SW-1 is used for highway pavement design.

The Development of SW-1: New Asphalt Institute

by John Duval, P.E.
Asphalt Institute Field Engineer

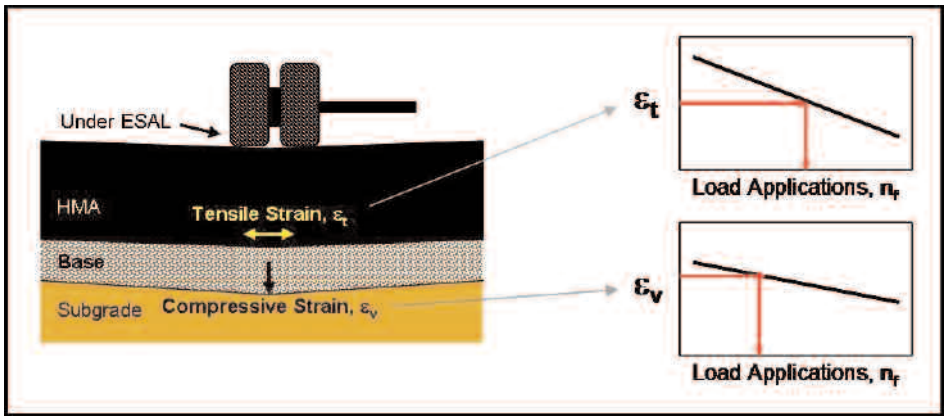
In 2001, the Asphalt Institute began to explore the idea of updating its computerized pavement design tools for highways, heavy wheel loads and airports. The DOS-based programs, HWY, HWLOAD, AIRPORT and the structural analysis tool DAMA, had long been respected among design professionals for ease and simplicity of use. But the programs were overdue for conversion to the Microsoft Windows® operating system to allow more accessibility to the current generation of pavement designers.

Originally, the development team was charged with simply converting the individual programs to Windows. Soon it became apparent that there was an opportunity to repackage the programs into a unified pavement design tool that could provide users with a much broader range of applications. The development team converted and integrated the procedures into a single, powerful and easy-to-use pavement design tool. *SW-1, Thickness Design Software*, as it is now known, was unveiled as the Asphalt Institute's primary thickness design tool in December 2004.

This article outlines some of the technical merits of the SW-1 system, including its foundation on mechanistic-empirical design principles, its broad range of capabilities and the power of the companion User's Guide.

Mechanistic-Empirical Design at its Core

The Asphalt Institute methods for pavement design are based on mechanistic-empirical (M-E) methods. As shown in the figure below, M-E design procedures consist of two parts: 1) calculating key stresses, strains and deflections in a loaded pavement structure, and 2) relating them to actual pavement performance.



AI's new SW-1, Thickness Design Software, is based on mechanistic-empirical design principles.

The developers of SW-1 harnessed the power of the M-E calculation engine to create specialized solutions for the most common applications, such as highways, roads, streets, parking lots, overlays, commercial and general aviation airports, ports and heavy industrial yards. For those users craving a bit more power, SW-1 offers the capability to perform Advanced Structural Analysis using the core M-E analysis engine.

Some of the advantages of the M-E-based design methods are the ability to easily characterize highway and street traffic using the common Equivalent Single Axle Load (ESAL). Airport and heavy wheel loads are characterized using single wheel loads or specific aircraft gear configurations. In the SW-1 design methods, the user is allowed to vary the climate by selecting the mean annual air temperature (MAAT). Users can characterize subgrade strength through the use of resilient modulus (M_r), California Bearing Ratio (CBR) and R-Value. SW-1 provides elegant M-E design solutions based on common engineering design inputs. The result is a powerful, yet practical, pavement design tool that everyone can use.

Broad Capabilities in an Integrated Design

SW-1 offers engineers a single point of reference for asphalt thickness design and analysis. Whether the project entails the design of a multilane interstate highway, a commercial airport, a container handling yard or an automobile parking lot, SW-1 provides a solution. The broad combination of capabilities in SW-1 allows an engineer to design an airport runway pavement one day and use the

SW-1 can be used to design heavy wheel load facilities.

Thickness Design Software

same familiar tool to design a city street pavement the next.

Users can switch quickly between design projects on SW-1's main screen. Known as the Project Definition tab, this is where users define a new project, open an existing project or save a new file upon starting the program. With a few simple clicks of the mouse, users can set up a project, e.g. a new highway pavement or an overlay for an airport runway. Once the project is defined, SW-1 prompts the user to input the required data on a sequence of screens. Once the input data is entered, the final step is to click on the Results tab.

User's Guide

Successful software programs are usually accompanied by complete documentation. SW-1 is no exception. The development team wrote the 108-page User's Guide to serve as a companion to the program during installation and operation. The first three chapters of the User's Guide describe step-by-step instructions for installing and conducting basic operations of the software, such as creating and organizing data files and project records, defining projects, viewing results and printing reports.

Chapter 4 discusses how climate is characterized using the MAAT. Chapter 5 provides details on entering subgrade information using M_r, CBR, or R-Value. Chapters 6-11 cover each of the primary pavement design methods: General Aviation Airports, Air Carrier Airports, Highways/Roads/Streets, Overlay Design, Planned Staged Construction and Heavy Wheel Load Applications. Each of these six chapters includes a discussion of the method and at least one example to further assist users in applying the software to their own projects.

The final chapter, Chapter 12, includes a discussion and an example of how to conduct Advanced Structural Analysis using the SW-1 core M-E calculation engine DAMA. Users will find that each example comes pre-loaded in the SW-1 software, making the User's Guide a powerful tool for getting the most out of the program. Download a FREE 30-day trial version of *SW-1, Thickness Design Software,* today at *www.asphaltinstitute.org.*