Measures for Highway Maintenance Quality Assurance

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Outline

- MQA in Context
- Background
- Measures Synthesis Overview
- Synthesis Findings
- Synthesis Conclusions
- Evolution since Scottsdale
- Next Steps in MQA

What is MQA?

- MQA programs help decision-makers
  - understand maintenance conditions
  - set priorities
  - document the relationship between dollars and outcomes
- Programs come in the midst of a national shift in emphasis
  - away from highway construction and toward operations & maintenance
  - toward using measures to manage government
  - toward making government more outcome-oriented

Background

- 74 attendees
  - 35 states & provinces
  - Counties
  - FHWA, USDA

Resources are available on MQA programs but little guidance on measures

- NCHRP 14-12: Highway Maintenance Quality Assurance
- NCHRP 8-32(A): Multimodal Transportation - Development of a Performance-Based Planning Process
- NCHRP 14-13: Customer Driven Benchmarking for Highway Maintenance Activities
- Conferences/Surveys
  - National Workshop on Commonly Recognized Measures for Maintenance
  - AASHTO Survey on Performance Measures
  - National MQA Peer Exchange and Survey
- On-line MQA document library http://www.mrutc.org/outreach/MQA/library/

Project Goals

- To provide a comprehensive list of the common measures used to quantify maintenance performance
- To highlight needs and next steps in the development of MQA

Motivation for Identifying Common Measures

- States practicing MQA want to know
  - what other states are doing
  - what measures are being used, and what works
- Common understanding of MQA and common measures will enable states to
  - better evaluate their own programs, and the performance of their highways
  - improve state-to-state communication about
    - MQA program development, and
    - effectiveness of maintenance strategies

Source of Information on Measures for MQA

- On-line MQA document library http://www.mrutc.org/outreach/MQA/library/
- 33 transportation agencies including 2 Canadian provinces
- Documents Types:
  - Rating manuals
  - Field guides
  - Annual reports
  - Correspondences
  - PowerPoint presentations
  - Financial reports
  - Inspection forms

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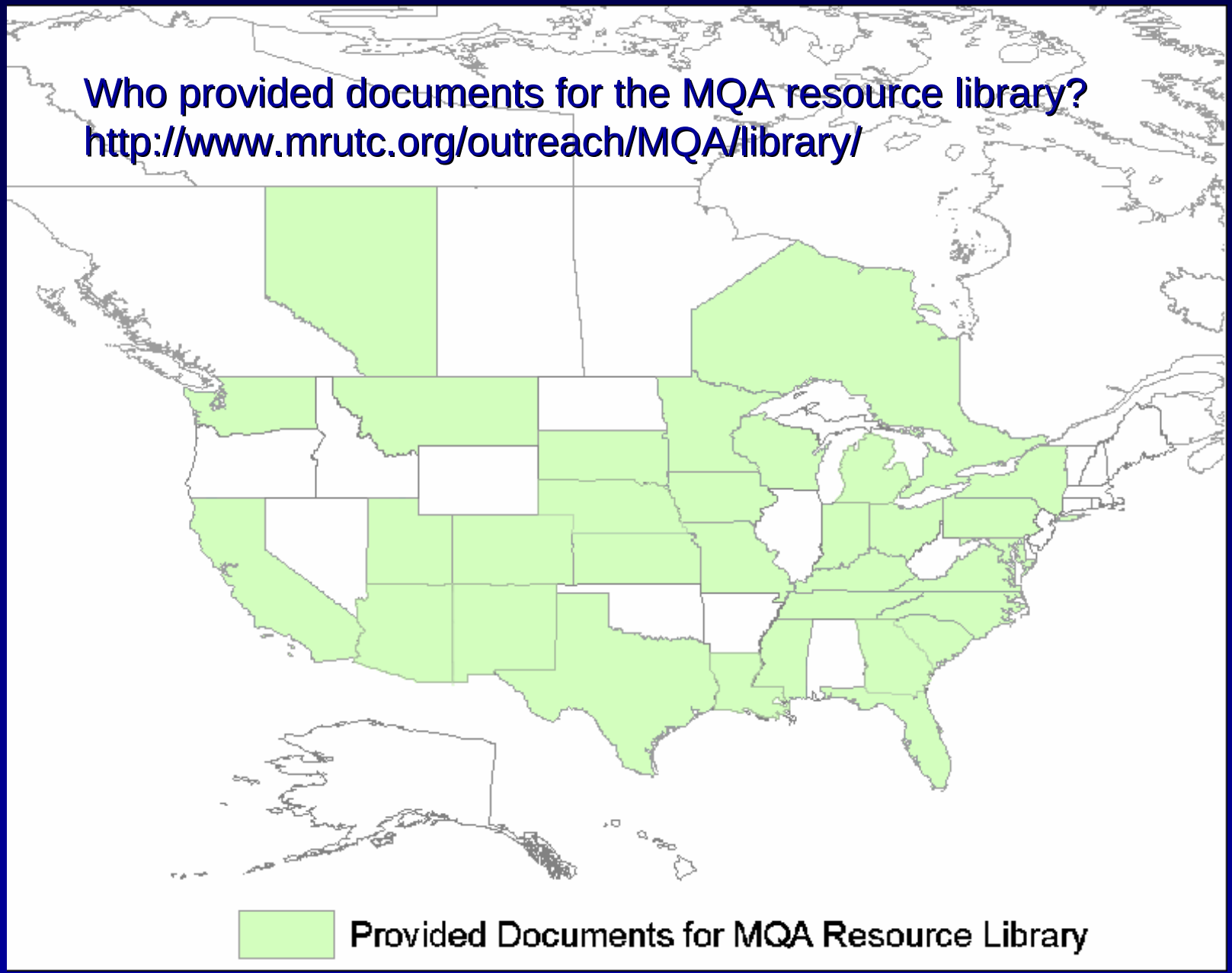
Who provided documents for the MQA resource library?
http://www.mrutc.org/outreach/MQA/library/



Synthesis Findings

- When compared to results of Scottsdale meeting in 2000, MQA programs have evolved considerably!
- Measurement of customer satisfaction and maintenance quality have evolved independently.
- Many states are thinking beyond what data to gather; they are concentrating on using information in decision-making.
- MQA programs include statistical analysis, and states are experimenting with alternate reporting formats to effectively communicate to legislatures and the public.
- There is reasonable agreement on groups of measures (maintenance categories) in MQA programs since these are tied to maintenance budgeting and work activities; but little agreement on features or characteristics in the groups.

Bad News: Still a long way to go..

- Inconsistent terminology makes it difficult to communicate
- Lack of consensus on what characteristics and features are important to measure
  - What features should be measured to quantify pavement ride quality?
  - Do we have to measure road kill and hazardous debris?
- Lack of consensus on how to quantify maintenance quality of characteristics and features
  - Should we record the number of defects, the area of defects, the total linear feet of defects or the percentage of defective area?
  - Should we make note of total sample size relative to the defective areas?
- Some states indicate that certain features are measured, but there are no “measures”.

MQA Terminology

- Maintenance Category
  - A logical grouping of maintenance features based on their location or function along a highway.
- Maintenance Feature
  - A physical asset or activity whose condition is measured in the field.
- Maintenance Characteristic
  - A specific quality/defect in a maintenance feature that is condition evaluated.
- Standard
  - A tolerance level or criterion that helps to identify whether a characteristic requires maintenance attention or a characteristic's condition is unacceptable; a tolerance level or criterion that helps to identify when a feature is not 'functioning as intended'. A standard indicates when maintenance is needed.
- Measure
  - Description of how to quantify the deficiency in a maintenance feature or characteristic.
- Threshold
  - An indicator of the current state of maintenance at a system wide level. This is achieved by binning or categorizing segments based on their amount of deficiency.
- Target
  - An indicator of the level or amount of allowable/acceptable backlog system wide. The target represents the expected threshold level that is attainable on a system wide basis given the available budget.

Maintenance Categories

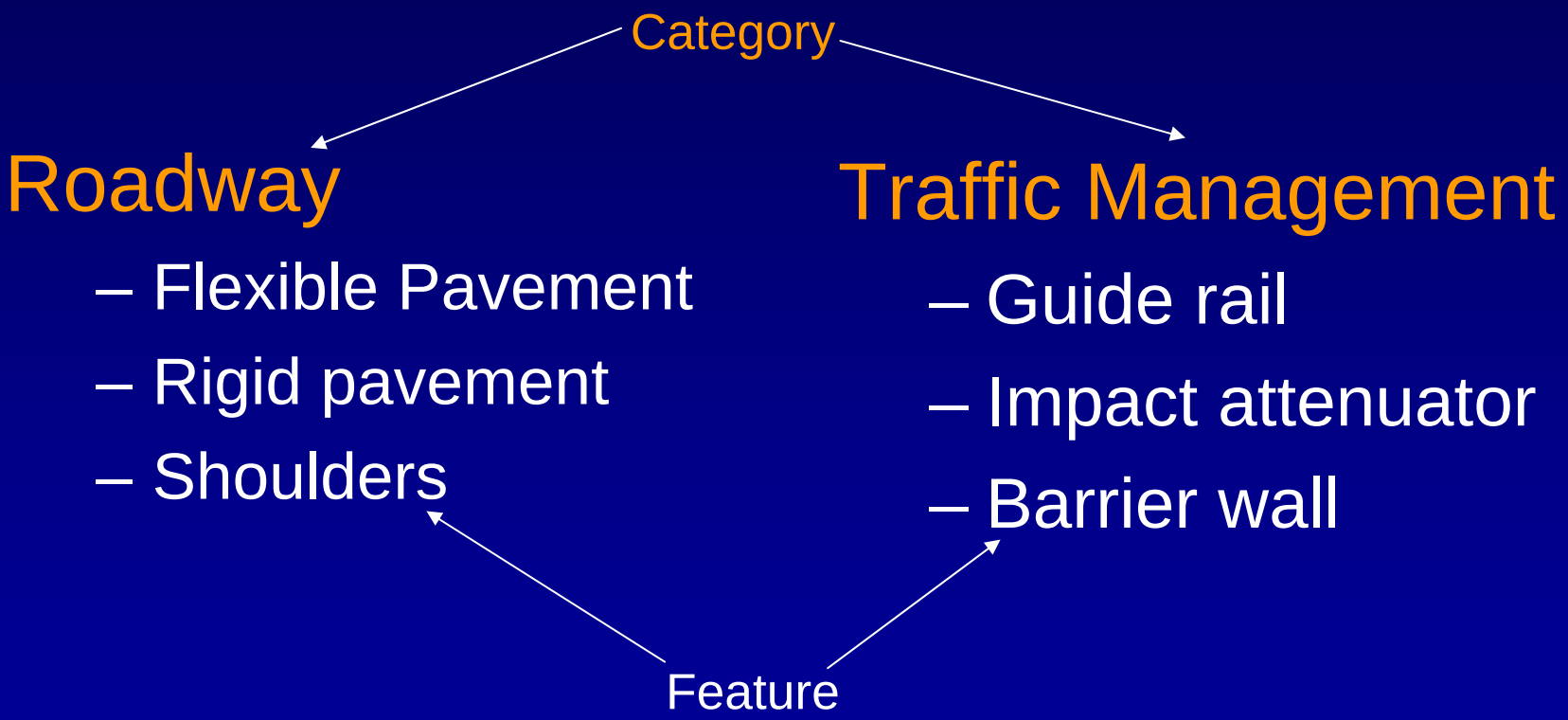
- Categories related to performance based budgeting
- Categories facilitate budgeting and tradeoffs in maintenance

- Maintenance Categories most frequently used
  - Roadway (ridge, flex, shoulders)
  - Drainage
  - Traffic Management
  - Roadside and Vegetation
  - Bridges
  - Snow and Ice
  - Rest areas

- But, states do not use the same categories, and not all states use these categories!

Category – Feature Relationship

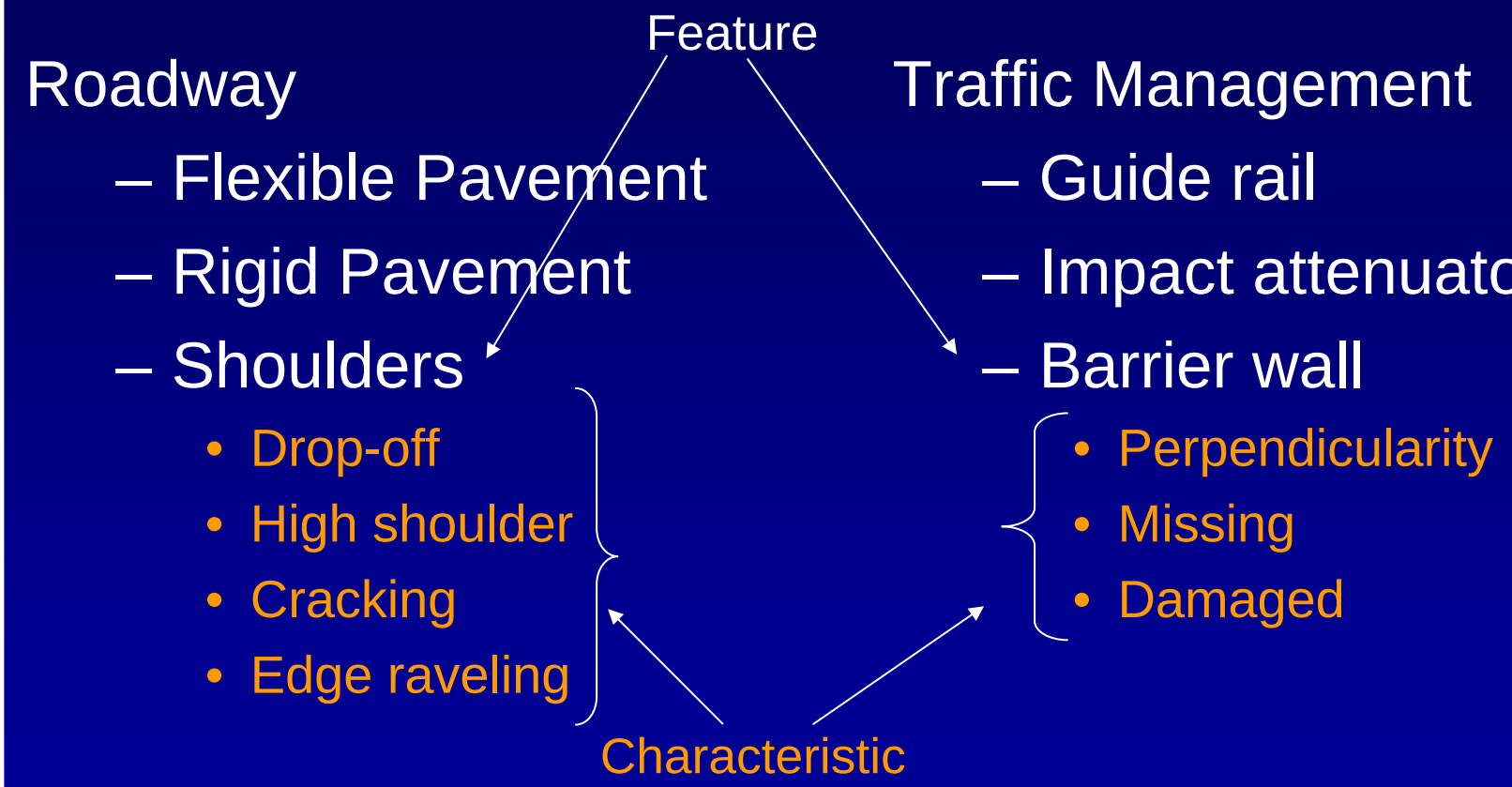
" A logical grouping of maintenance features based on there location or function along a highway"



"A physical asset or activity whose condition is measured in the field"

Feature – Characteristic Relationship

"A physical asset or activity whose condition is measured in the field"



"A specific quality/defect in a maintenance feature that is condition evaluated"

What is measured?

For MQA, states measure and analyze characteristics and features!

- Features (physical assets) are measured for these categories
  - Drainage
  - Traffic Management
  - Roadside and Vegetation
  - Bridges
  - Snow and Ice
  - Rest areas
- But, states do not measure the same features!

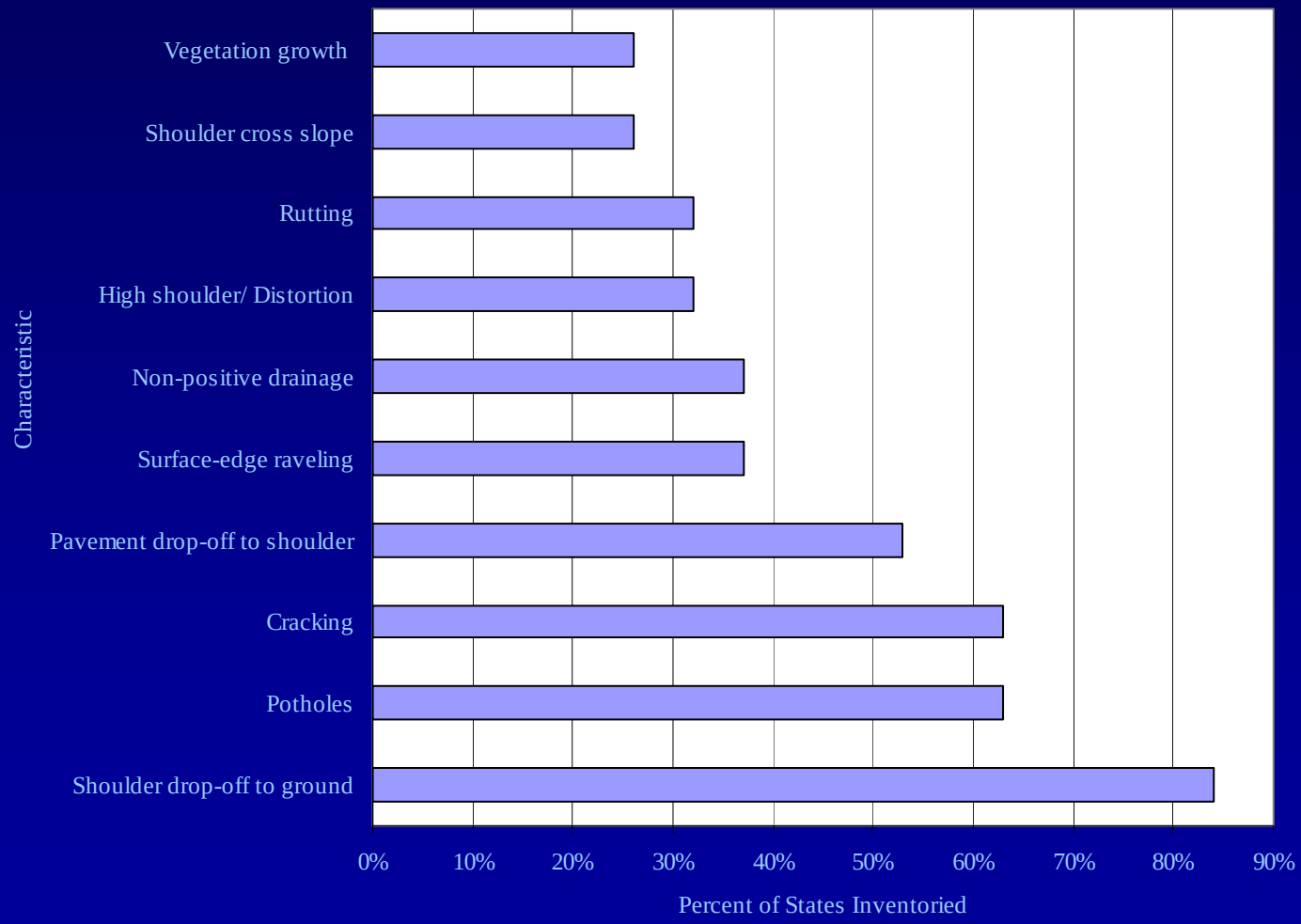
- Characteristics (quality defects) are measured for these features
  - Flexible Pavement
  - Rigid Pavement
  - Shoulders
- But, states do not measure the same characteristics!

States Measure Characteristics of Roadway Shoulders

Characteristic	State or Province																			
	AB	CA	CO	IA	IN	KS	KY	MD	MO	MS	NC	NE	NY	OH	SC	TN	TX	VA	WA	WI
Cracking	x	x		x	x	x		x	x			x				x		x	x	x
High shoulder/ Distortion							x	x	x		x				x			x		
Non-positive drainage					x	x		x	x			x				x			x	x
Pavement drop-off to shoulder			x	x	x		x	x	x			x		x		x	x			
Potholes		x		x	x	x	x	x	x							x	x	x	x	x
Rutting	x	x		x		x												x		x
Shoulder cross slope				x	x								x						x	x
Shoulder drop off to ground			x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x
Surface-edge raveling		x						x	x							x		x	x	x
Vegetation growth						x		x	x			x								

But, states do not measure the same characteristics!

Most commonly measured Characteristics of Roadway Shoulders



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States Measure Features of Traffic Management

Feature	State																				
	CA	CO	DC	IA	IN	KS	KY	MD	MN	MO	MS	MT	NC	NY	OH	SC	TN	TX	UT	VA	WA	WI
Barrier wall/ Concrete barrier	x		x	x	x	x	x	x		x	x	x					x			x		x
Delineators		x	x	x	x	x		x		x	x	x	x					x	x			x
Guard cable				x						x				x	x	x				x		x
Guiderail / Guardrail	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	
Highway lighting		x	x	x						x	x	x								x		
Impact attenuators	x	x	x		x	x	x	x		x	x		x		x	x	x	x				x
ITS		x										x										
Line striping	x	x	x	x		x	x	x	x		x	x	x	x		x		x	x	x		x
Non-regulation signs	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		x
Object markers				x		x				x												
Pavement markings	x	x	x		x	x		x		x	x	x	x	x	x	x	x		x	x	x	x
Raised pavement markings	x		x		x						x					x		x		x	x	x
Regulation Sgns	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		x
Traffic signals		x										x					x					

But, states do not measure the same features!

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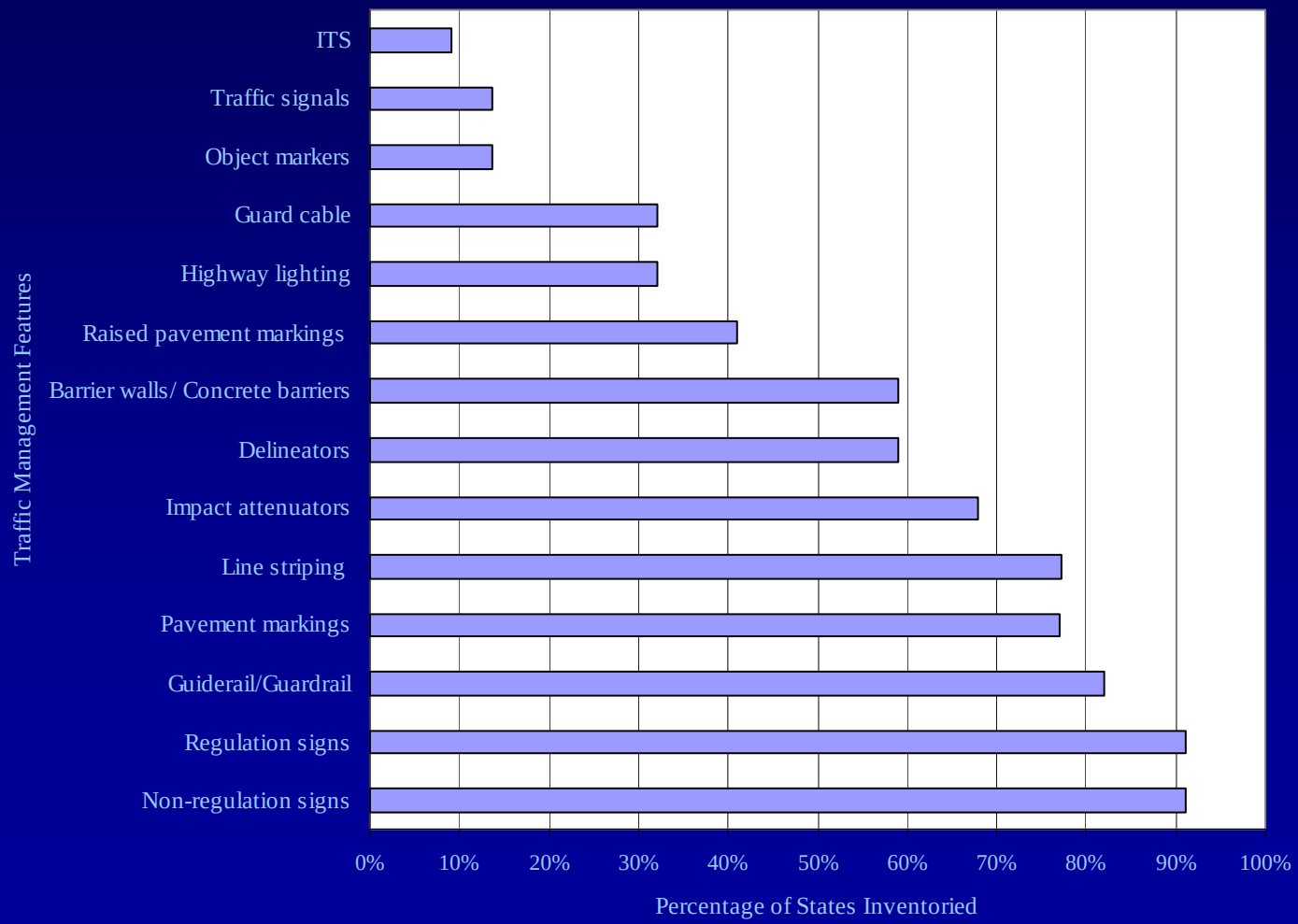
Most commonly measured Features of Traffic Management



What's a Standard?

"A tolerance level or criterion that helps to identify whether a characteristic requires maintenance attention or a characteristic's condition is unacceptable; a tolerance level or criterion that helps to identify when a feature is not 'functioning as intended'. "A standard indicates when maintenance is needed."

Standards apply for characteristics

Characteristic	Standards
Shoulder drop-off to ground/ Mainline drop-off/ Build-up	Shoulder drop-off requires attention when lower than travel way (e.g. 0.5 - 2 inches)
Potholes	All potholes greater than a specified depth (e.g. 0.5- 4 inches) require attention All potholes greater than a specified area require attention

Standards apply for features

Feature	Standard
Guiderail / Guardrail	Count as deficient any guardrail that is functionally or structurally impaired
Impact attenuators	Attenuators require attention if functioning at less than allowed percentage of design capacity

What's a Measure?

"Measures describe how to quantify the deficiency of a maintenance feature"

Measures for features

- Linear feet of damaged barrier wall
- Number of non functioning highway lights
- Distance line striping has moved from original location

Measures for characteristics

- Number of potholes
- Height of shoulder drop-off
- Area of surface oxidation
- Linear feet of cracking

A wide variety of measures are used to quantify maintenance need!

Some Roadway Shoulder Measures

Characteristic	Standards	Measures
Shoulder drop-off to ground/ Mainline drop-off/ Build-up	Shoulder drop-off requires attention when lower than travel way (e.g. 0.5 - 2 inches)	Longitudinal length where drop-off is lower than warranted Lane/shoulder drop-off height in areas where deficient Number of occurrences of unwarranted drop-off Percent of shoulder with drop-off greater than the allowable height
Potholes	All potholes greater than a specified depth (e.g. 0.5- 4 inches) require attention All potholes greater than a specified area require attention	Depth of potholes in inches Area in sq. feet of potholes Number of deficient potholes per segment Time to repair deficient potholes
Cracks	Cracks greater that the allowed width (e.g. 0.25-1.0 inches) require attention All unsealed cracks require attention	Linear feet of cracking

* An excerpt from the Shoulder Measures table

Some Traffic Management Measures

Feature	Standard	Characteristic	Measure
Guiderail / Guardrail	Count as deficient any guardrail that is functionally or structurally impaired	Damage Deviation from horizontal design height	The longitudinal length of any guardrail that is not functioning as designed or has been damaged Percent damaged as a function of original design capacity
Impact attenuators	Attenuators require attention if functioning at less than allowed percentage of design capacity	Damage	Number of attenuators needing repairs Length of deficient attenuators Percent of attenuators free of defects per segment
Barrier wall/ Concrete barrier	Walls require attention once deficient or not functioning as originally intended	Missing Damaged	Total number of crash barriers Number of crash barriers deficient or malfunctioning barriers

* An excerpt from the Traffic Management measures table

Evolution Since Scottsdale

Good News: Lots of progress since Scottsdale meeting in 2000

- But, there is no consensus on “common measures”.
- The “commonly recognized measures” identified at Scottsdale are now considered “features”.
- Maintenance categories - groups of features or characteristics – have evolved. These groups relate to maintenance budgeting.
- Concepts of features, standards, measures, thresholds, and targets have evolved.

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Next Steps

- Adopt consistent terminology to facilitate the development of MQA programs and concepts.
- Need to expand upon the comprehensive list of measures, and to develop a consensus on “common measures”.
- Need to agree on common standards as first step toward common measures.
- Need to develop concepts of thresholds and targets.
  - Threshold
    - The threshold tells the MQA official the current state of maintenance at a system wide level. This is achieved by binning or categorizing segments based on their amount of deficiency.
  - Target
    - The target identifies the level or amount of allowable/acceptable backlog system wide. The target represents the expected threshold level that is attainable on a system wide basis given the available budget.

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Thank you!

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