

# Performance Based Maintenance Synthesis



AASHTO MaC

Findings of Spring 2021 MDOT Survey of  
State DOT Maintenance Rating Systems

July 2021

**1 MDOT Maintenance Background**

**2 PBM Background**

**3 MiMRS Overview**

**4 AASHTO Survey**

**5 MDOT Future Plans**

**6 Closing Remarks – Contact Info**

# MDOT Regions

- Michigan has 83 Counties
- MDOTs Internal Organization:
  - 7 Region Offices
  - 21 Transportation Service Centers (TSC's)

## MDOT Regional Service Areas and Facilities



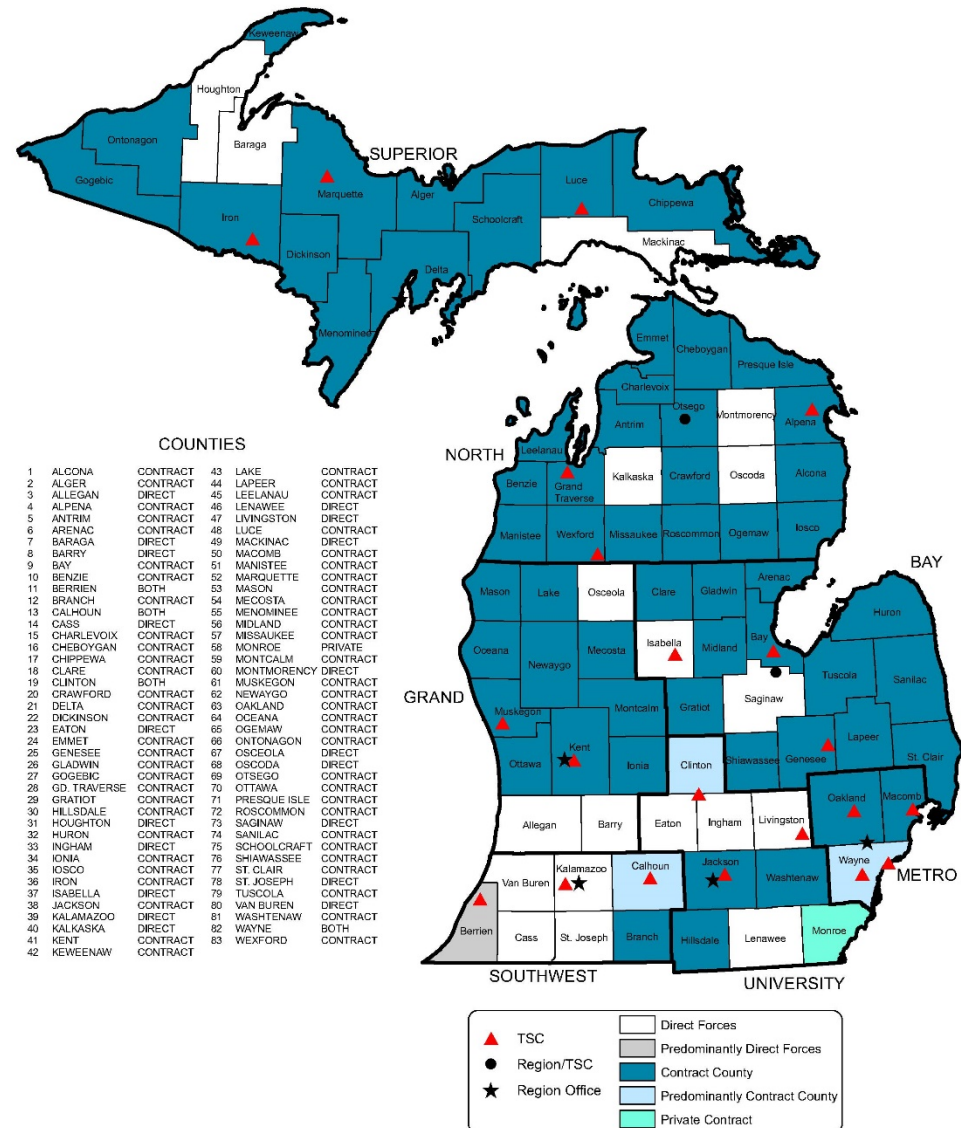
# Maintenance at MDOT

Maintenance responsibilities a mixture of:

- 63 RC Contract Counties
- 19 Direct Force Counties
- 1 Private Contract County
- Over 100 Municipal Maintenance Contracts
- 31 Maintenance Garages



## Maintenance Responsibilities by County

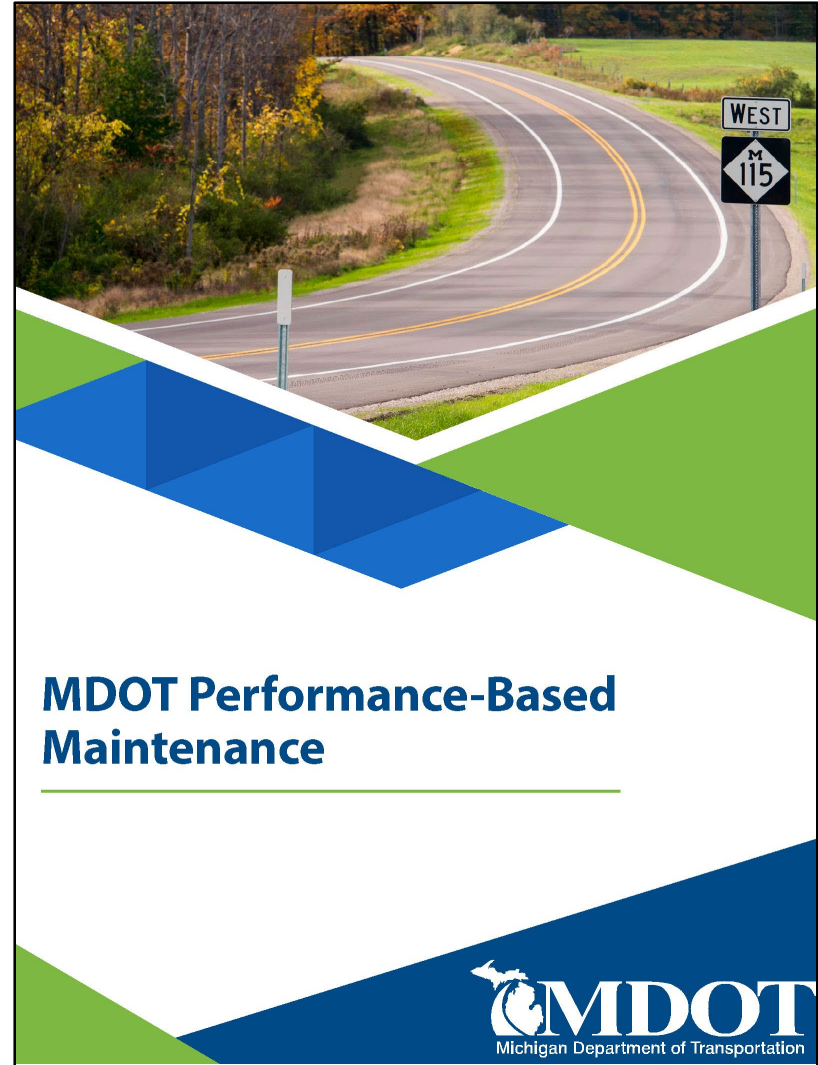




# Performance Based Maintenance at MDOT

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- Piloted in 2014 and rolled out statewide in 2015
- Tool to understand the maintenance LOS we are delivering
- Original focus on maintenance outcomes and utilization of data to drive budget decisions
- Ultimate goal of needs-based budgeting



# PBM Core Components

## Michigan Maintenance Rating System (MiMRS)

- Gives us a quantitative tool to measure our performance
- Helps us understand the outcomes we are achieving

## Performance Measures

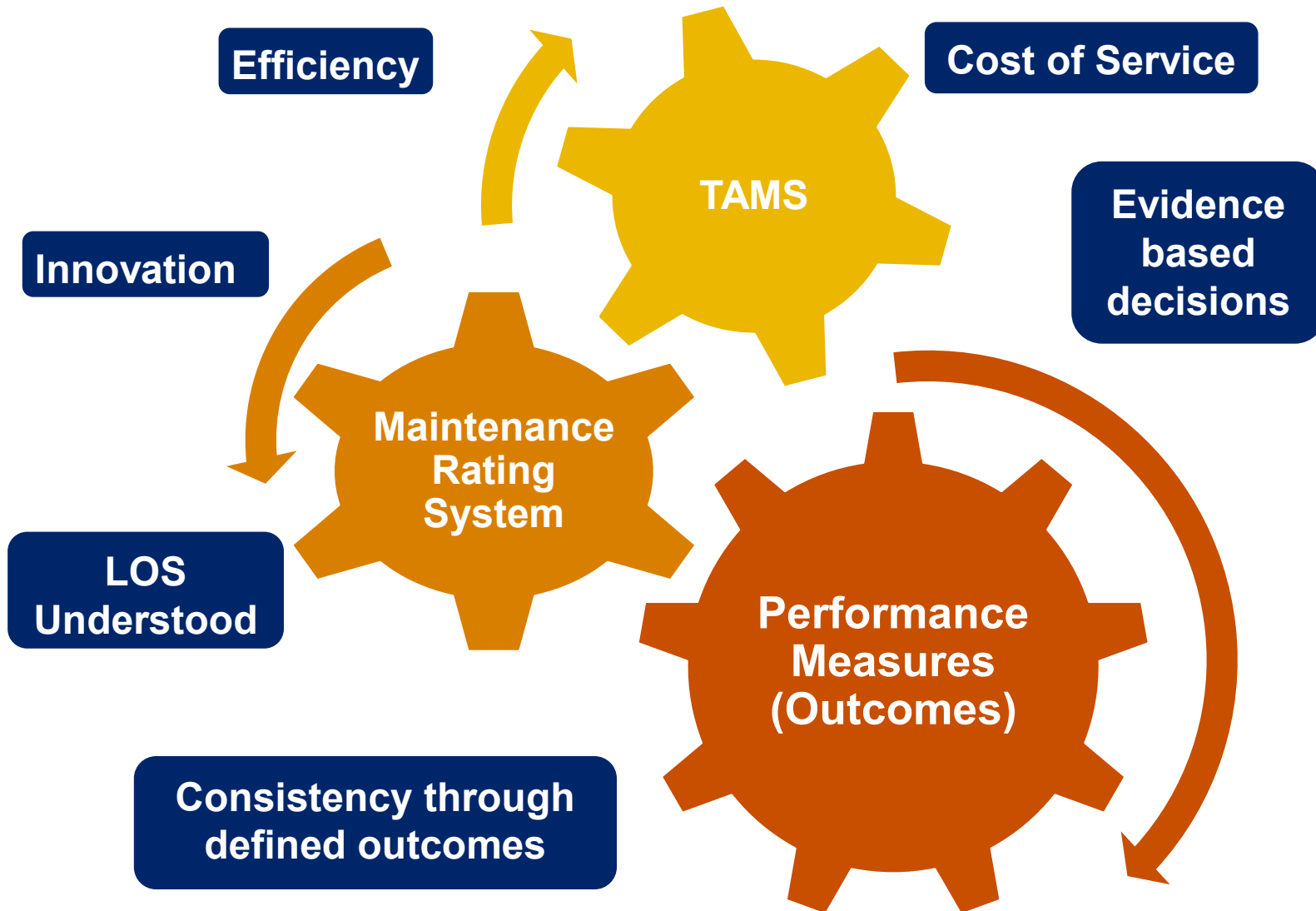
- Define the outcomes we wish to achieve
- Help us achieve consistency

## Transportation Asset Management System (TAMS)

- Gives us a tool to collect, store, and report highway maintenance data
- Helps us understand the cost of meeting our outcomes



# PBM Core Components

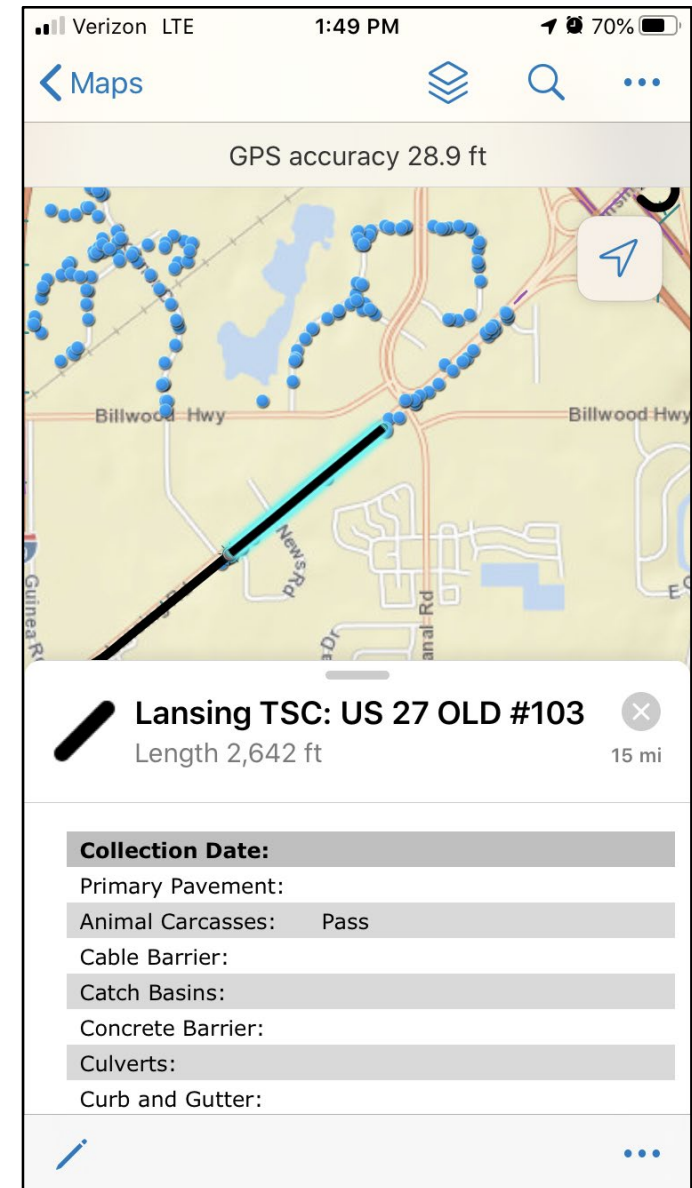


# Michigan Maintenance Rating System

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## MiMRS = is asset functioning as intended? (from maintenance perspective)

- Biannual ratings (May/October)
- ½ mile randomly generated segments (2,835 statewide)
- 135 segments per TSC (depending on lane miles)
- 23 maintenance measures
- Pass/Fail based on compliance criteria
- Data collected in ArcCollector App
- Reporting to SharePoint and a Macro Enabled Excel File



# MiMRS Performance Measures



## ROADWAY

Flexible – Cracking  
Flexible – Patching  
Flexible – Potholes  
Rigid – Cracking  
Rigid – Patching  
Rigid – Potholes  
Shoulders  
Catch Basins  
Curb and Gutter  
Debris



## TRAFFIC SAFETY SERVICES

Sweeping  
Guardrail  
Concrete Barrier  
Cable Barrier  
Impact Attenuators  
Signs  
Delineators



## ROADSIDE

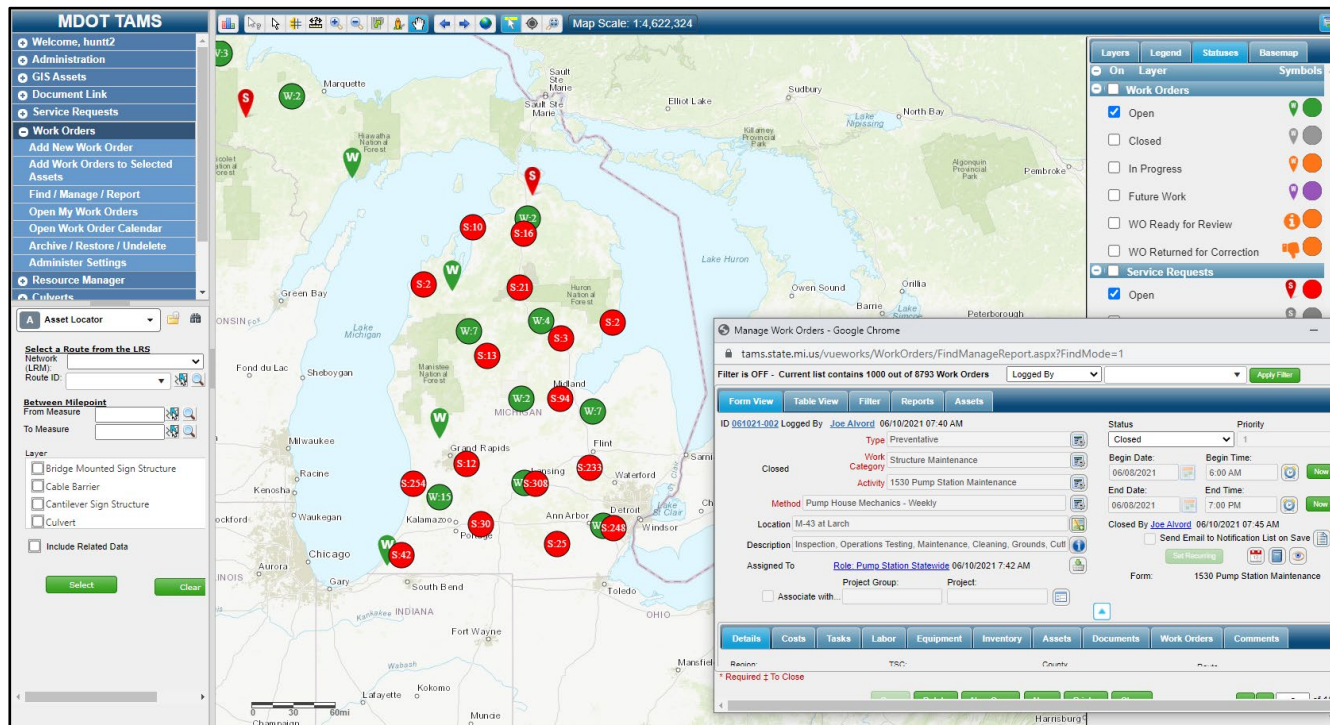
Ditches  
Culverts  
Vegetation Control  
Grass  
Litter  
Animal Carcasses



# Transportation Asset Management (TAMS)

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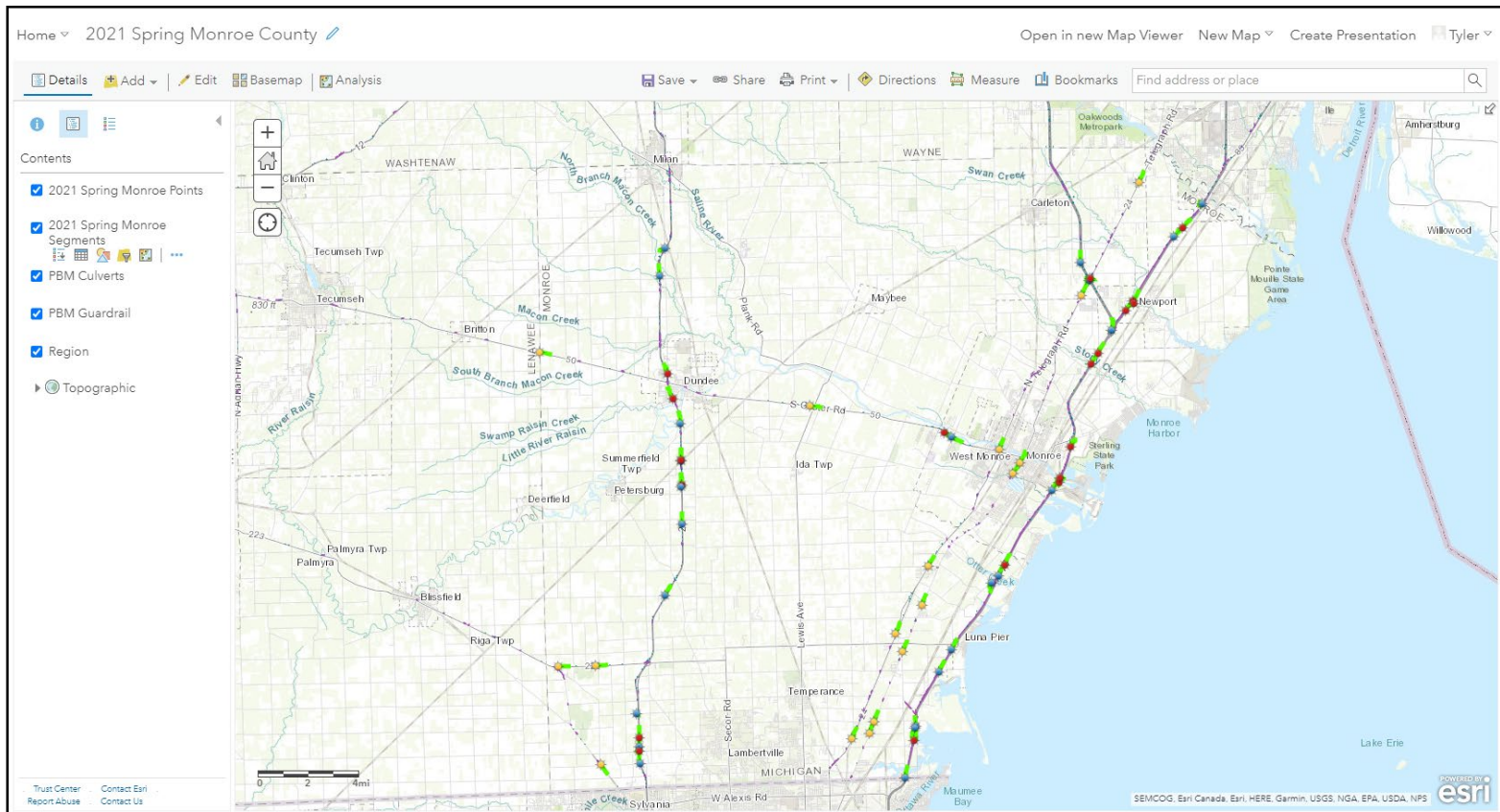
- Ability to complete detailed work activity costs
- Critical program for goal of needs-based budgeting
- PBM reporting functionality in TAMS
- Garages collect guardrail and cable barrier WO's
- Some collect culvert WO's
- Signs and signals inventories to be added soon



# Monroe County Maintenance Contract

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- MiMRS is an excellent tool for contractor tracking
- Set benchmarks for minimum LOS in RFP
- We provided historical LOS data for RFP
- Contractor can develop methodology to improve score



# MiMRS – Examples of Data Collection

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## Performance Measure Examples

- Provide an overview of some data we collect
- Show compliance criteria
- Provide some benefits and limitations of pass/fail metrics

### Performance Based Maintenance

Michigan  
Maintenance Rating  
System Handbook





# MiMRS – Shoulder Example

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Measure	MiMRS Non-Compliance
<b>Shoulders</b>	Any washout greater than two (2) inches in depth or greater than ten (10) sq. ft. in area.
	Any preventable condition either high or low by two (2) inches or more that impede the shoulder drainage to function as designed i.e. the free flow of water off the pavement.
	Edge loss greater than six (6) inches inward, or comprising more than ten (10) percent of the length of the segment.
	Any drop-off exceeding two (2) inches in depth.
	Any base material is exposed in any pothole, regardless of depth or area (in paved shoulders).





# MiMRS – Shoulder Example

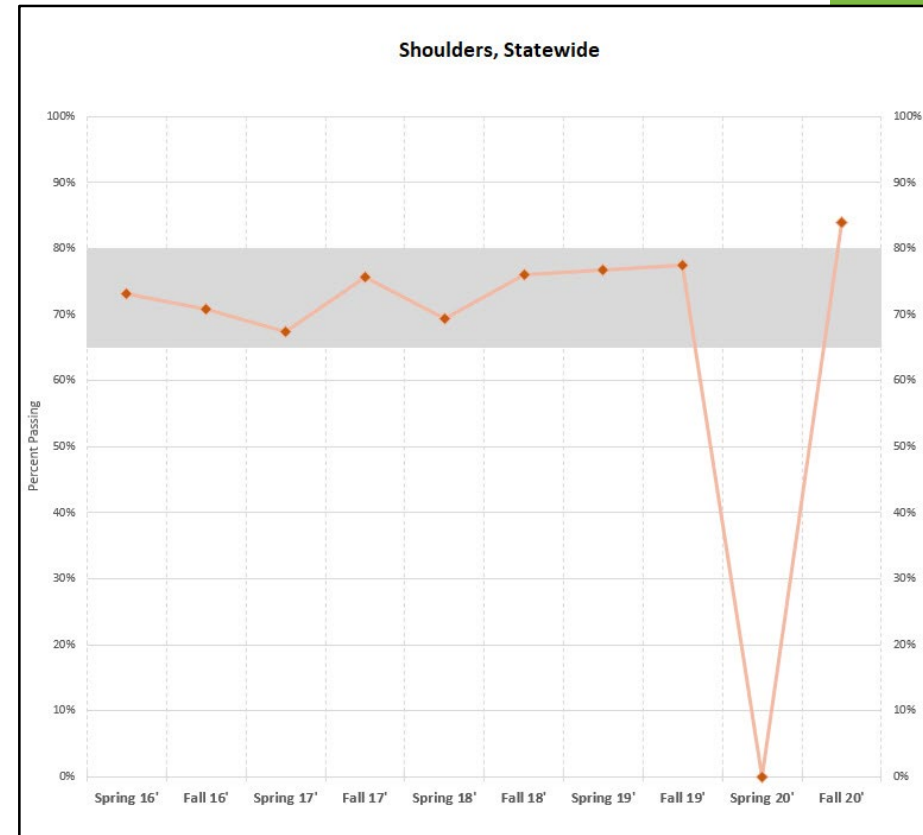
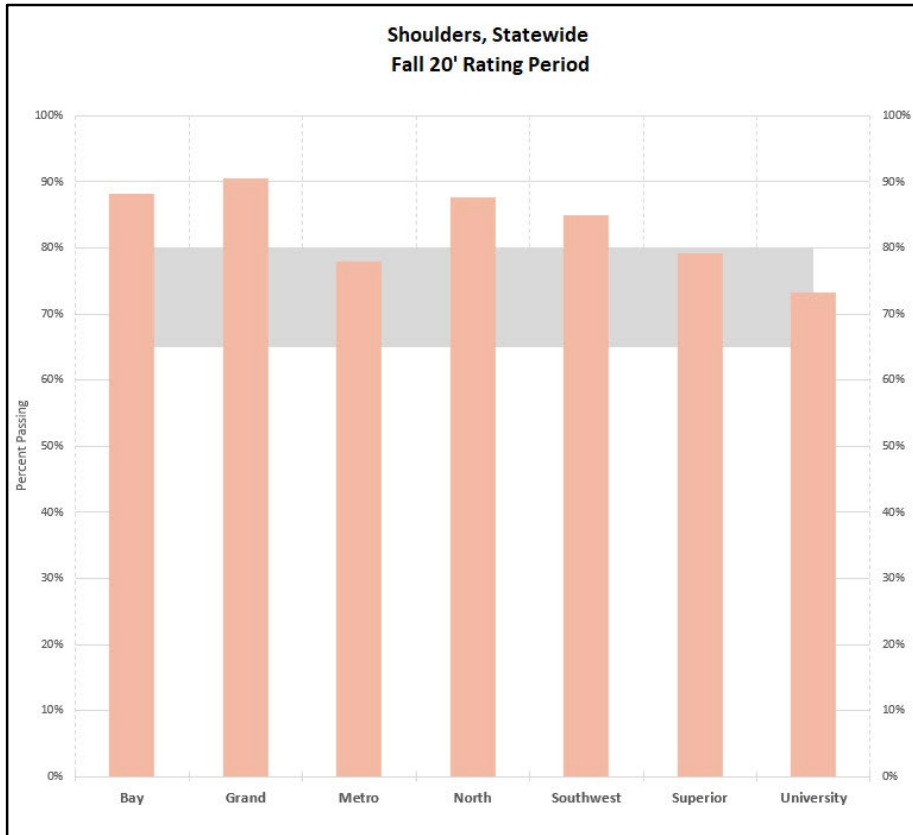
## Shoulder Data

- Reporting on shoulder data provides big picture
- Multiple types of maintenance issues possible
- Ratings would yes/no on maintenance needs for shoulders found in that ½ mile segment
- Worked on included granularity to shoulder ratings with some success





# MiMRS – Shoulder Example



# MiMRS – Roadway Example

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Measure	MiMRS Non-Compliance
Rigid/Flexible – Cracking	Greater than one (1) inch in width.
Rigid/Flexible – Patching	Broken up areas larger than 30 square feet.
	Broken up areas greater than (or equal to) one-half (1/2) of a travel lane.
Rigid/Flexible – Potholes	Potholes greater than two (2) inches in depth.
	Potholes greater than 0.5 sq. ft. in area.
	Potholes exceeding the top lift of HMA
	Any base material is exposed in any pothole, regardless of depth or area.





# MiMRS – Roadway Example

## Roadway Data

- Data provides the general type of roadway maintenance required on that segment
- Roads with maintenance work completed but in poor condition are considered passing (maintenance focused)
- Does not provide quantity of potholes, cracking, spalling, etc
- Roadway condition (DI, others) not applicable or intent of the program





# MiMRS – Culvert Example

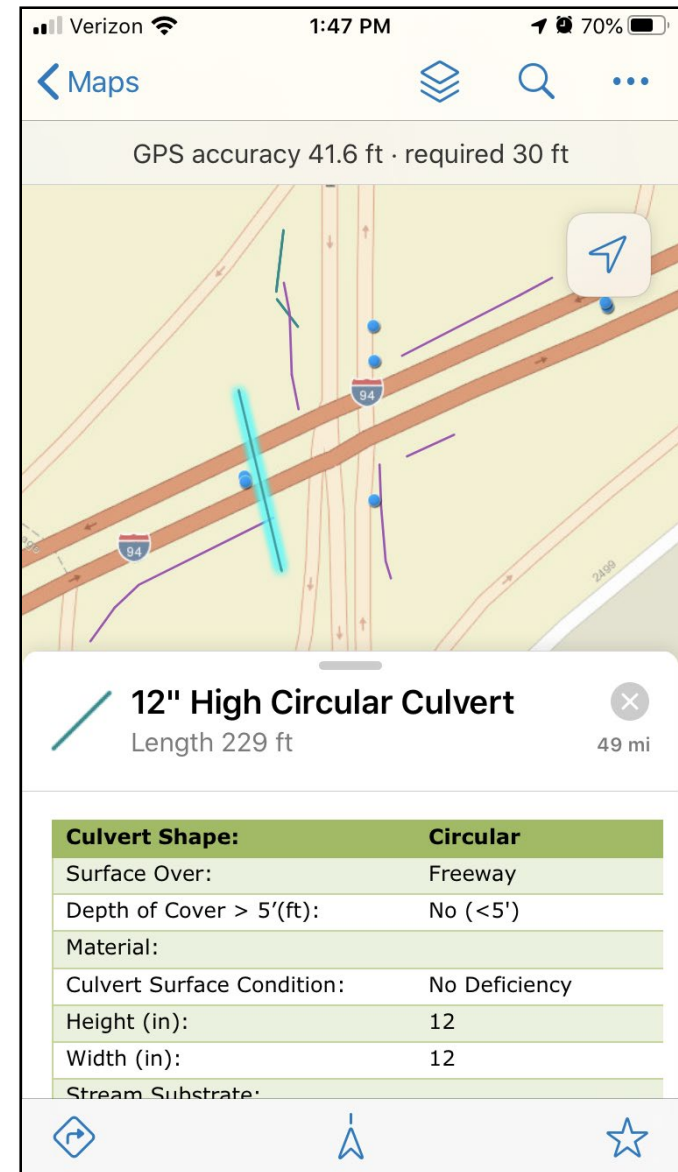
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Measure	MiMRS Non-Compliance
<b>Culverts</b>	Any debris or culvert damage that obstructs the water flow through the culvert or ditch basin
	More than 50 percent of a culvert opening is obstructed. More than a half of the culvert cannot pass water.
	Washouts of culvert backfill and erosion damage under or around the culverts e.g. perched.



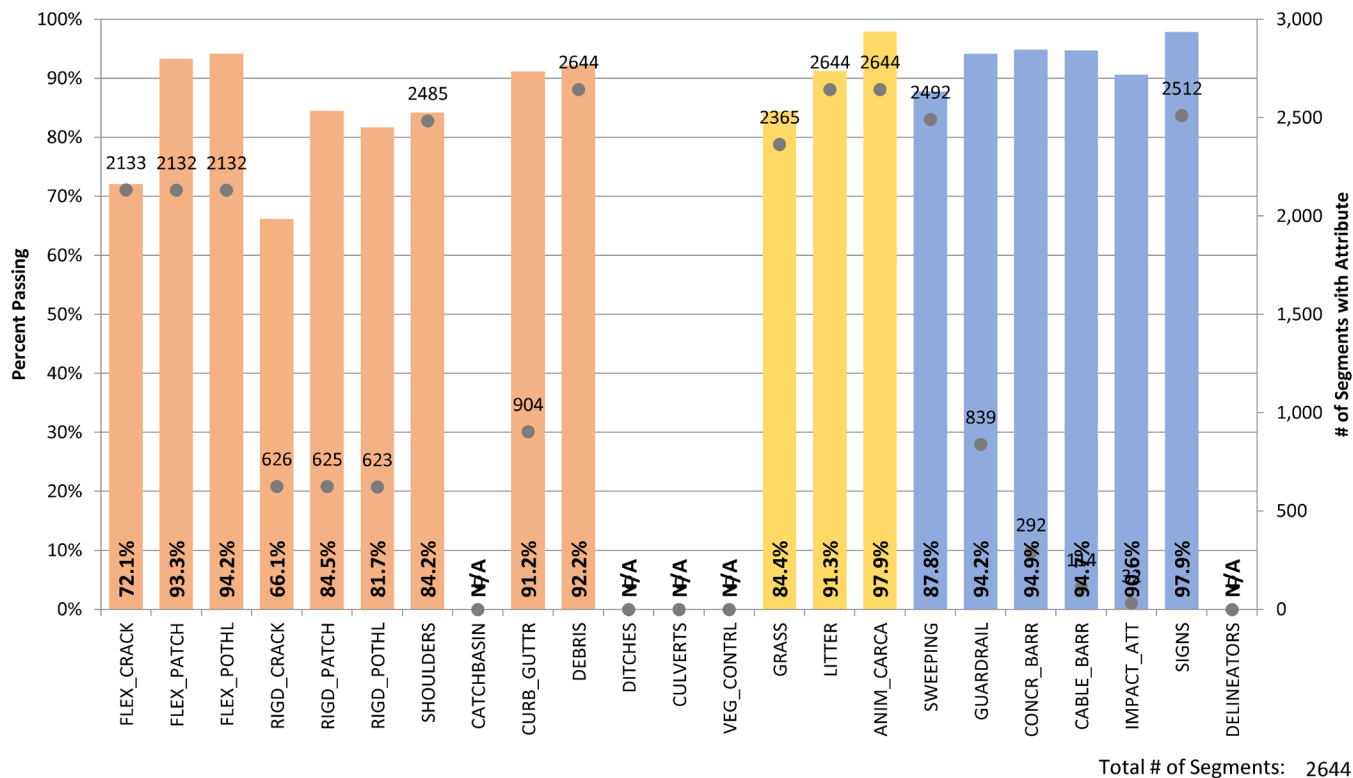
## 18

- Not intended to provide condition of the culvert
- If culvert is structurally o.k. and flowing water  $\geq 50\%$  = Pass
- If one culvert does not meet the criteria, the segment fails for culverts (whether there is only one or many culverts requiring work)
- Difficult to determine what the culvert maintenance needs are from data (jetting, slip lining, replacement, etc)
- Comments on culvert condition can be included in the app





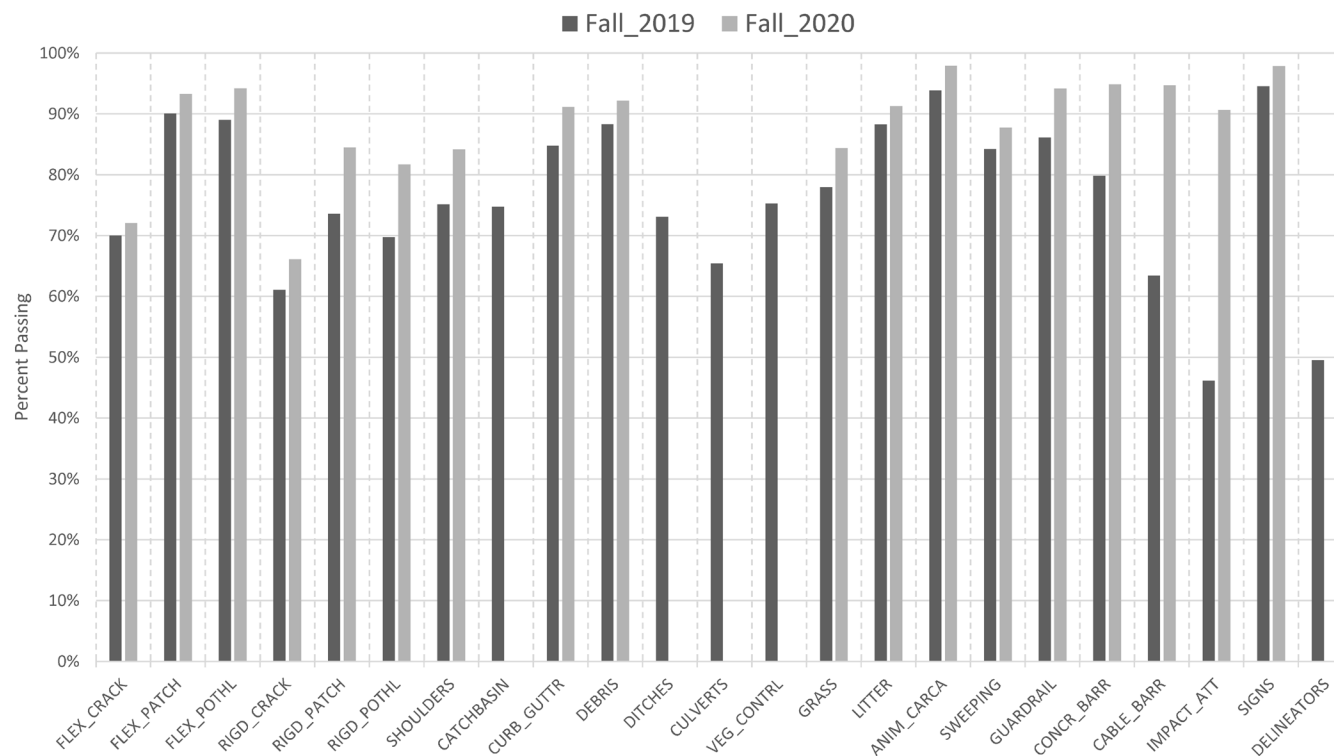
## Statewide Michigan Maintenance Rating System (MiMRS) Results All Measures - Rating Period: Fall\_2020



Location: Statewide  
Rating Period: Fall\_2020  
Report Generated: July 21, 2021

Measures	Performance Rating
Roadway - All	86.26%
Roadside	91.44%
Traffic Safety Services	93.12%
<b>Composite</b>	<b>89.19%</b>

## Statewide Michigan Maintenance Rating System (MiMRS) Results Rating Period Comparison - All Measures



**Location:** Statewide  
**Comparison Period 1:** Fall\_2019  
**Comparison Period 2:** Fall\_2020  
**Report Generated:** July 21, 2021  
*\*Only Select Regions Participated in Period 2*

Measures	Comparison	Difference
Roadway - All	↑	1.99%
Roadside	↑	8.62%
Traffic Safety Services	↑	7.47%
Composite	↑	5.17%

## MiMRS Data

- Confidence Level (5% margin of error)
  - Statewide  $\approx 95\%$
  - Region Level  $\approx 90\%$
  - TSC Level  $\approx 85\%$
- Pass/Fail data provides an indication of overall performance
- Need more details for some assets
- Never intended to give condition, future fix type, or RSL

### Statewide Focus Measures Dashboard

Fall 19' Rating Period

72.5%

**Flexible Pavement - Cracking**  
Percentage of network with no cracking (greater than 1 inch in width).

92.2%

**Flexible Pavement - Potholes**  
Percentage of network with no potholes (deeper than 2 in. and/or greater than 0.5 sq. ft. in area).

67.7%

**Rigid Pavement - Cracking**  
Percentage of network with no cracking (greater than 1 inch in width).

77.4%

**Shoulders**  
Percentage of network with shoulders that are even and traversable.

93.1%

**Guardrail**  
Percentage of network with no guardrail damage (that could cause the guardrail not to function as intended).

68.5%

**Culverts**  
Percentage of network without debris or damage that obstructs the water flow through the culvert.

# PBM & MiMRS Programs

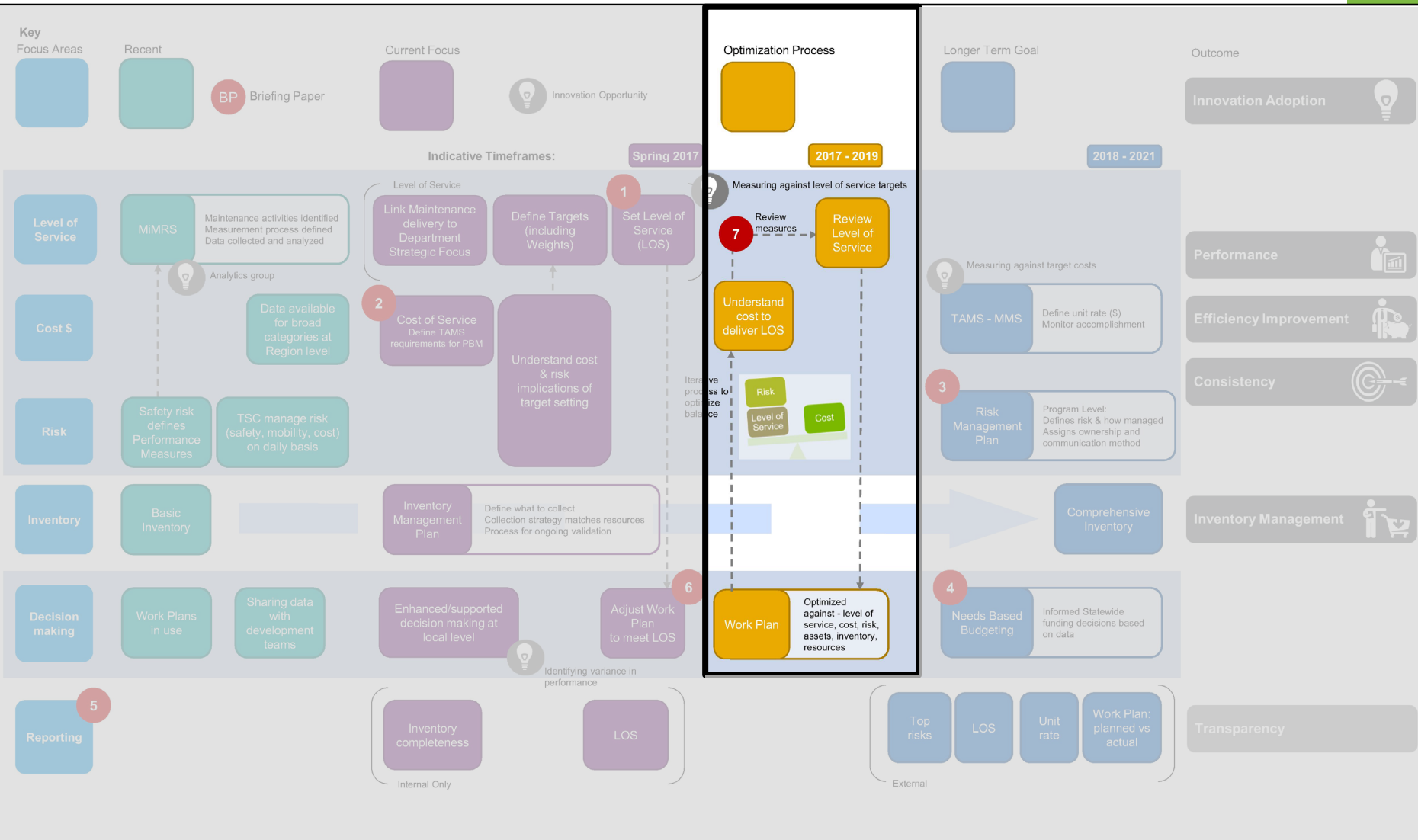
## Things PBM/MiMRS does well

- Defines specific measures to track
- Data is straightforward to interpret
- Understanding of maintenance outcomes statewide
- Allows consistent tracking of PBM contracts
- Straight forward data collection methodology (does not require extensive training or engineering expertise)



# MDOT PBM Roadmap

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# AASHTO Survey



## AASHTO Survey on Maintenance Rating Programs

# Reason for AASHTO Survey

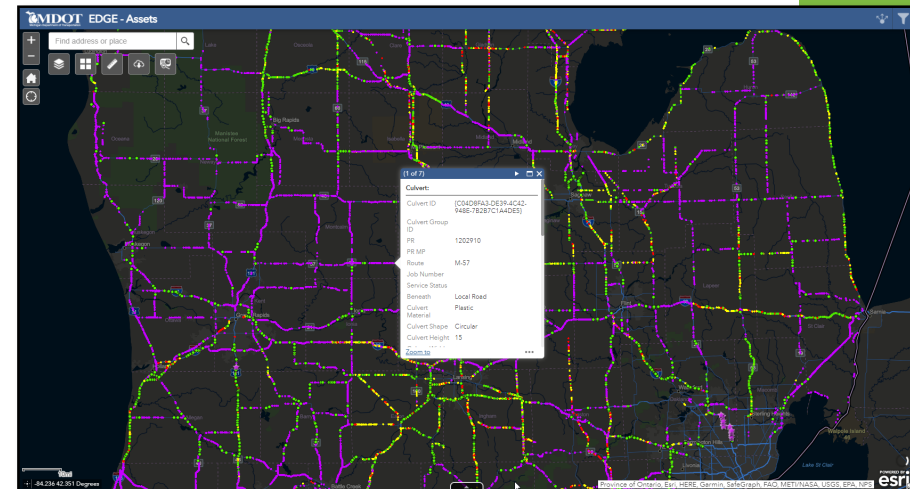
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## Determined a need to improve PBM

- Feedback was that some data is difficult to utilize in work planning
- Data collection can be resource intensive
- Set LOS targets for assets and found they were difficult to “move the needle” consistently
- Work activity tracking not a sufficient level for budgeting (TAMS)
- MDOT’s maintenance budgets changed as did our needs



- Need to know the inputs to “move the needle” without being condition rating
- Pavement condition is understood (DI, others) but ongoing functionality still needs to be assessed
- Can culvert and other condition data we collect be used for maintenance operations?
- How to incorporate work activity data we do have from TAMS? Can we function independently from TAMS in some areas?
- Do we need to collect condition data for assets or is functionality enough?



- Literature research of DOT programs
  - NCHRP Synthesis 470 (2015)  
Maintenance Quality Assurance  
Field Inspection Practices
- Excellent research on MQA programs nationwide
- Looked in depth at DOT's current practices
- Provided basis for our short survey

## **NCHRP** SYNTHESIS 470

NATIONAL  
COOPERATIVE  
HIGHWAY  
RESEARCH  
PROGRAM

### **Maintenance Quality Assurance Field Inspection Practices**



***A Synthesis of Highway Practice***

TRANSPORTATION RESEARCH BOARD  
OF THE NATIONAL ACADEMIES



## We wanted a brief update of DOT's MQA programs

- Where DOT's are in 2021
- General details of programs
- What is the goal of their programs?
- Has the goal changed?
- Lessons learned
- **Contact Info/Networking!!**



# AASHTO Survey Questions

1. Do you have a Maintenance rating system or equivalent?
2. If yes to question one, how long has your agency been rating assets for maintenance condition state purposes?
3. How many asset types do you rate?
4. How often do you rate them (annually, biannually, etc)
5. Is your rating system based on a “pass/failure” system or do you rate using some other scale/metric?
6. Are your ratings conducted by internal DOT staff, consultants or combination?
7. What is the goal/purpose of your rating system (tied to maintenance funding outcomes/benefits, justify maintenance funding needs, Level of Service, used to aid in decision making, information for executives/legislators/media/etc. or other)?
8. Who could we follow up with for more discussion and/or information (please provide name/phone/email)?
9. Please include any guidance, literature, examples, etc. you may have



# AASHTO Survey Responses

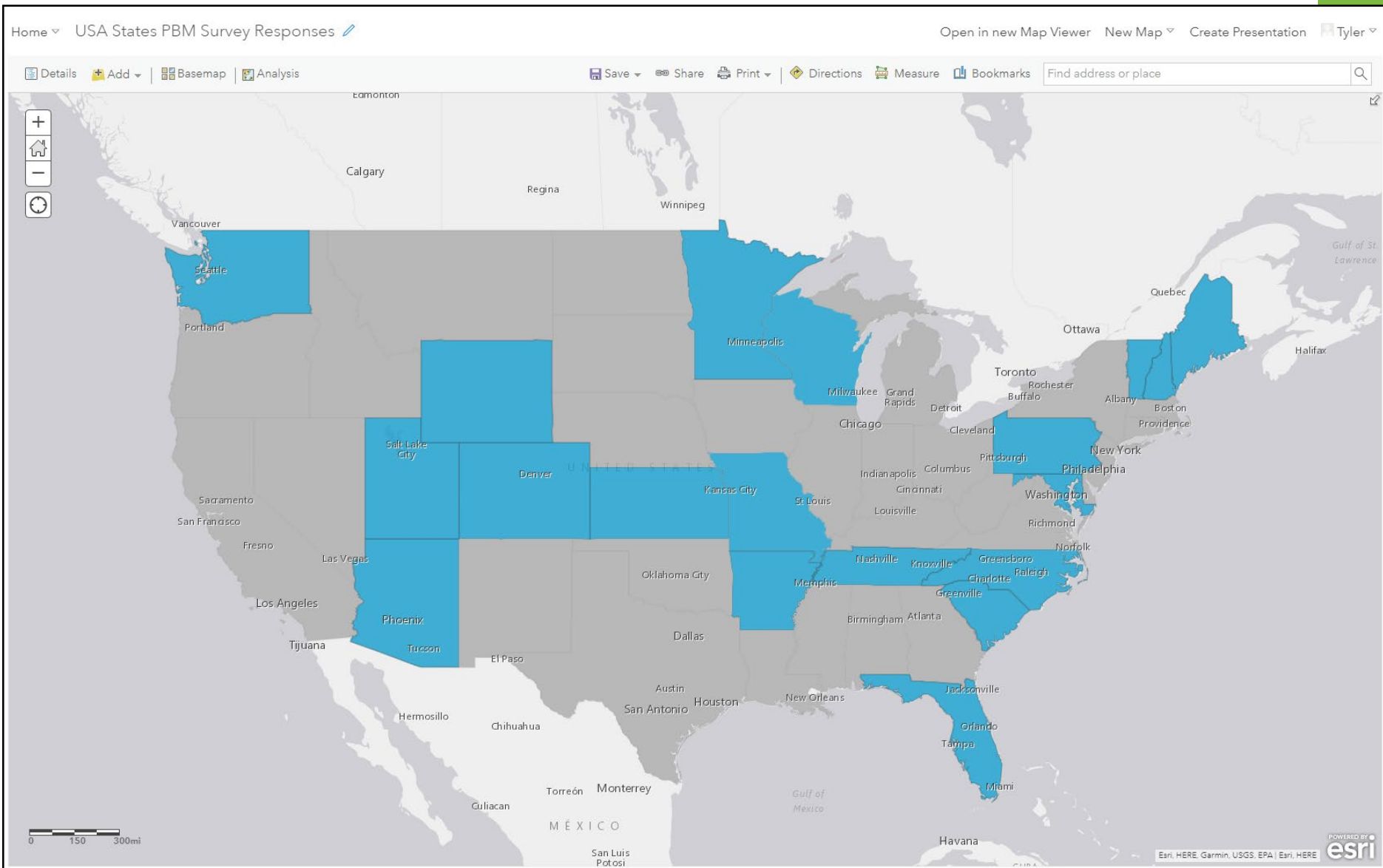
## **\*19 States responded (Thank You!)**

Arizona	North Carolina
Arkansas	Pennsylvania
Colorado	South Carolina
Florida	Tennessee
Kansas	Utah
Maine	Vermont
Maryland	Washington State
Minnesota	Wisconsin
Missouri	Wyoming
New Hampshire	

\*A few states not listed reached out after the deadline to provide information, these were included in the supporting documentation with the survey

# AASHTO Survey Responses

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## Responses Summary

- 14 states have rated for 15+ years, 4 started within the last ten
- States rate as little as 2 assets to as many as 227, most fall within 10 to 30

*Question could have been worded better, I would have broken it out to include asset types, and asset metrics within asset types*
- 7 states rate annually, 2 annually/biannually, 1 quarterly/annually/biannually, 1 triennially, 1 biannually, 1 annually/4 year, 1 monthly
- Pass/fail and sliding scale metrics were about evenly split, many used combination of pass/fail and scale
- Combination of internal staff and consultants was most common method for rating



## Data uses

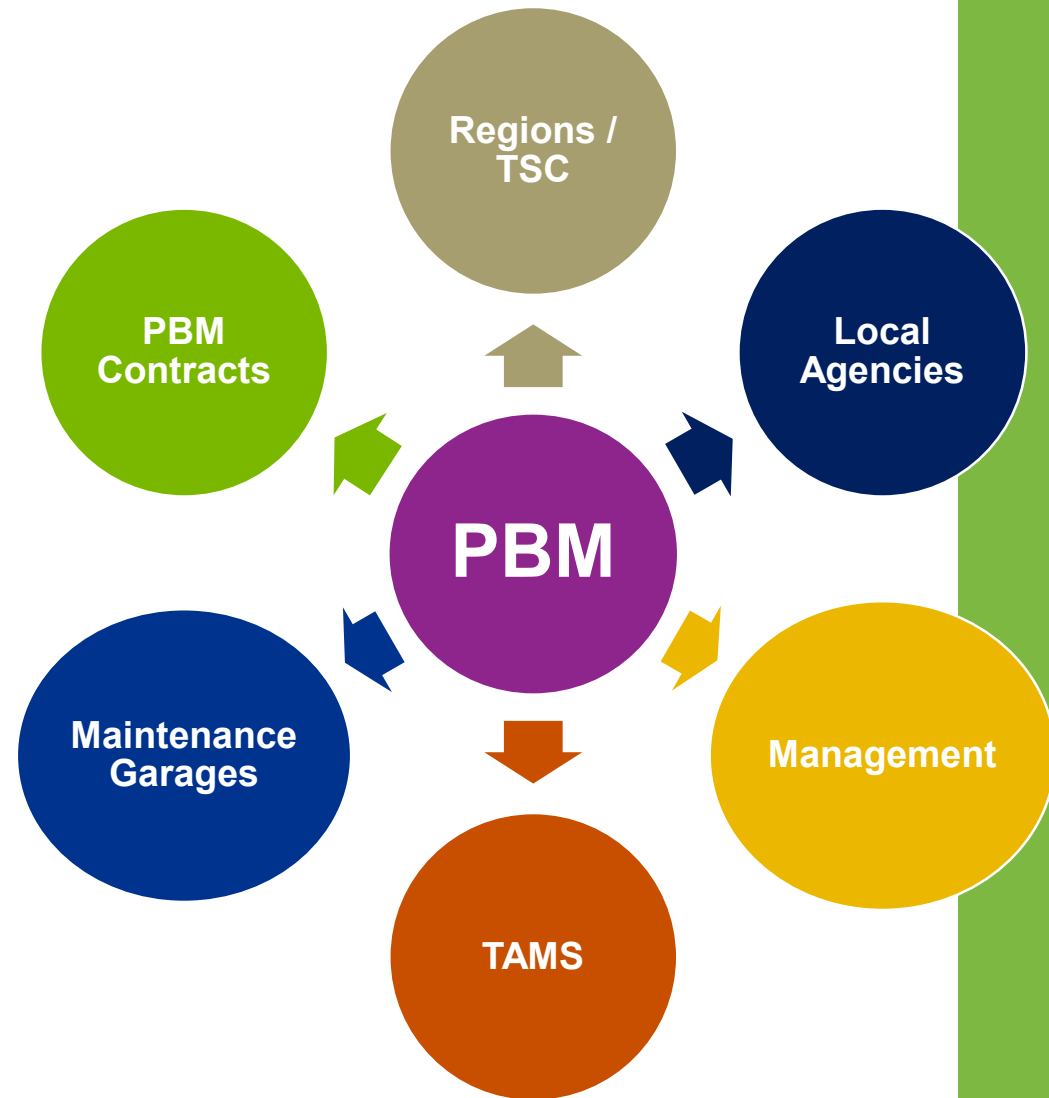
- Many use data for LOS tracking
- Many use for communication to upper management, consistency across state divisions
- Focus on maintenance outcomes for many
- A few were condition only assessments
- Planning maintenance work was common
- Used for decision making was less common (e.g. budgeting)

## Takeaways from survey

- Several methods to collect maintenance work data
- Mixture of condition and pass/fail is practical and beneficial
- Budgeting is difficult especially without robust work activity data
- Documentation related to DOT's programs (manuals, guidance documents, research)
- Some states currently looking into changes similar to our efforts
- Contacts for follow up!!!!

## Challenges Going Forward

- MDOT is mixture of direct force and contract county maintenance which adds complexity to set LOS targets
- Winter budgets difficult to estimate leading to unknowns for non-winter budgeting and ultimately work planning
- Developing a program that works for MDOT's unique Regions
- Utilize existing asset data for maintenance operations
- TAMS utilization once it is fully adopted
- **How to make PBM work for all of these areas?**





## Moving Forward

- Get back to the drawing board
- Use lessons from years of data collection
- Determine assets/metrics to collect based on lessons learned
- Reach out to industry on what is working elsewhere
- Potential RFP for help
- Creating a large scale asset condition assessment likely not the answer for MDOT



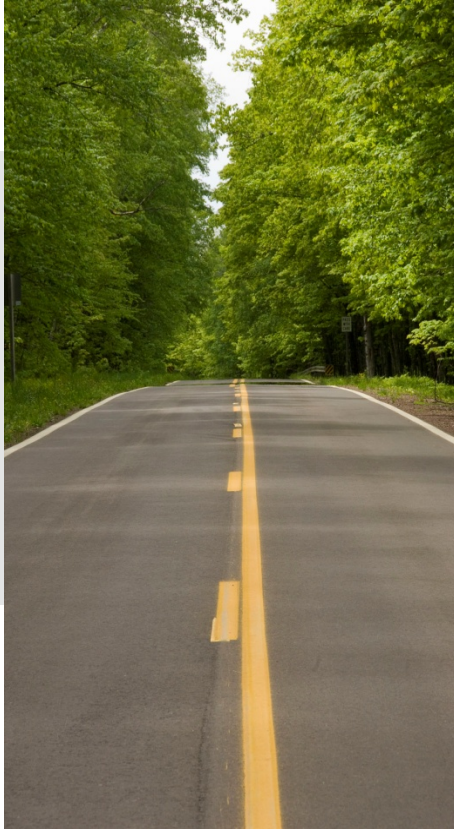
## Questions to be answered

- Can we collect adequate data that is not overly resource intensive?
- Is condition data required for work planning on most assets?
- If condition data is needed, how will it be updated frequently enough to meet yearly needs?
- How to consider winter maintenance budgeting unknowns?
- What is MDOT's goal for PBM long-term?



# Thank You!

## Questions?



If you would like a copy of the survey send me an email.

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