Visualization and Communication in Pavement Performance

Final Report July 2018

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Midwest Transportation Center U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology



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Final Report July 2018

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OVERVIEW

The researchers envisioned several possible scenarios of end users and possible questions that they might use visual analyses to answer. They believed that the two primary types of end users of these visualizations were (1) county office administrators examining the status of the roads in their counties and the state and (2) engineers working with the data sets. Accordingly, the researchers presented several visualizations that would be useful for each of these end-user groups. For each, a short description is given along with a sample question that the visualization could be used to answer.

The data set used for these visualizations was PMIS13.xlsx, which included the most recent data available for this purpose. Software programs used to produce them were Microsoft Excel 2010 and Tableau 9.0. PCI-2 was used for all analyses, but it is displayed below as pavement condition index (PCI).

VISUALIZATIONS

End User: County Administrators

This chapter presents the data for all "high" crack types by street in a specific county (see Figure 1). The data points can be selected singly or in a group (by highlighting) to show the specific data for the data point(s). The interactive drilldown information is illustrated in Figures 2 and 3.

Question: Which Streets Have the Largest Numbers of High Cracks in My County?

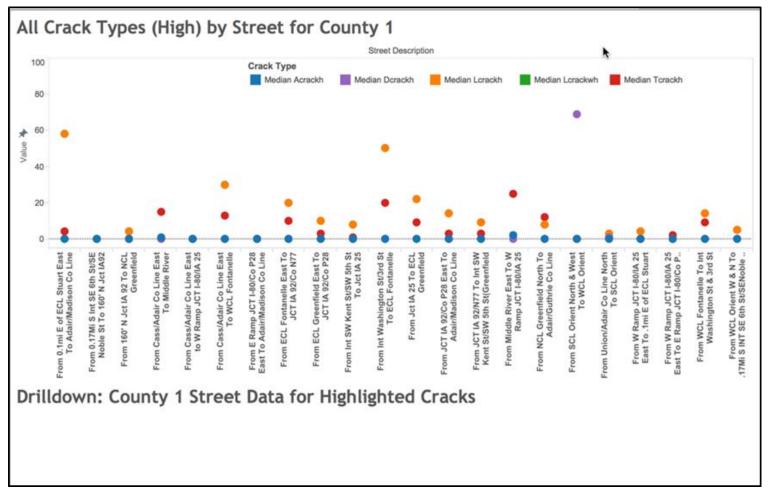


Figure 1. High crack data for all crack types by street in County 1

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		From 0.1mi E of ECL Stuart East To Adair/Madison Co Line	From 0.17Mi S Int SE 6th St/SE Noble St To 160' N Jct IA92	From 160' N Jct IA 92 To NCL Greenfield	From Cass/Adair Co Line East To Middle River	From Cass/Adair Co Line East to W Ramp JCT I-80/IA 25	From Cass/Adair Co Line East To WCL Fontanelle	From E Ramp JCT I-80/Co P28 East To Adair/Madison Co Line	From ECL Fontanelle East To JCT IA 92/Co N77	From ECL Greenfield East To JCT IA 92/Co P28	From Int SW Kent St/SW 5th St To Jct IA 25	From Int Washington St/3rd St To ECL Fontanelle	From Jct IA 25 To ECL Greenfield	From JCT IA 92/Co P28 East To Adair/Madison Co Line	From JCT IA 92/N77 To Int SW Kent St/SW 5th St(Greenfield	From Middle River East To W Ramp JCT I-80/IA 25	From NCL Greenfield North To Adair/Guthrie Co Line	From SCL Orient North & West To WCL Orient	From Union/Adair Co Line North To SCL Orient	From W Ramp JCT I-80/IA 25 East To .1mi E of ECL Stuart	From W Ramp JCT I-80/IA 25 East To E Ramp JCT I-80/Co P	From WCL Fontanelle To Int Washington St & 3rd St	. Orient W & N To 6th St/SENoble
		ECL SI ladiso	Int SE 160' N	ct IA 9	air Co To Mid	air Co p JCT	air Co NCL F	JCT I-{ ladiso	tanell T IA 9	enfiel CT IA 9	nt St/	ECL F	ct IA 2	Co P2 ladiso	th St(G	River E	Guthri	nt Norl To W	r Co L To Si	p JCT E of E	p JCT I	ontani gton S	Drient th St/S
		i E of I dair/M	7Mi S I St To	N .03	ss/Ad	ss/Adi	ss/Ad	camp . dair/M	SL For JC	CL Gr	SW Ke	Wash To	L mor	IA 92/ dair/M	T IA 9; /SW 5/	iddle F Ram	L Gree Adair/	Oriei	n/Adai	/ Ram	/ Ram Ramp	ACL F ashing	
		To A	m 0.17 Noble	om 16	om Ca	to M	om Ca	t To A	om E(om E(m Int	om Int	LL.	n JCT A	om JC' ent St	M mo	m NC	m SCI	Unioi	rom M ast To	rom M t To E	rom V W	From WCL
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or		CL Orier West To					.00				9.00				0.00				0.00				0.0

Figure 2. High crack data for all crack types by street in County 1 with drilldown for two specific streets

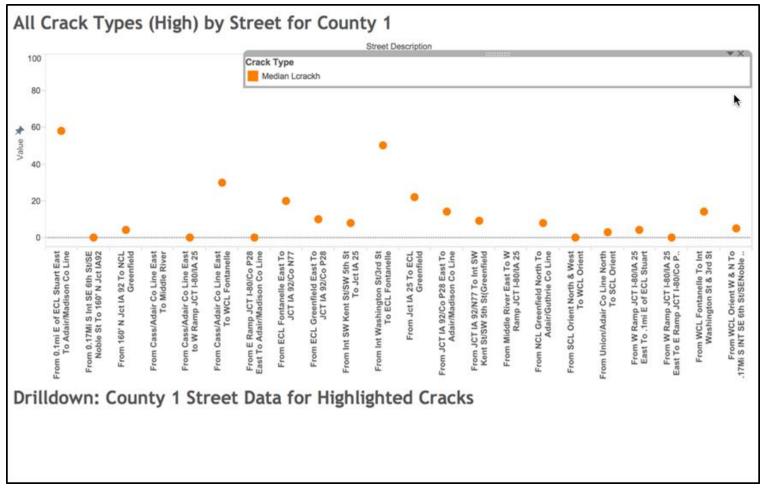


Figure 3. High crack data for L-cracks by street in County 1

The following shows two charts combined into one dashboard. The first shows the PCI and all pavement condition indices for a chosen county compared to the same data for all counties combined. The second shows the data for all high cracks for the chosen county compared to all counties (see Figure 4). Detailed information about each bar can be obtained, as shown in Figure 5.

Question: How Does My County Compare to All of the Counties Combined for Condition and Distress Data?

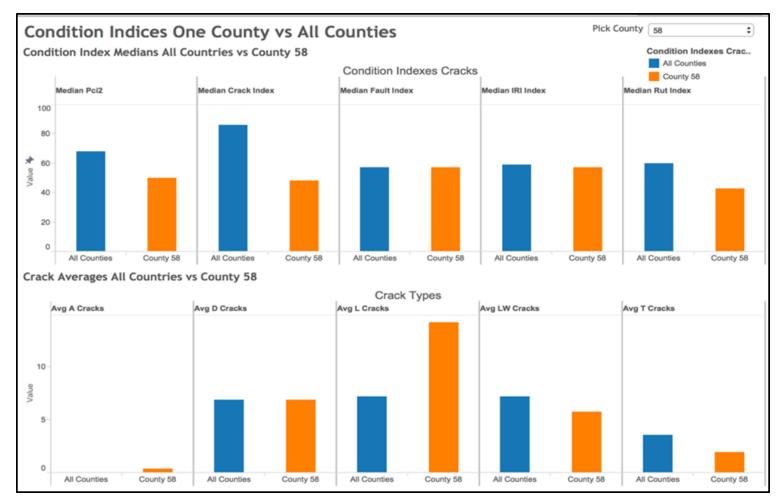


Figure 4. Comparison of condition indices and high cracks for County 58 compared to all counties combined

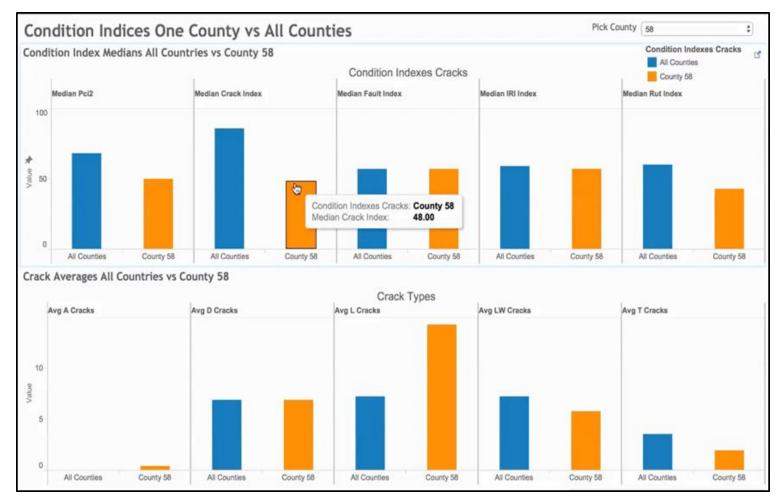


Figure 5. Comparison of condition indices and high cracks for County 58 compared to all counties combined with tooltip details

The following shows four charts combined into one dashboard. The first, third, and fourth show PCI, joints with spalling, and severity patches (bad condition) for each pavement type. The second shows all crack types (high) for each pavement type (see Figure 6). The specific detailed data for each bar can also be obtained, as shown in Figure 7.

Question: What Is the Performance of the Different Pavement Types in my County? Which Pavement Type Has the Highest PCI in my County?

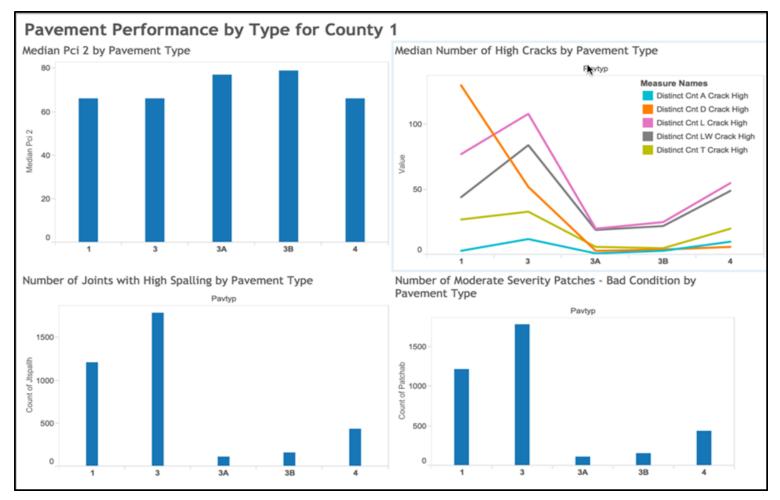


Figure 6. Performance of each pavement type for County 1

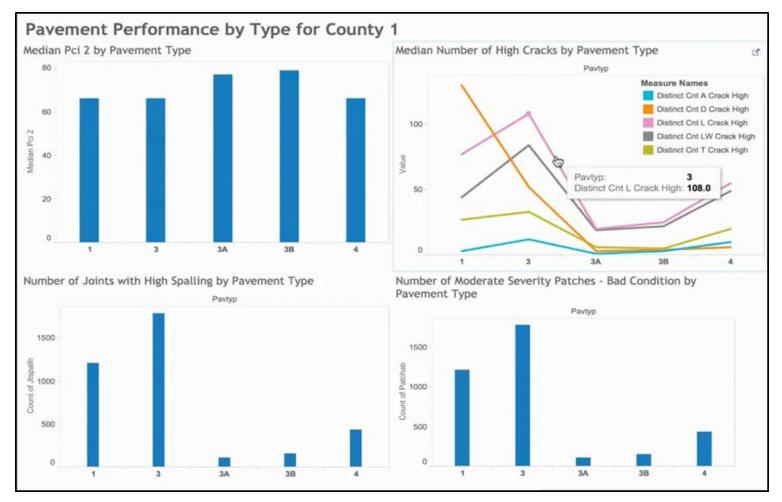


Figure 7. Performance of each pavement type for County 1 with tooltip details

End User: Engineers

The following shows three charts combined into one dashboard (see Figure 8). The first shows the mean PCI, average daily traffic (ADT), and trucks for a selected county and all counties combined. The second shows all three traffic kips for the selected county and all counties combined. The third shows all five traffic data metrics for 2012 to 2014 for the selected county. Detailed information about each bar can be obtained, as shown in Figure 9.

Question: How Does My County Compare to All of the Counties Combined for Truck Traffic and Kips?

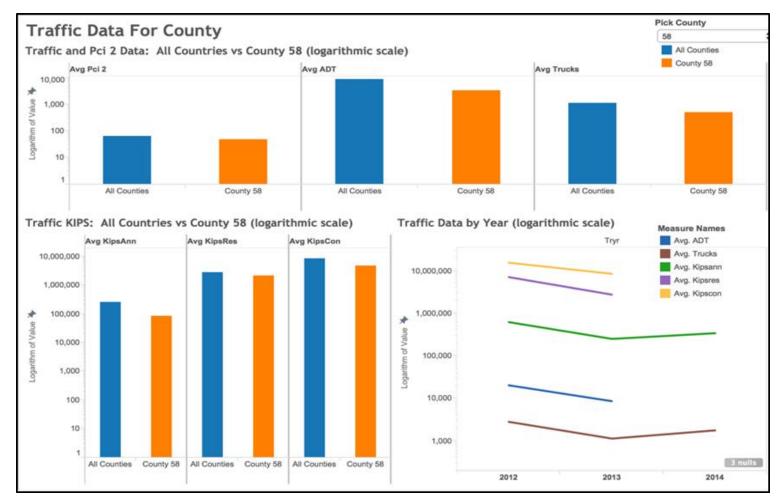


Figure 8. Comparison of traffic data for County 58 compared to all counties combined

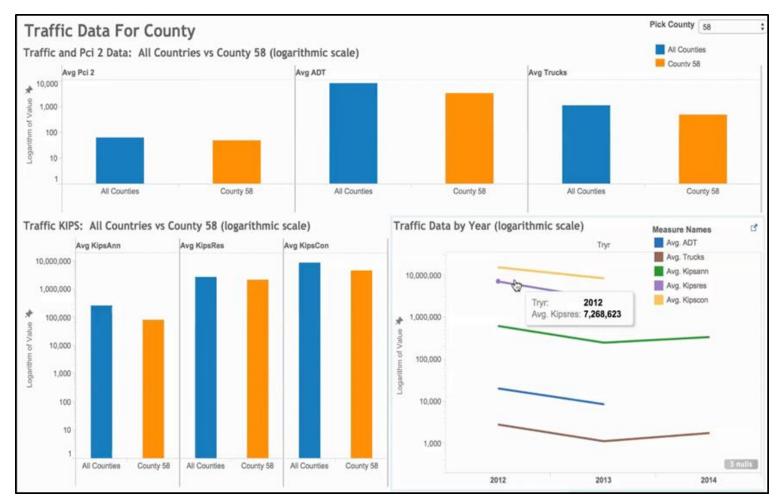


Figure 9. Comparison of traffic for County 58 compared to all counties combined with tooltip details

The following shows two charts combined into one dashboard that focuses on PCI and International Roughness Index (IRI) for different pavement types. Data can be filtered by district, county, system, pavement type, age, and speed (see Figure 10).

Question: How Do PCI and IRI Vary by Pavement Type?

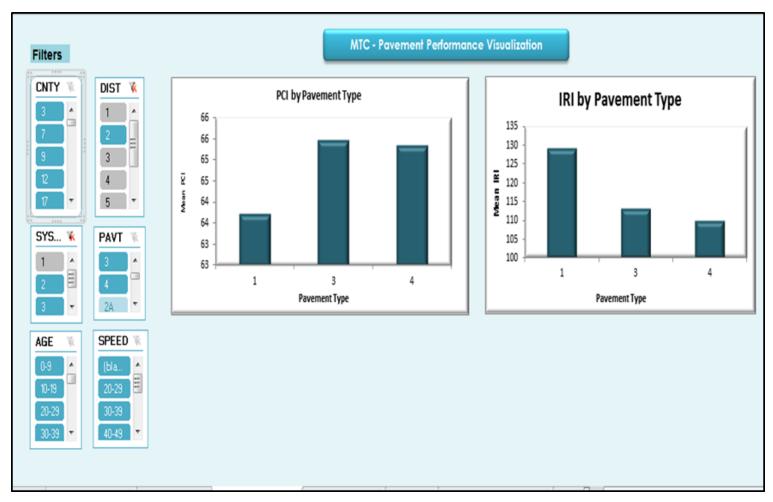


Figure 10. Pavement performance for District 2; Pavement Types 1, 3, 4; and Systems 2 and 3

The following shows four charts combined into one dashboard that focuses on four types of high cracks: A-cracks, D-cracks, L-cracks, and T-cracks. For each, data can be filtered by district, county, system, pavement type, age, and speed (see Figure 11).

Question: How Do High Cracks Vary by Pavement Type?

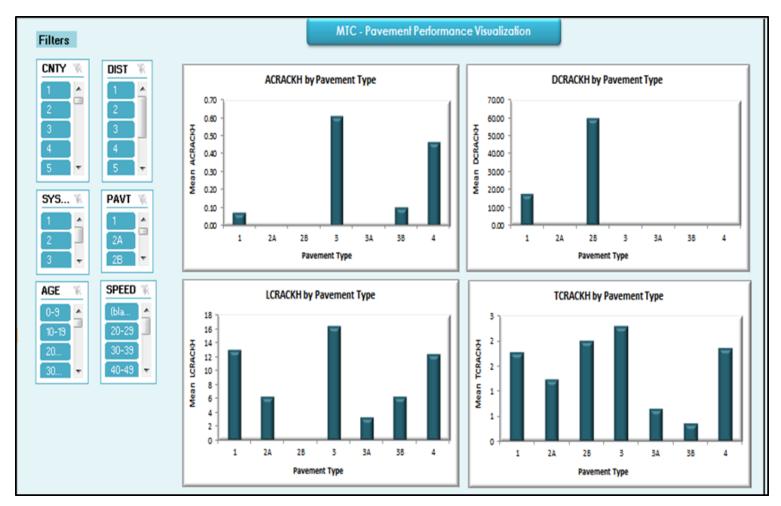


Figure 11. Crack performance over all districts, counties, systems, age, speed, and pavement types

The following shows four charts combined into one dashboard that focuses on the mean PCI by four high crack types: A-cracks, D-cracks, L-cracks, and T-cracks. For each, data can be filtered by district, county, system, pavement type, age, and speed (see Figure 12).

Question: How Does PCI Vary across High Cracks?

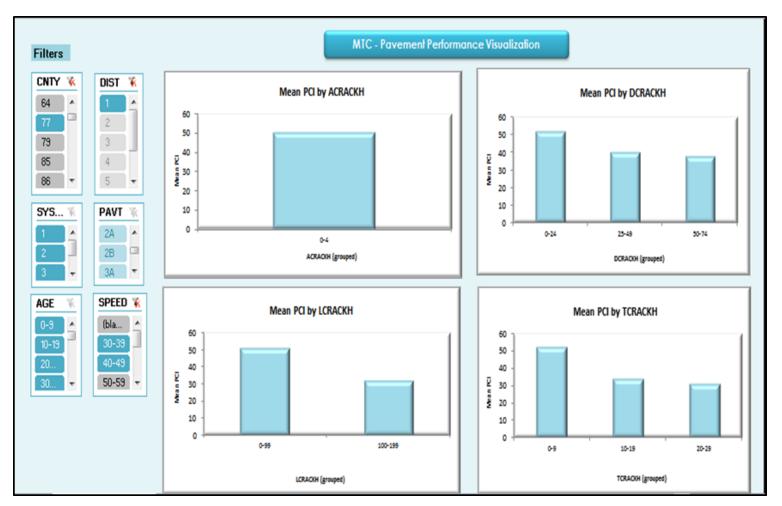
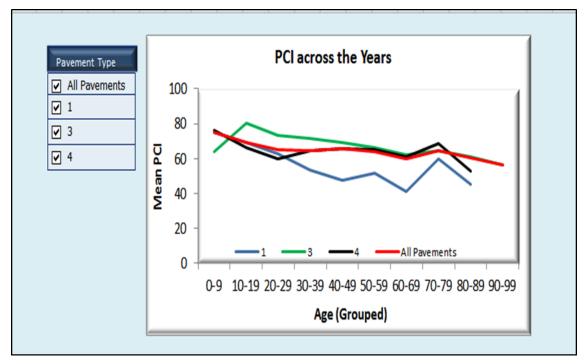


Figure 12. Mean PCI by crack type (high) and performance over District 1; Pavement Types 1 and 3; and speed limits of 30 to 39 and 40 to 49 mph

The following shows mean PCI for the age of the pavement, for up to four pavement types (see Figure 13).



Question: Has PCI Changed over the Age of the Pavement for All Pavement Types?

Figure 13. PCI over time for all pavement types

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