Example 3: Immediate settlement under a loaded area on Isotropic elastic half-space medium

1 Description of the problem

To verify the mathematical model of *ELPLA* for computing the immediate (elastic) settlement under a loaded area on Isotropic elastic half-space medium, the results of immediate settlement calculations obtained by *Bowles* (1977), Table 5-4, page 157, are compared with those obtained by *ELPLA*.

The vertical displacement *s* under an area carrying a uniform pressure *p* on the surface of Isotropic elastic half-space medium can be expressed as

$$s = \frac{pB\left(1-ny_s^2\right)}{E_s} I \qquad (4)$$

where:

ν_s *Poisson's* ratio of the soil [-]
E_s *Young's* modulus of the soil [kN/m^2]
B lesser side of a rectangular area or diameter of a circular area [m]
I Settlement influence factor depending on the shape of the loaded area [-]
p Load intensity [kN/m^2]

Eq. 4 can be used to estimate the immediate (elastic) settlement of soils such as unsaturated clays and silts, sands and gravels both saturated and unsaturated, and clayey sands and gravels.

Different loaded areas on Isotropic elastic half-space soil medium are chosen as shown in Figure 3. The loaded areas are square, rectangular and circular shapes. Load intensity, dimension of areas and the elastic properties of the soil are chosen to make the first term from Eq. 4 equal to 1.0, hence:

Area side or diameter	*B*	= 10	[m]
uniform load on the raft	*p*	= 1000	[kN/m^2]
Young's modulus of the soil	E_s	= 7500	[kN/m^2]
Poisson's ratio of the soil	ν_s	= 0.5	[-]

2 Analysis of the problem

The Isotropic elastic half-space medium for flexible foundation is available in the method "Flexible foundation 9".

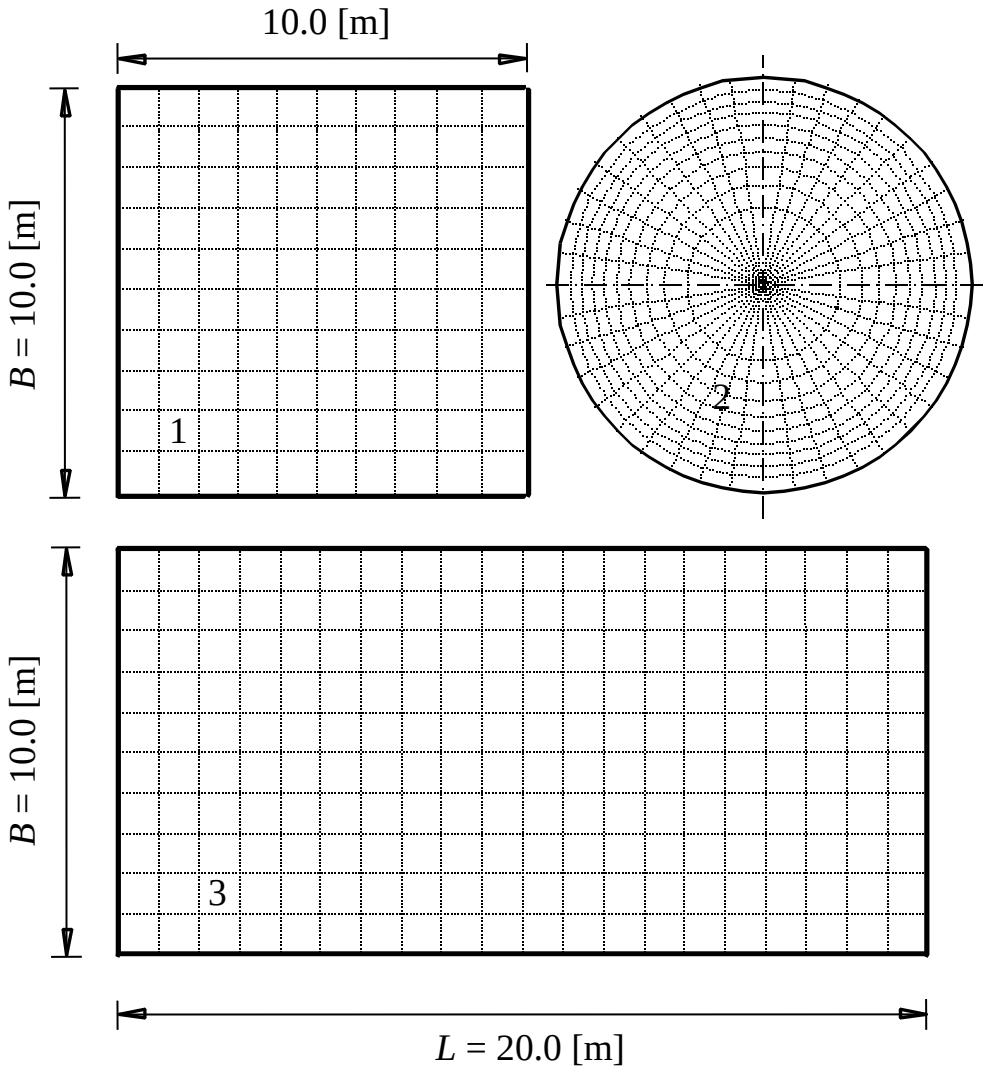

Figure 3 Various loaded areas with dimensions and FE-Nets

3 Results

Table 3 shows the comparison of settlement influence factors *I* obtained by *ELPLA* with those obtained by *Bowles* (1977) for different loaded areas.

Table 3 Comparison of settlement influence factors *I* obtained by *ELPLA* with those obtained by *Bowles* (1977)

Settlement influence factor *I* [-]				
Shape of area	Center		Corner	
	Bowles (1977)	*ELPLA*	*Bowles* (1977)	*ELPLA*
Circle	1.00	1.00	0.64 (edge)	0.63 (edge)
Square	1.12	1.12	0.56	0.56
Rectangular	1.53	1.53	0.77	0.77

Table 3 shows that the results of settlement influence factors *I* obtained by *ELPLA* and those obtained by *Bowles* (1977) are in good agreement.