

## MWP

### Masonry Column

The MWP application performs structural safety analyses for columns made of artificial masonry and takes biaxial load eccentricities and flexural buckling in both axis directions into account.

Columns under centric loading can be verified using the simplified verification method. In all other cases, the more accurate verification method must be used.

#### Basis of calculation

The design of the column can be based on the following standards

- DIN 1053-1:1996-11
- DIN 1053-100:2007-09
- EN 1996-1-1  
(more accurate calculation)
- EN 1996-3  
(simplified calculation)

as desired, in combination with the national annexes for

- Germany
- Austria
- Great Britain

#### System options

The masonry column can have one of following types:

- cantilever column
- hinged column
- fixed column

in the calculation. The bearing conditions are specified separately for the two main of the cross section.

#### Types of masonry

The user can choose between prescribed masonry, masonry subject to approval (approval database) or user-defined material for the analysis. In combination with DIN/ÖNORM EN 1996 Wienerberger/POROTON products are also available. In combination with EN 1996, the material parameters have to be entered according to the respective national stipulations.

#### Actions

The masonry column to be verified can be exposed to

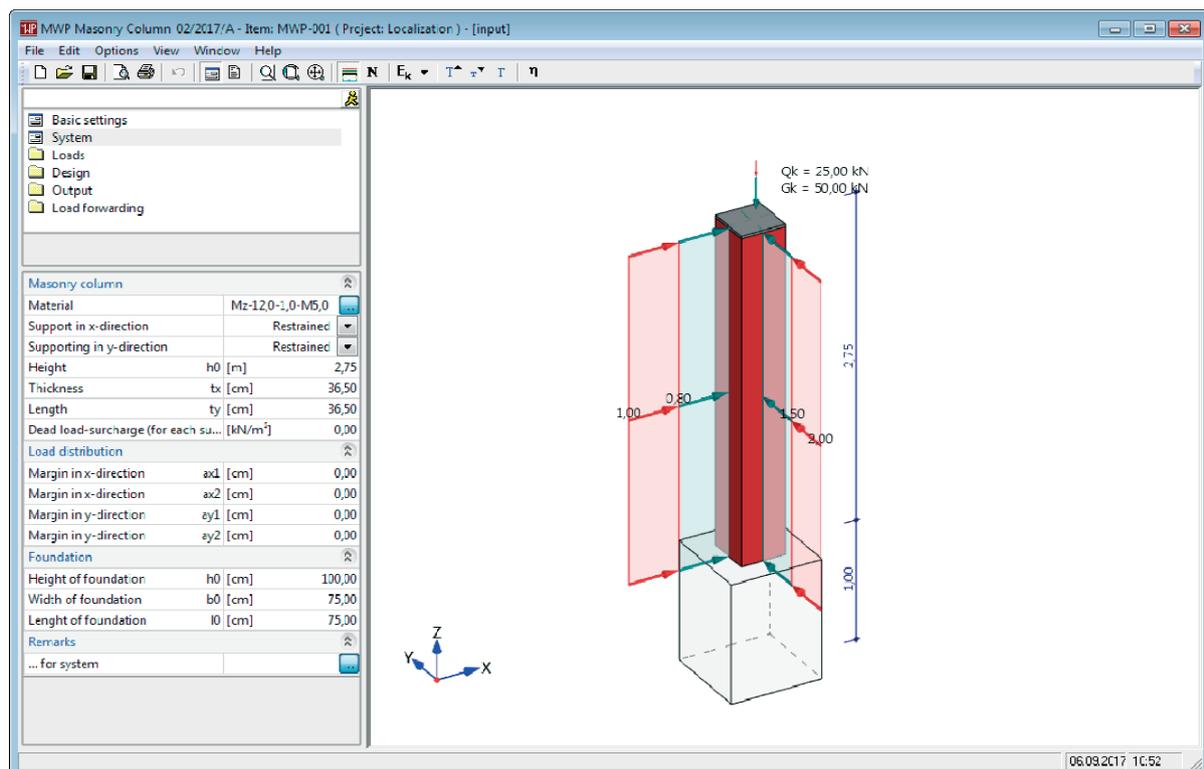
- centric or eccentric vertical concentrated loads at its head and/or
- lateral loads along the column axes.

#### Combinations of actions

MWP generates automatically the appropriate load cases and load case combinations depending on the defined actions and performs the necessary analyses, whereby the decisive load case combination is determined for each individual design check.

#### Calculation of the effects of actions

The problems that have to be examined in connection with walls, such as load propagation, tensile and flexural tensile stresses, in-plane shear and edge



strain, are not considered in the analyses of masonry columns. The structural safety analyses that have to be performed for columns are limited to out-of-plane shear and compressive stresses that typically apply at the column head, half of the column height and the column foot as well as at the point of the maximum load eccentricity. In the calculation of the loading on the cross section, oblique bending or failure of the tension zone can be taken into account, if this necessary. In addition to this, the flexural buckling analyses must be performed for both directions of failure.

### Analysis procedure

Depending on the selected standard and the defined loads, the following design checks are performed:

- Resistance to compressive loading with biaxial eccentricity, if applicable
- Resistance to out-of-plane shear with biaxial eccentricity, if applicable
- Eccentricity of vertical loads (not necessary with EN 1996)

The implemented design checks with biaxial eccentricity constitute practical extensions of the equations specified in the design standards. They are based on the fun-

damental principles of the corresponding standard and include exactly the standard equations for the special case of uniaxial eccentricity.

### Output

Comprehensive adjustment options allow a detailed control of the analyses and the output of system, load and result values.

### Load transfer

The characteristic values of bearing forces can optionally be transferred to the applications "Isolated Foundation FD+".

The screenshot shows a software print preview window for 'Frilo Software'. The main content area displays the following information:

**Frilo Software**  
 Stuttgarter Str. 40 | Tel.: +49 711 810020 | Project: Localization  
 70469 Stuttgart | Fax: +49 711 858020 | Item: MWP-001  
 06.09.2017 | Page: 1

**Item: MWP-001 Input**  
 Masonry Column MWP 02/2017/A (Frilo prerelease)  
 Scale 1: 50

The technical drawing shows a masonry column with a height of 2.75 m and a base width of 1.00 m. The column is subjected to a vertical load  $G_k = 50.00$  kN and a variable load  $Q_k = 25.00$  kN. The column is supported on a base with a width of 1.00 m. The column is divided into three sections with heights of 1.00 m, 1.50 m, and 1.25 m. The column is subjected to a horizontal load of 1.00 kN at the top.

**SYSTEM - COLUMN (head joints not solidified)**  $y_w = 1,598$  kN/m

Dimensions:  $t_x/t_y = 36.5/36.5$  cm clear height:  $h_s = 2.75$  m  
 Edge spacing load impact :  $ax_1/ax_2/ay_1/ay_2 = 0.0/0.0/0.0/0.0$  cm  
 Static system in x/y direction: Restrained / Restrained

Material	fbk [N/mm <sup>2</sup> ]	fk [N/mm <sup>2</sup> ]	fm [N/mm <sup>2</sup> ]	fvk0 [N/mm <sup>2</sup> ]	maxfvk [N/mm <sup>2</sup> ]
Mz-12,0-1,0-M5,0	12.00	4.61	5.00	0.20	0.78

**VERTICAL LOADS**

No. : load number  
 Dir : load direction  
 G : permanent part of load in [kN]  
 Q : variable part of load in [kN]  
 ex : eccentricity of vertical load in x-direction  
 ey : eccentricity of vertical load in y-direction  
 AGrp : type of action of variable part of load  
 SimGrp : Number of simultaneous group  
 AcGrp : alternative group

Nr.	Dir	Type	G [kN]	Q [kN]	ex [cm]	ey [cm]	AcGrp	ConGrp	AGrp	Pos
1	1	2	50.00	25.00	10.00	10.00	1	0	0	