Bentley®
Advancing Infrastructure

PRODUCT DATA SHEET

# PLAXIS® Monopile Designer

## Drive Power with Efficient Offshore Foundations

PLAXIS Monopile Designer introduces an enhanced design method for monopile foundations. It transfers the results of the PISA Project to daily engineering practice. PLAXIS Monopile Designer enables dramatic reductions in the amount of steel of each monopile and in the overall costs of any wind farm. It can be used as a stand-alone tool for the rule-based design method and in connection with PLAXIS 3D for the numerical-based design method.

### A WELL-PROVEN FINITE ELEMENT SOLUTION

The enhanced design method of PLAXIS Monopile Designer analyzes the ability of monopile foundations to resist lateral loads on the basis of a 1D Timoshenko beam finite element model, accurate even for large diameter monopiles and realistic soil reaction curves, while retaining many of the assumptions of the more conventional p-y approach. Research has shown a potential reduction in the embedded length of the piles by up to 35%.[1]

### EFFICIENT DESIGN TRANSLATES TO MORE SAVINGS

In the very competitive offshore wind industry, less conservative dimensioning of each monopile of a wind farm will result in a significant reduction in the amount of steel and, therefore, in fabrication, transportation, and installation costs.

### SEAMLESS INTEGRATION WITH THE PLAXIS ENVIRONMENT

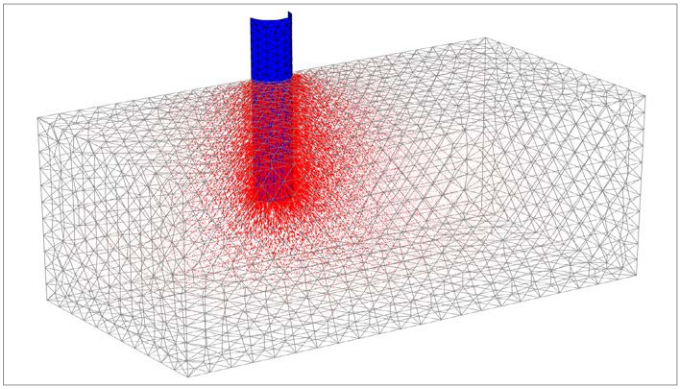
PLAXIS Monopile Designer can be used as a stand-alone application for 1D analysis with either the PISA rule-based, API, or user-defined soil reaction curves.

PLAXIS Monopile Designer reaches its full potential when used with PLAXIS 3D, which enables the automatic calibration of the soil reaction curves to the specific design space and characteristics of the site. In addition, PLAXIS 3D offers a complete, well-proven, and robust finite element solution for any type of offshore or onshore structure.

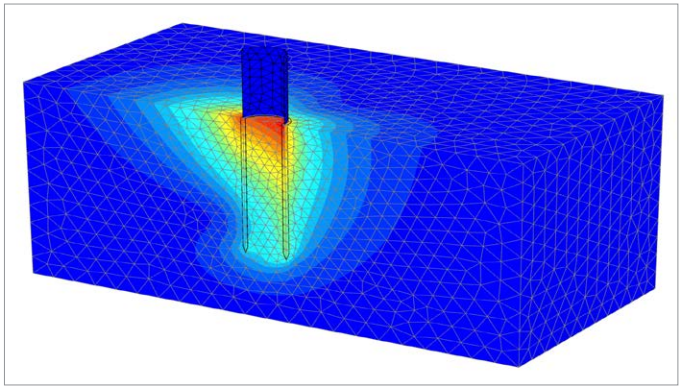
### STATE-OF-THE-ART RESEARCH BROUGHT TO ENGINEERING PRACTICE

PLAXIS Monopile Designer has been developed in collaboration with Oxford University and Fugro. It transfers the enhanced design method established in PISA Phase 1 and 2 to current industry design practices.

The underlying procedure has been validated via large-scale testing of monopile foundations at the two PISA test sites – the Dunkirk sand site and the Cowden clay site.



*Principal stress directions around a monopile foundation.*



*Analysis of layered soil profiles in accordance with PISA Phase 2.*

[1] *Byrne, B. et al. (2017). PISA: New Design Methods for Offshore Wind Turbine Monopiles. 8th International Conference for Offshore Site Investigation and Geotechnics, London.*

## SYSTEM REQUIREMENTS

**MINIMUM:** Intel Pentium-based or AMD Athlon-based processor, Windows 10 or Windows 11, 4 GB RAM, 2 GB hard disk, video card with 256 MB VRAM that supports OpenGL 3.3, display 1024 px by 768 px or better

**RECOMMENDED:** 8 GB RAM (more memory typically results in better performance)

# PLAXIS Monopile Designer At-A-Glance

### MODELING

- Analysis of homogeneous and layered profiles according to PISA Phases 1 and 2
- Seamless integration with PLAXIS 3D
- Nonlinear soil reaction curves for lateral loading, rotation, base shear, and base rotation (PISA) or lateral loading only (API)

### CALCULATIONS

- Automatic calibration and optimization of numerical soil reaction curves (PLAXIS 3D)
- Robust 1D kernel with highly efficient calculation times

### RESULTS

- Realistic assessment of displacements and structural forces
- Visualization and export of numerical PLAXIS 3D and parametric soil reaction curves
- Automatic generation of (PLAXIS 3D) design verification models
- Direct export of soil reaction curves to OpenWindPower

### CAPABILITIES

- Timoshenko beam theory ensures accurate results even for large diameter monopiles
- Optimized design method for monopile foundations
- Automated analysis set-up and extraction of results with Python scripting interface

| PLAXIS Monopile Designer Features | Stand Alone | With PLAXIS 3D and GSE |
|---|---|---|
| **1D ANALYSIS** | | |
| Homogeneous Soils | ✓ | ✓ |
| Layered Soils | ✓ | ✓ |
| With User-defined Depth Variation Functions | ✓ | ✓ |
| With API P-Y Curves | ✓ | ✓ |
| Export Results as TSV | ✓ | ✓ |
| Python Scripting Interface | ✓ | ✓ |
| **CALIBRATION** | | |
| Generation of 3D Calibration Models | | ✓ |
| Calibration with Target Displacement | | ✓ |
| Calculation of Soil Reaction Curves | | ✓ |
| Parameterization of Depth Variation Functions | | ✓ |
| Export to SACS/OpenWindPower® (Numerical) | | ✓ |
| Export to SACS/OpenWindPower (Parametric) | | ✓ |
| **3D DESIGN VERIFICATION** | | |
| Generation of 3D Verification Models | | ✓ |
| Calculation of 3D Verification Models | | ✓ |
| 3D Verification Results | | ✓ |
| Accuracy Metrics | | ✓ |
| Export to SACS/OpenWindPower (Numerical) | | ✓ |
| Export to OpenWindPower (Parametric) | | ✓ |

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