Example 16: Verifying elastic raft on Isotropic elastic half-space soil medium

1 Description of the problem

To verify the mathematical model of *ELPLA* for elastic raft, the results of an elastic raft at different relative stiffness obtained by other analytical solutions from *Stark*/ *Majer* (1988) and *Borowicka* (1939) are compared with those obtained by *ELPLA*.

A rectangular raft with sides 12 [m] and 6 [m], that rests on an isotropic elastic half-space soil medium is chosen and subdivided into 12 × 12 elements as shown in Figure 24. The elastic properties of the raft and the soil are E_s = 10 000 [kN/m^2], $E_b = 2.6 \times 10^7$ [kN/m^2], $\nu_s = 0$ [-] and $\nu_b = 0.15$ [-]. The raft carries a uniform load of 100 [kN/m^2].

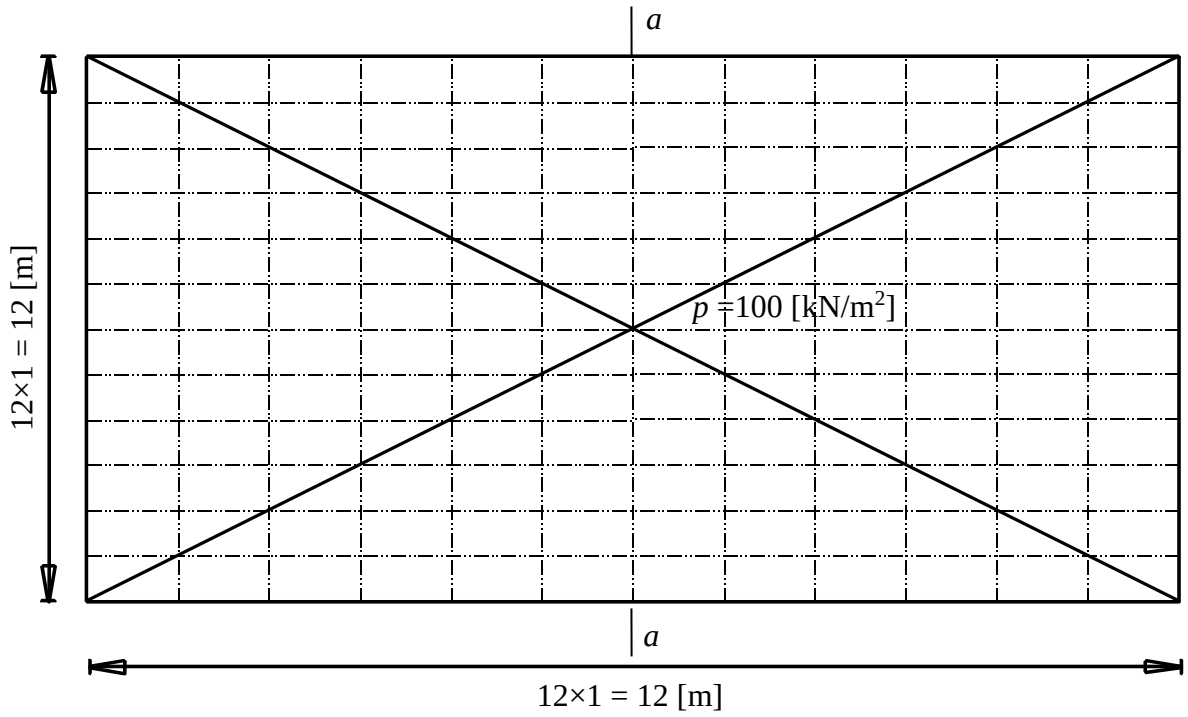

Figure 24 Raft geometry, loading and FE-Net

2 Results

Figure 24 to Figure 27 show the comparison of the results at the middle section a-a of the raft obtained by *ELPLA* with those obtained by *Stark*/ *Majer* (1988) and *Borowicka* (1939) for several relative stiffnesses k_B which are defined in Eq. 18 according to *Borowicka* (1939).

The relative stiffness of the soil-raft system, k_B [-], is defined by

$$k_B = \frac{1}{6}\left(\frac{1 - n\nu_s^2}{1 - n\nu_b^2}\right)\left(\frac{E_b}{E_s}\right)\left(\frac{d}{b}\right)^3 \qquad (18)$$

where:

ν_b and ν_s	*Poisson's* ratios for raft material and soil, respectively [-]
E_b and E_s	*Young's* modulus of raft material and soil, respectively [kN/m^2]
b	Half-width for the strip raft or radius for the circular raft [m]
d	Thickness of the raft [m]

In which, $k_B = 0.0$ indicates a perfectly flexible raft, and $k_B = \infty$ means a perfectly rigid raft. Eq. 18 was evaluated for $k_B = \pi/30$, $\pi/10$ and $\pi/3$.

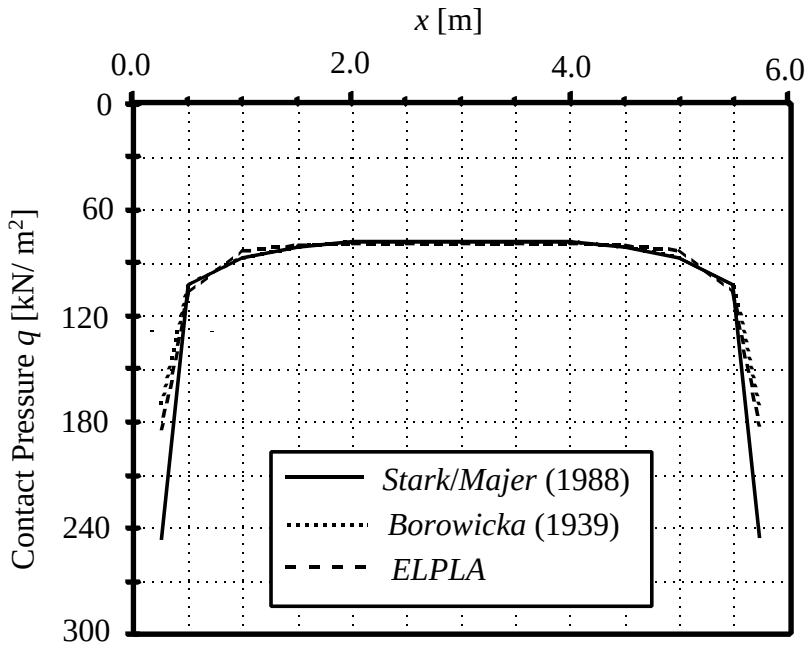

Figure 25 Contact pressure distribution q [kN/m^2] at section a-a, $k_B = \pi/30$, d = 18.5 [cm]

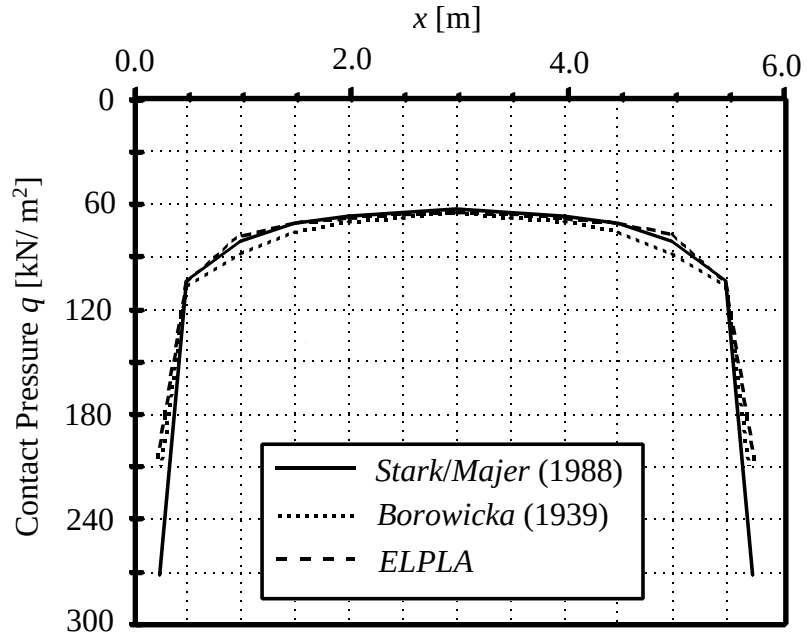

Figure 26 Contact pressure distribution q [kN/m^2] at section a-a, $k_B = \pi/10$, d = 26.7 [cm]

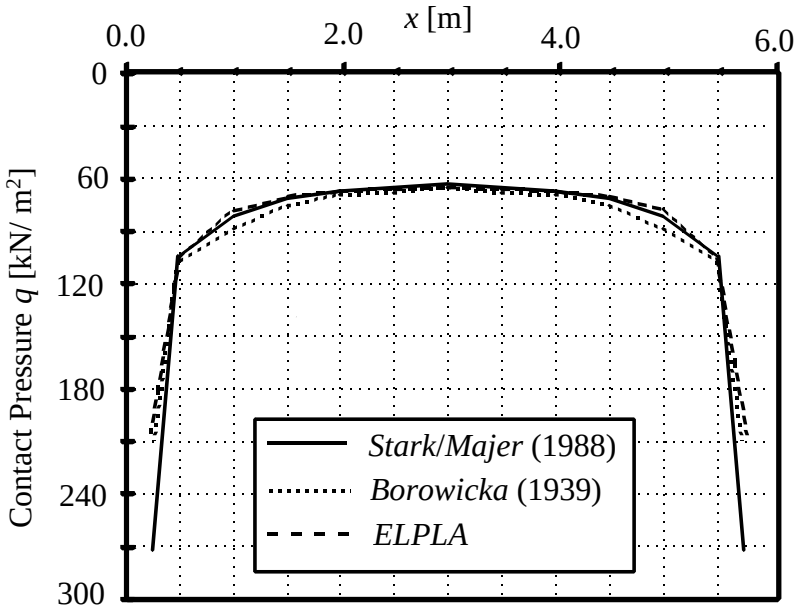

Figure 27 Contact pressure distribution q [kN/m^2] at section a-a, $k_B = \pi/3$, d = 40 [cm]

It is obviously from Figure 25 to Figure 27 that the results of elastic raft obtained by *ELPLA* are nearly equal to those obtained by *Stark*/ *Majer* (1988) and *Borowicka* (1939).