Example 2.2 Pad foundation with inclined eccentric load on boulder clay
Note: this is a persistent design situation; for simplicity, accidental design situations do NOT need to be checked.

Question		Instruction	Answer		
GENERAL					
1	Please provide your contact details in case we need to clarify your submission*	*Will be kept strictly confidential	Name *Dariusz Kiziewicz* Affiliation *Department of Geotechnical Engineering, Faculty of Engineering and Environmental Science, Warsaw University of Life Sciences, Poland* Email address *dariusz_kiziewicz@o2.pl*		
2	How many structures of this kind have you previously designed?	Tick one	☐ None ☒ 1-2 ☐ 3-6 ☐ More than 6		
3	Having completed your design to Eurocode 7, how confident are you that the design is sound?	Tick one	☐ Very unsure ☒ Unsure ☐ Confident ☐ Very confident		
4	How did you account for the location of boreholes relative to the foundation?	Tick one	☐ Did not consider borehole location ☐ Considered nearest borehole only ☐ Considered 'average' of all boreholes ☐ Considered trend of all boreholes, biased towards nearest ☒ Other (specify)		
5	Please explain the reasons for your answer to Q4	Free text	*I've taken into account all boreholes but using weights depending on distance between the borehole and the centre of foundation.*		
SERVICEABILITY LIMIT STATE					
6	Which parameters did you use for the SLS design of the spread foundation?	Tick all that apply	☐ Water content w ☒ Plasticity index I_P ☐ Liquidity index I_L ☒ SPT blow count N ☐ Corrected SPT blow count $(N_1)_{60}$ ☒ Undrained Young's modulus of elasticity E_u ☒ Drained Young's modulus of elasticity E' ☒ Poisson's ratio ν ☐ Shear modulus of elasticity G ☐ Permeability k ☐ Other (specify) …		
7	What correlations did you use to derive soil parameter values (if used) for the SLS verification? If more than one, please list others below	Free text	Description: *$m_v = 1/f_2 \cdot N \ [m^2/MN]$* Author: *Stroud M. A.* Title: *The standard penetration test in insensitive clays and soft rock. Proceedings of the 1st European Symposium on Penetration Testing, Stockholm, Sweden, vol. 2(2) (1974)* Pages: *367-375*		
7a	Any other correlations? (please give same info as above)	Free text	Description: *$E_u/N_{60} = 1,0 \div 1,2 \ (MPa)$* Author: *Butler F.G.* Title: *Heavily overconsolidated clays. General report and state-of-the-art review for session. Proc. 3rd Conf. on Settlement of Structures. Pentech Press, London 1975* Pages:		
8	What assumptions did you make in choosing these correlations?	Free text			
9	How did you account for any variation in parameters with depth?	Tick one	☐ Ignored variation with depth ☐ Assumed linear variation ☐ Assumed bi-linear variation ☒ Assumed stepped variation ☐ Other (specify) …		
10	Please explain the reasons for your answer to Q9	Free text	*Relationship $S_e = \mu_0 \cdot \mu_1 \cdot q \cdot B/E$ which was used to obtain instant settlements assumes that the soil is a homogeneous elastic material so, to obtain representative value of undrained elastic modulus, statistical method of getting mean value of used geotechnical parameters, at 95% confidence level with V unknown, was adopted, using tests results from depths to 2B below foundation.* *To obtain representative values of drained elastic modules, needed to calculate settlements resulting from consolidation, soil below foundation was divided into calculation layers to whom were attributed SPT results from proper depths leading to stepped variation of this parameter.*		
11	What is the characteristic value of N at these depths?	Provide uncorrected values	At 1 m, N = *32*	At 2 m, N = *31*	At 4 m, N = *45*
12	What is the characteristic value of E_u for a linear elastic calculation at these depths?	Provide values in units of MPa	At 1 m, E_u = *29*	At 2 m, E_u = *28*	At 4 m, E_u = *41*
13	How did you assess these values?	Tick all that apply	☐ By eye ☐ By linear regression ☒ By statistical analysis ☐ From an existing standard (specify) …		

			☒ From a published correlation (specify) … ☐ Comparison with a previous design ☐ From the soil description, not using the data ☐ Other (specify) …
14	Which calculation model did you use to determine settlement?	Tick one	☐ Annex F.1 from EN 1997-1 ☒ Annex F.2 from EN 1997-1 ☐ Annex F.3 from EN 1997-2 ☐ Alternative from national annex (specify) ☒ Alternative from national standard (specify) *PN-81/B-03020* ☐ Finite element analysis ☐ Finite difference analysis ☐ Other (specify) …
15	What limiting values of settlement and tilt are appropriate for this foundation?	Provide values in mm and 1/x	C_d = *50mm (according to Annex H from EN 1997-1)* C_d = *1/150 (according to Annex H from EN 1997-1)*
16	What width does the foundation need to avoid a serviceability limit state?	Provide value in m	B_{SLS} =

ULTIMATE LIMIT STATE

17	Which parameters did you use for the ULS design of the spread foundation?	Tick all that apply	☐ Water content w ☐ Plasticity index I_P ☐ Liquidity index I_L ☒ SPT blow count N ☐ Corrected SPT blow count $(N_1)_{60}$ ☒ Undrained shear strength c_u ☐ Angle of shearing resistance ϕ' ☐ Effective cohesion c´ ☐ Angle of interface friction δ ☐ Permeability k ☐ Other (specify) …
18	What correlations did you use to derive soil parameter values (if used) for the ULS verification? If more than one, please list others below	Free text	Description: *c_u = 4,75N_{field}* Author: *O. Sivrikaya, E. Togrol* Title: *Determination of undrained strength of fine-grained silos by means of SPT and its application In Turkey. Engineering Geology 86 (2006)* Pages: *52 - 69*
18a	Any other correlations? (please give same info as above)	Free text	
19	What assumptions did you make in choosing these correlations?	Free text	
20	What is the characteristic value of c_u at these depths?	Provide values in units of kPa	At 1 m, c_u = *152* | At 2 m, c_u = *147* | At 4 m, c_u = *214*
21	Which calculation model did you use to determine bearing resistance?	Tick one	☒ Annex D from EN 1997-1 ☐ Alternative given in a national annex (specify) … ☐ Alternative given in a national standard (specify) … ☐ Terzaghi ☐ Meyerhof ☐ Brinch-Hansen ☐ Finite element analysis ☐ Finite difference analysis ☐ Other (specify) …
22	Which country's National Annex did you use to interpret EN 1997-1?	Free text	
23	Which Design Approach did you use for verification of the Ultimate Limit State (ULS)?	Tick one	☐ Design Approach 1 Combinations 1 and 2 ☐ Design Approach 1 Combination 1 only ☐ Design Approach 1 Combination 2 only ☐ Design Approach 2 ☒ Design Approach 2* ☐ Design Approach 3 ☐ Other (specify) …

24 24a	What values of partial factors did you use for this ULS verification?	Provide values	1st combination		2nd combination (if used)	
			γ_G = *1,35*	γ_Q = *1, 5*	γ_G	γ_Q
			γ_ϕ	γ_c	γ_ϕ	γ_c
			γ_{cu} = *1*	γ_{Rv}	γ_{cu}	γ_{Rv}
			γ_{Rh}	γ_{Rd} = *1,4*	γ_{Rh}	γ_{Rd}

25	What width does the foundation need to avoid an ultimate limit state?	Provide value in m	B_{ULS} = *3,10m*
26	What are the structural forces (at its centreline) that the foundation must be designed for according to Eurocode 2?	Provide values in kNm and kN	Design bending moment M_{Ed} =*1500kNm* | Design shear force V_{Ed} =*2735kN*

CONCLUDING QUESTIONS

27	What other assumptions did you	Free text	

	need to make to complete your design?		
28	Please specify any other data that you would have liked to have had to design this type of foundation	Free text	
29	How conservative do you consider your previous national practice to be for this design example?	Tick one	☐ Very conservative ☒ Conservative ☐ About right ☐ Unconservative ☐ Very unconservative
30	How conservative do you consider Eurocode 7 (with your National Annex) to be for this example?	Tick one	☐ Very conservative ☐ Conservative ☒ About right ☐ Unconservative ☐ Very unconservative
31	How does your Eurocode 7 design compare with your previous national practice?	Tick one	☐ Much more conservative ☐ More conservative ☐ About the same ☒ Less conservative ☐ Much less conservative
32	Please provide any other relevant information needed to understand your solution to this design exercise	Free text	
PLEASE SUBMIT YOUR ANSWERS AT www.eurocode7.com/etc10/Example 2.2 **THANK YOU FOR YOUR CONTRIBUTION!**			