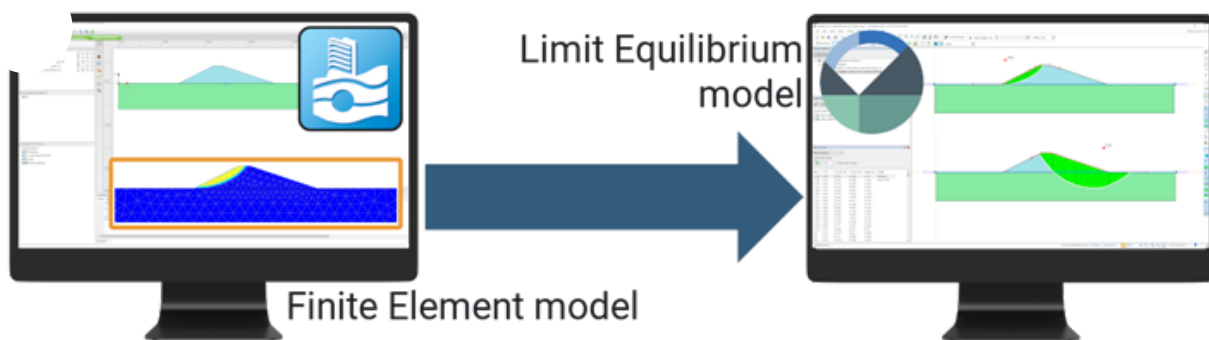


How to run a Limit Equilibrium Method analysis from PLAXIS 2D

Finite Element Analysis to Limit Equilibrium in One Click

Application	PLAXIS 2D PLAXIS 2D LE GeoStudio SLOPE/W
Version	PLAXIS 2D CONNECT Edition V22.01 PLAXIS LE CONNECT Edition V21 GeoStudio SLOPE/W 2022
Status	Technology Preview
Date created	10 May 2021
Date modified	10 October 2022



Easy conversion from PLAXIS 2D to GeoStudio SLOPE/W

Introduction

For the determination of a Factor of Safety the [strength reduction method](#) is a very powerful tool to obtain the most critical slip surface, a slip surface that may be circular but can also have any other form. However, there may be circumstances in which more information is required than just the most critical slip surface or when the critical slip surface is of minor importance from engineering point of view. For instance:

- For a large dam both the global stability as well as the stability of the sloped sections in between berms must be determined.

- For a road project in the mountains both the stability of the hillside above and below the road must be determined, as failure below the road would lead to a loss of the road whereas a failure above the road would only lead to rockfall and temporary loss of service.
- The critical slip surface is very small, for instance just the corner of the crown of an embankment. This is not important from engineering point of view and the global stability would be of larger interest.

In these cases, determining a Factor of Safety using the Limit Equilibrium Method would be the solution. With Limit Equilibrium it is possible to specify exactly what part of the model the Factor of Safety must be determined while the method would still have the benefit of determining the most critical, possible non-circular, slip surface in that area. It would also allow within one model to determine different factors of safety for different parts of the model.

With the *PLAXIS 2D to Limit Equilibrium converter* tool you will be able to quickly open the same model with the same geometry, the same staged construction configuration, the same loading conditions and the same material assignments in GeoStudio SLOPE/W or PLAXIS LE to run your Limit Equilibrium Method analysis.

Usage instructions

Download the package from **Downloads** below

- Extract the zipped package and copy the content (*lem_converter.pyw* file and the entire *plaxis_fele* folder to:

[PLAXIS 2D install folder]\pytools\input

When using the default PLAXIS 2D installation folder this will be:

C:\Program Files\Bentley\Geotechnical\PLAXIS 2D CONNECT Edition
V22\pytools\input

- Start PLAXIS 2D Input
- Load your PLAXIS 2D model and select the required phase
- Via the menu item, please select Expert > Run Python tool > lem_converter
- The PLAXIS 2D to Limit Equilibrium converter will be launched
- Verify you selected the correct phase
- Select the appropriate Limit Equilibrium package (SLOPE/W or PLAXIS LE) and the associated options
- Click on the Convert button
- After converting, the tool will display required actions and other relevant information
- Now we can launch SLOPE/W or PLAXIS LE to directly load the model to quickly run the Limit Equilibrium analysis.

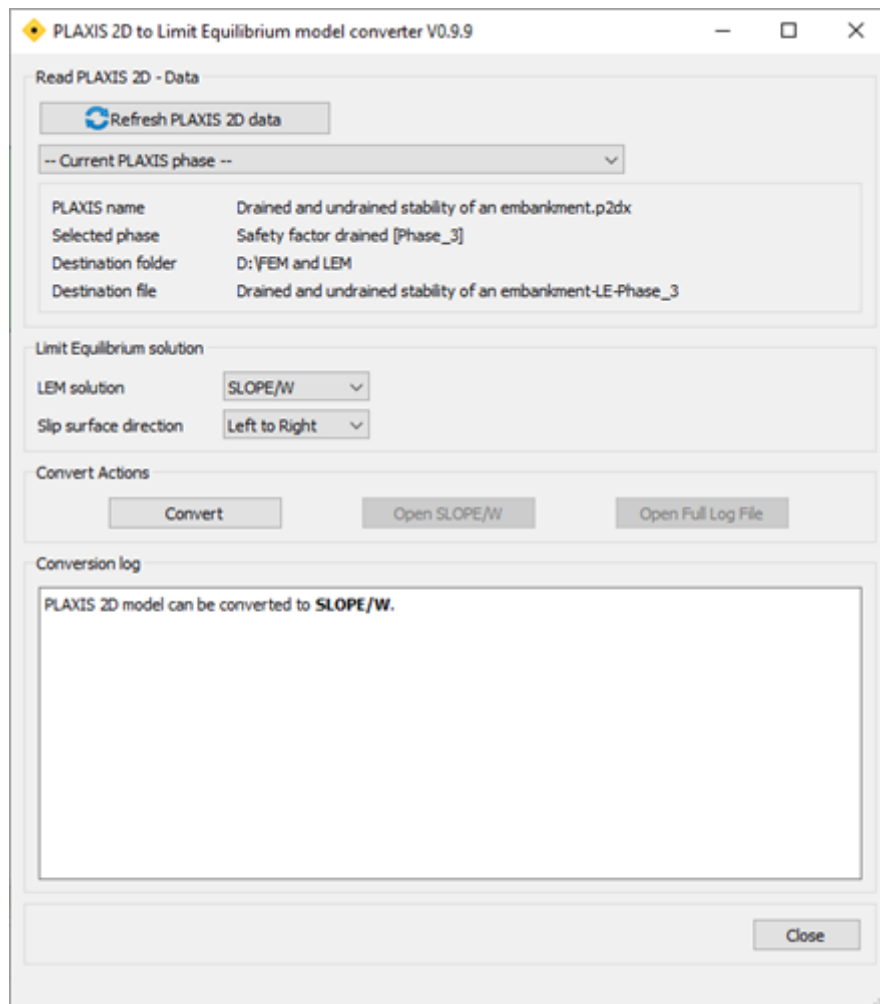


Figure 1. PLAXIS 2D to Limit Equilibrium converter tool user interface directly after launching

If you do not have write access to add files to the PLAXIS 2D installation folder, you can use this alternative approach:

- Save and extract the zipped package in a local folder
- Then, in PLAXIS 2D Input, go to Expert > Run Python script > Open ... and browse to `lem_converter.pyw` and select that one to launch the PLAXIS 2D to Limit Equilibrium converter

Example

In the video below, a slope has been modeled in PLAXIS 2D, and the safety analysis predicts one global factor of safety. With the PLAXIS 2D to Limit Equilibrium converter, we can investigate multiple parts of the analysis to run an analysis for.

Combining PLAXIS 2D with SLOPE/W for Slope Stability



An older demonstration using PLAXIS LE, see [here](#).

Limitations

The phase configuration of a PLAXIS 2D model can be converted into a Limit Equilibrium model (SLOPE/W or PLAXIS LE). By default, the geometry, material assignments and available parameters, distributed loads and the water table will be converted.

GeoStudio's SLOPE/W model starts by default with a Morgenstern-Price method and a Circular Entry and Exit method.

The PLAXIS LE model starts, by default, with a Circular Slope Search using the GLE (Fredlund) calculation method for a first, fast, robust approximation of the slope stability.

In the current version the following limitations/restrictions apply:

- Only PLAXIS 2D Plane strain models are supported.
- Not all soil models in PLAXIS 2D have an equivalent soil model in SLOPE/W or PLAXIS LE. Supported soil models include Mohr-Coulomb, Hardening Soil, HS small, Soft Soil, Soft Soil Creep, and Hoek-Brown.
- Groundwater flow definitions and specific pore pressure definitions are not converted, including settings for the hydraulic conductivity.
- Unsaturated soil behavior (suctions) is not converted.

- Structural elements can be converted to SLOPE/W Reinforcements or PLAXIS LE supports. However, plate elements, vertical embedded beams, fixed end-anchors, and node-to-node anchors (when not part of a tie-back/ground anchor) are not converted.
- PLAXIS 2D stress results cannot yet be included in the Limit Equilibrium analysis for a or a stress-based stability analysis (sometimes also referred to as *Kulhawy*).
- Soil polygons inside a bigger soil polygon that are not connected to the edge of the bigger cluster are not supported. It is suggested to connect the smaller "floating" soil polygon with at least two lines to the edge of the bigger contour.
- Circular/arc shapes are not supported in this converter. The conversion tool will discretize any arc into multiple segments with straight lines.
- Design approaches and design standards are not converted.
- Currently, we support GeoStudio SLOPE/W Version 2021 and PLAXIS 2D CONNECT Edition Version 21 Update 7 (21.07)

Note that the PLAXIS 2D to Limit Equilibrium converter will indicate this in the conversion log. Make sure to read it before continuing in your Limit Equilibrium solution.

Requirements

The PLAXIS 2D to Limit Equilibrium converter requires:

- PLAXIS 2D CONNECT Edition V22 Update 1
- Either PLAXIS LE 2D CONNECT Edition V21 or newer, or GeoStudio SLOPE/W 2021
- PLAXIS 2D started with activated Geotechnical SELECT Entitlements [GSE]. See [here](#) how to do this.

This tool requires access to the PLAXIS Python Remote scripting library using Python 3.8.x.

Updates and release version info

This tool is released as a Technology Preview and available as a separate download version only. Any updates will be added to this page, so check this page regularly.

- [2022-10-10] Version 0.9.9:
 - Updated to support PLAXIS 2D CONNECT Edition Version 22 Update 1 and Update 2 (22.01 and 22.02)
 - Upgraded to support Python Version 3.8.x
 - Added support for GeoStudio SLOPE/W
 - Added selector for PLAXIS 2D phase
 - Fixed an issue when the file path becomes longer than Microsoft Windows allows (255 characters)

- [2021-05-10] Version 0.9.3: Initial release for PLAXIS 2D CONNECT Edition Version 21 Update 1 (21.01) in combination with PLAXIS LE CONNET Edition Version 21 Update 1 (21.01)

Downloads

- [PLAXIS 2D to Limit Equilibrium converter – Version 0.9.9 \[zipped package\]](#)
supporting PLAXIS 2D V22.01, PLAXIS LE 21.01, GeoStudio 2021.1
- [PLAXIS 2D to PLAXIS LE phase converter – Version 0.9.3 \[zipped package\]](#)
supporting PLAXIS 2D V21.01, PLAXIS LE 21.01

See also

[Tutorial case Slope stability FEM and LEM \[PLAXIS + SLOPE/W\]](#) *[Tutorials]*

[Tutorial case Slope stability FEM and LEM \[PLAXIS LE\]](#) *[Tutorials]*

[Coffee Corner webinar: Combining a PLAXIS analysis with SLOPE/W's Limit Equilibrium for slope stability](#) *[Webinar]*

[PLAXIS 2D LE](#) *[main page]*

[Importing PLAXIS LE into PLAXIS 2D](#) *[Videos]*

[Using PLAXIS \(FEM\) to determine a Factor of Safety - SIG webinar](#) *[Webinar]*

[Using PLAXIS LE \(formerly known as SVSlope\) to determine a Factor of Safety - SIG webinar](#) *[Webinar]*

[Non-linear finite element analysis of safety factors](#) *[Publications]*

[GeoStudio](#) *[main page]*

[Introduction to SLOPE/W](#) *[YouTube video]*

[SLOPE/W Basics training](#) *[Seequent Learning]* * requires a Seequent ID log in

[Safety analysis and displacements](#) *[Tips and Tricks]*


[Safety analysis and undrained behaviour](#) *[Tips and Tricks]*

[Safety analysis and Updated Mesh](#) *[Tips and Tricks]*

[Safety calculation with a Target Value](#) *[Tips and Tricks]*

[Using PLAXIS Remote scripting with the Python wrapper](#) *[Tips and Tricks]*

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 [Limit Equilibrium](#)  [PLAXIS 2D LE](#)  [PLAXIS LE](#)  [PLAXIS](#)  [Interoperability](#)

 [Conversion](#)  [PLAXIS 2D](#)  [slope stability](#)  [LEM](#)



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