CIRCLY 5

MINCAD Systems

An Overview…

CIRCLY- Powerful and user-friendly

- CIRCLY 5.0 is a major step forward in pavement design:
  - a fully integrated system with superior design power and ease of use

the best of the old and the new...

- CIRCLY 5.0 draws on the proven technology of earlier versions of CIRCLY software [used on thousands of pavement designs over 20 years]
- Our system introduces a number of powerful new features:
  - enormous input data flexibility
  - extensive data-base saving re-entry of frequently used data
  - new parameters easily defined

all important design inputs:

TRAFFIC

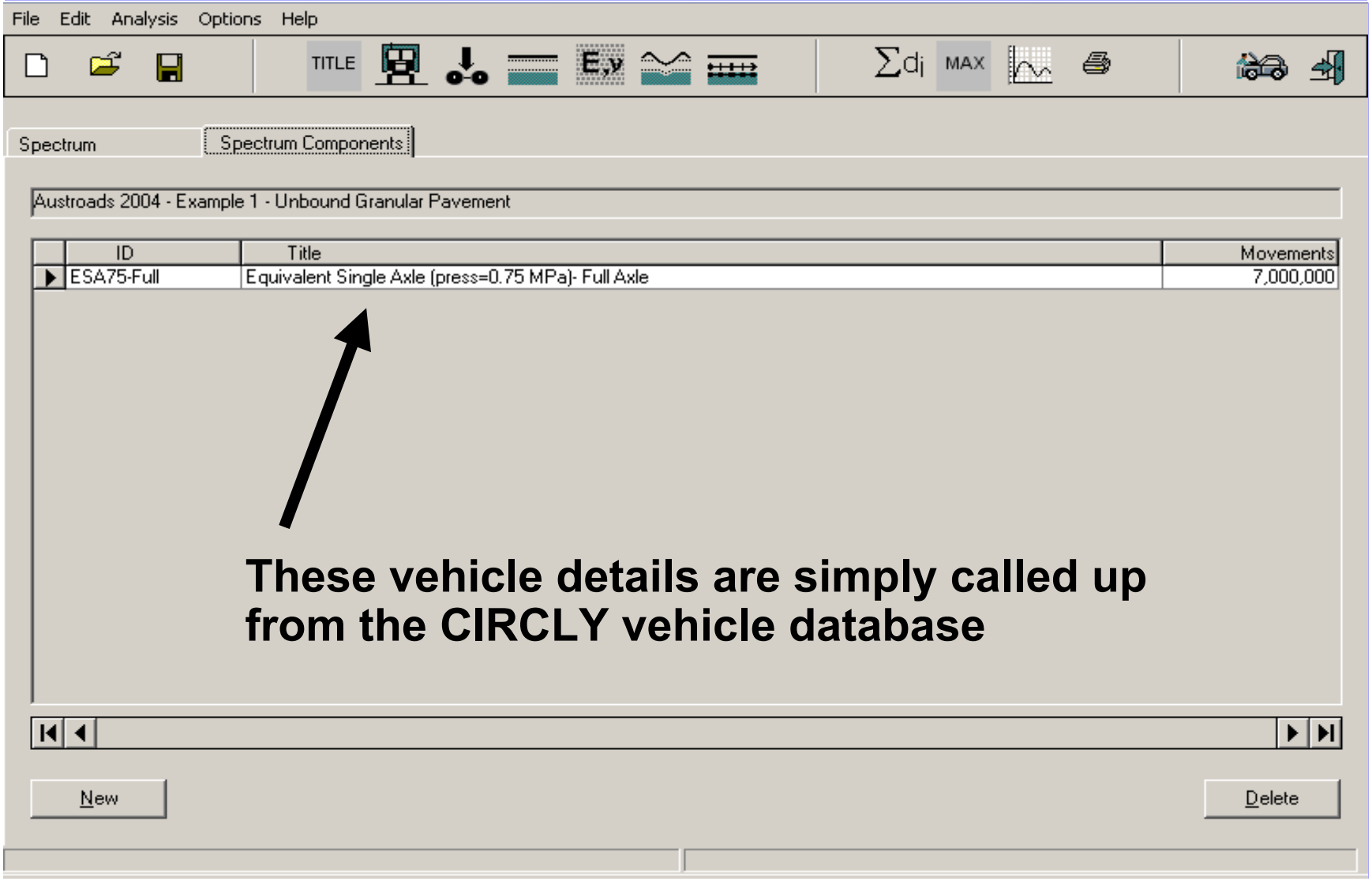
- any combination of vehicle types or load configurations
- any wheel layout
- braking or vertical loads
- varying contact stress distributions

MATERIALS

- any damage model
- isotropic or anisotropic

Any traffic spectrum can be analysed…

A typical input screen: The traffic details



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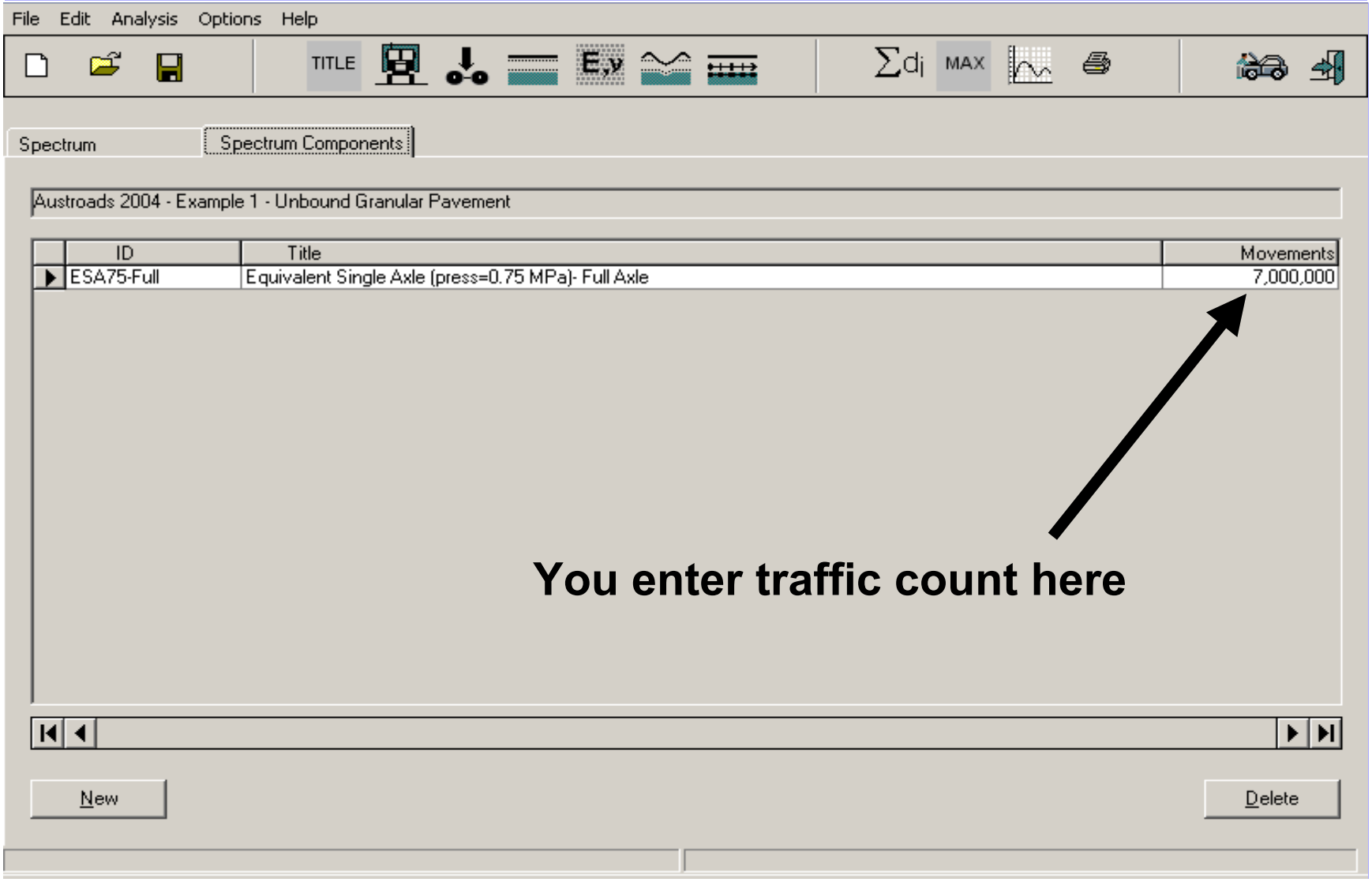

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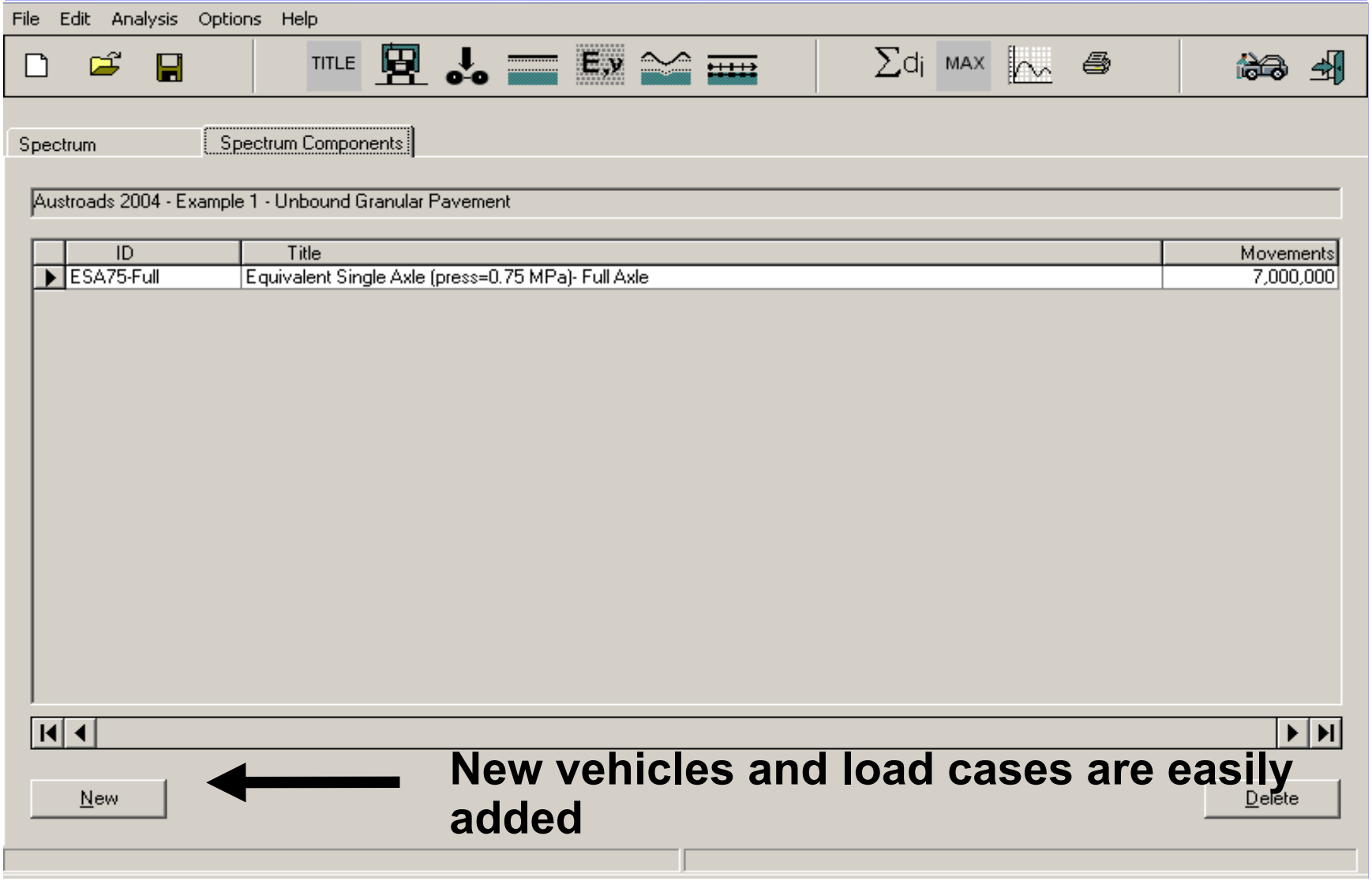
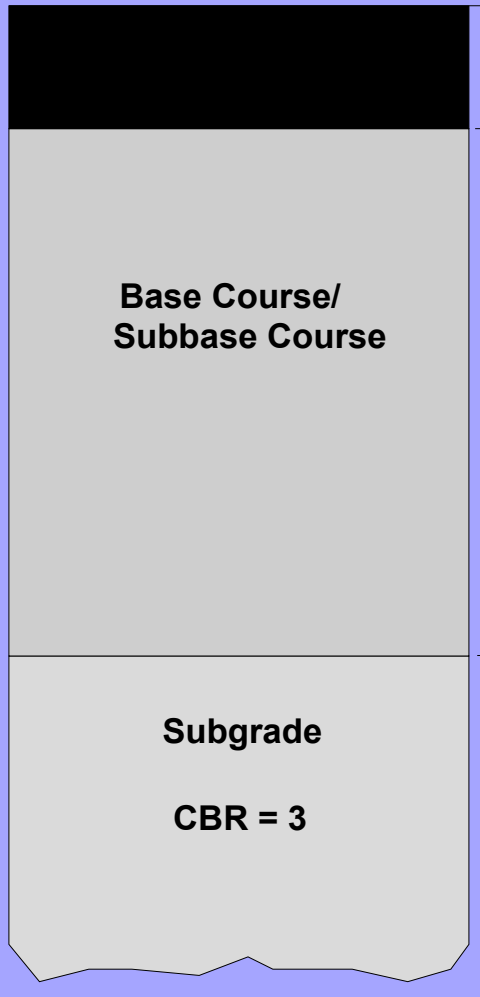


The pavement system...

CIRCLY realistically models pavement response:

- any combination of layer thicknesses and elastic properties
- state of the art damage indicators

Typical layered pavement model



	Thickness (mm)	Modulus (MPa)	Poisson's Ratio
	200	2800	0.4
Base Course/ Subbase Course	110	600	0.35
	150	600	0.35
	150	480	0.35
	150	240	0.35
	150	120	0.35
	150	60	0.35
Subgrade CBR = 3	Infinite	30	0.45

✓ anisotropic properties can be used

How damage models are defined

- A damage model relates pavement life to an indicator of damage such as subgrade compressive strain, etc.
- The models are of the form:

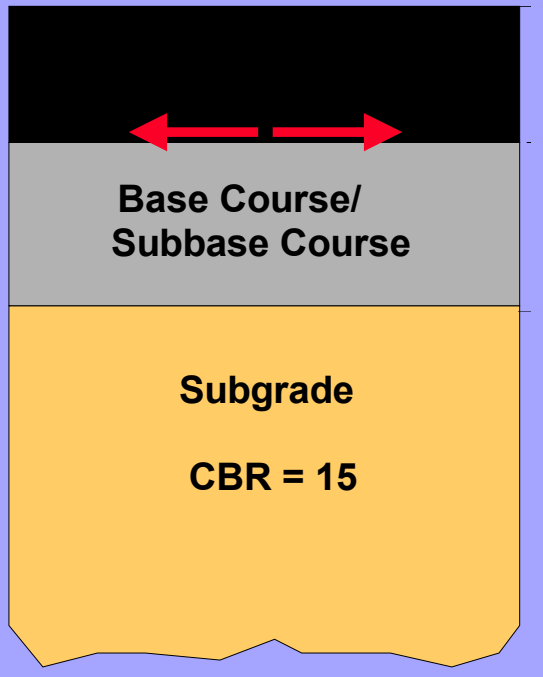
$$N = \left(\frac{k}{\varepsilon} \right)^{b}$$

where N is the predicted life
(repetitions to failure)
k is a material constant
b is the damage exponent
ε is the induced strain

You can choose damage indicators

Example:

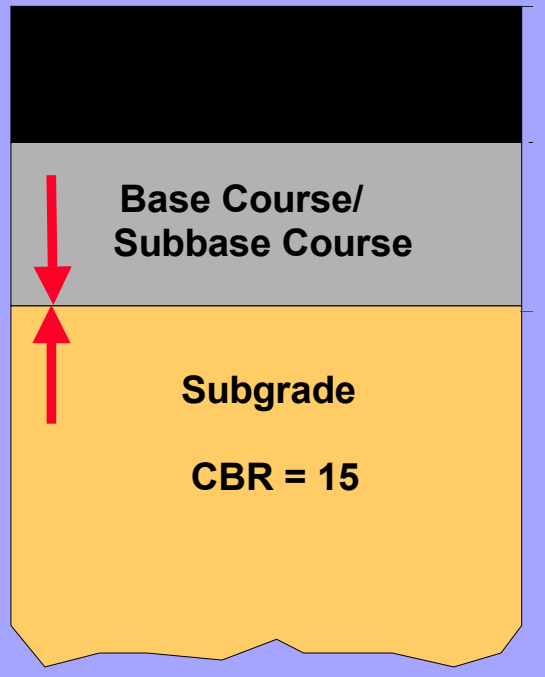
Tensile strain



You can choose damage indicators

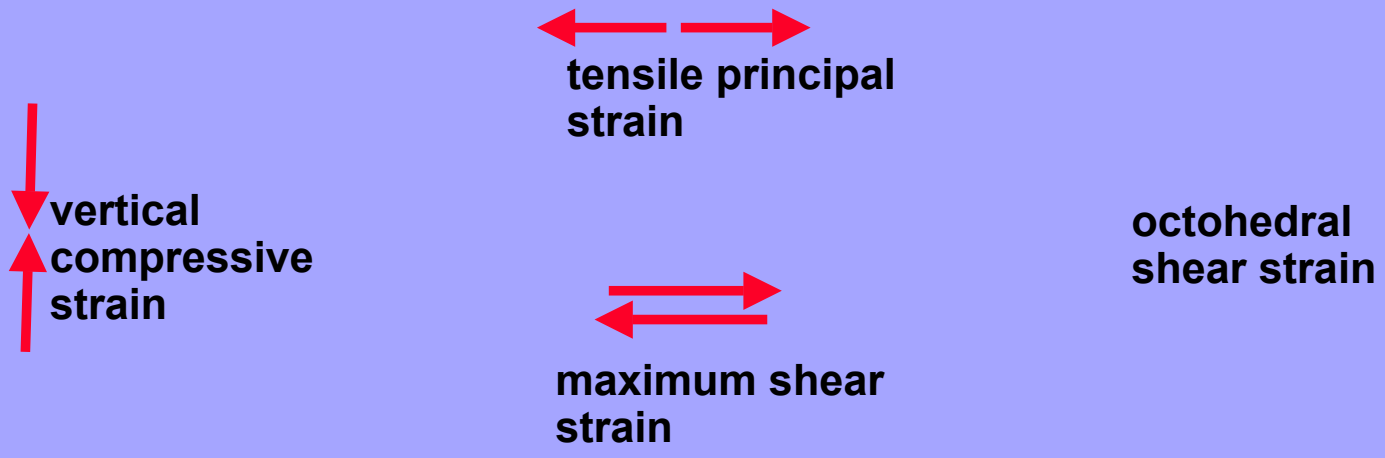
Example:

Vertical strain



CIRCLY handles all damage models

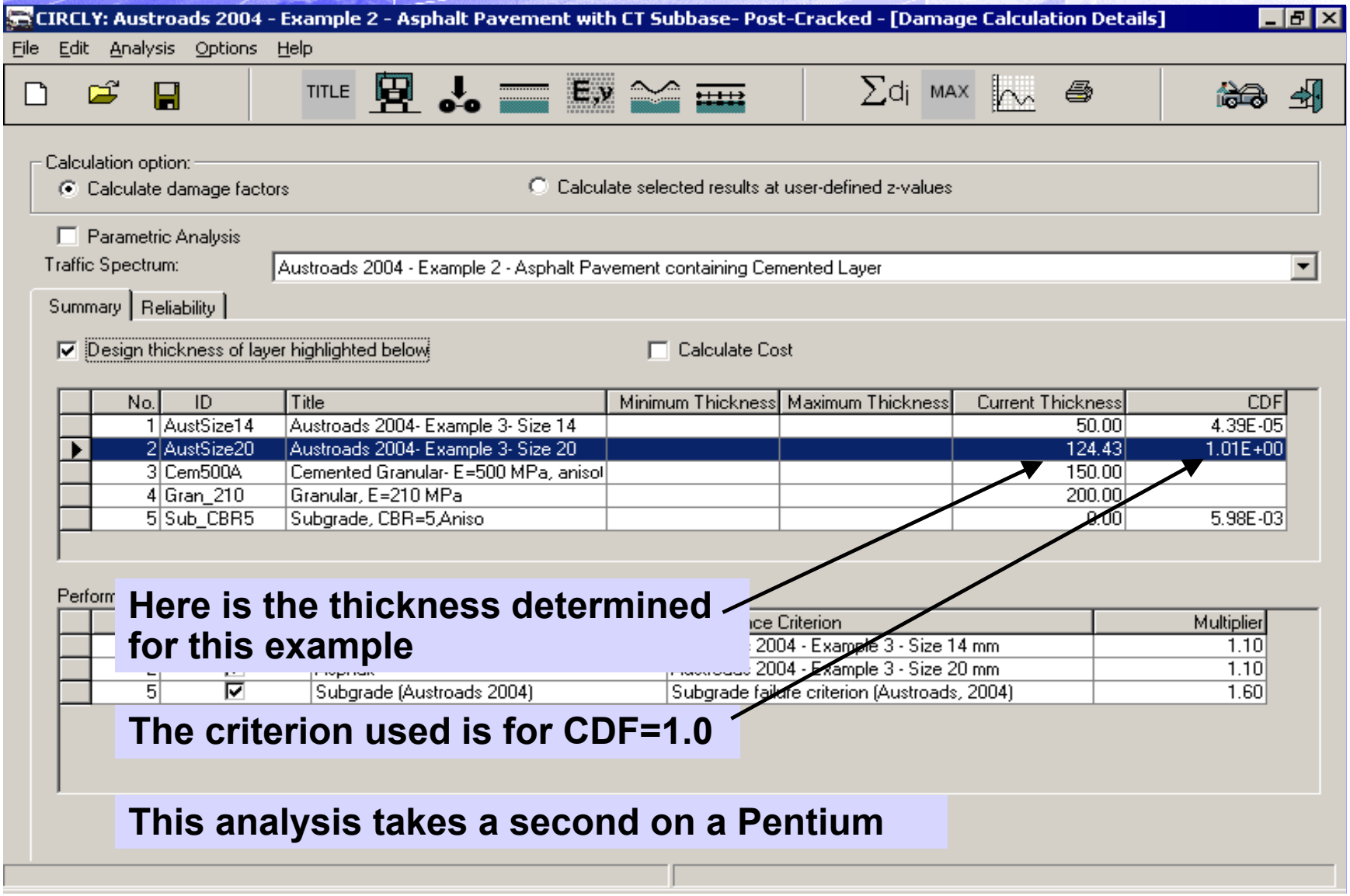
- you can define new models
- models can use any deflection, strain or stress component, e.g.:



CIRCLY gives *fast* results:

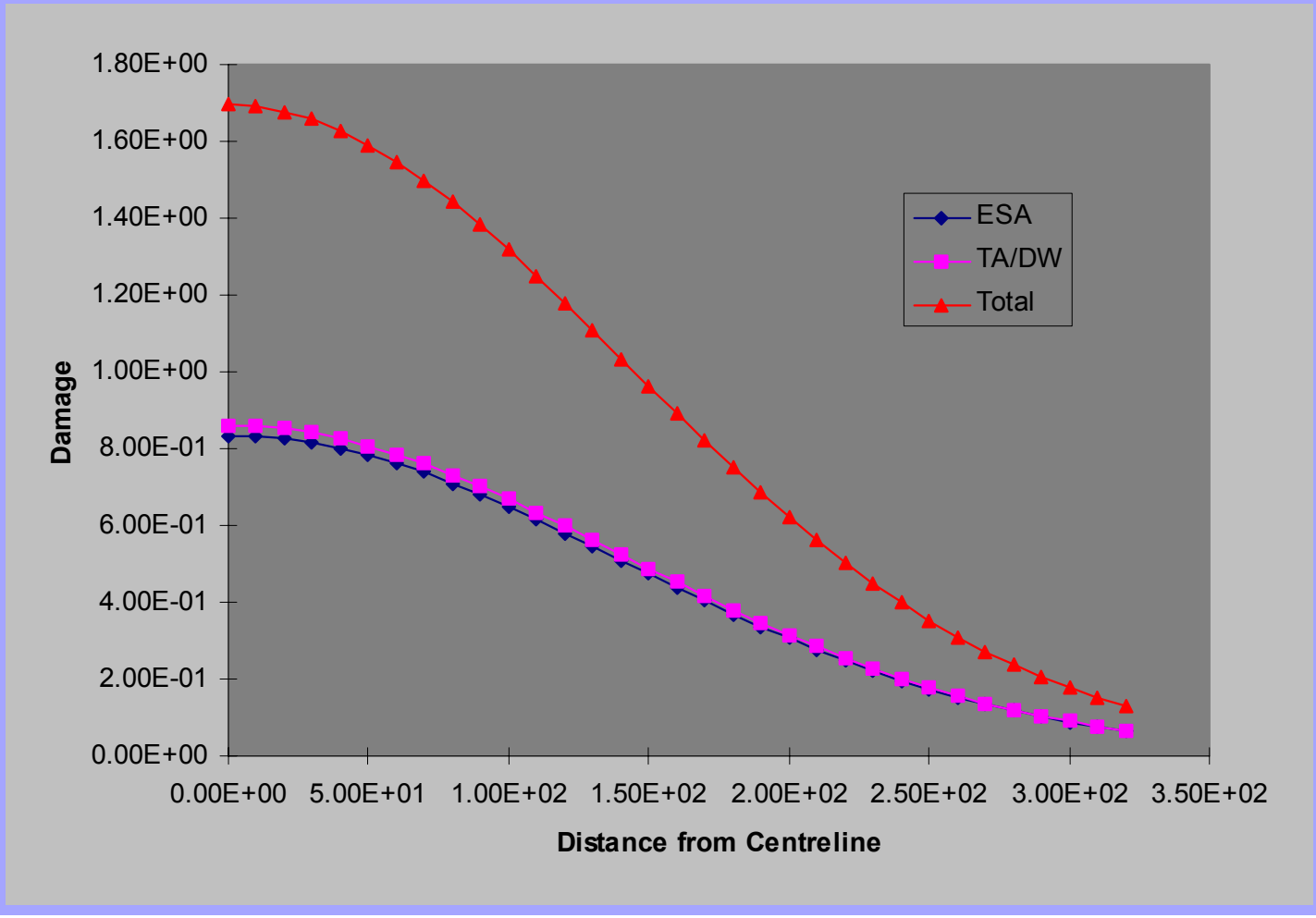
- Once parameters are defined, typical runs take only seconds on Pentium PCs
- Even the most complex combinations of vehicles and the most complicated pavement structures take seconds, not hours!

Automatic Thickness Design



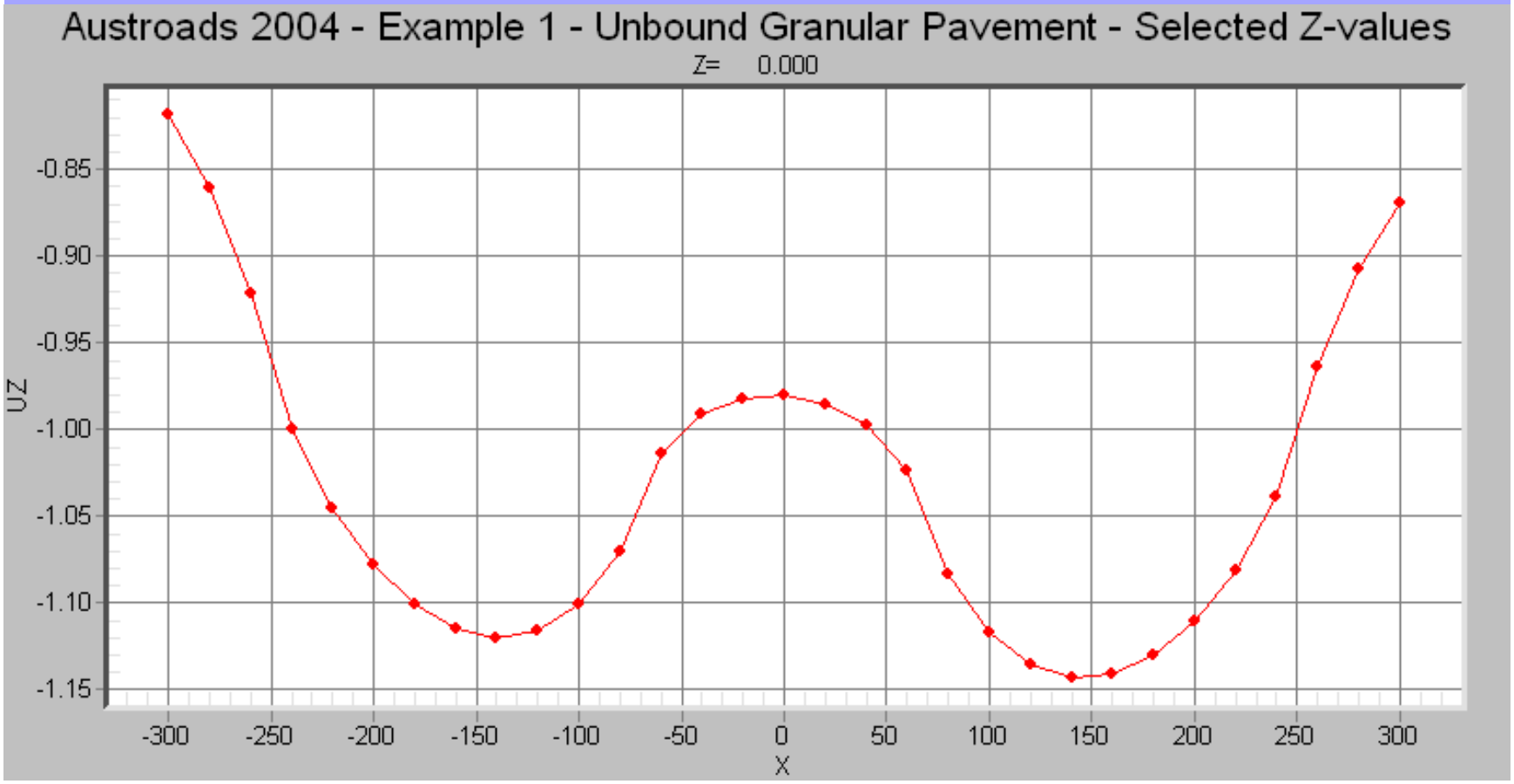
Results presentation

high quality plots can be output on any printer



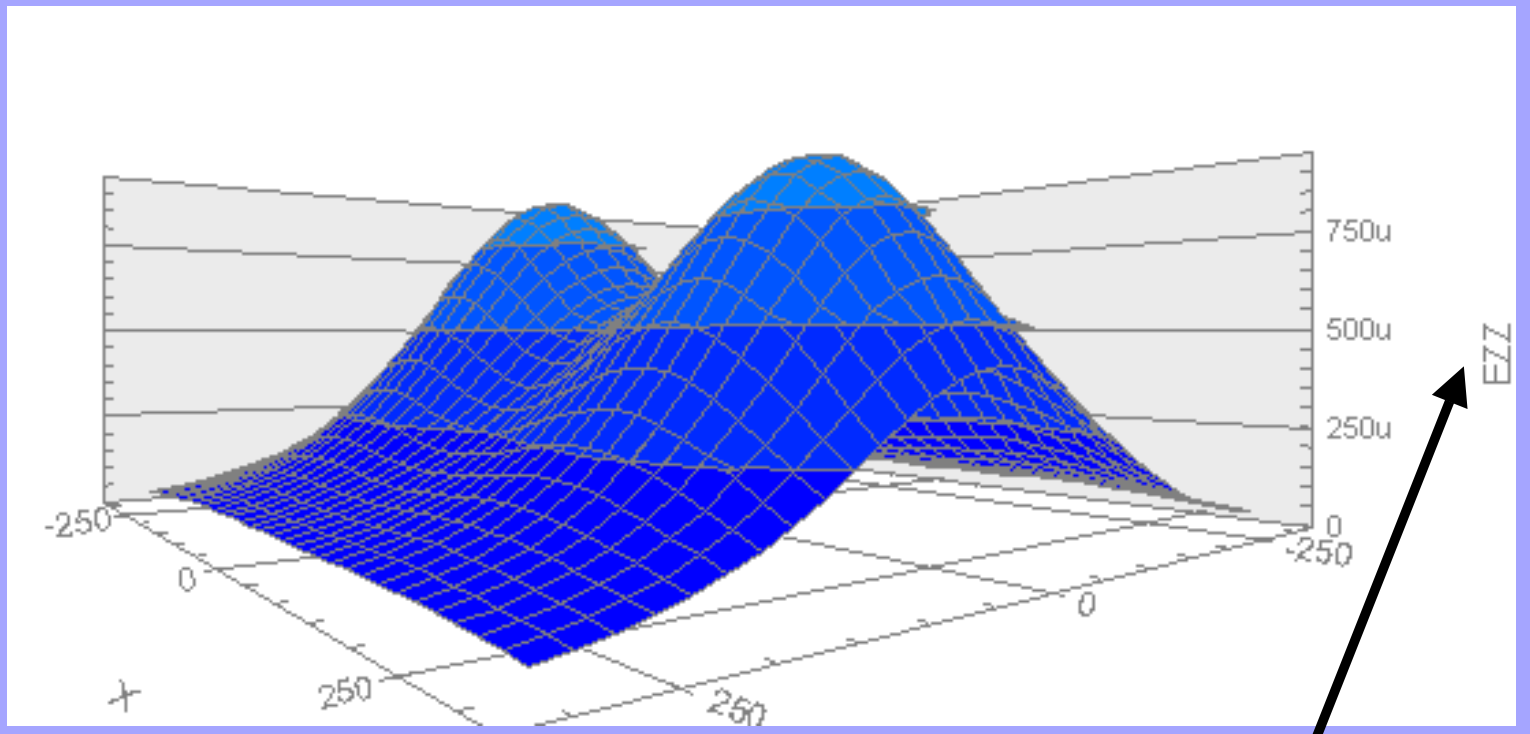
Results presentation

any deflection, strain or stress component,
e.g. surface displacements



Results presentation

any deflection, strain or stress component,
e.g. strain pulse under dual wheels

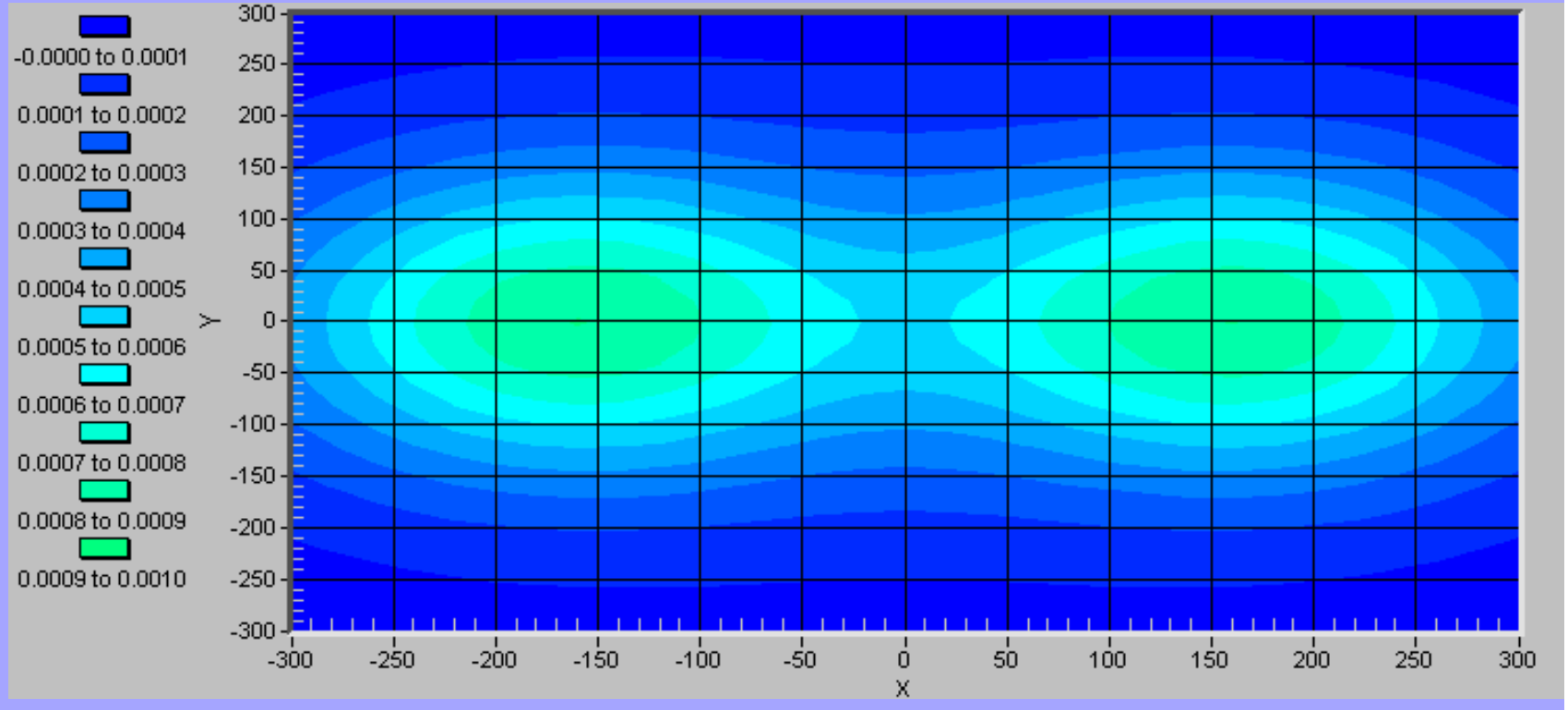


Vertical strain

Results presentation

any deflection, strain or stress component, e.g. strain pulse under dual wheels

Vertical strain



New features in CIRCLY 5.0…

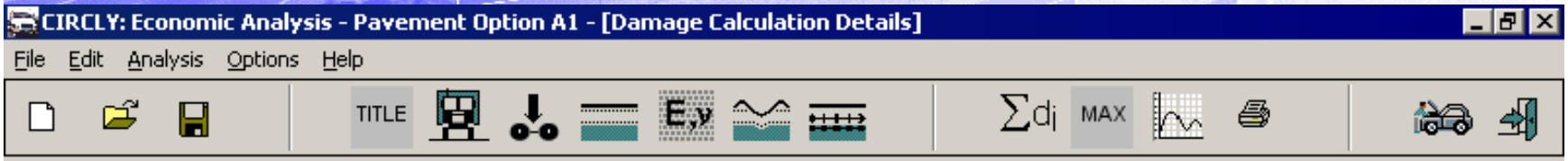
New features in CIRCLY 5.0…

- Full Support for *Austroads 2004 Pavement Design Guide*
- Cost Calculation
- Parametric Analysis – for cost optimisation
- *Fast* Built-in Graphics Engine

Support for *Austroads 2004 Guide*

- Project Reliability
- New Sub-Layering Method for Unbound Granular Materials
- Select Fill Subgrade Materials
- Example Jobs

Cost Calculation



Calculation option:

(•) Calculate damage factors ( ) Calculate selected results at user-defined z-values

Total Cost

[ ] Parametric Analysis

Traffic Spectrum: 10^7 ESAs

Summary | Reliability

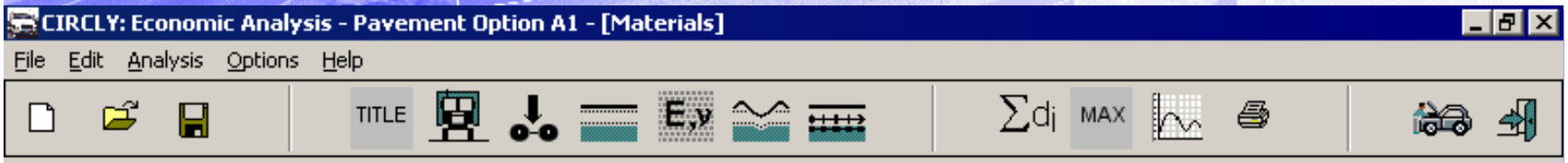
[ ] Design thickness of layer highlighted below [✓] Calculate Cost Total Cost: $57.44/m2

No.	ID	Title	Current Thickness	CDF
1	14H-40	Size 14 Type H - 40km/h	40.00	1.10E-30
2	20T-40	Size 20 Type T - 40km/h	50.00	7.37E-03
3	20R-40	Size 20 Type R - 40km/h	65.00	9.67E-01
4	Cem500	Cemented Granular- E=500 MPa, Isotro	150.00	
5	SubCBR3A	Subgrade,CBR3,Aniso	0.00	1.11E-01

Performance Criteria and Traffic multipliers:

No.	Material Type	Performance Criterion	Multiplier
1	Asphalt	Size 14 Type H - 40km/h	1.10
2	Asphalt	Size 20 Type T - 40km/h	1.10
3	Asphalt	Size 20 Type R - 40km/h	1.10
5	Subgrade (Austroads 1992)	Subgrade failure criterion (Austroads, 1992)	1.10

Cost Calculation



Entry of Unit Material Costs

Elastic Materials | Performance | Costs | Material Types

Asphalt

ID	Title	Cost/Volume [$/m3]	Cost/Weight [$/tonne]	Weight/Volume [tonne/m3]	Cost/Area [$/m2]
14H-40	Size 14 Type H - 40km/h		$115.00	2.50	$0.00
20R-40	Size 20 Type R - 40km/h		$125.00	2.50	$0.00
20T-40	Size 20 Type T - 40km/h		$115.00	2.50	$0.00
Asph2000	Asphalt- 2000MPa	$240.00			$0.00
Asph2800	Asphalt- 2800MPa	$240.00			$0.00
Asph3000	Asphalt- 3000 MPa, VB=11%	$240.00			$0.00
Asphalt	Asphalt- 1400 MPa	$240.00			$0.00
AustSize14	Austroads 2004- Example 3- Size 14				
AustSize20	Austroads 2004- Example 3- Size 20				

Automatic Parametric Analysis

- Automatically loop through one or two thickness ranges
- Simultaneously design the thickness of another layer
- Lets you fine-tune layer thicknesses to minimize construction and maintenance costs

Cost Optimization Example

Thickness		Unit Cost
T_1 = 40 mm	Asphalt: Size 14, Type H	\$288 / m^3
T_2 = ?	Asphalt: Size 20, Type T	\$288 / m^3
T_3 = ?	Crushed Rock: 20 mm , Class 4	\$50 / m^3
	Subgrade, CBR = 3	

Cost Optimization Example

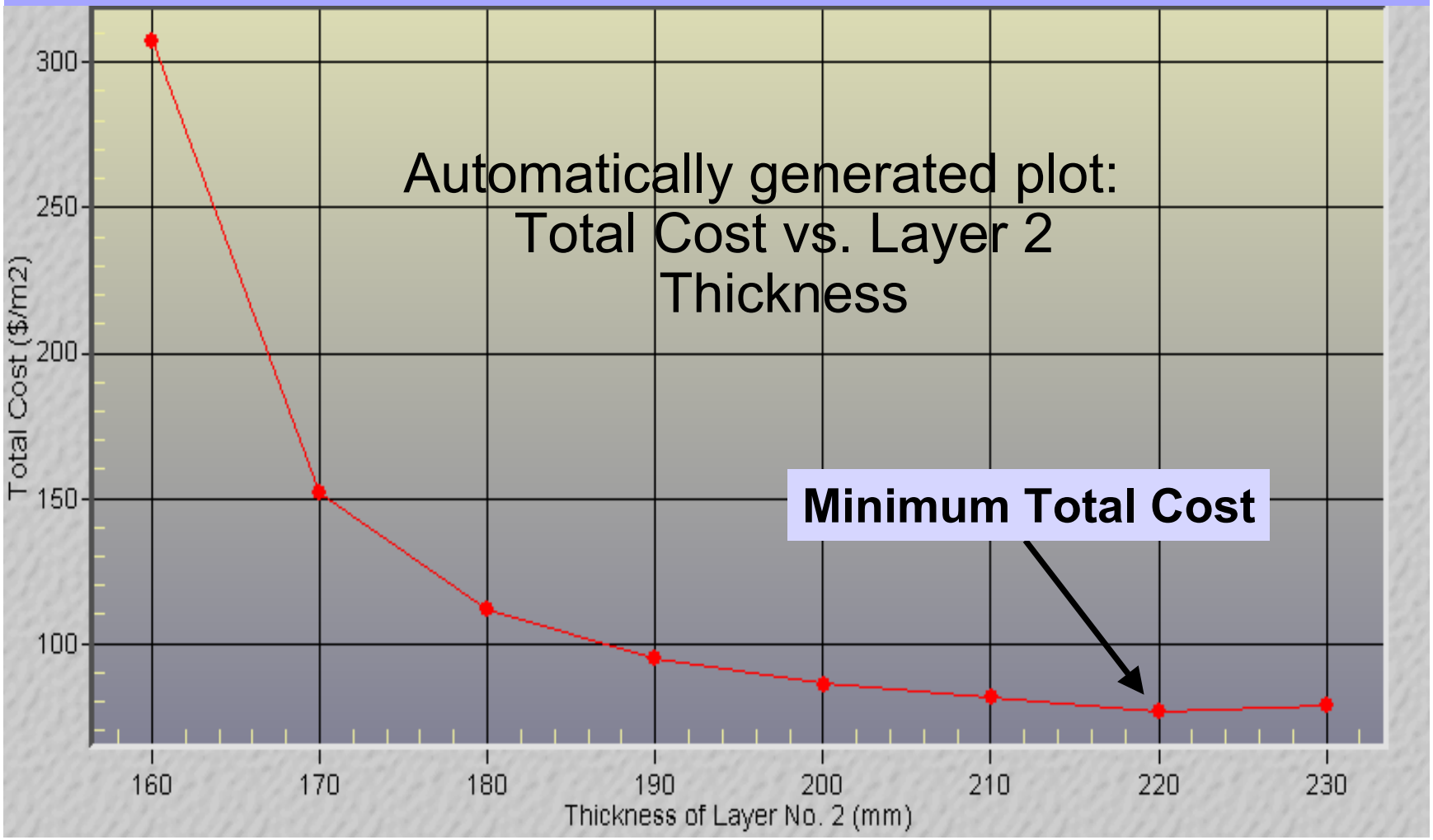
Summary of Results

Layer 2 Thickness	Layer 3 Thickness	Max. CDF	Total Cost ($/m^2)
170	1826	1.0	151.7
180	973	1.0	112.0
190	573	1.0	94.8
200	343	1.0	86.2
210	189	1.0	81.4
220	100 (min.)	0.89	79.9

Minimum Cost

Cost Optimization Example

How it works….



In summary.....

A complete design system.....

- models actual traffic spectrum
- models all design vehicle loads
- uses multi-layered pavement
- predicts pavement life with user-defined state-of-the-art damage models

CIRCLY - easy to use.....

- complete integrated system
- runs on IBM-compatible PCs
- rapid analysis
- ready-to-use databases for vehicle loading, pavement composition and damage models
- new parameters easily defined
- quality hard copies of results on any printer or plotter

Technical Support

- Comprehensive 86 page User Manual includes worked examples
- Users are notified of updates
- Latest version can be downloaded from website

CIRCLY 5

MINCAD Systems

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