



INFRASTRUCTURE SUSTAINABILITY

Development of a Low-temperature Cracking Analysis and Design Tool: Visual LTC
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RESEARCH

Low-temperature cracking of hot-mix asphalt (HMA) pavements continues to be a leading cause of pavement failure in regions of cold climate and/or where significant thermal cycling occurs.

Asphalt pavements undergo contraction due to the decrease in temperature, which leads to build-up of stresses in transverse direction. When the stresses exceed the material capacity, cracks develop in the pavement. Cracks allow for infiltration of water and create structural weaknesses that eventually lead to formation of potholes and complete pavement failure.

Recent advances in fracture testing and modeling of hot-mix asphalt (HMA) materials have greatly aided in the understanding of the reason behind this important cause of pavement failure. These new modeling technologies allow for the design of more reliable, more sustainable pavement systems.

There is a need to implement these models into a standalone program which can be readily utilized by researchers and practitioners to analyze/design pavements that are susceptible to low-temperature cracking.

For this project, researchers developed a graphical user interface (GUI) to help design pavements that are more resistant to low-temperature cracking. This program is now available to practitioners and researchers, and utilizes the existing thermal-cracking analysis model (TCModel).

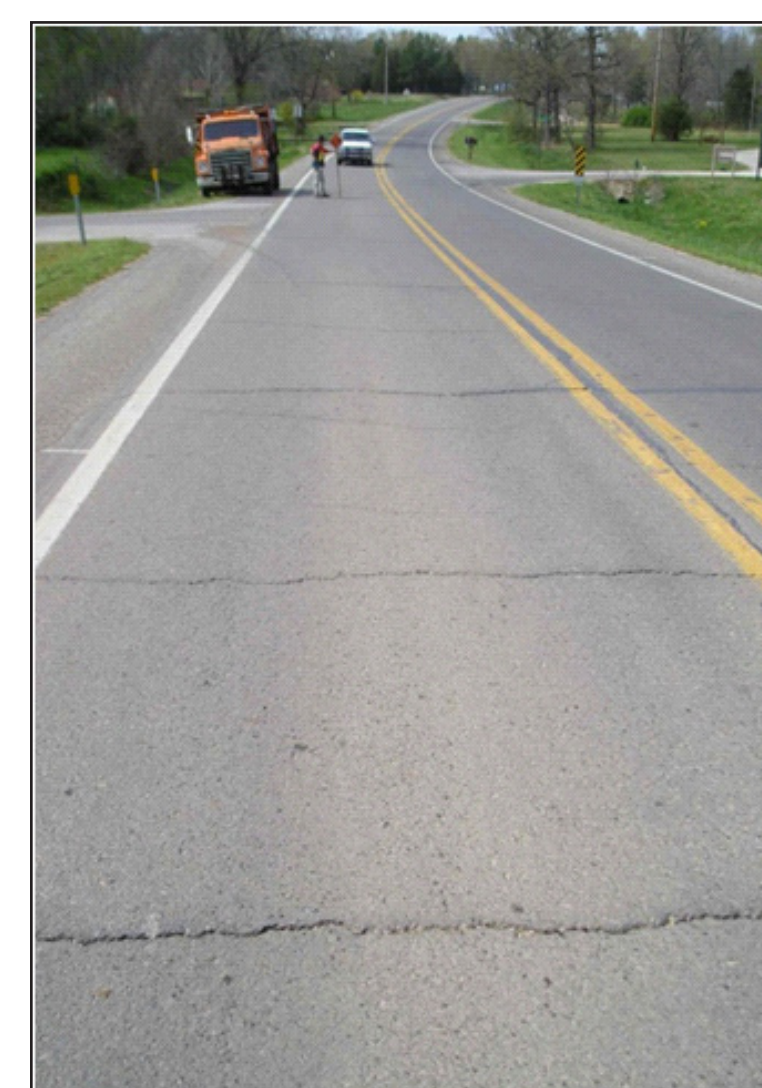


Figure 1: Typical examples of low-temperature cracking

SIGNIFICANCE

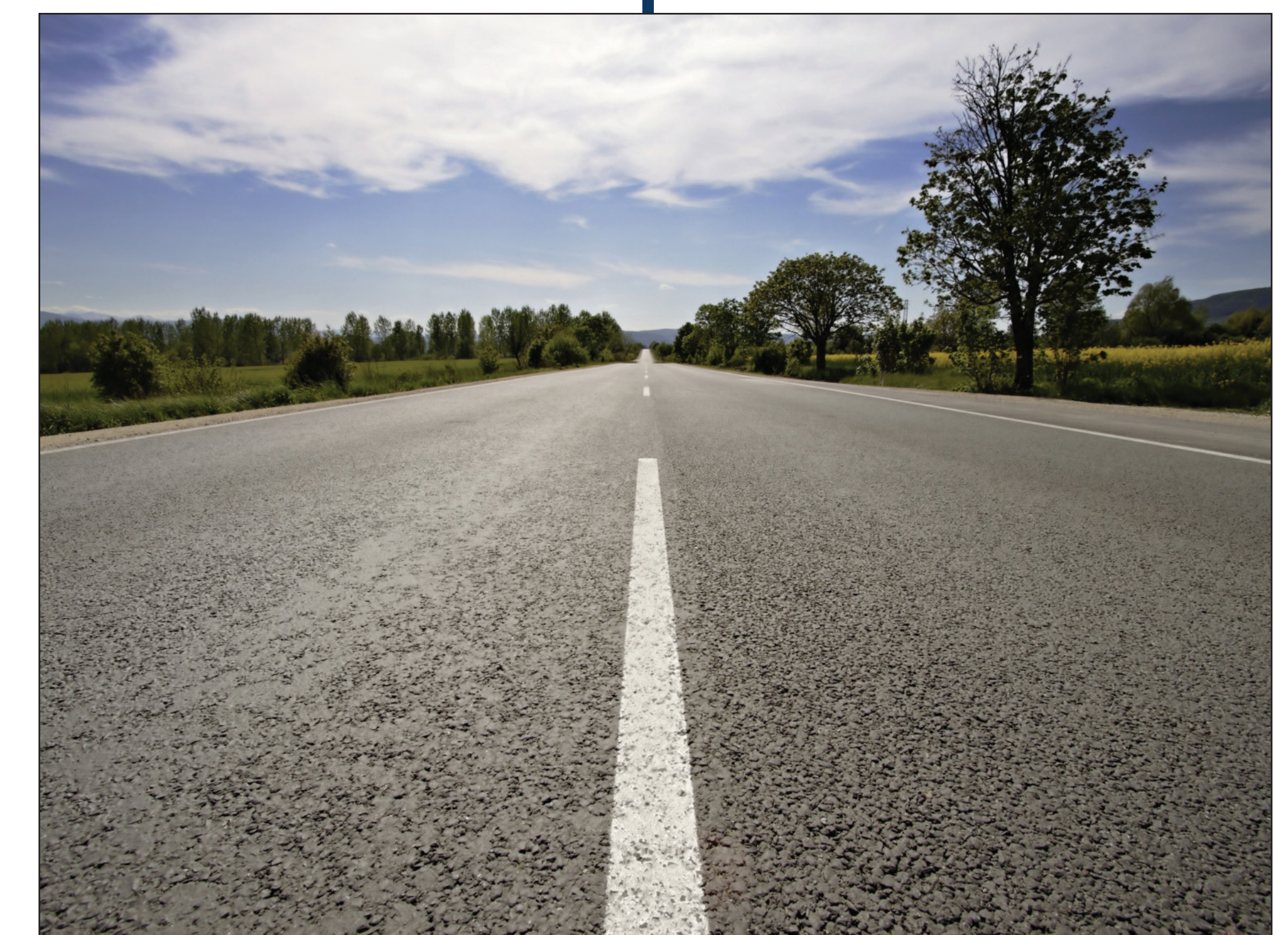
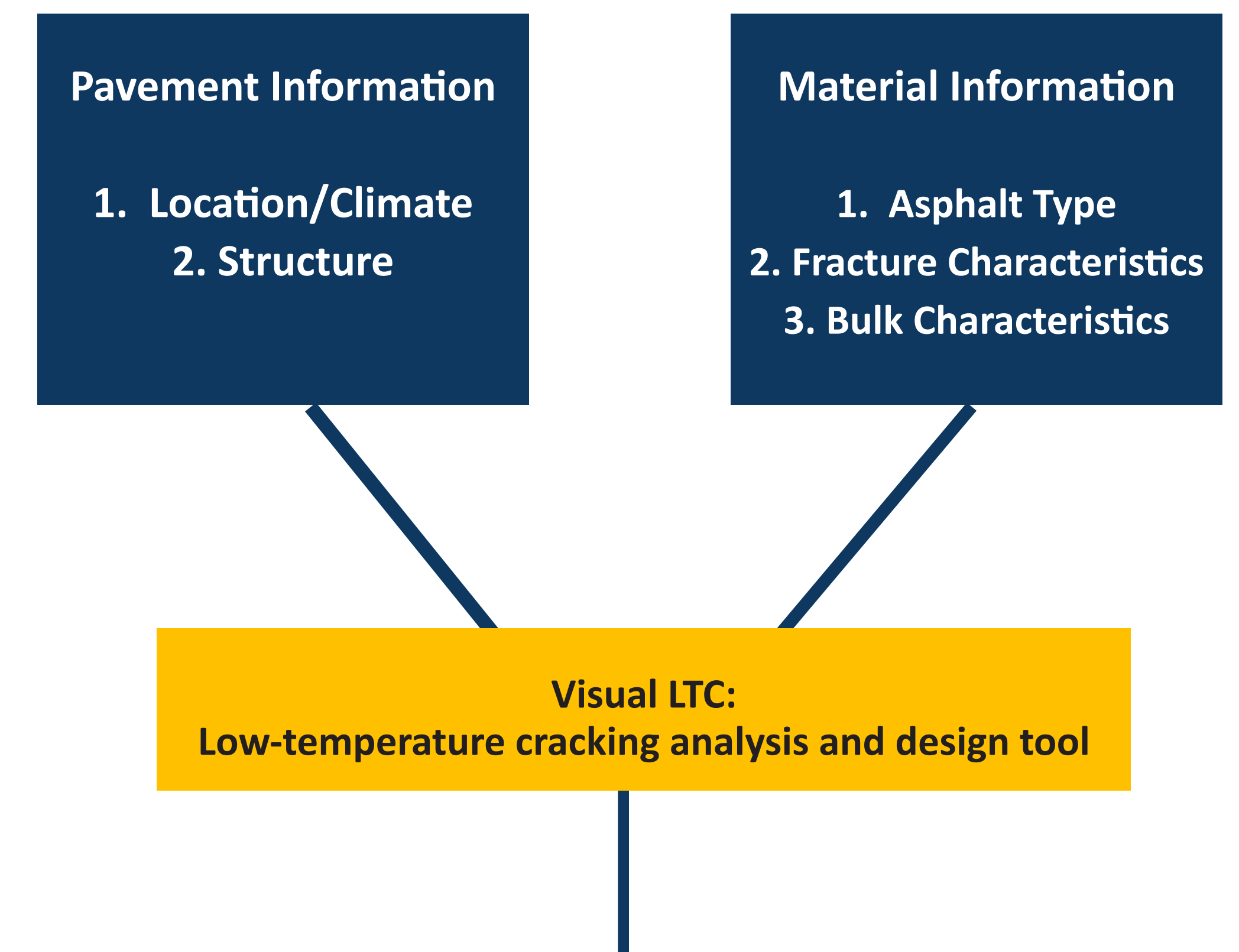
A graphical user interface (GUI) plays an important role in the process of pavement design. Lack of a GUI not only makes the design procedure extremely laborious, but introduces a greater probability of user error. Another key feature of the GUI is that it allows users to develop a library of material properties and pavement structures that can be quickly recalled during the design process, thereby increasing productivity and eliminating repetitive data input steps.

With access to Visual LTC, pavement engineers now have capability to design pavements with greater reliability against low temperature cracking. Thus, pavement engineers can reduce cost of maintenance and repair and increase comfort and safety to the public.

OUTCOMES

A user-friendly graphical user interface (GUI) called Visual LTC was developed, which provides practitioners with unparalleled access to highly advanced pavement prediction models (e.g., TCMODEL and in the future, the new program being developed in the National Pooled Fund study on Low Temperature Cracking).

Currently, a finite-element based-analysis engine is under development (Pooled Fund LTC Model), which will greatly increase the reliability of GUI predictions by using sophisticated computer models to accurately represent cracking in HMA.



Sustainable Pavement System Design

Figure 2: Project Outcome