Transportation Systems Management and Operations (TSMO)

Sue Porter
Traffic Topics
February 20, 2018

Agenda

What is TSMO and Why it is Important?
What is MnDOT missing with its current TSMO activities?
Capability Maturity Matrix (CMM)
Strategic Plan
Implementation & Business Plan
What about Autonomous and Connected Vehicles?
Discussion/Questions

What is Transportation System Management and Operation?

Defined in MAP 21 & FAST Act

- "Integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects"

- Supported and enabled by Intelligent Transportation System (ITS) technologies

Integration is both technical and institutional

Iowa DOT's Simpler Definition

A coordinated approach to managing and operating our roadways as safely and efficiently as possible focused on:

- maximizing existing infrastructure,

- addressing the causes of breakdowns in flow,

- overall performance of the transportation system.

Why is TSMO important?

Percentage of Miles of Twin City Urban Freeway System Congested
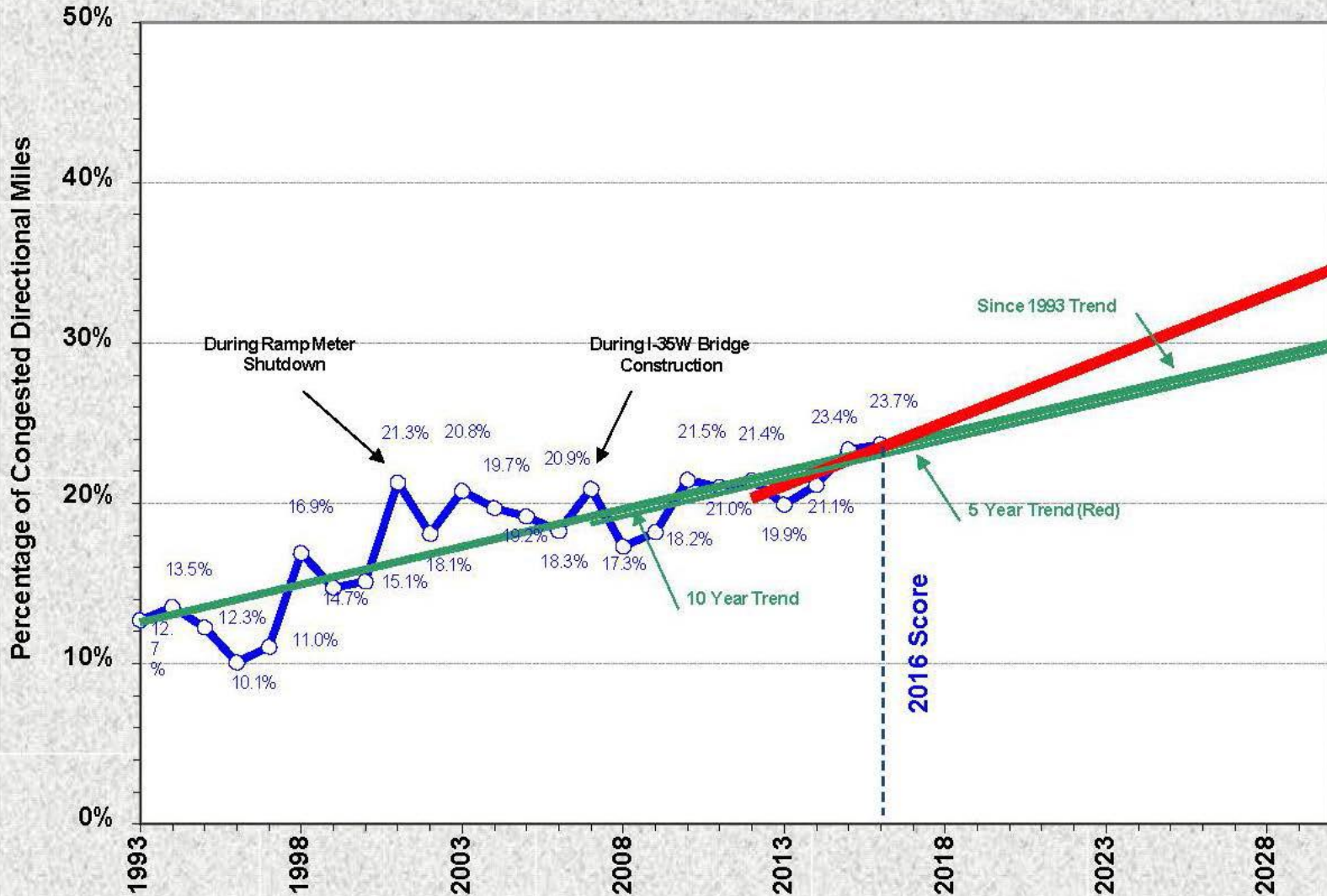
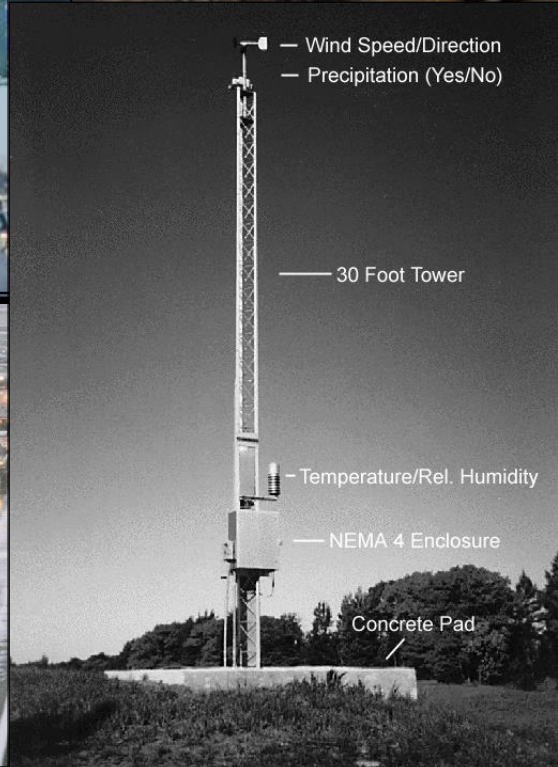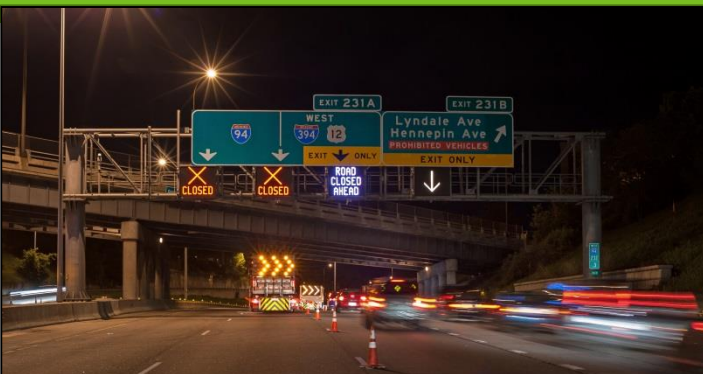# Example Operations Strategies and Solutions

- 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

- Connected & Autonomous Veh

❖ **Very Broad**
❖ **Technology, policies, partnerships (from every-day activities to cutting edge**
❖ **Applied in both urban and rural environments**

MnDOT Operations Strategies

- Wind Speed/Direction
- Precipitation (Yes/No)
- 30 Foot Tower
- Temperature/Rel. Humidity
- NEMA 4 Enclosure
- Concrete Pad

FREEWAY TIME TO
94   10 MIN
HWY 36   16 MIN

What is MnDOT Missing w/TSMO
(i.e. Reaching Full Potential of Operations)

- Full potential is **<u>not</u>** primarily a "technology" issue or knowledge of best operations practices

- The key: Put in place and manage specific supportive business and technical processes and supporting institutional arrangements
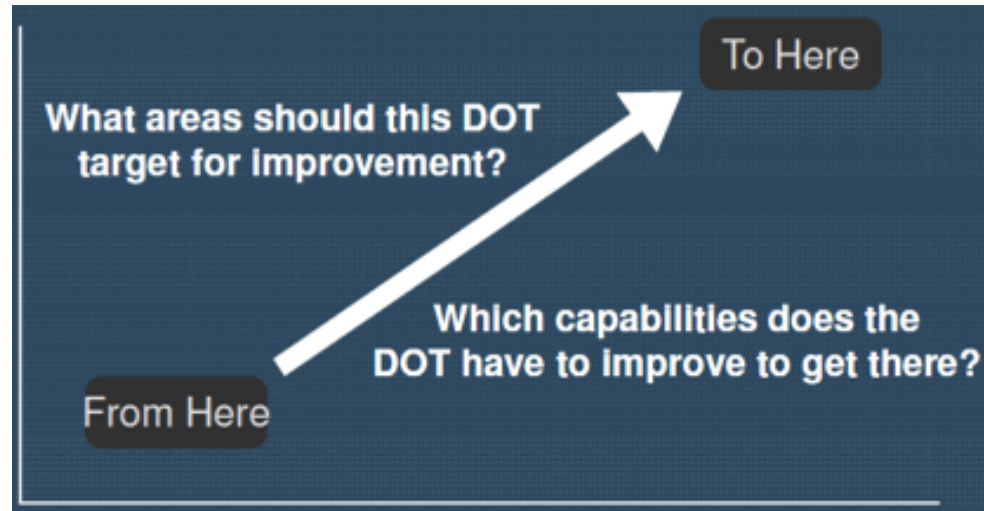
"Mainstreaming Operations"

Operations needs to be a formal core MnDOT program just like construction and maintenance.
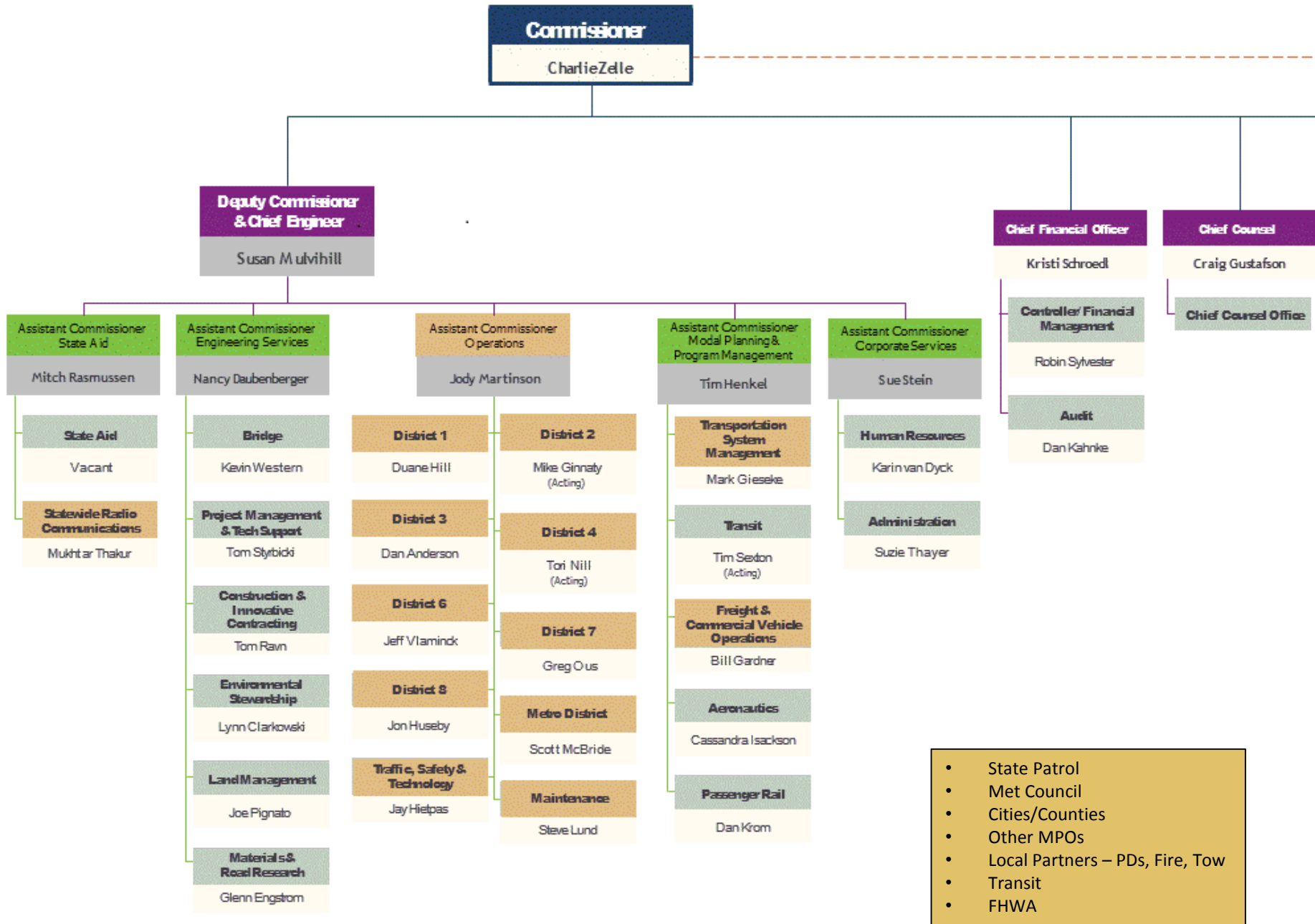
Key Leadership Questions for Mainstreaming Operations

- What are your customers' needs and expectations?

- What are your current business processes for operations
(e.g., who is responsible, what expertise is needed, what resources)?

- Where are you today?

- Where do you want and need to go?

- How are you going to get there?

Each DOT will have unique challenges and opportunities.

What areas should this DOT target for improvement?

To Here

From Here

Which capabilities does the DOT have to improve to get there?

Mainstreaming Operations

- Consider organizational issues and relationships

- Focus on supporting business and technical processes within the agency

- Define what constitutes an effective program

- Mutual Benefits – Including operations in the Highway Safety Improvement Program, Congestion Management Process, Asset Management Plan, etc.

The "Program"

↑

Needed Processes

↑

Supporting Institutional Framework
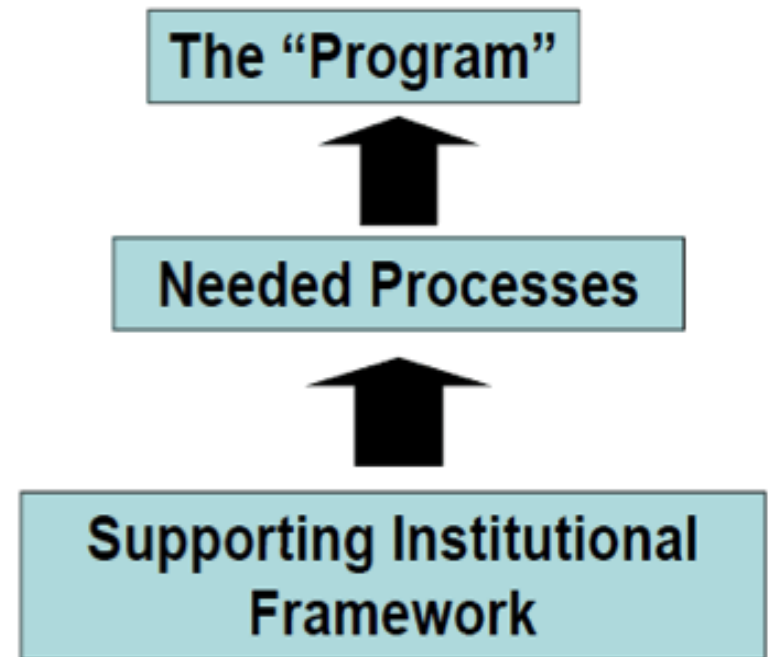
Critical Dimensions for Improved Operations in a DOT

Business Processes

Systems & Technology

Performance

Culture

Organization / Staffing

Collaboration

- All (6) dimensions are:
  - Essential
  - Interrelated
- Require executive support and leadership
- Support continuous improvement of operations and reliability

TSM&O Regional Workshops

- August 2014 – Milwaukee

  - Ray Starr – ITS R&D
  - Jim Kranig – RTMC Manager
  - Todd Stevens – District Maintenance Engineer
  - Mike Schweyen – District Traffic Engineer

- May 2015 – Northwest Passage (mini – CMM)

  - Cory Johnson – ITS R&D
  - Brian Kary – RTMC
  - Mike Kamnikar – Metro Maintenance
  - Steve Misgen – Metro Traffic
  - Tiffany Dagon – Metro Traffic

- Introduction to the TSM&O Capability Maturity Matrix – Developed under SHRP2

Operations Capability Dimensions

Business Processes

- Planning and programming

- Budgeting (resources)

- Project Scoping

Performance

- Defining measures

- Data acquisition and analytics

- Presentation (internal and external)

Systems and Technology

- Use of systems engineering

- Systems architectures

- Standards and interoperability

Operations Capability Dimensions

Culture

- Leadership
- Outreach
- Technical understanding

Organization / Staffing

- Programmatic status
- Organizational structure
- Staff development and retention

Collaboration

Relationships and partnering:

- Within DOT
- Among levels of government
- Public safety agencies
- MPOs
- Private sector

Levels of Capability Maturity

Ultimate Goal for the Future

Most Agencies Today

LEVEL 1 — Performed
- Relationships & Activities ad hoc
- Champion-driven

LEVEL 2 — Managed
- Processes developing
- Staff training
- Limited accountability

LEVEL 3 — Integrated
- Process documented
- Performance measured
- Organization aligned
- Program budgeted

LEVEL 4 — Optimized
- Performance-based improvement
- Formal program
- Formal partnerships

Assessment of MnDOT Capabilities

Category	Current Assessment Level
Business Processes (Planning, programming, budgeting, implementation)	**Level 2 Plus**
Systems & Technology (Systems engineering, standards and technology interoperability)	**Level 3**
Performance Measurement (Measures, data & analytics and utilization)	**Level 2**
Culture (Technical understanding, leadership, outreach, and program authority)	**Level 2 Plus**
Organization/Workforce (Organizational structure and workforce capability development)	**Level 2 Plus**
Collaboration (Partnerships among levels of government and with public safety agencies and private sector)	**Level 4 Minus**

Minnesota CMM

- Business Processes – 2 Plus

  - Some planning (HSOP, TAMP), plans include funding for roadside infrastructure, asset management, office budgeting process, operations mentioned in MnSHIP and STMP

  - No formal TSMO plan

- Systems & Technology – 3

  - Approved products, equipment on state contract, ITS architecture, training in systems engineering and are using it, common software

Minnesota CMM

- Performance Measurement – 2 plus

  - High level and detailed performance measures identified and tracked for metro freeways, MnDOT Performance Score Card

- Culture – 2 plus

  - Senior management support for operations due to cost effectiveness, not as much support within GM MnDOT

  - No single overall core program

Minnesota CMM

- Organization / Workforce – 2 minus

  - No dedicated top level management, roles not formally defined

- Collaboration – 4 minus

  - TOCC state patrol agreements, 800 MHz digital trunked radio, agreements for operating signals, cooperative operation with neighboring states, data and video provided to media, academic and private entities

Business Processes Actions

- Create a formal statewide TSMO plan

    - Formalize goals, roles, functions, organization

- Gain support within MnDOT and external partners (cities, counties, MPOs, MSP, Fire, etc)
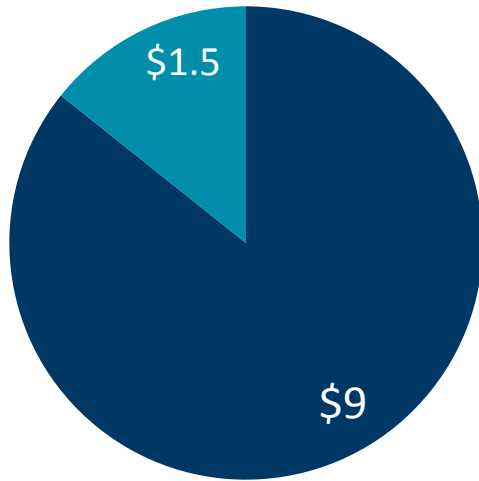
First big step

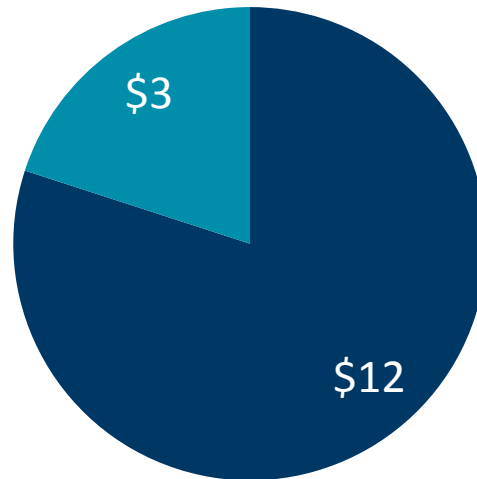▸ Develop a MnDOT Statewide ITS plan (completed July 2015)

Statewide ITS Plan
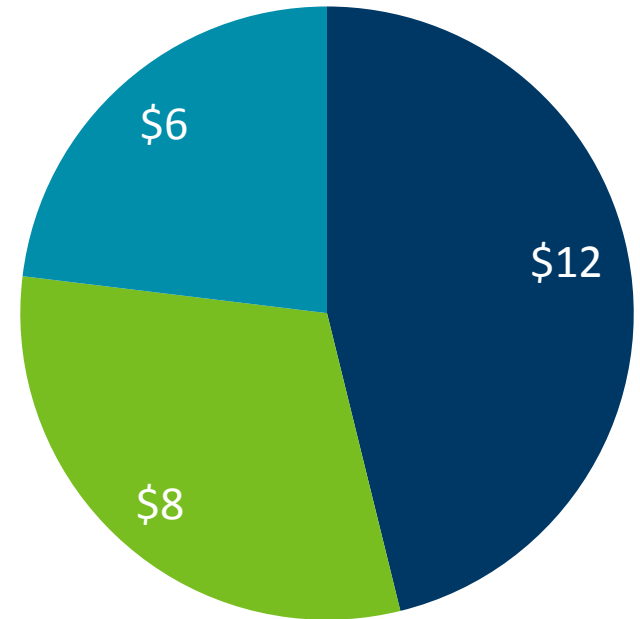## 10 YR Investment Needs Above Base

Scenario A: $10.5 M

Scenario B: $15M

Scenario C: $26M

- ■ Asset Management
- ■ Expansion
- ■ Operations

Statewide ITS Plan
Outcomes of Optimization Scenario

Expansion/Asset Mgmt.

- All expansion of other scenarios
- Build out of ITS on Hwy 52 and I-35 in D6, Hwy 169 in D7, I-94 in D3/4
- ITS assets replaced at life cycle targets
- 511 road weather is automated

Decommissioned ITS

- Only those devices no longer needed

ITS Communications

- Statewide virtual ITS network (with Mn.IT) for management of devices at RTMC
- All ITS devices are connected

Operations

- All ITS operations managed through RTMC 24 x 7
- Improved Emergency Management ability
- Automated 511 road/weather data input

Staffing

- 4 FTE for RTMC Operations
- 1 FTE for Metro Traffic
- 1 FTE for statewide Maintenance and Integration
- 2 FTE for ITS Design

Transportation System Management & Operations

- Core strategy for Agency
- TSM&O Plan developed and implemented
- Seek to achieve highest level of TSM&O in most areas

Sue's role*

- Be the point of contact for MnDOT TSM&O related issues and national committees

- Establish a high level agency leadership team to oversee TSM&O

- Determine "current state" of all TSM&O strategies using the Capability Maturity Matrix

- Determine if a formal TSM&O plan should be developed

- Prepare MnDOT Organization for Connected and Autonomous Vehicle growth (headed by OTST – Jay Hietpas/ITS R&D group)

TSM&O Leadership Team
(Management Group similar to PCMG, CMG, OMG, AMG)

- Sue Mulvihill   Deputy Commissioner & Chief Engineer
- Jody Martinson   Assistant Commissioner Operations Division
- Amr Jabr   Asst. Division Director
- Jeff Vlaminck   District Engineer
- Duane Hill   District Engineer
- Steve Lund   State Maintenance Engineer
- Bryan Dodds   Metro Maint & Ops Office Director
- Steve Misgen   Metro Traffic
- Brian Kary   RTMC
- Ray Starr   ITS R&D
- Mark Nelson   MnDOT Planning Director
- Sue Porter   TSMO Lead
- James McCarthy   FHWA
- Jed Falgren   District Maint Engineer
- Tom Dumont   District Traffic Engineer

FY 18 – FY 19 Change Request

1	Statewide ITS System Integrator	Statewide integrator to support Greater Minnesota ITS but also take pressure off RTMC integration staff that currently support Greater Minnesota. Includes one vehicle.	1 FTE
2	Probe Data	Purchase probe data to be integrated into RTMC iPEMs system for real-time operational decision making along arterial corridors with no data and within construction zones.	$400K
4	RTMC Operator/ Dispatchers	RTMC Operator/Dispatchers to expand RTMC hours of operation on <u>weekends</u> to support incident management, construction projects and events	2 FTE
5	RTMC Operator/ Dispatchers	RTMC Operator/Dispatcher to do part-time statewide operations. <u>MSP would still do statewide ops overnight.</u>	2 FTE
6	Signal Operations Staff	Signal Operation staff to support central system, performance measures, SPaT, ATCMTD, Greater Minnesota Signal Operations.	1 FTE
7	New FIRST Route including vehicle	One new FIRST route to provide coverage in the northern metro and additional coverage on the weekend (total 2 routes) to include one new vehicle with CMS.	2
8	Streaming Video to Public statewide	Ability to provide streaming video to general public via 511 as well as higher quality video to external partners such as media, multiple local 911 call centers, emergency responders, local traffic agencies, etc. Initial capital investment and then on-going operational cost.	$750K

FY 18 – FY 19 Change Request

Autonomous Bus	This is an unfunded project that is a priority to the Commissioner. Funds will be used to procure the contract, provide temporary infrastructure for testing at MnROAD, and consultant support.	$450K
Electrical Engineer/ Project Manager	Electrical Engineer - Project manager to CV/AV projects and succession planning behind Ray Starr. Supports CV/AV, ESS, and Signals and Lighting Standards	1 FTE
SPaT Challenge	AASHTO has challenged each state to provide Connected Vehicle technology at 20 signals by 2020. These funds will be used for Phase I (develop data security measures)	$400K
RTMC Programmer	RTMC (embedded MN.IT) to support various needs including ATCMTD (AV/CV), IRIS enhancements, video switch, support signalized arterials, etc.	2 FTE
Connected Corridors	Additional Funds for SPaT phase II.	$1.2M

Scope of TSMO Planning Effort – 18 Months

- Task 1: Strategic Planning (6 months – Complete by Jun 2018)

    - Review MnDOT strategic direction

    - Review state of TSMO practice

    - Conduct strategic workshop

    - Develop strategic TMSO document

- Task 2: Tactical Decision-Making

    - Define process for developing implementation plan

Scope of TSMO Planning Effort

- Task 3: Implementation Planning

  - Develop list of potential projects, services and activities based on strategic goals and objectives

  - Apply tactical decision-making process (from Task 2)

  - Establish prioritized list of projects, services and activities

- Task 4: Business Planning

  - Develop business plan for programmatic aspects of TSMO

  - Business planning will begin in Task 1 as MnDOT plans are reviewed in relation to five business plan elements

  - Decision-making process and 5-year implementation plan developed in Tasks 2 and 3 will also be incorporated into business plan elements

Connected and Autonomous Vehicles Perspectives

DEPARTMENT OF TRANSPORTATION

TOWARD ZERO DEATHS

Connected and Autonomous Vehicles

- Establish a MN AV/CV Jurisdictional Committee.

- Support Legislators in developing regulation for testing and operations (Proposed legislation sent forward fall 2017)

- Stay connected nationally with organizations and committees researching and deploying technology (Ray, Jay/Cory)

- Continue our own CV research (connected corridor project with 20 SPaT intersections)

- Conduct an Autonomous Shuttle Bus Demonstration project.

- Develop Strategic Plan for Long Range Plan (RFP out now - 12 month timeframe -)

- Establish a MnDOT CAV Multi-disciplinary (met twice)

Connected and Autonomous Vehicles

- Effect on How MnDOT plans for and builds roads?

    - YES!, the question is how fast technology will be deployed.

        - Short term – Safety improvements still needed (358 deaths last year) until majority of vehicles are autonomous.

    - Important to monitor trends and adapt future planning impacts

Final thoughts/summary

- TSM&O Leadership Team established with correct MnDOT Management (should we reached out to transit or other agencies or just get MnDOT's act together?)

- Met Council just established a "Congestion Management Process Advisory Committee" to develop regional objectives, strategies, perhaps a separate solicitation for signal retiming for locals

- ITS Architecture being updated and just met with many stakeholders to identify project needs.. Need to coordinate with this plan.

- Develop a full MnDOT TSM&O strategic, implementation and business plan.

- Develop a separate MN (not just DOT) CAV Strategic Plan (RFP our now).

Thank you again!

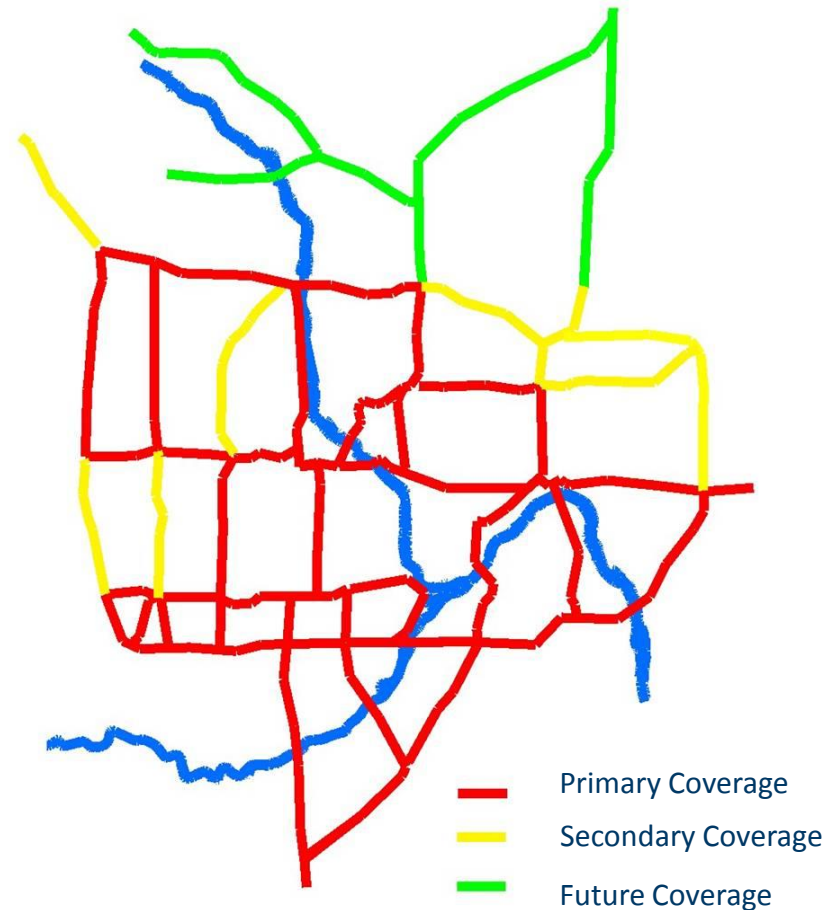**Sue Porter**

Susan.Porter@state.mn.us

651-366-5734

Extra Slides Follow

Next steps to improve the FIRST Program – Brian Kary

- Expand coverage to north metro

  - Secondary routes become primary allowing for more coverage in core metro.

- Expand hours of operations

  - Weekend coverage is currently only one-driver

— Primary Coverage
— Secondary Coverage
— Future Coverage

Next steps to improve the FIRST Program

- Increase coverage during major construction
    - Additional FIRST drivers
    - Contracted Tow Trucks

- Types of Vehicles
    - Pickup Trucks
    - Incident Response Trucks

Next steps to improve the Road Weather Technology Program - Curt Pape

- Expand road weather data backbone. (RWIS)

  - Add 60 sites throughout state over three year period $1.2m per year

- Need for additional regional coordinator on a permanent basis.

- Improve IT support, develop framework and create expertise.

- Finish the Management Reports project.

- Equip new trucks with AVL as purchased.

- Finish testing and expand the use of Plowcams.
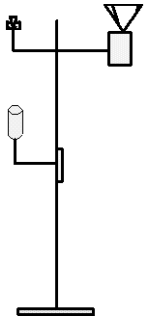
Next steps to improve the Traveler Information Program

- Consolidate the district's CARS users to central location (RTMC – if the Ops Center goes to 24/7)

  - More consistent entries
  - Easier quality control
  - Help with deployment of DMS signs statewide
  - Help with other 511 responsibilities especially during weekends, holidays and during vacations

- Integrate MDSS into 511 updates automatically

- Marketing

  - Promotions, news releases and media outreach will equal more 511 end users (Bill Boards, bus covers)

511 Enhancements

- Geofenced Messages (pushed alerts)

  - Flooding – road closures
  - Tornado Warning
  - Pushed messages to your 511 app based on your location

- MnPASS Pricing displayed on 511 (sooner rather than later)

- Multimodal enhancements (Transit data)

- Rest Area Amenities and Truck parking (in the works)

- Connected Vehicles

  - 511 can help bridge the gap of vehicles not having onboard systems that receive traveler information

Next Steps Signals (Metro)

- Transition to new central system (Maxview Sept 2017)

- Transition to Transportation Asset Management System (TAMS-Sept 2016)

- Transition to using Signal Performance Measures (UtahDOT)

  - Retiming driven by actual need

- Talent Management

  - What skills are needed for future applications (Performance Measures, CAV)?

Next steps to improve the Work Zone Program

- How do we better coordinate with Metro Cities/Counties? 13% of MN Citizens believe delay is unacceptable or completely unacceptable.

- More active role from construction staff to monitor and place importance on keeping the WZ's up to standards. Once WZ's are in place they are often never relooked at.

- Start TC plan earlier in the process. Often things are discovered during the design process (i.e. major culvert replacement).

- Best practice in GM larger cities (like Duluth and Rochester) to annually meet with Counties and City.

WZ Opportunities

- Driver delay is a soft cost so spending hard $ difficult sell
- [Metro District Traffic Mitigation Memo](#) – Should this be statewide practice – Set aside a certain % of construction cost for work zone mitigation applications such as Travel Time systems
- Improved Training (Contractors, Inspectors, Consultants, Maintenance, Utilities)
- Worker Safety Culture (our injury rates are higher than industry average)
- Workers feel safer when traffic is slow - How can we slow people down (Auto Speed Enforcement or Full Closures)
- TTC Quality and a "race to the bottom"

- Expand to cover outstate districts

  - Greater focus on traveler information than MSP dispatch

- Expand hours of operations

  - Current duties are transitioned to either Metro Maintenance or MSP dispatch

Mn/DOT District Boundaries
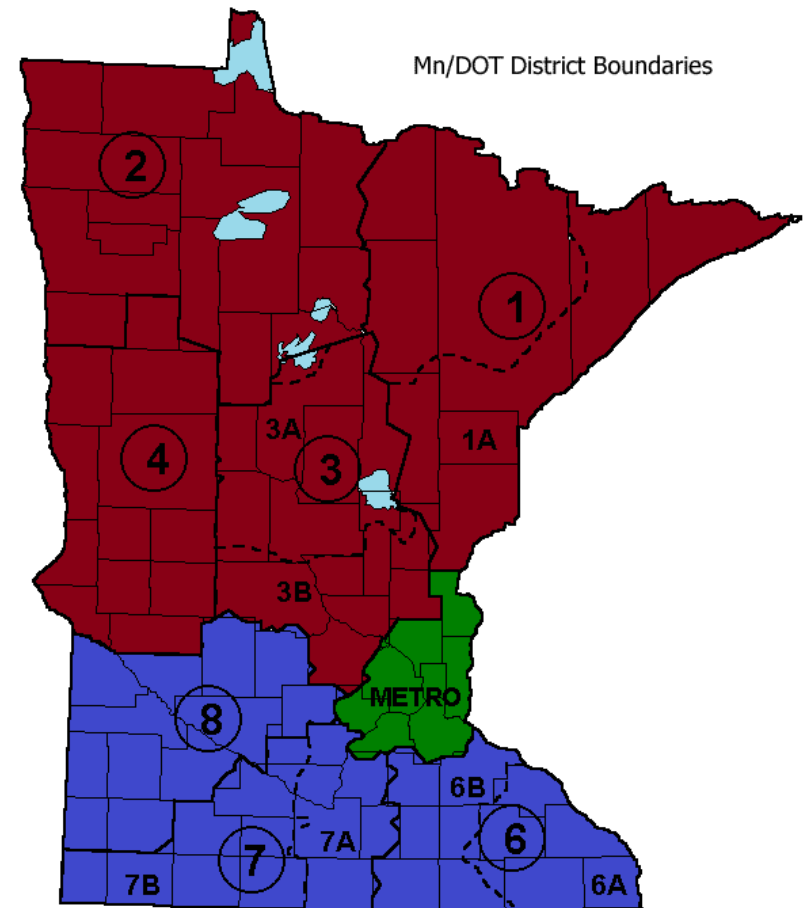
Next steps to improve the Freeway Operations/Active Traffic Management

- Adaptive Ramp Metering
    - Continued use and expansion
    - One of the most cost effective tools with a B/C ratio of 15:1

- MnPASS Express Lanes
    - Continued use and expansion
    - All new capacity is considered for HOT lanes

- Dynamic Shoulders
    - Nothing planned, but still in the toolbox
    - I-35W Price Dynamic Shoulder Lane (PDSL) being rebuilt as a permanent lane starting in 2017.

Next steps to improve the Freeway Operations/Active Traffic Management

- Dynamic Lane Control
  - No plans to expand existing system
  - Signs failing at a high rate. Manufacturer went out of business. No warranty. Limited spare parts.
  - Plan to cannibalize low priority ILCS to keep higher priority ILCS running
  - Some removal as part of future construction projects
    - Lake St, Minnesota River Bridge
  - ATM Lite
    - Looking to replace system with more frequent DMS rather than Intelligent Lane control Signs (ILCS) (WB 94)
    - Most of the benefits at about half the cost

Next steps Freeway Operations/Active Traffic Management iPeMS

- Interis Performance Measurement System

- RTMC has been using since 2012

  - Includes all traffic sensors for Metro and D3

  - Adding traffic sensor data from D1 and D6

- Has the ability to incorporate 3rd party data

  - INRIX, NPMRDS

- Iteris is developing a module to support Map-21 performance measures

- Received funding for pilot of purchasing probe data Summer 2018 for real-time operational decisions