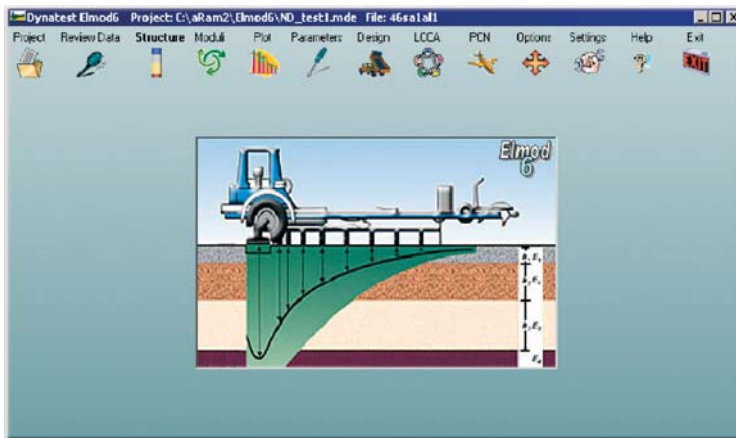# Elmod® 6

ELMOD® is an acronym for Evaluation of Layer Moduli and Overlay Design.

Many current methods of pavement evaluation and rehabilitation design rely almost exclusively on empirical relationships. Since empirical rules are difficult to generalize across a wide range of pavement types, loading and local environmental conditions, a primary goal for the **Dynatest® methodology** has been to reduce the reliance on empirical approaches.

Instead, pavements can be analysed like most other civil engineering structures, ie, through the use of calculated and allowable stresses and strains at critical points within the pavement structure, under load, the relationships between allowable stresses and strains, and pavement distress, remains essentially empirical. The calculation of existing stresses and strains within the pavement structure can be accomplished through an analytical or mechanistic approach.

The Elmod® 6 Core module has now been expanded to include a design sub-module for the design of new pavements and rehabilitations for existing pavements based on any number of existing layers.

Elmod® 6 has been redesign to make things simpler and more user friendly

- Operates in a Windows 7®, Windows Vista®, XP® and 2000
- The menus have been restructured to be more logical having icon and click free navigation
- The user interfaces have been redesign with greater functionality with graphical interfaces to assist with inputs and modifications of modeling.
- Utilises up to 15 geophones.
- Batch processes FWD/HWD data files.
- Can utilize point related structure information, like output from GPR testing and analysis.

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Elmod® 6 forms the core module of the Dynatest® suite of analytical programs including:

The FEM / LET / MET module, LCCA module and PCN module

To assist with Analysis and Design

The **Structure** window allows the engineer to enter the complete pavement structure, including materials, and to view the pavement sections graphically. GPR data is handled automatically to provide section definitions.

- The Parameter Setup has been redesigned to be more logical.
- Criteria can be selected from a pre-defined list.
- Criterias, temperature correction function and seasonal variations can be viewed graphically.
- The setup of design loads is easier and more flexible.
- Better guidance regarding temperature used for modulus correction.
- Calculation of moduli at reference conditions, and to view these in Plots.
- All traffic related information has moved to design window.
- Possibility to do design based on existing unbound layers or subgrade.
- Possibility to do design of new structure & option for using Monte Carlo Simulation.
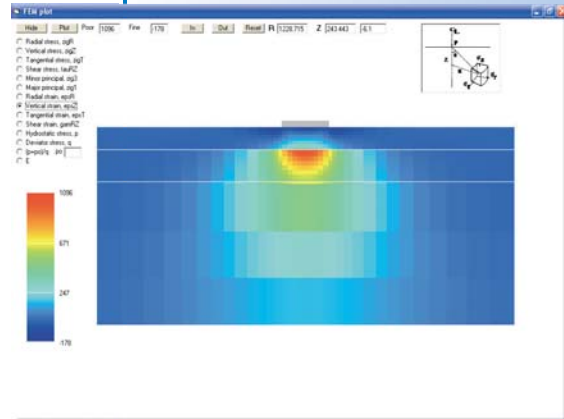- Possibility to create batch reports for all files in a project.

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The Optional Modules

Three modules can be included with Elmod® 6. They can be accessed through the Elmod interface and function as fully integrated parts of Elmod®.

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FEM / LET / MET module

The FEM (Finite Element Module) makes use of an axial symmetric finite element program. The LET (Linear Elastic Theory) option makes use of the Waterways Experiment Station's program (WESLEA), and MET is similar to the method used in ELMOD with improved adjustment factors.

The program can be used to manually change the layer moduli (or other parameters) and compare the effect on the deflections. An automatic fitting of measured and calculated basins may also be done, either on a point-by-point basis or for all points in the FWD file. With FEM all of the layers may be treated as non-linear elastic, and with MET the subgrade may be non-linear. Both LET and MET may determine the depth to bedrock. The program may also be used to calculate the critical stresses and strains at the layer interfaces.
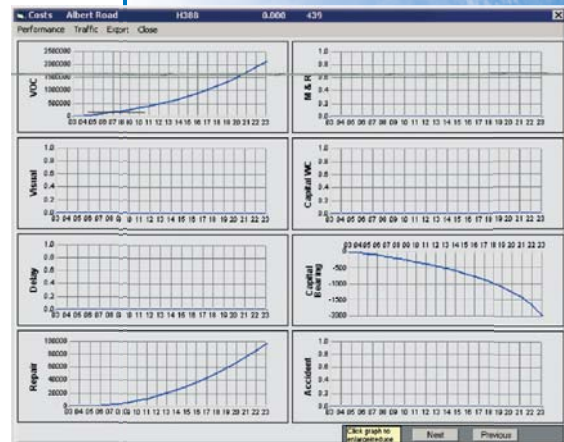
LCCA module

The LCCA (Life Cycle Cost Analysis) module allows the user to select the optimum rehabilitation and maintenance solution for the pavement section. The main inputs are the backcalculation results from Elmod® 6 and a user defined choice of rehabilitation solutions.

The program performs a life cycle cost analysis for each maintenance option, and arranges the solutions according to cost/benefit ratios.

LCCA makes use of incremental-recursive analysis methods that are similar to the approach of the proposed AASHTO 2002 design guide.

Other performance data like roughness, rut depth, friction and visual surveys may be included in the modeling.

The performance models and cost models are user adjustable and calibrated to specific conditions.

PCN module

PCN (Pavement Classification Number) is an optional module that uses the data files from Dynatest FWD/HWD equipment to calculate ACN/PCN values based on the methods used by ICAO and FAA. The program includes a database of over one hundred and twenty-five aircraft.

The results of the Elmod Backcalculation process are used to calculate the PCN value.

Parameters defining material properties, unrestricted traffic etc. are all user controllable.

Elmod® 6 forms the core module of the Dynatest® suite of analytical programs.

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