

# RS<sup>2</sup> (Phase<sup>2</sup> 9.0)

Excavation & Support Design Software

**RS<sup>2</sup> (Phase<sup>2</sup> 9.0) is an extremely versatile 2D finite element stress analysis program for designing underground or surface excavations and their support systems. RS<sup>2</sup> (Phase<sup>2</sup> 9.0) can be used for rock or soil applications and includes slope stability analysis, fully-coupled groundwater and dynamic analysis capabilities.**

## Modeling

RS<sup>2</sup> (Phase<sup>2</sup> 9.0) provides new material models for rock and soil including Anisotropic, Mohr-Coulomb with Cap, and Softening/Hardening. Groundwater pore pressure can be determined using steady state or transient finite element seepage analyses. For consolidation analysis, RS<sup>2</sup> (Phase<sup>2</sup> 9.0) also comes with fully-coupled fluid/solid analysis based on Biot Theory.

## Support Design

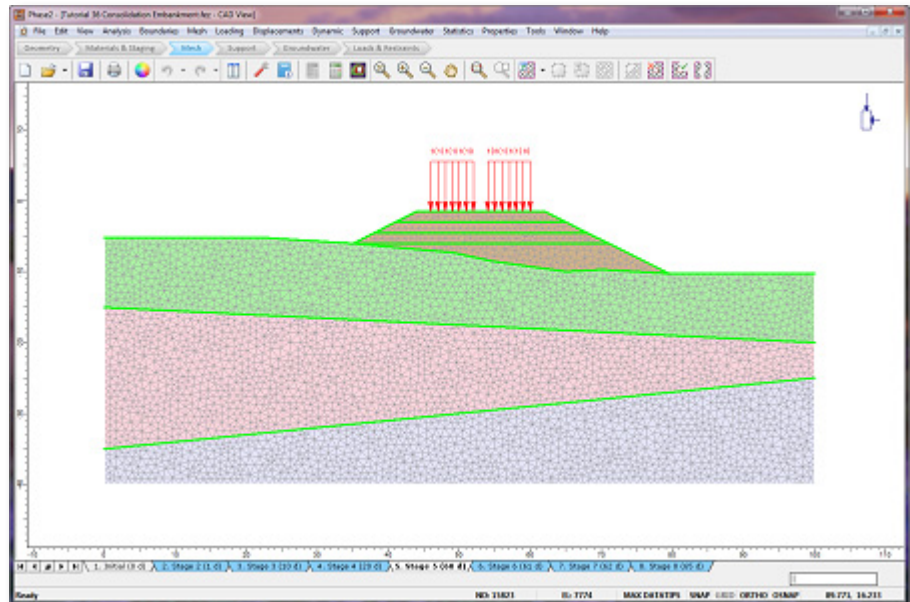
RS<sup>2</sup> (Phase<sup>2</sup> 9.0) offers a wide range of support modeling options, including a variety of bolts and liners. Liners can be used to model retaining walls, piles, geotextiles, steel set systems, and much more. Support-capacity envelopes can be generated based on the following codes: CSA A23.3, ACI 318-11, EC2 EN1992-1.

## Slope Stability Analysis

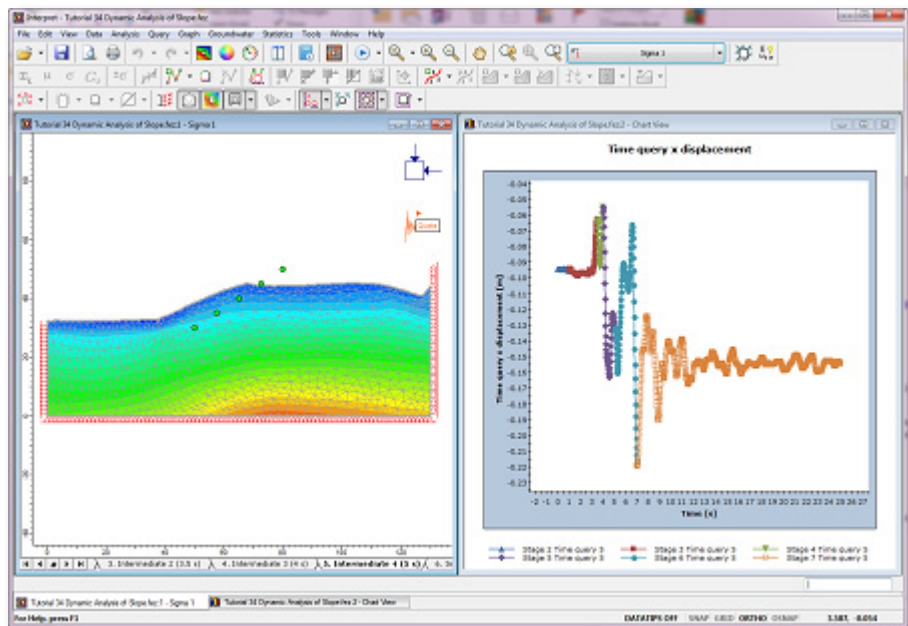
The shear strength reduction method is fully automated and can be used with either Mohr-Coulomb or Generalized Hoek-Brown strength parameters. Slope models can be imported from Slide and computed in RS<sup>2</sup> (Phase<sup>2</sup> 9.0).

## Dynamic Analysis

In RS<sup>2</sup> (Phase<sup>2</sup> 9.0), the dynamic analysis option can be used to examine earthquake, blast, and machine loading scenarios. Dynamic boundary conditions allow the user to absorb incoming pressure and shear waves, transmit motion into the model, and insert user-defined dashpot dampers and nodal masses.



Consolidation analysis of embankment under variable load.



Dynamic modeling - earthquake analysis results: Deformed mesh and Sigma1 contours and time-query Horizontal Displacement vs Time results

### Modeling

- interactive geometry entry
- intuitive workflow tabs
- 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
- Tunnel Wizard

### Elements & Meshing

- triangular or quadrilateral finite elements
- 3 or 6-noded triangles
- 4 or 8-noded quadrilaterals
- one-click mesh generation
- graded, uniform or radial meshing
- mapped meshing
- custom meshing
- check/define mesh quality
- easily apply boundary conditions

### Materials

- elastic or non-linear
- strength criteria – Mohr-Coulomb, Generalized Hoek-Brown, Cam-Clay, Modified Cam-Clay, Drucker-Prager, discrete function, anisotropic, Mohr-Coulomb with Cap, Softening/Hardening
- staged material properties
- datum dependent properties
- isotropic, transversely isotropic, orthotropic elastic models
- import from RocData

### Groundwater

- finite element steady state or transient seepage analysis
- staged groundwater
- material permeability functions
- discharge sections
- piezometric lines

- pore pressure grids
- fully-coupled consolidation
- include pore pressure for effective stress analysis

### 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 (includes CSA, ACI, EC2 codes)

### 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
- dynamic

### Joints

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

### Probabilistic Analysis

- Monte Carlo, Latin Hypercube, Point Estimate methods
- random variables - materials, joint properties, field stress
- contour / error plots of statistical output

### 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

### Price & Licensing

#### Personal License (no USB)

\$4995 USD

#### Flexible\* License (no USB)

\$7995 USD

\*add \$200 USD for USB

RS<sup>2</sup> (Phase<sup>2</sup> 9.0) is part of our Maintenance Subscription plan (15% annual fee). Please contact [software@rocscience.com](mailto:software@rocscience.com) for more information.

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