# Mast Foundation FDM+

## Contents



## Basic Documentation – Overview

In addition to the individual program manuals, you will find basic explanations on the operation of the programs on our homepage www.frilo.com in the Campus-download-section.

# Application options

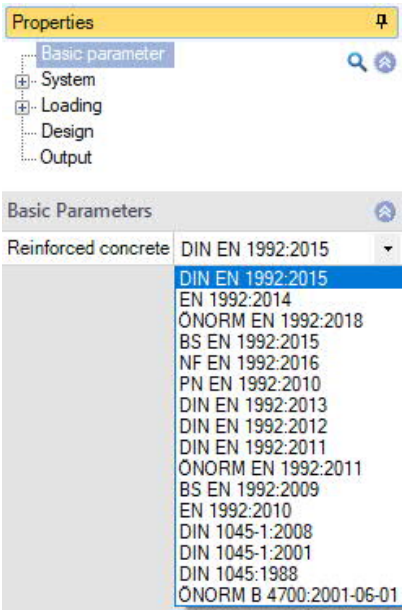
Mast foundations are typically pad foundations that are embedded in the ground. The foundations are loaded by moment in the first place. Their stability is ensured by the earth resistance. The serviceability analysis of these foundations is performed in accordance with the subgrade reaction modulus method 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

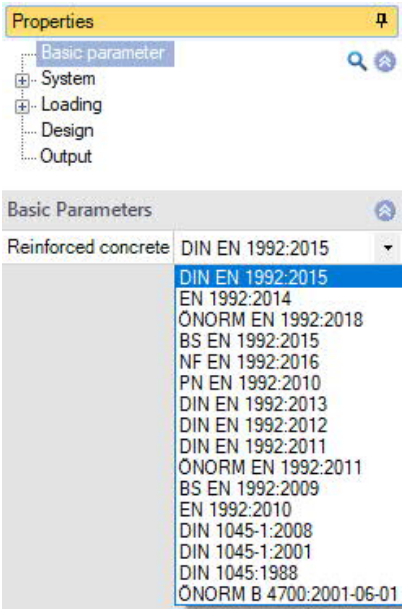
- EN 1992: 2010/2014
- DIN EN 1992: 2011/2013/2015
- ÖNORM EN 1992: 2011/2018
- BS EN 1992: 2009/2014
- NF EN 1992:2016
- PN EN 1992: 2010




- Bautechnik 66 (1989), H. 2
- Older standards (DIN 1045-1, ÖNORM B4700) are also available for selection.
- Bautechnik 66 (1989) H.2 Wilhelm Ernst & Sohn Publishing House for Architecture and Technical Sciences

FDM+ offers support for all 3 verification methods according to Eurocode 7, adjustable for all national annexes.

# 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

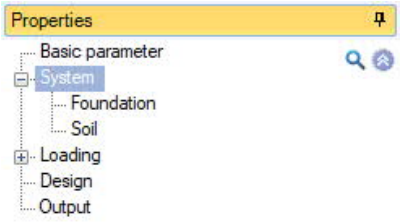
## Reinforced Concrete

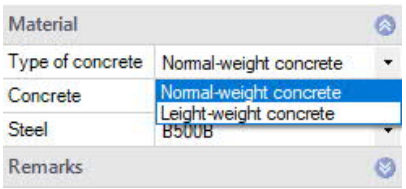
Select the desired reinforced concrete standard.

# Structural system

## Material

Selection of normal or lightweight concrete as well as the concrete quality and reinforcement steel grade for the foundation.



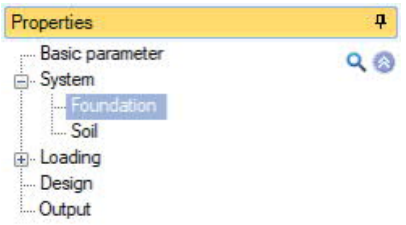

## Remarks

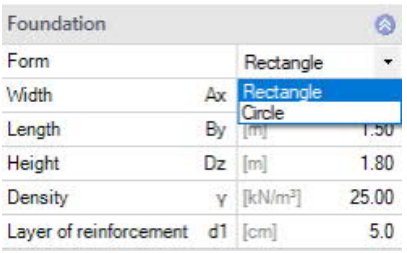
Click on the  button, to enter your own comments to the system.

## 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.

| | |
|---|---|
| Form | rectangle or circle |
| Width | foundation dimension in the x-direction |
| Length | foundation dimension in the y-direction |
| Height | foundation height |
| Diameter | foundation dimensions for circular shape |
| Density γ | specific weight of the concrete |
| Layer of reinforcement d1 | reinforcement layer |

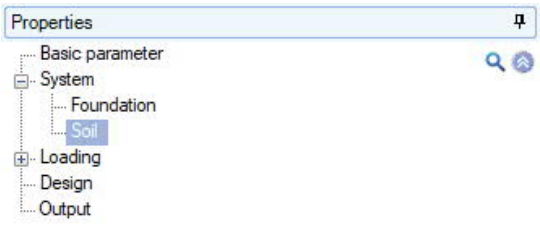


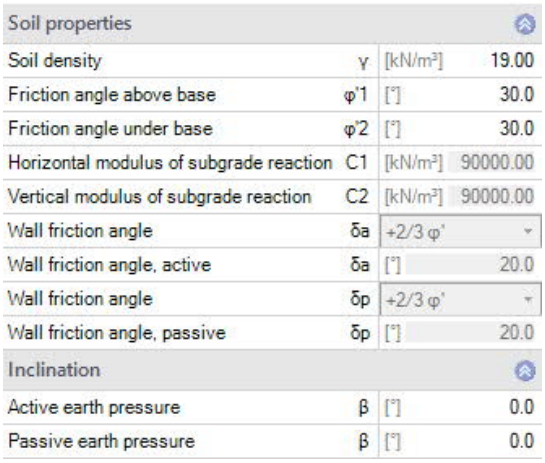




## Soil

### 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. |
| C1/C2 | 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 |




### Inclination

Allows you to describe the inclination of the surrounding ground.

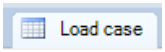
| | |
|---|---|
| Active earth pressure β | inclination of the ground surface on the side of the active earth pressure (increasing direction is positive) |
| Passive earth pressure β | inclination of the ground surface on the side of the passive earth pressure (increasing direction is positive) |

# Loads

| | |
|---|---|
| Delete horizontal loads | the button allows you to delete all horizontal loads with a mouse click!<br>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 

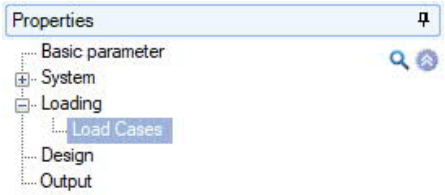
tab.

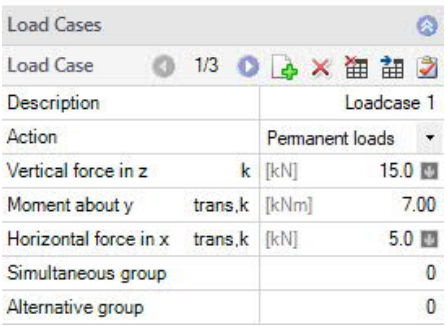
Load case toolbar: 

see Data entry via tables (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.*



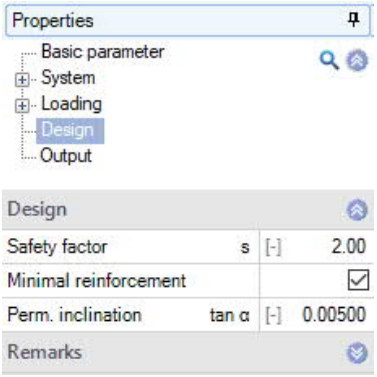

| | |
|---|---|
| Description | allows you to enter a short designation for the load case |
| Action | category or kind of action of the load |
| Vertical force in z | vertical force (characteristic value) |
| Moment about y | moment (characteristic value) about the y-axis |
| Horizontal force in x | 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.<br>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.<br>The group is defined by a group number entered by the user. |

## Load value compilation 

By clicking on the arrow icon  you can access a load value compilation - see the description of the LOAD+ program.

# 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. |




## Remarks

Click on the  button, to enter your own comments.

# Output

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

See also the document Output and printing.