Example 9: Rigid circular raft on Isotropic elastic half-space medium

1 Description of the problem

To verify the mathematical model of *ELPLA* for rigid circular raft, results of a rigid circular raft obtained by other analytical solutions from *Borowicka* (1939) and *Stark* (1990), Section 5.2, page 106, are compared with those obtained by *ELPLA*.

According to *Borowicka* (1939), the vertical displacement w [m] of a rigid circular raft on Isotropic elastic half-space medium may be evaluated by

$$w = \frac{p r \pi \left(1 - \nu_s^2\right)}{2 E_s} \qquad (13)$$

where:

ν_s *Poisson's* ratio of the soil [-]
E_s *Young's* modulus of the soil [kN/m^2]
r Raft radius [m]
p Load intensity on the raft [kN/m^2]

While the contact pressure distribution q [kN/m^2] under the raft at a distance e [m] from the center may be evaluated by

$$q = \frac{p r}{2\sqrt{r^2 - e^2}} \qquad (14)$$

A circular raft on Isotropic elastic half-space soil medium is chosen and subdivided into 40 × 40 elements. Each element has a side of 0.25 [m]. Load on the raft, raft radius and the elastic properties of the soil are chosen as follows:

Raft radius	r	= 5	[m]
Uniform load on the raft	p	= 100	[kN/m^2]
Young's modulus of the soil	E_s	= 6000	[kN/m^2]
Poisson's ratio of the soil	ν_s	= 0.25	[-]

2 Analysis of the raft

The available method "Rigid raft 9" in *ELPLA* is used here to determine the vertical displacement of the raft on Isotropic elastic half-space medium. 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. Figure 11 shows a quarter of the raft with FE-Net.

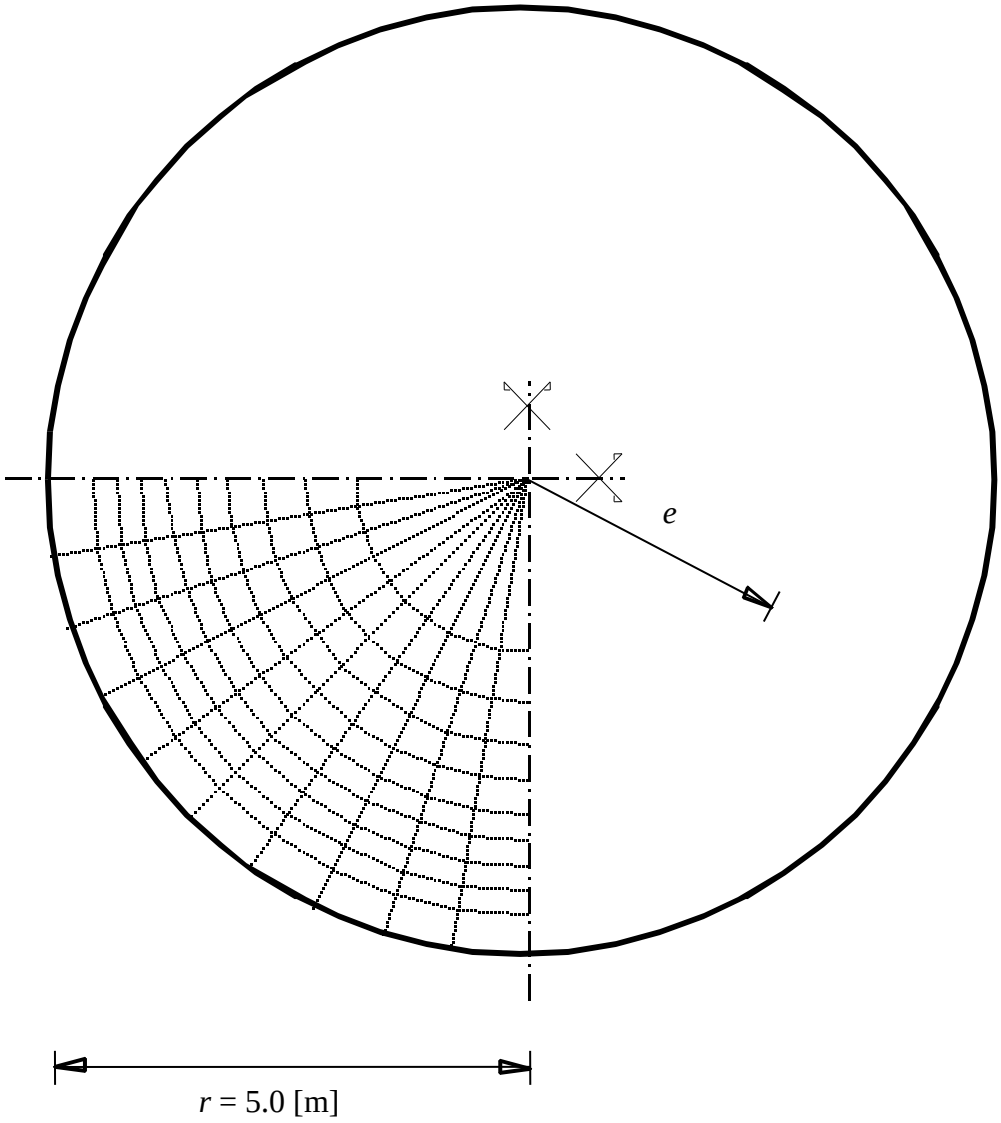

Figure 11 Quarter of rigid square raft with dimensions and FE-Net

3 Results

Figure 12 shows the comparison of the contact pressure ratio *q/p* [-] at the middle section of the raft obtained by *ELPLA* with those obtained by *Borowicka* (1939) and *Stark* (1990). Besides, Table 11 shows the comparison of the central displacement *w* obtained by *ELPLA* with those obtained by *Borowicka* (1939) and *Stark* (1990).

Table 11 Comparison of the central displacement *w* obtained by *ELPLA* with those obtained by *Borowicka* (1939) and *Stark* (1990)

	Borowicka (1939)	*Stark* (1990)	*ELPLA*
Central displacement *w* [cm]	12.272	12.195	12.164

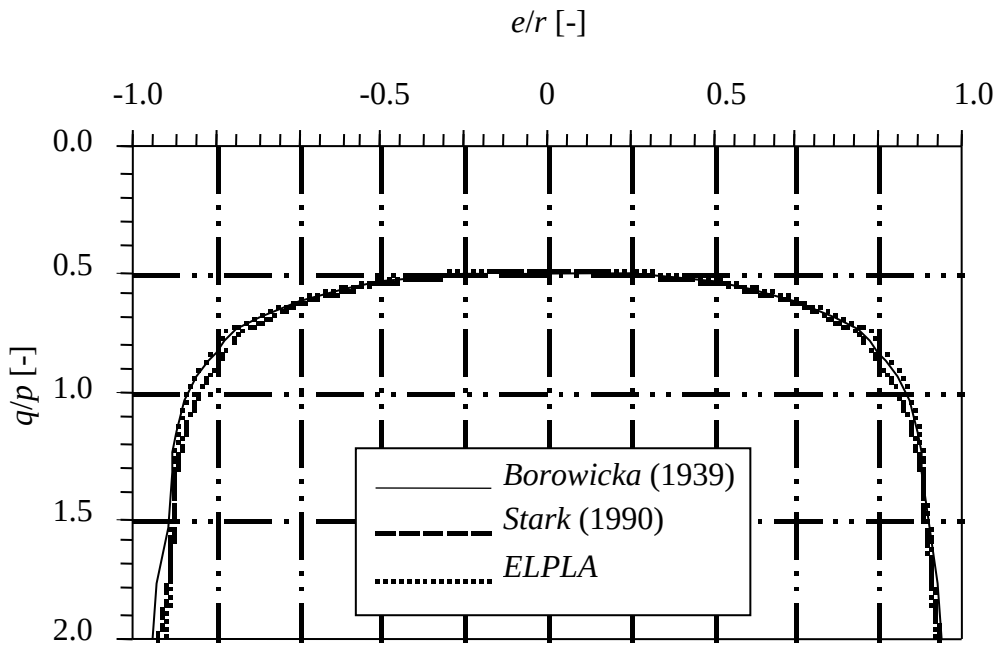

Figure 12 Contact pressure ratio *q/p* [-] under the middle of the circular rigid raft

It is obviously from Table 11 and Figure 12 that results of the circular rigid raft obtained by *ELPLA* are nearly equal to those obtained by *Borowicka* (1939) and *Stark* (1990).