



# New Developments

Ronald Brinkgreve

In the previous Bulletin information was given about the Plaxis 3D developments. It is a pleasure to mention now that the first general 3D program (Plaxis-GiD) has been released. This program is available as a service to those who feel restricted by the geometrical limitations of 3D Tunnel or 3D Foundation. More information can be obtained from the Plaxis sales department.

In this Bulletin I like to mention another new development that is currently in progress: Fully coupled flow-deformation analysis.

Most Plaxis users are familiar with the Consolidation option in Plaxis 2D and 3D. So far, Plaxis has only considered Biot coupled consolidation under saturated conditions, forming a coupling between deformation and excess pore pressures. This works well for cases with constant hydraulic conditions, where the time interval or loading rate is such that the situation is neither fully drained nor fully undrained. For cases with changing hydraulic conditions, a simplified solution is available by combining the standard Plaxis program with the transient flow module PlaxFlow. However, if pore pressure is influenced by loading of (partially) undrained soil as well as changing hydraulic conditions, there is a need for consolidation based on total pore pressures, i.e. fully coupled flow-deformation analysis. Examples where this type of analyses is required are clay embankments in tidal areas or excavations with dewatering in medium soft soils.

With the change of consolidation based on excess pore pressure to total pore pressure it becomes important to consider the phreatic surface and the unsaturated zone above. As a result of loading or changing hydraulic conditions, ground water flow may occur, and the position of the phreatic surface may change. Soil that has been fully saturated may become unsaturated or vice versa. Hence, together with the implementation of fully coupled flow-deformation analysis, there is also need for models that can describe unsaturated soil behaviour in more detail. First of all, there are the Van Genuchten relationships between suction, relative permeability and degree of saturation, which are also used in PlaxFlow. Secondly, there is the well-known Barcelona Basic Model that deals with suction and swelling in the unsaturated zone. All this is implemented in the Plaxis calculation kernel to complete the fully coupled flow-deformation analysis feature.

These new features will be available in Plaxis 2D version 9.1, which is planned for release mid 2009. When the implementation is ready, we can start beta-testing with a selected group of users. After implementation in Plaxis 2D we will proceed with the implementation in the 3D calculation kernel. We are confident that the new features will help many users in analysing their coupled and unsaturated soil problems.

Ronald Brinkgreve  
Plaxis bv

