FRILO
Software
A NEMETSCHEK COMPANY

Mast Foundation FDM+

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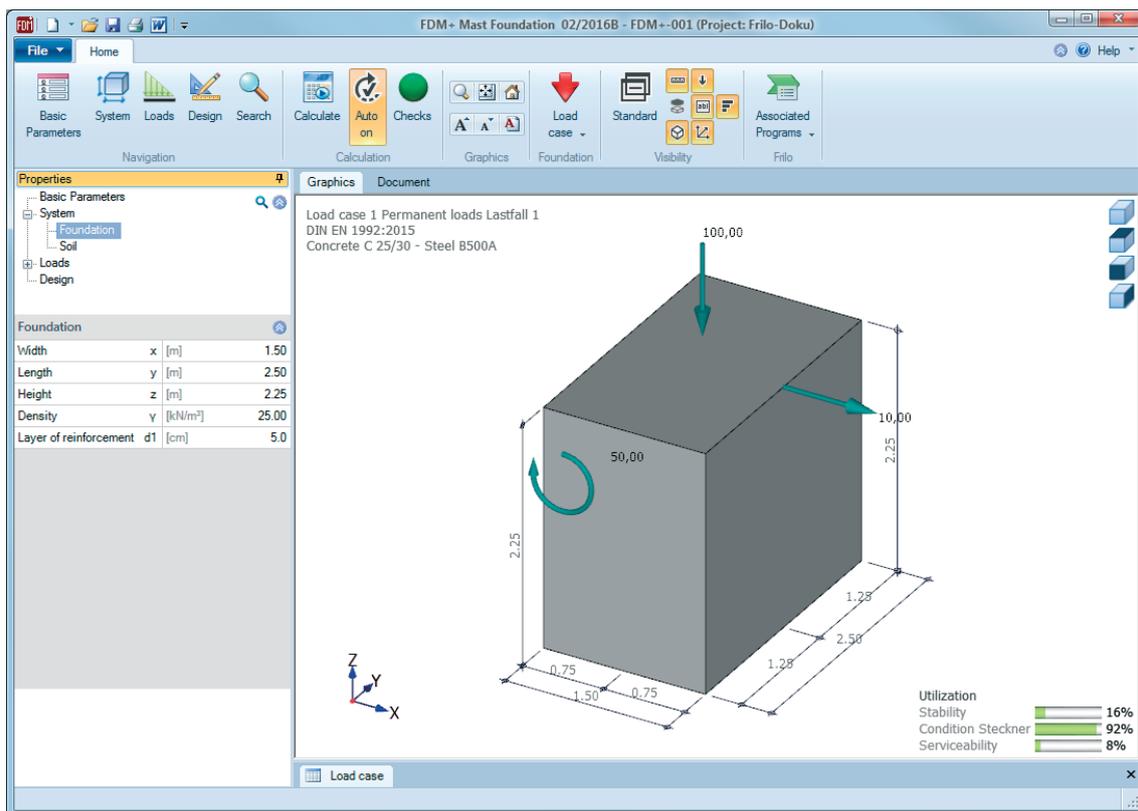
Mast Foundation FDM+

Contents

Application options

Mast foundations are typically pad foundations that are embedded in the ground. The foundations are loaded by moment in the first place. Their stability is ensured by the earth resistance. The serviceability analysis of these foundations is performed in accordance with the subgrade reaction modulus method published by Sulzberger in Switzerland in 1945. The subgrade reaction modulus depends on the foundation thickness and the angle of inner friction (equation (3) in the article by Steckner mentioned below). It is determined by the software in accordance with this method. Sebastian Steckner published the article "Gebrauchstauglichkeits- und Standsicherheitsnachweis für eingespannte Blockfundamente" (serviceabilty verification and stability verification of restrained pad foundations) in the Bautechnik magazine (66/1989, p. 55). In this article, he corrects the discrepancies in Sulzberger's theory and makes clear what happens in the transition area when the base friction is overcome. Furthermore, he enhances Sulzberger's method in regard to sloped ground surfaces and establishes a relation between the subgrade reaction modulus and the earth pressure coefficient. Moreover, he describes a calculation model for the stability verification. The verifications of the serviceability and the stability are performed in accordance with the specifications of this article. In addition to these verifications, the software performs the design of the foundation. Uniaxially loaded pad foundations (loaded by N, M, H) with dimensions in the range of 2/3 < D/A <= 4 (A = width in loading direction and D = foundation thickness) can be verified with the method described by Steckner. These criteria help distinguishing the foundations to be verified from flat foundations, mast footings and wall-type foundations.

!!Attention: *The FDM+ Mast Foundation software allows you to verify foundations of all kinds of masts and towers as well as of columns for noise-protection walls, signal boards and similar structures. If the defined loads and dimensions of the structural system produce a deviating load-bearing behaviour another calculation method is required and you should use the appropriate application program.*

Basis of calculation

Available standards

- EN 1992
- DIN EN 1992
- ÖNORM EN 1992
- BS EN 1992
- Bautechnik 66 (1989), H. 2

Data entry

You can enter values and define control parameters in the menu on the left screen section. The effect of the entered values is immediately shown in the graphical representation on the right screen section. Before entering any data, you can edit the dimensional units (cm, m ...) via the options File
▸ Program options.
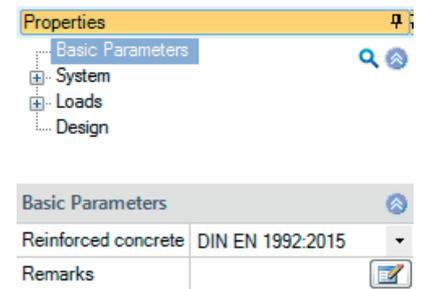
Wizard

The definition wizard is automatically launched when you start the software. You can disable the wizard in the settings menu.

Input options in the three-dimensional GUI

The data entry via the GUI is described in the document Basic Operating Instructions-PLUS.

Basic parameters

Reinforced Concrete

Select the desired reinforced concrete standard.

Remarks

Enter any comments which you like to be put out together with the item.

Structural system

Material

Selection of the concrete quality and the reinforcing steel grade.

Foundation

In the foundation plan view, the x-axis (positive) runs from the left to the right and the y-axis (positive) from the bottom to the top.

Width x	foundation dimension in the x-direction
Length y	foundation dimension in the y-direction
Height z	foundation height
Density γ	specific weight of the concrete
Layer of reinforcement d1	reinforcement layer

Foundation

Width	x	[m]	1.50
Length	y	[m]	2.50
Height	z	[m]	2.25
Density	γ	[kN/m³]	25.00
Layer of reinforcement	d1	[cm]	5.0

Soil

Soil Properties

Soil Density γ	specific weight of the soil
Base friction angle φ	friction angle of the soil above or underneath the foundation base.
CB1/CB2	horizontal or vertical subgrade reaction modulus at the level of the foundation base (depends on the angle of inner friction).
Wall friction anglel	active or passive wall friction angle at the vertical foundation surface

Soil properties

Soil density	γ	[kN/m³]	19.0
Friction angle above base	φ'	[°]	30.0
Friction angle under base	φ'	[°]	30.0
Horizontal modulus of subgrade reaction	CB1	[kN/m³]	112500
Vertical modulus of subgrade reaction	CB2	[kN/m³]	112500
Wall friction angle, active	δa	[°]	20.0
Wall friction angle, passive	δp	[°]	20.0

Inclination

Active earth pressure	β	[°]	0.0
Passive earth pressure	β	[°]	0.0

Inclination

Allows you to describe the inclination of the surrounding ground.

Active earth pressure β	inclination of the ground surface on the side of the active earth pressure (increasing direction is positive)
Passive earth pressure β	inclination of the ground surface on the side of the passive earth pressure (increasing direction is positive)

Loads

H loads application	☐ Option unchecked: The horizontal loads apply at the top edge of the footing and generate a moment with a corresponding lever arm. ☑ Option checked: The horizontal loads apply directly in the foundation joint (no moment).
Delete horizontal loads	the button allows you to delete all horizontal loads with a mouse click! This function is helpful when you have imported many load cases from other application programs (GEO, B5 etc.).
Note:	*The horizontal loads of the individual load cases can be defined and edited via the menu item "Load cases".*

Load cases

Enter the data of the first load case either in the corresponding data-entry mask or directly in the load case table, which you can display below the graphic by activating the ▦ Load case tab.

Load case toolbar: Load case ◐ 1/2 ◑ ⬚ ✕ ⊞ ⊞ ☑ see <u>Data entry via tables</u> (Basic Operating Instructions).

To add load cases, always set up a new load case first by activating the ⬚ button (a data-entry mask for the new load case is displayed each time).

Tip: *A description is displayed in the status line each time you click into a particular data-entry field.*

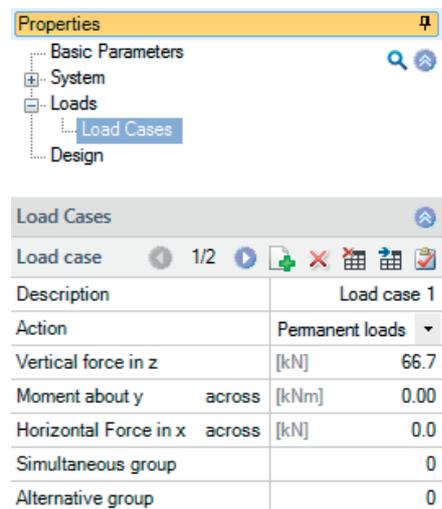|	
Description	allows you to enter a short designation for the load case
Action	category or kind of action of the load
Vertical force in z	vertical force (characteristic value)
Moment about y	moment (characteristic value) about the y-axis
Horizontal force in x	horizontal force (characteristic value) in the x-direction
Simultaneous group	assignment of the load to a group of loads acting simultaneously. The group is defined by a group number entered by the user. Loads that are assigned to the same concurrent group always apply simultaneously. Loads in a concurrent group must also be member of an action group.
Alternative group	assignment of the load to a group of loads excluding each other. The group is defined by a group number entered by the user.

Design

Safety factor s		safety factor for stability in accordance with Steckner.
Minimum of reinforcement		minimum reinforcement for a ductile behaviour of the structural component
Permissible inclination tan α		permissible inclination of the foundation (of the vertical centroidal axis); it is positive from the left to the right.

Properties

- Basic Parameters
- System
- Loads
- **Design**

Design			
Safety Factor	s	[-]	2.00
Minimum of reinforcement			☑
perm. inclination	tan α	[-]	0.00500

Output

Activating the Document tab allows you to display the document in PDF format.

See also the document "FDC - Output and printing_eng.doc".