



Work Zone Construction & Maintenance Needs



Smart Work Zones

- Real-Time Traveler Information
- Queue Warning
- Dynamic Lane Merge
- Incident Management
- Variable Speed Limits
- Automated Enforcement
- Entering/Exiting Construction Vehicle Notification
- Performance Measurement
- Other(s)

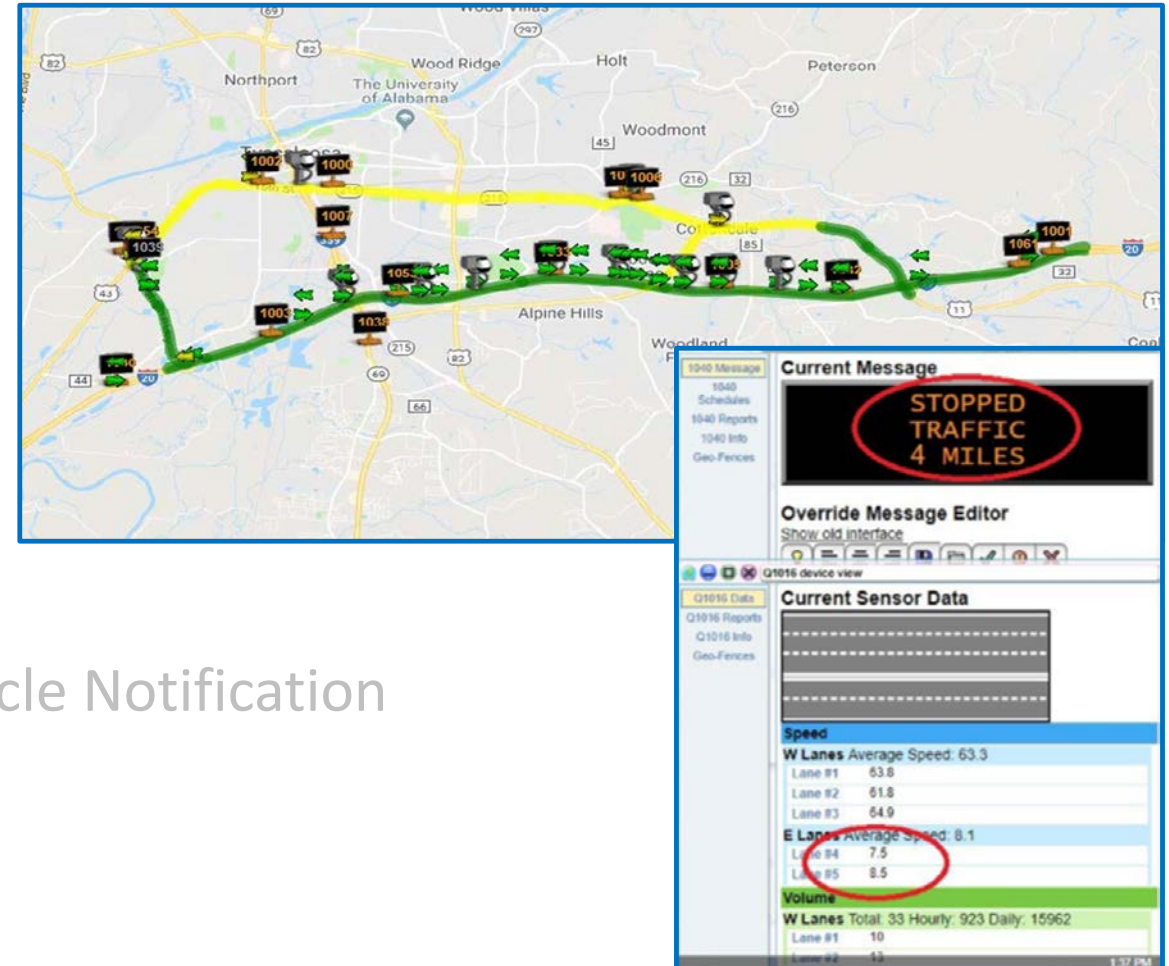


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Work Zone Construction & Maintenance Needs



Traffic Interruption Reporting

- Guideline for Operation (GFO) developed
 - Title 23 CFR Part 511
 - Roles and Responsibilities
 - Data Needs
 - Exemptions



Work Zone Construction & Maintenance Needs



Construction Information Memorandum (Portable CMS)

- Appropriate use
- Static vs. Dynamic messaging
- Project quantities



ALDOT Maintenance



Annual Statewide Maintenance Budget: \$150,000,000

Dedicated Statewide Maintenance Employees: 1,020

Statewide Maintenance Fleet: 1,911

Maintenance Activities:

- Asphalt & Concrete Pavement maintenance
- Drainage maintenance
- Vegetation management
- Signs, Lines, RPMs, Rails, & Signals
- Bridge Inspection, Maintenance, & Repair
- Oversize/Overweight Enforcement



ALDOT Operations



Annual Statewide Operations Budget: \$9,400,000

Dedicated Statewide Operations Employees: 129

Statewide Operations Fleet: 29

Operations Activities:

- ITS Field Device Maintenance
- RTMC Operations
- Service Patrol
- Regional Traffic Operations Program

All Operations resources are a subset of the Maintenance resources.



ALDOT CMM



ALDOT has not utilized the Capability Maturity Model framework to address maintenance workforce needs.

ALDOT Operations performs an Annual CMM Assessment in January each year. It evaluates each Region across the six CMM dimensions. Other than an objective score for Organization/Workforce, it does not address actual needs. The Alabama Statewide TSM&O Strategic & Program Plan does address actual needs by organizational structure and high-level position descriptions. We are reviewing our current CMM process for January 2020; whereby we will look to evaluate each of the nine Service Layers of the Strategic Plan against the six CMM dimensions.



MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

**2019 NOCoE Operations and
Maintenance Peer Exchange**

Sandi Sauter, Janet Frenkil, Joey Sagal
MDOT SHA

WHAT IS TSMO?

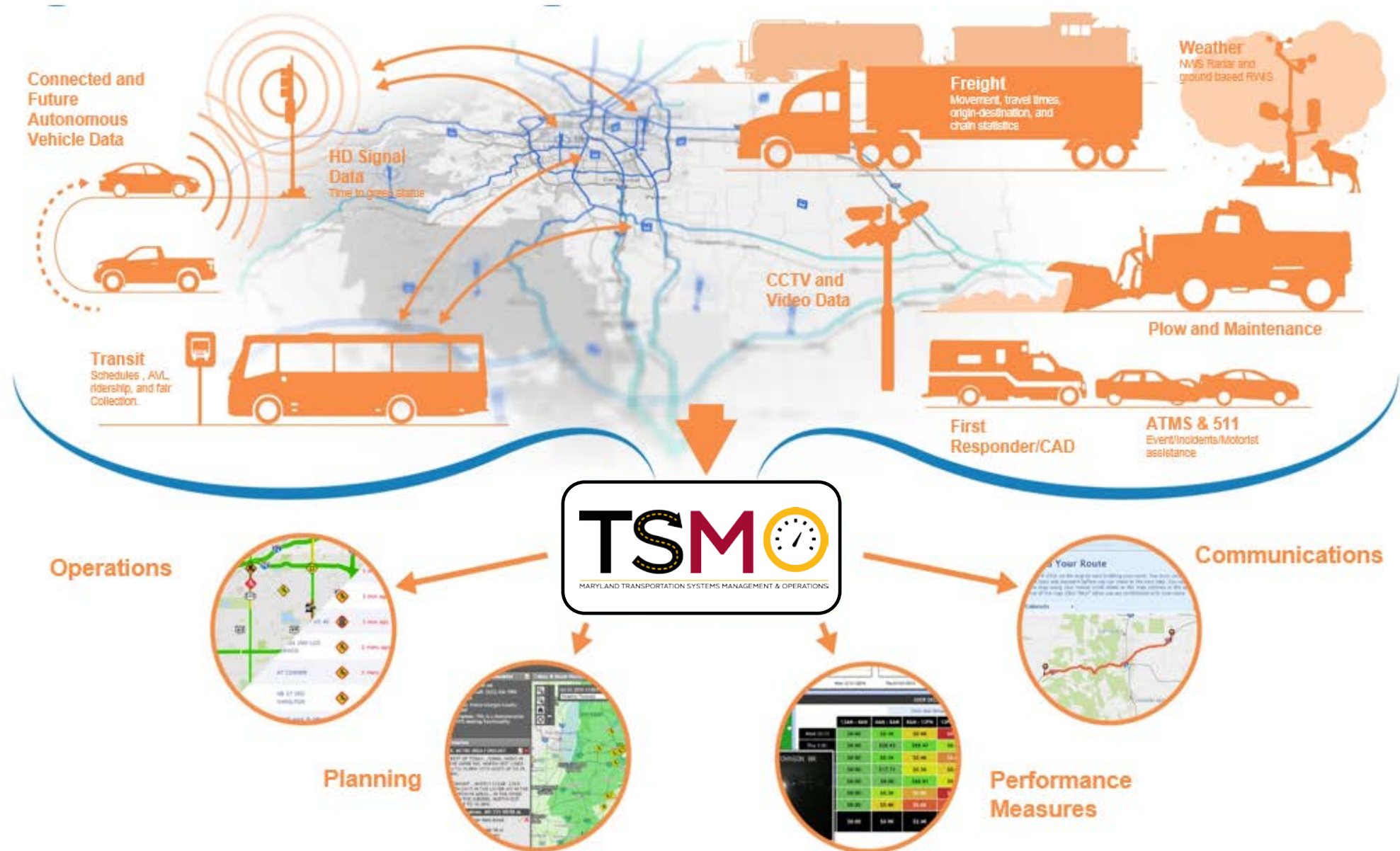
MDOT SHA TSMO Definition:

"An integrated approach to programmatic optimization of planning, engineering, operations, and maintenance in implementing new and existing multi-modal systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system."

Or put another way:

"The intent of TSMO is to effectively manage and operate existing facilities and systems to maximize their full service potential. TSMO strategies aim to optimize capacity that is limited by recurring and non-recurring congestion."

THE ROAD AHEAD IN A CONNECTED/ AUTOMATED FUTURE



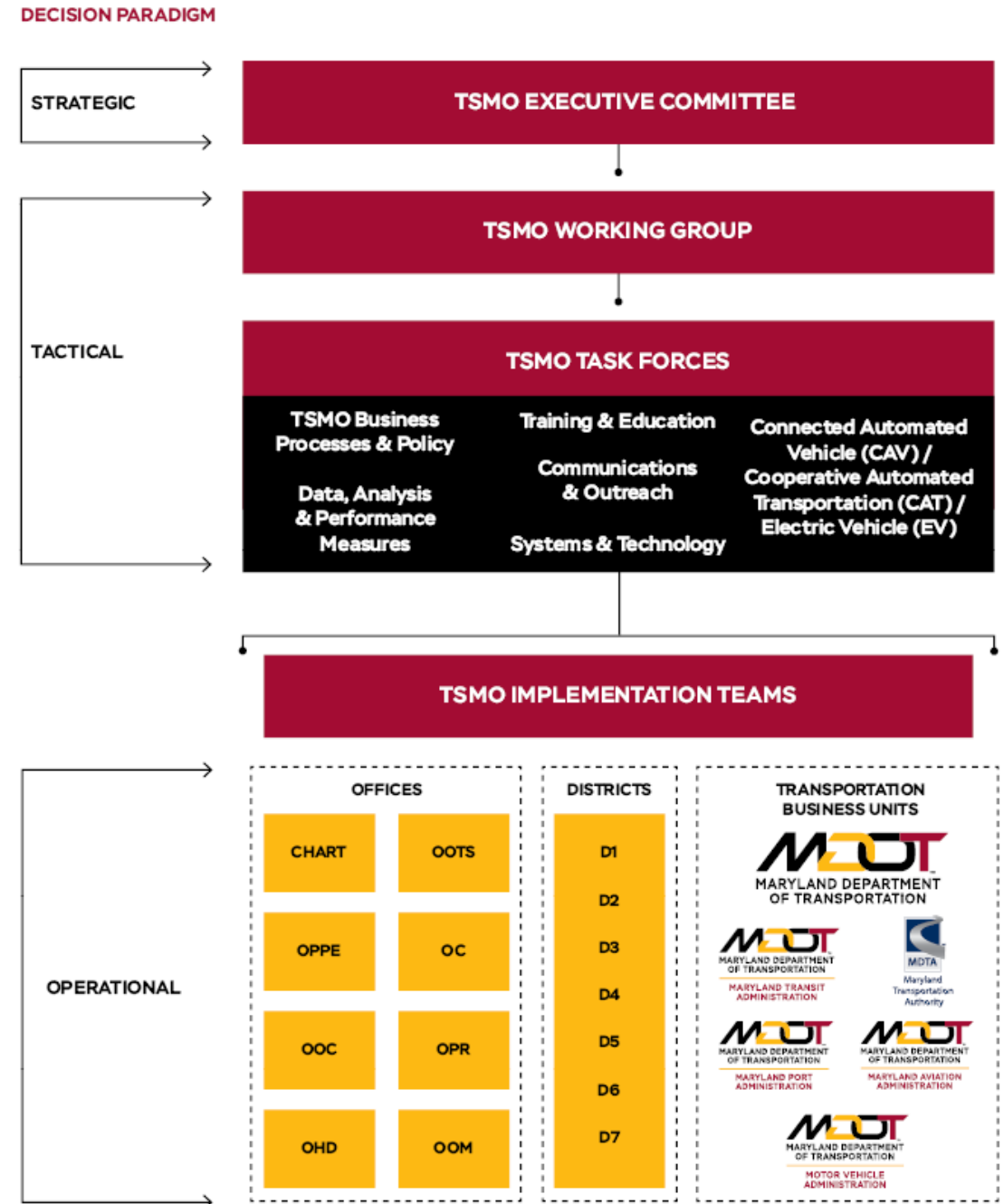
TSMO PROGRAM 2.0

- TSMO Program Guided by TSMO Strategic Plan (update to be released soon)
- TSMO Program Development Started in 2014 with FHWA Sponsored Workshop
- First TSMO Strategic Plan Approved in August 2016
- Many 2016 Strategic Plan Action Item Accomplishments
- Rapidly Evolving Environment Necessitated Development of New TSMO Strategic Plan



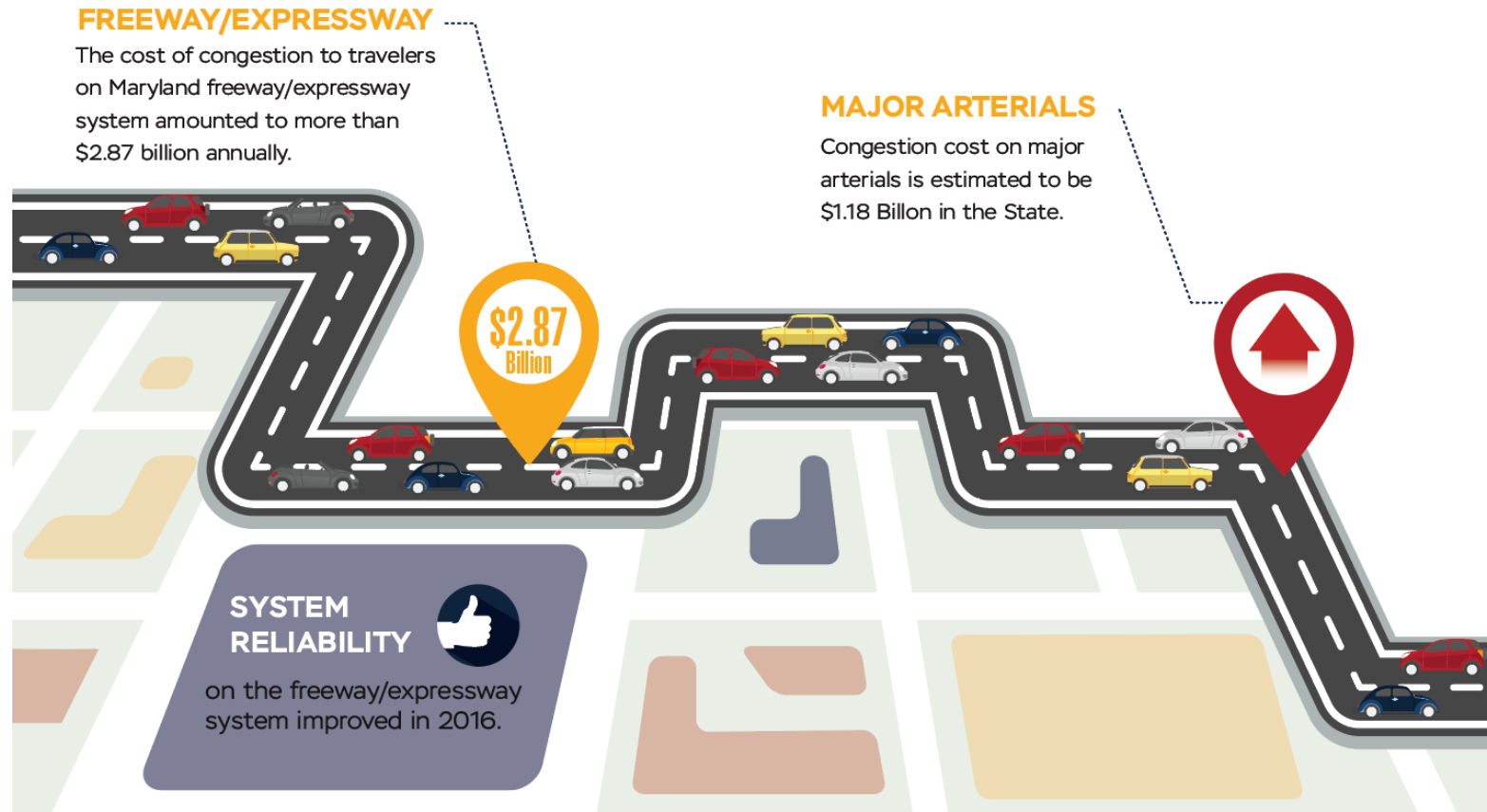
TSMO ORGANIZATION STRUCTURE

MDOT SHA leadership has created a TSMO Division within the Office of CHART and ITS Development to lead TSMO coordination and collaboration between MDOT SHA offices and outside agencies, and to ensure successful delivery of MDOT SHA TSMO Program.



MARYLAND STATISTICS (c.,2017)

Congestion Trends

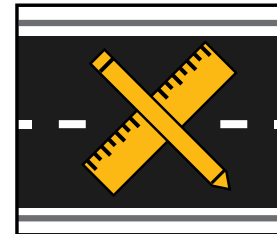
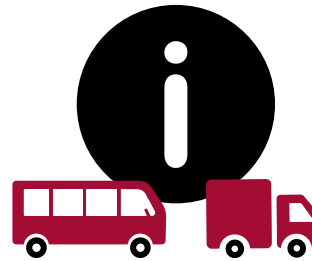
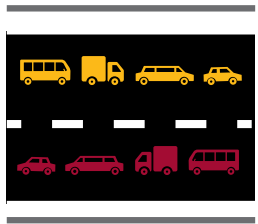


Accomplishments

$$\begin{array}{ccccccc} \$1500 \text{ Mil.} & + & \$50 \text{ Mil.} & + & \$29 \text{ Mil.} & + & \$55 \text{ Mil.} & = & \$1634 \text{ Mil.} \\ \text{CHART} & & \text{Capital} & & \text{Signal Systems \&} & & \text{Park and Ride} & & \text{TOTAL SAVINGS} \\ & & \text{Improvements} & & \text{Multimodal Strategies} & & \text{Program} & & \end{array}$$

TSMO STRATEGIES AND SOLUTIONS

- Work Zone Management
- Traffic Incident Management
- Service Patrols
- Special Event Management
- Road Weather Management
- Transit Management
- Freight Management
- Traffic Signal Coordination
- Traveler Information
- Ramp Management
- Managed Lanes
- Active Traffic Management
- Integrated Corridor Management



MDOT SHA AND TSMO STRATEGIES

TSMO Strategy: Traffic Incident Management

Office of CHART and ITS Development/Districts and Shops

- Statewide and regional operations centers
- 24-7 service patrols
- Statewide traffic incident management training
- Automated inclement weather messaging
- Lane closure permitting system
- Mobile video patrol
- Highway operations technicians
- CHART system software development and maintenance
- 511 Traveler Information System
- Freeway and arterial monitoring
- System infrastructure design, implementation, and maintenance



TSMO STRATEGIES AND MAINTENANCE OPERATIONS

TSMO Strategy: Traffic Incident Management

- Reducing the impact of crashes and traveler delay on Maryland roadways
- Coordination with shops for additional resources and support for FITM detours



TSMO STRATEGIES AND MAINTENANCE OPERATIONS

TSMO Strategy: Work Zone Management

- Reducing the impact of motorist delay resulting from maintenance activities such as:
 - Shoulder repair
 - Guardrail repair
 - Mowing operations
 - Line striping
 - RPM replacements
 - Emergency operations



MDOT SHA AND TSMO STRATEGIES

TSMO Strategy: Emergency Management
*Office of CHART & ITS Development/
Office of Maintenance/District Offices and Shops*

- Large-scale impacts
- Severe weather
- Homeland security
- Can happen anytime, often without warning
- Transportation operations are critical to effective response
- Impacts to transportation infrastructure?
- Coordination prior, during, & following an event
- Multi-agency planning and coordination a must
- Debris management
- Truck parking app during winter operations



TSMO STRATEGIES AND MAINTENANCE OPERATIONS

TSMO Strategy: Road Weather Management

- Reducing the impact of adverse weather conditions on travelers
 - Road Weather Information Systems (RWIS)
 - Snow Plow Tracking System
 - Prioritization of System Recovery during major events
 - Coordination with Utility companies on system restoration when affected
 - Emergency Operations Reporting System (EORS)
 - Traveler Information
 - Truck parking app



MDOT SHA AND TSMO STRATEGIES

TSMO Strategy: Planned Special Event Management *Office of CHART & ITS Development, Districts, Shops*

Effective event management requires intra and inter agency collaboration and coordination

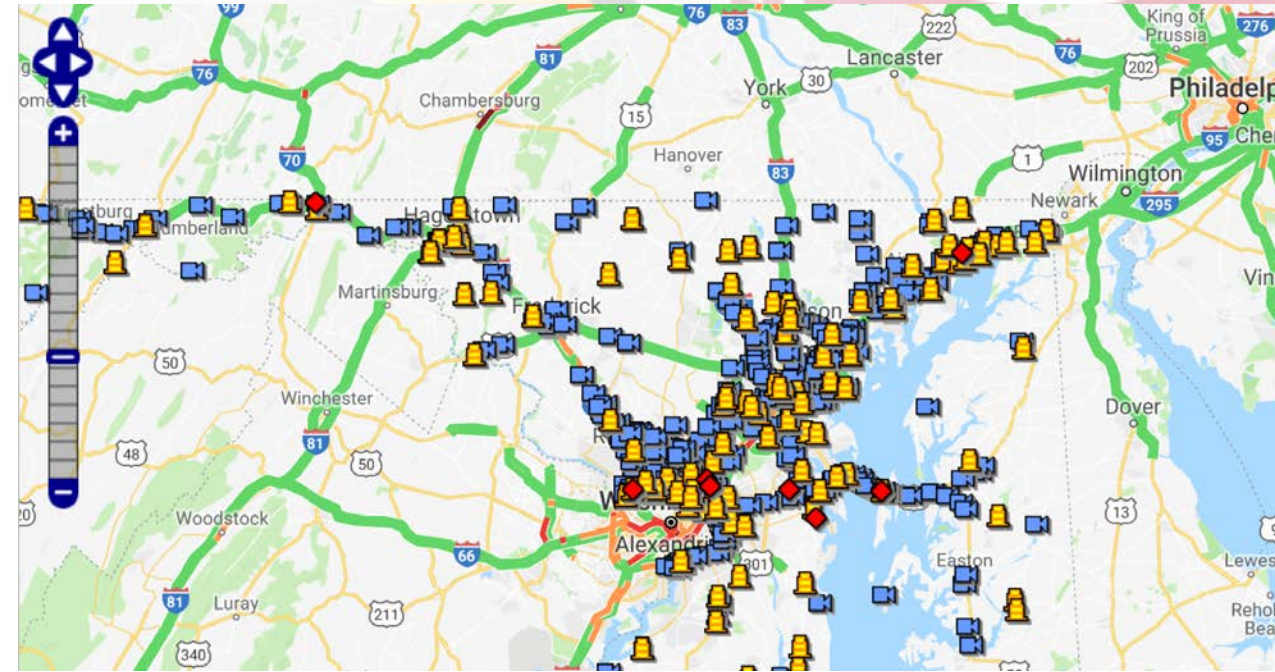
- Planning and protocols - coordination with districts, shops and outside agencies on the development of operational plans when required
- Day-of-event activities – coordination with districts/shops on operation plan
- Post-event activities – after action review with all stakeholders



MDOT SHA AND TSMO STRATEGIES

TSMO Strategy: Traveler Information *Office of CHART and ITS Development*

- 511 Web, CHART Web, Regional Integrated Transportation Information System (RITIS), Metropolitan Area Transportation Operations Coordination (MATOC)
- I-95 Corridor Coalition
- Dynamic message signs (DMS)
- Highway Advisory Radio
- Radio and television traffic reports
- Smart Phone app
- Social media tools
- Commercial traffic conditions and prediction services



MDOT SHA AND TSMO STRATEGIES

TSMO Strategy: Active Transportation and Demand Management

Various techniques in place or planned

Broad operational philosophy – an integrated approach for dynamically and pro-actively managing and influencing travel demand and traffic flow

Uses a combination of the real-time operational strategies:

- Those previously noted
- Managed Lanes (e.g. existing MDTA)
 - New P3 Initiative
- Active Traffic Management
 - Hard Shoulder Running during peak periods
 - Dynamic speed & lane control
 - Queue warning
- Park and Ride lots
- Integrated Corridor Management
 - I-95 Integrated Corridor ConOps



WHAT DOES TSMO MEAN TO MAINTENANCE
OPERATIONS (OOM/DISTRICTS/SHOPS)?



TSMO AND MAINTENANCE OPERATIONS– WILL ANYTHING CHANGE FOR ME?

- Maintenance and Operations may be asked to support MDOT SHA TSMO performance management activities through provision of data and performance tracking (e.g., measure Winter Operations, “Regain Time”)

GOAL 1



**BUSINESS PROCESSES
& COLLABORATION**

GOAL 2



SYSTEMS & TECHNOLOGY

GOAL 3



**DATA, ANALYSIS &
PERFORMANCE MANAGEMENT**

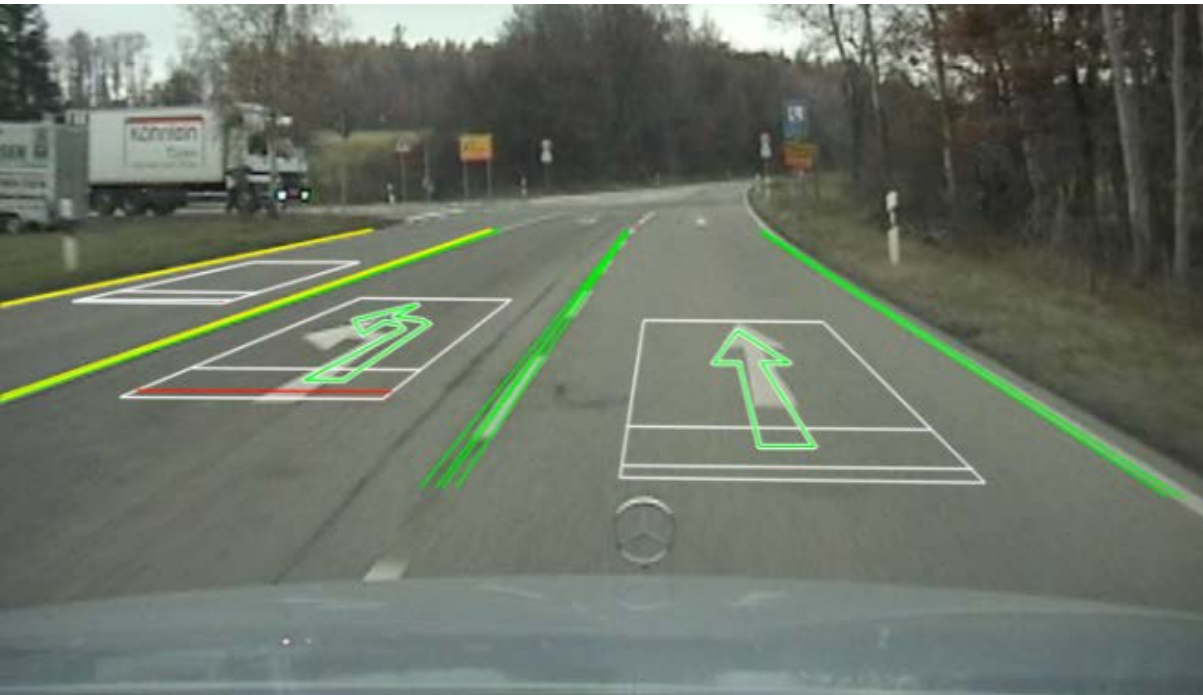
GOAL 4



**CUSTOMER EXPERIENCE
& ENGAGEMENT**

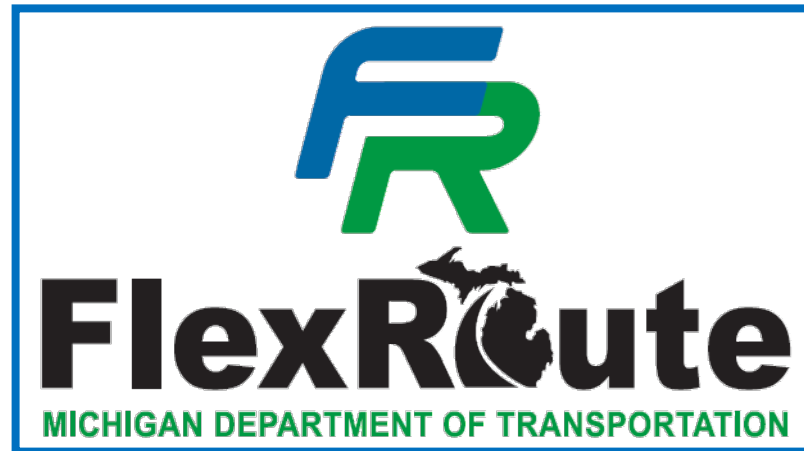
TSMO AND MAINTENANCE OPERATIONS – WILL ANYTHING CHANGE FOR ME?

- Maintenance activities such as maintaining pavement markings/stripping is becoming more critical with the advent of new vehicle safety systems and increasing levels of vehicle automation. ***The future of CAV is advancing rapidly!***



Increasing Lane Capacity within Existing ROW

US-23 Flex Route



Jennifer Foley
University Region Traffic & Operations Engineer
Michigan Department of Transportation



US-23 Background



- Located North of Ann Arbor
- Rural between two urban areas
- Recurring Directional Peak Hour Congestion
- Non-Recurring Congestion
 - Incidents
 - Special events
- Interchange and Mainline Operational Issues
- Road and bridge improvements already planned



Understanding Maintenance

- Requirements for system reliability
 - Goal of 97 percent system reliability
- Preventative maintenance plans
- ITS maintenance efficiencies used to improve response times
 - Allowable work hours
 - Originally only planned on night work
 - Currently performing Force Account Work
 - New Contracting Method





Maintenance Efficiencies

- Modifications made to LCS
 - Controllers removed from sign and placed in cabinet
 - Increased cabinet size to accommodate additional controllers
 - Wire- Copper versus Aluminum
- Maintenance Efficiencies
 - Installed Iboot bars in each cabinet in order to remotely re-boot equipment to decrease maintenance response times
 - Installed environmentally controlled laptops at the two nodes to reduce response time for maintenance





Winter Maintenance Procedures

- During winter operations (snow storms) Michigan State Police (MSP) have special request
 - Contacting MDOT asking for maximum speed to be set to 40 mph
 - Reducing traffic speed during snow storms
 - Developed categories to assist operators what to post on LCS
 - When difficult to determine speeds or road conditions, post SLOW



Flex Route
QRG 11 – ATM SYSTEM USE DURING
WINTER MAINTENANCE



When to Use

- Using the ATM system during winter maintenance events.

Winter Maintenance Event Categories

1. Winter maintenance events are defined by the following three categories:
 - Mild – light snow, winter maintenance is monitoring and potentially plowing
 - Moderate – snowing, winter maintenance plowing and using salt
 - Severe – heavy snow / white out conditions, winter maintenance plowing and using salt plus chemicals

VSL Advisory Speed

2. The VSL Advisory Speed System can be used during winter maintenance based on the following three event categories:
 - Mild – Allow the VSL Advisory Speed System to run as ATMS software recommends.
 - Moderate – Manually set maximum advisory speed due to weather at the direction of MDOT or MSP.
 - Severe – Override the VSL Advisory Speed message with "SLOW".

Note: See QRG 02 – Variable Speed Advisory for instruction on operating and overriding the VSL Advisory Speed.

3. Priority for Small DMS messaging:

- 1) Queue Warning messages (automated response).
- 2) Winter Weather Message (manual override).
- 3) Shoulder Open/Closed to Traffic (automated response).

4. TOC Operator to maintain contact with winter maintenance personnel to determine when winter maintenance event is over and remove VSL Advisory Speed overrides.

Contacts

5. If median shoulder roadway conditions appear to be snow/ice covered, contact the Brighton Maintenance Garage or Washtenaw County Road Commission to inquire if they plan to plow again. If conditions warrant, the median shoulder may be closed at the direction of MDOT, MSP, or Washtenaw County Road Commission.

Questions?



Jennifer Foley
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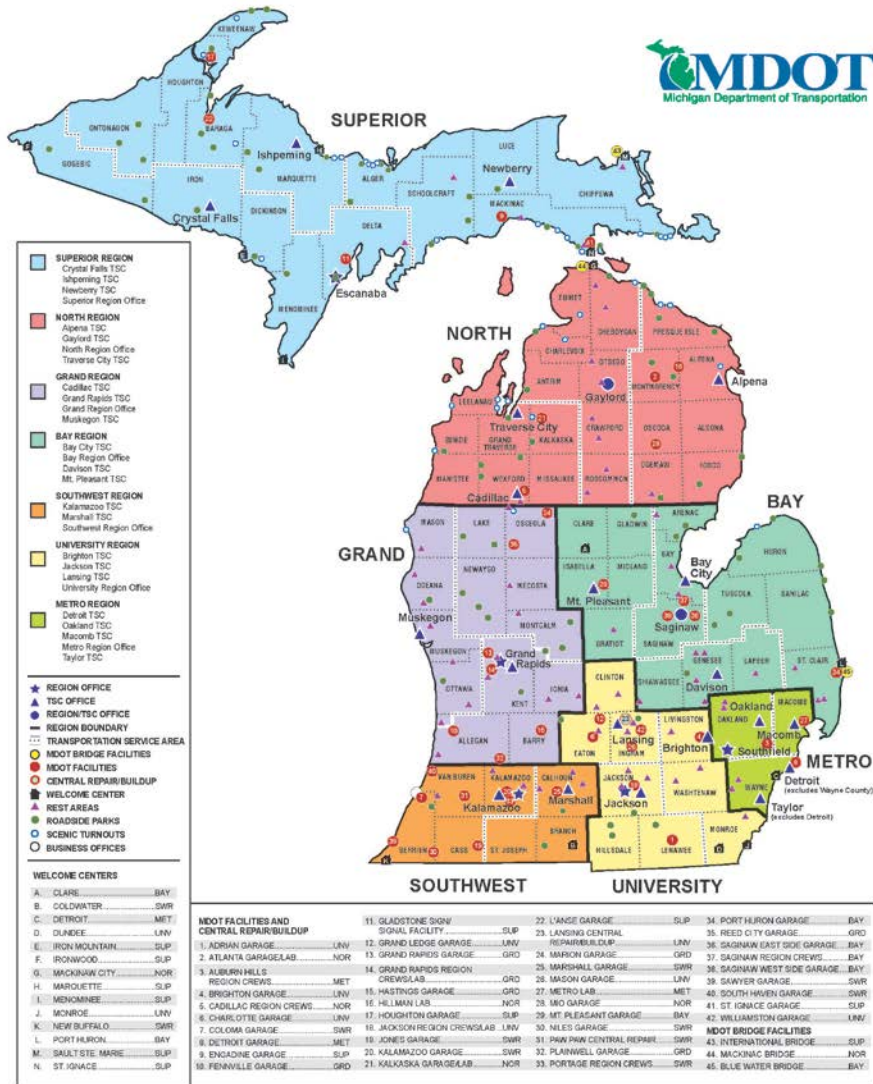
Bay Region: Work Zones & Maintenance



Kimberly Zimmer, P.E.
Associate Region Engineer – Operations
Bay Region Office



MDOT Regional Service Areas and Facilities



Bay Region Work Zones & Maintenance

- MDOT: Bay Region
 - 15 County Jurisdiction
 - Two Direct Force Counties:
 - Saginaw County
 - Isabella County
 - Thirteen Contract Counties
 - Regionwide Crews
 - Specialized
- Annual Maintenance Budget
 - Bay Region: \$37M
 - Statewide: \$300M +/-

Bay Region Work Zones & Maintenance

- Mobility Maps and Work Restrictions
- Coordinate Multiple Types of Work on Corridor
- Bi-weekly Mobility Calls
- Utilize Capital Project Work Zones
- Work Zone Typical and Manual
- Multi-Year Construction Projects
 - Coordinate Staging for Winter Operation and Drainage



Questions



Kimberly Zimmer, P.E.

Associate Region Engineer – Operations

MDOT: Bay Region Office

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Traffic Incident Management (TIM) Program

TIM Program operational goals

- Relationship to TSMO Goals
 - Goal: Improve Reliability, Mobility, and Efficiency
 - Objective: Reduce the frequency of congestion or slowed traffic on the freeways and arterials in metro areas throughout Minnesota
 - Objective: Reduce incident response and clearance times in the Twin Cities and Greater Minnesota
 - Goal: Increase Safety
 - Objective: Reduce the frequency of secondary crashes and crashes related to work zones
 - Objective: Reduce responder exposure

TIM Program Strategies from TSMO Plan

- Develop Regional Traffic Incident Management (TIM) Programs
 - Improve collaboration among TIM partners
 - Establish TIM teams
 - Conduct after action reviews
 - Expand safety service patrols
 - Enhance crash reconstruction
- Develop Traffic Incident Management (TIM) Strategies for Work Zones
 - TIM response plans for specific work zones
 - Establish TIM team dedicated to work zone
 - Dedicated safety service patrols

Secondary Issues Created by Operations

- Any changes in Policy, processes, and performance
 - “Open Roads” – A statewide policy between MNDOT and State Patrol to make re-opening roads & lanes a priority.
 - “Quick Clearance” – A change in state law 169.041, applies to Metro district only, gives MSP & MNDOT additional legal force to clear obstructions promptly.
- Performance Goals:
 - Goal for Metro: Average Incident Clearance Time in 35 Minutes
 - Goal Statewide: Clear incidents from roadway in 90 minutes.

Secondary Issues Created by TIM Operations

- Expected maintenance needs and unforeseen maintenance needs
 - Metro District: 24/7 response with goal of providing initial traffic control within 30 minutes during normal business hours and 60 minutes after normal working hours. Provide heavy equipment to clear incidents.
 - Greater MN Districts: 24/7 response with goal of providing initial traffic control within 60 minutes during normal business hours and 90 minutes after normal working hours.
 - Statewide: Provided equipment, materials, and manpower to clear incidents.
 - Challenges: Postponing regular maintenance duties for incidents

Secondary Issues Created by Operations

- Any changes in Equipment utilization and coordination

Takeaways, Solutions and Lessons Learned

- Successes
 - Initial agreement along with initial training rollout
- Challenges
 - New staff are not familiar with open roads policy
 - Collecting data for performance measures
- Lessons learned
 - Need for continuous training
 - Need for continuous collaboration

Other details

- Extra slides as long as you keep your presentation to 10 minutes

Quick Clearance

MN Statutes sec 169.041, subd 5a

“DOT & MSP may move, remove, or cause to remove obstructions from road if:”

- Within Metro District 8 county area.
- Collision, accident or spilled load that blocks or aggravates an emergency on road
- MNDOT cooperates with Patrol & MSP authorized tow/recovery company.

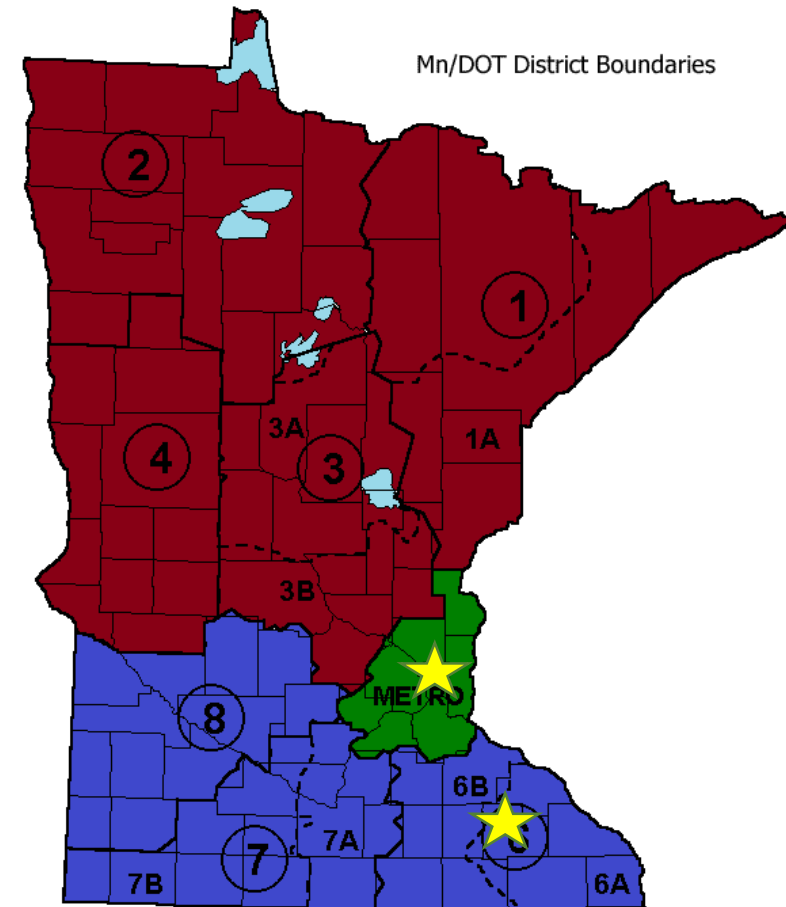
Quick Clearance cont.

And

- SP makes a “reasonable effort” to contact owner.
- DOT makes a “reasonable effort” to allow owner to arrange to remove by licensed tow service capable of safely moving.
- “...taking into account any time delay and safety issues”
- Tow charges must be “reasonable”

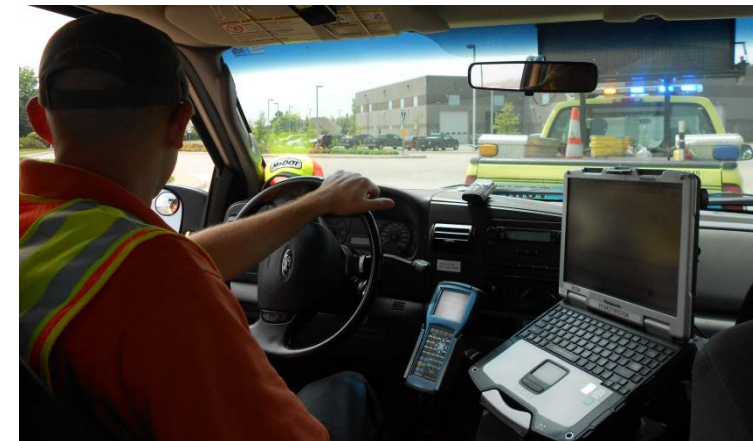
Two Operational Models

- Twin Cities Metro Area
 - MnDOT Responsibilities
 - Traffic Operations
 - Traveler Information
 - Freeway Service Patrol
 - Maintenance Dispatch
 - State Patrol Responsibilities
 - Emergency management and dispatching
- Greater Minnesota
 - State Patrol Responsibilities
 - Traveler Information
 - Maintenance Emergency Notification
 - Emergency management and dispatching



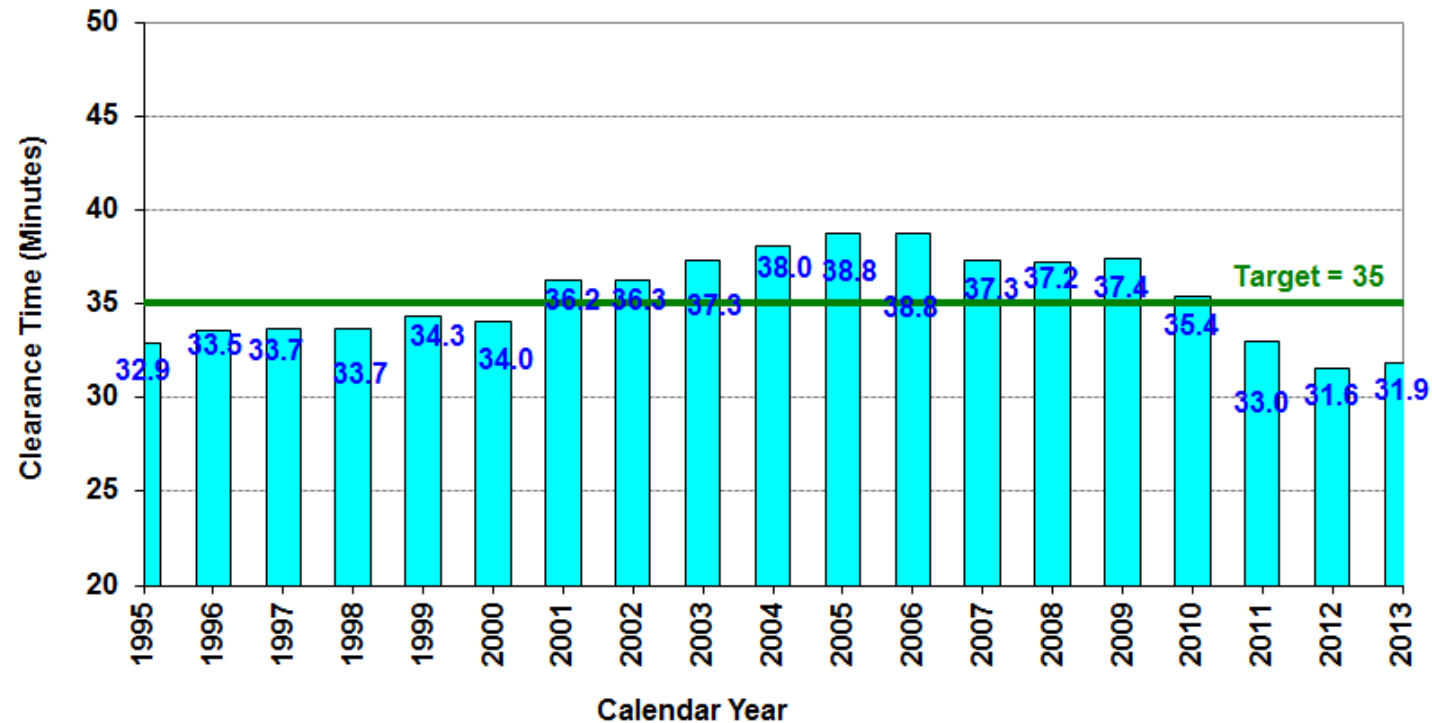
FIRST - Freeway Incident Response Safety Team

- Twin Cities Metro Freeways
- 8-11 Routes
- 250 Miles
- DOT owned vehicles and DOT employees
- B:C Ratio = 15:1



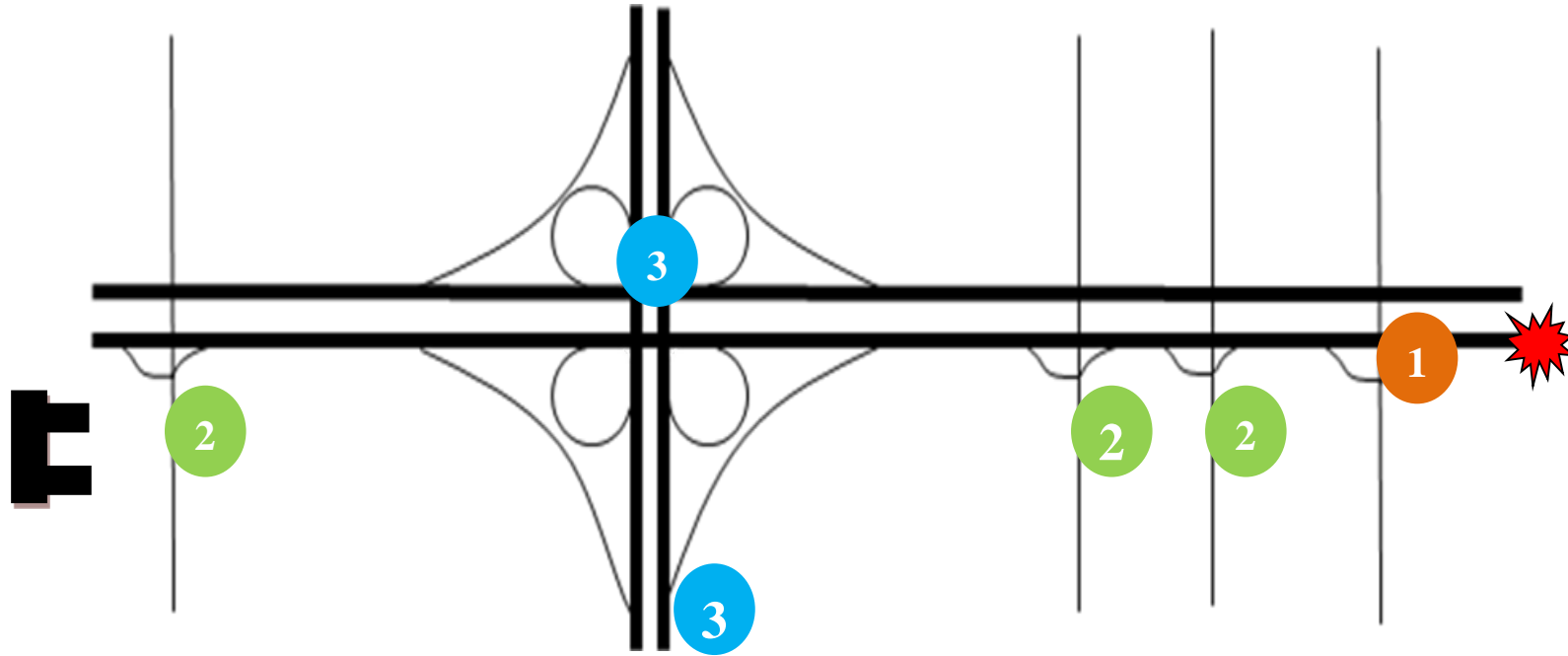
Performance Measures (Measures, data & analytics, & utilization)

Average Clearance Time for Urban Freeway Incidents



Systems & Technology

- Computer Aided Dispatch (CAD)
 - Deployed in 2008
 - Improved communications with MSP and RTMC Dispatch
 - Data tracking
- ARMER Radio System
 - Shared 800 mHz radio system
 - Improved communications with MSP and Metro Maintenance



- 1 Hard Closure at immediate upstream intersection on-ramp (close) & off-ramp (detour to nearest ramp) (1 unit/lane)
- 2 High Priority Soft Closure at On-Ramps (1-2 units/location)
- 3 Lower Priority Soft Closure at On-Ramps(1-2 units/location)

Road Closure Plans

Incident Location: I-35W SOUTHBOUND between I-94 and 31st St



Closure Priority	Description	Location	Number of Units
	Incident Location	SB I-35W between I-94 and 31 st St	-
	Hard Closure	Mainline SB I-35W at Exit to Hiawatha	2 units
		On-ramp from 4 th Ave to SB I-35W	2 units
		On-ramp from 12 th St to SB I-35W	3 units
		On-ramp from WB I-94 to SB I-35W	1 unit
	Soft Closure	-	-
	Soft Closure	-	-
Total Number of Units			8 units
Other Actions		Post Message to DMS at: <ul style="list-style-type: none"> • SB I-35W prior to Washington Ave (V35WS0) • WB I-94 prior to 20th Ave (V94W09) • EB I-94 prior to Penn Ave (V394E12) • EB I-94 prior to Louisiana Ave (V394E09) • SB I-94 prior to Broadway Ave (V94E06) 	

- Routes
 - I-94 in Districts 3 and 4
 - I-35 in District 6
- Alternate Route Signing
- Detour Route Maps
- Coordination with Local Agencies



TDOT Incident Management/Maintenance

- Support MOU between DOT and Safety by
 - Participating in unified command
 - Being proactive in safe quick clearance
 - Commit resources depending on the time/availability of resources from recovery

Secondary Issues Created by Operations

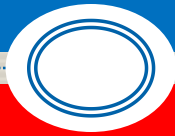
- Balancing the timeline for repairs what has to be done in the incident phase to what can be scheduled
- Two things under development
 - Clarification of “maintenance” employees role in rural incidents
 - Formalizing/Standardization of TDOT’s role with a SOG covering from accident, initial reporting, incident response, thru the final recovery stage

Takeaways, Solutions and Lessons Learned

- Implementation is robust, comprehensive, and effective
- Rural incidents have a challenging dynamic between managing the incident and completing tasks
- Dump Trucks as screens, sometimes light is all that is needed, asking a rock quarry to help because it was saved 30-45 minutes
- Relationships are priority, success over time is more important than single incident outcome

Traffic Incident Management Training

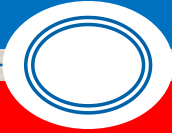
- Support Interdisciplinary TIM Training through the Regional TIM committees with involvement from District Maintenance Staff
- Provide hands on training for District Maintenance staff.
- Provide advanced TIM training to District Maintenance leadership to develop a common understanding of TDOT's roles as it relates to incident response in Tennessee.



At this crash, the southbound lanes were closed because the victim would have been clearly visible to traffic. TDOT just happened to have several dump trucks in the area working on the slide so they were brought down and used as a screen which allowed us to open 1 SB lane.



THINK OUTSIDE THE BOX



At this crash, two school buses hit head on, involving fatalities, requiring an extensive investigation, TDOT supplied supplemental lighting and two lowboys to haul both buses minimizing degradation of evidence



Ask other agencies what support is needed

BEST PRACTICES/LESSONS LEARNED



- TDOT must have a representative on scene actively working with other agencies to have a voice in how an incident plays out
- We can and should use any equipment/resources available to us if it will reduce the overall clearance time for an incident
- With few exceptions, lanes should not be blocked for the off-loading of cargo
- If wreckage is clear of the roadway, recovery work should be done at night, scheduled

Peer exchange Discussions

- Discussion of three major topics on Day 1
 - Topic 1: Traveler Information in Work Zones
 - Nevada DOT: Lessons Learned Using Smart Work Zones for Automated Real Time Traveler Information
 - Michigan DOT: Lessons Learned on Redeveloping 511 Website
 - Minnesota DOT: Lessons Learned on Streamlining Internal Processes
 - Topic 2: Lane Closure Management
 - The Ownership, Maintenance, System Integration, Safety, and Physical Security Considerations for Smart Work Zone Equipment
 - Compliance of Work Zone Agency Policies
 - Variable Speed Limits in Work Zones
 - Topic 3: Technology in Work Zones
 - Connected Work Zone
 - FHWA Work Zone Data Initiative
 - Minnesota DOT: Lessons Learned on Active Traffic Management System at I-895 Bridge Project
- Day 2 – Break out groups

Maintenance-related takeaways

- Spare parts for smart work zone equipment
- Learning curve for equipment set up and maintenance
- Equipment maintenance is key in success/failure
- Outsourcing versus in house
 - Time limitations/resource limitations
 - Extracting data from equipment
 - QA/QC
- Work Zone Gaps/Issues by Capability Maturity Model Categories
 - Gap in Business Processes: Different schedules for project cycles and maintenance cycle
 - Gap in culture (Engaging diverse stakeholders): different levels/jurisdictions of maintenance staff

Washington State DOT

Increasing Lane Capacity within Existing ROW

Ron Morton – Everett Maintenance Supervisor

Courtney Sell – Southwest Region Traffic

SR 14 Bus on Shoulder Pilot



SR 14 Bus on Shoulder Pilot

- The goal is to improve transit travel times by allowing C-TRAN buses to by-pass traffic when the highway is backed up
 - About 1.5 miles between I-205 and 164th Ave interchanges
- Road Setting: Urban

Secondary Issues Created by Operations

- Expected maintenance needs:
 - shoulder brushing
- Any changes in Policy, processes, and performance:
 - Buses may only use shoulder when mainline speeds are less than 35 mph, and may only travel 15 mph over mainline speeds at a max of 35 mph
 - Improved travel times and reliability
- Any changes in Equipment utilization and coordination
 - Narrowed shoulders require lane closures for median work

Takeaways, Solutions and Lessons Learned

- Successes and Challenges
 - Maintenance work on an additional lane and narrowed shoulders
 - C-Tran improvements
- Unique approaches for solutions
 - Used 3M temporary tape
- Lessons learned
 - Maintenance is too busy to brush shoulders every day

Washington State DOT

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