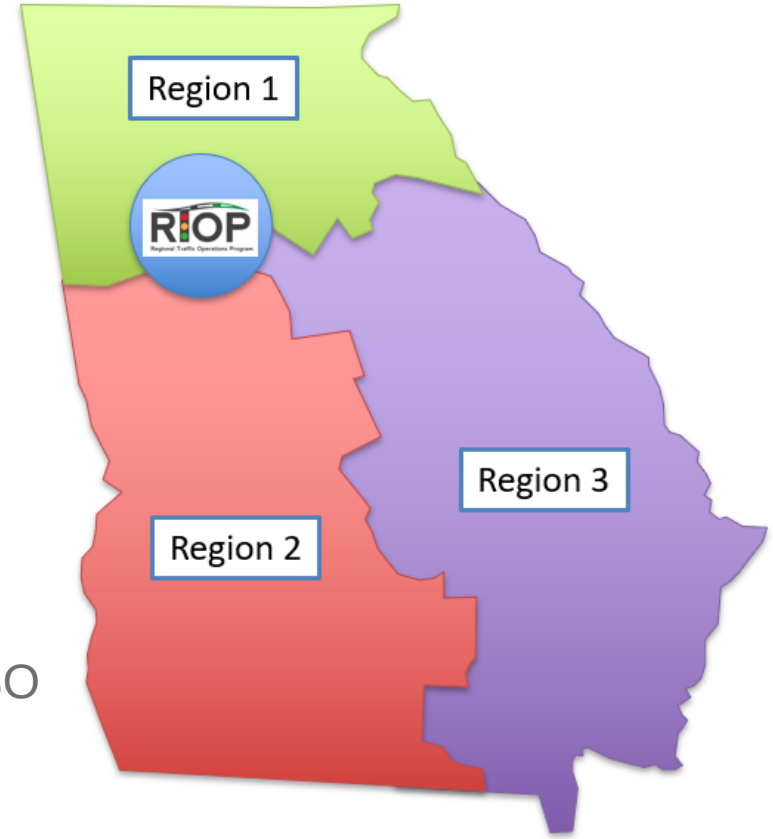
- 1700+ intersections
- RTOP 1 (reds/oranges)
  - PTOP
- RTOP 2 (greens/yellows)
  - DTOP
  - MTOP





Statewide

- Expanded dedicated resources
- Increased support for local jurisdictions
- Established framework of large scale proactive traffic signal management
- Adopted a regional approach
- Contracts titled as **R**egional **T**raffic **S**ignal **O**perations => RTSO



Concept of Operations

Mission Statement

To proactively manage and maintain traffic signals statewide by leveraging existing and emerging technology.

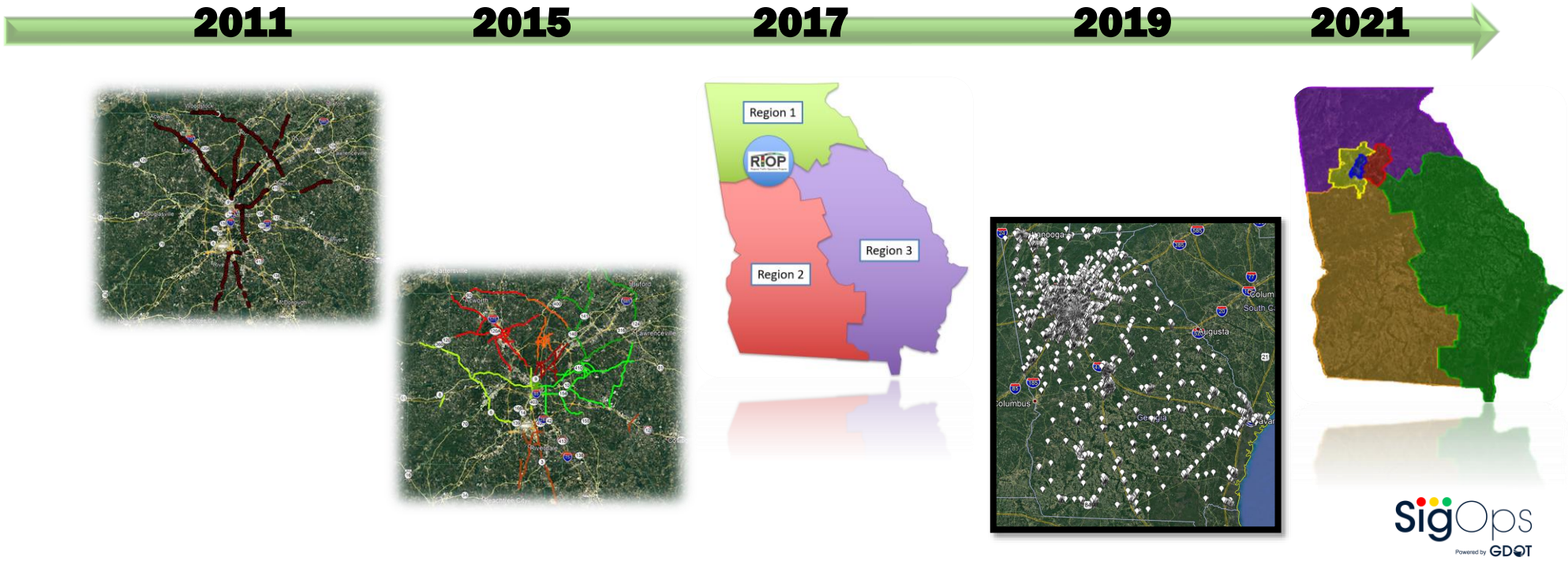
Concept of Operations

Goals:

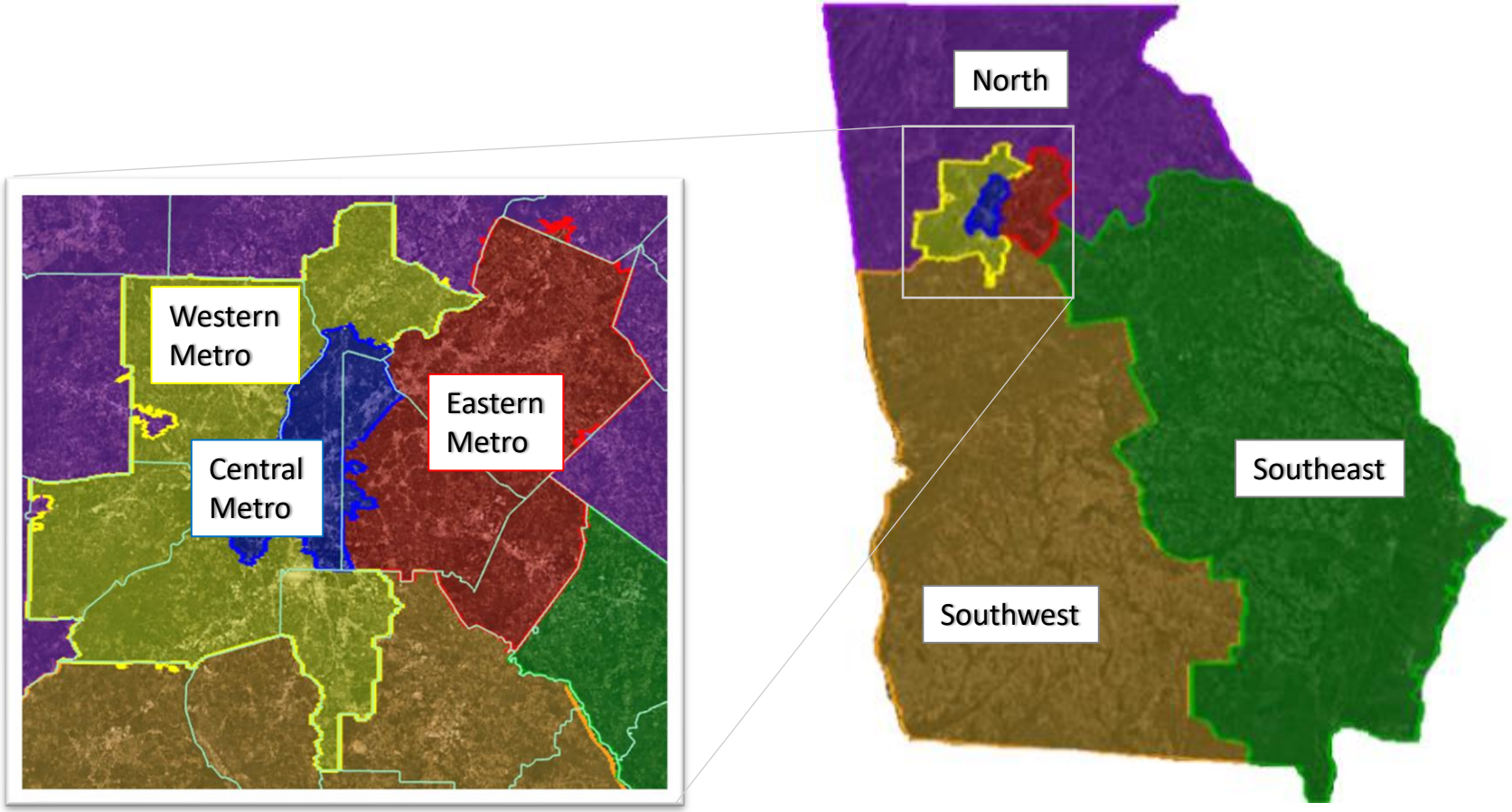
1. To provide a **safe, efficient and well-maintained** statewide traffic signal system
2. To provide a **flexible, accountable, scalable, and transparent** traffic signal program
3. To **promote collaboration and cooperation** between statewide, regional and local partners
4. To facilitate informed **data driven decision making** through technology
5. To **efficiently manage and allocate** financial and contract resources
6. To provide a **high level of customer satisfaction** for traffic signal operations and maintenance


Signal Operations
Signal Performance Metrics
Signal Maintenance
Signal Specifications
Signal Design
Signal Upgrade Program
Signal Communications
Innovation
SigOps
Powered by GDOT

A Decade of Active Management Signal Operations in Georgia



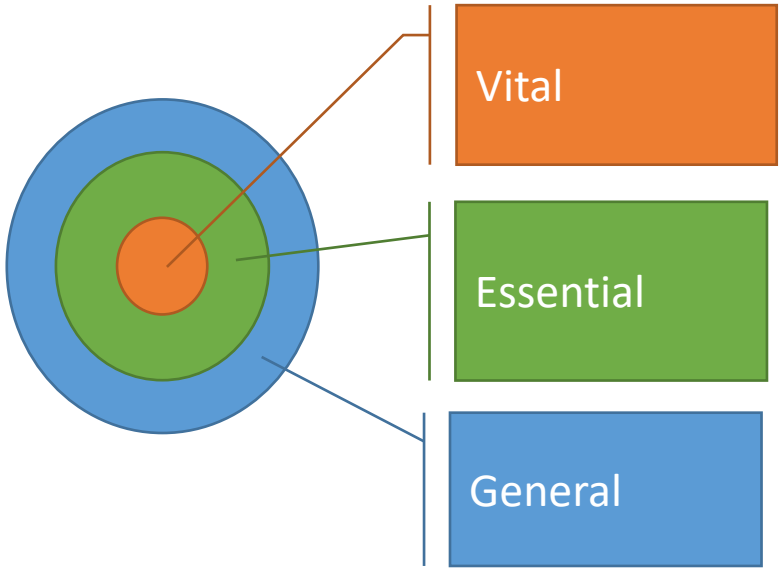
SigOps Regions



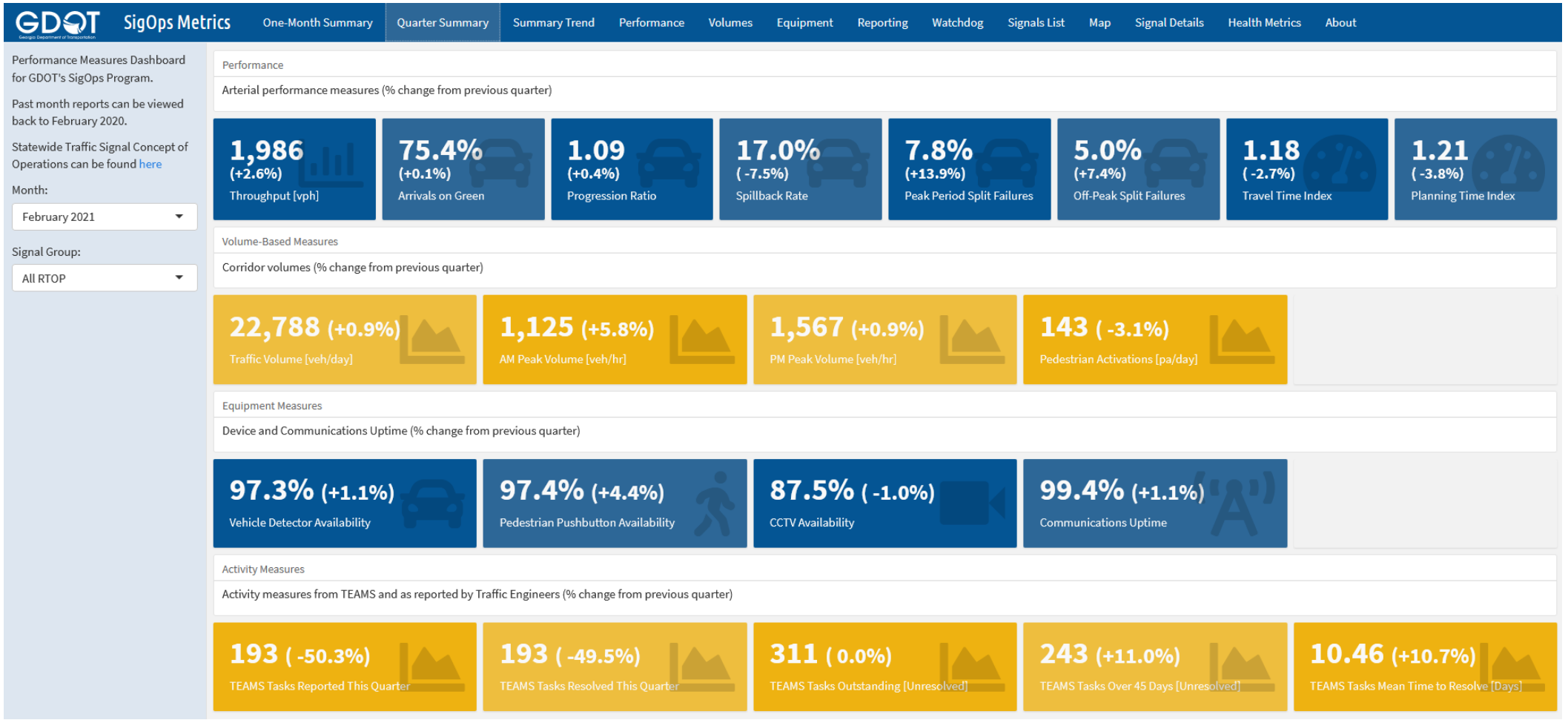
Shift to Regional Approach

Active/Proactive Management for all signals

- **All signals will be remotely monitored on a automated basis**
- Levels define remote monitoring and field presence required
- Signals can shift between levels



SigOps Metrics



www.sigopsmetrics.com

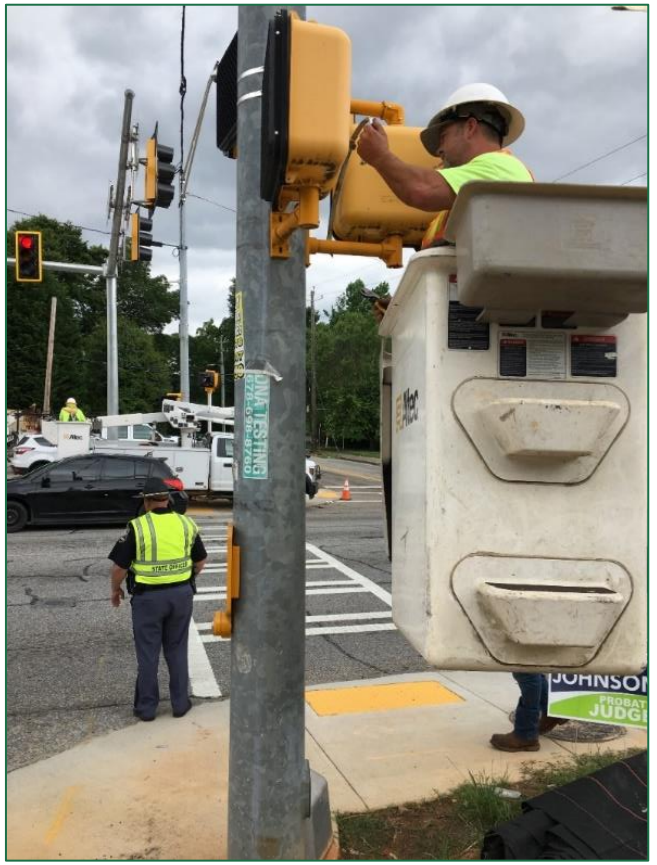
SigOps Metrics – Health Metrics

Operations	Maintenance	Safety
• Platoon Ratio • Pedestrian Delay • Split Failures • Travel Time Index • Buffer Index	• Detection Uptime • Pedestrian Detection Uptime • Communications Uptime • CCTV Uptime • Number of Flash Incidents	• Crash Rate Index • KABCO Crash Severity Index • High Speed Index • Pedestrian Injury Exposure Index

Traffic Signal Maintenance Group

Responsibilities:

- Traffic Signal Specifications
- Qualified Products List
- Warehouse Contract
- On-Call Maintenance Contract



On-Call Maintenance Contract

Pre-defined prices based on:

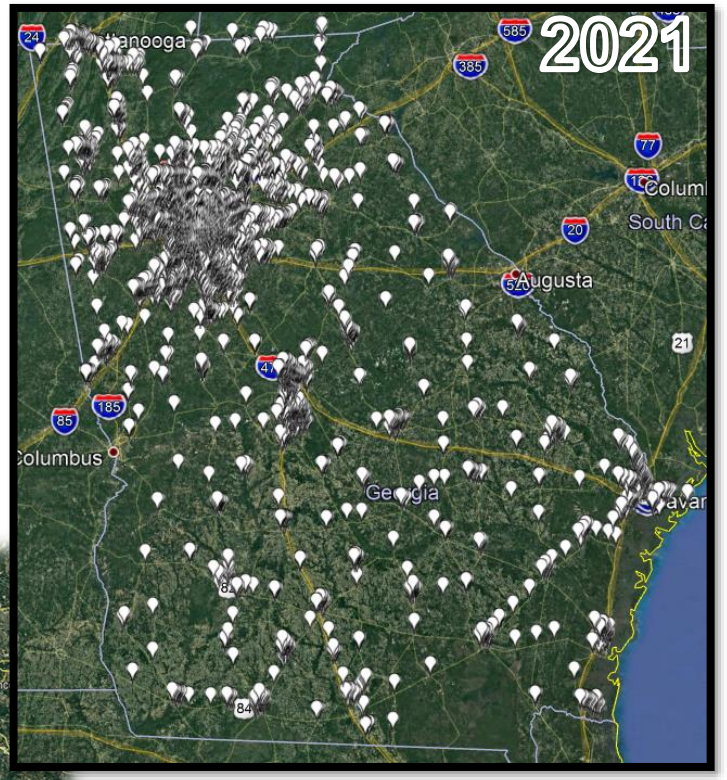
- Location – state divided into different regions
- Time frame to complete (24 hr, 30 day, 120+ day)
- Tasks

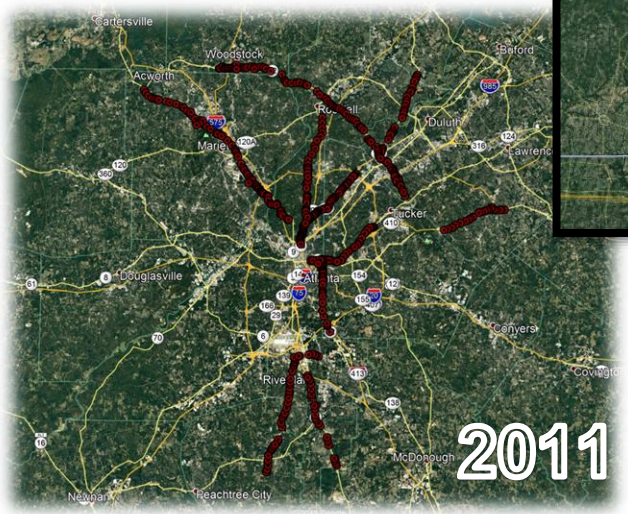
Limitations:

- Cannot add pavement
- Must work within existing ROW

Changes

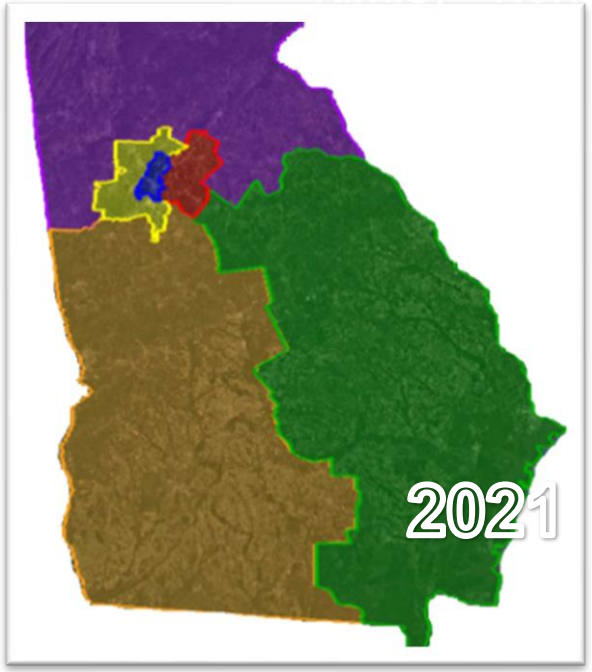
Scale:	2011 → 2021	
Actively Managed Intersections	396	8000+
Boundaries	Metro Atlanta	Statewide
Consultant Teams under Contract	1	8
Dedicated Funding	$8 million	$30 million

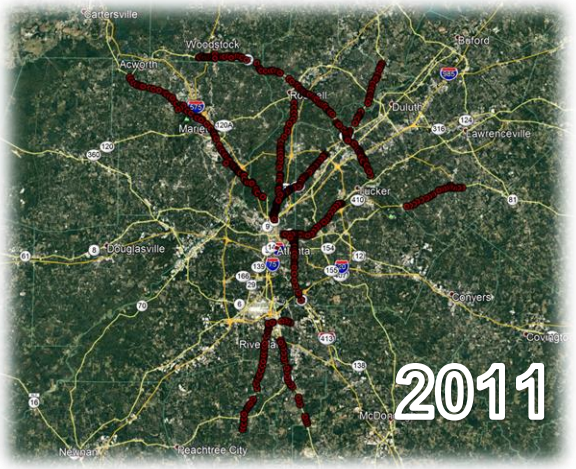




Changes

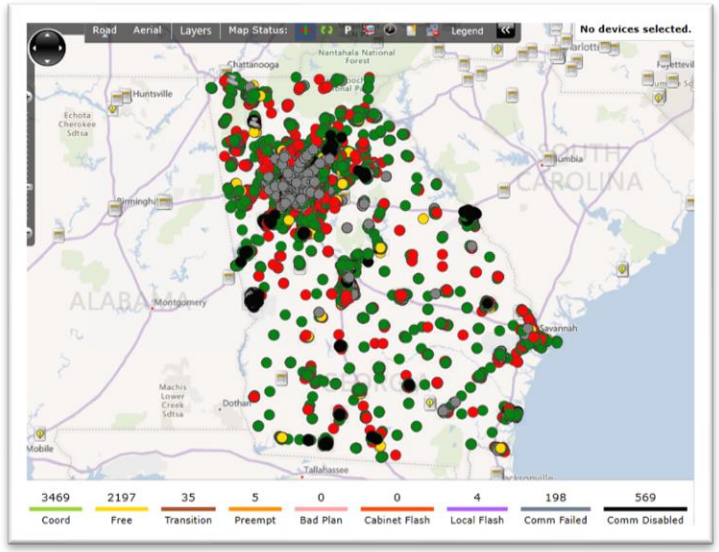
Approach/Vision:	2010 → 2021	
Model	Corridor Based	Region Based
Priority/Mission Statement	Increase travel throughput	Proactive management
Monitoring	Field	Central & Remote

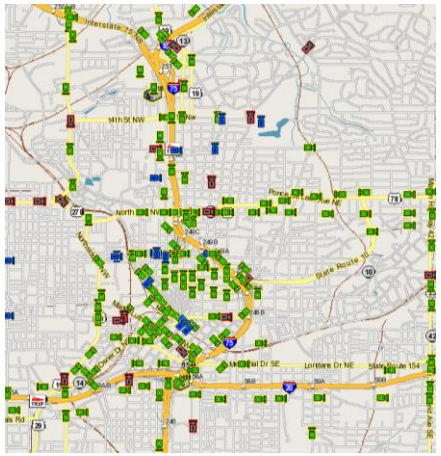


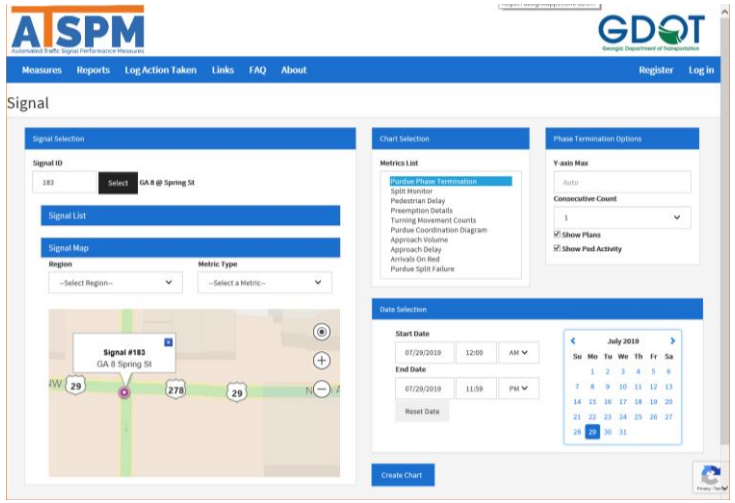


Changes

Technology	2010	2021
Communication to Central Server	0	6700
Arterial Traffic Monitoring Cameras	0	1000+
High Resolution Controller Data	0	7000+
Performance Metrics	Travel Runs	ATSPM







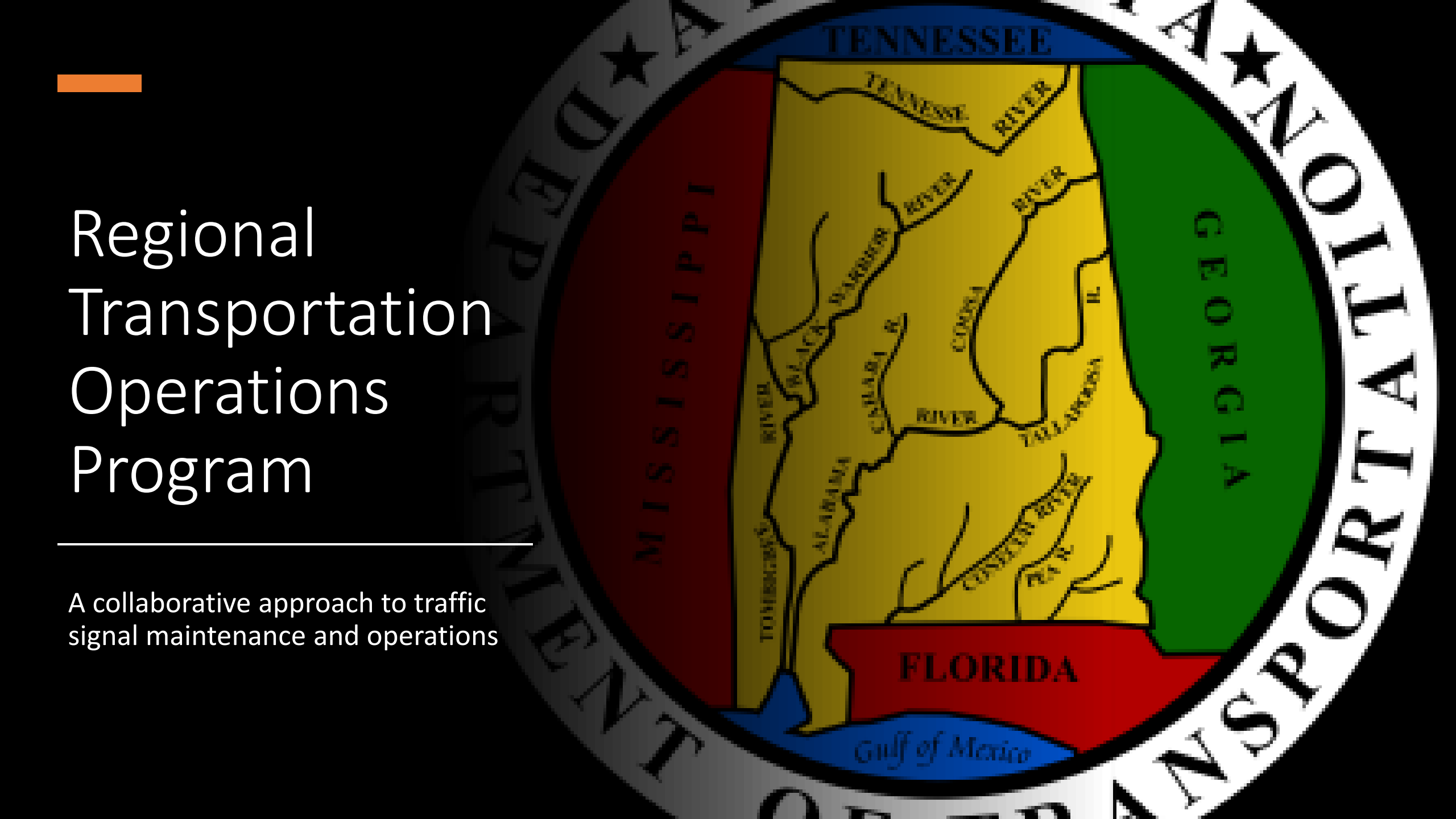
Questions?

Regional Traffic Operations (RTOP)

Brett Sellers, PE, Emerging Technologies Engineer
Alabama DOT

Regional Transportation Operations Program

A collaborative approach to traffic signal maintenance and operations



Typical Signal Operations

- Perform existing conditions travel time runs
- Take counts
  - Done while school is in on typical weekday
    - Turning movements at each intersection and tube count to establish progression direction and TOD change points
- Build model
  - Develop timings
- Implement timings
- Fine tune timings in the field
- Perform post implementation travel time runs
- ***See you in 3+ years***

Typical Maintenance Operations

- Maintenance agreements
- Varies from location to location
  - In-house
  - Contractor
  - Combination
- More with less
- Little, if any preventative maintenance performed
- ***Reactionary***

Obstacles to Improvements

- Limited Connectivity
- Multiple equipment manufacturers
- Age of equipment
- Staffing numbers
- Knowledge (engineering & technical)
- Funding
- Overcome “kingdoms”
- Taking ownership of the technology (adaptive)

We can do better, but how?

What are other states doing?

How can we learn?

How can we make the business case?

How can we bridge the engineering knowledge divide?

How can we bridge the technical knowledge divide?

How can we bridge the financial divide?

How can we unite the “kingdoms”

A Better Way…….

RTOP model from Georgia

Find an area willing to pilot the program

Begin instilling a collaborative culture

Illustrate a positive ROI

Expand the footprint

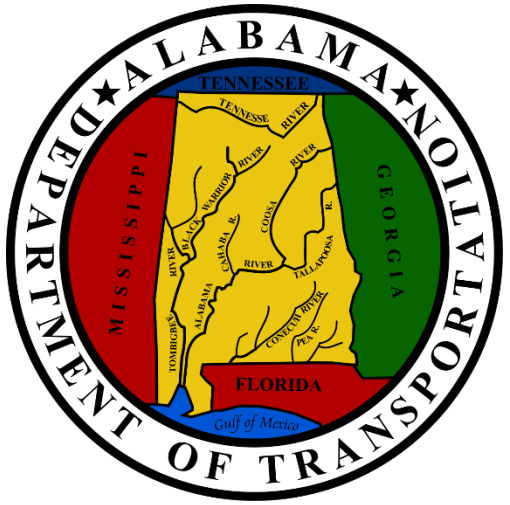
Develop talent

Our Start….

- Tuscaloosa Pilot
  - Started April 2018
  - 174 intersections touched
    - 135 Urban (Tuscaloosa/Northport)
    - 39 Rural (Jasper, Clanton, Livingston)
  - CV Pilot

RTOP
Regional Traffic Operations Program

College of Engineering
THE UNIVERSITY OF ALABAMA®



City of TUSCALOOSA

Success in Tuscaloosa

Table 4. Percent Change for Arrival on Green and Peak Volumes

No.	Intersection	% Change		
		NB/WB	SB/EB	Peak Volume
1	US 82 at US 43	3%	6%	0%
2	*US 82 at LLBW*	16%	8%	25%
3	*US 82 at Watermelon*	7%	0%	13%
4	*US 82 at 15th (NB/SB)*	9%	8%	0
5	*US 82 at Skyland (NB/SB)*	Not coordinated	15%	-20% Construction
6	Skyland at US 82 (EB/WB)	1%	1%	0%
7	*US 69 at Skyland (WB and NB only)*	6% WB	-3% NB	20%
8	Skyland at Greensboro	9%	0%	0%
9	US 69 at Bear Creek	12%	11%	0%
10	15th Street at Hillard Drive	11%	8%	18%
11	*15th Street at Hackberry*	6%	0%	14%
12	15th Street at 10th Avenue	22%	1%	5%

- 4 minutes saved per trip
- 2,350 minutes saved per day
- $45,800 saved in time (average wage) per day
- $17,625 dollars in fuel savings per day
- All representing $15.8 million in time and fuel savings per year

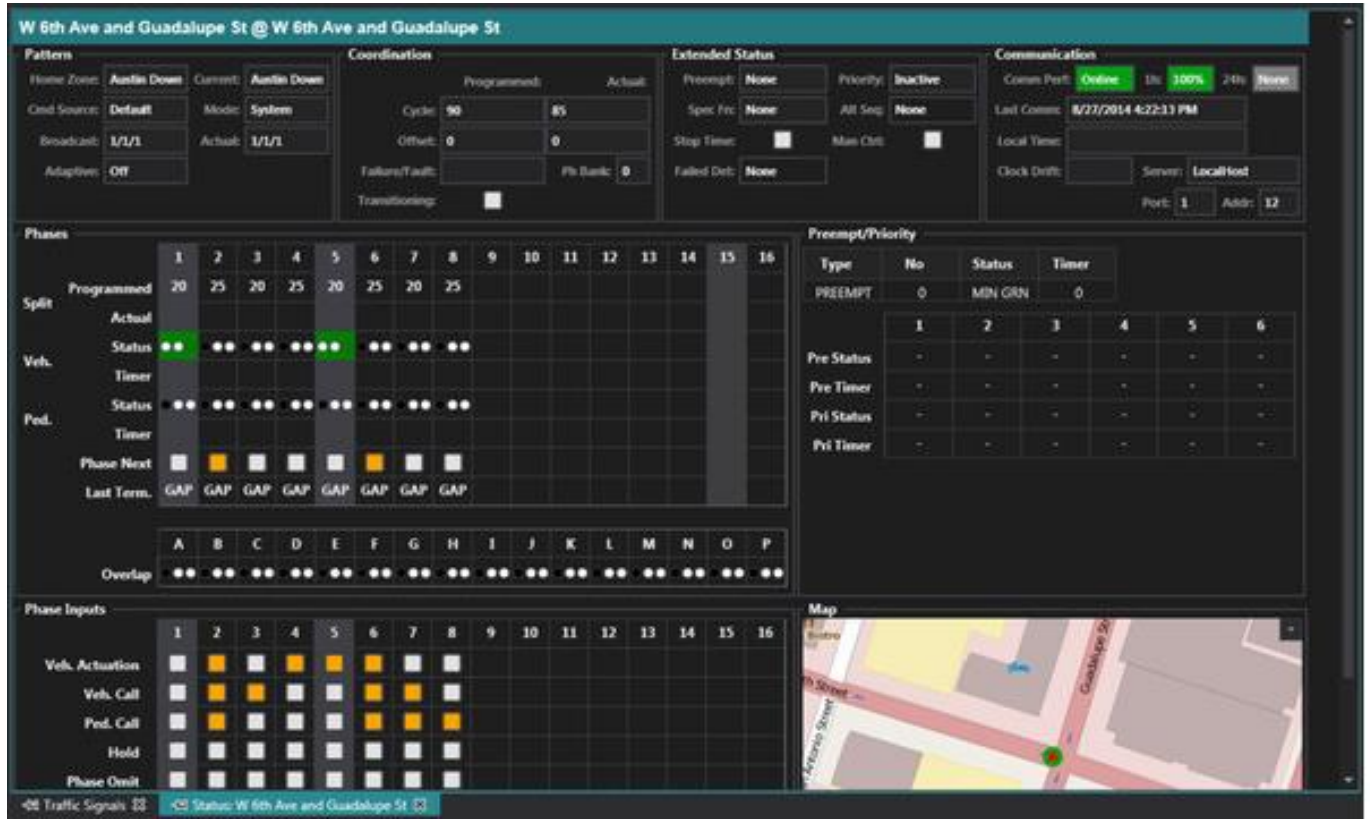
RTOP Tasks

traffic engineers and maintenance providers

- Inventory and Maintenance
- Modeling and Signal Timing
- Area Support (events & upgrades)
- Stakeholder Meetings

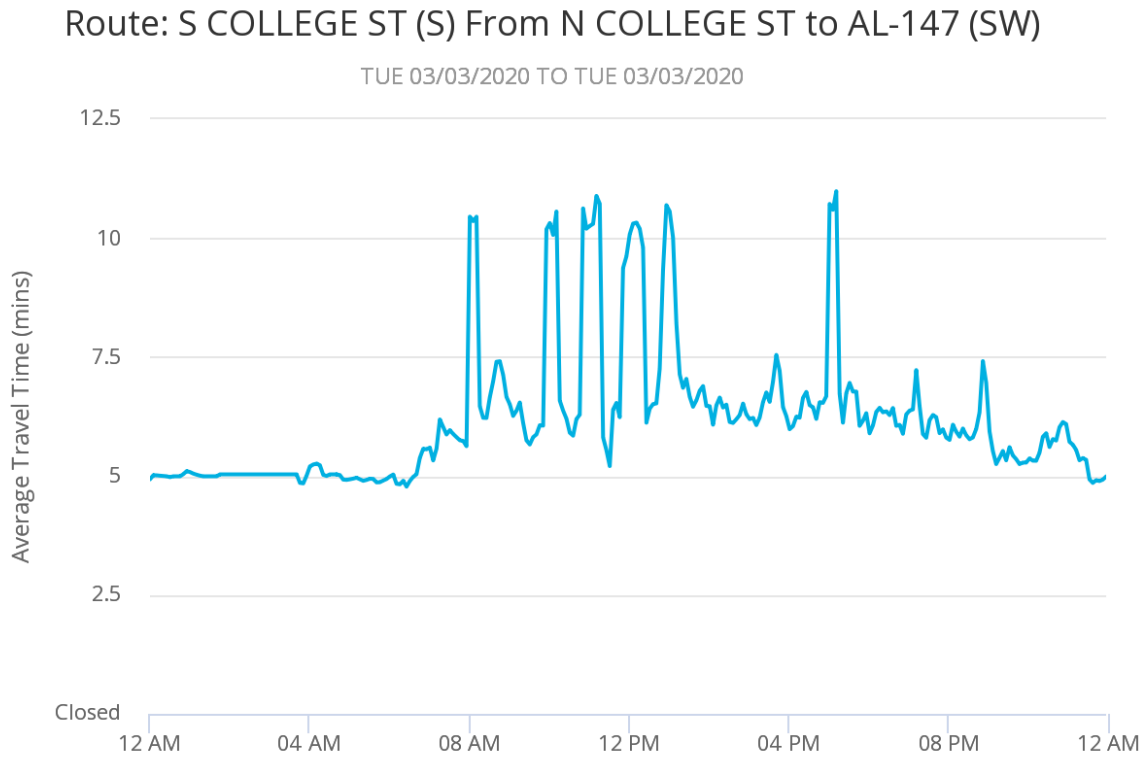
Inventory and Maintenance - Hardware

- Hardware
  - Signs
  - Electrical
  - Structures
  - Detection and surveillance equipment,
  - Communications equipment (fiber, cell modems, switches)
  - Cabinet equipment (controller, conflict monitor, fan, lights, etc.)
  - Documentation



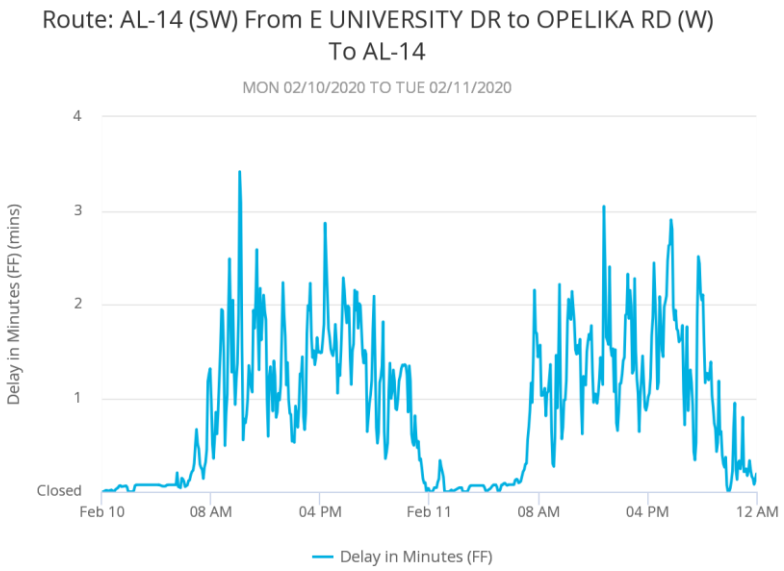
I & M – Software/Firmware Systems

- Switch programming
- Central TCC systems
- Performance
- Reporting tools



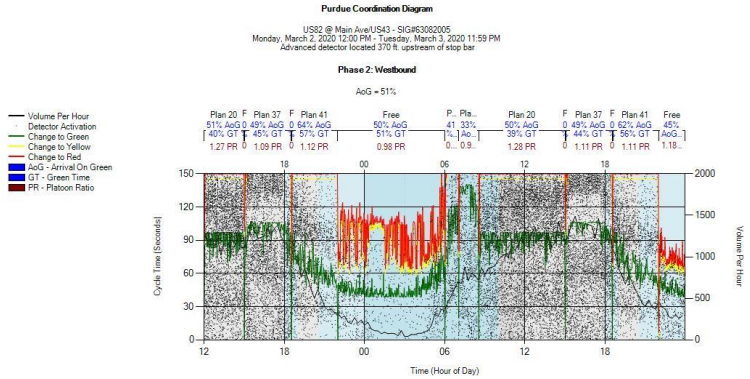
Modeling and Signal Timing – Data Collection

- Existing timings
- Existing travel times
- Post travel times
- Queue lengths
- Delay
- Counts



ATSPM

Automated Traffic Signal Performance Measures



Tools Available

M & ST – Timing Deployment

- Area strategy
- Data collection
- Modeling
- Reporting
- Initial programming
- Fine tuning
- Documentation
- Continued monitoring & adjustments

Area Support – Events and Upgrades

- Event Management Functions
- Detour / Construction Zone Management
- Observations
- Cabinet and ITS

Protective
STADIUM

Collaboration Stakeholders

Wholistic Approach

"In the game together with strengths and assets!"

City of ……

- Traffic Engineering
- IT
- Police

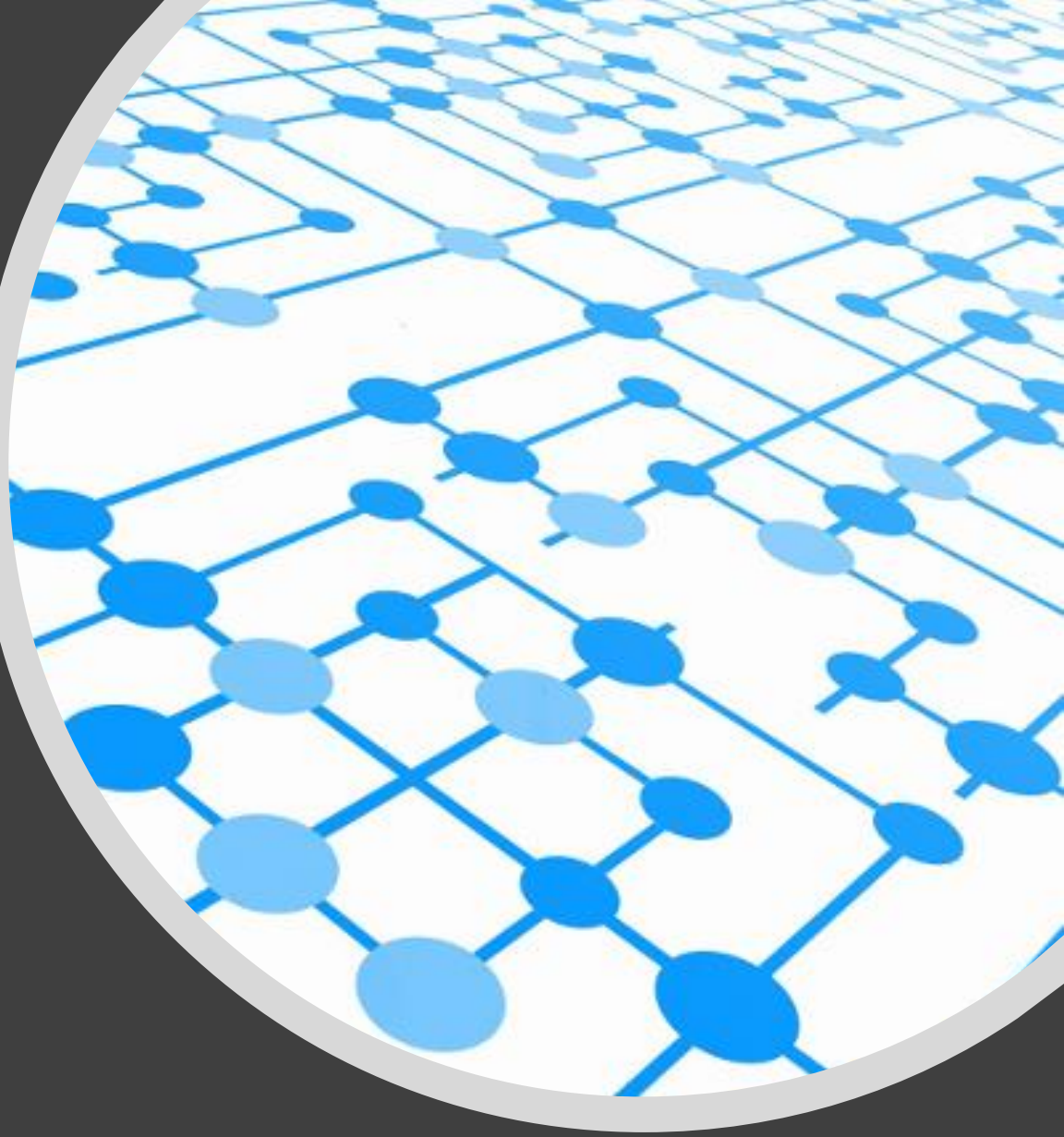
ALDOT

- Traffic Engineering
- Regional Traffic Management Center (RTMC)
- ASAP
- IT
- TSMO / Region Signal Operations Engineer

Central Consultant

How we view the transportation network

- Jurisdictional lines
- See the network as our customers see it
- A central manager working for the good of the area
- Willing personnel at the blocking and tackling level
- Solving challenges together



Current Situation

- Regions submitted routes for evaluation in customized prioritization tool
- Received funding commitment
- RFP advertised and team selections made
- Work currently underway in Mobile, Montgomery, and Birmingham (inventories, stakeholder meetings, early wins, equipment upgrades)
- Building stakeholder bridges
- Establishing communications / building resiliency / expanding ITS
- Securing a statewide signal software system
- Playing the funding game
- Created Region Signal Operations Engineer positions
- Efforts to combine technician classifications

Thank You

Brett J. Sellers, P.E.

Assistant State TSMO Engineer, ALDOT

sellersb@dot.state.al.us

Wrap Up

Ginna Reeder, Director, Innovation Program
The Eastern Transportation Coalition

In Closing….

Thank you for joining today

For additional information, please contact:

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THE EASTERN TRANSPORTATION COALITION

CONNECTING FOR SOLUTIONS