Di Laora, R., Mylonakis, G., & Mandolini, A. (2017). Size Limitations for Piles in Seismic Regions. Earthquake Spectra, 33(2), 729-756. DOI: 10.1193/032116EQS045M

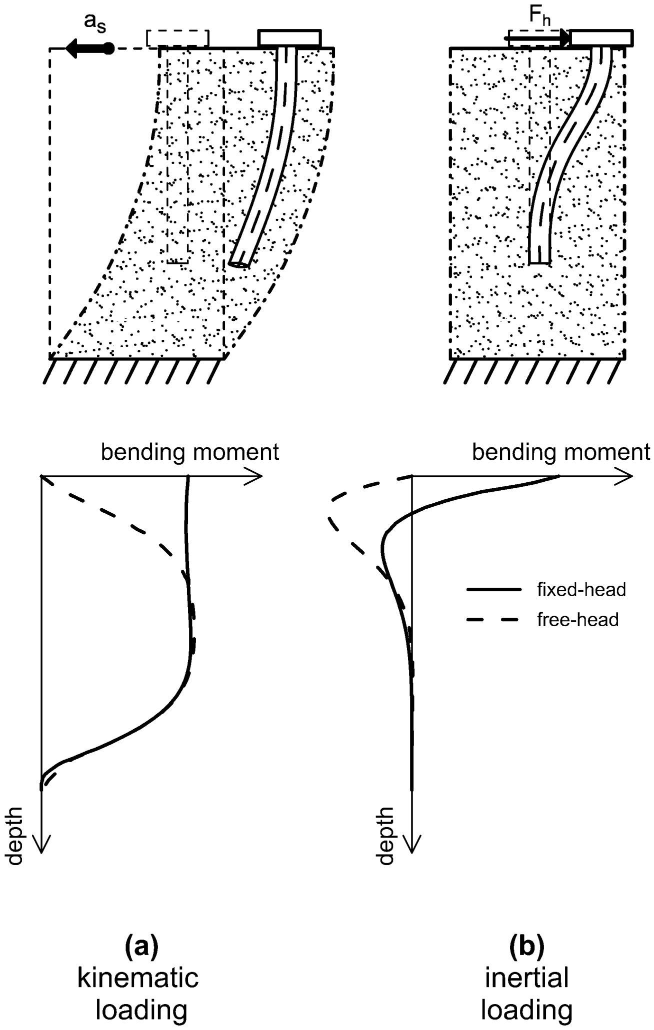

Figure 1. Kinematic and inertial loading and associated bending profile of pile foundations.

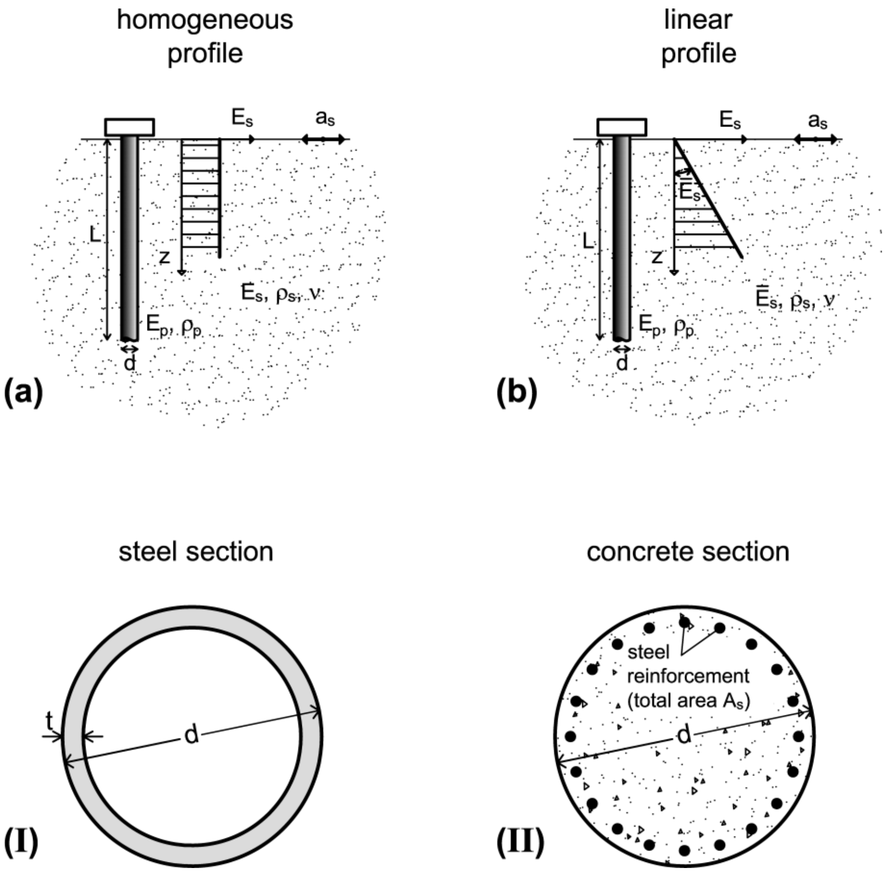

Figure 2. Soil profiles (a, b) and pile sections (I, II) considered in the study.

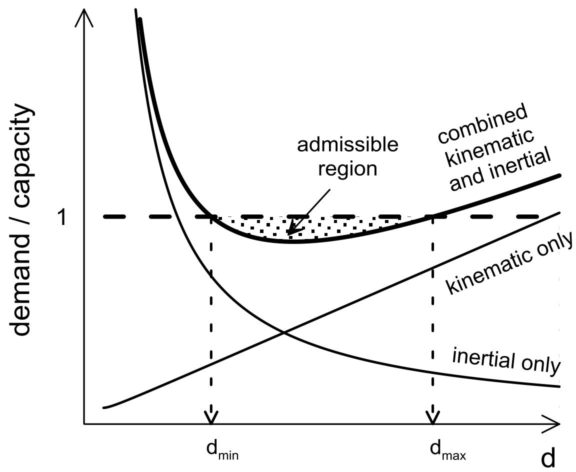

Figure 3. Kinematic and inertial bending moments over corresponding capacity as function of pile diameter.

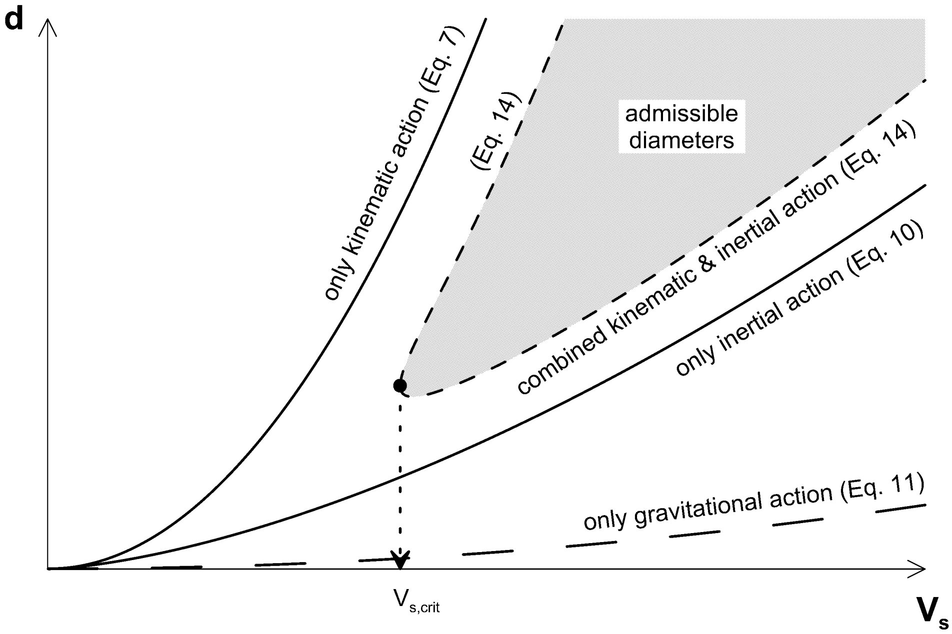

Figure 4. Range of admissible and inadmissible diameters for different types of loading. For inertial and gravitational loads points above curves are admissible and viceversa. The opposite is true for the curve involving solely kinematic action.

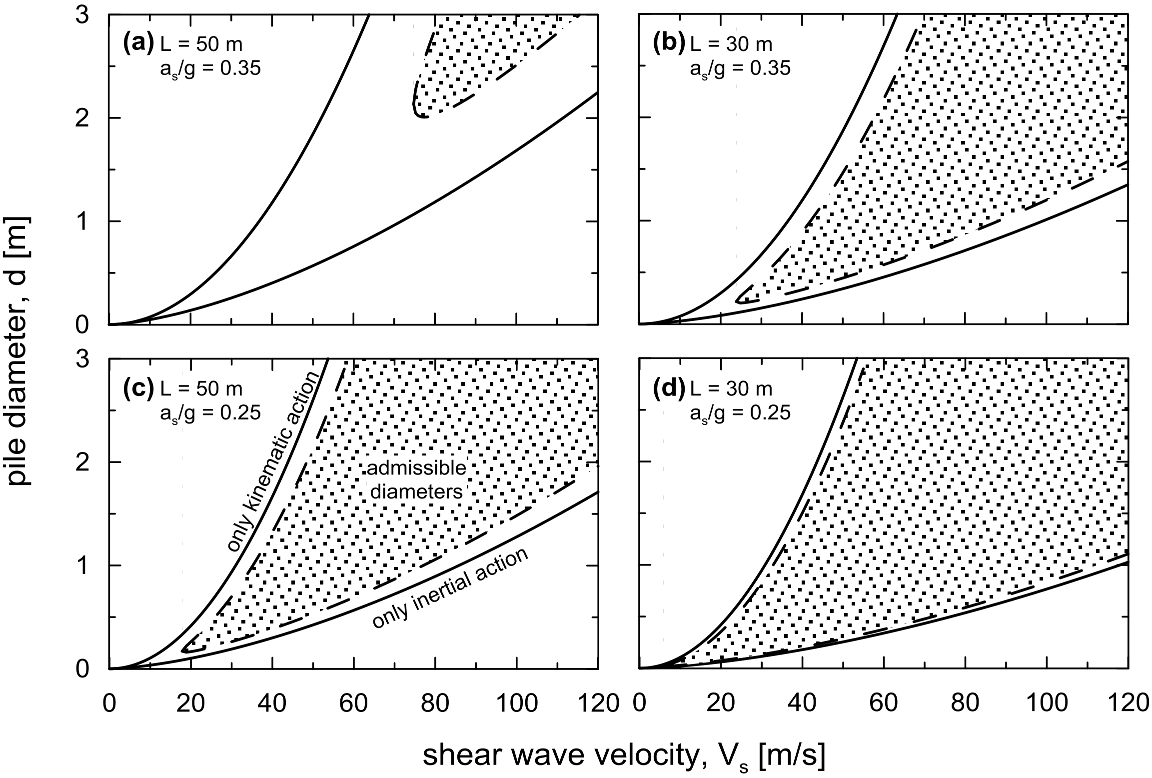

Figure 5. Admissible pile diameters against soil shear wave velocity (E_s/s_u = 500, $f_{yk,s}$ = 275 MPa, E_p = 210 GPa, ν_s = 0.5, ρ_s = 1.7 Mg/m^3, S_a = 2.5, FS = 3, t/d = 0.015, α = 0.7, δ = 1.2, T_1 = 0). Continuous lines represent pure kinematic and inertial actions whereas dashed lines refer to the combined action.

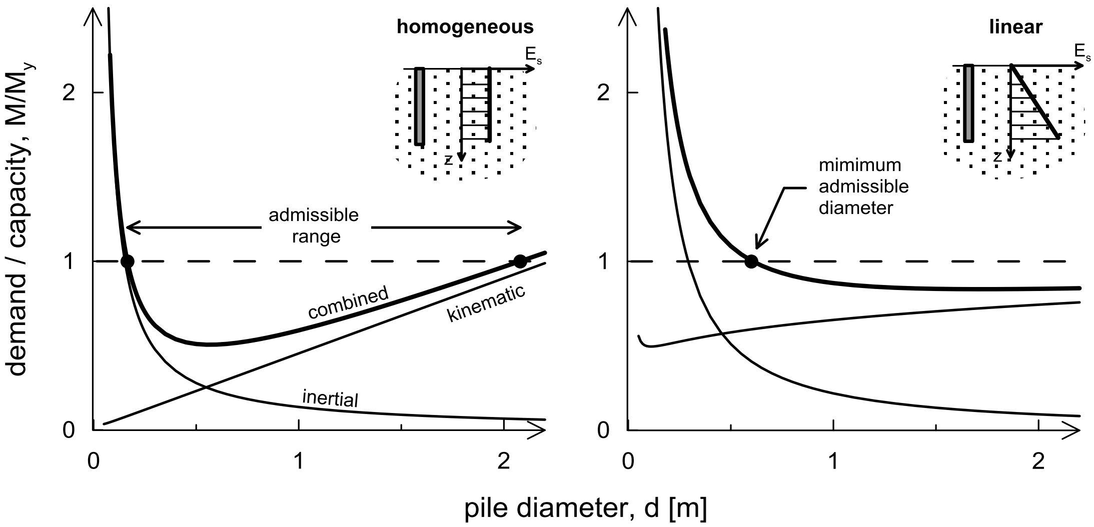

Figure 6. Kinematic, inertial and combined moment vs. capacity for homogeneous and linear soil stiffness profile. In all graphs, $a_s/g = 0.35$, $E_s/s_u = 500$, $f_{yk,s} = 275$ MPa, $E_p = 210$ GPa, $\nu_s = 0.5$, $\rho_s = 1.7$ Mg/m^3, $S_a = 2.5$, FS = 3, t/d = 0.015, $\alpha = 0.5$, L = 15 m, $\bar{E}_s = 2$ MPa/m, $E_s = \bar{E}_s L/2 = 15$ MPa.

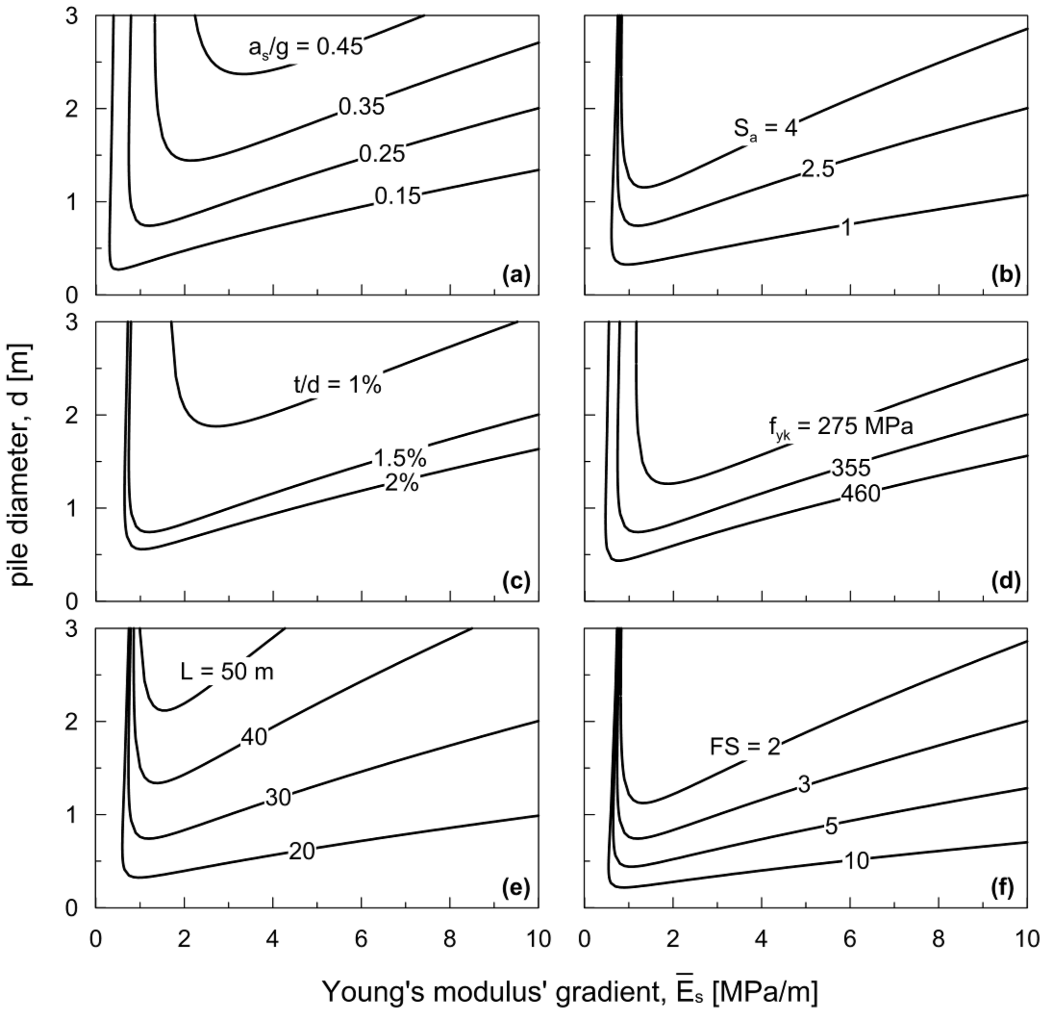

Figure 7. Admissible pile diameters for a steel pile in soil with stiffness proportional to depth. In all graphs, except specifically otherwise stated, $a_s/g = 0.25$, $E_s/s_u = 500$, $f_{yk,s} = 355$ MPa, $E_p = 210$ GPa, $\nu_s = 0.5$, $\rho_s = 1.7$ Mg/m^3, $S_a = 2.5$, FS = 3, t/d = 0.015, $\alpha = 0.5$, L =30 m.

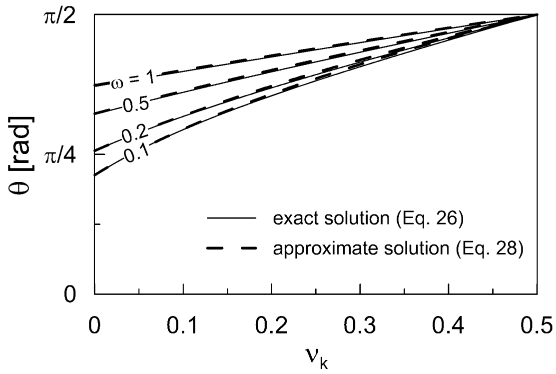

Figure 8. Comparison between the exact values of θ (Eq. 26) and the estimates provided by the approximate formula in Eq. (28), for different values of reinforcement percentage.

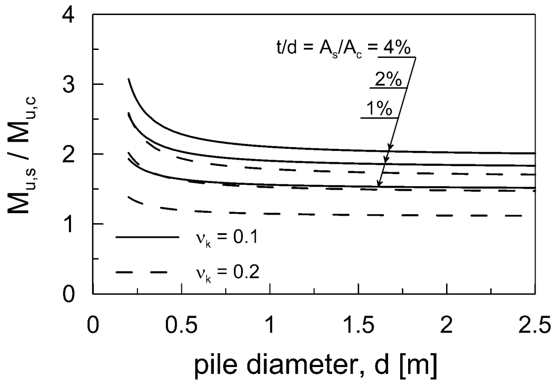

Figure 9. Capacity ratio of steel over concrete section as function of diameter for different values of reinforcement ratio (or wall thickness ratio) and dimensionless axial load. (s_u = 60 kPa, α = 0.5, FS = 3, L=20 m, f_{ck} = 25 MPa, $f_{yk} = f_{yk,s}$ = 450 MPa, $\nu_k = N/(f'_{ck}\, \pi d^2/4) = N/(f_{yk,s}\, q_I\, \pi d^2/4)$).

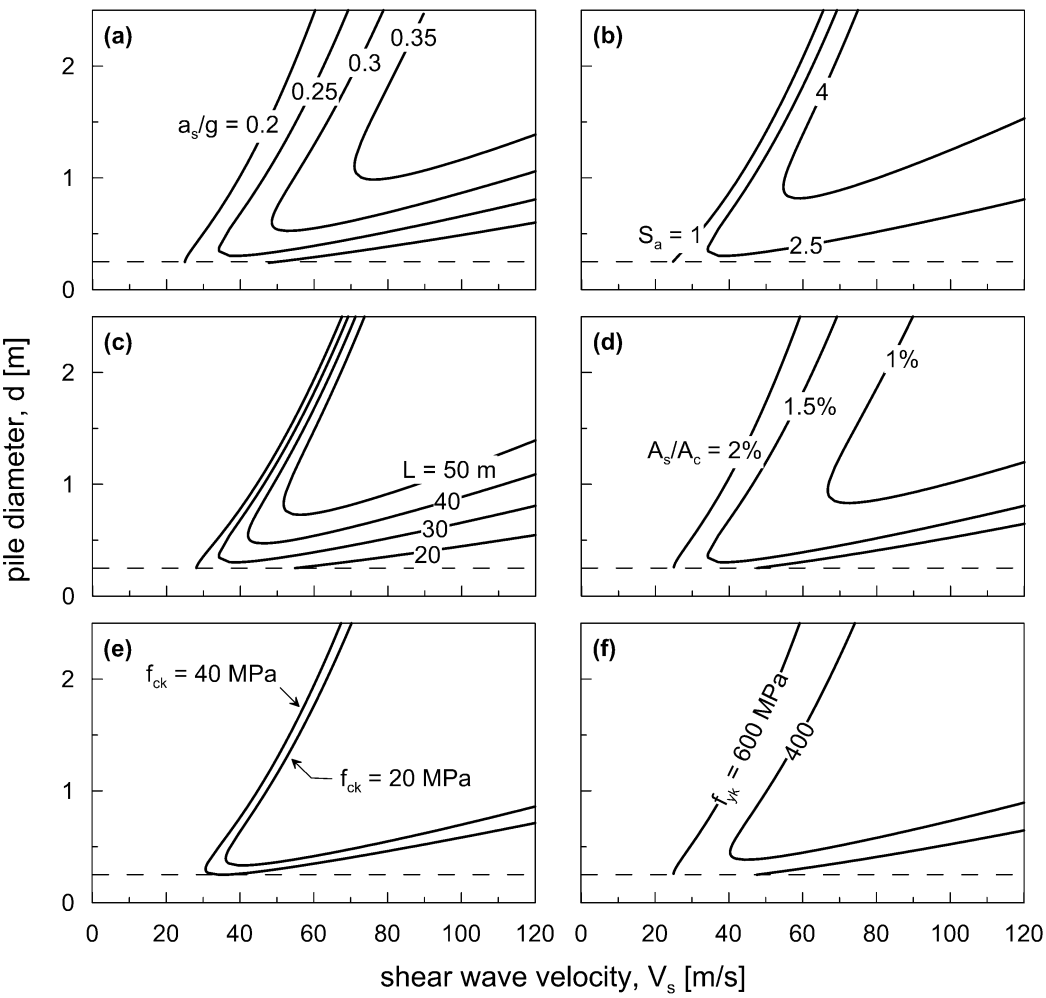

Figure 10. Admissible pile diameters for a concrete pile in homogeneous soil. In all graphs, except specifically otherwise stated, $a_s/g = 0.25$, $E_s/s_u = 500$, $E_p = 30$ GPa, $\nu_s = 0.5$, $\rho_s = 1.7$ Mg/m^3, $S_a = 2.5$, FS = 3, $A_s/A_c = 0.015$, $f_{ck} = 25$ MPa, $f_{yk} = 450$ MPa, $\alpha = 0.5$, L = 30 m.

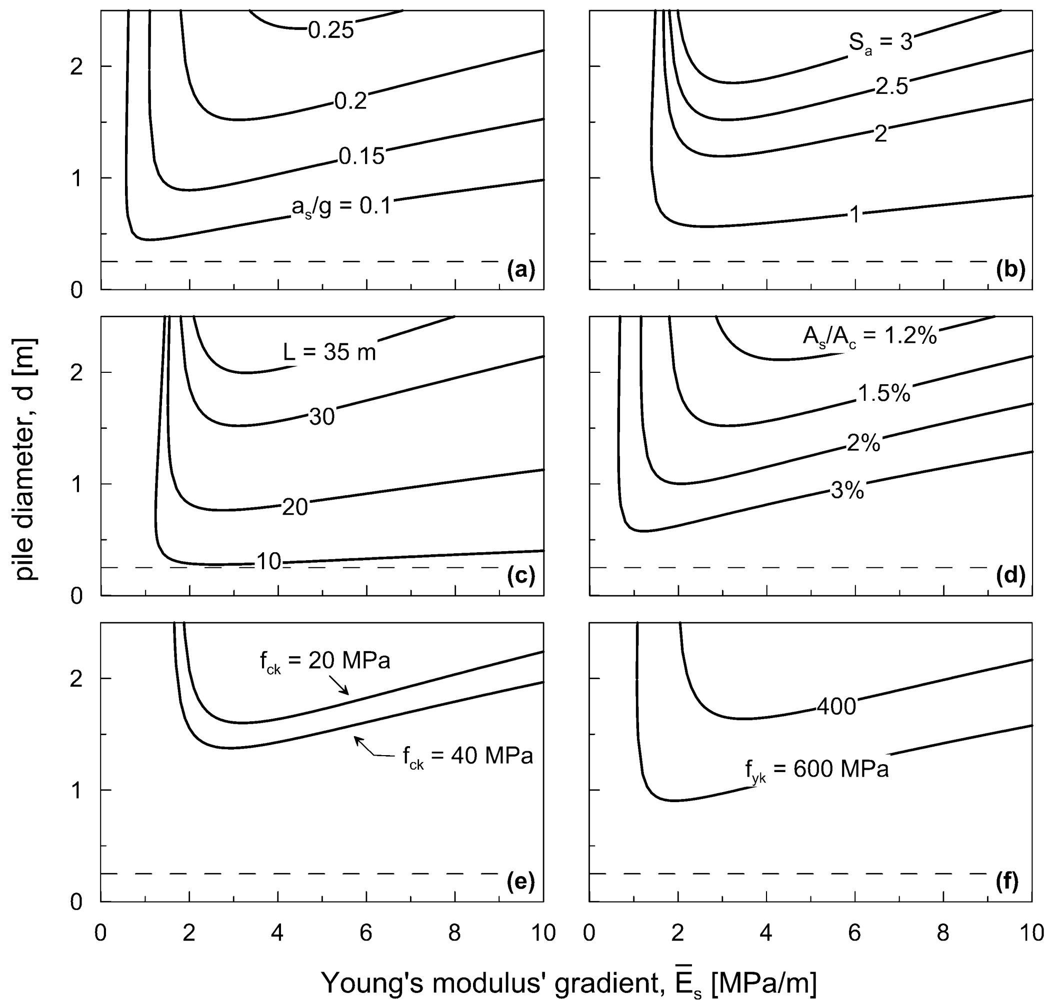

Figure 11. Admissible pile diameters for a concrete pile in soil with stiffness proportional to depth. In all graphs, except specifically otherwise stated, $a_s/g = 0.2$, $E_s/s_u = 500$, $E_p = 30$ GPa, $\nu_s = 0.5$, $\rho_s = 1.7$ Mg/m^3, $S_a = 2.5$, FS = 3, $A_s/A_c = 0.015$, $f_{ck} = 25$ MPa, $f_{yk} = 450$ MPa, $\alpha = 0.5$, L = 30 m.

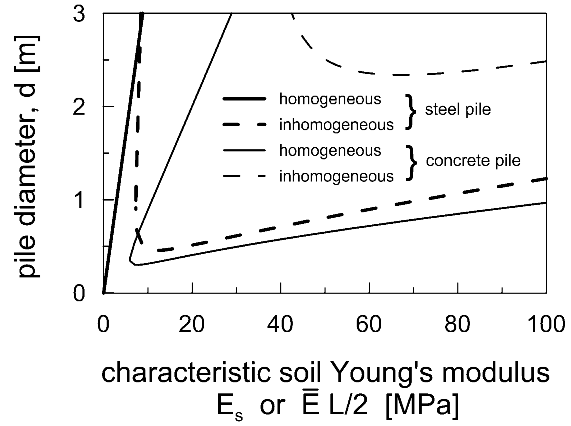

Figure 12. Steel and concrete piles in homogeneous or linear stiffness profile. In all graphs, $a_s/g = 0.25$, $E_s/s_u = 500$, $f_{yk,s}$ (steel) = f_{yk} (concrete reinforcement) = 450 MPa, $f_{ck} = 25$ MPa, $E_p = 30$ GPa or 210 GPa (for concrete and steel, respectively), $\nu_s = 0.5$, $\rho_s = 1.7$ Mg/m^3, $S_a = 2.5$, FS = 3, $t/d = A_s/A_c = 0.015$, $\alpha = 0.5$, L = 30 m.