Example 17: Verifying *Winkler's* model and Isotropic elastic half-space soil medium

1 Description of the problem

A simple example was carried out to verify *Winkler's* model and Isotropic elastic half-space soil medium, by comparing *ELPLA* results with those of *Mikhaiel* (1978), Example 34, page 189, and *Henedy* (1987), Section 3.6, page 66, or *Bazaraa* (1997).

A square raft of 0.4 [m] thickness and 10 [m] side was chosen and subdivided into 64 square elements, each has dimensions of 1.25 [m] × 1.25 [m]. The raft carries four column loads, each 500 [kN] as shown in Figure 28.

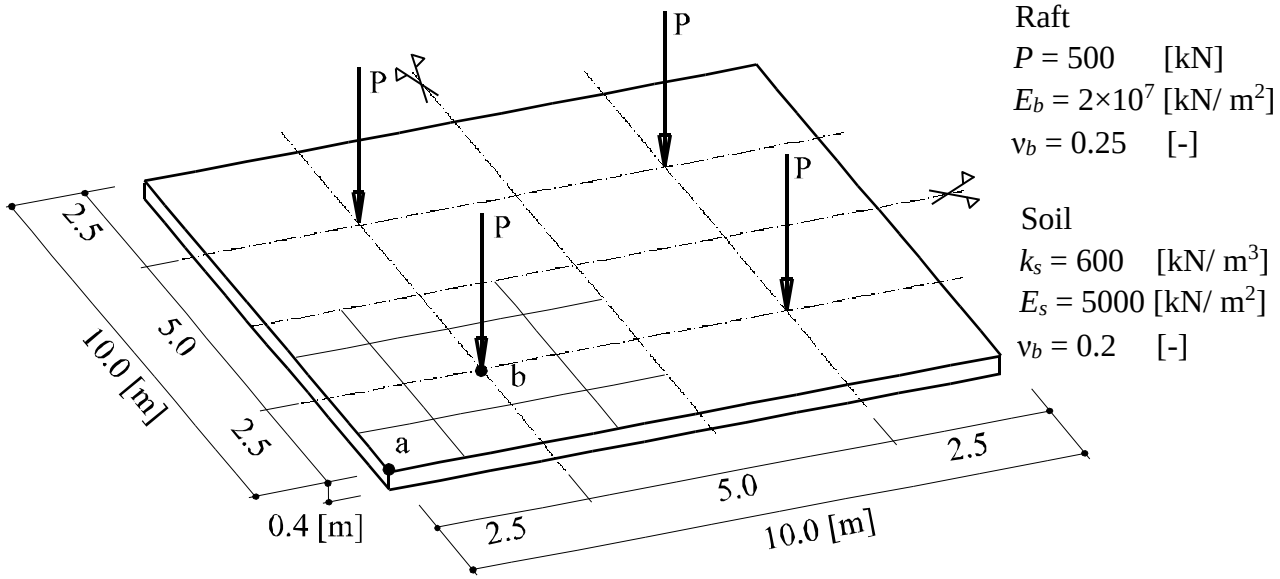

Figure 28 Raft dimensions, FE-Net and loads

The raft material has the following parameters:

Young's modulus	E_b	$= 2 \times 10^7$	[kN/m^2]
Poisson's ratio	ν_b	$= 0.25$	[-]
Unit weight	γ_b	$= 0$	[kN/m^3]

2 Results

Taking advantage of the symmetry in shape, soil and load geometry about both *x*- and *y*-axes, the analysis is carried out by considering only a quarter of the raft.

a) *Winkler's* model

The raft rests on *Winkler's* springs having modulus of subgrade reaction of k_s = 600 [kN/m^3]. Table 21 compares the results obtained by *ELPLA* with those of *Mikhaiel* (1978) and *Bazaraa* (1997) at the selected points *a* and *b*.

Table 21 Comparative examination of the results of *Mikhaiel* (1978), *Bazaraa* (1997) and *ELPLA* (*Winkler's* model)

Settlement *s* [cm]	*Mikhaiel* (1978)	*Bazaraa* (1997)	*ELPLA*
under the column (point *b*)	3.401	3.411	3.412
at the corner (point *a*)	3.143	3.070	3.069

b) Isotropic elastic half-space soil medium

The same problem shown in Figure 28 was examined for the case where Isotropic elastic half-space medium represents the soil. The soil has modulus of elasticity E_s = 5000 [kN/m^2] and *Poisson's* ratio ν_s = 0.2 [-]. The obtained results for Isotropic elastic half-space soil medium according to *Mikhaiel* (1978), *Bazaraa* (1997) and *ELPLA* at the selected points *a* and *b* are shown in Table 22.

Table 22 Comparative examination of the results of *Mikhaiel* (1978), *Bazaraa* (1997) and *ELPLA* (Isotropic elastic half-space soil medium)

Settlement *s* [cm]	*Mikhaiel* (1978)	*Bazaraa* (1997)	*ELPLA*
under the column (point *b*)	3.421	3.440	3.458
at the corner (point *a*)	2.834	2.709	2.746

It is obviously from Table 21 and Table 22 that the results of *Winkler's* model and Isotropic elastic half-space soil medium obtained by *ELPLA* are nearly equal to those obtained by *Mikhaiel* (1978) and *Bazaraa* (1997).