

FLAC Training Course
Basic Concepts and Recommended Procedures for
Geotechnical Numerical Analysis

This course introduces users to the application of FLAC for geotechnical numerical analysis. The three-day course includes two days of software fundamentals with discussions on the theoretical background, basic concepts and modelling principles for geotechnical analysis, and a third day that offers a choice between practical applications in civil geotechnical analysis or fundamentals and application in dynamic analysis.

Course topics include: grid creation, application of boundary conditions, selection of appropriate constitutive (material) models, solution of the static equilibrium state, simulation of the construction stages, installation of structural support, and inclusion of either transient or steady groundwater flow states. On the third day, two parallel sessions are offered that discuss example applications of FLAC for either civil underground construction analysis or seismic analysis of earth structures.

The course also includes discussion on using the built-in programming language in FLAC (called FISH) to manipulate the FLAC model. This is "hands-on" training, and exercises with FLAC are provided throughout the course.

Day 1

- **Introduction to FLAC**
 - Overview of potential applications and capabilities in geo-engineering analysis and design
- **Introduction to the FLAC Graphical Interface**
 - Menu-driven versus command-driven operation
- **FLAC Theoretical Background**
 - Explicit Finite-Difference Solution
- **FLAC Operation**
 - Recommended solution procedure
- **Grid Generation**
 - Virtual-grid generation
 - Grid building/altering/shaping tools; adding interfaces
- **Basic Material Models**
 - Assigning material models and properties
- **Boundary Conditions / Initial Conditions**
 - Applying boundary and initial conditions
- **Solution**
 - Solving for equilibrium and monitoring model response

Day 2

- **Introduction to FISH in FLAC**
 - FISH variables, arithmetic, syntax and data types
 - Writing FISH functions
- **Introduction to Effective Stress and Groundwater Flow Analysis**
 - Procedures for effective stress analysis, transient fluid flow and coupled analysis
- **Soil/Rock Structure Interaction**
 - Application of structural reinforcement
- **Factor of Safety Calculation**
 - Implementation of the strength reduction method in FLAC

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Day 3 (Session A)

- **Dynamic Analysis**
 Considerations when running dynamic analysis: wave attenuation, dynamic loading and boundary conditions, material models and damping, comparison on nonlinear analysis to equivalent linear analysis, liquefaction modelling principals

- **Practical Exercise**
 Pile-supported wharf on liquefiable soils: setting up and running a seismic analysis

Day 3 (Session B)

- **Practical Application 1 - Braced Excavation Analysis**
 - **Dewatered construction of a retaining wall:** establishing the initial stress state in saturated soils, dewatering, and staged construction including adding strut support and simulating the 3D effect of spaced struts in a 2D analysis

- **Practical Application 2 - Tunnel Construction**
 - **Multi-stage tunnel construction:** developing a ground reaction curve, dewatering, installing temporary shotcrete lining followed by permanent concrete liner, simulating the 3D effect of tunnel advancement in a 2D analysis