Origin of the Flat Dilatometer

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ABSTRACT: This Note tells the story of the origin of the Flat Dilatometer

1 ORIGIN OF THE FLAT DILATOMETER

I have been requested by the Organizers of this Conference to tell the story of the origin of the Flat Dilatometer.

Regretfully, I have to transfer the blame of having introduced one more in situ device (in the forest of the existing ones) to two dearest persons, Mike Jamiolkoski and my wife, Eleonora.

Mike, in my first months of profession with him, gave me many assignments where the problem of laterally loaded piles was often central (he had even advised me, before, to choose my thesis at Imperial College on this topic, which I did). Soon I realized that, despite some helpful tables by Terzaghi and others, I ended up choosing design moduli essentially based on my mood that day. This made me uncomfortable, because good engineering requires a modulus "unemotional" and linked to measurements.

My wife had the fault of snatching me, in August 1974, from my beloved table covered by papers on piles, dragging me to the Alassio Riviera. On the beach there are, of course, many beach umbrellas oscillating under the breeze. Observing their base, the question came by itself : Would it be possible to conceive a mechanism to force, in the embedded part of the pole, some curvature and measure the reaction that the soil opposes to such deformation?

The rest of the story – seven steps leading from the beach umbrella to the DMT - is described in a 1977 Note (Proc. Spec. Session No. 10 of the 9th ICSMFE in Tokyo). An excerpt of such contribution and the original figures of the steps are reproduced below.

It is singular that for many years after his conceivement, much of the research and use of the DMT was attracted by the evaluation of design parameters (in particular Su, M and OCR). It was only some 15 years later (Robertson et al. 1987, Marchetti et al. 1991) that DMT methods for laterally loded piles were developed. The two methods are still used today and generally predict well the behaviour of laterally loaded piles.

As a conclusion, DMT is a tool that was stimulated by two persons who are not the person telling this story. Moreover DMT is mostly used for purposes other than the original one !

2 EXCERPT FROM SPECIALTY SESSION 10 OF THE TOKYO 1977 9TH ICSMFE: THE EFFECT OF HORIZONTAL LOADS ON PILES

Devices for in situ Determination of Soil Modulus Es – by S. Marchetti, Faculty of Engineering, L'Aquila University.

……different devices were examined (Figs. a to g) :

(a) ***Small diameter short penetration pipe*** : Es can be worked out by the ratio load/deflection. However this system can supply only Es values near ground surface.

(b) ***Small diameter pipe, with an internal jack producing inflection of an embedded pile portion***. The shortcoming is that, if the pipe has to be robust enough to withstand driving forces, almost the totality of the inflecting action is absorbed by the pipe, so obscuring the influence of soil deformability.

(c) ***Pipe of elliptical cross section***: by pumping a fluid into the pipe, measured changes of diameter enable soil deformability evaluation. Same shortcoming as (b). Also corrugated shapes as (d) have the same shortcoming.

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(e,f) The conclusion was that ***two members, having separate tasks***, were necessary: the first one to carry driving forces, the second one to provide an easily expandable element.

(g) ***This "Flat dilatometer" was finally chosen***; the circular shape of the membrane makes easier mechanical construction and test interpretation. In situ tests with (g) closely duplicate (although in different scale) the load sequence induced on soil by driven piles subsequently subjected to lateral loads: to the penetration stage follows the stage in which the points at contact are displaced horizontally, all in the same direction. Correlations between E_S and soil modulus determined by dilatometer should be more direct than other existing correlations.

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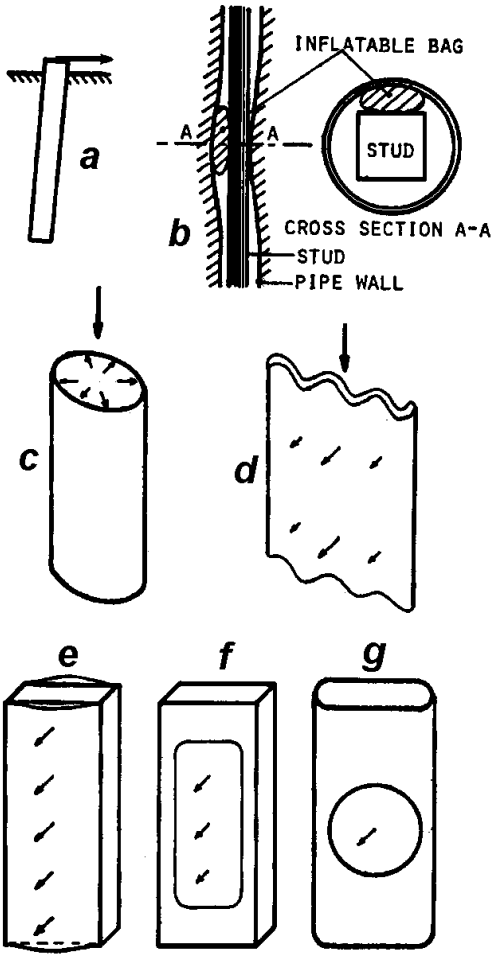

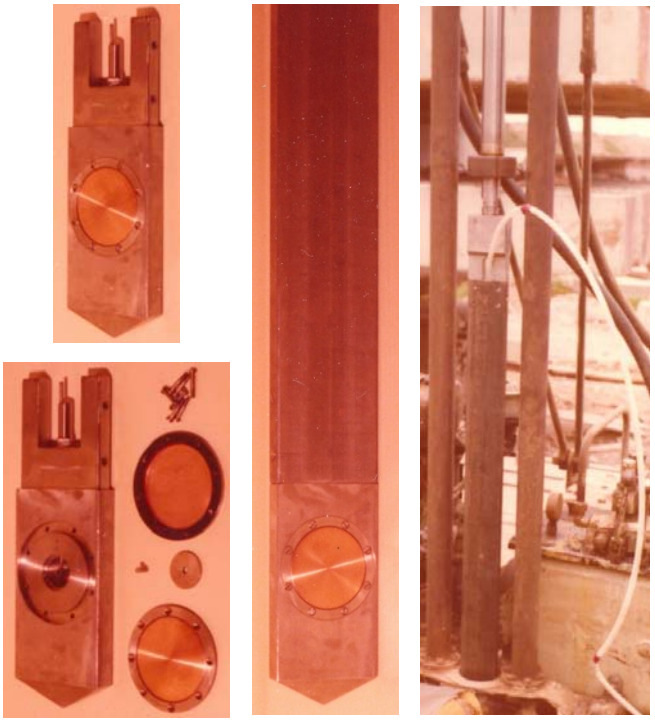

Version 1974 of the blade.
The membranes are made out of copper. The tip has a cuspidal shape. There are two membranes, one on each face. The push rods had initially a rectangular cross section (not easy to mount and to join). The tubings were coaxial, so the exhaust found its way up to the surface through the annular interspace.

Version 1975 of the blade.
The membrane is made out of steel. The push rods are circular.

Current version of the blade.

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