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IGNORANCE IS BLISS

And that is why we sleep so well!

Bengt H. Fellenius

Why is it that loadcells so rarely are used for static pile test loading? "We never used it and never had a problem!" "Too late now, the test is due to start tommorrow." "My jack is always right!" Yet, to expect the jack to deliver the load on the pile and, in addition, to provide an accurate measurement of the magnitude of that load, is grossly unfair. It just cannot do both.

A hydraulic jack used for pile test loading must be able to withstand eccentric and inclined loading and have a piston that can extend at least 200 mm. A repeatable and high precision load calibration can be obtained in the laboratory, where the load is applied concentrically and axially and where, in particular, the jack piston is not moving. Invariably, the laboratory testing frame is made to act against the jack. When testing piles in the field, however, the jack is acting (piston is extending) against the pile and the reaction system.

I was asked recently to verify a pile test loading. Of course, I requested the use of a loadcell and one was provided. Unfortunately, the calibration was quite old, but there was no time to have the cell checked out before the test. It was soon obvious that something was wrong. The loadcell indicated load values greater than the manometer-and-jack load values, which is not possible. It turned out that the loadcell was erroneous, and another proven loadcell was obtained and the test repeated. For the repeat test, the manometer and the jack, as well as the loadcell, were calibrated—both separately and together. The calibration curves showed linear behaviour with regression coefficients of 0.9998.

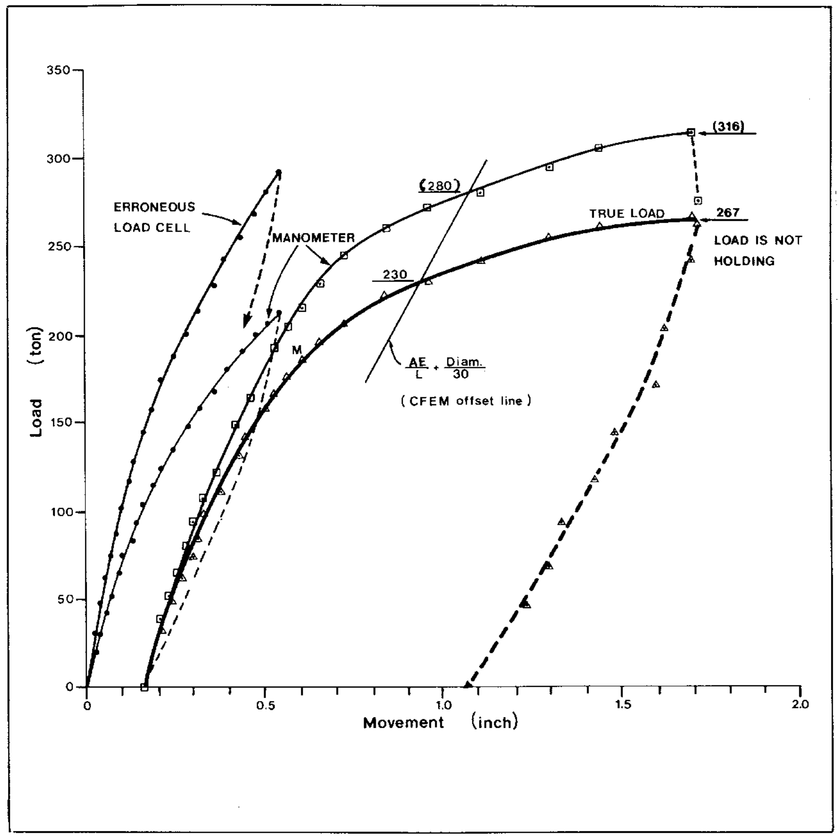

Figure 1: Load movement curves obtained from first and repeat test.

Figure 1 shows the load movement curves obtained from both the first and the repeat test.

During the repeat test, the loadcell indicated considerably less load than that calculated from the manometer pressure. At the maximum load applied of 267 tons (loadcell determined), the test was halted and the jack pressure released for unloading. The first small release had a considerable effect on the jack pressure, but only a small effect on the loadcell. This difference is a clear sign of friction in the jack. In fact, the discrepancy between the loadcell and the manometer-and-jack curves is mostly caused by friction in the jack due to unavoidable eccentric and inclined loading.

Figure 2 shows the compilation of the discrepancy between the two load measuring systems found in the repeat test. In loading, the error was an overestimation of 10 to 20 per cent. In unloading, the error was one of underestimation of about 5 per cent.

While I have experienced errors in loading as small as about 5 per cent, the error in loading is always one of overestimation and usually about 15 per cent of the applied load. I find errors of this magnitude unacceptable. What allowable load would you assign to the pile as based on the manometer-and-jack failure load of 316 tons—provided, of course, that you did not know of the loadcell values? Then, having obtained the loadcell values and found the value of the failure load amended to 267 tons, would you stay with the first allowable load value? Oh! and have you checked your liability insurance lately!

The current practice of static pile testing does not recognize modern measurement techniques and that data obtained conventionally are often unreliable. In fact, the approach to field testing of piles has not kept up with the

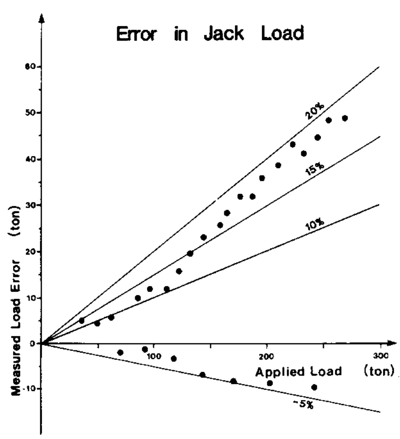

Figure 2: Compilation of discrepancy between two load measuring systems.

continuously increasing allowable loads on piles. I do not believe that there is room for accepting errors such as the one illustrated in this case history. Let us listen to the recommendations of Casagrande and Peck: apply both braces and belt to geotechnical works. In this case, that would be to make sure that the applied load is measured by two independent methods—using both monometer and loadcell. Thus we may avoid losing both trousers and shirt on our next piling project.

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