

## **TDOT Intelligent Transportation Systems, State of the State**



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# Outline

- 1. Current TDOT SmartWay ITS Infrastructure
- 2. ITS Project Status Update
- 3. Future & Developing Projects
- 4. ITS Approved Product List
- 5. Traffic Incident Management Decision Support System
- 6. ATMS Development
- 7. Traffic Management Center Co-Locations
- 8. TDOT Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Grant Proposal
- 9. AASHTO SPaT Challenge



### **Deployment of the TDOT SmartWay**

- June 6, 2003 Nashville Transportation Management Center (TMC) Opens
- May 5, 2005 Knoxville TMC Opens
- November 13, 2008 Memphis TMC Opens
- December 14, 2011 Chattanooga TMC Opens



### **TDOT SmartWay Deployment Numbers** Knoxville SmartWay (TDOT Region 1)

- Dynamic Message Signs (DMS): 32
- CCTV Cameras: 112
- Radar Detection System (RDS): 232
- Video Detection System (VDS): 29
- Highway Advisory RadiosrethaR): 20





## **TDOT SmartWay Deployment Numbers** Chattanooga SmartWay (TDOT Region 2)

- DMS: 26
- CCTV Cameras: 100
- **RDS: 219**
- HAR: 7

- Visibility Sensors: 9
- **Dynamic Speed Limit** Signs: 10
- Automated Swing Gates:

Miles of Dark Fiber: 93 

REGION 2



### **TDOT SmartWay Deployment Numbers** Nashville SmartWay (TDOT Region 3)

- DMS: 71
- CCTV Cameras: 180
- RDS: 512

- HAR: 14
- Miles of Dark Fiber:
   213



### **TDOT SmartWay Deployment Numbers**

Memphis SmartWay (TDOT Region 4)

- DMS: 45
- CCTV Cameras: 125
- RDS: 328



Miles of Dark Fiber: 83





#### **TDOT SmartWay Statewide Deployment Numbers**

- Dynamic Message Signs: 174
- CCTV Cameras: 517
- Radar Detection
   System: 1291
- Video Detection
   System: 29
- Highway Advisory Radios: 57

- Visibility Sensors: 9
- Dynamic Speed Limit Signs: 10
- Automated Swing Gates: 6
- Miles of Dark Fiber: 465





### **Ongoing Project Updates**

#### **ITS Projects Timeline**



### **Region 1**

- I-75 SmartWay Deployment, Anderson & Campbell Counties: Deploy SmartWay infrastructure on I-75. Includes the deployment of CCTV cameras at Exit 122 (Clinton), Exit 128 (Lake City), Exit 134 (LaFollette), Exit 141 (Huntsville), and Exit 160 (Jellico).
- I-40 SmartWay Corridor (East), Cocke & Jefferson Counties: Deploy SmartWay infrastructure on I-40. Includes the deployment of CCTV cameras at Exit 424 (SR 113), Exit 432 (Newport), Exit 435 (Newport), Exit 440 (Walton Springs Rd), Exit 443 (Foothills Parkway), Exit 447 (Hartford), and Exit 451 (Waterville).
- North I-75 RWIS Deployment, Campbell County: Implement RWIS including a fog and severe weather detection system on I-75 in the mountainous terrain from SR 63/US 25W (Exit 134) to SR 9/US 25W (Exit 160).



### **Region 2**

REGION :

ransportation

 I-40 ITS Rural Expansion at Rockwood Mountain, Cumberland County:

CCTV Camera & DMS placement on the Eastbound approach to Rockwood Mountain. DMS placement prior to and CCTV coverage at Exit 329 to provide diversion information.

 I-40 SmartWay Cookeville Deployment, Putnam & Cumberland Counties:

Deploy SmartWay infrastructure on I-40 from SR 24 (Spring Street, Exit 290) to SR 299 (Exit 338) at 9 interchanges. Includes the deployment of 9 CCTV cameras, 2 DMS, and 2 RWIS. Fiber optic cable deployment will not be included.

 I-75 Route Diversion ITS, Bradley, Hamilton & McMinn Counties: Install ITS equipment for route diversion along lower capacity routes to include signal coordination, special diversion timing plans, and center-to-center communications for US 11 & 25W. Includes Campbell, Anderson & Knox (R1).



### **Region 3**

- Nashville Area I-40 SmartWay Expansion, Cheatham, Davidson, Dickson, Williamson, & Wilson Counties: Expand ITS along I-40 from MM 172 to US 70S (Exit 196) and SR 255 (Donelson Pk, Exit 216) to US 70 (Exit 239). Deployment includes 18 CCTV cameras, 8 DMS, and 4 RWIS.
- Tennessee River I-40 SmartWay Deployment, Houston & Benton Counties:

Deploy CCTV cameras and DMS along I-40 adjacent to the Tennessee River Bridge near Cuba Landing from SR 191 (Exit 133) to SR 13 (Exit 143). This project is located in Houston County (Region 3) and Benton County (Region 4).

 Dickson I-40 SmartWay Deployment: Deploy CCTV cameras, DMS and RWIS along I-40 near Piney River from SR 48 (Exit 163) to SR 46 (Exit 172).





### **Region 4**

- Jackson I-40 SmartWay Deployment, Madison County : Deploy ITS infrastructure on I-40 in the City of Jackson area. Deployment includes 18 CCTV cameras and 4 DMS.
- Fiber Optic Communication Across Mississippi River, Shelby County:

Replace existing wireless connection across the Mississippi River with a fiber optic cable connection. The fiber will connect the TDOT SmartWay TMC in Memphis with the TDOT CCTV cameras and DMS along I-40 and I-55 in Arkansas.

Memphis SR 385/I-269 North SmartWay Expansion
 Implement SmartWay ITS system on SR 385/I-269 from I-40
 northward and westward to the future I-69 near Highway 51
 to include the installation of fiber optic cable, 14 CCTV
 cameras, 7 DMS, and 7 HAR.



#### **SmartWay Life-Cycle Replacements**



#### **Road Weather Information System Renovation**



- 36 RWIS locations statewide
- Deployments include both wireless and wired communication
- Deployments include both noninvasive and in road sensors

#### **Wrong Way Driver Detection & Alert Systems**

E. Summit Hill Dr. @ Downtown Loop (SR 158), Knoxville TN





Wrong Way Detection: Texas, Florida, Rhode Island <a href="https://youtu.be/snD67-ohlvw">https://youtu.be/snD67-ohlvw</a>



### **Wrong Way Driver Detection & Alert Systems**

Mercedes-Benz is developing a sign recognition system that will help eliminate unintentionally driving in the wrong direction (Daimler 2015). The system will warn the driver by flashing a red no entry symbol on the driver display as shown below. Source FHWA-AZ-15-741



Department of Transportation TDOT has posted an ITS Approved Product List to help ensure future SmartWay system compatibility. This list does not represent an exclusive catalogue of items that will be approved for installation on TDOT projects. It's sole purpose it to streamline the approval process by providing a list of those items that have been found compatible with TDOT's ITS specifications.

https://www.tn.gov/tdot/topic/its-office-approved-productlist



#### **TIM Decision Support System**

### C.R.A.S.H. (Crash Reduction Analyzing Statistical History) Tool

- The Tennessee Highway Patrol has developed a predictive software tool that analyzes multiple data points and provides probability predictions for crashes.
- Probability numbers for a 30 square mile area are tiled on a map of the state in 4 hour increments.
- The tool consumes historical crash data, weather forecasts, and event data
- The THP is using this tool for allocating staff resources to proactively prevent traffic incidents.
- The tool is averaging a 72% accuracy rate.



#### **TIM Decision Support System**

#### C.R.A.S.H.





#### **TIM Decision Support System**

### **Predictive Analytics for TIM Response**

- TDOT has received a 100K State Transportation Innovate Councils (STIC) grant to develop a predictive tool based upon the Tennessee Highway Patrol's C.R.A.S.H. system.
- TDOT intends to merge this CRASH system into the operational environment of TDOT's four Regional Traffic Management Centers (RTMCs) to optimize its deployment of freeway service patrol units.







#### **TMC Co-Location**

# **TDOT Region 2 TMC**

- 10/7/2015 The Tennessee Highway Patrol co-locates 2 dispatch offices into the Region 2 (Chattanooga) TMC.
- 3 Shifts with 2-3 FTEs.





# **TDOT Region 1 TMC**

- The Tennessee Highway Patrol is moving 2 dispatch centers (Knoxville & Falls Branch) in the Region 1 (Knoxville) TMC.
- Move in is scheduled to occur November, 2016.





#### **TMC Central Software Development**









#### **9 KEY COMPONENTS OF THE ATCMTD PROGRAM**

- 1. Advanced Traveler Information Systems.
- 2. Advanced Transportation Management Technologies.
- 3. Infrastructure Maintenance, Monitoring, and Condition Assessment.
- 4. Advanced Public Transportation Systems.
- 5. Transportation Systems Performance Data Collection, Analysis, and Dissemination Systems.
- Advanced Safety Systems, Including V2V and V2I, AV and Collision Avoidance Systems using Cellular Technology.
- 7. Integration of ITS with Smart Grid and other energy distribution and charging systems.
- 8. Electronic Pricing and Payment Systems.
- 9. Advanced Mobility and Access Technologies.





### TDOT's Goals: Phase 1 (Foundation)

- 1. Build a unified platform for TDOT to share with local agencies across the state.
- 2. The singular platform will assist TDOT with creation of Center-to-Center deployments across the state.
- 3. Shared data and resources between TDOT and Local agencies will help federal dollars go further.
- TDOT will position itself in a leadership role for "how" advanced transportation technologies (i.e.; CV and AV) are developed across the state.





### TDOT's Goals: Phase 2

Phase 2 of the project will be to develop the modules for this Statewide ATMS system in cooperation with FDOT, TxDOT and SwRI for the following systems to be included in ActiveITS:

- Transit
- AVL
- Transit Scheduling Reliability
- Electronic Pricing and Paying Systems
- Car Share
- Uber/Lyft Data
- Taxis

- Bike Share
- Open Data Portals
- Accessible Transportation Technologies Research Initiative (ATTRI)
- Traffic Signal Interface
- Parking Applications.



### TDOT's Goals: Phase 3

The third phase will provide a replicable "proof-of-concept" for connected vehicle and other ITS technologies. TDOT intends to deploy these technologies at its Traffic Incident Management Training Site at the Tennessee Highway Patrol Academy. Doing so allows TDOT to fully test the various technologies prior to implementation and deployment within the TDOT Intelligent Transportation Systems





Oncoming Vehicles Warns drivers of lane closings and reduced speeds when approaching incident zones.

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Responder Vehicles Warns on-scene responders of vehicles approaching the incident zone at speeds or in lanes that pose a high risk to their safety. Sp.

HARNING

Barry .

ADUSOR

### Phase 3 DSRC



This Phase will work with the existing 39 HELP Trucks in Region 3 and will also work with Metro Nashville Fire Department who is installing a similar system on their Fire Apparatus.

- The TDOT CV test bed will investigate Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG).
- The Queue Warning (Q-WARN) program builds upon and enhances TDOT's "Protect the Queue" program. It utilizes I2V and V2V communications to detect and predict impending queues.



# Partnerships

#### Verbal Commitments

- Franklin, TN
- Murfreesboro, TN
- Knoxville, TN
- Kingsport, TN
- Vanderbilt University
- Oak Ridge
   National
   Laboratory

#### **Letters of Support**

- Nashville, TN
- Memphis, TN
- Johnson City, TN
- UT Knoxville
- UT
  - Chattanooga
- University of Memphis

#### MOU

• Chattanooga, TN



#### AASHTO SPaT Challenge

#### Vehicle to Infrastructure Deployment Conundrum...



#### AASHTO SPaT Challenge

# **Proposed Policy Resolution**

- The purpose is to create an AASHTO nationwide challenge to deploy
   Dedicated Short Range Communications (DSRC) infrastructure with Signal Phase and Timing (SPaT) broadcast in at least one corridor (approximately 20 signalized intersections) in each of the 50 states by January 2020.
- It is recognized that the 20 intersections may include either state, county, or local city intersections.
- The challenge is intended to demonstrate a commitment to DSRCbased V2I infrastructure deployments.





# Questions?

