

What's New in GeoStudio 2007

GeoStudio 2007 is an integrated tool for running GEO-SLOPE's leading suite of geotechnical modeling software products: **SLOPE/W**, **SEEP/W**, **SIGMA/W**, **QUAKE/W**, **TEMP/W**, **CTAN/W**, **AIR/W** and **VADOSE/W**. It will run on Microsoft Windows 2000, XP, or Vista.

This document describes the significant benefits of the GeoStudio environment, as well as the engineering enhancements made to each product since the 2004 (version 6) release. The new features are based on extensive feedback from our software users. We are also introducing AIR/W as a new product in the GeoStudio suite. We hope that using GeoStudio 2007 will increase the types of problems you can analyze and make it easier to model geotechnical problems on a routine basis.

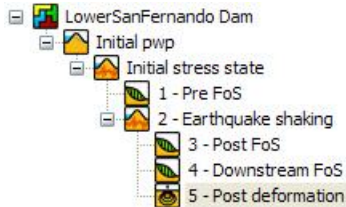
Enhancements to all GeoStudio 2007 Products

Product Integration: Multiple Analyses

Multiple analyses of similar or different types can be done in a single project file. Different solutions can be compared in the same file.

Staged Analyses

Staged analyses can be done for construction sequencing with moving boundary conditions.



New Geometry Based Modeling

Define your boundary conditions and material properties on your region geometry, rather than on the finite element mesh. This allows you to freely change your model without worrying about losing your existing model definition. For example, if you increase the height of a soil layer, your boundary conditions are moved along with the soil, and a new finite element mesh is automatically generated.

Material Models

New material models are available in all products. User Add-In constitutive models are now available in SIGMA/W.

Material models and boundary conditions are tied to the geometry, not the mesh.

New Meshing

Take control of your mesh with new meshing patterns, such as unstructured quadrilateral patterns, with flexible fine-tuning options. Interface elements can be added on lines to model soil-structure interactions, liners and geofabrics, cutoff walls and wick drains.

Reporting

Generate a report for any analysis, summarizing all input data including geometry, material properties, functions, etc. The SLOPE/W report includes a summary of all results for the critical slip surfaces.

With the click of a button, bring your input and results summary directly into a formatted Word or HTML document. Edit and add screen captured images to further enhance your report or presentation.

All New Graphing and Contouring

Graphing has been re-designed with saved graphs, cut lines, and multiple series plots. Define a results graph on a geometry object (line, point, or region) or on any arbitrary line or plane cutting through your geometry. Superimpose multiple graphs to compare data.

Create many different Contour views and save them by name.

You can make a contour plot in DEFINE to show your exact initial conditions that will be applied in the model. This is useful if you have various

sources for initial conditions, such as previously solved data combined with new soil "activation" values.

Updated Sketch Text

Sketch Text can now be linked to any or all analyses in the project file. Dynamic Sketch Text can be tied to all solver results data.

Animation in CONTOUR

Make a movie of your analysis to visually communicate how your results change over time. Include dynamic sketch text in the movie that is updated at every frame.

Improved Function Definitions

Function definitions have been vastly improved, including graphing multiple functions on one plot.

Define a Spatial Function that varies with the x and y coordinates. Spatial Functions can be used to vary strength properties in SLOPE/W, or for any initial condition parameter in the finite element models.

You can now define custom Add-In functions in all products. Write your own material property or boundary condition functions using internal solver data or data from outside GeoStudio. Link your function live with Excel or any other .NET program.

Region Face Boundary Conditions

Apply a boundary function to a region face, so that the volume of the element is used to apply a mass load to the model. You can model source or sink values that are tied to element volume, not just edge length.

SLOPE/W 2007 – Additional Enhancements

Spatial Functions

Unit weight, C, Phi and pore-water pressure can vary as a function of the x or y coordinate using a Spatial Function in a modified Mohr-Coloumb Spatial Model.

New Add-In Functionality

Write your own functional relationship or constitutive model. Your Add-In—written in Visual Basic or any other .NET language—can now use custom data parameters to read data from memory or write data to the solver's results file for later contouring or graphing.

A Software Developer Kit (SDK) can be downloaded from the website to learn all about Add-Ins and to get started writing your own.

New Searchable Examples

Many new examples have been created for each product. Each example now comes with a detailed discussion on how to use and apply the relevant GeoStudio features and how to interpret the results.

The examples can be searched by keyword from the start page of GeoStudio or on the geo-slope.com web site.

Windows Explorer Thumbnail View

GeoStudio now supports the Explorer thumbnail view, displaying an image of the last saved view of your model.

Network Licensing Improvements

Licensing is more fault-tolerant on a wide area network. A network license server can now be unavailable for a short time while GeoStudio has a license checked out without immediately forcing GeoStudio to shut down.

When a network license cannot be checked out, a list of users currently using the license is displayed.

Network license borrowing is now available by request.

Transient Stability

Linking SLOPE/W to a transient SEEP/W or SIGMA/W model allows solving for factor of safety versus time.

Automatic Water Force and Pressure

You no longer need a no-strength water region. SLOPE/W will compute the pore-water pressure on the ground surface and generate the correct water weight load. Visual feedback shows you exactly what the solver is applying in the model. You can override or modify the water weight with a surcharge load.

Improved Data Entry

Entering material properties and other data is now faster and less error-prone. Changes made in dialog boxes are now accepted as soon as you enter them. There is no longer a need to click a “Copy” button.

Rapid Drawdown

A total stress staged rapid drawdown procedure has been added. Simply specify the total stress strength parameters and the amount of the drawdown.

Strength Due to Suction

You can specify a maximum suction value above a water table, and the shear strength arising from the suction can now be related more realistically to a Volumetric Water Content function.

Multiple Analyses

You can do many analyses within one project and save all the analyses in one data file, making it easier to keep track of your different scenarios. For example, you can evaluate several reinforcement designs to see how each alternative affects overall stability. Using multiple analyses also improves the ability of SLOPE/W to integrate with other products.

Collapse Surface

A collapse surface can now be defined for loose soils together with steady-state strengths. This information is very useful for flagging zones of potential liquefaction and zones with a sudden loss in shear strength.

Improved Graphing

When creating graphs of your results, you can now decide which variables to show on the same graph. For example, you can plot both total and effective normal stresses along the slip surface. You can create many graphs and save them with the data file. This allows you to instantly retrieve the graphs the next time you open your file.

SEEP/W 2007 – Additional Enhancements

New AIR/W Option

AIR/W can be used inside SEEP/W to account for ($u_a - u_w$) matric pressures. Model tunneling under air pressure, soil vapor extraction, and convective air flow in coarse materials by linking with TEMP/W for density effects.

Material Models

New material models such as ‘fully saturated/unsaturated’ and ‘saturated only’ have been added. There are also new interface models for liners, barriers and cutoffs. You can now easily add wick drains to your model.

Add-In Functions and Boundary Conditions

Define your own custom Add-In functions that can be applied to boundary conditions or materials. This feature will allow you to include hysteresis in your analysis, for example.

Multiple Analyses in a single file

Multiple analyses in a single file means you can have steady state and transient analyses in the same file. Change the mesh and re-solve the entire project in one step. Link analyses together to account for construction of tailings dams where soil is added and boundary conditions move with time.

Other Changes

- Boundary conditions are preserved if you change the mesh.
- New time stepping setup and results saving scheme.
- New built-in sample soil property functions.
- New options for Van Genuchten functions.

SIGMA/W 2007 – Additional Enhancements

User Add-In Constitutive Models

Define custom Add-In constitutive models in SIGMA/W. Your external model can be written in any .NET language such as Fortran, C++, C# or Visual Basic. Your function can then talk with internal solver data or link to external data at the same time. You can share your functions with others or sell them. Your Add-In variable list will appear within SIGMA/W so you don't need to compile variable values into your code.

Bars and Beams

Bars and beams are now better than ever. Beams and bars can exist in space on geometry lines and don't need to be tied to soil elements.

New Dynamic Deformation Model

There is a new model to handle post-earthquake deformation according to any constitutive relationship you feel is appropriate.

Advanced Staged Construction

Multiple analyses in a single file means you can run in-situ models and staged load deformation models in a single file. Perform detailed construction sequence modeling with moving boundary conditions.

Friction Based Interface Elements

Interface elements and a friction-based soil-structure interaction material model are now available. Specify different behavior on each side of the interface. The interface can cross over different soil strata.

Drained and Undrained in One Model

With enhanced soil models and analysis options you can include total stress drained soil regions with effective stress and pore-water pressure regions in the same analysis.

Stress Redistribution and C-Phi Reduction

A new stress-redistribution analysis option has been added. You can perform a C-Phi reduction, but more importantly, reduce C-Phi and then bring the stresses into SLOPE/W to check the factor of safety. Don't rely on non-convergence to give you a factor of safety.

Bring excess earthquake generated pore-pressures from QUAKE/W into SIGMA/W so you can look at post-earthquake deformations. Review the San Fernando Dam detailed example discussion.

Collapse Surface

A collapse surface can now be defined for loose soils together with steady-state strengths. This information is very useful for flagging zones of potential liquefaction and zones with a sudden loss in shear strength.

Other Changes

- A new circular opening mesh has been added, with boundary conditions applied on the opening edge. Add an interface element to simulate a tunnel liner.
- A new submerged deposition analysis option has been added. Construct a tailings facility in a staged model.
- Effective stress with pore-pressure changes has been enhanced. Do excavation with moving hydraulic boundary conditions.
- Adaptive load stepping has been added to help with convergence issues in non-linear Elastic-Plastic models.

QUAKE/W 2007 – Additional Enhancements

Non-Linear Model

A new effective stress non-linear model has been added. This new model uses accumulated volumetric strain to compute the development of excess pore-pressures.

Time Stepping Sequence

The time stepping integration sequence can now be related to the earthquake time history record. This ensures that the time steps are not greater than the time intervals in the input record.

G-Modulus Functions

The shear modulus G can now be defined by a generalized data point function dependent on the effective overburden stress. In addition, a G-modulus function can be selected from a range of sample functions for both granular and cohesive soils.

Collapse Surface

A collapse surface can now be defined for loose soils together with steady-state strengths. This information is very useful for flagging zones of

potential liquefaction and zones with a sudden loss in shear strength.

Post-Earthquake Deformation

The excess pore-pressures and steady-state strengths can be used in a SIGMA/W stress-redistribution analysis to estimate permanent deformations that may arise due to the shaking.

Case History Examples

The San Fernando Dam case histories have been re-analyzed and documented in detail, to show what can be done with the new version.

Soil-Structure Interaction

The performance of beam and bar elements has been enhanced, making it possible to consider the effects of the structural stiffness on the ground response to earthquake shaking. This also makes it possible to examine the stress changes in tie-back anchors, for example, during an earthquake.

TEMP/W 2007 – Additional Enhancements

Link to AIR/W and SEEP/W

AIR/W, which is tied to SEEP/W, can be linked with TEMP/W to account for convective heat transfer in moving air.

New Material Models

New material models have been added: full thermal, simplified thermal, and convective thermal with SEEP/W and AIR/W. There are now interface models for liners, barriers and thin insulation layers.

Add-In Functions

Define your own custom Add-In functions which can be applied to boundary conditions or materials. This feature, for example, will allow you to include your own climate boundary condition algorithm.

Multiple / Staged Analyses

Multiple analyses in a single file means you can have steady state and transient analyses in the same file. Change the mesh and re-solve the entire project in one step. Link analyses together to account for construction of tailings dams where soil is added and boundary conditions move with time.

Other Changes

- Boundary conditions are preserved if you change the mesh.
- New time stepping setup and results saving scheme.
- New built-in sample soil property functions.
- Improved thermosyphon boundary conditions.

CTRAN/W 2007 – Additional Enhancements

Define Geometry in CTRAN/W

Now you can build your model in CTRAN/W and have it exist in the same project file as SEEP/W or VADOSE/W. If you change the geometry in CTRAN/W, it is automatically changed everywhere.

Multiple Analyses in a Single File

Perform an advection/dispersion analysis in the same file as a particle tracking model. Results can be easily compared.

Add-in Functions and Boundary Conditions

Define your own custom Add-In functions which can be applied to boundary conditions or materials.

AIR/W 2007 – NEW!

A New GeoStudio Product!

AIR/W is an exciting new product from GEO-SLOPE that completes the ($u_a - u_w$) matric suction stress state variable. The formulation is for density dependent compressible air flow, with or without thermal effects that can then be added by linking with TEMP/W.

AIR/W is a plug-in license that requires SEEP/W.

Student Edition

AIR/W is now in the free Student Edition.

Analysis Possibilities

- Soil vapor extraction.
- Tunneling under air pressure.
- Heat transfer due to air movement in frozen or unfrozen soils.
- Reduced water infiltration due to air pressure blockage in dam cores or agricultural soils.

VADOSE/W 2007 – Additional Enhancements

New! - VADOSE/W Basic

VADOSE/W Basic is now available as an affordable one-dimensional product. As the most advanced physically-based model on the market today, we think you will enjoy using the Basic Edition of VADOSE/W as an alternative to the HELP model.

Add-In Functions and Boundary Conditions

Define your own custom Add-In functions which can be applied to boundary conditions or materials. Include hysteresis, for example, or your own vegetation algorithm. Link the Add-In function to data that is solving simultaneously in Excel or another .NET framework program.

New Solver

There is a new solver option to use the faster PARDISO system. The finite element equations are also now optimized for multi-processor computers.

Solve Coupled, Uncoupled or Isothermal

Choose the level of coupling you want in the model.

Advanced Meshing and Surface Layer Design

The meshing and surface layer design tools are vastly improved. The automatically generated default mesh will now suit most needs.

Greatly Improved Results Graphing

VADOSE/W generates a great deal of result data. You can now set up and save graphs and plot various graph series at the same time. Compare water balance categories such as infiltration and base flow on the same chart.

New Student Edition

VADOSE/W one-dimensional analyses can now be done in the free Student Edition.

Other Enhancements

Project Templates

Create project templates to save personalized GeoStudio settings and model defaults.

Solvers

Multi-threaded solvers now take advantage of multiple processors in computers.

Improved Dynamic Sketch Text

Sketch text inserted fields can now be linked with results data; when you re-solve the model, the results are updated right on the screen.

View Results Information

Use the new View Results Information command in CONTOUR to multi-select nodes or gauss points to compare tabular data at different locations.

Other Changes

- Meshing is now controlled by changing global settings or by putting restrictions on any geometry object.
- When you change a key input parameter, the program will notify you that a solution is out of date and provide details as to what has changed.
- All example files are shipped with the input files and detailed discussions.
- All tutorials are now in movie format so you can watch, pause, try, and continue to build your models.

