Fax Message

To: Gary Person
From: Mike O'Neill
Consulting Engineer
Houston, Texas
Date: March 11, 1996

Fax: 612-779-5616

Dear Gary,

The limiting end-bearing value of 7.7 tsf that you questioned in your fax of March 8 (report on the foundations for the St. Croix River Bridge, Stillwater, January, 1996, p. 19) was indeed computed for a theoretical penetration of 10 (ten) feet into the sandstone. However, upon considering the possibility that the quality of the sandstone may be relatively poor very near its contact with the overlying soil, I concluded that if end bearing were to be used the drilled shafts should probably not penetrate the sandstone less than 20 feet without further study. I neglected to change the value of 7.7 tsf, which is theoretically applicable to a penetration of 10 feet, to 9.2 tsf, which as you pointed out is applicable to a penetration of 20 feet. Therefore, a conservative value of limiting unit end bearing resistance for a penetration of 20 feet is indeed 9.2 tsf.

I apologize for this oversight. Please contact me if you have any more questions.

University of Houston
Department of Civil and Environmental Engineering

Refer to:
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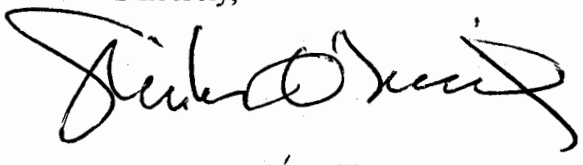
March 4, 1996

Mr. Gary Person
Assistant Foundations Engineer
Minnesota DOT
Materials and Research Laboratory
1400 Gervais
Maplewood, MN 55109

Dear Gary,

As noted in our phone conversation earlier today, there is a typographical error in Equation 4 on p. 35 of our recent report on the analysis of the drilled shaft and pile tests for the St. Croix River Bridge (TH 36). The square root sign should have been a pair of brackets. The correction is contained on the attached sheet. Please replace the present p. 35 with the new page that is attached. I apologize for this error.

Sincerely,



Michael W. O'Neill

enclosure

the shaft is clean according to the standards given above and no weaker rock exists below the base of the socket than exists at the base of the socket. Note the definition of "net" on p. 20.

8. Because of the need for scaling of the test results to conditions in the St. Croix River, the meager data on end bearing, and the unusual, extremely ductile behavior of the axial test socket, the Minnesota DOT should consider verifying the capacities of the prototype test shafts by placing bottom-hole load cells, such as the Osterberg Cells used in the test sockets, at the bases of a representative number of the production sockets for the bridge piers, and loading such sockets to at least 1.5 times their design loads prior to placing any drilled shaft caps or superstructure elements. Corresponding measurements of socket movement should be made, and minimal instrumentation should be installed to delineate resistance in the rock socket from resistance developed in the sand/gravel and the muck. Following any such tests, the load cells and any annular space around such cells should be grouted with high-strength grout.

9. Lateral load behavior for both driven piles and drilled shafts can be analyzed using COM624P, LPILE, or similar software. Conventional p-y curves can be used to represent the muck (Matlock's soft clay criterion) and the sand/gravel (Reese's sand criterion). Cyclic versions of these criteria should be used if the critical lateral loading is cyclic.

The p-y relation developed in this report for the sandstone is as follows. This relation can be used for static loading or for several major one-way cycles of loading.

$$p = Ap_u \tanh\left[\frac{E_s}{Ap_u} y\right], \tag{4}$$

where

$$p_u(\text{lb/in.}) = (1.4z(\text{in.}) + 2.2D(\text{in.}))\sigma'_v(\text{psi}) \le 17.7D(\text{in.})\sigma'_v(\text{psi}), \tag{7}$$

and

$$E_s = E_{s\,test}\sqrt{\frac{\sigma'_{v\,test}}{\sigma'_{vz}}} = 54{,}130\sqrt{\frac{\sigma'_{vz}(\text{psf})}{11780}}\ (\text{lb/in./in.}). \tag{8}$$

A is taken as 1.0 for static loading and 0.9 for cyclic loading. The reader is referred to the main text for the definition of terms.

Lateral resistance in the sandstone should be assumed to exist only below the bottom of the permanent casing unless grout is placed outside the casing, as indicated in