



PLAXIS

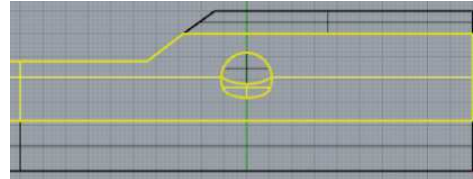
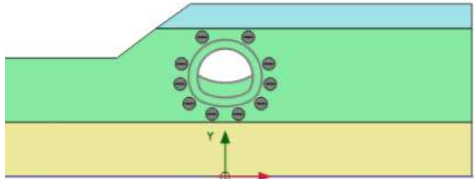
Release notes PLAXIS 2D 2018



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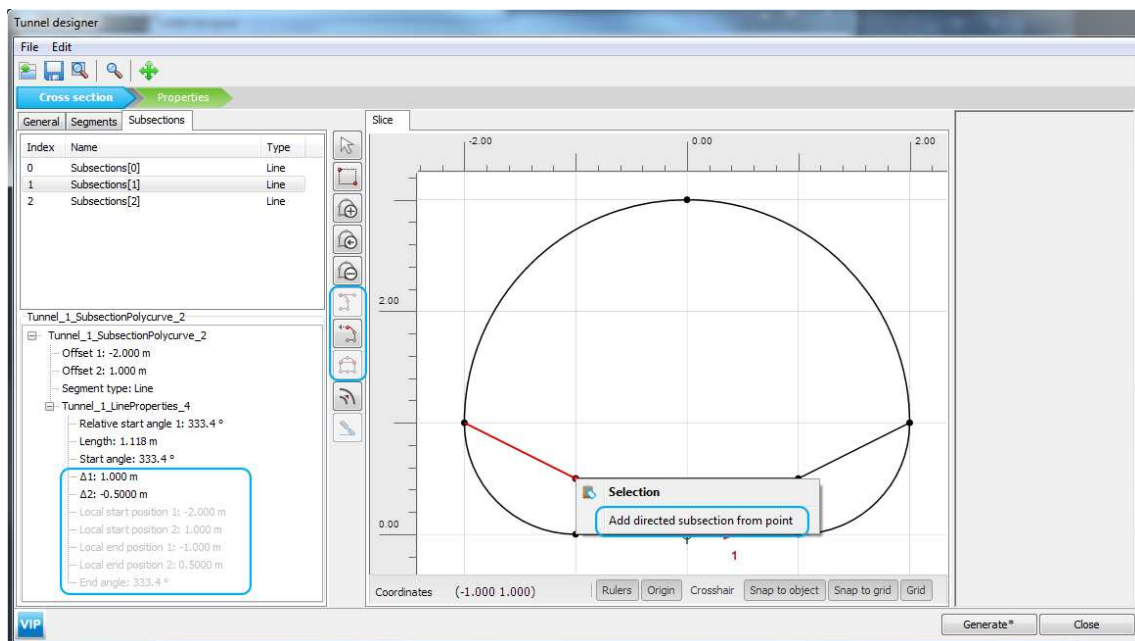
1 Export PLAXIS model to CAD & STEP Import (VIP)

Via the user interface and command line, users can now export their whole PLAXIS model as DXF and STEP files. Through the command line additional conditions can be given, exporting only parts of the model. The exported model can be used in other CAD software, or incorporated into BIM workflow. In addition users can now import geometry in STEP format.



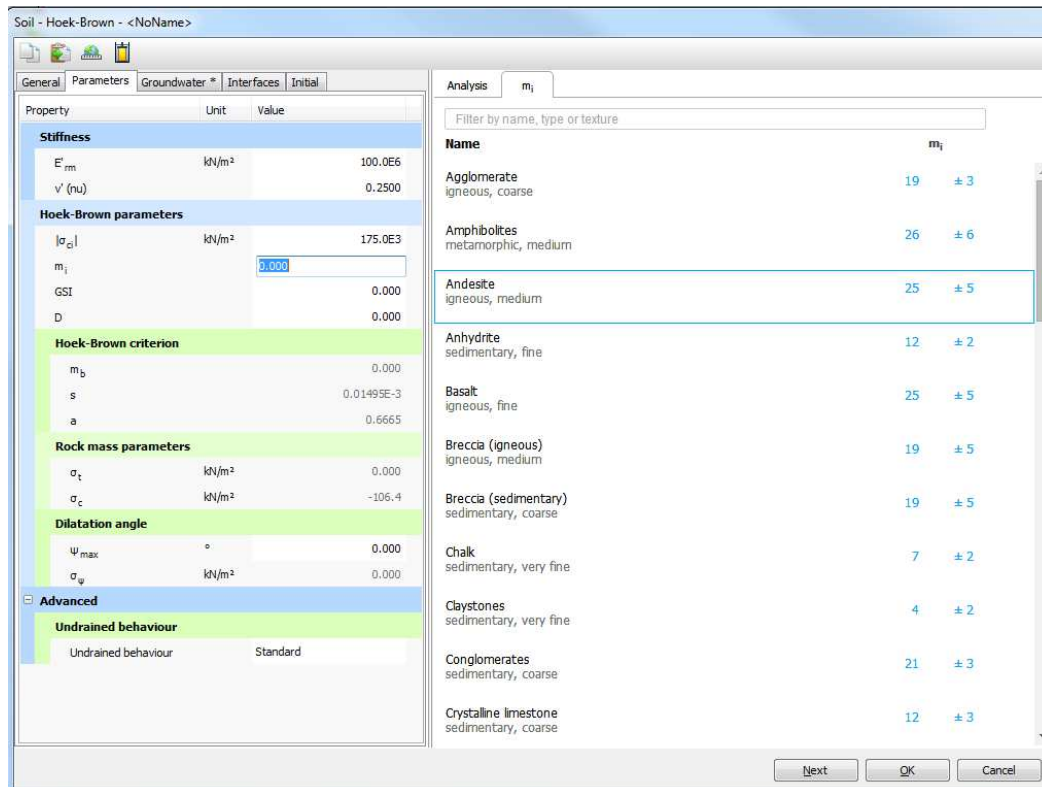
2 New tools, geometry definition and checks in the Tunnel designer (VIP)

In the tunnel designer it's now even easier to create subsections. Users can create a subsection by selecting a point, or selecting a line and a point, then choosing *add (directed) subsection from point*. This speeds up drawing of, for example, an elephant's foot or sidewall drift on the tunnel cross-section and improves the model accuracy. Users can also select two points and create a straight line in between, via the right mouse button. For these new options buttons are available on the toolbar. Additional information about line length, start angle and local start and end positions is now shown for segments and subsections, making it easier for the user to correctly place subsections. The new parameters $\Delta 1$ and $\Delta 2$ also make it easier for users to increase or decrease segment or subsection lengths and angles, providing users with an alternative to input their designed tunnel. The tunnel designer now also performs checks on the geometry, especially useful with imported tunnel cross-sections, warning about potential errors which have been made in the CAD model. All is available through scripting as well, making automated model creation easier and more precise, including a command to import a CAD file into the tunnel designer.



3 Hoek-Brown parameter guide (VIP)

Via the side-panel of the Hoek-Brown material model users can find an interactive parameter guide for the model, consisting for example of: selectable rock types and proposed magnitudes for the UCS, a searchable and clickable rock database for M_i , etc. An analysis tab is available as well, automatically plotting the major and minor principal stress based on the given parameters.



4 Load displacement curves available in Output

The Output program has been extended with additional data regarding applied loads. Users can now directly plot curves of the progression of force magnitudes for applied loads in the model through the use of post-calculation nodes on soils or structural elements where these loads are applied. This information can also be retrieved through the Output command line, as well as through scripting. This makes it more user friendly to create load-displacement curve plots to for example assess the ultimate load capacity.

5 Deconfinement

Currently users apply the Beta-method in combination with a ΣMstage < 1, in order to maintain a certain unbalance in the model to account for 3D effects in the 2D model for tunnelling applications. With the new deconfinement property for soil clusters, a more advanced method is introduced. When deactivating soil clusters, users can now input the level of deconfinement (as percentage) for these clusters. The level of deconfinement, or unbalance left in the model, can thus be controlled individually for each part of the excavated tunnel. The level of deconfinement can also be maintained across phases and can also be applied independently for multiple tunnels in the model. By default deactivated clusters will have a 100% deconfinement value, so users who do not do any tunnelling applications can safely ignore this new property.

6 Dynamic with consolidation, PM4Sand model & updated mesh

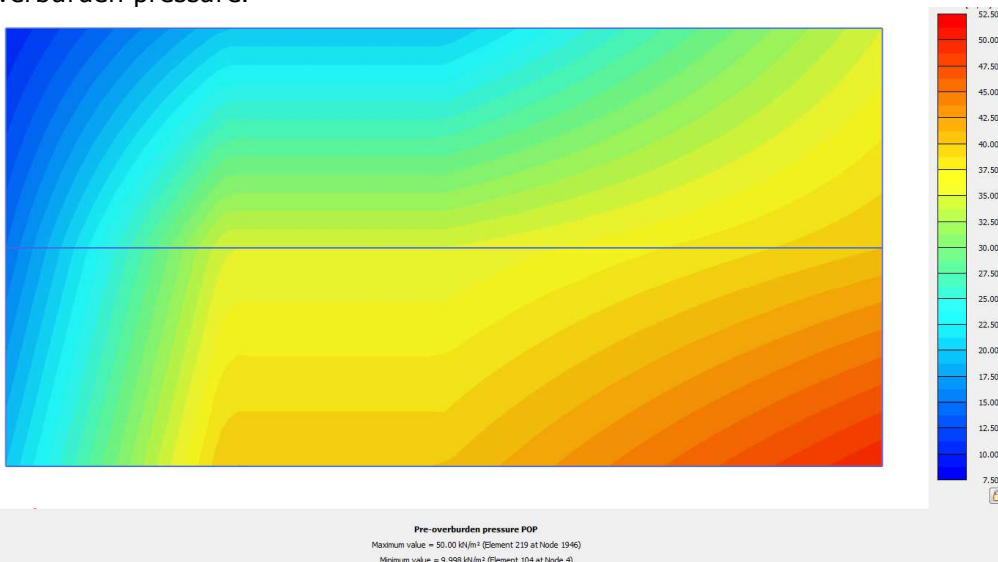
A new advanced calculation option, "Dynamic with consolidation", is introduced for Dynamics users with PLAXIS VIP. It allows users to simulate the coupling between soil deformations and transient seepage in the dynamic loading phase and provides generally improved stress predictions and accounts for both eventualities of accumulation and dissipation of excess pore pressures during the earthquake. Users can now also perform dynamic calculations with the "updated mesh" setting in order to account for large displacements, which may occur during dynamic events, especially when dealing with liquefaction. And lastly a new User Defined Soil Model for liquefaction is introduced, the PM4Sand model (Boulangier & Ziotopoulou, 2017). The PM4Sand model is defined in the framework of the stress-ratio controlled, critical state compatible, bounding surface plasticity model for sand by Dafalias & Manzari (2004). The model successfully simulates material behavior of sands in dynamic loading, including the pore pressure generation, liquefaction and post-liquefaction phenomena. It is a very attractive model for the industry due to a small number of parameters to be calibrated, mostly related to the usually available data in the design practice. This model combined with the new updated mesh and Dynamic with consolidation options provides users with state-of-the-art technology to perform all aspects of geotechnical earthquake analysis.

7 Fourier Amplitude Spectrum, Arias intensity & extreme values

The Output program has been extended with new curve plots for dynamic analyses. The Fourier Amplitude Spectrum curve plot involves a Fast-Fourier Transform transforming a plotted quantity from the time domain into the frequency domain. The Arias intensity curve plot can be used to determine the significant duration of a motion. The extreme values are now also highlighted in curve plots, but can also be inspected through tables which can be accessed when viewing the curve plots.

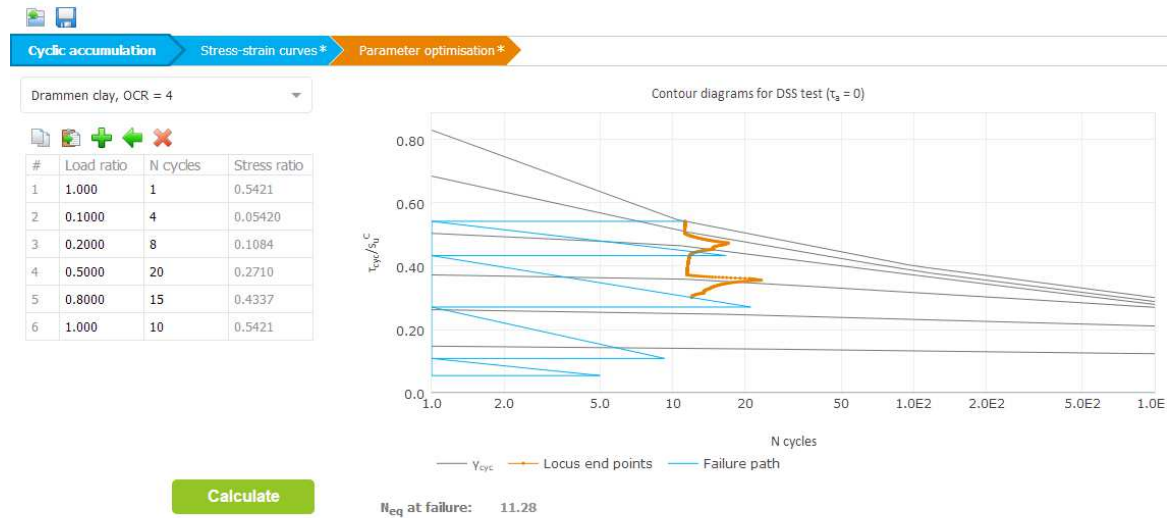
8 Spatial variation and definition of preconsolidation through boreholes

Users now have the option to define the pre-overburden pressure (POP) directly through the borehole in the new *Preconsolidation* tab. In this tab users can change the condition from the default "From material" to "From boreholes". Per borehole, users can input a top and bottom value for the POP for each individual layer in the borehole. In between boreholes the values are automatically interpolated, and all values are assigned to the mesh elements. This way users can take into account a spatial variation of the pre-overburden pressure.



9 UDCAM-S and Cyclic accumulation and optimization tool (VIP)

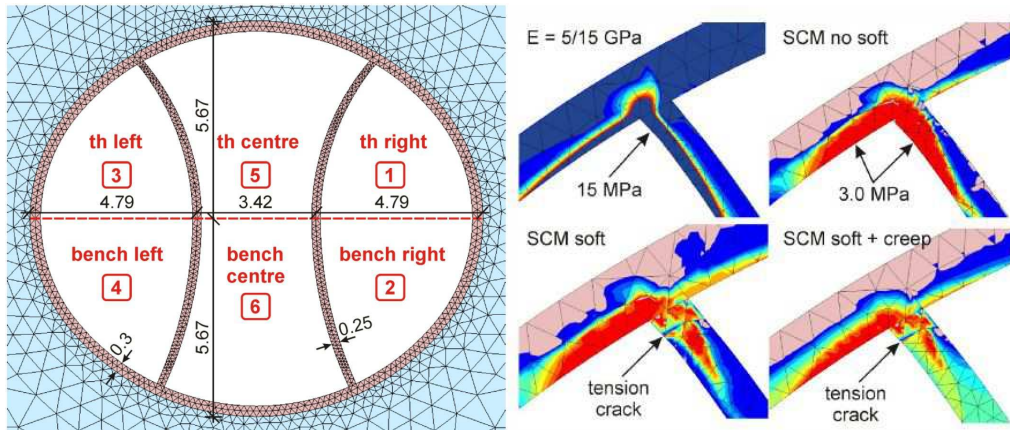
Based on the UDCAM (UnDrained Cyclic Accumulation Model) originally developed by the Norwegian Geotechnical Institute, PLAXIS now offers the simplified UDCAM-S model in combination with a cyclic accumulation and optimization tool. Through the tool users can transform the full cyclic load history into an equivalent number of cycles. This allows for determining stress-strain curves that are representative of the behavior of the soil in DSS and triaxial conditions. Through these different modes, the tool provides assistance in generating UDCAM-S material properties, which properly reflect the degraded soil conditions based on the simulated cyclic load.



10 Zoom command in Output

With the introduction of the zoom command in output, users can now use the command line to zoom in on specific objects by including the objects name in the command, or zoom in on a region by providing for example a lower left and upper right coordinate for the area of interest. This is especially useful for scripted models and results generation, allowing users to preset the area of interest for automated plot export.

11 Concrete Model (former UDSM Shotcrete) (VIP)



The former UDSM Shotcrete is now integrated as a native PLAXIS model for VIP subscribers and has been renamed to Concrete model. The model was developed in cooperation with Graz University of Technology, and allows users to take into account time dependent strength and stiffness of concrete, strain hardening/ softening in compression and tension as well as creep and shrinkage. Most of the input parameters for the concrete model can be derived from standard uniaxial tension and compression tests. While the model was mainly developed to model the behaviour of shotcrete, it has also proven useful in applications related to soil improvements, for example jet grout columns.

12 Cyclic triaxial test (VIP)

A new type of SoilTest is available, the Cyclic triaxial test. It enables users to easily simulate triaxial laboratory tests with cyclic loading in order to determine the dynamic properties of the soil. Users can evaluate the shear modulus G and damping ratio and determine the liquefaction potential for sand in undrained conditions.

13 Extended tabulate command and GUI option

The tabulate command has been extended allowing users to see or compare for example the activation state, assigned material sets or load values and much more across a number of phases or a group of objects. Users can also select objects through the interface and use the right mouse button to issue a tabulate on the objects. This extension allows users to query their model in a convenient way to check the consistency and trace (potential) errors in their input.

```

0224> _tabulate (Soil_1_11) Phase_3
Object      Active      Material    ApplyStrengthReduction
InitialPhase True        Sand        True
Phase_1     True        Concrete    True
Phase_2     True        Concrete    True
Phase_3     True        Concrete    True
    
```

14 Miscellaneous features

- UBC3D-PLM available a standard model in material library (VIP)
- Support for User-Defined Soil Models in Parameter optimization
- Contraction revised, define planar or tunnel contraction for plates, geogrids
- Scripting support for adding or removing objects in a selection
- Significant performance increase when generating curves in Output
- Support for unlimited number of points for curves in Output (VIP)
- Set independent scaling options in Output for load arrows, water loads etc.
- Cross-sections made in Output respond to visibility changes in the model explorer
- PLAXIS 2D 2018 Viewer