Current Practices in Conducting Field Inspections for Maintenance Quality Assurance (MQA)

March 1, 2016

Today's Presenters

- **Moderator**
  Anita Bush, PE – Nevada Department of Transportation
- **NCHRP Synthesis 470: Maintenance Quality Assurance Field Inspection Practices**
  Katie Zimmerman, PE – APTech
- **TDOT Prescribes MRI for Highways: Roadway Condition Assessment in Tennessee**
  Chris Harris, PE – Tennessee Department of Transportation
- **MQA Data Quality and Utilization**
  Lonnie Watkins, PE – North Carolina Department of Transportation

NCHRP is...

A state-driven national program

- The state DOTs, through AASHTO's Standing Committee on Research...
  - Are core sponsors of NCHRP
  - Suggest research topics and select final projects
  - Help select investigators and guide their work through oversight panels

NCHRP delivers...

Practical, ready-to-use results

- Applied research aimed at state DOT practitioners
- Often become AASHTO standards, specifications, guides, manuals
- Can be directly applied across the spectrum of highway concerns: planning, design, construction, operation, maintenance, safety

NCHRP uses...

A range of research approaches

- Traditional NCHRP research reports
- Syntheses of highway practice
- Innovations Deserving Exploratory Analysis program studies
- Domestic scans of innovative practices
- Quick-response research for AASHTO committees
- Research for AASHTO and state DOT leadership
- Long-range strategic studies

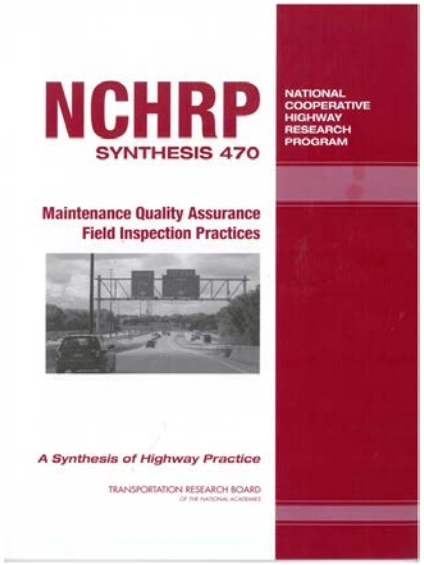
NCHRP Webinar Series

- Part of TRB's webinar program
- Opportunity to interact with experts and learn about challenges, opportunities and updates
- Complementary to other products that spread results and foster implementation
  - *Reports and Syntheses*
  - *Research Results Digests*
  - *Legal Research Digests*
  - *Web-Only Documents and CD-ROMs*

Today's First Presenter

- NCHRP Synthesis 470: Maintenance Quality Assurance Field Inspection Practices
- Katie Zimmerman, PE - APTech

A Summary of Maintenance Quality Assurance (MQA) Field Inspection Practices



Results From NCHRP Synthesis Project 45-13
Published as NCHRP Synthesis 470

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Panel Members

- Anita Bush, Nevada DOT
- Scott Bush, Wisconsin DOT
- Kevin Griffin, Utah DOT
- Roger Olson, Minnesota DOT
- Lonnie Watkins, North Carolina DOT
- Joe Mahoney, University of Washington
- Marshall Stivers, ICA
- Tim Aschenbrener, FHWA
- Morgan Kessler, FHWA

Synthesis Objectives

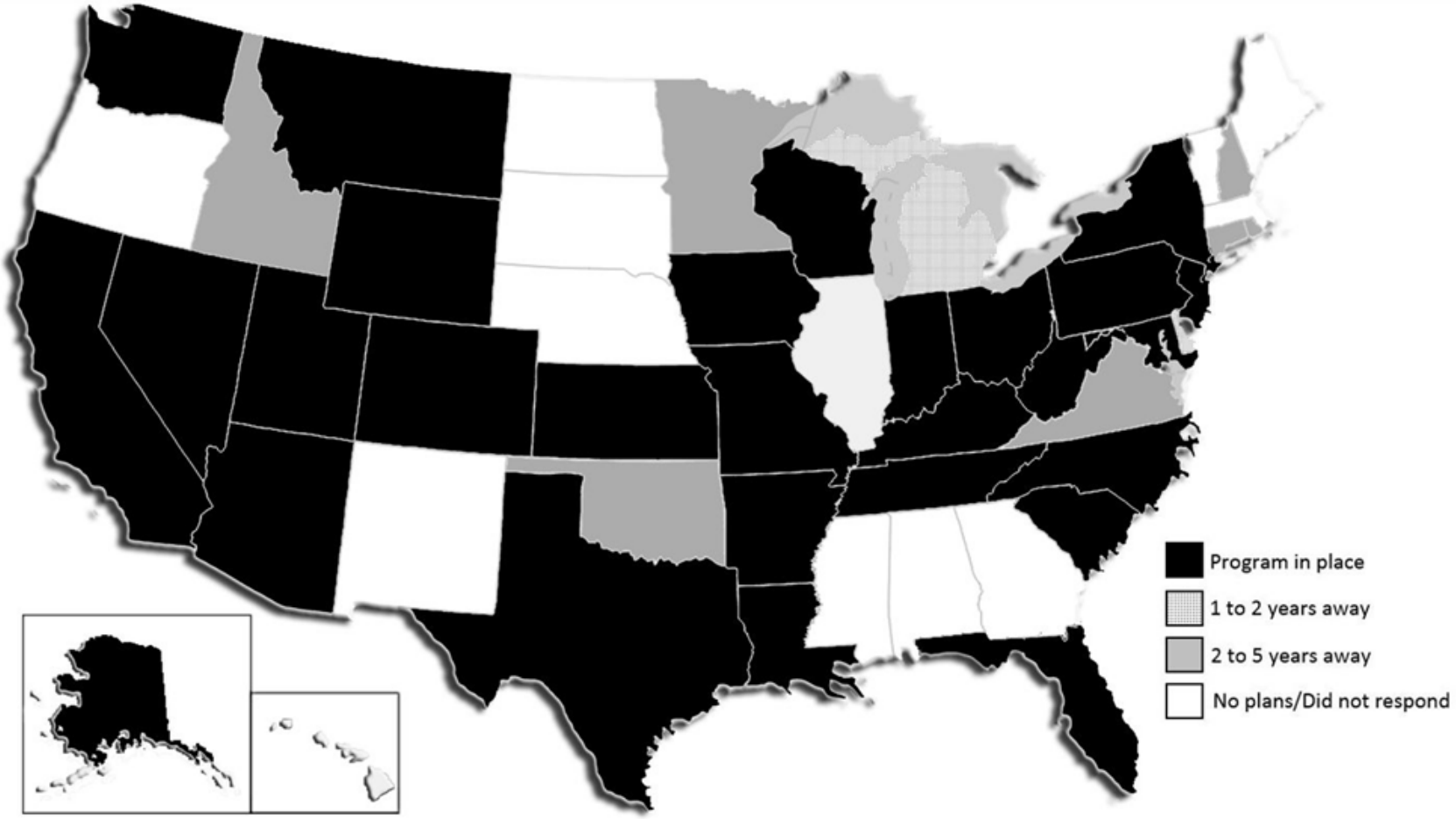
- To document the use of MQA field inspection practices to support maintenance investments
  - Types of data collected
  - Methodology used to asses condition
  - Processes used to ensure data quality
  - Use of data for budgeting and reporting
  - Rationale and motivation behind the adoption of the MQA program

Data Sources

- Literature review
- Survey of state practice
- Interviews with representatives from:
  - Alaska DOT
  - Florida DOT
  - Kentucky Transportation Cabinet
  - Montana DOT
  - North Carolina DOT
  - Utah DOT
  - Washington DOT
  - Wisconsin DOT

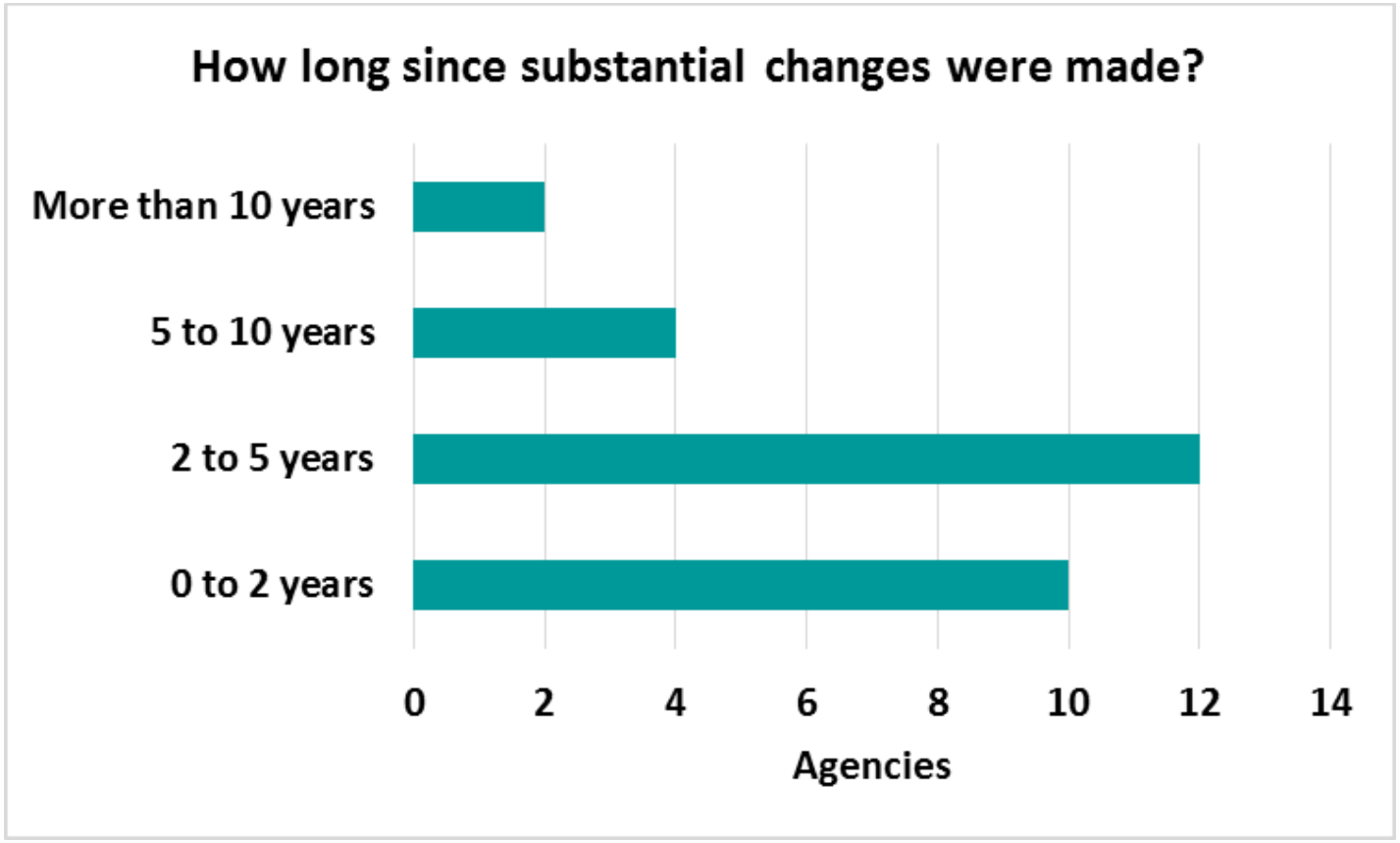
Findings – MQA Program Status

- 28 of 40 states have a program in place



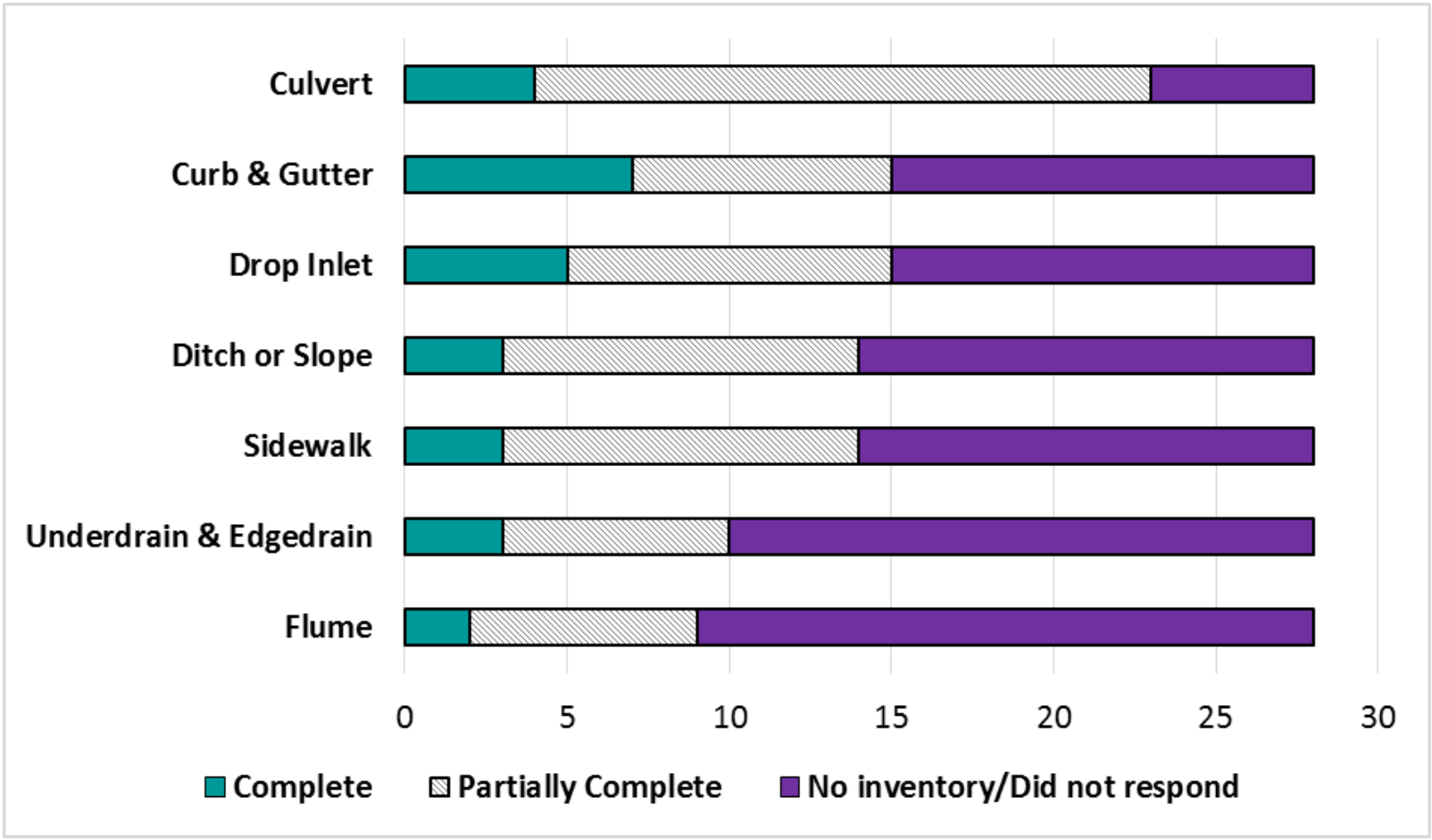
Findings – Program Status

- Most programs have undergone substantial changes since originally implemented



Findings – Data Collection

- Drainage Assets

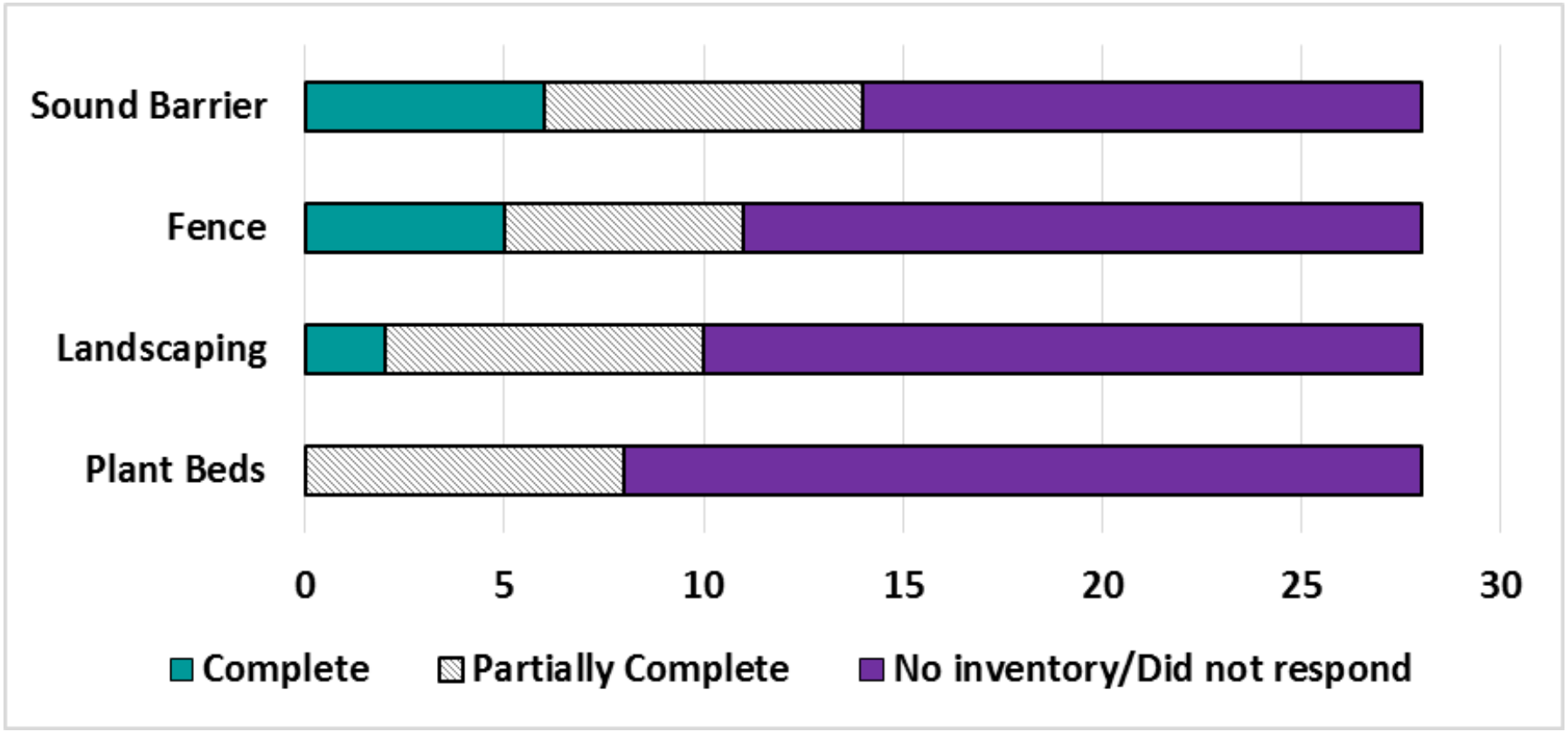


Most Common Condition Attributes - Drainage

- Culverts: Channel condition (22), culvert condition (18), erosion (13)
- Flume: Channel & flume condition (7 each)
- Curb & Gutter: Flowline interrupted (12), structural damage/spalling (10)
- Sidewalk: Displacement/heaving (5)
- Ditch: Inadequate drainage (21), erosion (16)
- Slope: Erosion (16)
- Drop Inlet: Blockage (20), grate broken/missing (16), structural deficiency (13)
- Underdrain and Edgedrain: Pipe blocked (8), end protection damage (7), pipe crushed (6)

Findings – Data Collection

- Roadside Assets

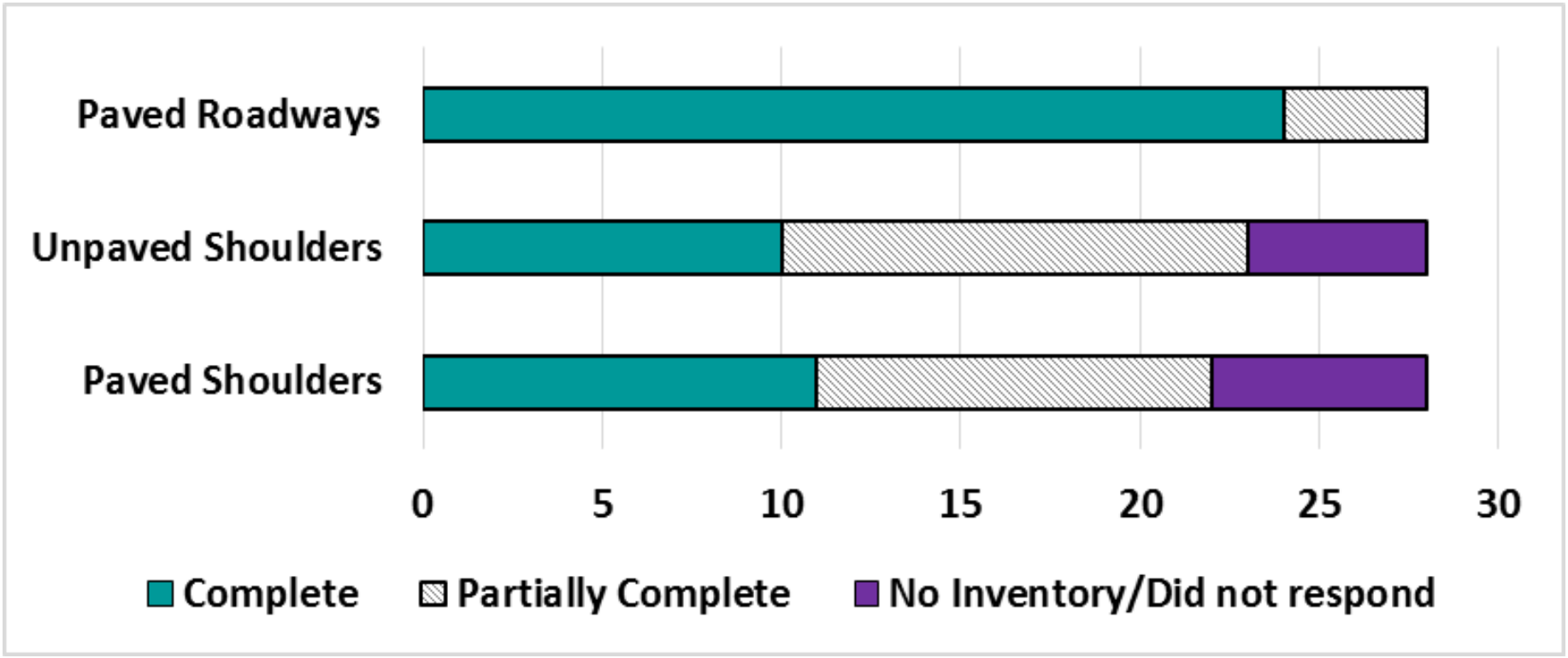


Most Common Condition Attributes – Roadside Assets

- Fence: Length of damaged or missing (13)
- Grass Mowing: Grass height (17)
- Brush: Vision obstructions (10)
- Litter: Volume within a certain length (18)
- Weed Control: Amount within a certain area (13)
- Landscaping: Appearance (7)
- Plant Beds: Appearance or Presence of undesirable vegetation (3 each)
- Sound Barrier: No measure used by more than 1 agency

Findings – Data Collection

- Pavements



Most Common Condition Attributes - Pavements

- Paved Shoulders: Drop-off (14), structural distress (12), functional distress (10)
- Unpaved Shoulders: Drop-off (17)
- Paved Roadway: Cracking (16), rutting (15), structural distress (14), roughness (12), use PMS results (12)

Findings – Data Collection

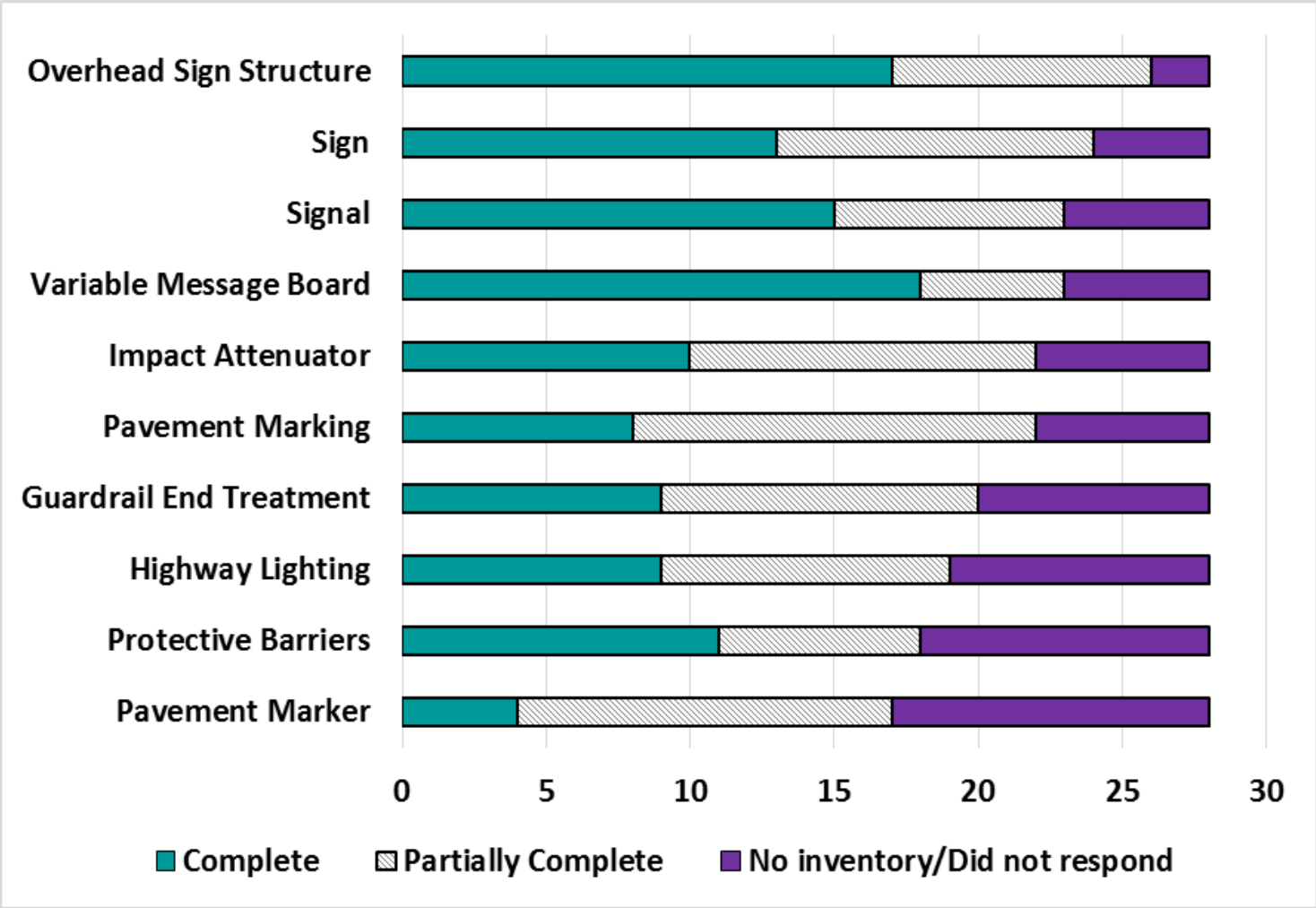
- Bridges
  - 27 of the 28 agencies reported having a complete bridge inventory

Most Common Condition Attributes - Bridges

- Bridge Management Inspections (14), deck condition rating (13), joint condition rating (11), bearing condition rating (10), structural adequacy (10)

Findings – Data Collection

- Traffic Assets

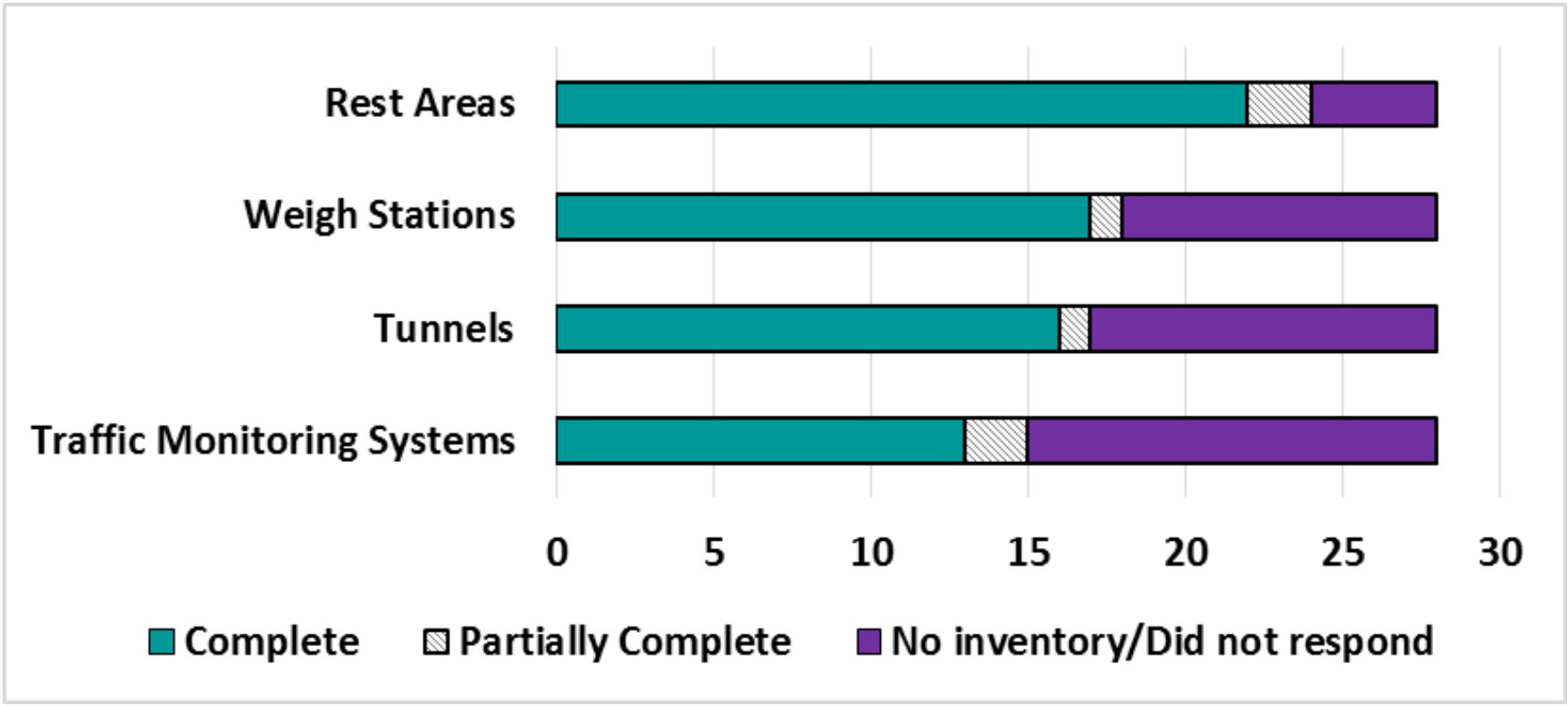


Most Common Condition Attributes – Traffic Assets

- Signal: No metric used by more than 1 agency
- Signs: Panels damaged (22), legibility (20), post damage (17), sign orientation (15), obstructions (14), visibility (13)
- Pavement Marking: Missing/damaged (18), day visibility (16), night retroreflectivity (10)
- Pavement Marker: Number missing, damaged, or obstructed (15)
- Guardrail End Treatment: End treatment damage (18), post damage (15), functionality (11), end treatment alignment (10)
- Overhead Sign Structure: Structural integrity (9)
- Impact Attenuator: Structurally damaged (16), functionality (15)
- Protective Barriers: Structurally damaged (18), functionality (14), misaligned (11)
- Variable Message Board: No metric used by more than 1 agency
- Highway Lighting: % Operational (7)

Findings – Data Collection

- Special Facilities

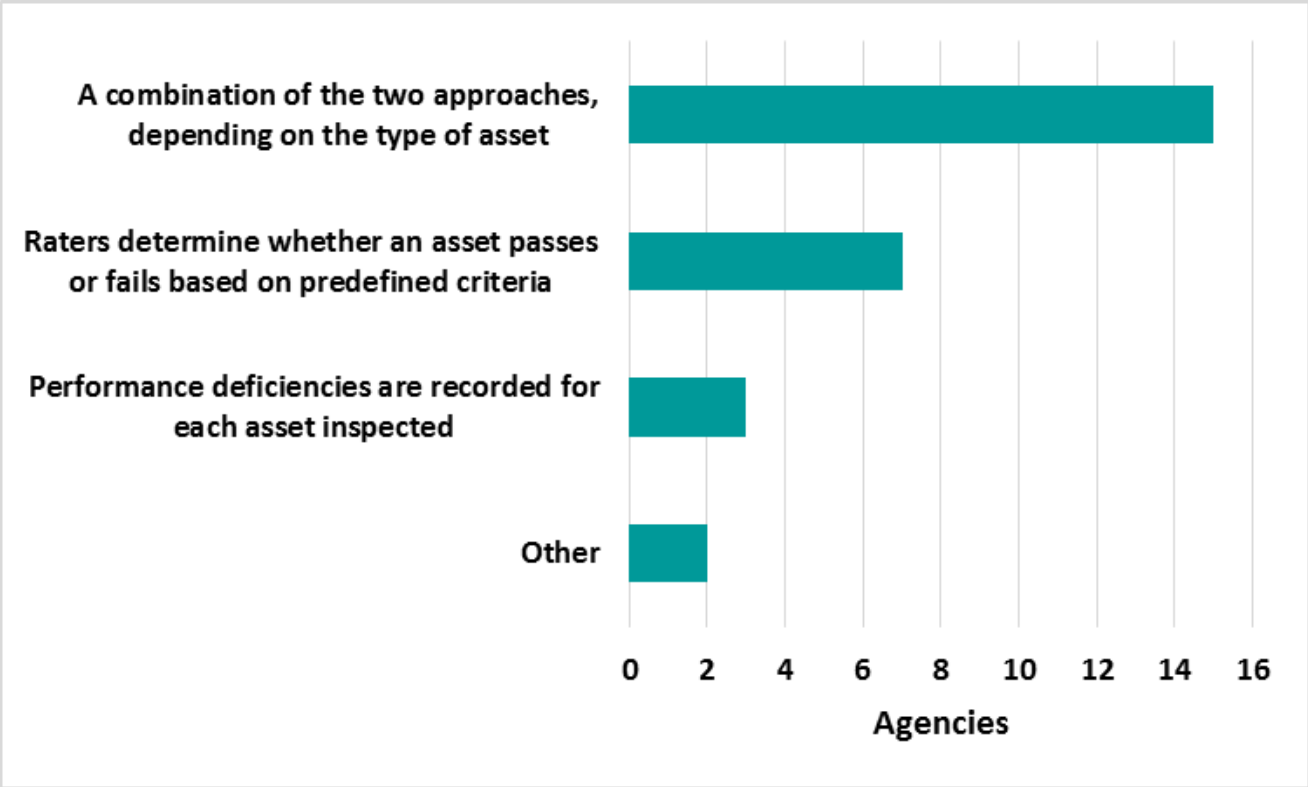


Most Common Condition Attributes – Special Facilities

- Rest Areas: Working properly, appearance, landscaping, & cleanliness (10 each)
- Tunnels: Lighting, debris, & drainage (4 each)
- Weigh Stations: Functionality (2)
- Traffic Monitoring Systems: No metrics reported

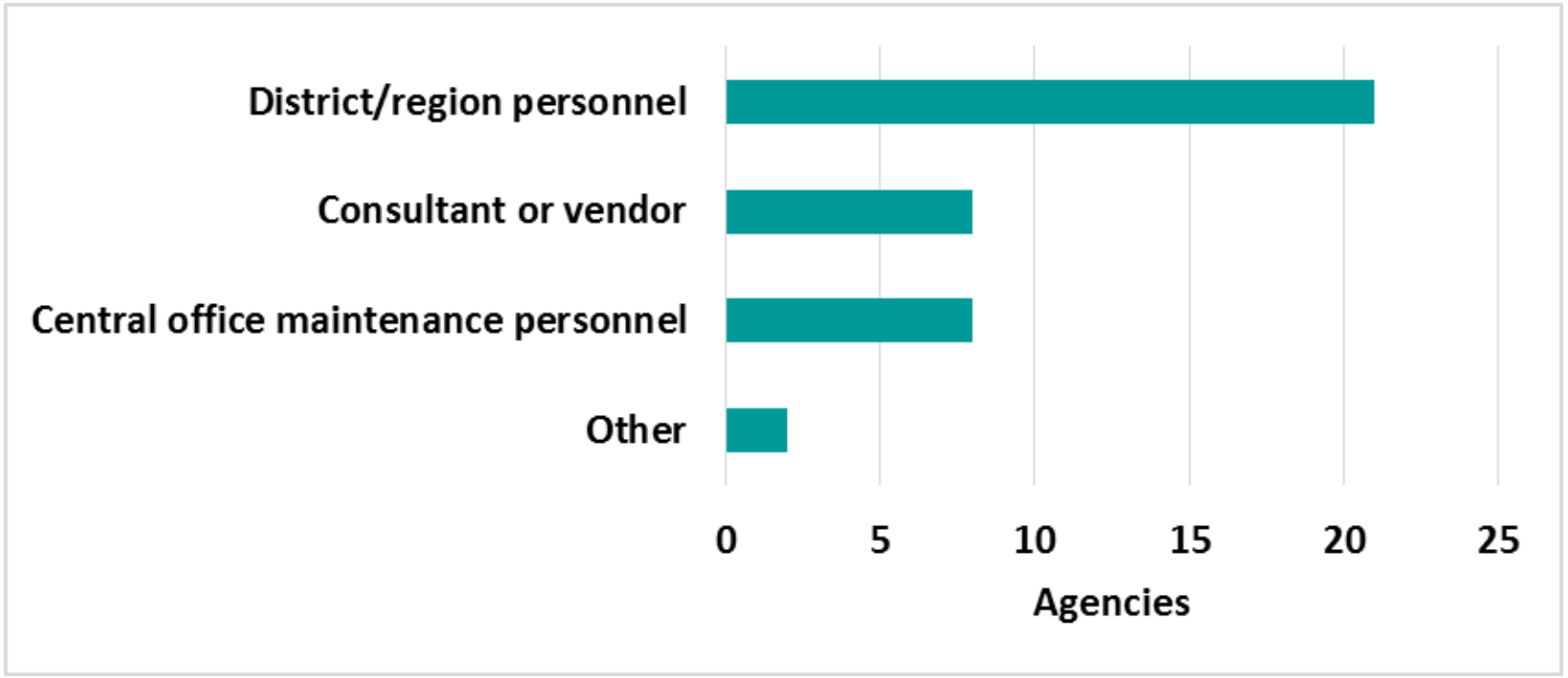
Findings – Survey Methods

- MQA programs are generally classified as a pass/fail approach, a graded approach, or a combination of the two



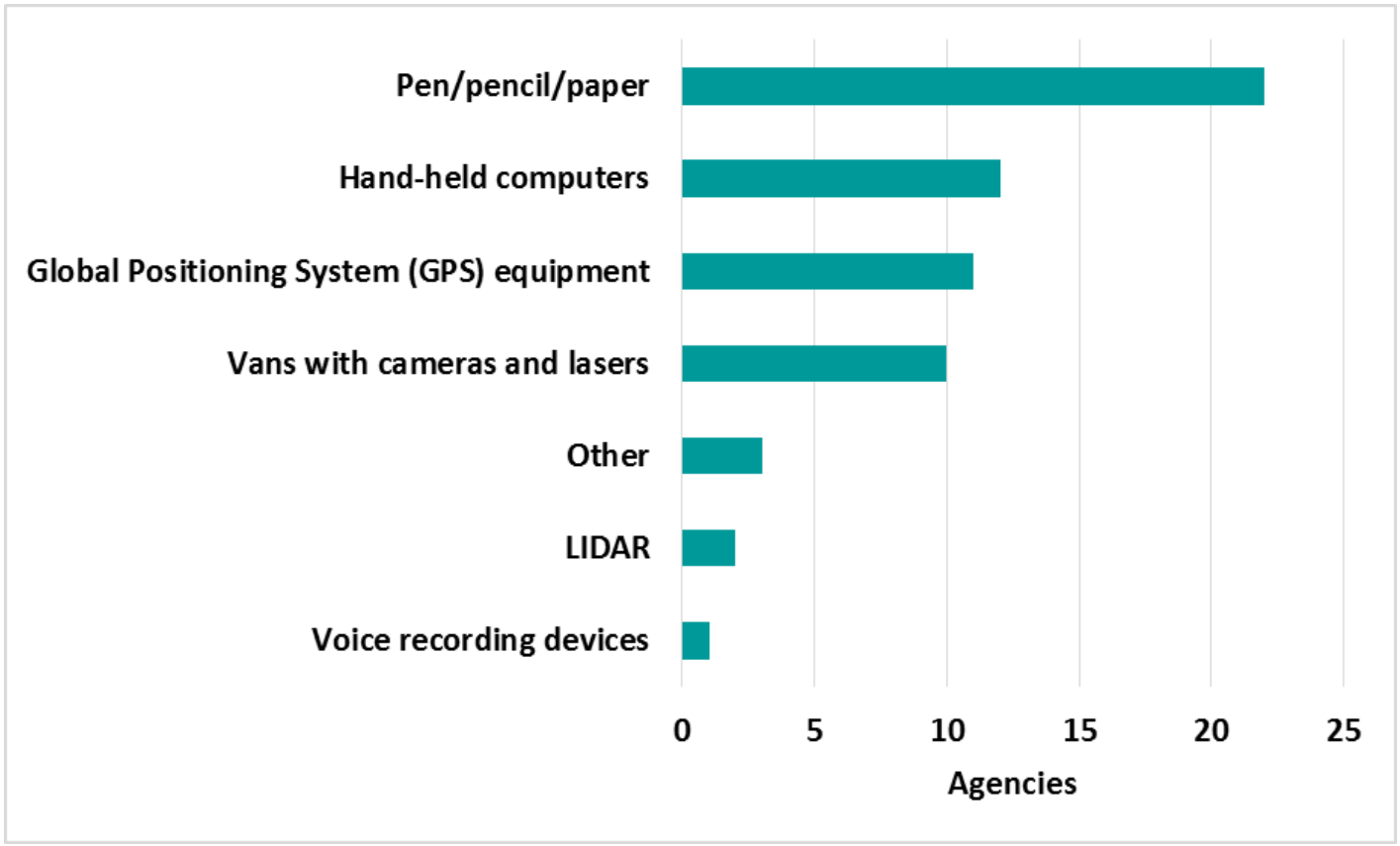
Findings - MQA Survey Approaches

- The majority of state DOTs rely on district or regional personnel to conduct surveys
- Annual surveys are most common



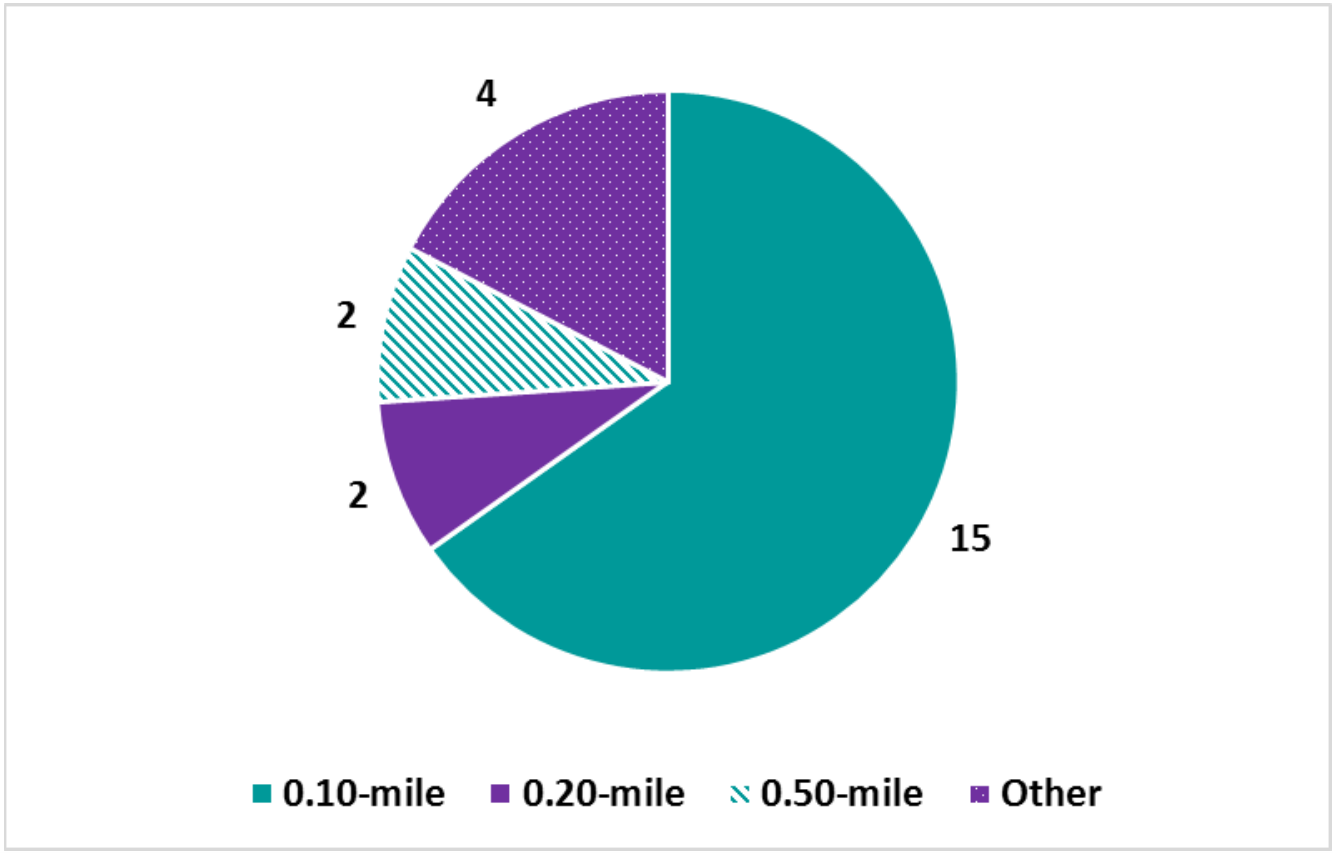
Findings - Type of Equipment Use

- Most states conduct manual surveys using low-tech tools for collecting MQA data



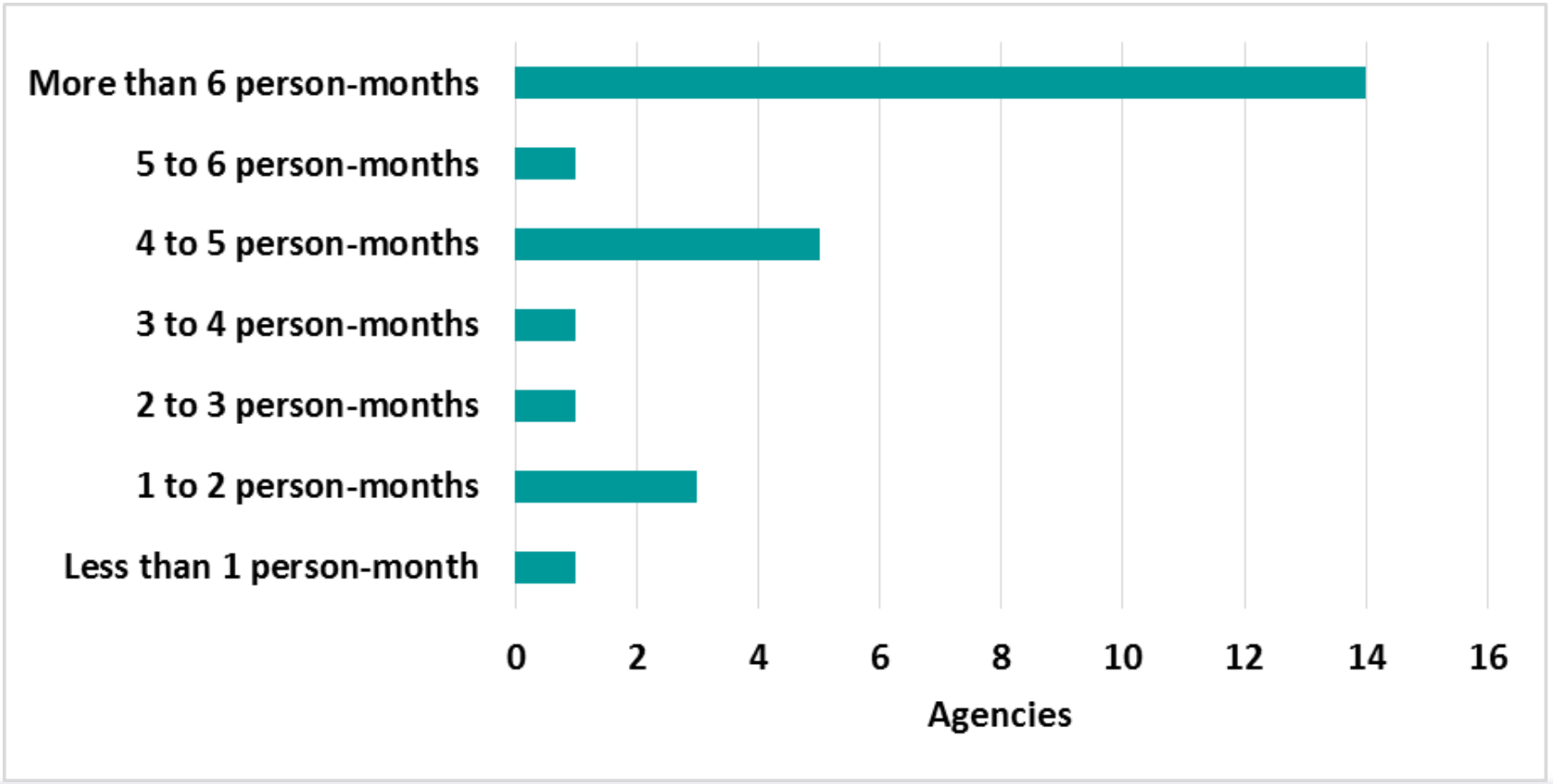
Findings - Sampling

- 23 of the 28 states use sampling
- Most states use 0.10-mile samples



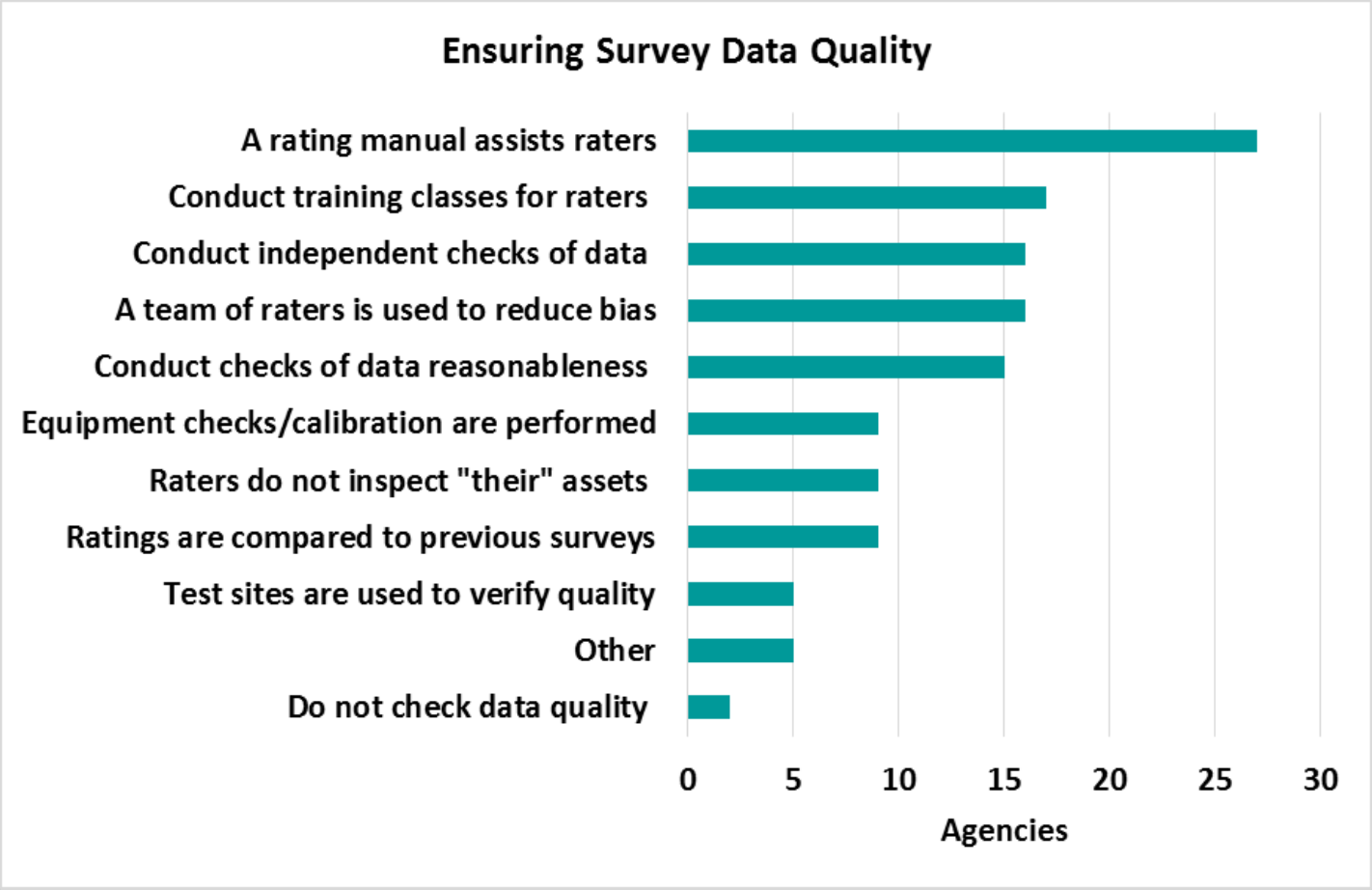
Findings – Resource Requirements

- The total number of samples inspected varies from 100 to 22,000 samples



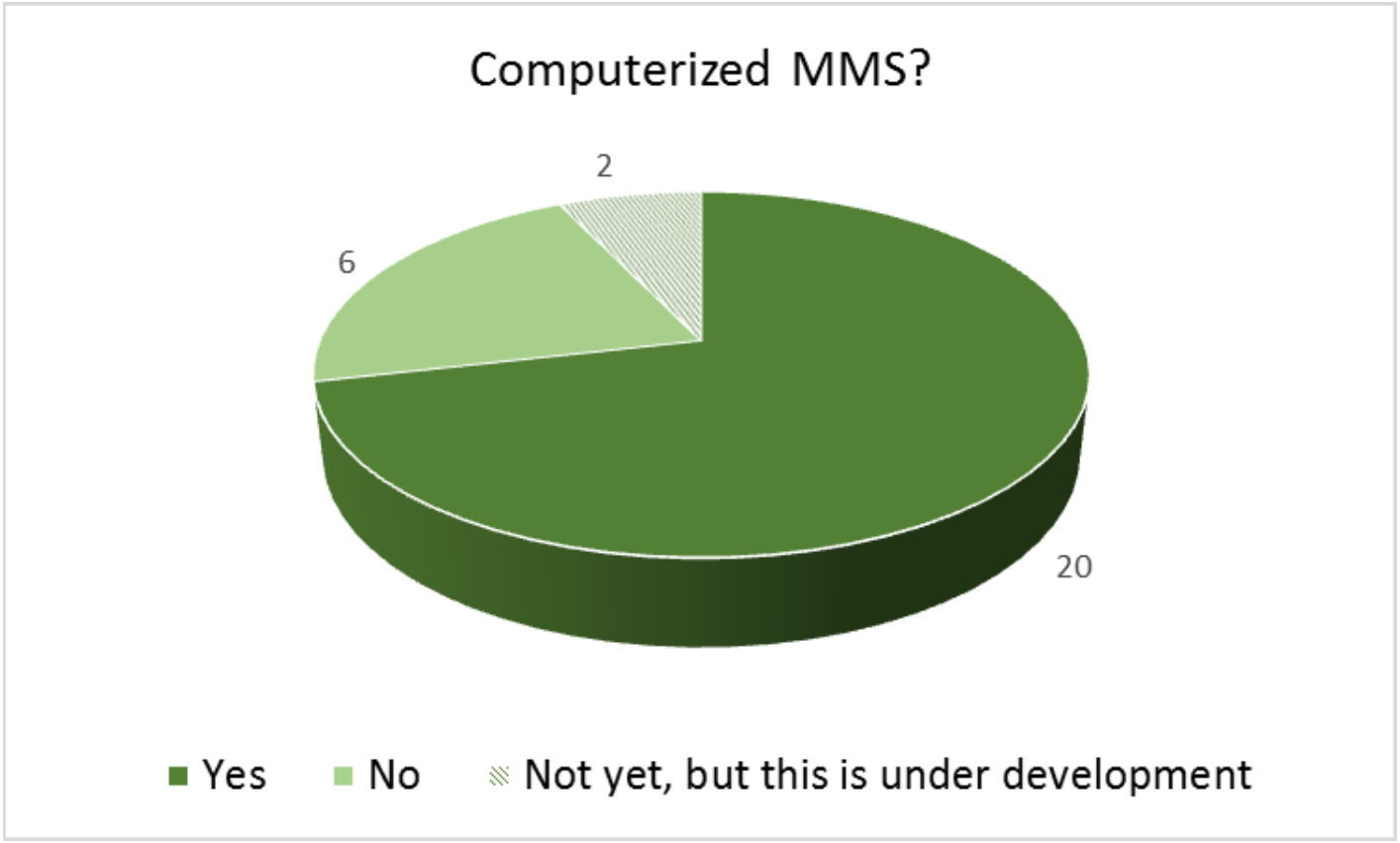
Findings – Methods Used to Ensure Quality

- Most states have procedures in place to ensure data quality



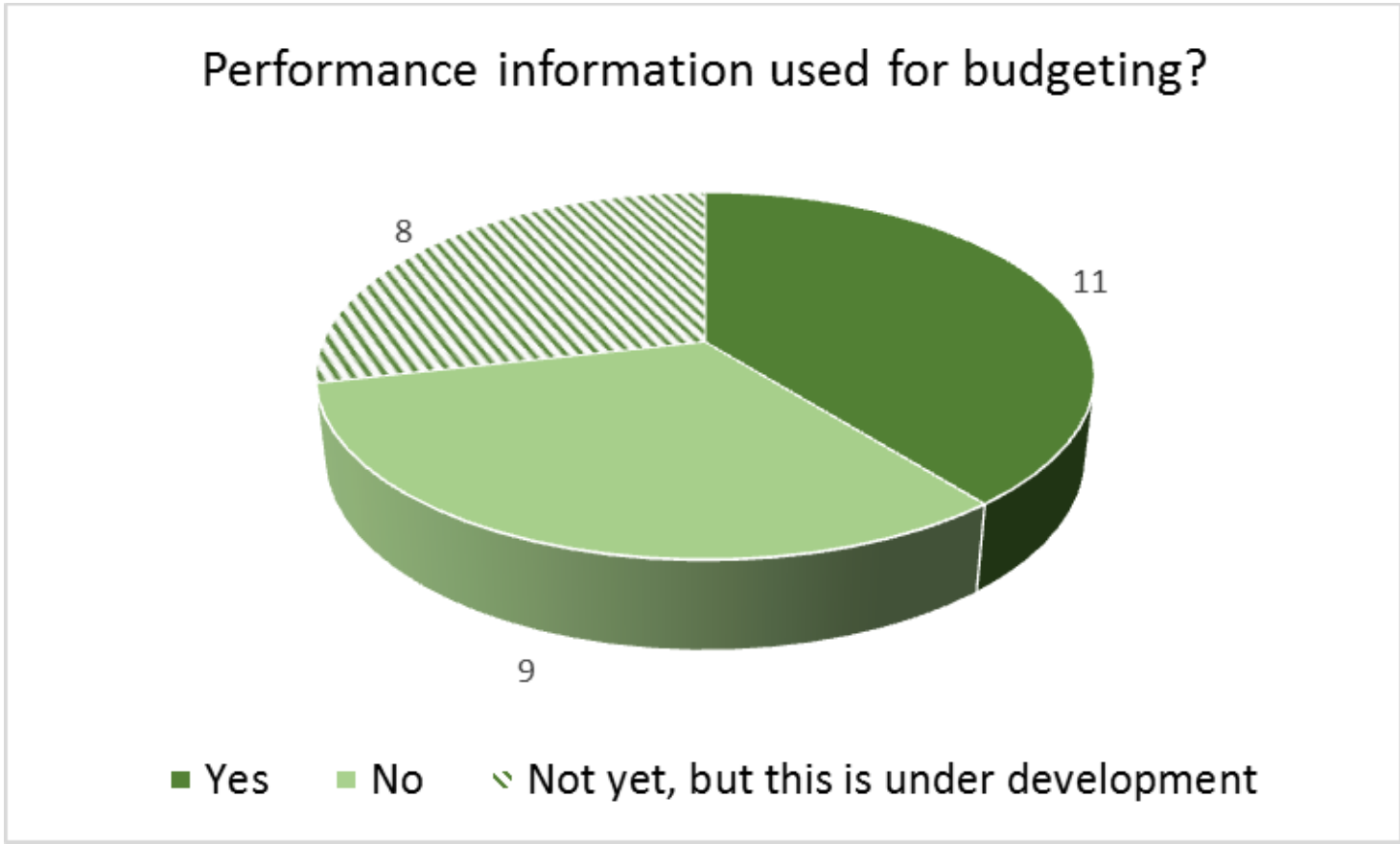
Findings – Availability of a MMS

- Most states with an MQA program have a computerized MMS in place



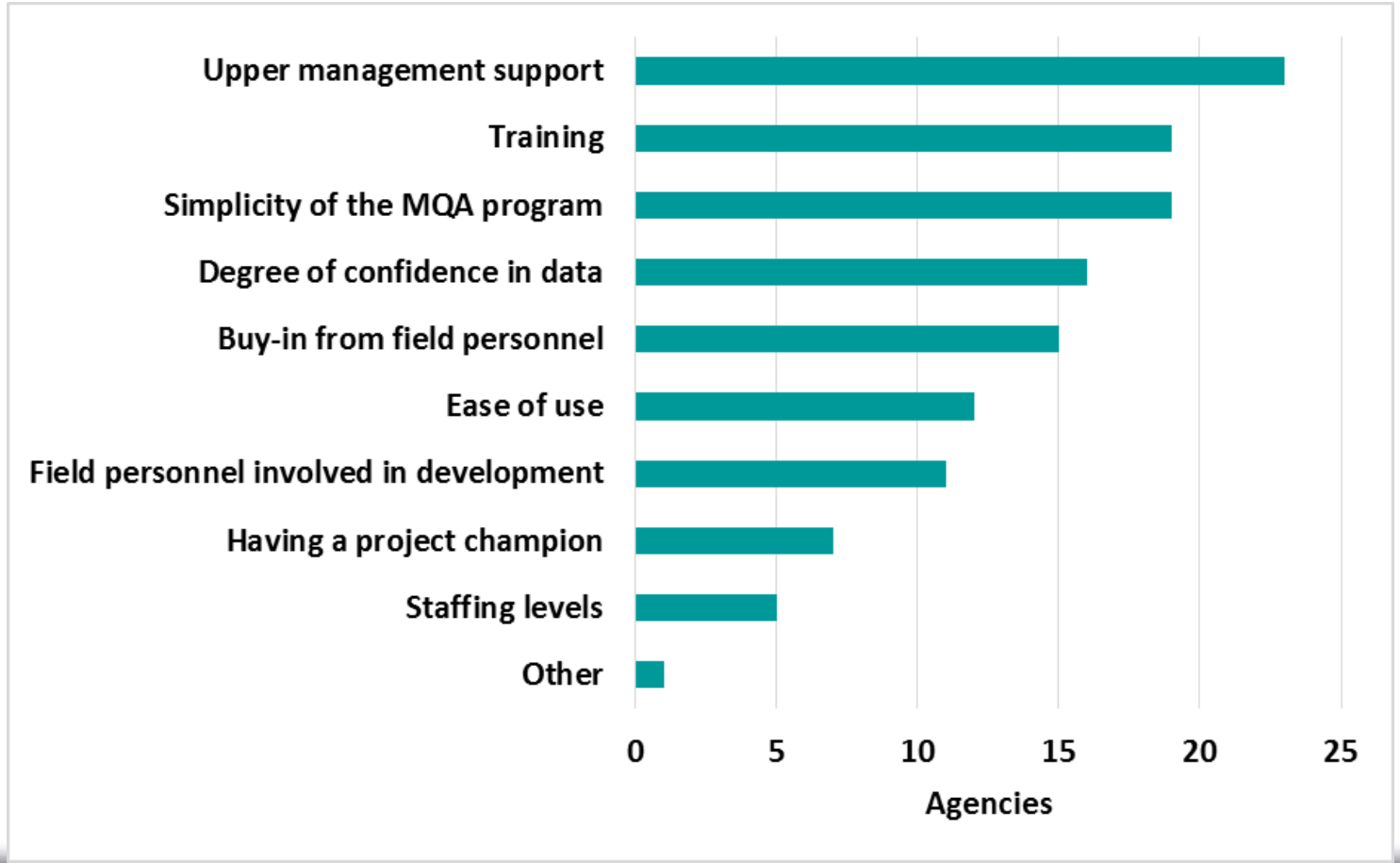
Findings – Use of MQA Data for Budgeting

- States are interested in using MQA data for budgeting activities



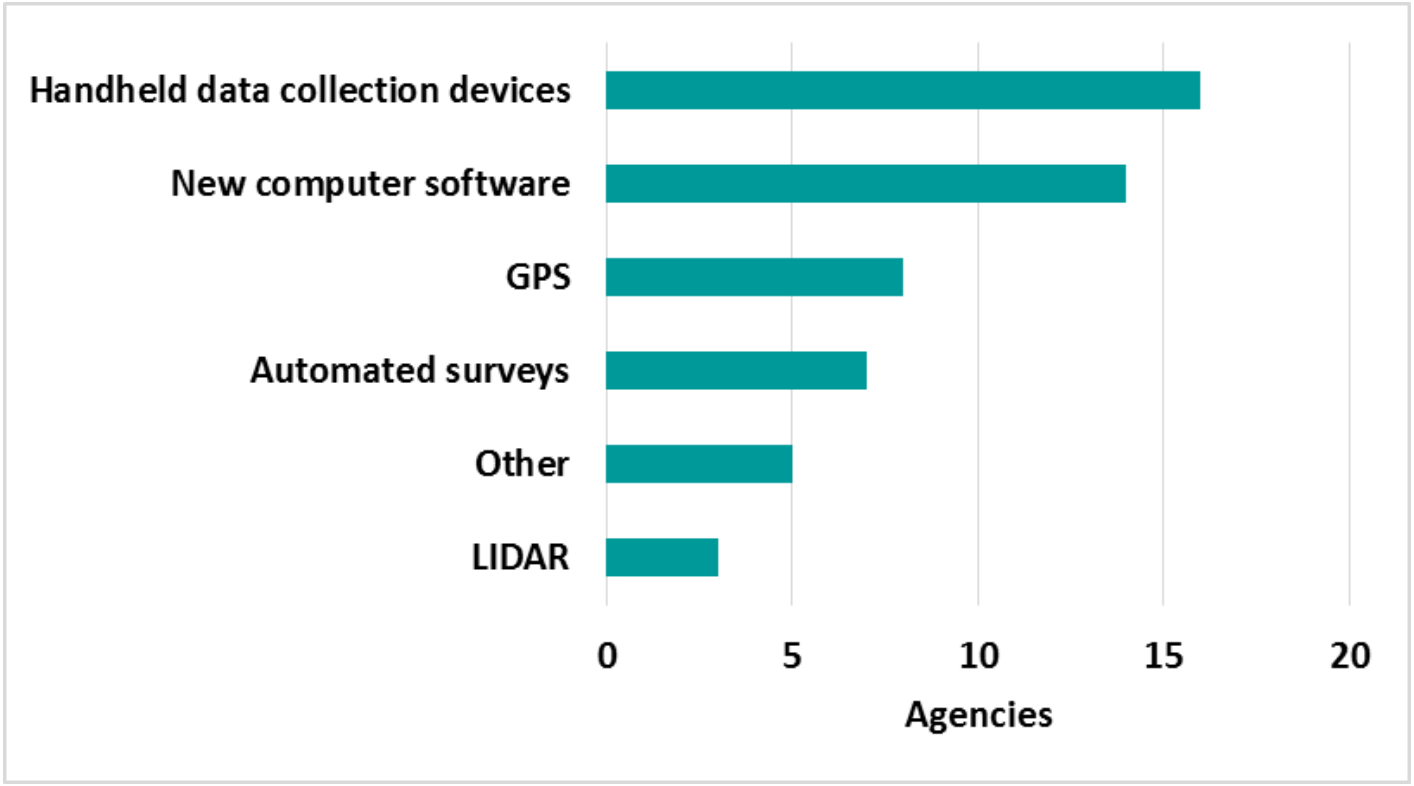
Findings – Keys to Success

- Upper management support is a key success factor



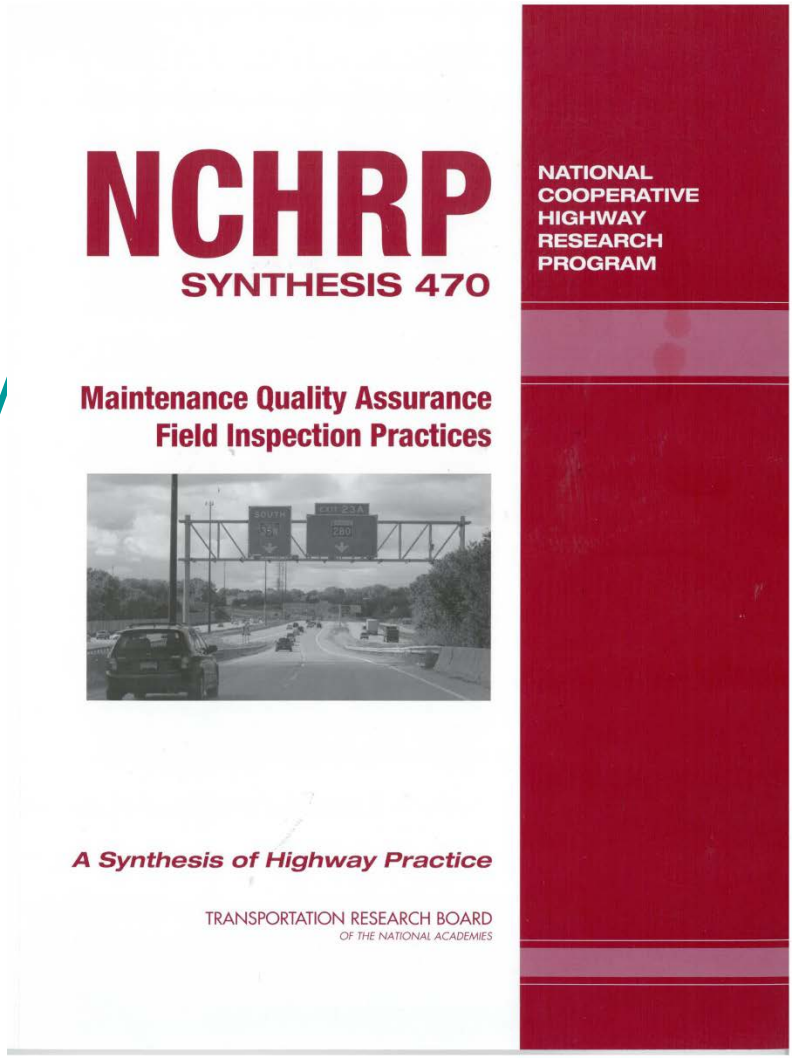
Findings – Initiatives and New Technology

- Many states are considering these new initiatives or technologies



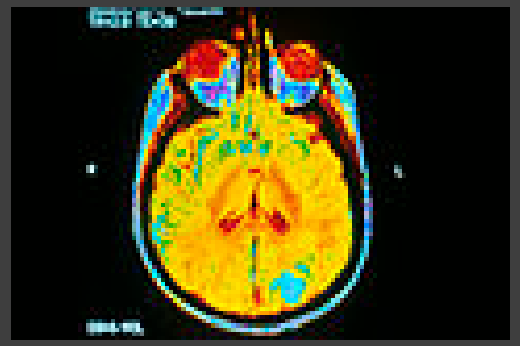
To Obtain a Copy of the Report

- Google NCHRP Synthesis 470 to get a copy OR use this link: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_470.pdf



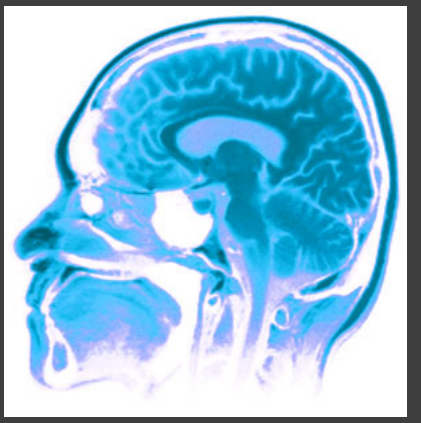
TDOT Prescribes MRI for Highways:

Road Condition Assessment in Tennessee



Chris Harris, PE
Tennessee Department of Transportation
Maintenance Division – Asset Management Office

March 1, 2016



Maintenance Rating Index

Maintenance Rating Index

- Current process at TDOT
- In place since 2001
- Pass/Fail/NA
- 5 Elements – Pavement, Shoulder, Roadside, Drainage, Traffic Services
- Weighted Scoring
- Overall target score of 85 out of 100
- Not tied to budget

Maintenance Rating Index

- Random Samples
- 6.5% of network per year
- 1/10th mile segments
- Monthly Inspections (600)
- Performed by District Staff
- 10% QA by Consultants
- Stratify by Interstate/SR
- Statistically valid at District Level and in large counties

MAINTENANCE RATING FORM

Region: 3 District: 38 Segment ID: 6542

Inspector: County: HICKMAN

Route: I0040

MAINTENANCE RATING FORM

Region: 3 District: 38 Segment ID: 6542

Inspector:	
System Type:	Interstate
Inspection Period:	6/2014
Date of Inspection:	

County:	HICKMAN
Route:	I0040
Special Case:	0
County Seq.:	1
Begin LM:	158.9
End LM:	159

CONCRETE	CONC JOINTS			
	CONC CRACKING			
	CONC POTHOLES			
	CONC EDGE DROPOFF			
	CONC SLAB FAULTING			

SHOULDER				
SH. ASPHALT	ASPH SHLD CRACKING			
	ASPH SHLD/ROADWAY JOINT			
	ASPH SHLD POTHOLES			
	ASPH SHLD ALIGATORCRACK			
	ASPH SHLD FLUSH/HEAVE			
	ASPH SHLD EDGEDROPOFF			
	ASPH SHLD BUILDUPS			
SH. CONCRETE	CONC SHLD JOINTS			
	CONC SHLD CRACKING			
	CONC SHLD POTHOLES			
	CONC SHLD EDGEDROPOFF			
	CONC SHLD SLAB FAULTING			
	CONC SHLD BUILDUPS			
SH. UNPAVED	UNPAVED SHLD BUILDUPS			
	UNPAVED SHLD WASHOUTS			
CURB & GUTTER	CURB + GUTTER			

DRAINAGE			
BOX CULVERTS			
CROSSDRAIN PIPES			
DITCHES			
CATCH BASINS + INLETS			
SIDE DRAINS			
ILLICIT DISCHARGE		■	

TRAFFIC SERVICES			
WARNING/REGULATORY SIGNS			
GUIDE SIGNS			
PAVEMENT MARKINGS		■	
RAISED PVMT MKR/DELINATOR			
GUARDRAIL/CABLE/TERMINALS			
BARRIER WALLS			
ATTENUATORS			

ARE RAMPS PRESENT IN SEGMENT? YES / NO

WERE PREVIOUSLY PAINTED MRI MARKINGS PRESENT UPON ARRIVAL? YES / NO

-WAS SEGMENT LENGTH >= 500 FT? YES / NO

- IF NOT, THEN ENTER SEGMENT LENGTH

Inspector Comments

DT-1723

MAINTENANCE RATING FORM

Region: 3 District: 38 Segment ID: 6542

Inspector:

System Type: Interstate
Inspection Period: 6/2014
Date of Inspection:

County: HICKMAN
Route: I0040
Special Case: 0
County Seq.: 1
Begin LM: 158.9
End LM: 159

Maintenance Element		Pass	N/A	Fail
TRAVELED PAVEMENT				
ASPHALT	ASPH CRACKING			
	ASPH POTHOLES			
	ASPH ALLIGATOR CRACKING			
	ASPH PLUSH/HEAVE/RAVEL			
	ASPH EDGE DROPOFF			
RUTTING	MAINLINE RUTTING			
	INTERSECTION RUTTING			
CONCRETE	CONC JOINTS		✓	
	CONC CRACKING		✓	
	CONC POTHOLES		✓	
	CONC EDGE DROPOFF		✓	
	CONC SLAB FAULTING		✓	
	ASPH SHLD PLUSH/HEAVE			
	ASPH SHLD EDGEDROPOFF			
	ASPH SHLD BUILDUPS			
SH. CONCRETE	CONC SHLD JOINTS			
	CONC SHLD CRACKING			
	CONC SHLD POTHOLES			
	CONC SHLD EDGEDROPOFF			
	CONC SHLD SLAB FAULTING			
	CONC SHLD BUILDUPS			
SH. UNPAVED	UNPAVED SHLD BUILDUPS			
	UNPAVED SHLD WASHOUTS			
CURB & GUTTER	CURB + GUTTER			

aintenance Element	Pass	N/A	Fail
SIDE			
APING + WILDFLOWERS			
		■	
NG		■	
TI		■	
TION + BRUSH			
/EROSION/TURF RUT			
NAGE			
LVERTS			
RAIN PIPES			
S			
BASINS + INLETS			
RAINS			
T DISCHARGE		■	
FIC SERVICES			
G/REGULATORY SIGNS			
GUIDE SIGNS			
PAVEMENT MARKINGS		■	
RAISED PVMT MKR/DELINATOR			
GUARDRAIL/CABLE/TERMINALS			
BARRIER WALLS			
ATTENUATORS			

ARE RAMPS PRESENT IN SEGMENT? YES / NO

WERE PREVIOUSLY PAINTED MRI MARKINGS PRESENT UPON ARRIVAL? YES / NO
-WAS SEGMENT LENGTH >= 500 FT? YES / NO
- IF NOT, THEN ENTER SEGMENT LENGTH

Inspector Comments

DT-1723

Element/Characteristic Standards and How to Measure Defects –Travel Pavement

- Unsealed Cracking
  - **Condition Standard:**
    - ✓ if cracks have a cumulative length ≥ 50 feet with a width > 3/16 inch, or
    - ✓ if any portion of a crack exceeds ½ inch and is unsealed, then the characteristic **"Fails"**

MAINTENANCE RATING FORM

Region: 3 District: 38 Segment ID: 6542

Inspector:

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County: HICKMAN
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Begin LM: 158.9
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Maintenance Element		Pass	N/A	Fail
TRAVELED PAVEMENT				
ASPHALT	ASPH CRACKING	✓		
	ASPH POTHOLES			✓
	ASPH ALLIGATOR CRACKING	✓		
	ASPH PLUSH/HEAVE/RAVEL	✓		
	ASPH EDGE DROPOFF	✓		
RUTTING	MAINLINE RUTTING			✓
	INTERSECTION RUTTING		✓	
CONCRETE	CONC JOINTS		✓	
	CONC CRACKING		✓	
	CONC POTHOLES		✓	
	CONC EDGE DROPOFF		✓	
	CONC SLAB FAULTING		✓	
	ASPH SHLD PLUSH/HEAVE			
	ASPH SHLD EDGEDROPOFF			
	ASPH SHLD BUILDUPS			
SH. CONCRETE	CONC SHLD JOINTS			
	CONC SHLD CRACKING			
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	CONC SHLD EDGEDROPOFF			
	CONC SHLD SLAB FAULTING			
	CONC SHLD BUILDUPS			
SH. UNPAVED	UNPAVED SHLD BUILDUPS			
	UNPAVED SHLD WASHOUTS			
CURB & GUTTER	CURB + GUTTER			

aintenance Element	Pass	N/A	Fail
SIDE			
APING + WILDFLOWERS			
		■	
NG		■	
TI		■	
TION + BRUSH			
/EROSION/TURF RUT			
NAGE			
LVERTS			
RAIN PIPES			
S			
BASINS + INLETS			
RAINS			
T DISCHARGE		■	
FIC SERVICES			
G/REGULATORY SIGNS			
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PAVEMENT MARKINGS		■	
RAISED PVMT MKR/DELINATOR			
GUARDRAIL/CABLE/TERMINALS			
BARRIER WALLS			
ATTENUATORS			

ARE RAMPS PRESENT IN SEGMENT? YES / NO

WERE PREVIOUSLY PAINTED MRI MARKINGS PRESENT UPON ARRIVAL? YES / NO
-WAS SEGMENT LENGTH >= 500 FT? YES / NO
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Inspector Comments

DT-1723

MAINTENANCE RATING

Region: 3 District: 38 Segment

Inspector:

System Type: Interstate
Inspection Period: 6/2014
Date of Inspection:

County:
Route:
Special Case:
County Seq.:
Begin LM:
End LM:

Maintenance Element		Pass	N/A	Fail
TRAVELED PAVEMENT				
ASPHALT	ASPH CRACKING			
	ASPH POTHOLES			
	ASPH ALLIGATOR CRACKING			
	ASPH FLUSH/HEAVE/RAVEL			
	ASPH EDGE DROPOFF			
RUTTING	MAINLINE RUTTING			
	INTERSECTION RUTTING			

Maintenance Element	Pass	N/A	Fail
ROADSIDE			
GRASS			
LANDSCAPING + WILDFLOWERS			
LITTER		■	
FENCE			
SWEEPING		■	

Maintenance Element		Pass	N/A	Fail
SHOULDER				
SH. ASPHALT	ASPH SHLD CRACKING			
	ASPH SHLD/ROADWAY JOINT			
	ASPH SHLD POTHOLES			
	ASPH SHLD ALIGATORCRACK			
	ASPH SHLD FLUSH/HEAVE			
	ASPH SHLD EDGEDROPOFF			
	ASPH SHLD BUILDUPS			
SH. CONCRETE	CONC SHLD JOINTS			
	CONC SHLD CRACKING			
	CONC SHLD POTHOLES			
	CONC SHLD EDGEDROPOFF			
	CONC SHLD SLAB FAULTING			
	CONC SHLD BUILDUPS			
SH. UNPAVED	UNPAVED SHLD BUILDUPS			
	UNPAVED SHLD WASHOUTS			
CURB & GUTTER	CURB + GUTTER			

Maintenance Element	Pass	N/A	Fail
DRAINAGE			
BOX CULVERTS			
CROSSDRAIN PIPES			
DITCHES			
CATCH BASINS + INLETS			
SIDE DRAINS			
ILLICIT DISCHARG			

GUIDE SIGNS
PAVEMENT MARK
RAISED PVMT M
GUARDRAIL/CAB
BARRIER WALLS
ATTENUATORS

ARE RAMPS PRES

WERE PREVIOUSL
MARKINGS PRES
-WAS SEGMEN
- IF NOT, THEN

Maintenance Element	Pass	N/A	Fail
TRAFFIC SERVICES			
WARNING/REGULATORY SIGNS			
GUIDE SIGNS			
PAVEMENT MARKINGS		■	
RAISED PVMT MKR/DELINATOR			
GUARDRAIL/CABLE/TERMINALS			
BARRIER WALLS			
ATTENUATORS			

	July 2015 - January 2016
FY 2015-2016	
REGION	(All)
DISTRICT	(All)
COUNTY_NAME	(All)
Month Nbr	(All)

MRI Target	TDOT Avg Score	QC Avg Score
85.00	85.98	80.49

TDOT Avg Score is 5.49 points higher than the QC Avg Score

TDOT Avg Score exceeds the MRI Target of 85.00

ELEMENT	CHAR_NAME	TDOT Characteristic Score	QC Characteristic Score	TDOT Composite Score	QC Composite Score	TDOT Evaluation Count	QC Evaluation Count
1 - PAVEMENT	01 - ASHP CRACKING	41.00	34.62			4,124	413
	02 - ASPH POTHOLES	94.81	93.46			4,124	413
	03 - ASPH ALLIGATOR CRACKING	77.09	68.28			4,124	413
	04 - ASPH FLUSH/HEAVE/RAVEL	95.39	86.68			4,124	413
	05 - ASPH EDGE DROPOFF	88.07	81.60			4,124	413
	06 - MAINLINE RUTTING	97.50	98.46			3,956	390
	07 - INTERSECTION RUTTING	85.26	88.46			190	26
	08 - CONC JOINTS	82.56	66.67			86	6
	09 - CONC CRACKING	74.42	66.67			86	6
	10 - CONC POTHOLES	75.58	50.00			86	6
	11 - CONC EDGE DROPOFF	97.67	100.00			86	6
	12 - CONC SLAB FAULTING	93.02	100.00			86	6
1 - PAVEMENT Total		82.93	77.78	21.56	20.22		
	35 - VEGETATION + BRUSH	93.81	93.12			3,779	349
	36 - SLOPES/EROSION/TURF RUT	94.23	84.00			3,901	400
3 - ROADSIDE Total		89.40	84.73	13.41	12.71		
4 - DRAINAGE	37 - BOX CULVERTS	86.78	79.17			295	24
	38 - CROSSDRAIN PIPES	81.69	56.62			1,475	136
	39 - DITCHES	88.66	92.45			3,820	384
	40 - CATCH BASINS + INLETS	89.99	79.52			839	83
	41 - SIDE DRAINS/FRENCH DRAINS	60.64	37.89			2,269	227
4 - DRAINAGE Total		81.16	70.93	13.80	12.06		
5 - TRAFFIC SERVICES	42 - WARNING/REGULATORY SIGNS	79.22	63.24			1,983	185
	43 - ADVISORY SIGNS	81.88	62.70			1,363	126
	44 - PAVEMENT MARKINGS	96.28	95.67			4,145	416
	45 - RAISED PVMT MKR/DELINATOR	89.15	90.65			2,443	246
	46 - GUARDRAIL/G.R. TERMINALS	91.36	68.37			937	98
	47 - BARRIER WALLS	95.65	100.00			115	9
	48 - ATTENUATORS	87.76	#DIV/0!			49	-
	49 - ILLICIT DISCHARGE	#DIV/0!	#DIV/0!				
5 - TRAFFIC SERVICES Total		89.61	83.22	22.40	20.80		
Grand Total				85.98	80.49		

MRI Scores

ELEMENT	CHAR_NAME	TDOT Characteristic Score	QC Characteristic Score	TDOT Composite Score	QC Composite Score	TDOT Evaluation Count	QC Evaluation Count
1 - PAVEMENT	01 - ASHP CRACKING	41.00	34.62			4,124	413
	02 - ASPH POTHOLES	94.81	93.46			4,124	413
	03 - ASPH ALLIGATOR CRACKING	77.09	68.28			4,124	413
	04 - ASPH FLUSH/HEAVE/RAVEL	95.39	86.68			4,124	413
	05 - ASPH EDGE DROPOFF	88.07	81.60			4,124	413
	06 - MAINLINE RUTTING	97.50	98.46			3,956	390
	07 - INTERSECTION RUTTING	85.26	88.46			190	26
	08 - CONC JOINTS	82.56	66.67			86	6
	09 - CONC CRACKING	74.42	66.67			86	6
	10 - CONC POTHOLES	75.58	50.00			86	6
	11 - CONC EDGE DROPOFF	97.67	100.00			86	6
	12 - CONC SLAB FAULTING	93.02	100.00			86	6
1 - PAVEMENT Total		82.93	77.78	21.56	20.22		

July 2015 - January 2016

MRI Target	TDOT Avg Score	QC Avg Score
85.00	85.98	80.49

TDOT Avg Score is 5.49 points higher than the QC Avg Score

TDOT Avg Score exceeds the MRI Target of 85.00

	16 - ASPH SHLD ALIGATORCRACK	93.85	91.37			2,600	278
	17 - ASPH SHLD FLUSH/HEAVE	98.38	96.40			2,600	278
	18 - ASPH SHLD EDGEDROPOFF	85.77	86.33			2,600	278
	19 - ASPH SHLD BUILDUPS	77.15	91.37			2,600	278
	20 - CONC SHLD JOINTS	96.25	#DIV/0!			80	-
	21 - CONC SHLD CRACKING	86.25	#DIV/0!			80	-
	22 - CONC SHLD POTHOLES	93.75	#DIV/0!			80	-
	23 - CONC SHLD EDGEDROPOFF	92.50	#DIV/0!			80	-
	24 - CONC SHLD SLAB FAULTING	96.25	#DIV/0!			80	-
	25 - UNPVD SHLD EDGEDROPOFF	82.50	#DIV/0!			80	-
	26 - UNPAVED SHLD BUILDUPS	77.34	82.05			2,772	273
	27 - UNPAVED SHLD WASHOUTS	94.16	86.81			2,772	273
	28 - CURB + GUTTER	81.80	69.23			456	52
2 - SHOULDER Total		87.09	86.43	14.81	14.69		
3 - ROADSIDE	29 - GRASS	84.77	90.98			4,071	410
	30 - LANDSCAPING + WILDFLOWERS	99.53	100.00			213	26
	31 - LITTER	80.80	80.05			4,145	416
	32 - FENCE	81.02	76.19			469	42
	33 - SWEEPING	85.86	66.59			4,145	416
	34 - GRAFFITI	99.61	99.28			4,145	416
	35 - VEGETATION + BRUSH	93.81	93.12			3,779	349
	36 - SLOPES/EROSION/TURF RUT	94.23	84.00			3,901	400
3 - ROADSIDE Total		89.40	84.73	13.41	12.71		
4 - DRAINAGE	37 - BOX CULVERTS	86.78	79.17			295	24
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	46 - GUARDRAIL/G.R. TERMINALS	91.36	68.37			937	98
	47 - BARRIER WALLS	95.65	100.00			115	9
	48 - ATTENUATORS	87.76	#DIV/0!			49	-
	49 - ILLICIT DISCHARGE	#DIV/0!	#DIV/0!				
5 - TRAFFIC SERVICES Total		89.61	83.22	22.40	20.80		
Grand Total				85.98	80.49		

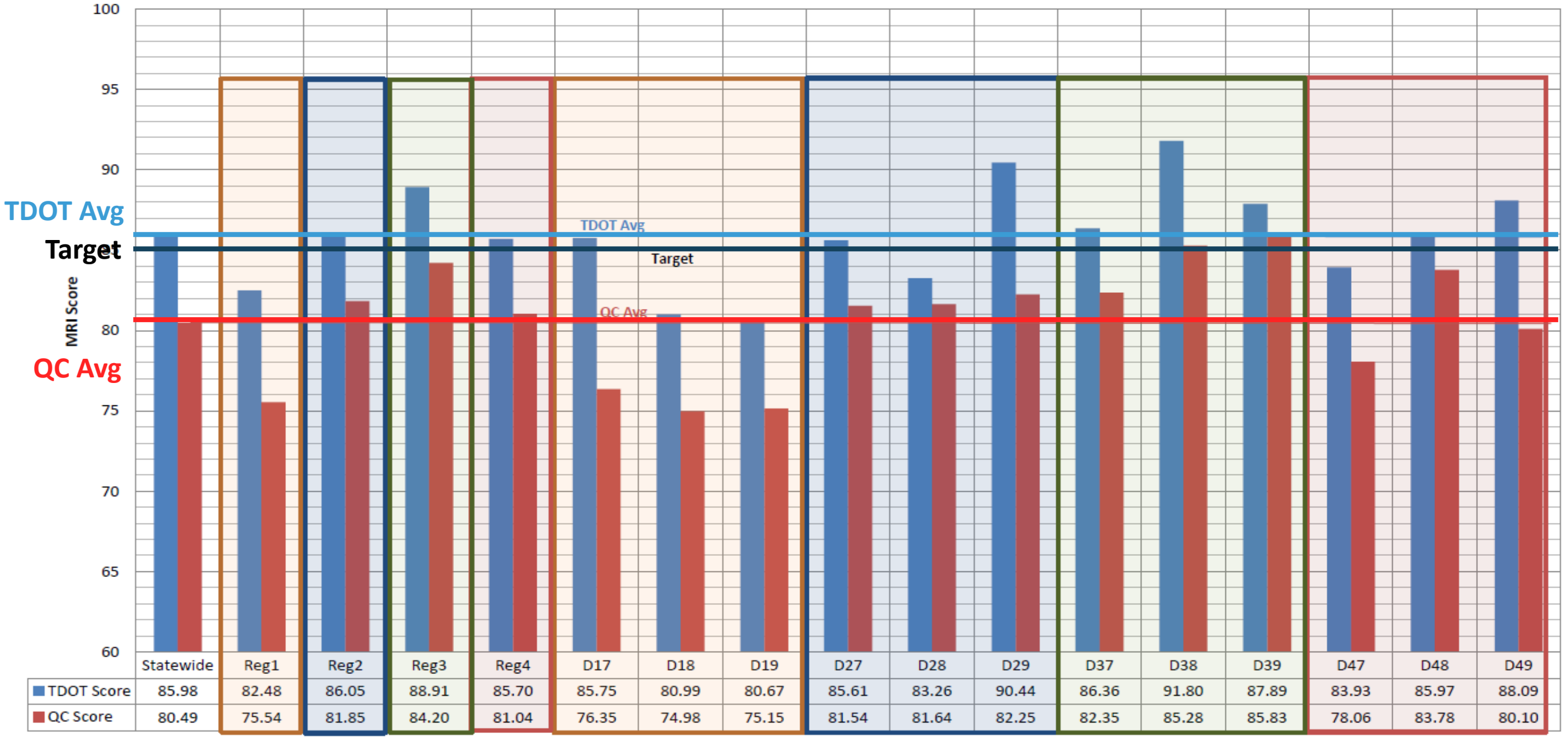
MRI Target	TDOT Avg Score	QC Avg Score
85.00	85.98	80.49

TDOT Avg Score is 5.49 points higher than the QC Avg Score

TDOT Avg Score exceeds the MRI Target of 85.00

- Scoring at multiple levels:
  - State
  - Region
  - District
  - County

Comparison of MRI Scores
TDOT and QC - FY 2016 (July 2015 - January 2016)



	Statewide	Reg1	Reg2	Reg3	Reg4	D17	D18	D19	D27	D28	D29	D37	D38	D39	D47	D48	D49
TDOT Score	85.98	82.48	86.05	88.91	85.70	85.75	80.99	80.67	85.61	83.26	90.44	86.36	91.80	87.89	83.93	85.97	88.09
QC Score	80.49	75.54	81.85	84.20	81.04	76.35	74.98	75.15	81.54	81.64	82.25	82.35	85.28	85.83	78.06	83.78	80.10

New MQA Program

Maintenance Quality Assurance

- New process under development
- Pass/Fail ➔ LOS (A+ thru F-)
- GIS map based
- Electronic form on mobile device
- Still 1/10th mile long random segments
- Evaluated by TDOT District Staff

New MQA Program

Maintenance Quality Assurance

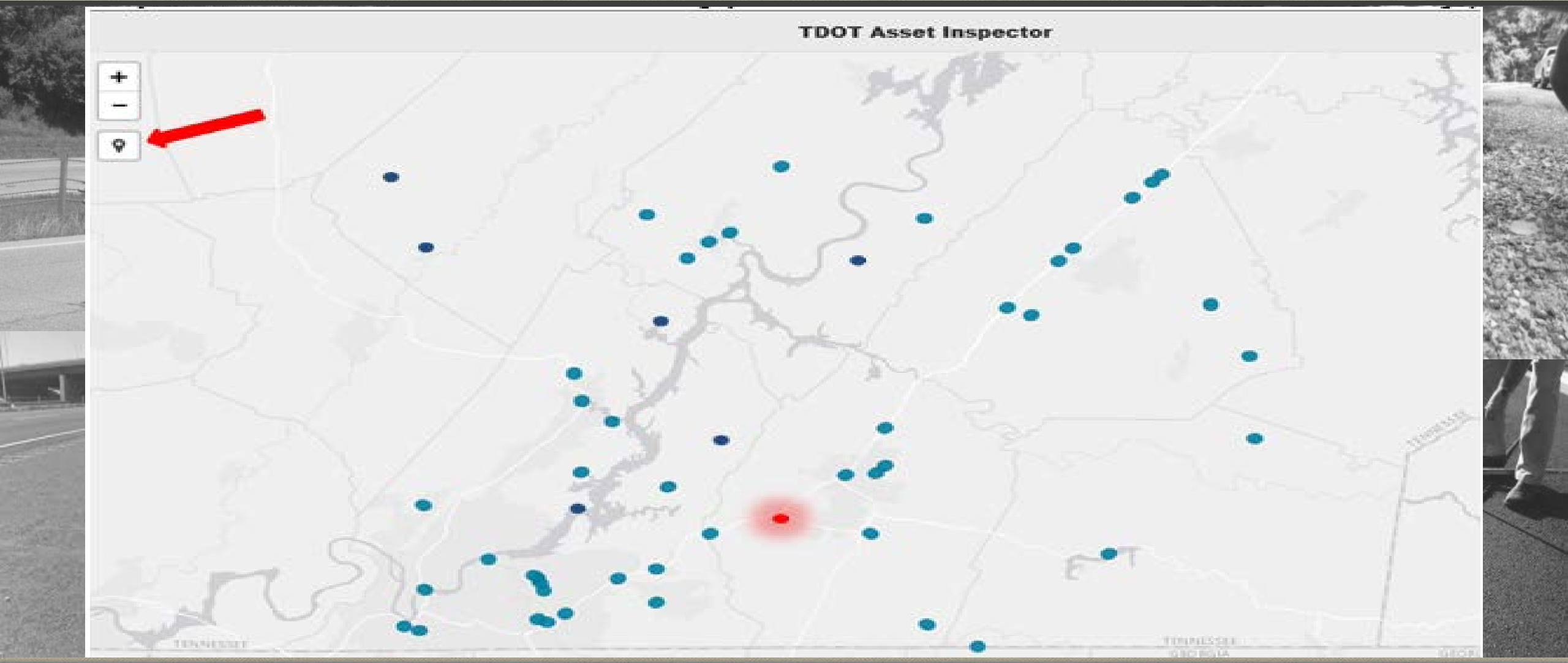
- 10% QA by consultants
- Definition of defects similar to pass fail
- Inspector measures quantity of each defect
- LOS (A+ thru F-) calculated based on percentage of assets that are deficient
- LOS can be assessed for State, Region, District, or County

New MQA Program

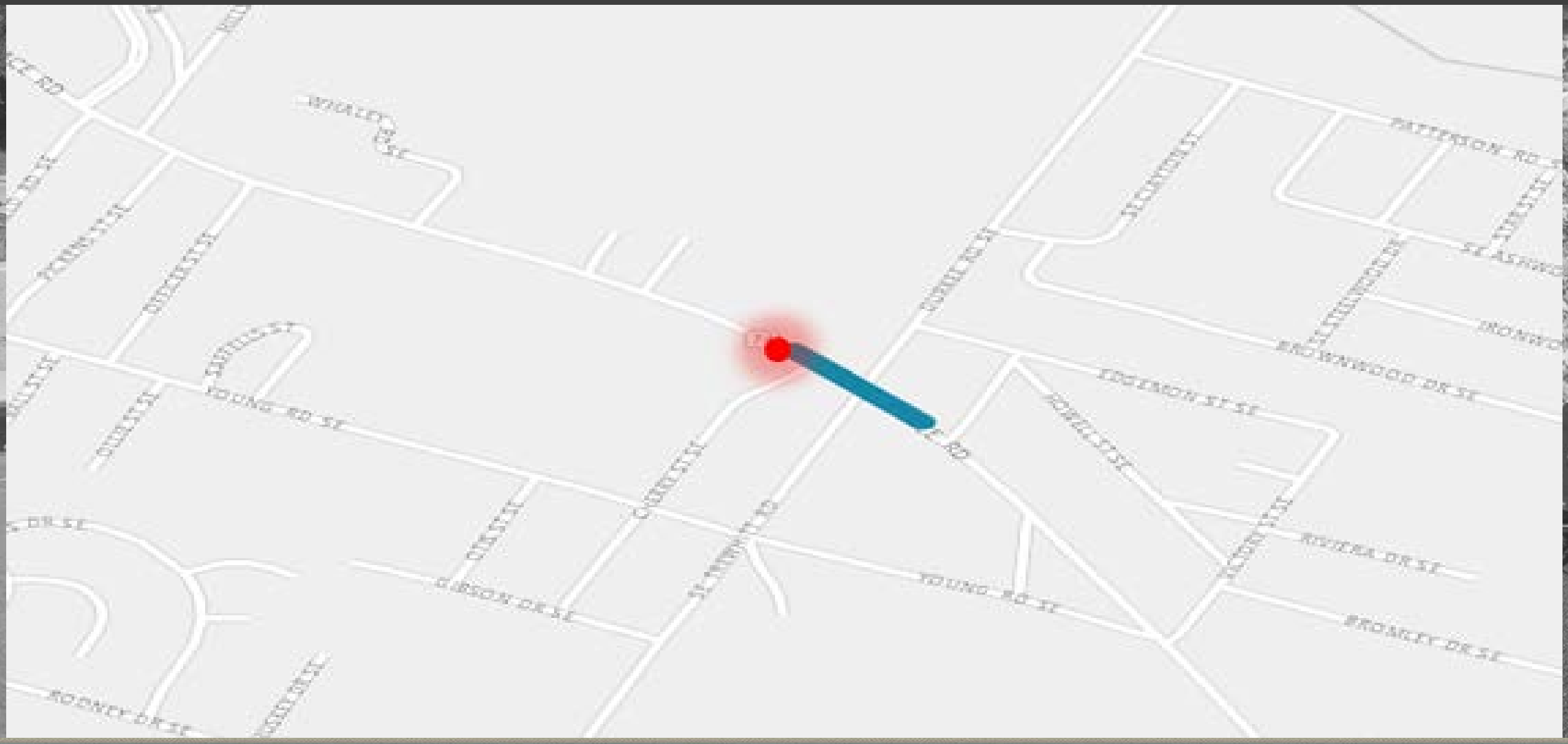
Maintenance Quality Assurance

- Budget distribution based on LOS condition
- Individual Targets for each Characteristic
- Targets can be revised based on available funding
- Use pavement data to improve inspector safety

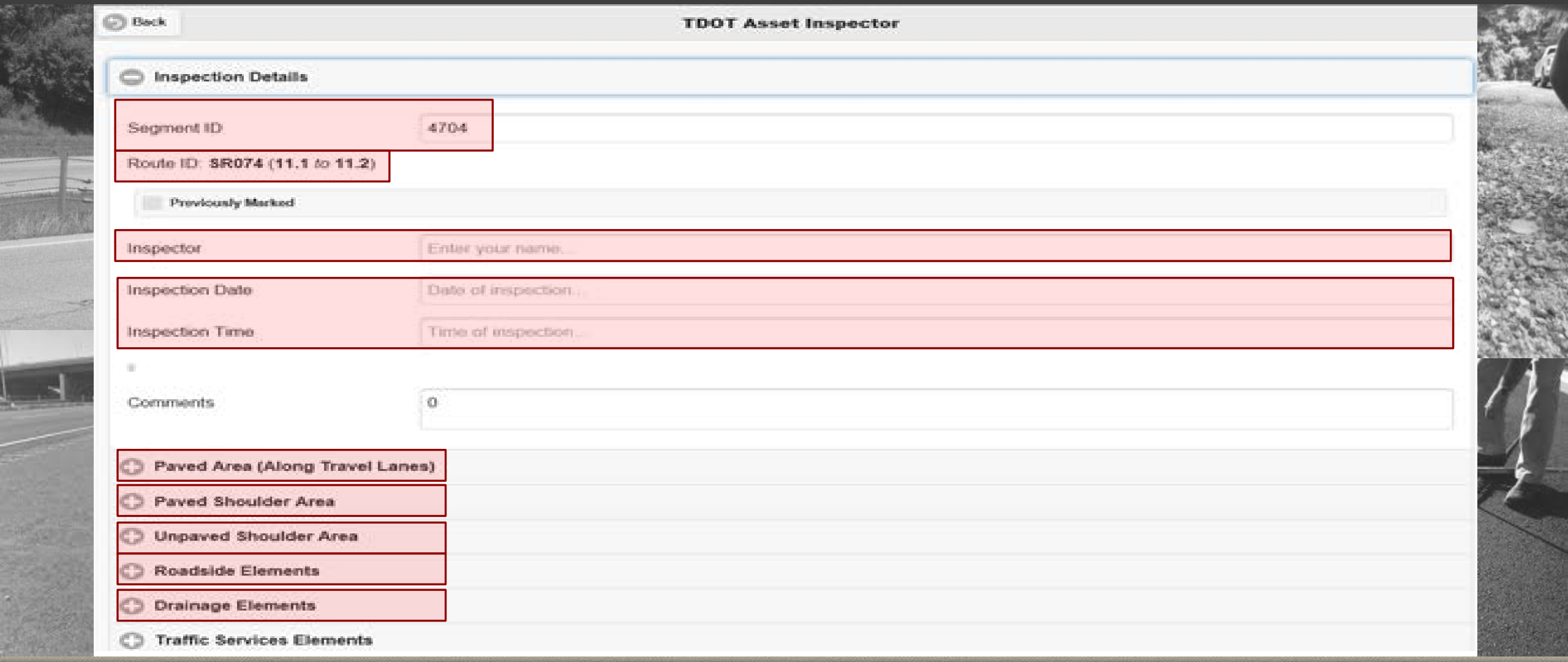
Condition Assessment



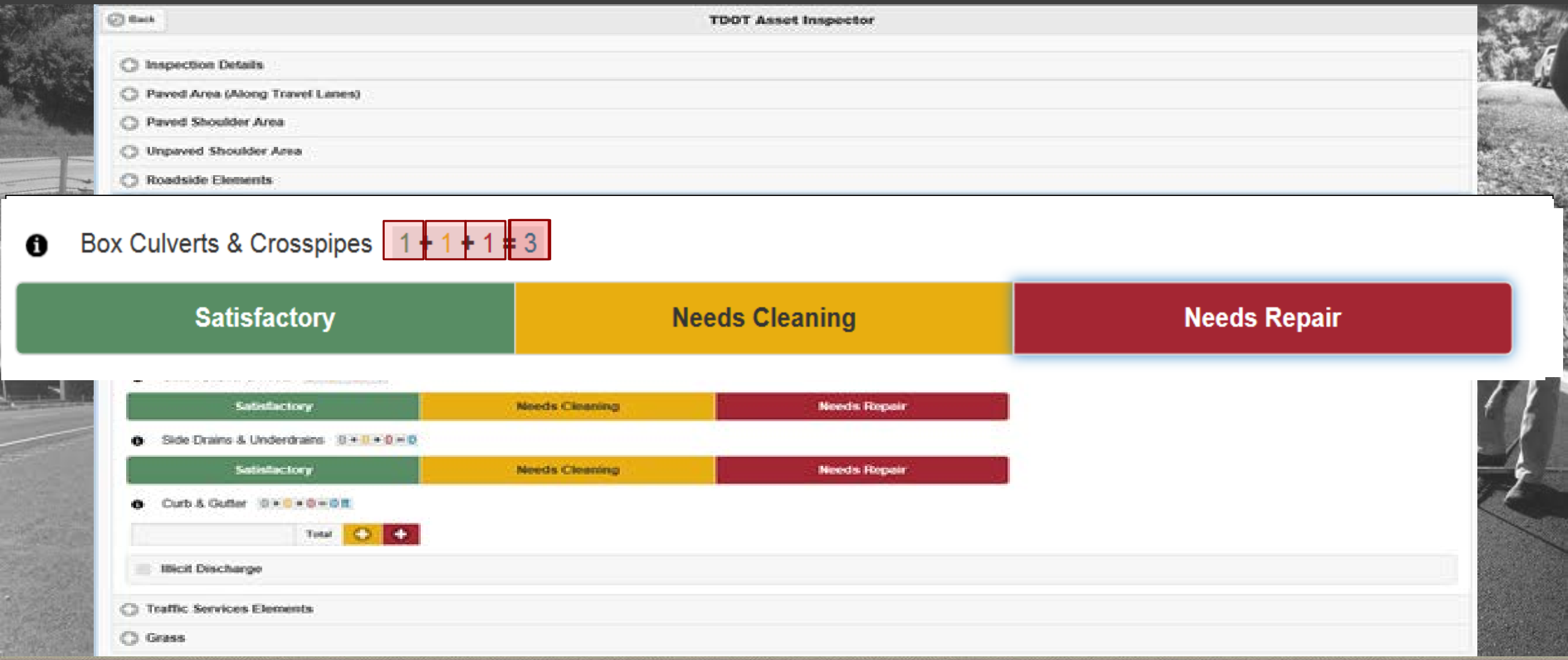
Condition Assessment



Condition Assessment



Condition Assessment



Level of Service (LOS) Targets

Maintenance Quality Assurance

AssetType	Units	Total Inventory	Total Deficient	%Deficient	LOS	Target	Result
Operational Box Culverts and Crosspipes	EACH	29.00	7.00	24.14%	C	C+	Below Target
Structural Box Culverts and Crosspipes	EACH	29.00	2.00	6.90%	B	B-	Above Target
Operational Ditches	LF	27,357.00	1,126.00	4.12%	A	B	Above Target
Structural Ditches	LF	27,357.00	10.00	0.04%	A	B	Above Target
Operational Catch Basins and Inlets	EACH	75.00	13.00	17.33%	B	B	On Target
Structural Catch Basins and Inlets	EACH	75.00	-	0.00%	A	B	Above Target
Operational Side Drains/Underdrains	EACH	54.00	22.00	40.74%	D	C+	Below Target
Structural Side Drains/Underdrains	EACH	54.00	8.00	14.81%	C	C+	Below Target
Operational Curb and Gutter	LF	6,584.00	1,941.00	29.48%	B	B-	Above Target
Structural Curb and Gutter	LF	6,584.00	242.00	3.68%	A	A	On Target
Illicit Discharge	# Per Segment	1.00			U	U	Not Evaluated
Warning/Regulatory Signs	Sq. FT	1,298.67	98.38	7.58%	F	A-	Below Target
Guide Signs	Sq. FT	2,784.63	32.75	1.18%	A	A	On Target
Pavement Striping	LF	97,306.25	62.00	0.06%	A	A	On Target
Pavement Specialty Marking	EACH	168.00	27.00	16.07%	F	B+	Below Target
Raised Pavement Markers and Delineators	EACH	1,208.00	125.00	10.35%	F	A-	Below Target
Guardrail and End Terminals	LF	9,241.00	190.00	2.06%	B	B	On Target
Barrier Walls	LF	6,489.00	157.00	2.42%	B	B	On Target
Cable Rail	LF	-	-		U	B	Not Evaluated
Attenuators	EACH	2.00	-	0.00%	A	B	Above Target

Level of Service (LOS) Targets

Maintenance Quality Assurance

Operational Box Culverts & Cross Drain Pipes (Cleaning)			Structural Box Culverts & Cross Drain Pipes (Repair)		
Percentage			Percentage		
From	To	Grade	From	To	Grade
0.00%	3.33%	A+	0.00%	1.67%	A+
3.33%	6.67%	A	1.67%	3.33%	A
6.67%	10.00%	A-	3.33%	5.00%	A-
10.00%	13.33%	B+	5.00%	6.67%	B+
13.33%	16.67%	B	6.67%	8.33%	B
16.67%	20.00%	B-	8.33%	10.00%	B-
20.00%	23.33%	C+	10.00%	13.33%	C+
23.33%	26.67%	C	13.33%	16.67%	C
26.67%	30.00%	C-	16.67%	20.00%	C-
30.00%	33.33%	D+	20.00%	23.33%	D+
33.33%	36.67%	D	23.33%	26.67%	D
36.67%	40.00%	D-	26.67%	30.00%	D-
40.00%	43.33%	F+	30.00%	33.33%	F+
43.33%	46.67%	F	33.33%	36.67%	F
46.67%	50.00%	F-	36.67%	40.00%	F-

Level of Service (LOS) Achievements

Maintenance Quality Assurance

AssetType	Units	Total Inventory	Total Deficient	%Deficient	LOS	Target	Result
Operational Box Culverts and Crosspipes	EACH	29.00	7.00	24.14%	C	C+	Below Target
Structural Box Culverts and Crosspipes	EACH	29.00	2.00	6.90%	B	B-	Above Target
Operational Ditches	LF	27,357.00	1,126.00	4.12%	A	B	Above Target
Structural Ditches	LF	27,357.00	10.00	0.04%	A	B	Above Target
Operational Catch Basins and Inlets	EACH	75.00	13.00	17.33%	B	B	On Target
Structural Catch Basins and Inlets	EACH	75.00	-	0.00%	A	B	Above Target
Operational Side Drains/Underdrains	EACH	54.00	22.00	40.74%	D	C+	Below Target
Structural Side Drains/Underdrains	EACH	54.00	8.00	14.81%	C	C+	Below Target
Operational Curb and Gutter	LF	6,584.00	1,941.00	29.48%	B	B-	Above Target
Structural Curb and Gutter	LF	6,584.00	242.00	3.68%	A	A	On Target
Illicit Discharge	# Per Segment	1.00			U	U	Not Evaluated
Warning/Regulatory Signs	Sq. FT	1,298.67	98.38	7.58%	F	A-	Below Target
Guide Signs	Sq. FT	2,784.63	32.75	1.18%	A	A	On Target
Pavement Striping	LF	97,306.25	62.00	0.06%	A	A	On Target
Pavement Specialty Marking	EACH	168.00	27.00	16.07%	F	B+	Below Target
Raised Pavement Markers and Delineators	EACH	1,208.00	125.00	10.35%	F	A-	Below Target
Guardrail and End Terminals	LF	9,241.00	190.00	2.06%	B	B	On Target
Barrier Walls	LF	6,489.00	157.00	2.42%	B	B	On Target
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Level of Service (LOS) Targets

Maintenance Quality Assurance

Operational Box Culverts & Cross Drain Pipes (Cleaning)			Structural Box Culverts & Cross Drain Pipes (Repair)		
Percentage			Percentage		
From	To	Grade	From	To	Grade
0.00%	3.33%	A+	0.00%	1.67%	A+
3.33%	6.67%	A	1.67%	3.33%	A
6.67%	10.00%	A-	3.33%	5.00%	A-
10.00%	13.33%	B+	5.00%	6.67%	B+
13.33%	16.67%	B	6.67%	8.33%	B
16.67%	20.00%	B-	8.33%	10.00%	B-
20.00%	23.33%	C+	10.00%	13.33%	C+
23.33%	26.67%	C	13.33%	16.67%	C
26.67%	30.00%	C-	16.67%	20.00%	C-
30.00%	33.33%	D+	20.00%	23.33%	D+
33.33%	36.67%	D	23.33%	26.67%	D
36.67%	40.00%	D-	26.67%	30.00%	D-
40.00%	43.33%	F+	30.00%	33.33%	F+
43.33%	46.67%	F	33.33%	36.67%	F
46.67%	50.00%	F-	36.67%	40.00%	F-

Level of Service (LOS) Achievements

Maintenance Quality Assurance

AssetType	Units	Total Inventory	Total Deficient	%Deficient	LOS	Target	Result
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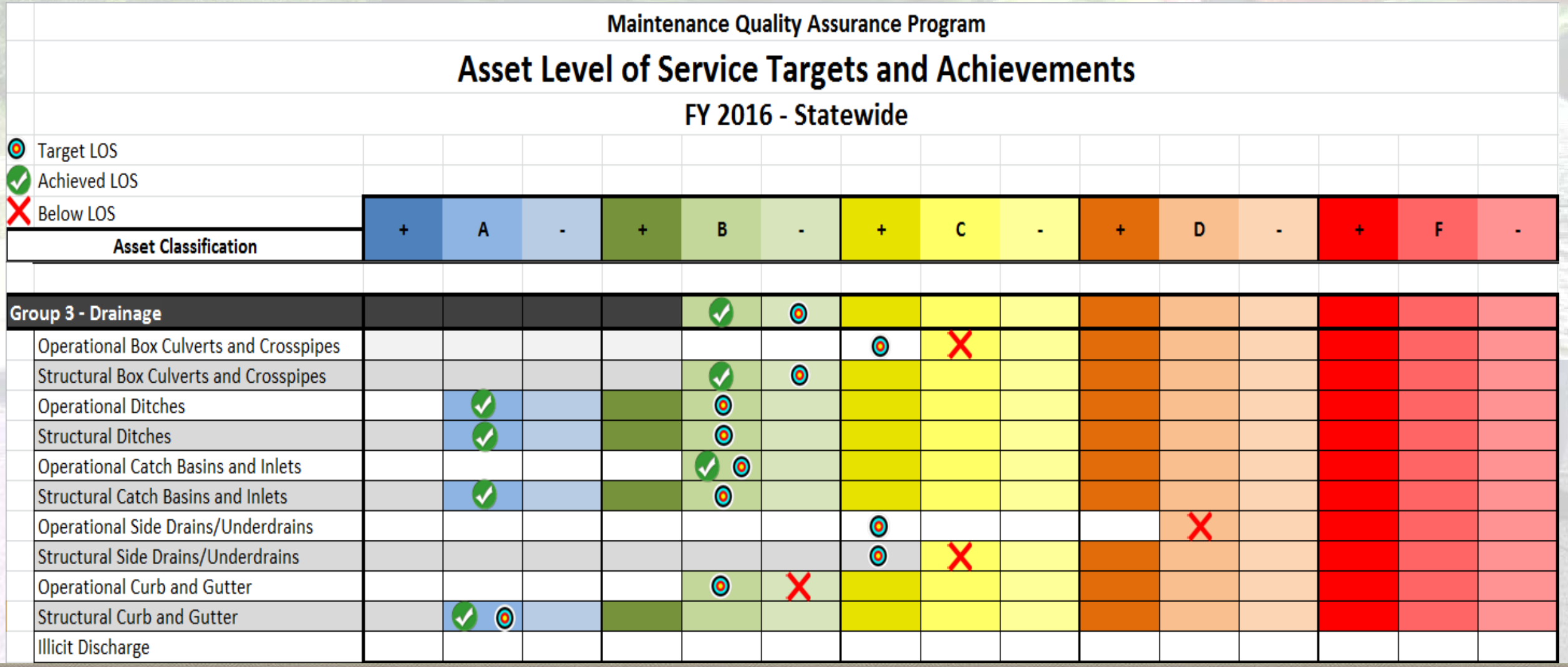
Cable Rail	LF	-	-		U	B	Not Evaluated
Attenuators	EACH	2.00	-	0.00%	A	B	Above Target

Level of Service (LOS) Targets & Achievements



Maintenance Quality Assurance Program

Asset Level of Service Targets and Achievements

FY 2016 - Statewide

Target LOS
Achieved LOS
Below LOS

Asset Classification	+	A	-	+	B	-	+	C	-	+	D	-	+	F	-
Group 3 - Drainage					✓	◎									
Operational Box Culverts and Crosspipes							◎	✗							
Structural Box Culverts and Crosspipes					✓	◎									
Operational Ditches		✓			◎										
Structural Ditches		✓			◎										
Operational Catch Basins and Inlets					✓ ◎										
Structural Catch Basins and Inlets		✓			◎										
Operational Side Drains/Underdrains							◎				✗				
Structural Side Drains/Underdrains							◎	✗							
Operational Curb and Gutter					◎	✗									
Structural Curb and Gutter		✓ ◎													
Illicit Discharge															

Condition Assessment

Maintenance Quality Assurance

Desired Outcomes

- Predict additional $$ required to move up from one LOS to another (B+ to A-)
- Predict potential $$ savings to move down from one LOS to another (A- to B+)
- Establish budgets based on condition of assets
- If need-based budget not possible, then predict LOS to expect based on funding level provided

Maintenance Quality Assurance

Thank You!

Chris Harris, PE
TDOT Asset Management Office
Chris.Harris@tn.gov
615-532-3453

North Carolina
DEPARTMENT OF TRANSPORTATION

MQA Data Quality and Utilization

Lonnie Watkins, PE
State Management Systems Engineer

March 1, 2016

Talking Points

- **North Carolina Highway System**
- **MQA Program**
- **MQA Data Unitization**
- **MQA Data Quality**

NCDOT Highway System

- 79,585 road miles
  - Interstate 1326
  - Primary 13,736
  - Secondary 64,522
- 163,450 paved lane miles
- ~4,000 miles of unpaved roads
- 18,303 structures (13,528 Bridges)
- 95.8 M sf bridge deck area

MQA Program

MQA Program

- Random sampling by system
- Level: Interstate – Division

  Primary & Secondary – County
- 90% Confidence with a margin of error +- 5%
- Assess over 22,000, 0.1 mile sections
- Year Round – Update Quarterly
- Manual Survey

Conducting the Assessment

- 12 2-men teams statewide
- An inventory and failure quantity is recorded for each element per section
- Not pass/fail per section

11 Elements

- Shoulders
- Lateral Ditches
- Crossline Pipes Blocked
- Crossline Pipes Damaged
- Gutters Blocked
- Inlets (Blocked or Damaged)
- Brush & Tree Control
- Turf Condition
- Pavement Striping
- Words & Symbols
- Pavement Markers

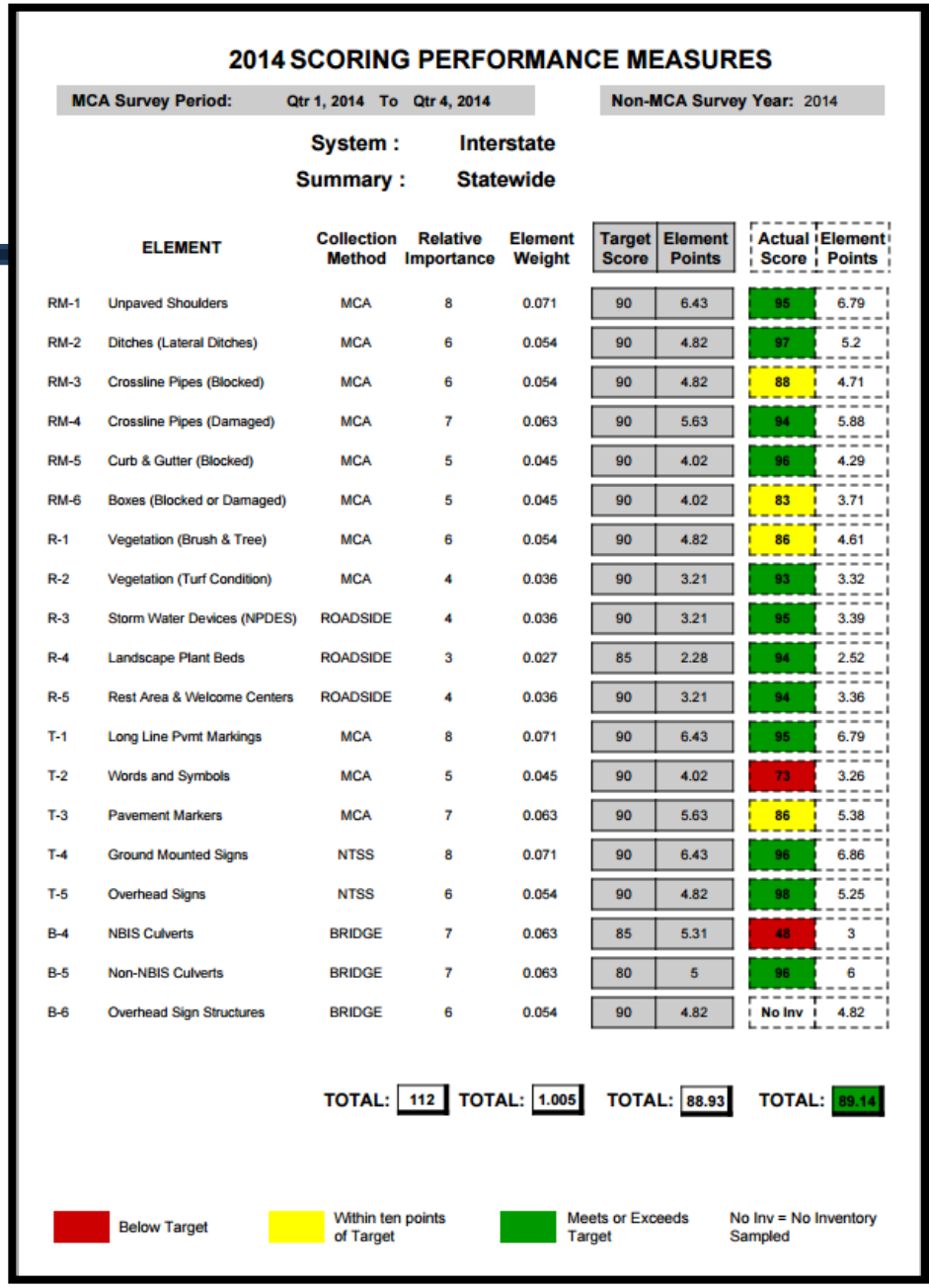
MQA Data Utilization

MQA Data Utilization

- Condition reports (Scorecards)
- Infrastructure health index
- Maintenance and operations planning
- Division maintenance allocation
- Legislative report on maintenance needs

Condition Rating Score Card

- Statewide, Division, County
- Interstate, Primary, Secondary
- Updated Quarterly – Rolling Year
- Produced within MMS



2014 SCORING PERFORMANCE MEASURES

MCA Survey Period: Qtr 1, 2014 To Qtr 4, 2014 | **Non-MCA Survey Year:** 2014

System : Interstate
Summary : Statewide

	ELEMENT	Collection Method	Relative Importance	Element Weight	Target Score	Element Points	Actual Score	Element Points
RM-1	Unpaved Shoulders	MCA	8	0.071	90	6.43	95	6.79
RM-2	Ditches (Lateral Ditches)	MCA	6	0.054	90	4.82	97	5.2
RM-3	Crossline Pipes (Blocked)	MCA	6	0.054	90	4.82	88	4.71
RM-4	Crossline Pipes (Damaged)	MCA	7	0.063	90	5.63	94	5.88
RM-5	Curb & Gutter (Blocked)	MCA	5	0.045	90	4.02	96	4.29
RM-6	Boxes (Blocked or Damaged)	MCA	5	0.045	90	4.02	83	3.71
R-1	Vegetation (Brush & Tree)	MCA	6	0.054	90	4.82	86	4.61
R-2	Vegetation (Turf Condition)	MCA	4	0.036	90	3.21	93	3.32
R-3	Storm Water Devices (NPDES)	ROADSIDE	4	0.036	90	3.21	95	3.39
R-4	Landscape Plant Beds	ROADSIDE	3	0.027	85	2.28	94	2.52
R-5	Rest Area & Welcome Centers	ROADSIDE	4	0.036	90	3.21	94	3.36
T-1	Long Line Pvmt Markings	MCA	8	0.071	90	6.43	95	6.79
T-2	Words and Symbols	MCA	5	0.045	90	4.02	73	3.26
T-3	Pavement Markers	MCA	7	0.063	90	5.63	86	5.38
T-4	Ground Mounted Signs	NTSS	8	0.071	90	6.43	96	6.86
T-5	Overhead Signs	NTSS	6	0.054	90	4.82	98	5.25
B-4	NBIS Culverts	BRIDGE	7	0.063	85	5.31	48	3
B-5	Non-NBIS Culverts	BRIDGE	7	0.063	80	5	96	6
B-6	Overhead Sign Structures	BRIDGE	6	0.054	90	4.82	No Inv	4.82

TOTAL: 112 TOTAL: 1.005 TOTAL: 88.93 TOTAL: 89.14

Below Target | Within ten points of Target | Meets or Exceeds Target | No Inv = No Inventory Sampled

Infrastructure Health Index

- Combines MQA scores, PCS ratings, and bridge indices
- Provides a system rating for all three assets and an overall network rating
- Statewide and Division level

SCORE =
Pavement % Good x Weight Value (40)
+ (MCA SCORE / 100) x Weight Value (25)
+ BHCI x Weight Value (35)

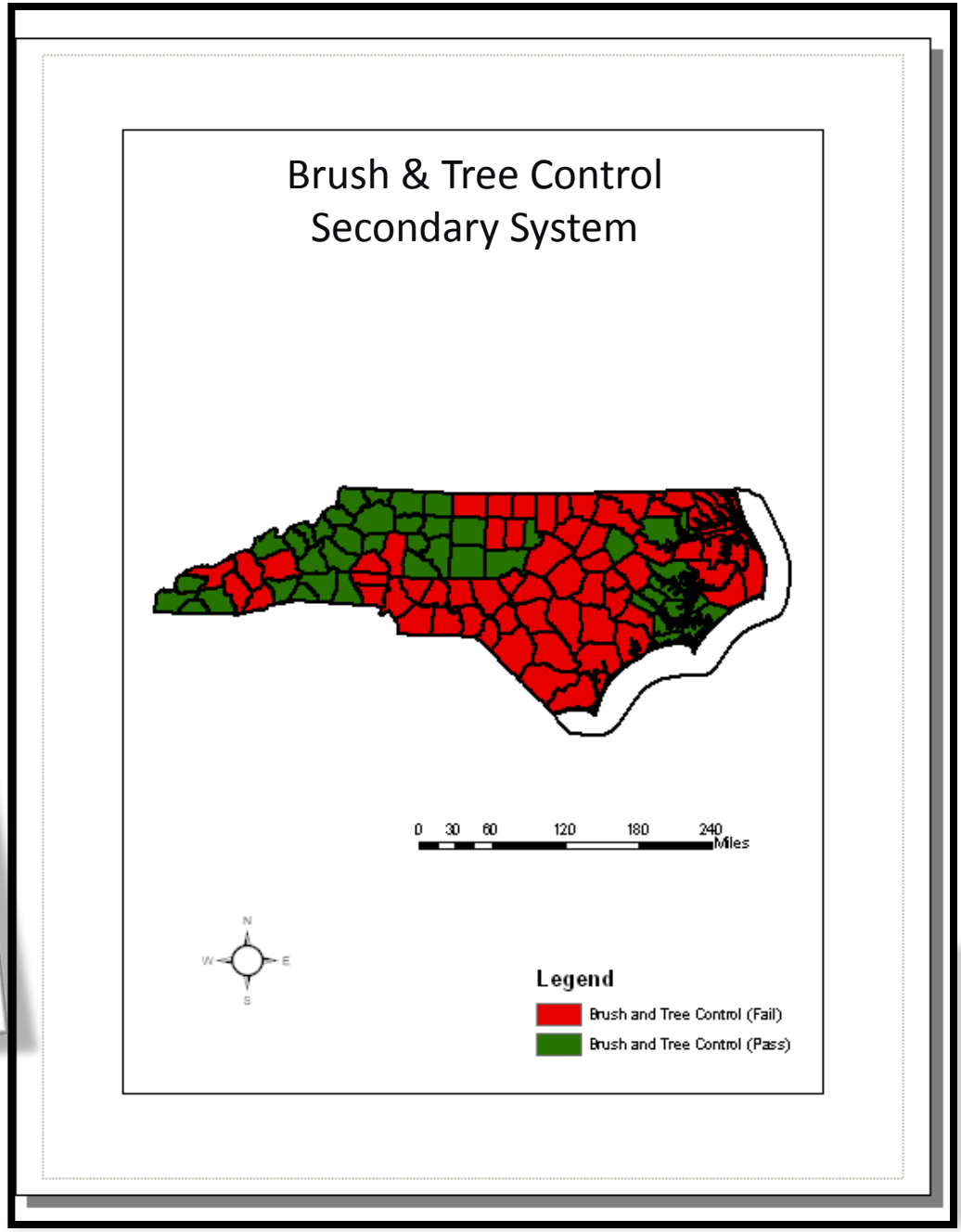
STATEWIDE - ALL SYSTEMS
EXISTING INFRASTRUCTURE HEALTH WEIGHTED BY VMT (80%) AND LM (20%)

				PAVEMENTS			MCA			BRIDGE HEALTH INDEX				TOTAL IHCS EXISTING	
				WEIGHT VALUE		40	WEIGHT VALUE		25	WEIGHT VALUE			35		
	80%	20%	WEIGHTED			OVERALL			OVERALL	ALL	EXIST		OVERALL		
SYSTEM	VMT %	LANE MI	FACTOR	% GOOD	LMG	SCORE	SCORE	LMS	SCORE	# BRIDGES	CR>=6	BHCI	SCORE	LOS	SCORE
INTERSTATE	45	5,038	36.59	84.9%	4,277	31.06	89.79	4,524	32.85	909	723	79.5%	29.10	B	**84.2**
PRIMARY	30	35,640	28.15	66.1%	23,558	18.61	86.41	30,797	24.32	4,199	2,796	66.6%	18.74	D	**71.3**
SECONDARY	25	131,074	35.26	67.5%	88,475	23.80	85.04	111,466	29.99	8,490	4,989	58.8%	20.72	D	**68.8**
TOTAL		171,752				**73.47**			**87.17**	13,598	8,508	**62.6%**	68.57		
COMPOSITE VALUES						**29.4**			**21.8**				**24.0**	C	**75.2**

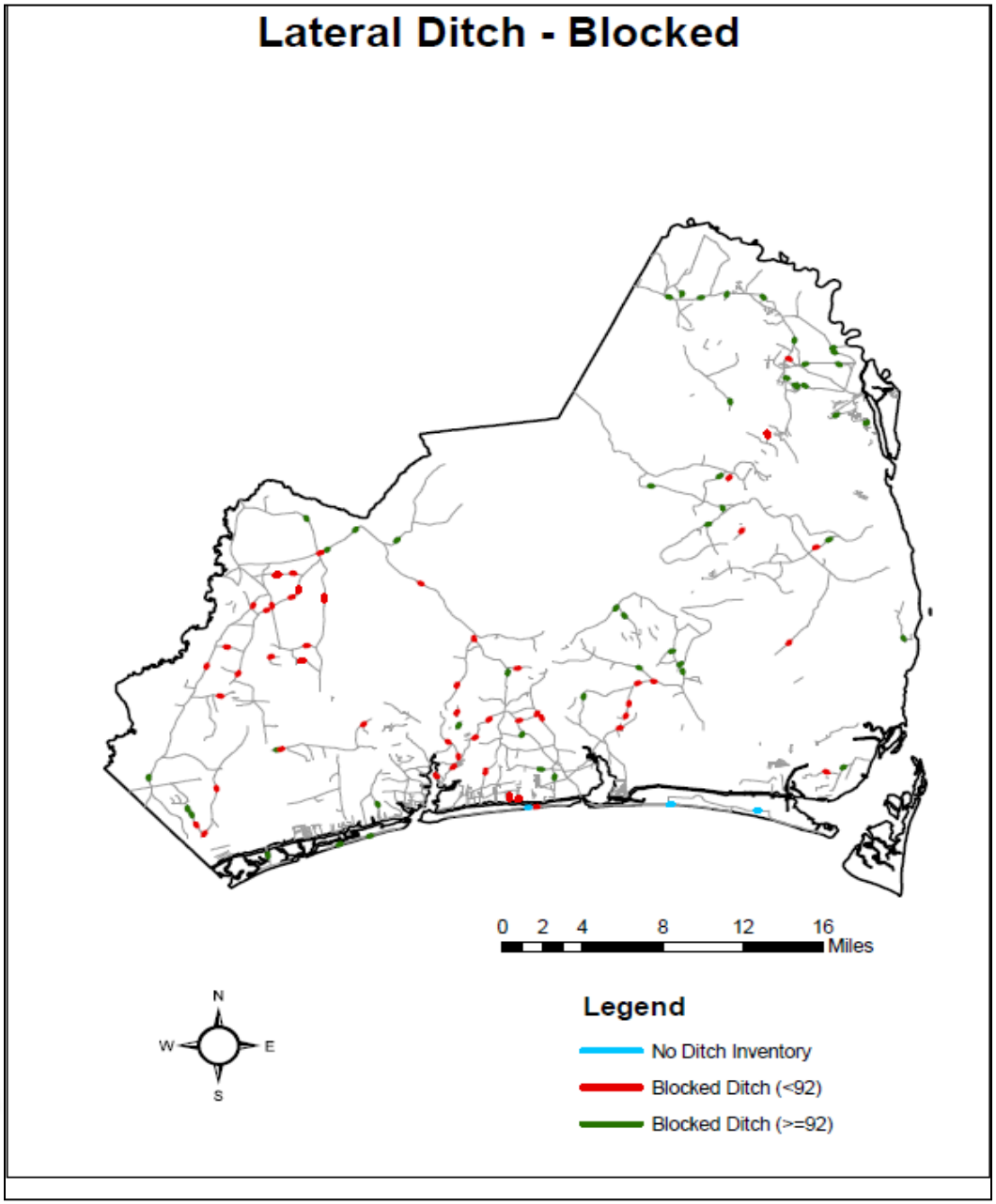
COMPOSITE VALUES = TOTAL OVERALL SCORE x WEIGHT VALUE

TOTAL COMPOSITE SCORE = SUM OF COMPOSITE VALUES

Maintenance & Operations Planning



Maintenance & Operations Planning



Division Maintenance Allocation

Needs Based Budgeting

- Directly ties the maintenance allocation to the need:
  - Condition
  - Operational improvements

- Emphasis is placed on funds being used:
  - Assets that are below targets
  - Optimized to achieve the overall target level of service.

Need Sheets

- **Summary of Need by Category**
- **Division by System**

Primary Roadway Maintenance Needs

FY 2016 **DIVISION 1**

	Need Type	Total Need
Division Emergency and Administration		
Division Emergency and Administration		
Guardrail	Historic Expenditure	$ 360,000.00
Incident Management	Historic Expenditure	$ 100,000.00
Landscaping	Historic Expenditure	$ 178,000.00
Rest Area	Historic Expenditure	$ 875,000.00
Roadway Lighting	Historic Expenditure	$ 0.00
Traffic Control Devices	Historic Expenditure	$ 92,678.00
Traffic Signalization	Historic Expenditure	$ 433,948.00
	TOTAL	**$ 2,039,626.00**
Non-Assessed		
Non-Assessed		
Indirect	Historic Expenditure	$ 4,685,782.47
Litter	Division Provided	$ 2,320,737.66
Mowing	Division Provided	$ 870,092.01
	TOTAL	**$ 7,876,612.14**
Assessed Needs		
Bridge		
Bridge Maintenance	Condition Based	$ 14,556,856.30
NBIS Culvert	Condition Based	$ 110,522.00
Non-NBIS Culvert	Condition Based	$ 1,264,953.48
	TOTAL	**$ 15,932,331.78**
Maintenance		
Boxes (Blocked or Damaged)	Condition Based	$ 1,269,941.14
Crossline Pipes (Blocked)	Condition Based	$ 1,281,966.82
Crossline Pipes (Damaged)	Condition Based	$ 1,549,678.31
Curb & Gutter (Blocked)	Condition Based	$ 1,086,171.46
Ditches (Lateral Ditches)	Condition Based	$ 1,416,839.24
Ground Mounted Signs	Condition Based	$ 1,935,401.39
Landscape Plant Beds	Condition Based	$ 1,318,899.32
Long Line Pvmt Markings	Condition Based	$ 1,379,538.34
Overhead Sign Structures	Condition Based	$ 0.00
Overhead Signs	Condition Based	$ 1,180,846.87
Pavement Markers	Condition Based	$ 3,184,621.79
Storm Water Devices (NPDES)	Condition Based	$ 1,082,496.72
Unpaved Shoulders	Condition Based	$ 2,344,685.99
Vegetation (Brush & Tree)	Condition Based	$ 1,849,831.02
Vegetation (Turf Condition)	Condition Based	$ 1,432,515.76
Words and Symbols	Condition Based	$ 1,332,162.28
	TOTAL	**$ 23,645,596.45**
Pavement		
Pavement Maintenance	Condition Based	$ 663,880.43
Preservation	Condition Based	$ 419,490.00
Reconstruction	Condition Based	$ 0.00
Resurfacing	Condition Based	$ 21,610,789.00
	TOTAL	**$ 22,694,159.43**
	TOTAL NEED	**$ 72,188,325.80**

Division Maintenance Allocation

Allocation / Funding Formulas

Primary and Secondary Road Maintenance & Bridge Maintenance

$$\frac{\text{Division Assessed Needs + Non-Assessed Needs}}{\text{Statewide Assessed Needs + Non-Assessed Needs}}$$

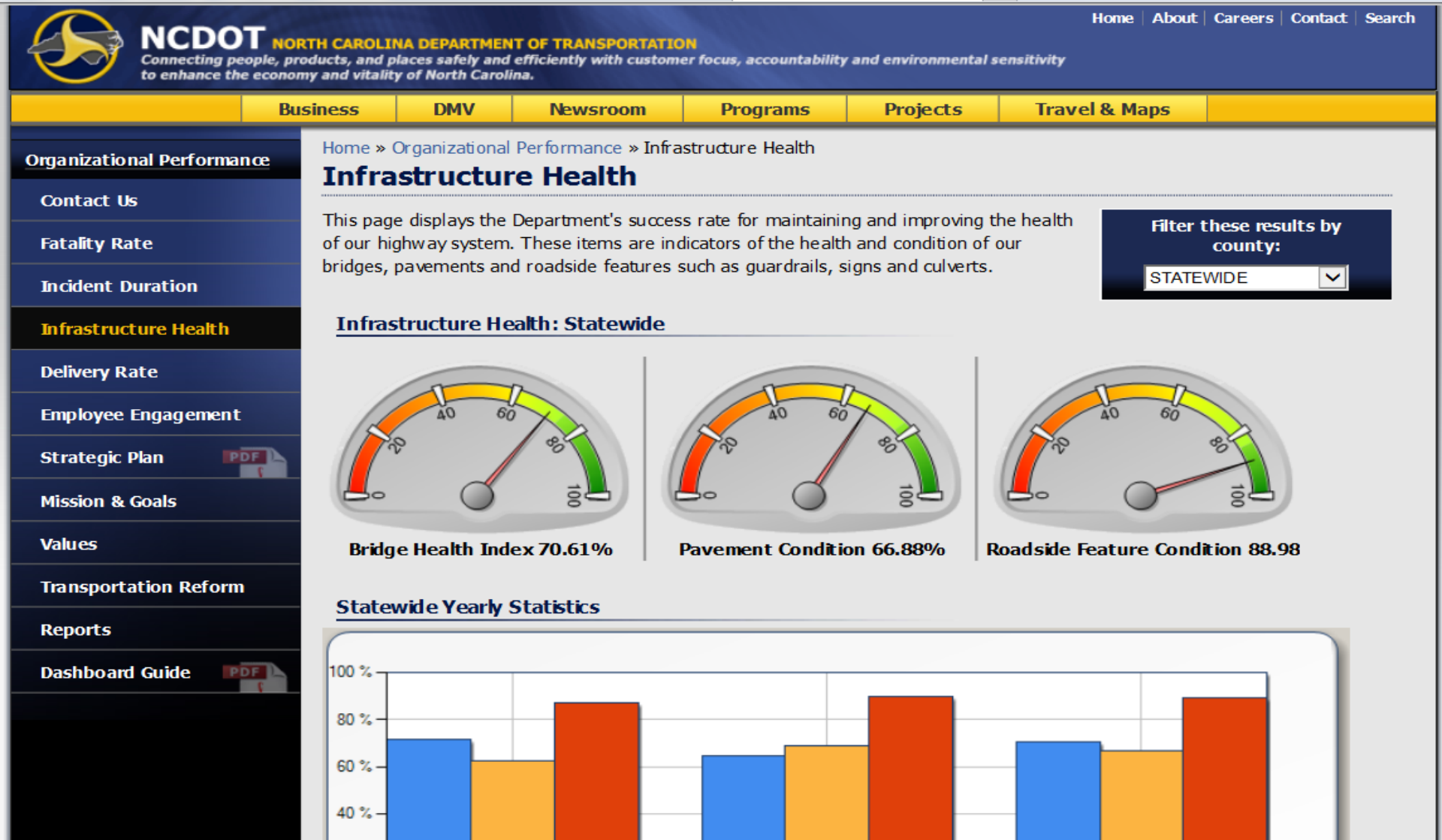
Distribution Method

Secondary Maintenance Allocation

Road Maintenance	$237,318,313
Administration	$9,381,746
Remaining	**$227,936,567**

Division	Needs	Weight	Allocation - Need	Div Emergency & Admin	Total Allocation
1	$22,090,104	0.045	$10,174,911	$279,084	$10,453,995
2	$32,488,471	0.066	$14,964,497	$258,845	$15,223,342
3	$33,517,176	0.068	$15,438,328	$390,800	$15,829,128
4	$30,652,825	0.062	$14,118,981	$502,714	$14,621,695
5	$34,482,461	0.070	$15,882,948	$2,415,482	$18,298,430
6	$31,662,007	0.064	$14,583,820	$352,748	$14,936,568
7	$42,048,921	0.085	$19,368,131	$1,699,668	$21,067,799
8	$40,478,158	0.082	$18,644,622	$322,322	$18,966,944
9	$34,061,942	0.069	$15,689,253	$508,400	$16,197,653
10	$36,962,381	0.075	$17,025,222	$1,501,608	$18,526,830
11	$42,936,614	0.087	$19,777,010	$183,518	$19,960,528
12	$37,603,735	0.076	$17,320,636	$794,647	$18,115,283
13	$38,569,954	0.078	$17,765,686	$26,413	$17,792,099
14	$37,303,885	0.075	$17,182,522	$145,497	$17,328,019
Total	$494,858,634	1.00	$227,936,567	$9,381,746	$237,318,313

Dashboard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Connecting people, products, and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina.
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Home » Organizational Performance » Infrastructure Health
Infrastructure Health
This page displays the Department's success rate for maintaining and improving the health of our highway system. These items are indicators of the health and condition of our bridges, pavements and roadside features such as guardrails, signs and culverts.
Filter these results by county:
STATEWIDE
Infrastructure Health: Statewide
Bridge Health Index 70.61%
Pavement Condition 66.88%
Roadside Feature Condition 88.98
Statewide Yearly Statistics
100 %
80 %
60 %
40 %

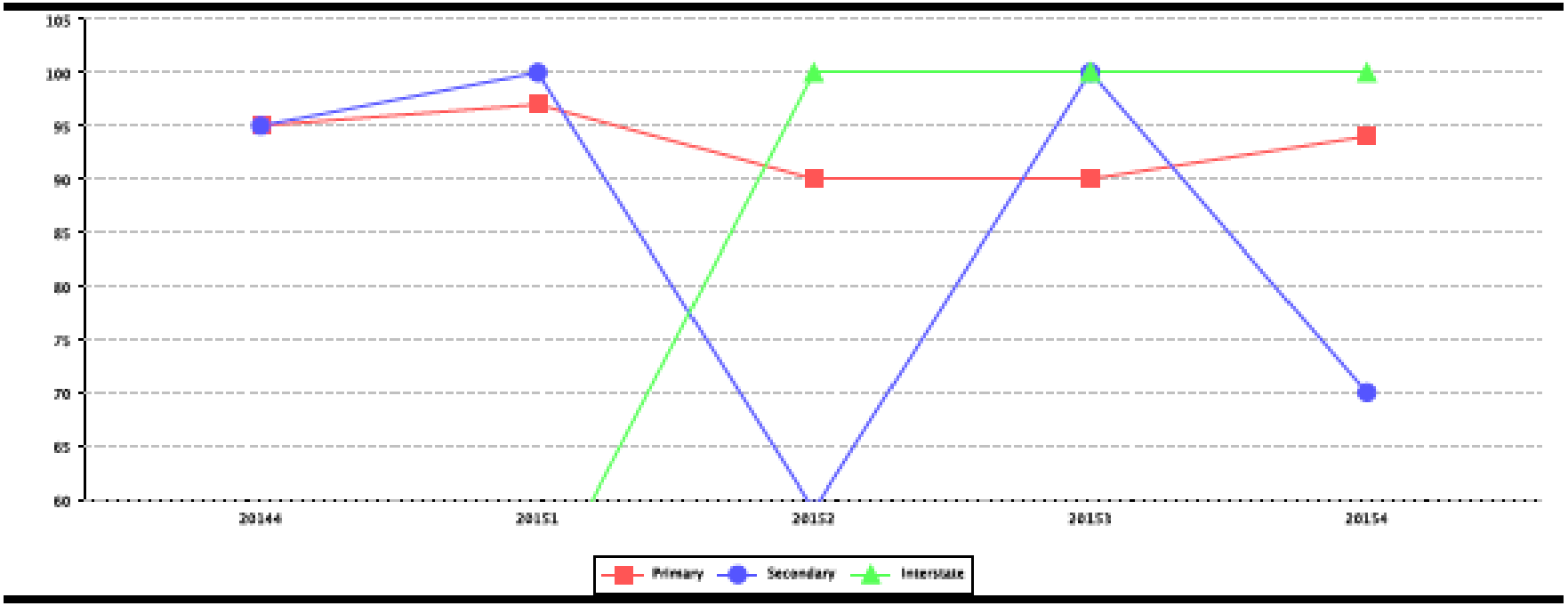
MQA Data Quality

MQA Data Quality

- Rating manual to assist raters
- Conduct training classes for raters
- Conduct independent checks of data
- Team of raters is used to reduce rater bias
- Conduct checks of data reasonableness
- Equipment checks/calibration are performed
- Test sites are used to verify quality
- Ratings are compared to previous surveys

MQA Data Quality

Division: 1 Curb & Gutter (Blocked)



Questions