



# Kansas LTAP Fact Sheet

## A New Pavement Management System for County Roads

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This article mainly focuses on the results of a research study that developed an innovative and efficient pavement management system (PMS) which uses a new optimization methodology for managing local paved roads in Wyoming.

### What does a pavement management system do?

A PMS is a set of tools that assists decision-makers in finding optimum strategies for providing and maintaining pavements in a serviceable condition over a given period. The main function of a PMS is to provide objective information and useful data to help managers to make more clear, cost-effective, consistent and defensible decisions for preserving and maintaining a pavement network.

### Components of a PMS

There are three primary tasks performed by a PMS – data collection, analyses and feedback. Each of these tasks helps provide a basic understanding of the possible consequences of alternative options for maintenance.

**Data collection.** This includes an *inventory* (physical pavement features like number of lanes, length, surface type, functional classification), *history* (past project dates and types of construction, reconstruction, preventive maintenance, and rehabilitation), a *condition survey* (roughness or ride, pavement distress, rutting and surface friction), *traffic information* (volume, vehicle types, and load), *costs*, and a *database* (compilation of all data files used in the PMS).

**Analyses.** These create output useful for making decisions. Analyses include pavement condition analysis, priority assessment models, and optimization models.

**Feedback.** This process includes ongoing field observations to improve the reliability of the PMS analysis.

### Pavement management systems in Kansas

Kansas has a statewide PMS managing the state highway system and it is used for optimally allocating funds. More information on the Kansas PMS can be found on the KDOT website. The 2019 KDOT Transportation Asset Management Plan ([TAMP](#)) sets out a performance-based process to manage physical assets like bridges and pavement while meeting federal requirements. Some local agencies in Kansas also have a PMS, such as the [City of Burlington](#) and the [City of Eudora](#). There is no standard PMS for local road systems in Kansas.



Block cracking plagues county roads. Above is an example of a low distress road from Iowa's Department of Transportation.

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### Wyoming LTAP's new Optimization Model for managing paved county roads

In Wyoming, WYDOT's PMS is used for managing a total of 6,844 miles of state highways and interstates, while county governments manage their roads use engineering judgement, without any PMS. Most optimization models in the literature and in practice

focus on characteristics of state highways and interstate systems and don't translate well to county paved roads – because county roads have lower standards, carry lower traffic volumes and generally do not receive adequate funding for their maintenance. Drivers also have different perceptions about what looks and feels like a serviceable road on the local system vs. the state system. To address these issues, the Wyoming Technology Transfer Center (WYT<sup>2</sup>/LTAP) developed a new optimization methodology for managing county roads (many of which were built decades ago) using data they collected in 2014. This data included roadway inventory data, pavement condition data, and roadway thicknesses.

The research investigated three main issues related to county roads management: 1) serviceability prediction, 2) the cost of measuring pavement roughness, and 3) optimizing budgets for pavement management. The following are the results of the study:

**A Pavement Serviceability Index Model Developed.** A ride quality survey was conducted to develop new serviceability prediction models (models that can predict the level of service a pavement provides to the users) suitable for county paved roads. Based on the perceptions of Wyoming residents, a Pavement Serviceability Index (PSI) model was developed for county paved roads that was statistically valid and better represents county road conditions when compared with the current state model.

**Predicting IRI Values.** Besides PSI, the International Roughness Index (IRI) is another pavement performance indicator commonly used around the world for evaluating and managing road systems. In simple terms, pavement roughness is defined as the irregularities seen on the road surface that affect user comfort and safety. Due to the limited funds available to local governments to collect pavement condition data, this study evaluated the ability of smartphones to measure IRI as part of PMS, as a cost-effective solution. Using IRI values measured from smartphones and reference IRI values measured using a standard profiler, two models were developed to predict IRI values. It was found that there was no statistically significant difference between the predicted and measured IRI.

**A New Methodology for Counties.** This research project also developed a new risk-based PMS methodology (risks related to minimizing life-cycle costs, increasing traffic, truck loading, and budget constraints) to identify and manage the best mix of road maintenance and preservation projects for limited available resources. This innovative methodology is tailored specifically for the county paved roads and is flexible for analyzing different scenarios, such as determining minimum budgets, developing a five-year

CIP within a limited budget and maximizing benefit to the public. It was concluded that the new methodology can be implemented in all 23 Wyoming counties and can be used by other states for developing a PMS for their county paved roads.

## Conclusion

The Wyoming Technology Transfer Center (WYT<sup>2</sup>/LTAP) developed an optimization methodology tailored for county paved roads. This new model can help decision-makers allocate funding for maintenance by identifying priorities among all their jurisdiction's paved roads. The new methodology can be used to develop multi-year pavement maintenance plans that would aim for specific performance targets within maintenance policies and budget levels. Smartphone applications can easily predict the IRI directly. However, more research is required to identify and address different variables for county roads that may affect IRI measurement using smartphones. More detailed information on this new PMS methodology for local roads can be found online at <https://www.ugpti.org/resources/reports/downloads/mpc19-397.pdf>.

## For more information

For more information on the 2019 Transportation Asset Management Plan by KDOT, visit this free web-based resources at [http://www.tamptemplate.org/wp-content/uploads/tamps/042\\_kansasdot.pdf](http://www.tamptemplate.org/wp-content/uploads/tamps/042_kansasdot.pdf).



## Endnotes

1. Hafez, M., Saha, P., Aleadelat, W. and Ksaibati, K., 2019. Developing an Optimization Model for Managing County Paved Roads. Laramie, Wyoming. Accessed Online: <https://www.ugpti.org/resources/reports/downloads/mpc19-397.pdf>
1. Saha, P., and Ksaibati, K. (2015). "A risk-based optimization methodology for pavement management system of county roads." International Journal of Pavement Engineering, 17(10), 913-923, DOI: 10.1080/10298436.2015.1065992.
2. National Cooperative Highway Research Program. 1979. "Pavement Management System Development." Washington, D.C.: Transportation Research Board National Research Council. Accessed Online: [http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp\\_rpt\\_215.pdf](http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_215.pdf)

## Additional Sources:

- Vitillo, Nick. 2020. State.NJ.US. Accessed June 23. <https://www.state.nj.us/transportation/eng/pavement/pdf/PMSOverviews0709.pdf>.