Phase² 8.0 is an extremely versatile 2D elasto-plastic finite element stress analysis program for designing underground or surface excavations and their support systems. Phase² 8.0 can be used for rock or soil applications and includes finite element slope stability and groundwater seepage analysis.

Modeling
Phase² 8.0 provides material models for rock and soil including Mohr-Coulomb, Generalized Hoek-Brown and Cam-Clay. Complex multi-stage excavations can be easily created and edited using state-of-the-art CAD tools. Groundwater pore pressure can be determined using steady state finite element seepage analysis — flows, pressures and gradients are calculated based on user defined hydraulic boundary conditions.

Support Design
Phase² 8.0 offers a wide range of support modeling options. Bolt types include end anchored, fully bonded, cable bolts, split sets and grouted tiebacks. Liner elements can be applied in the modeling of shotcrete, concrete, steel set systems, retaining walls, piles, multi-layer composite liners, geotextiles and more. New liner design tools include support capacity plots which allow you to determine the safety factor of reinforced liners.

FE Slope Stability
One of the major features of Phase² is finite element slope stability analysis using the shear strength reduction method. This option is fully automated and can be used with either Mohr-Coulomb or Hoek-Brown strength parameters. The analysis parameters can be customized if required. Slope models can be imported from Slide and computed in Phase² allowing easy comparison of limit equilibrium and finite element results.
**Modeling**
- interactive geometry entry
- boundaries – external, material, excavation, stage, joint, piezo, structural interface
- grid/vertex/object snapping
- sequential staging of excavation and support (up to 300 stages)
- plane strain or axisymmetric analysis
- one-click material assignment
- import/export in DXF format
- unlimited undo/redo
- right-click editing shortcuts

**Support**
- staged support installation
- bolt types – end anchored, fully bonded, cable bolts, Swellex, split-set, tiebacks
- liner types – beam, reinforced concrete, geotextile, cable truss
- composite liners
- reinforcement database
- Timoshenko or Bernoulli beam models
- staged liner properties
- elastic or non-linear
- peak/residual strength
- interactive support capacity plots (thrust/moment, thrust/shear) for reinforced concrete liners

**Far-field Stress**
- constant stress field
- gravity stress field
- multiple stress fields (customize per material)
- load split per stage or material

**Loads**
- constant or linear distributed loads
- concentrated load
- seismic load
- ponded water load
- staged loading
- springs

**Joints**
- elastic or non-linear
- Mohr-Coulomb, Barton-Bandis or Hyperbolic slip criterion
- natural or artificial joints
- pressurized joints
- staged joint properties
- statistical modeling of joint networks

**Groundwater**
- finite element seepage analysis
- staged groundwater
- material permeability functions
- discharge sections
- piezometric lines
- pore pressure grids
- include pore pressure for effective stress analysis

**Finite Element Slope Stability**
- automated FE slope stability using shear strength reduction method
- import/export Slide models

**Data Interpretation**
- view stress, displacement, strength factor contours
- effective stress, pore pressure contours
- contour user-defined data
- stress/failure trajectories, deformation vectors
- display deformations to user-defined scale
- query and graph material, support, joint data
- export to Excel
- show values directly on model
- highlight yielded material, support, joint elements
- add iso-contours
- data tips for any object
- ubiquitous joints
- annotation and dimensioning tool kit
- save display options, drawings, annotations
- export image/movie files

**Probabilistic Analysis**
- Rosenblueth point estimate method
- random variables - materials, joint properties, field stress
- contour / error plots of statistical output

**Price & Licensing**

Phase² 8.0 is sold as a single license, which is purchased outright, for $4995 USD ($4995 CDN).

Flexible Licenses are also available; they are sold as a yearly subscription, with price based on the number of concurrent users. Please contact: software@rocscience.com for more information.

www.rocscience.com