Example 10: Rigid circular raft on Isotropic elastic half-space medium

1 Description of the problem

The definition of the characteristic point s_o according to *Graßhoff* (1955) can be used to verify the mathematical model of *ELPLA* for flexible foundation and rigid raft. The characteristic point of a uniformly loaded area on the surface is defined as the point of a flexible settlement s_o identical with the rigid displacement w_o. For a rectangular area, the characteristic point takes the coordinates a_c = 0.87A and b_c = 0.87B, where A and B are the area sides.

Figure 13 shows a raft of dimensions 8 [m] × 12 [m] resting on three different soil layers of thicknesses 7 [m], 5 [m] and 6 [m], respectively.

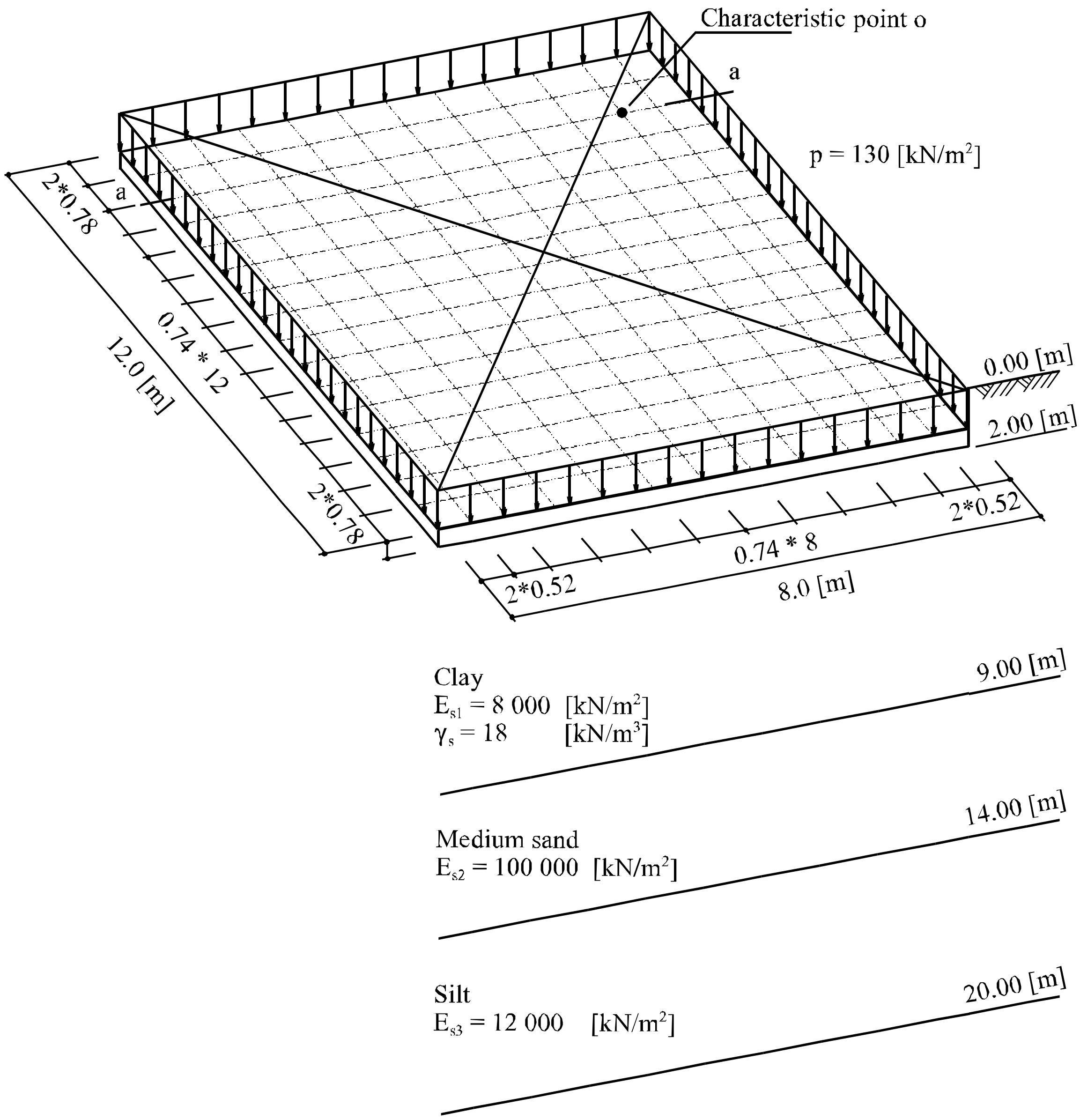

Figure 13 Raft dimensions, loads, FE-Net and subsoil

2 Soil properties

The raft rests on three different soil layers of clay, medium sand and silt overlying a rigid base as shown in Figure 13 and Table 12. *Poisson's* ratio is constant for all soil layers and is taken ν_s = 0.0 [-]. The foundation level of the raft is 2.0 [m] under the ground surface.

Table 12 Soil properties

Layer No.	Type of soil	Depth of layer underground surface z [m]	Modulus of compressibility E_s [kN/m^2]	Unit weight of the soil γ_s [kN/m^3]
1	Clay	9.0	8 000	18
2	Medium sand	14.0	100 000	-
3	Silt	20.0	12 000	-

3 Loading

The raft carries a uniform load of p = 130 [kN/m^2].

4 Analysis of the raft

The raft is divided into 12 × 16 elements as shown in Figure 13. First, the analysis is carried out for the flexible foundation using the method "Flexible foundation 9", where the contact stress is equal to the applied stress on the soil. Then, the analysis is carried out for the rigid raft using the method "Rigid raft 8", where for a raft without eccentricity such as the studied raft, all points on the raft will settle the same value w_o. The settlement s_o may be obtained by using *Kany's* charts (1974) for determining the settlement under the characteristic point of a rectangular loaded area. Table 13 compares the settlement at the characteristic point $s_o = w_o$ obtained by using *Kany's* charts with the settlements of flexible foundation and rigid raft obtained by *ELPLA*.

Table 13 Settlement $s_o = w_o$ [cm] obtained by using *Kany's* charts and *ELPLA*

	Kany (1974) $s_o = w_o$	*ELPLA* - Flexible raft s_o	*ELPLA* - Rigid raft w_o
Settlement [cm]	7.37	7.56	7.33
Difference [%]	0	2.58	0.54

Figure 14 shows the settlements at the section a-a through the characteristic point *o* for flexible foundation and rigid raft. It can be clearly observed that the settlement s_o at characteristic point *o* for flexible foundation is identical to the vertical displacement w_o of rigid raft according to the assumption of *Graßhoff* (1955).

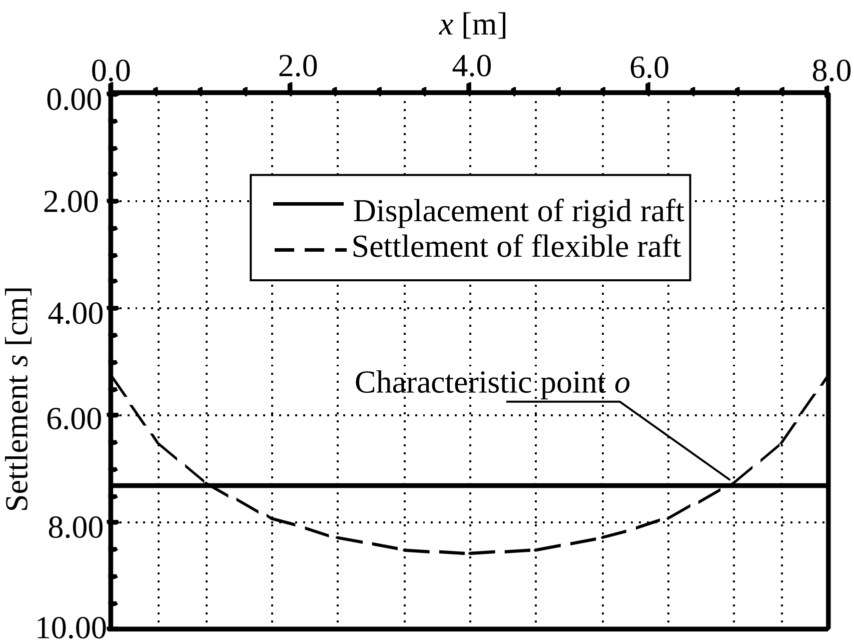

Figure 14 Settlement *s* [cm] at section a-a through the characteristic point *o*