Discussion of "Undrained Stability of Dual Circular Tunnels" By Daniel Wilson, Andrew Abbo, Scott Sloan, and Andrei Lyamin,

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The discusser would like to thank the authors for the praiseworthy remarks on the upper bound (UB) solution of Osman (2010). However, the results shown in Figure 16 for $\gamma D/c_u=0$ and attributed to Osman (2010) are incorrect and inconsistent with Osman (2010). However, the results for $\gamma D/c_u =3$ seems to be correct (with a margin of about 1%). Comparison between the authors' results and the upper bound solution of Osman (2010) is shown in the table and the figure below. These calculations are carried out using MATLAB. The code can be found at http://www.sciencedirect.com/science/article/pii/S0886779810000052.

Indeed, the authors' solution gives better upper bound solution. However, the differences between the two solutions for $\gamma D/c_u =0$ are much narrower than what shown in Figure 16. For example for $\gamma D/c_u =0$ and C/D=8, the $(\sigma_s- \sigma_t)/ c_u$ value attributed to Osman (2010) is 5.33 (estimated from the graph) while the correct value is 4.24 and for C/D=1.2, a value of 4.06 is shown while the correct value is 3.42. It seems that the two dash-dot-dot lines in Figure 16 have almost the same shape with a shift of 10.5 in the corresponding y-coordinates.

References

Osman, A. S. (2010). "Stability of unlined twin tunnels in undrained clay." Tunnelling Underground Space Technol., 25(3), 290–296.

S/D	$\gamma D/c_u$ =0			$\gamma D/c_u$ =3		
	UB FEM	UB Block	UB Osman (2010)	UB FEM	UB Block	UB Osman (2010)
1.2	3.17	3.04	3.4194	-6.69	-6.66	-6.4275
1.4	3.13	3.01	3.3411	-6.75	-6.75	-6.4639
1.6	3.11	3.01	3.3217	-6.83	-6.81	-6.4428
1.8	3.10	3.02	3.3539	-6.86	-6.85	-6.4159
2	3.11	3.05	3.4218	-6.89	-6.88	-6.352
2.2	3.13	3.09	3.4934	-6.91	-6.89	-6.2814
2.4	3.15	3.14	3.569	-6.93	-6.89	-6.2313
2.6	3.18	3.20	3.6439	-6.93	-6.88	-6.1644
2.8	3.22	3.26	3.7277	-6.93	-6.86	-6.0946
3	3.25	3.33	3.7991	-6.93	-6.83	-5.9751
3.2	3.29	3.4	3.8748	-6.91	-6.80	-5.9004
3.4	3.33	3.48	3.9533	-6.90	-6.76	-5.8194
3.6	3.37	3.56	4.034	-6.88	-6.71	-5.7364
3.8	3.41	3.64	4.1144	-6.87	-6.66	-5.7437
4	3.45	3.72	4.1905	-6.84	-6.61	-5.6767
4.2	3.49	3.80	4.2602	-6.86	-6.56	-5.5019
4.4	3.54	3.88	4.3225	-6.79	-6.50	-5.4359
4.6	3.58	3.96	4.3775	-6.76	-6.44	-5.3785
4.8	3.62	4.04	4.4254	-6.74	-6.37	-5.3715
5	3.66	4.13	4.4647	-6.70	-6.31	-5.325
5.5	3.76	4.32	4.5435	-6.64	-6.14	-5.2365
6	3.87	4.50	4.5735	-6.61	-5.97	-5.1742
6.5	3.97	4.50	4.5909	-6.48	-5.80	-5.1567
7	4.06	4.50	4.5971	-6.44	-5.63	-5.155
7.5	4.16	4.50	4.5991	-6.33	-5.63	-5.1507
8	4.24	4.50	4.5993	-6.25	-5.63	-5.1496

Table 1 Upper bound solutions for dual circular tunnels with H/D=3

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Fig. 1 Comparison of upper bound solutions for H/D=3