

# RS<sup>3</sup> 1.0

## 3D Finite Element Analysis for Rock and Soil

**RS<sup>3</sup> 1.0 is a 3D finite element stress analysis program for designing underground or surface excavations and support systems. This new program can be used for soil or rock applications and includes 3D finite element groundwater seepage analysis.**

### Modeling

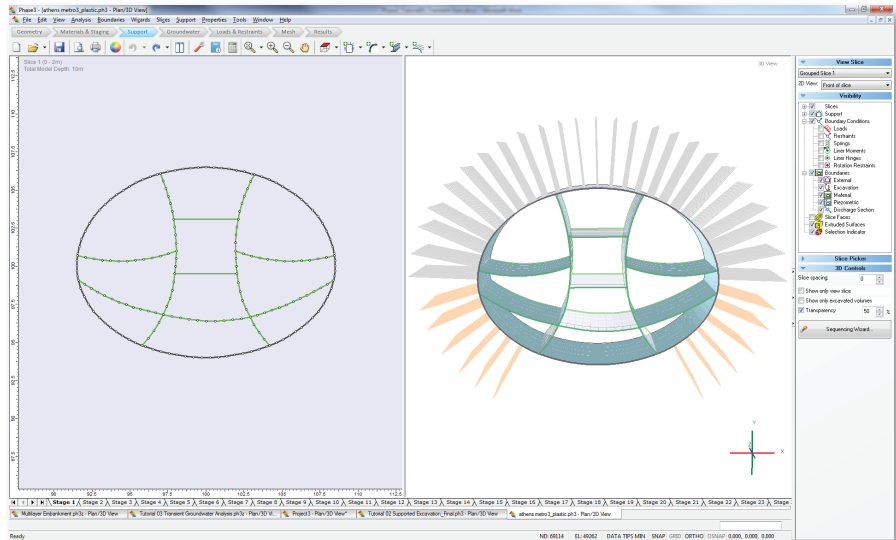
This is a brand new program for 3D stress analysis of excavations in soil or rock. Boundaries are defined in a 2D view and used to create a sequence of 3D slices. Complex multi-stage excavations can be quickly defined and edited using the sequencing wizard. Horizontal or vertical excavations can be modeled (e.g. tunnels, caverns, foundations). Boundary conditions, support and loading can be easily edited and customized.

### Support Design

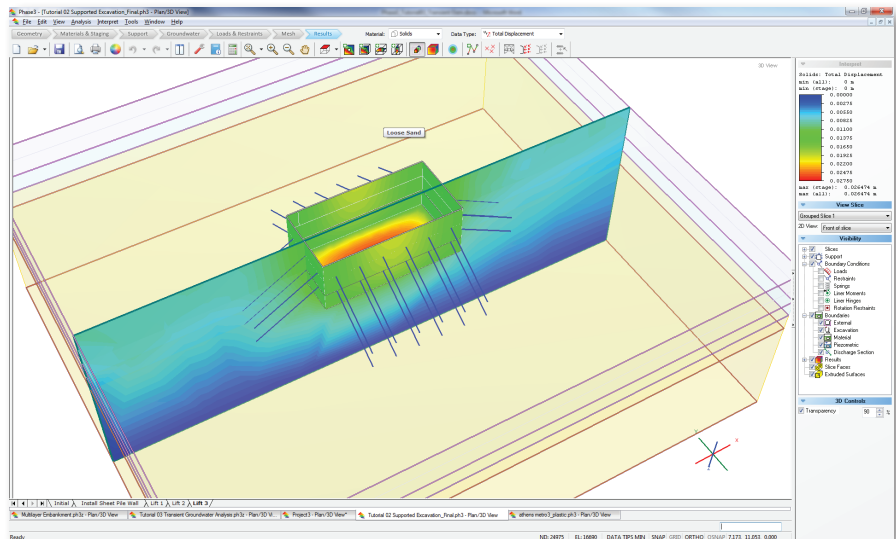
The program offers a comprehensive range of support design options, including bolts, liners, beams, piles and forepoles. Bolt types include end anchored, fully bonded, cable bolts, split sets and grouted tiebacks. Liners can be used to model shotcrete or concrete support, including multi-layer composite liners with sliding interface elements. Beams can be used to model steel sets or truss elements. Piles or forepoles can be used for retaining walls, foundation and tunnel support.

### Groundwater

Groundwater pore pressure can be determined using steady state or transient finite element seepage analysis – flows, pressures and gradients are calculated based on user defined hydraulic boundary conditions. The program offers fully coupled stress / pore pressure analysis based on Biot Theory. You can also choose uncoupled analysis or use the groundwater seepage as a standalone module independent of the stress analysis.



Three dimensional staged excavation of metro subway tunnel. Support system consists of staged installation of both temporary and permanent shotcrete and concrete liners and grouted cable bolts.



Surface excavation for building foundation supported by sheet pile walls and tiebacks. Multi layer soil profile. Displacement contours on vertical plane and on excavation boundary.

### Modeling

- horizontal excavation mode (e.g. tunnels, caverns)
- vertical excavation mode (e.g. foundations, mine plans)
- define boundaries in 2D view
- create 3D model from 2D extruded sections
- sequencing wizard for staged excavation and support
- multiple excavations
- interactive geometry entry
- vertex / object snapping
- one-click material assignment
- import / export DXF
- import from Phase2
- undo / redo
- right-click editing shortcuts
- interactive sidebar

### Meshing

- 3D tetrahedral mesh
- 4-noded or 10-noded elements
- one-click mesh generation
- graded meshing
- custom meshing
- check / define mesh quality

### Materials

- soil or rock
- elastic or plastic
- multiple materials
- Mohr-Coulomb, Generalized Hoek-Brown, Cam-Clay, Duncan-Chang material models
- staged material properties
- datum dependent properties
- isotropic, transversely isotropic, orthotropic elastic models
- import from RocLab / RocData

### Groundwater

- 3D finite element seepage analysis
- steady state or transient
- staged groundwater
- material permeability functions
- discharge sections
- piezometric lines
- pore pressure grids
- coupled/uncoupled analysis

### Support

- bolts
- liners
- beams
- forepoles / piles
- staged support installation
- bolt types – end anchored, fully bonded, cable bolts, Swellex, split-set, tiebacks
- composite liners with interface elements
- elastic or plastic
- peak / residual strength

### Compute

- parallel 64 bit processing
- fully optimized
- direct or iterative solver
- coupled stress/pore pressure using Biot theory

### Far-field Stress

- constant stress field
- gravity stress field
- stress field per material

### Loads

- point load
- line load
- distributed load
- ponded water load
- staged loading
- springs

### Data Interpretation

- 2D / 3D view
- plot contours on horizontal, vertical or arbitrary planes
- plot contours on boundaries
- view stress, displacement contours
- effective stress, pore pressure contours
- contour user-defined data
- deformation vectors
- groundwater discharge vectors
- display deformations to user-defined scale
- query and graph material, support data
- show values directly on model
- highlight yielded material and support elements
- display isosurfaces
- data tips for any object
- annotation and dimensioning tool kit
- transparency
- rotate, pan, zoom
- customize / save view options
- export to Excel
- export image files

### Price & Licensing

RS<sup>3</sup> 1.0 is sold at the prices listed below.

**Personal License** (no USB key)  
\$7995 USD (\$7995 CAD)

**Portable License** (Uses USB key)  
\$9995 USD (\$9995 CAD)

**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](mailto:software@rocscience.com) for more information.

[www.rocscience.com](http://www.rocscience.com)