

**Bentley**  
Advancing Infrastructure



## PLAXIS® PlaxFlow

2D and 3D Geotechnical Groundwater Flow Analysis Software

Groundwater in excavation is inevitable. It is the most fearsome geotechnical unknown of all. Research shows that for infrastructure engineers, for example, groundwater table and seepage are on top of their agenda. Groundwater flow analysis and modeling are critical for the geotechnical, environmental, and hydrological engineering projects. And now with PlaxFlow groundwater flow analysis software, geotechnical engineers can analyze groundwater behavior in all engineering challenges, including excavations, rockfill dams, construction and operation, slope stability analysis, effects of rain and flooding, water flow around structures and drainage systems and pumping tests simulation.

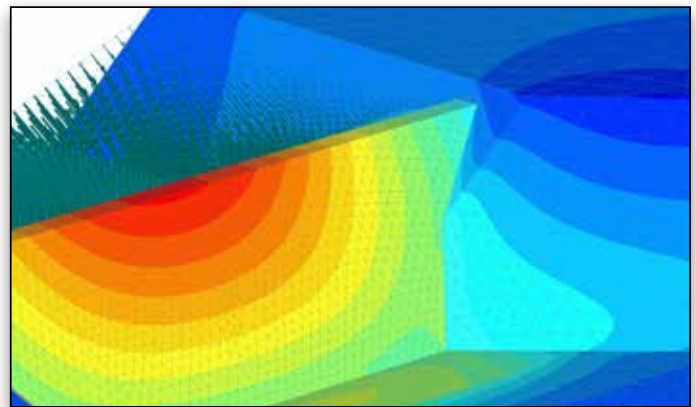
### Reliable Data, Geotechnical Expertise, Digital Workflows

PlaxFlow is a software module within PLAXIS 2D and PLAXIS 3D for fully coupled flow-deformation analysis, as well as steady-state and transient groundwater flow analysis. PlaxFlow uses sophisticated models for saturated and unsaturated groundwater flow, using the robust “Van Genuchten” relations between pore pressure, saturation, and permeability. It finally provides state-of-the-art capabilities for time-dependent boundary conditions.

With the PlaxFlow module, engineers can deploy various predefined properties to analyze time-dependent groundwater flow, unsaturated soils and interaction between flow, pore pressure, and settlements using common soil classification system like Hypres, USDA, and Staring as well as predefined data sets for the Van Genuchten and Approximate Van Genuchten models for all types of soil. And, for the experts on groundwater flow modeling, all Van Genuchten model parameters or user-defined relationships between groundwater head, permeability and saturation can be entered manually.

### Powerful Capabilities

In order to take groundwater flow into account in geotechnical software applications, advanced models for the simulation of the unsaturated, time-dependent, and anisotropic behavior of soil are required. PLAXIS PlaxFlow allows for predefined as well as user-defined parameters to simulate the most complex hydrological conditions. The input of the time-dependent properties is based on harmonic, linear, or table functions. Water levels can be assigned a time-dependent component. Powerful modeling and analytics are based on robust calculations. Through the fully coupled-flow deformation and flow-only calculation types, the pore pressure calculation type is extended with a time-dependent option, in addition to the already available steady-state option. A flow-only mode is available to ignore any deformation or stresses of the soil in all calculation



*Time dependent flow boundary conditions.*

phases to purely focus on the groundwater aspects. Ultimately, the coupled flow-deformation calculation type allows users to calculate the complex interplay between changes in pore pressure, stress and deformation.

Complex pore pressure distributions in the base PLAXIS software may be generated through a combination of phreatic levels or direct input of water pressures. A steady-state groundwater flow calculation can be applied to generate the pore pressure distribution in problems that involve steady flow or seepage. PlaxFlow extends those capabilities by allowing complex pore pressure distributions to be calculated at any point in time with time dependent groundwater flow calculations. PlaxFlow extends the powerful PLAXIS Output program with various new plot types to display contours and vectors of groundwater flow, pore pressures, saturation, suction, and Darcy flux. For curves, options exist to visualize the development of groundwater head and pore pressures in time through various calculation phases, providing valuable insight in the groundwater flow process.

### User-friendly Technology

PLAXIS PlaxFlow is fully integrated and interoperable with PLAXIS' suite of geotechnical software solutions for seamless management of your project. PlaxFlow is user-friendly software built around intuitive geotechnical digital workflows for efficient project management. Flexible interface allows for easy geotechnical process management and inputs while the output program allows for powerful reporting and analysis through animation, graphs, and numeric results. PLAXIS PlaxFlow users can rely on easy-to-use licensing and user management platform as well as the Bentley support and educational resources, as well as regular product updates.

## System Requirements

### Operating System

Windows 8 Professional 64-bit  
Windows 10 Pro 64-bit

### Graphics Card

Required: GPU with 256 MB OpenGL 1.3. Bentley recommends avoiding simple onboard graphics chips in favor of a discrete GPU from the Nvidia GeForce or Quadro range with at least 128-bit bus and 1 GB of RAM, or equivalent solution from ATI/AMD

### Processor

Required: Dual Core CPU  
Recommended: Quad Core CPU

### Memory

Recommended for 2D: minimum 4 GB. Large projects may require more.  
Recommended for 3D: minimum 8 GB. Large projects may require more.

### Hard Disk

Minimum 2 GB free space on the partition where the Windows TEMP directory resides, and 2 GB free space on the partition where projects are saved. Large projects may require significantly more space on both partitions. For best performance, ensure that the TEMP directory and the project directory reside on the same partition.

### Video

Required: 1024 x 768 pixels, 32-bit color palette  
Recommended: 1920 x 1080 pixels, 32-bit color palette

### Internet connection

Required for SES licensing

Find out about Bentley at: [www.bentley.com](http://www.bentley.com)

### Contact Bentley

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## PLAXIS PlaxFlow At-A-Glance

### Modeling and Analysis

- Flow of pore water in saturated or unsaturated zones
- Fully coupled flow-deformation analysis, flow-only mode
- Pore pressures
- Seepage
- Groundwater flow
- Impact of fully coupled-flow deformation and time-dependent groundwater flow on safety factors and enhanced safety analysis
- Deformations, displacements, and strains in fully coupled analyses
- Total or effective cartesian and principal stresses in fully coupled analyses
- Deformation in structures and interfaces in fully coupled analyses
- Apply Sensitivity analysis to fully coupled analyses
- Stress and strain diagrams in fully coupled analyses
- Displacement-time or pore-pressure-time curves
- Cyclic accumulation (rain flow)

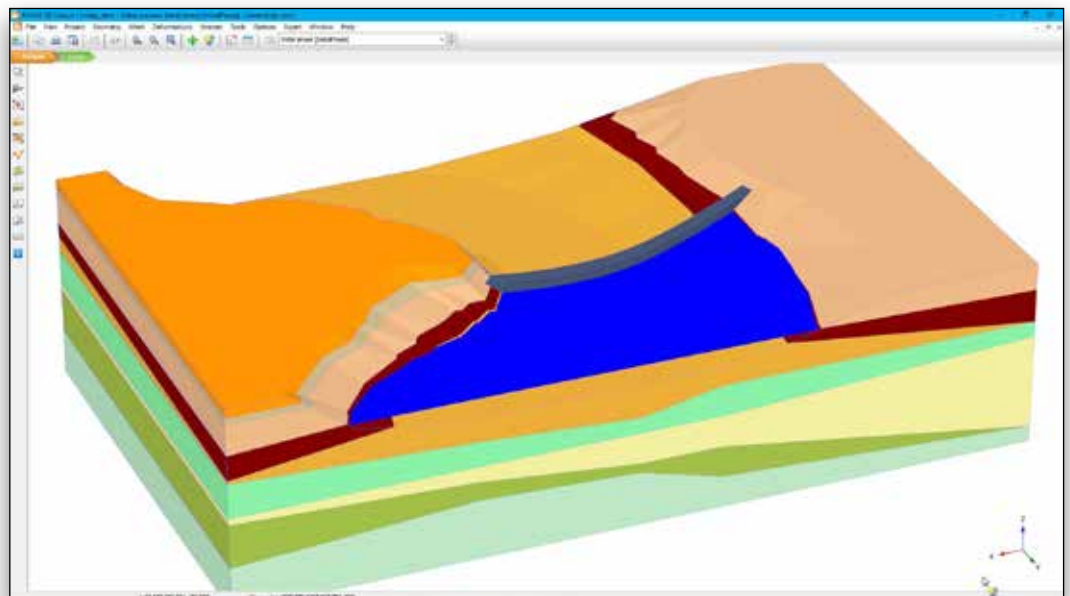
### Groundwater Calculations of Realistic Geotechnical Problems

- Transient groundwater flow
- Flow only with steady-state and transient groundwater flow
- Fully coupled flow deformation
- Consolidation calculations
- Pore Pressures, including:
  - » Groundwater head
  - » Active pore pressure
  - » Pore water pressure

- » Steady-state pore pressure
  - » Excess and extreme excess pore pressure
  - » Change in pore pressure in each phase
  - » Suction and effective suction
- Groundwater flow, including:
    - » Discharge
    - » Saturation
    - » Hydraulic gradient
    - » Effective saturation
    - » Relative permeability
    - » Soil deformations and pore pressures in each stage
    - » Total and history of pore-pressures or head in selected points

### Usage

- Submerged construction of an excavation
- Cyclic vertical capacity and stiffness of circular underwater footing
- Stability of dam under rapid drawdown
- Flow through an embankment
- Flow around a sheet pile wall
- Potato field moisture content
- Simulations of unsaturated soil behavior
- Earth and rockfill dams (time dependent problems)
- Excavation, mine dewatering
- Analysis of rapid drawdown situations
- Slope stability analysis, effect of rain and flooding
- Soils with collapse risks (compacted soils)
- Drainage systems
- Simulate pumping tests



Arch dam reservoir.