

Kentucky Transportation Cabinet Road Network Maintenance

TEM/AREA 5 Meeting

June 5-7, 2017



DUBROVNIK, CROATIA

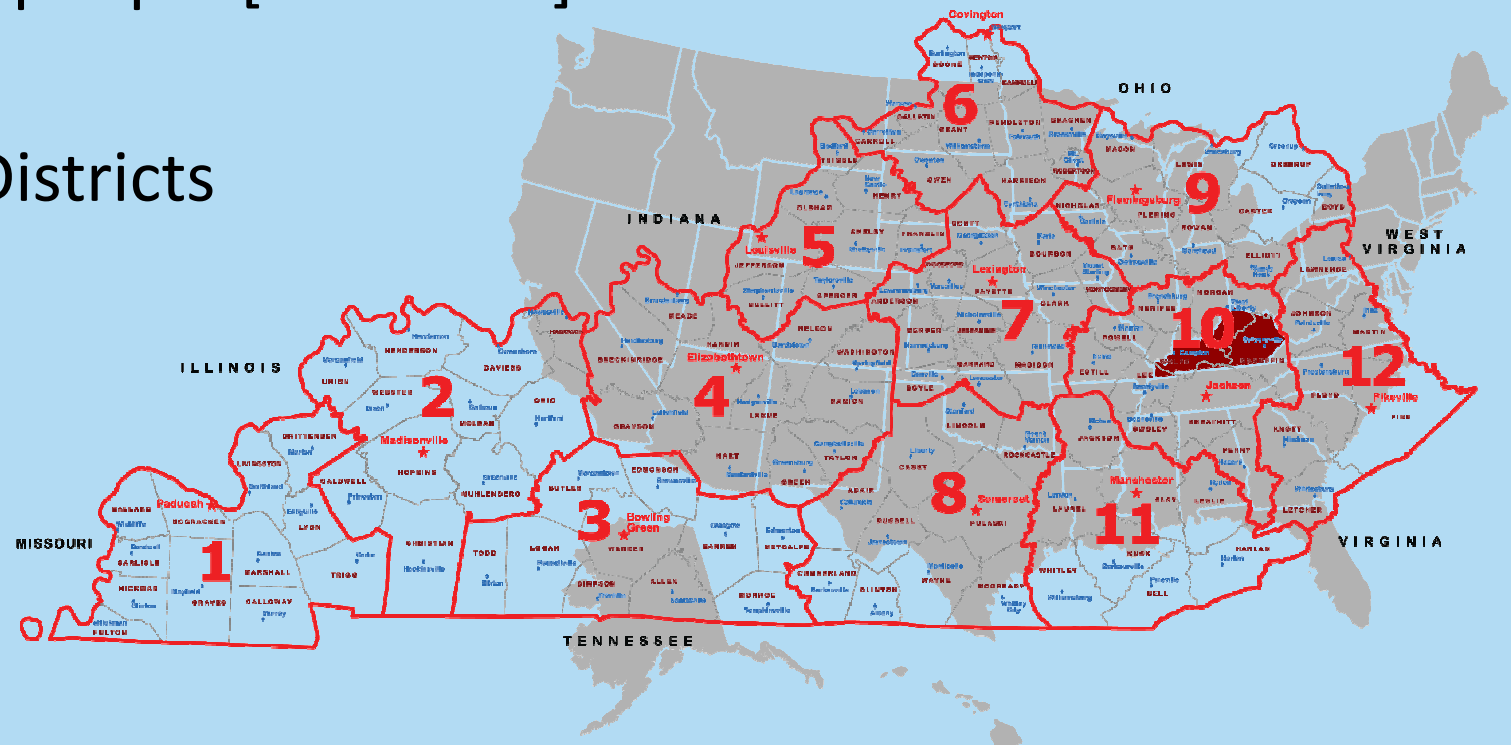


HEEP Mission Statement

The Highway Engineering Exchange Program (HEEP) is an international organization that promotes advances in transportation engineering through the exchange of knowledge and information technology.

Kentucky Geographics/Demographics

- 104,695 km² (40,400 mi²) in area [37th largest]
- 4.436 million people [26th most]
- 120 Counties
- 12 Highway Districts

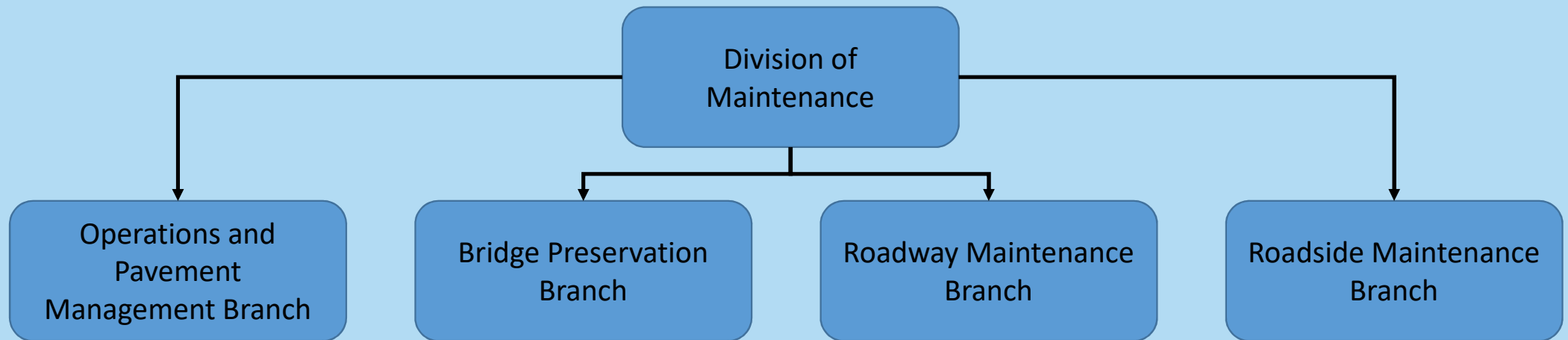


Topography



Photo Credit: Bill Griffin

Organization Structure – Central Office



- Pavement Data Collection and Analysis
- Operations (ITS)

- Bridge Inspection
- Underwater Inspection
- Fracture Critical
- Tunnel Inspection
- Bridge Preservation

- Routine Maintenance

- Agronomy
- Snow & Ice

District Office Re-Organization

- Each county has a Maintenance facility and staffing
- Combined Maintenance and Construction to form Project Delivery & Preservation
- Responsible for “minor” Maintenance activities



Road Assets

- 44,448 km of paved roadways [eq. to 102,232 km lanes] and valued at \$60 billion
 - Interstate (Motorway) [Appx. 1,357 km]
 - Parkway System [Appx. 925 km]
 - MP (State Primary, State Secondary & Supplemental Roads) [Appx. 21,648 km]
 - Rural Secondary (22.2% Road Fund) [Appx. 20,551 km]
 - No Toll Roads - 2 bridges (Appx. \$3.00 per crossing)

Road Assets



Interstate 65



State/Rural Secondary

Bridge Assets

- Appx. 15,000 Bridges (structures over 6 meters)
 - Appx. 400 are considered “major” (over 152 meters length)
 - Mix of state and local owned structures
 - Agreement with neighbor States
- Tunnels
 - 5 under State Inspection and Maintenance
 - Longest is 518 m



Misc. Assets

- 24 active Rest Areas (privately operated on contract)
- ITS and Traffic Cameras
- Weigh Stations

Maintenance Funding

- Mix of Federal Match and Road Fund \$\$\$
 - Gas Tax (22.5-31 cents per gallon)
 - Registration and Licensing Fees
- Federal Bridge Replacement Program (BRO, BRX, BRZ)
- Pavement Rehabilitation on NHS

Routine Maintenance

- Categories
 - A: Mainline Pavement Patching (potholes)
 - B: Shoulder Repair
 - C: Roadside (guardrail repair, litter, dead animals, etc.)
 - D: Drainage (ditching, pipe/catch-basin cleanout or replacement)
 - E: Agronomy
 - K: Snow and Ice (also Operational)
 - T: Pavement Striping
- Mostly State Funded (\$275 million annually)
- Some work handled by State Forces

Routine Maintenance

- Master Agreements
 - Multiple Contractors by District Grouping
 - Open-ended contract to supply materials and labor
 - Less variance in scope of work
- Traditional Contract Procurement (Low Bid)

Routine Maintenance

- Maintenance Standards Guide (Maintenance Manual)
- Regularly spend more or less depending on health of the Road Fund

Routine Maintenance

- Appx. \$100 Million Annually on Resurfacing
 - Equates to 974 centerline km
 - 17-18 year resurfacing cycle
- Appx. \$2 million annually on new guardrail
 - \$1 million from Maintenance funds
 - \$1 million match from HSIP
 - Traditional Contract Procurement
 - Additional Work (slope stabilization)



Non-Scheduled Routine Maintenance

- Identified by District/County Maintenance Employees
- Identified by roving contractors
- Submitted by citizen through website

Routine Maintenance Issues



Routine Maintenance Issues



Routine Maintenance Issues



Snow & Ice Removal

Jeremy_Map

Jeremy_District_County_PieChart

Jeremy_SwimLane

Interval: 3 hours

Jeremy_Priority_BarChart

Jeremy_Count

District/County	Count	Avg	Total
PIKE	10,178	47.87	4,368.56
ELLIOTT	6,259	37.57	3,382.89
KNOX	3,899	31.49	2,580.92
ROWAN	3,744	26.11	2,191.47
ADAIR	3,249	40.68	3,391.03

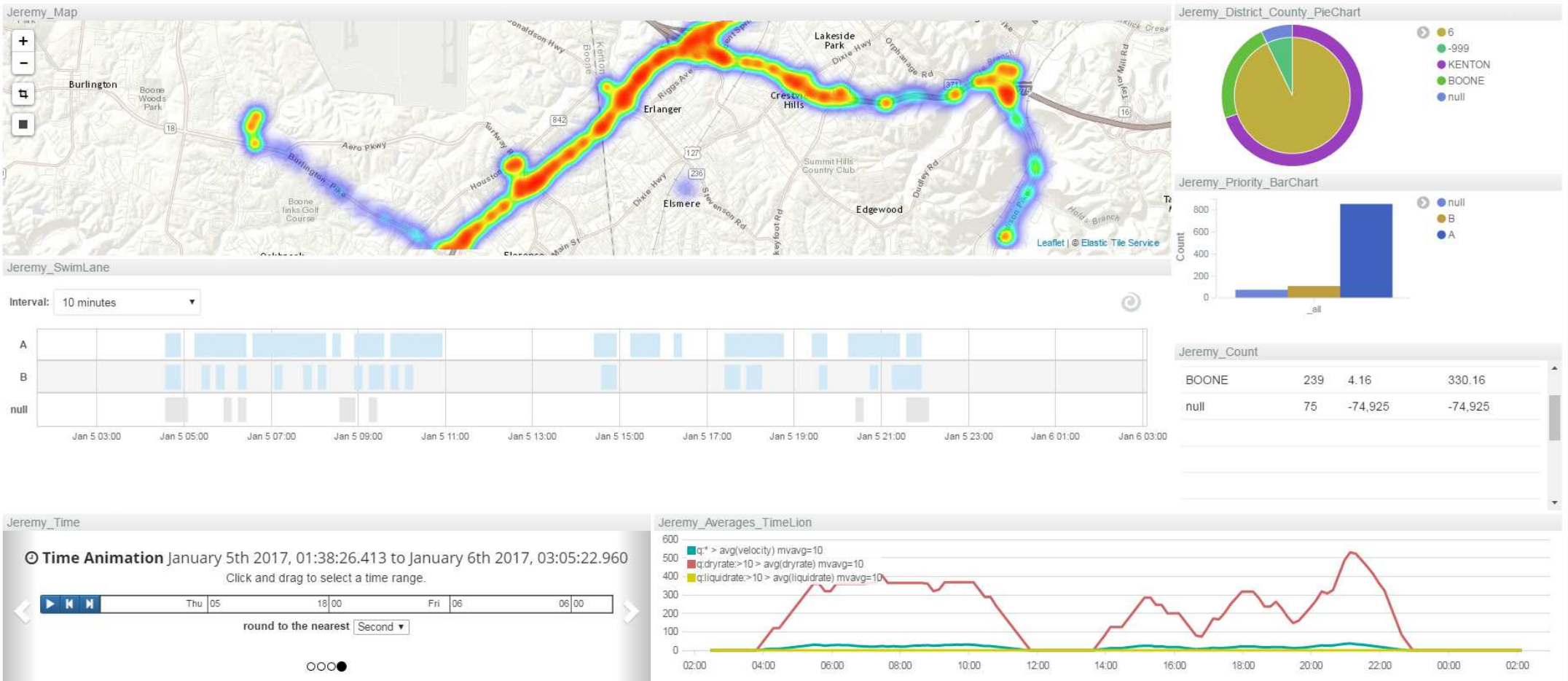
Jeremy_Averages_TimeLine

Jeremy_Time

From: 2016-12-05 00:43:40.014 To: 2017-03-27 06:30:52.689

YYYY-MM-DD HH:mm:ss.SSS

Snow & Ice Removal



Routine Maintenance KPIs and LOS

- Maintenance Rating Program (MRP)

- Random inspection
- Visual or Manual Measurement
- Yearly Sampling

Explanation and Score Equivalence of Inspection Features

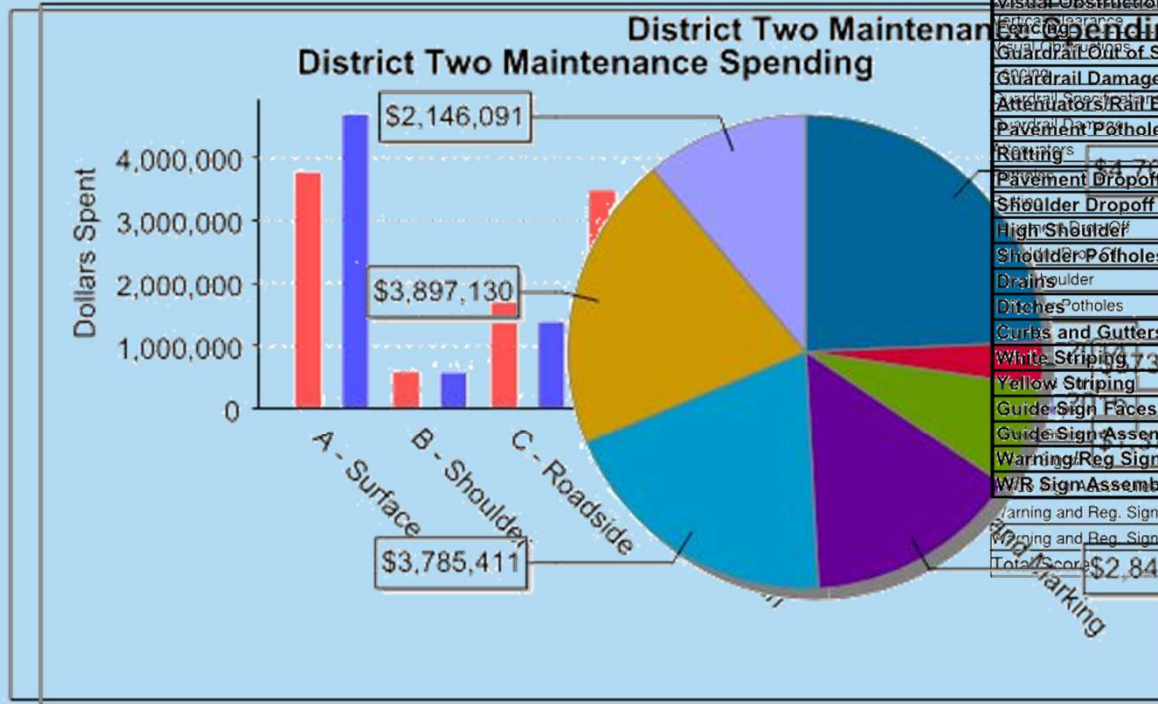
Inspection Features	Explanation	Score	Evaluation	MRP Score
International Roughness Index	A measure that indicates smoothness and ride quality for the highway user.	51 or less		90 +
01-0001		52 - 90		70 - 89
District 01	County: LIVINGSTON	Route: E-24	Mile Point: 030.563	Dir: E
Number of Lanes: 4	Surface: AC	Median: Earth	Shoulder: AC	79.9
Lane Width: 12	Category: Intersecting	Median Width: 48	Shoulder Width: 10	60 - 69.9
r1 - General Aesthetics (Grass, Vegetation)	on the population.	1=Excellent 2=Good 3=Acceptable 4=Poor 5=Unacceptable		
r2 - Is there roadway or shoulder with less than 15' vertical clearance?		168+		59.9 and below
r3 - Are there visual obstructions of intersections (height of grass, litter, unsightly patching, etc.) of the roadway and roadside as it would be seen by the public.		100% acceptable		100
r4 - Is there right-of-way fencing?		80%		(4) Y N
r5 - Is there fence not providing a positive barrier?				(5) Y N
r6 - Is there guardrail?		60%		(6) Y N
r7 - Is there guardrail outside height specifications (25" to 29")?				(7) Y N
r8 - Is there guardrail with post or accident damage?	Roadways and shoulders are free of any canopy (trees or other vegetation) or other obstructions	0% obstructed		(8) Y N
r9 - Number of guardrail attenuators/rail ends	at least a minimum height of 15 feet.	20%		(9) _____
r10 - Number of attenuators/rail ends damaged				(10) _____
p1 - Number of pavement potholes 6" long, 6" wide and 1" deep or larger (maximum = 20)		40%		(11) _____
p2 - Rutting - Outside wheel path at 0 feet	Vegetation, structures, signs, etc. cause horizontal or vertical visual obstructions of intersections, curves, signs, oncoming lanes, etc.	0% obstructed	Less than or equal to 1/4"	100
p3 - Rutting - Outside wheel path at 100 feet (Circle One)		20%	Greater than 1/4"	80
s1 - Is there pavement dropoff to shoulder greater than or equal to 1.5'?				(14) Y N
s2 - Is there shoulder dropoff to ground greater than or equal to 3.0'?		40%		(15) Y N
s3 - Is there high shoulder?				(16) Y N

Routine Maintenance KPIs and LOS

- Maintenance Rating Program (MRP)
 - Report helps guide spending
 - Performance Measures

District Two Scores

District:	1	2	NATIONAL	4	5	6	7	8	9	10	11	12
Rideability Index	73.0	72.3	77.6	75.3	70.3	66.5	73.8	75.4	72.3	66.6	70.0	69.8
Appearance	95.4	94.6	89.0	80.1	99.1	83.8	98.3	99.8	80.5	98.7	88.9	93.4
Vertical Clearance	87.3	86.8	74.6	68.2	74.9	81.3	85.1	85.8	62.5	96.2	83.2	45.9
Visual Obstructions	98.1	89.7	86.6	91.0	82.8	88.4	89.8	94.6	82.4	99.6	95.4	93.9
Guardrail Out of Specifications	90.8	70.1	99.2	94.2	100.0	95.9	62.9	100.0	97.2	96.5	88.7	NA
Guardrail Damaged	95.8	90.2	93.6	90.8	89.6	99.1	93.4	88.4	79.5	86.0	82.7	87.5
Attenuators/Rail Ends Damaged	100.0	87.5	85.8	97.8	87.7	97.7	100.0	100.0	79.3	97.4	87.2	79.1
Pavement Potholes Classified	92.7	18.7	90.2	72.0	66.1	74.0	90.0	93.7	43.4	89.0	63.5	54.8
Rating's	62.9	73.4	83.7	52.4	94.3	73.7	83.7	95.6	71.8	97.4	67.2	80.4
Pavement Dropoff	87.2	60.5	96.5	69.7	95.9	75.0	90.4	98.9	66.3	96.5	91.8	61.7
Shoulder Dropoff	85.2	86.5	86.6	55.2	68.6	64.5	73.1	81.8	79.8	84.2	75.5	65.9
High Shoulder	97.4	87.7	95.3	94.1	81.2	93.0	86.0	98.9	55.8	98.2	87.3	86.1
Shoulder Potholes	97.8	75.7	92.6	84.1	65.2	81.9	96.4	95.7	82.3	96.2	71.8	83.0
Drains	93.1	54.0	62.9	89.9	88.7	78.7	85.4	96.3	80.3	85.6	64.5	77.4
Ditches	90.4	86.0	73.6	96.4	85.6	85.2	86.0	99.1	68.0	93.1	83.4	69.3
Curbs and Gutters	NA	NA	64.1	89.6	90.0	97.3	92.3	NA	62.1	NA	NA	93.1
White Striping	96.4	90.8	91.0	85.1	96.5	92.2	94.8	95.6	84.5	87.6	83.2	71.4
Yellow Striping	95.0	79.5	89.3	88.2	95.2	85.4	86.9	80.4	91.3	59.9	78.6	46.8
Guide Sign Faces	95.9	93.2	65.6	98.6	87.4	85.0	81.7	98.1	83.3	96.6	89.9	99.3
Guide Sign Assemblies	92.0	92.4	55.8	92.2	68.6	82.8	94.9	95.1	82.5	95.8	97.7	86.3
Warning/Reg Sign Faces	82.4	80.0	73.9	100.0	87.5	79.3	94.2	94.5	87.0	95.1	71.2	87.4
WR Sign Assemblies	64.0	91.0	79.4	88.6	70.2	68.3	90.5	95.0	93.4	96.0	92.2	81.6
Warning and Reg. Signs	95.1	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
Warning and Reg. Sign Assem	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0	91.0
Total Score	87.8	84.9	80.8	80.8	80.8	68.5	80.8	80.8	76.7	80.8	76.7	80.8



TOTAL = \$ 19,328,686
 *Some values may appear to be shaded incorrectly due to rounding

Routine Maintenance KPIs and LOS

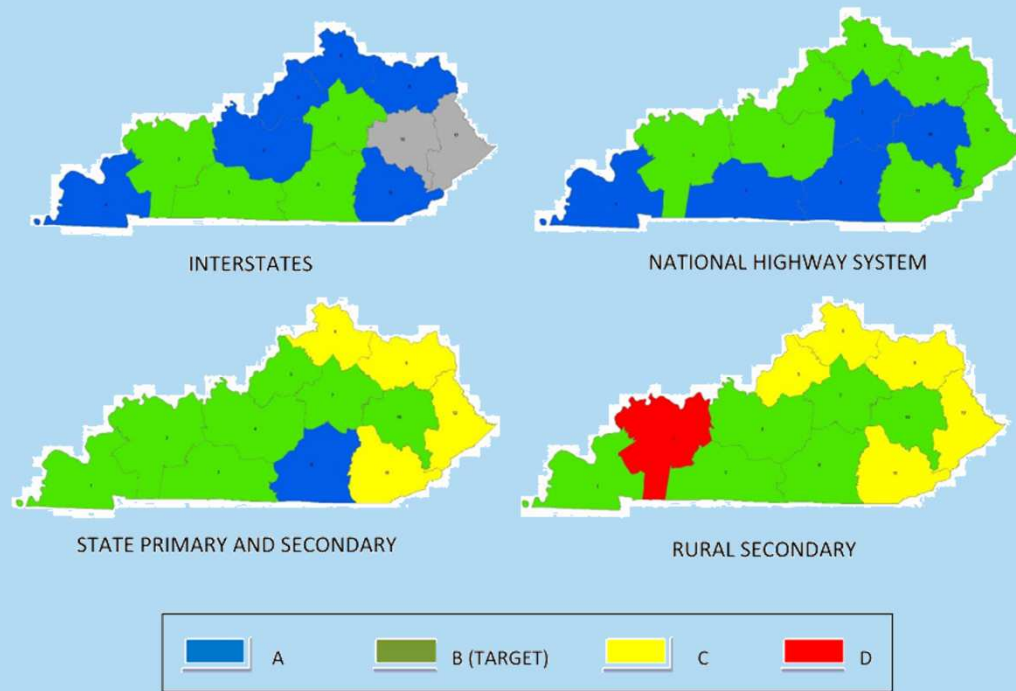
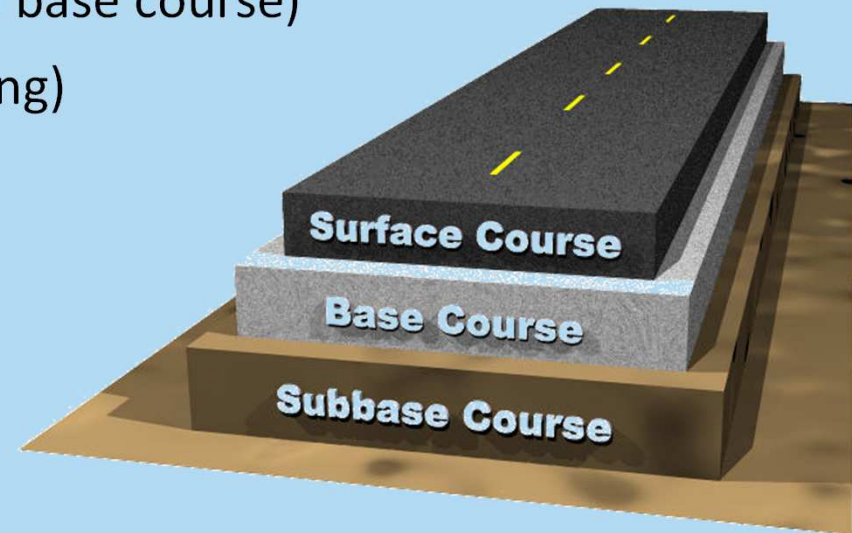


Figure 2: District Maintenance Levels of Service

Structural Maintenance

- Pavement Rehabilitation
 - Mill & Fill (Milling and surface overlay)
 - Mill & Intermediate Overlay (additional base course)
 - JPC Repair & Diamond Grinding (Patching)
 - Remove & Replace JPC
 - Average of \$150 million per year
 - Must be on NHS



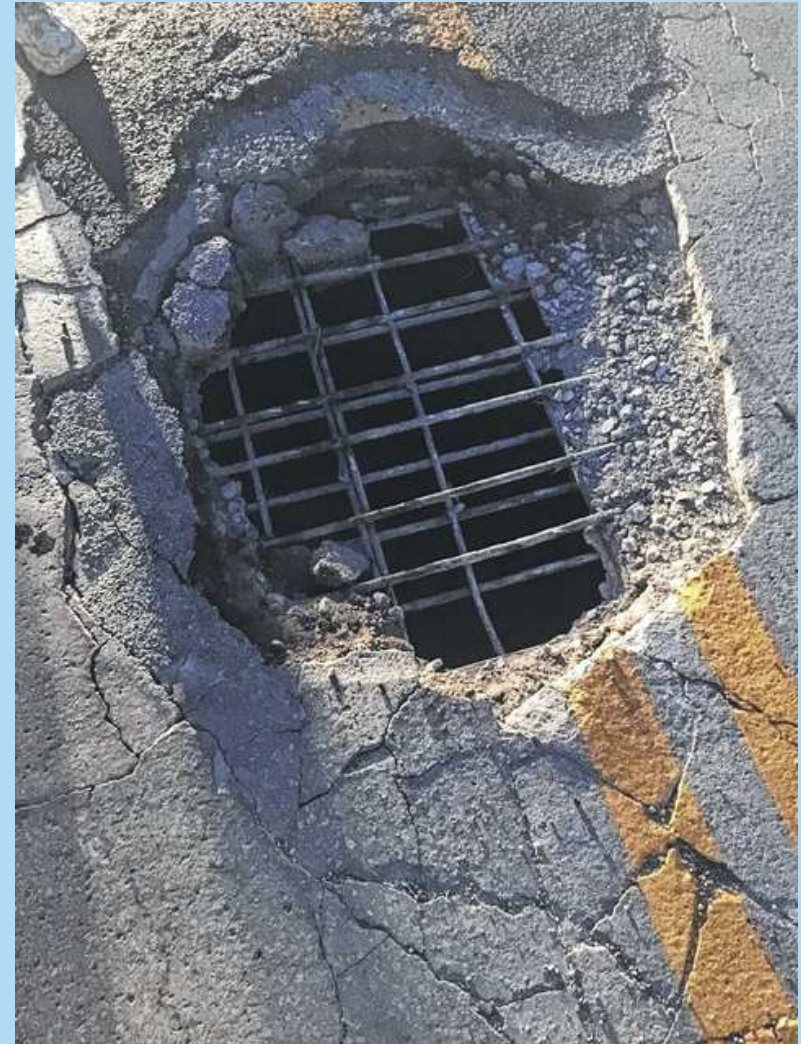
Structural Maintenance

- Bridge Maintenance
 - Funded through Federal Trans. Bill
 - Inspected every other year
 - Underwater Inspection every 5 years
 - Fracture Critical required on 300 bridges



Structural Maintenance

- Maintenance Activities
 - Deck Repair
 - Joint Repair
 - Painting
 - Appx. \$35 million annually
- Data Driven – AASHTO BrM



Emergency Structural Maintenance Issues



Emergency Structural Maintenance Issues



Emergency Structural Maintenance Issues



Asset Collection Vehicles

- 4 vehicle fleet (2 in operation)
- \$400,000 each
- Data collection
 - Laser Crack Scanning
 - Rutting
 - Cross Slope
 - Intl' Roughness Index
 - Faulting
- Interstates & NHS (annually)
- Other Routes (biennially)



Photolog Viewer

- <http://maps.kytc.ky.gov/photolog/>

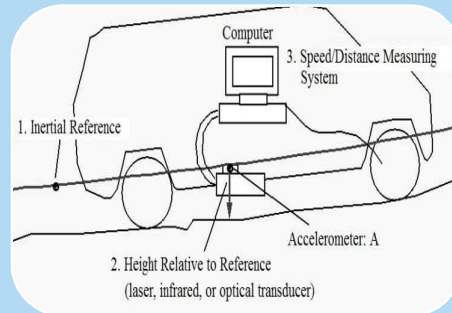


Pavement Metrics (KPI)



Pavement Distresses

Cracking allows moisture infiltration into the pavement thus causing further deterioration. Distresses can increase pavement roughness and create greater maintenance needs.



Roughness

Roughness is a measure of irregularities in the pavement surface that adversely affect the ride quality of the vehicle. This is quantified as the International Roughness Index (IRI). Higher values indicate rougher pavement on the scale.



Rutting

Rutting is a longitudinal surface depression in the wheel path of the pavement. Rutting often creates ponding of water and can be a safety concern.



Concrete Faulting

Faulting is a difference in elevation across a joint or crack in concrete pavement.

Performance Standards (Pavement)



Good Pavement

- Meets the “good” IRI threshold (0-80)
- Has a smooth ride
- Minor to no pavement distress
- Not in need of resurfacing



Fair Pavement

- Meets the “fair” IRI threshold (81-150)
- Moderately smooth ride
- Moderate pavement distresses
- May need pavement resurfacing within two to five years

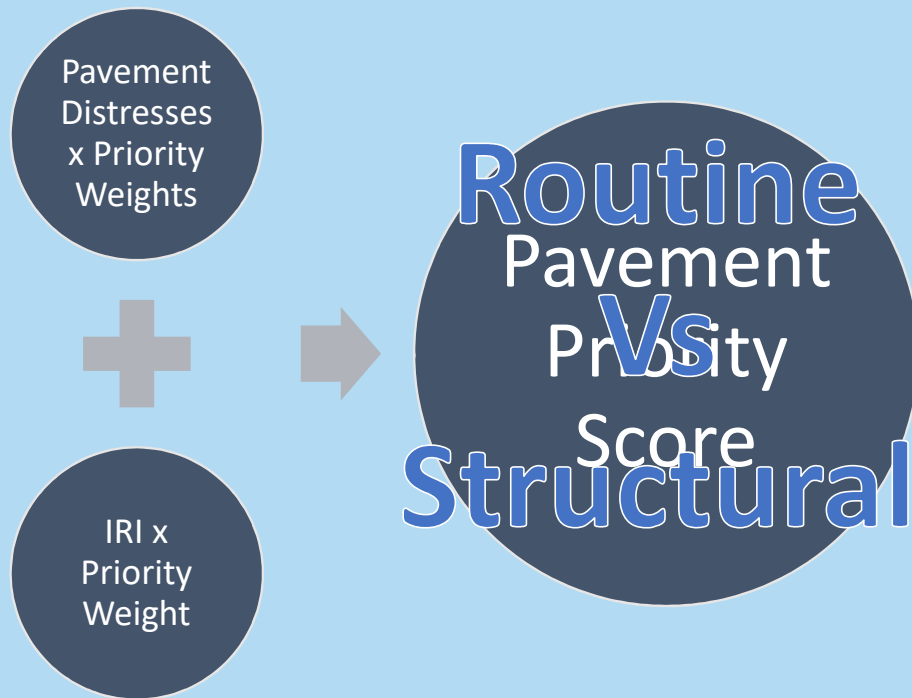


Poor Pavement

- IRI exceeds “poor” threshold (151+)
- Pavement has rough ride
- Moderate to severe pavement distresses
- Needs resurfacing or rehabilitation within one year

Project Prioritization

- Joint Venture with University of Louisville
- Use Analytic Hierarchy Process (AHP)



Asset Management

Asset management is the strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practical cost.



Asset Management (TAM GAP)

- Transportation Asset Management Gap Analysis Plan
- Identified 5 Goals (multitude of sub-goals)
 - Goal 1: Articulate an asset management framework with strategies and objectives to formalize and integrate the adoption of asset management as a way of doing business.
 - Goal 2: Produce a risk-based asset management plan that establishes clear goals for performance and condition of infrastructure assets, linking treatments to budget allocations that achieve the desired state of good repair.
 - Goal 3: Use measures such as asset sustainability ratio, deferred liability, and remaining service life to communicate the benefits of TAM and use financial forecasting and funds management to catalyze adequate investment.
 - Goal 4: Formalize and implement systematic preservation and maintenance processes and update management systems to reflect these changes.
 - Goal 5: Implement a comprehensive data management framework with data governance policies and procedures to support analysis needs and data driven risk-based asset management decisions.

Asset Management RFP

- Create a “risk-based” Management Plan
- Initial plan due 30-4-2018, final due 30-6-2019
- Professional Services contract (up to \$500,000) for 2 years (mod 2 additional years)
- Awarded to Applied Pavement Technologies

Asset Management RFP

- Task 1 – Review of KYTC TAM Self-Assessment
- Task 2 – Gap Analysis
- Task 3 – Development of Plan
- Task 4 – Recommendations for Long Term TAMP Administration
- Task 5 – KYTC Leadership Workshop
- Task 6 – Quarterly Progress Reports

Asset Management RFP

- Task 3 – Development of Plan
 - Summary listing and condition description of the NHS pavements and bridges
 - NHS pavements and bridges targets
 - Asset management objectives and measures
 - Performance gap analysis
 - Risk analysis
 - Life-cycle planning
 - Financial plan (minimum 10 years)
 - Investment strategies

Questions?

2017 IHEEP Conference

September 24-28, 2017

Northern KY Convention Center

Covington, KY

