DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Implementing a New Pavement Management System

Adopting improved ways to collect pavement data to better predict performance, consider what-if scenarios, and invest dollars wisely

Pavement

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Project Title:
Support of Pavement Management System

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WHAT IS THE NEED?

Managing pavements has become more complex as California must focus on the importance of preserving and maintaining its roadway infrastructure in addition to new construction. To maintain California's roadways requires having data on the materials used, the surface and subsurface stresses experienced, and conditions and traffic loads.

In 2005, to address the changes in materials and structures for constructing sustainable pavements, Caltrans, in partnership with the University of California Pavement Research Center (UCPRC), developed a mechanistic-empirical (ME) design method, a process that uses more detailed information to better assess the specific needs of each site. The ME pavement design methodology requires information about traffic loading, climate, material properties, and structural forces—data that has not been fully available in the past.

Many roads within the state system do not have adequate documentation of the pavement structure, especially roads assumed into the state system from counties and cities. In addition, with more roads to maintain, the state must budget resources wisely.To address budgetary allocations and provide the data needed for the ME pavement design method, Caltrans has begun implementing a new pavement management system called PaveM.

WHAT WAS OUR GOAL?

The goal of this multiphase project was to develop an improved pavement management system that provides pavement engineers the necessary data to support the ME pavement design method and allows for more efficient and improved building, preservation, and rehabilitation.

WHAT DID WE DO?

Caltrans, in partnership with the UCPRC, gathered the data necessary for developing a data model for the PaveM software. First, the researchers used ground-penetrating radar (GPR) to determine the pavement structure of state and interstate routes. Cost savings were achieved by analyzing only some of the lanes of a roadway, for instance, one side of a two-lane highway or only one or two lanes of a multilane freeway.

Caltrans also started an annual process of collecting surface distress data of all pavement in California using an automatic pavement condition survey (APCS) methodology. The Caltrans Distress Manual was updated with the help of UCPRC to determine the appropriate data to build models. The modifications were necessary because the newer collection methods and analysis tools require geometric information regarding distresses. The previous results do not allow for developing the performance modeling needed. The modified distresses also provide data used to improve the ME pavement design method.

The data was also checked for reasonableness and completeness via a software tool developed by UCPRC. To confirm the pavement type and thickness results, the researchers set up blind verification sections, which were extensively cored and measured with more accurate walking GPR and GPS tools and then compared. Questionable areas were further examined with follow-up sections to confirm the interpretation of the original data.The PaveM software was developed using the new distress data. Configuration details include developing the data model on which the system will operate, decision trees that define the appropriate strategies, defining the performance models, and eventually perform optimizations.

WHAT WAS THE OUTCOME?

The substructure pavement information gathered from GPR provides additional data not available in the past and contributes to more accurate performance modeling. For example, asphalt over a Portland cement base performs differently than asphalt over an aggregate base. This data also provides a means for segmenting the roadway network into structural categories so that pavement work can be better distributed over relatively homogeneous sections. In addition, engineers can use this substructure data to inform upcoming project designs.

Data from the automated distress survey has been scripted to feed directly into the PaveM software. The new survey also uses digital photos of the pavements, so districts with test sections can keep a history.

WHAT IS THE BENEFIT?

The automatic pavement condition survey has provided a wealth of pavement information. Previous manual walking surveys rated only a portion of the state's pavements, whereas the new survey covers 100%. The automated survey method offers an additional safety benefit, because it is performed in a vehicle at highway speeds, so personnel no longer have to walk along the roadway to gather information. Going forward, the methods adopted and the new software will continue to improve pavement preservation and maintenance as well as complement the ME design method, which is more accurate in assessing pavement needs.

IMAGES

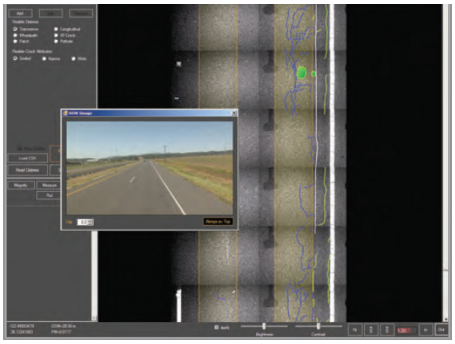

Figure 1: Crack map of a highway section