

Fast Foundation for Soft Clay

Discussion on article by Hilton J. R., Rage, R. E., and Novotny, R. I.

in Civil Engineering March 1993, pp. 62 - 65.

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The authors describe the design and construction features of a large deep foundation fast track project in Southern Ontario, Canada, completed in 14 months time. I do not doubt that the major aspects of the project were completed satisfactorily and in agreement with the current state-of-the-art. It appears to me, however, that the approach taken toward the design of the pile foundations could have benefited from some more in-depth consideration.

In my opinion, the design is conservative to the point of being wasteful. At a site with such well-defined and commonly encountered conditions, the 12-inch pipe pile can be assigned a much higher design load than 100 tons; 130 tons would not be excessive. It is my understanding that the piles performed well under static testing to maximum test loads of 250 tons.

All piles at this site will experience drag load due to negative skin friction, not just the piles in the vicinity of the stockpiles (and which were bitumen coated and had the design load reduced to 75 tons). However, for conditions such as at this site, negative skin friction is not a problem for the bearing capacity of the piles. Nor would the maximum load at the neutral plane (drag load in combination with the dead load from the structure) reach a level that would be of concern for the structural strength of the pile. Neither is settlement of the piles a problem, because the piles derive the bearing from resistance in the glacial till and/or the bedrock. Therefore, the bitumen coating and reduction of design load near the stockpile are not necessary.

The authors indicate that it was difficult to fit a sufficient number of piles inside the area of one structure to resist the horizontal loads. The horizontal design load of 2.5 tons, however, is very conservative in the light of the generous 0.5-inch allowance for horizontal movement, and the number of piles could have been reduced by an increasing the horizontal design load. I accept the authors' statement that static tests for horizontal behavior demonstrated 'elastic' deflection of 0.5 inch for 5 kips and 10 kips horizontal loads. However, my understanding is that these tests were made with free-head piles and such tests are not representative for the actual service condition of the subject piles, which are stiffly connected to the pile cap.

The authors report that 1,777 piles were driven at a total foundation cost, including excavation, of \$7.75 million, that is, about \$4,000/pile, a value in agreement with common costs for this pile size used at the mentioned lengths. Yet, had the design loads been set closer to the actual capacity of the piles, the bitumen coating eliminated, and the reduction for drag load not applied, at least about 30 % piles could have been eliminated from the project. This could have saved much time and about \$2 million for the project. Money that Ontario Hydro surely needs to maintain service and employment of its personnel in the present time of strict austerity measures and layoffs.