 Agenda

– I-24 SC
  • Intro: Purpose and Need, Mission and Vision
  • Our Solution: I-24 Smart Corridor
  • Project Phases 1-3
  • Project Schedule and Status
  • Initial ICM Operation and Maintenance Needs
  • Lane Control System (LCS) and Variable Speed Limits (VSL)
  • Public Outreach for Project
  • Artificial Intelligence (AI) powered Decision Support System (DSS)
  • Challenges for Initial ICM Deployment in Tennessee
  • Next Steps

– SWCS Upgrades
  • ATMS upgrade and background
  • ICM Decision Support System
  • SWCS Expansion – Next Steps
Integrated corridor management (ICM) -- the coordination of transportation operations to improve travel management
I-24 SMART Corridor Update

https://www.youtube.com/watch?v=c5HOIYXyszs
I-24 Smart Corridor Mission & Goals

TDOT Mission:
To provide a safe and reliable transportation system that supports economic growth and quality of life.

I-24 Smart Corridor Mission:
To improve the safety and reliability of all travel along the corridor through the proactive management of intelligent and connected infrastructure, and the formation of strong operational partnerships between local and state agency stakeholders.

I-24 Smart Corridor Goals:
Goal 1: Increase Travel Time Reliability
Goal 2: Increase Mobility of all Modes
Goal 3: Reduce the Concentration of Crashes
Goal 4: Develop Agency Coordination
Contributors to Congestion

Traffic Incidents 27%

Incidences Breakdown 2015
(Total Crashes: 1,661)
### I-24 Smart Corridor
#### Purpose and Need

#### Safety

<table>
<thead>
<tr>
<th></th>
<th>Fatal Crashes</th>
<th>Major Injury Crashes</th>
<th>Minor Injury Crashes</th>
<th>Prop Damage Crashes</th>
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*Data as of mid-August 2020

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<th>Fatal Crashes</th>
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<td>126</td>
<td>372</td>
<td>521</td>
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*Data as of mid-August 2020

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**TDOT**

Department of Transportation
Reliability

System Wide Peak Periods:

6:30 am – 8:30 am and 4:00 pm – 6:00 pm

<table>
<thead>
<tr>
<th></th>
<th>AM Peak Travel Time Index (TTI)</th>
<th>PM Peak Travel Time Index (TTI)</th>
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<tr>
<td><strong>I-24</strong></td>
<td></td>
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<tr>
<td>2018</td>
<td>1.52</td>
<td>1.35</td>
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<td>2019</td>
<td>1.38</td>
<td>1.40</td>
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<td><strong>SR-1</strong></td>
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<td>2018</td>
<td>1.31</td>
<td>1.48</td>
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<tr>
<td>2019</td>
<td>1.19</td>
<td>1.39</td>
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Based on weekday averages (M-F)
Historical Travel Time Data - 2017

Weekday AM Peak Period Travel Time
I-24 From I-840 to Briley Pkwy

Travel Time
Average Travel Time: 30.36 mins
95th Percentile Travel Time: 45.34 mins
Historical Travel Time Data - 2018

Weekday AM Peak Period Travel Time
I-24 From I-840 to Briley Pkwy

Travel Time
Average Travel Time: 29.40 mins
95th Percentile Travel Time: 41.88 mins
Weekday AM Peak Period Travel Time
I-24 From I-840 to Briley Pkwy

Travel Time
Average Travel Time: 26.90 mins
95th Percentile Travel Time: 37.79 mins
Our Solution: I-24 Smart Corridor

Improve Operations of the Corridor

Strategies that improve traffic flow:
- Ramp extensions
- Emergency pull-offs
- Active Lane Management
- Ramp meter system
- Upgraded signal equipment and software

Improve Management of the Corridor

- Improved processes for O&M
- Decision Support System (DSS)
- Interagency Coordination

Incident Management
Traditional/Reactive

Installation of Devices that GET information:
- CCTV
- Radar
- DSRC
- Probe

Traffic Management
Novel/Proactive

Installation of Devices that GIVE information:
- DMS (roadside)
- DMS (overhead/over lane)
- DSRC

Improve Communication with The Public

Installation of Devices that GET information:
- CCTV
- Radar
- DSRC
- Probe

Improve Situational Awareness

Installation of Devices that GIVE information:
- DMS (roadside)
- DMS (overhead/over lane)
- DSRC
I-24 SMART Corridor Project Partners
Phases 1 & 2

**Length:** 94.10 Total Miles (29.5 Miles along I-24)

**Termini:**
- I-24 from I-440 to SR-231
- SR-1/US 41 from I-24 to SR-231
- Various connector routes

**Phase 1**

- **Scope of Work:**
  - ITS and signal improvements on all project roadways
  - Connected Vehicle Infrastructure
  - Interchange ramp improvements along I-24
  - Emergency pull-offs along I-24

- **Let to Contract:** October 2018
- **Contractor:** Stansell Electric
- **Completion:** December 2021

**Phase 2**

- **Scope of Work:**
  - Install 67 overhead dynamic message signs (LCS and VSL) on I-24 between I-440 and SR-102
  - Traffic Signal upgrades: radar and video detection
  - Implement Active Traffic Management (Arterial & Freeway)

- **Let to Contract:** October 2019
- **Contractor:** Stansell Electric
- **Estimated Completion:** May 2023

*May 2023*
Phase 3

- **Length:** 94.10 Miles
- **Termini:**
  - I-24 from I-440 to SR-231
  - SR-1 from I-24 to SR-231
  - Various connector routes
- **Scope of Work:**
  - Ramp Meters
  - Arterial DMS
  - Arterial CCTV Cameras
  - Communication upgrades
  - Intersection Operations Improvements (ADA, Pedestrian Signals, etc)
- **Earliest Letting:** CY 2023
Ramp Meter Selection

• Final ramp meter analysis report to be submitted this summer
  • HELPER Algorithm selected and will be optimized for the I-24 Smart Corridor.
  • Results will feed into development of Phase 3 preliminary design plans
Phase 1 (*CNS 300*)
- Contract was awarded October 2018
- The project final acceptance December 2021

Phase 2 (*CNT 356*)
- Contract was awarded October 2019
- The project is scheduled for final acceptance Spring 2023

Phase 3
- Earliest projected Letting Summer of 2023
I-24 Smart Corridor – Operations & Maintenance Program Schedule

Phase 1 Construction
11/18/18 - 7/6/21

Phase 2 Construction
11/15/19 - 10/27/22

Phase 2 Burn-In
11/7/22 - 5/8/23

Incident Management Development
3/15/21 - 4/29/22

Implement Active Arterial Management
5/2/22 - 8/26/22

Con Ops Update
7/15/21 - 4/15/22

Standard Operating Guidelines
7/12/21 - 5/17/22

Network Communication Support
6/21/21 - 1/28/22

I-24 SC ICM Plan
10/4/21 - 6/29/22

ICM O&M Plan
10/18/21 - 4/22/22

TMC Integration
8/3/21 - 10/27/22

CRD - Marketing - Grassroots Campaign
6/9/21 - 10/7/22

Spring 2021 - SMART Corridor Update Video
5/3/21 - 7/2/21

2022 Video Updates
3/17/22 - 11/15/22

Today
Initial ICM Operations Needs

- **Local Agency Operations Support**
  - Assists and trains Local Agencies on Active Arterial Management.
  - Assists local agencies in planning and execution of ICM strategies.
  - Assists and trains staff in maintenance of ICM components within their jurisdictions.
  - Provide supplemental TOC support – during business hours; on call after hours
    - **Monitor, Coordinate, Control**
    - “If you let us in, we will help”
ICM Maintenance Expectations

- Set maintenance goals and expectations for the local agencies
  - Identify critical field assets
  - Define KPIs such as percent uptime
  - Establish expected repair times
- TDOT’s role if local agency cannot repair critical asset within accepted duration
  - TDOT maintain new technology; local agencies maintain traditional traffic signal elements
- Paradigm Shift for Traffic Signal O&M in TN
  - TSM&M
Operations and Maintenance Support and Training for Local Agencies

• Provide Agency Specific Training:
  – Bluetooth Devices
  – Connected Vehicle Technologies
  – Traffic Responsive Signal Operation
  – Improved Signalized Intersection Vehicle Detection Technologies
  – Centracs (Signal Controller central management software)
  – RITIS Training

• Four local agencies
  – Varying capabilities
Initial ICM Operation and Maintenance Needs

• ICM Coordinator Role
  • Defines and coordinate training needs
  • Manage a team to actively monitor the corridor
  • Monitor and manage LCS and VSL from TMC
  • Support the TMC on active freeway and arterial management strategies
• Coordinate with Local Agencies
  • Implement active arterial management for daily traffic
  • Implement incident management signal timing plans for diversions to/from I-24
  • Work shoulder to shoulder with Local Agencies
• Provide corridor specific Traffic Incident Management support
The Lane Control System will provide lane by lane indications for upcoming roadway impacts. The system also includes Variable Speed Limits which will automatically detect decreased traffic speeds and display them. The intent is to warn drivers about slow traffic ahead and which lanes are blocked to help navigate through the incident.
Public Outreach for Project

• Providing relevant and timely information to the public is critical to this project’s success
  • Media campaigns in advance of project milestones:
  • Grassroots education
  • Fall 2022* LCS / VSL Activation:
    • Video – “What drivers will see”
    • Video – “How it impacts you”
    • Video – “How it works”
  • Update of the project website as well as SmartWay 511.
I-24 SMART CORRIDOR

Phase 2 has begun! A lot of work is being done behind the scenes and the public will begin to see work on the road beginning in April.

GOAL:
Travel Time Reliability and Safety

The average commute time may not be drastically reduced, but these improvements are expected to make the average commute times more consistent.

CONSTRUCTION LANE CLOSURES:

- Gantry Construction:
  - April - June
  - From Exit 3 to 7
  - Work will be performed from 7 a.m. to 10 p.m., weekends.

- Installation of Communication Devices:
  - July - September
  - Network communication
  - Traffic impacts

OVERHEAD GANTRIES

A total of 67 lane control sign gantries will be placed over exit and westbound lanes. They will be constructed in the overnight hours beginning April. The signs will be dark until October.

ITS UPGRADES

Several Intelligent Transportation Systems (ITS) improvements will be implemented to help effectively manage the corridor.

ACTIVE TRAFFIC MANAGEMENT

Improvements made to the transportation system to actively manage traffic across multiple jurisdictions to enhance travel time reliability and safety.

Traffic Volumes:
- 177,000 (2021 AADT) between Thompson Station and Harding Place
- 123,000 (2021 AADT) between I-40 and SR 102

Infrastructure Improvements:

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<th>Device Type</th>
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<th>Phase 2</th>
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<tr>
<td>Traffic Signal Controllers</td>
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<td>-</td>
<td>122</td>
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<tr>
<td>Traffic Signal Detector</td>
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<td>122</td>
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<tr>
<td>DSRC/Bi-racial Sensors</td>
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<td>Roadside OMS</td>
<td>10</td>
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<tr>
<td>Ramp Extenders</td>
<td>4</td>
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<td>Emergency Pull Offs</td>
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<tr>
<td>CCTVs</td>
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<tr>
<td>Radar Sensors</td>
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<tr>
<td>LCS/GIS Ganters</td>
<td>-</td>
<td>87</td>
<td>87</td>
</tr>
</tbody>
</table>

- NOTE: 07 Lane Control Sign (LCS) Variable Speed Limit (VSL) Ganters (33 EB, 34 WB)

Project Cost: Phase 1 = $18M, Phase 2: $54M

Schedule: Phase 1 completion = December 2021; Phase 2 completion = May 2023

Public Outreach:
- 5 local presentations since Fall of 2021 - City of Murfreesboro, Smyrna, Brentwood Rotary Club, City of LaVergne, Rutherford County Chamber of Commerce
- Upcoming presentations: ITS TN in April, FHWA TN Division in May, in discussions with community groups along the corridor

TSMO Factors:
- The likelihood of a secondary crash increases by 2.8% for each minute the primary incident continues to be a hazard
- Every minute of blockage on a freeway travel lane increases delay after the incident is cleared by a factor of four
- Traffic incidents and Work Zones account for approximately 35% of all congestion
- Poor Signal Timing and Special Events account for approximately 10% of all congestion

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ATCMTD Grant Project
ICM DSS

- Artificial Intelligence-powered decision support tools for Integrated Corridor Management

- Tools include:
  - Artificial Intelligence-based ICM Decision Support System
  - Web interface for ICM partners
  - Traffic Management Center ICM software integration
Challenges for Initial ICM Deployment in Tennessee

• Multiple TSMO / ICM Strategies deployed for the first time in Tennessee
  • Motorist Education
  • Construction Challenges
    • IT Network – first time for C2C
    • Supply Chain
  • Operational Challenges
    • TDOT’s Role in arterial management
    • Local Agency Role to support ICM
    • Maintenance requirements
    • Holistic corridor management
      • Shoulder to shoulder with locals
  • MOE to show ROI
  • Dedicated funding
    • From Pilot to sustainable program
Next Steps

- Incident Management Signal Timing Plans
  - Centracs Database programming and field fine-tuning
- LCS and VSL Operations
  - Demo of test system; troubleshooting; training
- Continue Interagency Coordination
  - Monthly TAC meeting with the Local Agencies and First Responders
  - Review and approve ICM O&M Plan and SOGs
- I-24 Smart Corridor Phase 3 Design
  - Preliminary Plans Submittal & Stakeholder Review
- Implement lessons learned from Peer States
TDOT’s Journey to Integrated Corridor Management

- TDOT Network Upgrade
- ATMS Upgrade
- I-24 Smart Corridor Phase 1
- I-24 Smart Corridor Phase 2
- ICM Decision Support System
- I-24 Smart Corridor Phase 3
- Cisco Networking Equipment
- Replacement of all Layer 2 and Layer 3 Switches
- Addition of 829 Routers
- Updated security and IP-Scheming
Why was SWCS needed?

- Efficient incident/HELP Truck management
- Recurring congestion management
- Establish a unified software platform
- Integrated Corridor Management (ICM) support
- Data exchange between different TMCs/TOCs

Tennessee roads experience 410 vehicle crashes everyday on average!
Where did we start?

Multiple software for Incident Management:

- MIST
- IM/LOCATE
- Cameleon
- SWIFT
- Vero
- Platinum
• All modules in one package
• Unified map interface
• Statewide consistency
• Single databus to facilitate automation
• Center to Center Communications
SWCS Capabilities

Event/Incident Management
Help Trucks Management
Traffic Congestion Management
Device Management
Reporting
Event/Incident Management

- Incident Location
- Lane Maps
- Event Type
- Involved Vehicles
- HELP Dispatch
Event Workflow

Previous ATMS Workflow (full event entry)
Event Workflow

Improved Operations: New Workflow (SWCS)
Efficiency/Consistency/Uniformity – Single Data Entry & Automatic Response Plan Generation
Response Plans
Automated Vehicle Location (AVL)

- Cisco IE 829 routers connect HELP trucks to operator's map
- Application developed using Cisco Kinetic
- Facilitate capabilities for operators to enter incidents
- Additional future benefits
Reporting

• A wide variety of report templates that can export reports
• These templates are initially grouped by similar type or functionality but are configurable
SWCS Performance Metrics

- Developed in Crystal Reports
- Quarterly Performance Measures Report
- Performance Measures for HELP Truck Operations
The ICM DSS:
- aggregates all relevant data generated about the corridor,
- fuses the data into its most meaningful and valuable representations, and
- provides actionable intelligence to the TMC Operators when appropriate and/or requested

Generates response plans with limited intervention!
Statewide Expansion of SmartWay ITS
Platform for Innovation and Research Grants
Overcoming Traffic Congestion Growth
Connected Automated Vehicles (CAV)
Over-height Detection
I-24 Smart Corridor
Construction Activities
Traveler Information
ICM DSS
Wrong Way Driver Detection
Contact Info:
Lee Smith - TDOT Traffic Operations Division, Interim Director
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