Discussion of:

“Design Process of Deep Soil Mixed Walls for Excavation Support”

by Casandra J. Rutherford, Giovanna Biscontin, Demetrious Koutsoftas, and Jean-Louis Briaud

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INTRODUCTION

The authors are congratulated on preparing a very useful paper for DSM wall design. The discusser was involved with the use and refinement of the procedures in Pearlman and Himick (1993).

In the discusser’s experience, shear resistance and the compressive arch (middle diagram on Figure 8 of the original paper) produce similar required compressive strengths of the mixed soil for beam spacings of 4 feet. For larger spacings, the compressive arch would govern. For small spacings, the shear failure would govern. The simple Taki and Yang procedure would suggest that the soil mix could be any strength even less than that of the ground.

The discusser offers two comments on the shear resistance check (Figures 8 and 15).

1. Another Method of Shear Resistance of Soil Mix. The discusser and Pearlman and Himick (1993) considered that the shear strength of the mixed soil was 1/3 of the unconfined compressive strength and then applied a factor of safety of 2 or more.

2. Errors in Formula on Figure 15. The ACI method presented in the paper is a possible and probably conservative way of looking at shear resistance. However, the term “b_w” should be a unit vertical height and definitely not the clear distance between the beams. This clear distance between the beams has nothing to do with shear resistance, but does affect the applied shear. The use of b_w equal to the clear space is very unconservative. A better solution is to eliminate the b_w term as follows:

$$V_{\max} = p \cdot L_2 \cdot b_w$$

Where:
p is the maximum earth pressure;
L2 the clear distance between flanges; and
bw is a unit depth.

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$$V_c = \lambda \cdot 2 \cdot f_c^{0.5} \cdot b_w \cdot d$$

$$2 \cdot V_c > V_{\max} \text{ from sum of forces}$$

$$2 \cdot (\lambda \cdot 2 \cdot f_c^{0.5} \cdot b_w \cdot d) > p \cdot L_2 \cdot b_w$$

$$\Rightarrow f_c^{0.5} > (p \cdot L_2 \cdot b_w) / (2 \cdot (\lambda \cdot 2 \cdot b_w \cdot d))$$

$$\Rightarrow f_c^{0.5} > (p \cdot L_2) / (2 \cdot (\lambda \cdot 2 \cdot d))$$

$$\Rightarrow f_c > [(p \cdot L_2) / (2 \cdot \lambda \cdot 2 \cdot d)]^2$$

Note that the second 2 in the denominator has the units of psi$^{0.5}$. Also, note that the b_w term cancels out and is no longer in the equation.

Using λ of 0.75 is equal to factor of safety of $1/\lambda = 1.33$. This seems low but given the conservative concrete beam model may be appropriate.

Also, the term "d" should only extend to the excavated face of the beams.

REFERENCES

Pearlman, S.L. and Himick, D.E (1993). Anchored Excavation Support Using SMW. Deep Foundation Institute, 18th Annual Conference, Pittsburgh, PA, 101-120.