

Data Driven Decision Making in Arkansas

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This paper covers the development of the Arkansas State Highway and Transportation Department's selection process for District Maintenance activities. Communication between the District offices and the Asset Management Section has caused project selection to evolve from an opinion based process into a data driven procedure. Data collection and processing technology has played a major role in the success of Asset Management's Pavement Management System and has resulted in pavement condition information becoming available throughout the Department.

Each year, the Arkansas State Highway and Transportation Department (AHTD) Maintenance Division repairs approximately 750 miles of highway with an annual budget of \$130 million. These repairs involve more than 250 miles of overlay treatments, nearly 400 miles of asphalt surface treatments, and approximately 100 miles of leveling treatments. In the past, decision making regarding roadway maintenance activities, route selection, and treatment options have been influenced by the recommendations of District personnel from each county. These individuals are responsible for maintaining the routes in their respective counties, and know the locations where treatment is most needed. However, with the advancement of data collection technology, as well as processing and reporting software, highway condition information is becoming more readily available and decisions concerning highway repairs are becoming more data driven.

In 2011, the AHTD Asset Management Section completed its first series of statewide data collection using automated technology. With the use of crack detection software, rut calculation programs, and segmenting tools, the section was able to process and report condition information for all of its 16,398 centerline miles of highway. The following year AHTD and FHWA reached an agreement known as the Preventative Maintenance Plan (PMP) which would be based on the reported condition data of the state's highways. The PMP states that federal funding may be used on sections of highway which comply with a combination of indices set forth in the plan. These indices are Roughness, Cracking, Rutting, and Average Daily Traffic (ADT). Good, Fair, and Poor pavement condition ratings combined with Low, Medium, and High traffic counts can qualify a highway section for various maintenance treatments. The information compiled by analyzing data provided by the Department's data collection vehicle, as well as information which was manually collected by field crews, was reported in the form of charts (Figure 1) and maps (Figure 2).

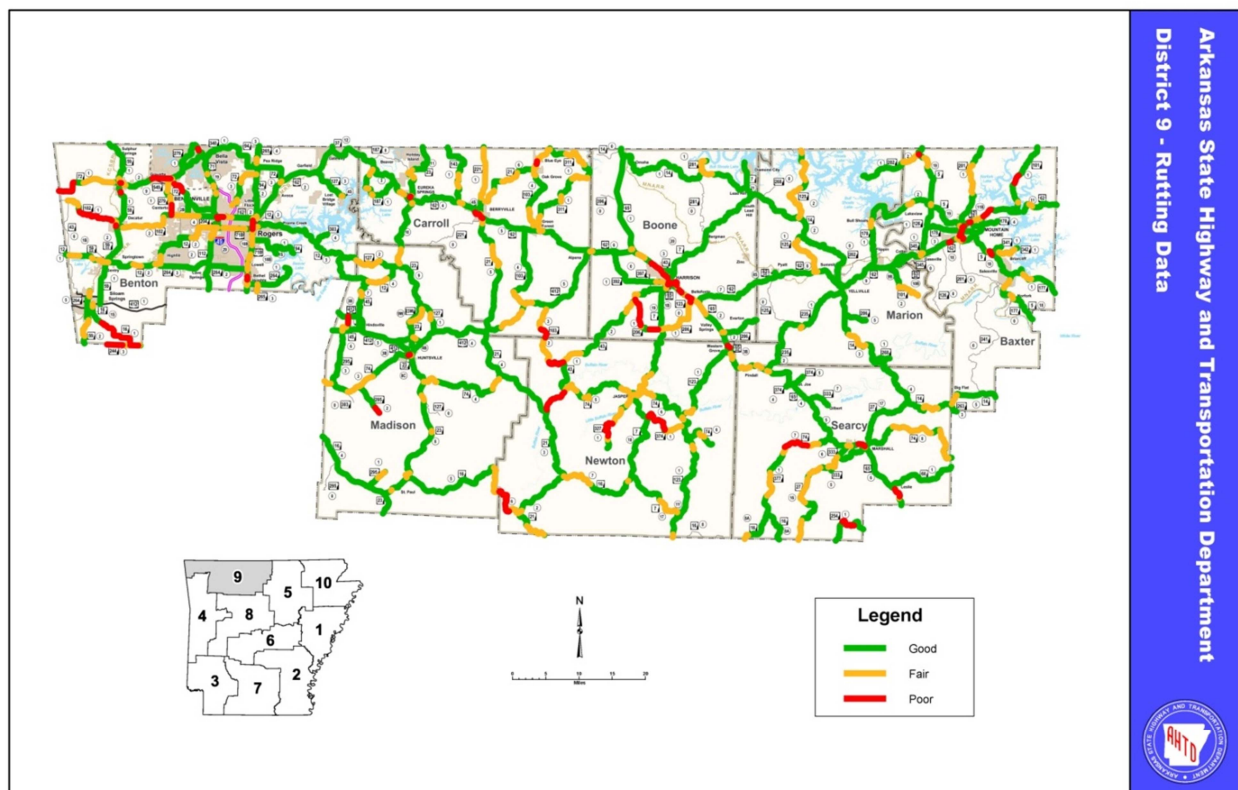
Figure 1

District	County_No	County_Name	Route	Section	Begin_LM	End_LM	Rutting(in)	IRI(in/mi)	Cracking(UCI)	ADT
9	4	BENTON	112	020	0.00	0.10	0.28	154	39	5800
9	4	BENTON	112	020	0.10	0.20	0.31	89	30	5800
9	4	BENTON	112	020	0.20	0.30	0.35	98	27	5800
9	4	BENTON	112	020	0.30	0.40	0.23	86	28	5800
9	4	BENTON	112	020	0.40	0.50	0.19	76	28	5800
9	4	BENTON	112	020	0.50	0.60	0.16	88	25	4600
9	4	BENTON	112	020	0.60	0.70	0.12	83	23	4600
9	4	BENTON	112	020	0.70	0.80	0.18	75	20	4600
9	4	BENTON	112	020	0.80	0.90	0.21	94	25	4600
9	4	BENTON	112	020	0.90	1.00	0.15	72	28	4600
9	4	BENTON	112	020	1.00	1.10	0.13	73	26	4600
9	4	BENTON	112	020	1.10	1.20	0.21	86	27	4600
9	4	BENTON	112	020	1.20	1.30	0.23	82	20	4600
9	4	BENTON	112	020	1.30	1.40	0.33	99	14	4600
9	4	BENTON	112	020	1.40	1.50	0.13	100	18	4600
9	4	BENTON	112	020	1.50	1.60	0.11	96	24	4600
9	4	BENTON	112	020	1.60	1.70	0.13	94	24	4600
9	4	BENTON	112	020	1.70	1.80	0.12	97	19	4600
9	4	BENTON	112	020	1.80	1.90	0.14	111	18	4600
9	4	BENTON	112	020	1.90	2.00	0.17	114	25	4600

ADT
Low
Medium
High

Condition
Good
Fair
Poor

Figure 2



Information regarding the PMP, as well as the capabilities of the Department's Pavement Management System, was presented at the annual Transportation Research Committee (TRC) Meeting in 2013 and District Engineers were immediately intrigued. They began requesting the data which was used for project selection and prioritization so that more informed decisions could be made concerning roadway maintenance activities. Upon this request, the Asset Management Section was able to provide maps which displayed highway conditions and possible project locations throughout the state, as well as tabular data including tenth mile data for various conditions and information, which were placed on the AHTD network in order to be available for use across the agency.

Only a few months after the TRC presentation, District Engineers began to request not only the condition information, but recommendations for projects based on the processed data. The Pavement Management System was able develop a selection procedure based on a Pavement Condition Index (PCI), ADT, minimum length, and truck percentage. PCI values were "graded" on an A – F scale (Figure 3), a minimum project length of one mile was set, and a minimum ADT was also implemented. In addition, estimates for various treatment methods were included in order to work within a budget. With these standards, continuous tenth mile sections of D and F grade PCI were queried, sorted, and averaged (Figure 4). At that point, sections can be prioritized based on a variety of inputs including a Composite Index (CI) which combines PCI and Truck Volume. In this process, selected sections can be verified by using AHTD's internally created Multimedia-based Highway Information System (MMHIS) (Figure 5).

Figure 3

State Highway System Grading Scale (PCI)		
Grade	High PCI	Low PCI
A	100	85
B	85	70
C	70	55
D	55	40
F	40	0

Figure 4

Dist.	County	Route	Sect.	Beg_LM	End_LM	Length	AvgPCI	CI	YearRecon	ADT	Truck_Pct	System	NumberLanes	SurfaceType	Grade	TreatmentCost	ProjectCost
9	BENTON	12	010	4.4	6.1	1.5	31.74	58.93	1994	5,400	0.09	APHN	2	Asphalt	F	\$ 305,000.00	\$ 1,037,000.00
9	BENTON	72	020	0.0	1.2	1.2	33.18	55.33	1988	4,900	0.04	APHN	2	Asphalt	F	\$ 305,000.00	\$ 732,000.00
9	BOONE	392	010	9.0	10.4	1.4	34.58	54.95	1970	7,018	0.04	APHN	2	Asphalt	F	\$ 305,000.00	\$ 854,000.00
9	BENTON	72	020	5.1	8.2	3.1	37.36	51.91	1992	4,700	0.04	APHN	2	Asphalt	F	\$ 305,000.00	\$ 1,891,000.00
9	BAXTER	62	118	0.0	1.7	1.7	37.75	54.38	1991	13,000	0.04	APHN	4	Asphalt	F	\$ 305,000.00	\$ 2,074,000.00
9	CARROLL	103	040	14.6	17.2	2.4	40.19	48.28	1951	1,082	0.04	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 442,000.00
9	CARROLL	23	110	0.0	6.8	6.4	40.20	49.15	1997	3,400	0.04	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 1,156,000.00
9	BAXTER	5	190	12.1	14.4	2.3	40.38	49.08	1990	2,388	0.06	APHN	2	Asphalt	D	\$ 122,000.00	\$ 561,200.00
9	SEARCY	65	050	9.3	10.4	1.1	41.03	55.37	2000	6,200	0.17	NHS	4	Asphalt	D	\$ 130,000.00	\$ 572,000.00
9	BAXTER	5	180	4.4	12.0	7.2	41.23	48.90	1994	3,300	0.06	APHN	2	Asphalt	D	\$ 122,000.00	\$ 1,854,400.00
9	CARROLL	62	030	10.3	11.6	1.3	41.39	49.95	1995	4,750	0.07	APHN	2	Asphalt	D	\$ 122,000.00	\$ 317,200.00
9	CARROLL	62	050	8.1	9.8	1.6	41.57	48.97	1991	5,900	0.04	APHN	2	Asphalt	D	\$ 122,000.00	\$ 414,800.00
9	MARION	62	090	0.0	4.6	4.6	41.82	51.67	2001	7,400	0.08	NHS	2	Asphalt	D	\$ 130,000.00	\$ 1,196,000.00
9	MARION	178	010	3.7	11.5	7.6	42.14	47.11	1979	2,785	0.03	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 1,326,000.00
9	NEWTON	7	180	16.6	17.9	1.2	42.91	47.28	1998	2,400	0.07	APHN	2	Asphalt	D	\$ 122,000.00	\$ 317,200.00
9	MARION	62	080	10.7	13.2	2.5	43.23	49.90	2001	5,081	0.1	NHS	2	Asphalt	D	\$ 130,000.00	\$ 650,000.00
9	BAXTER	62	108	0.1	2.0	1.9	43.58	46.38	1974	1,600	0.08	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 323,000.00
9	BAXTER	126	010	1.4	2.6	1.2	43.58	46.19	2001	2,700	0.04	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 204,000.00
9	BAXTER	5	190	5.4	6.8	1.2	43.94	49.11	2005	8,000	0.06	APHN	2	Asphalt	D	\$ 122,000.00	\$ 341,600.00
9	SEARCY	65	040	0.9	5.5	4.3	44.05	52.96	1991	4,800	0.22	NHS	2	Asphalt	D	\$ 130,000.00	\$ 1,196,000.00
9	BENTON	59	010	0.8	1.8	1.0	44.20	49.04	1992	2,617	0.19	APHN	2	Asphalt	D	\$ 122,000.00	\$ 244,000.00
9	BENTON	62	020	8.3	11.4	2.9	44.20	51.36	1991	9,100	0.09	NHS	2	Asphalt	D	\$ 130,000.00	\$ 806,000.00
9	BAXTER	178	040	3.3	4.3	1.0	44.26	45.22	1978	1,600	0.04	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 170,000.00
9	NEWTON	7	180	13.1	16.2	2.5	44.44	46.06	1998	2,400	0.07	APHN	2	Asphalt	D	\$ 122,000.00	\$ 756,400.00
9	BENTON	59	010	5.2	7.5	2.1	44.52	49.49	1992	3,100	0.19	APHN	2	Asphalt	D	\$ 122,000.00	\$ 561,200.00
9	CARROLL	23	110	7.2	11.0	3.5	44.64	44.89	1997	1,523	0.04	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 646,000.00
9	NEWTON	7	180	6.7	11.3	4.5	44.70	45.52	2004	1,464	0.09	APHN	2	Asphalt	D	\$ 122,000.00	\$ 1,122,400.00
9	BAXTER	178	020	0.0	3.7	3.6	44.83	45.10	1979	3,300	0.03	APHN	2	Asphalt	D	\$ 122,000.00	\$ 902,800.00
9	CARROLL	62	030	0.2	3.2	2.6	45.01	45.46	1974	1,900	0.08	APHN	2	Asphalt	D	\$ 122,000.00	\$ 732,000.00
9	BENTON	265	030	0.0	1.0	1.0	45.32	47.24	NULL	9,600	0.04	APHN	2	Asphalt	D	\$ 122,000.00	\$ 244,000.00
9	MADISON	16	040	3.3	6.6	2.8	45.32	44.39	1977	1,100	0.06	APHN	2	Asphalt	D	\$ 122,000.00	\$ 805,200.00
9	MARION	14	030	7.4	10.3	2.8	45.33	44.69	1987	1,400	0.07	APHN	2	Asphalt	D	\$ 122,000.00	\$ 707,600.00
9	BENTON	279	010	0.0	2.9	2.7	45.44	44.34	1990	1,400	0.05	Non-APHN	2	Asphalt	D	\$ 85,000.00	\$ 493,000.00

Figure 5



The Multimedia-based Highway Information System (MMHIS) began in 1996 as a research project with a purpose to assist the development of the newly created Pavement Management System. It utilizes the images and information from the Department's data collection vehicle, contract information from past and programmed jobs, bridge data, traffic safety information, and research data, and displays the information dynamically in a continuous drive-through format. This program was first implemented in 2001 and was available on only ten computers in select locations. Today it is available to almost every Department employee in the Construction, Maintenance, and Research Divisions and is utilized in the decision making process.

The purpose of this paper was to display the possibilities and uses of highway condition data and information which Highway Departments and DOTs already have. In addition, it is intended to stress the importance of communication between the various divisions and sections within State Agencies. Because of the information provided to the decision makers, they are not only able to make more informed choices, but are also equipped with information to provide inquiring citizens.