SIMSG ISSMGE

ABMS

ARAQUARI
Campo Experimental
Araquari Experimental Site

Araquari Experimental Testing Site, Brazil

Prediction Event

DSI DYWIDAG-SYSTEMS INTERNATIONAL

Brasfond

BR PETROBRAS

UFRGS UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL

UFPR UNIVERSIDADE FEDERAL DO PARANÁ

UDESC

Università degli Studi di Napoli SUN

FUGRO

GEOFORMA Engenharia Ltda.

Votorantim Cimentos

INÁCIO estaqueamento

GeoTechne

FLEXFER ESTRIBOS INTELIGENTES

PI Pile Dynamics, Inc.

geotesc Fundações e Concreto Pré-Misturado

MINERAÇÃO VEIGA LTDA.

RUDNICK MINÉRIOS LTDA.

Araquari Experimental Testing Site

Pile Installation

Araquari Experimental Testing Site

Reaction frame

Araquari Experimental Testing Site

Instrumentation

Organizing Committee

Schnaid, F.	*Universidade Federal Rio Grande do Sul*
De Mello, L. G.	*Vecttor Projetos*
Kormann, A.	*Universidade Federal do Paraná*
Odebrecht, E.	*Universidade do Estado de Santa Catarina*
Mandolini, A.	*Second University of Napoli*
Milititsky, J.	*ISSMGE Vice-President for South America*
Mascarucci, Y.	*Second University of Napoli*
Nienov, F.	*Universidade Federal do Rio Grande do Sul*
Sestrem, L. P.	*Universidade Federal do Rio Grande do Sul*

Scientific Committee

Frank, Roger
Jamiolkowski, Michele B.
Mayne, Paul W.
Norkus, Arnoldas
Poulos, Harry G.
Randolph, Mark
Salgado, Rodrigo
Van Impe, William
Viggiani, Carlo

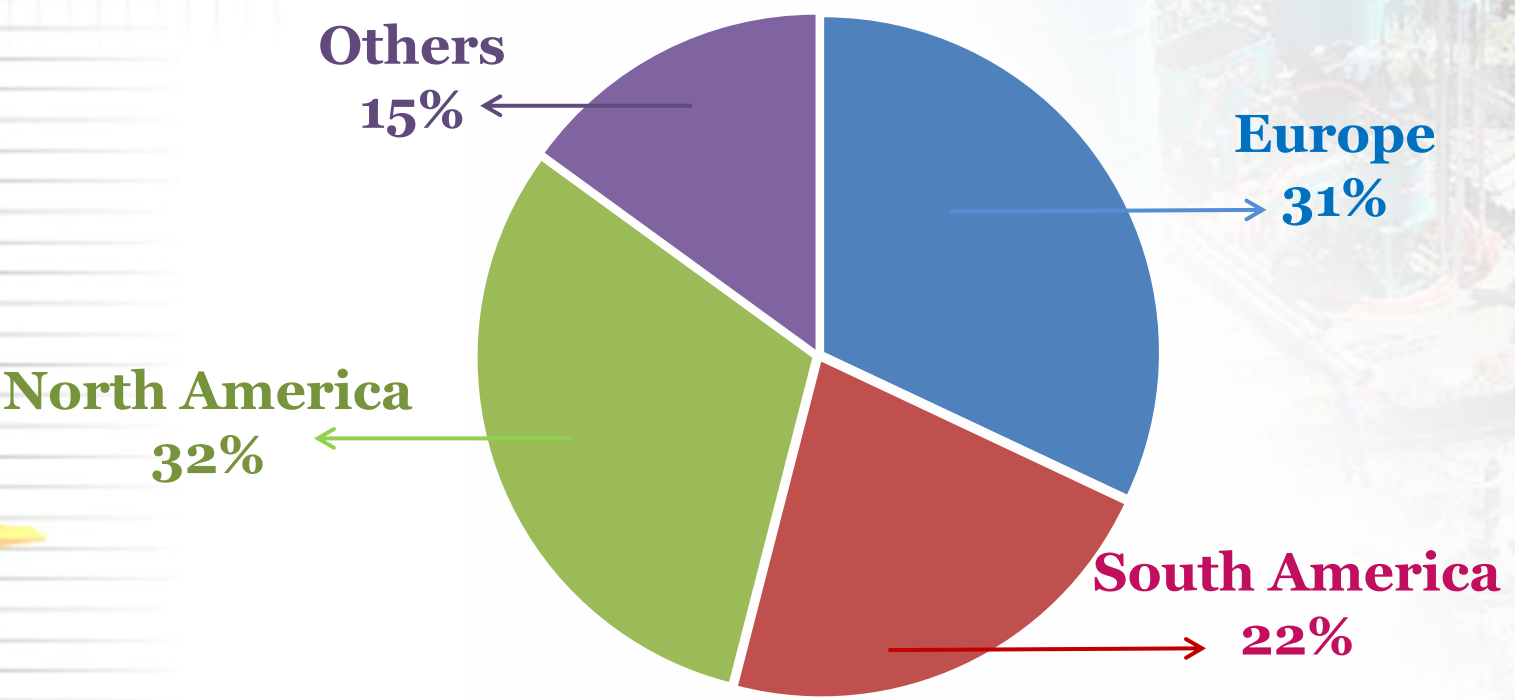
Local working group

Adam Scherer - Fugro
Alessander Kormann- Fugro
André Moraes - Fugro
Dany Romero - Fugro
Edgar Odebrecht - Geoforma
Edmar Caetano - Fugro
Fabiano Nienov - UFRGS
Fernando Schnaid - UFRGS
Francesco Fusconi – Carmix
Gianfranco Faccin - Brasfond
Hyllttonn W. D. Bazan - Fugro
Laísa Benetti - Fugro
Liamara Paglia Sestrem - UFPR
Lilian Maier Swinka - Fugro
Luis Fernando Debas - Fugro
Marcio Coimbra de Novaes - Fugro
Marcio Costanzi - Brasfond
Mariluz Barreto - Fugro
Sandré Lima - GeoTechne
Ylenia Mascarucci - SUN
Washington Peres - Brasfond
Wanderlei Honório - Fugro

Predictions: 72 Participants

42% Academics

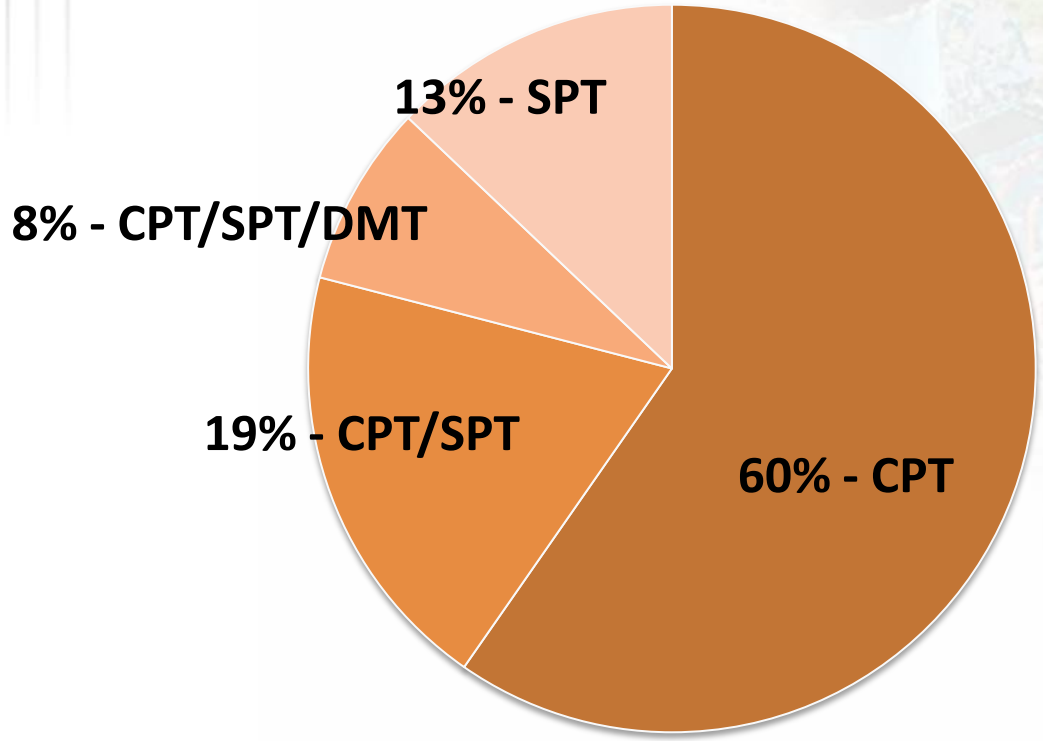
58% - Practitioners



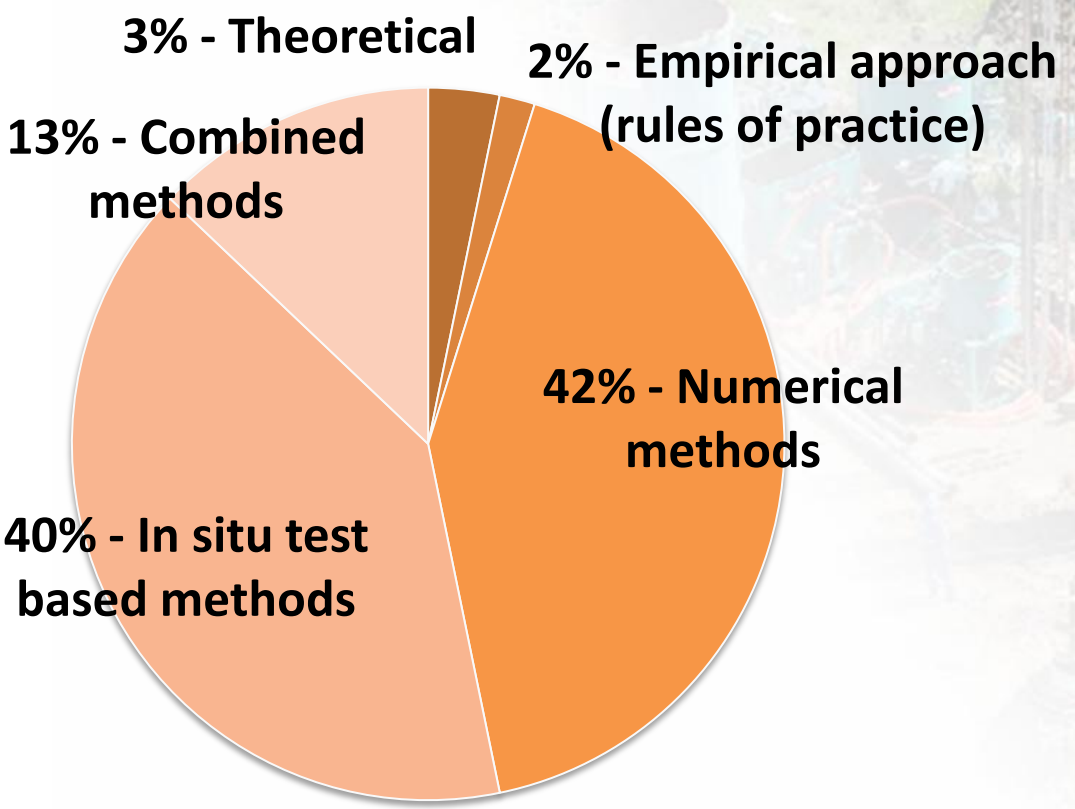
Countries

N_o	*Country*	*N_o*	*Country*
1	South Africa	1	Singapore
1	Bulgari	2	Australia
1	Chile	2	Belgium
1	China	2	France
1	Croatia	3	England
1	Hungary	4	UAE
1	Iran	10	Italy
1	Lithuania	15	Brazil
1	Sweden	23	USA
1	Switzerland		

Database adopted for predictions

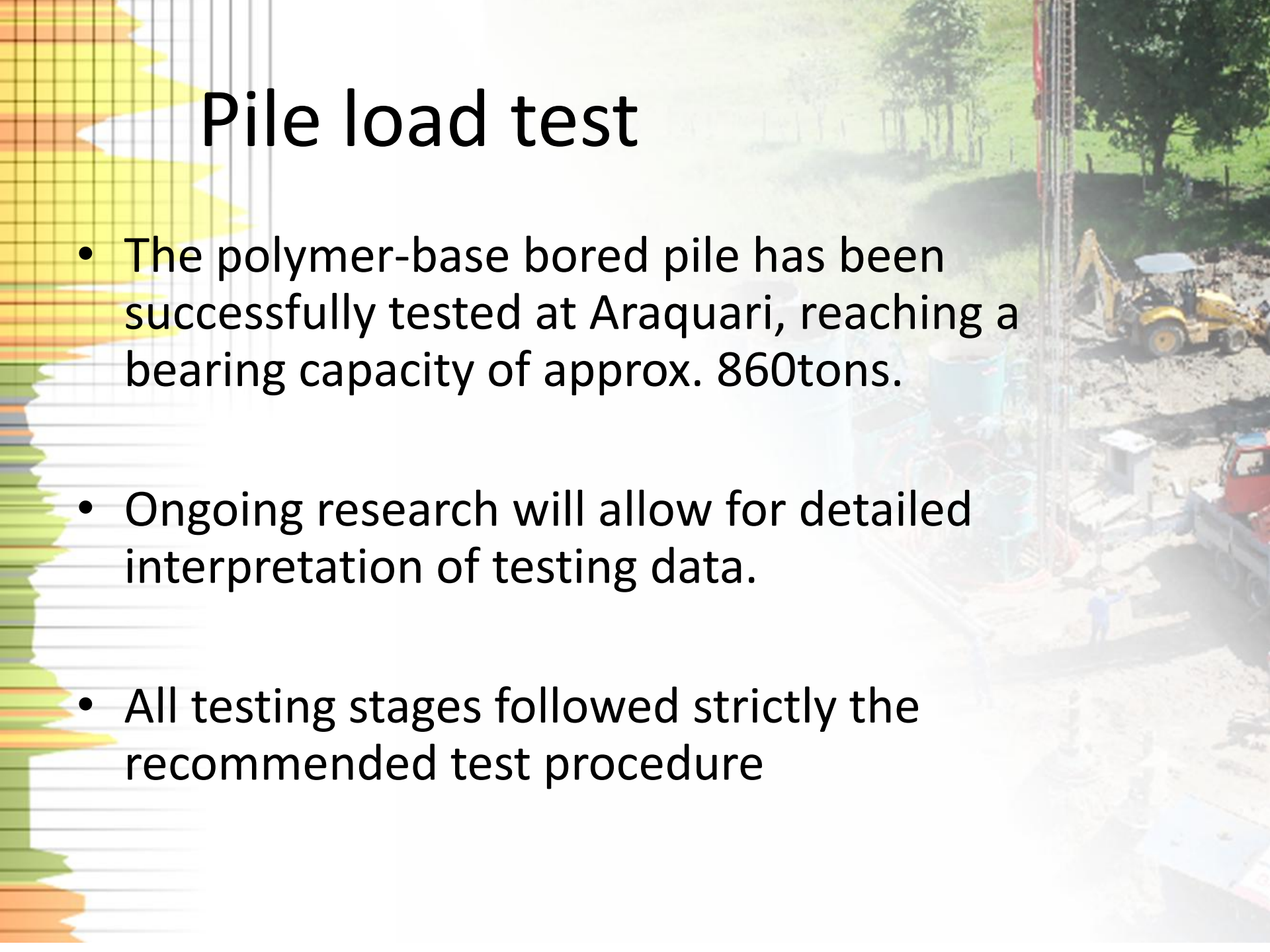


Adopted Methods



Pile load test

- The polymer-base bored pile has been successfully tested at Araquari, reaching a bearing capacity of approx. 860tons.
- Ongoing research will allow for detailed interpretation of testing data.
- All testing stages followed strictly the recommended test procedure

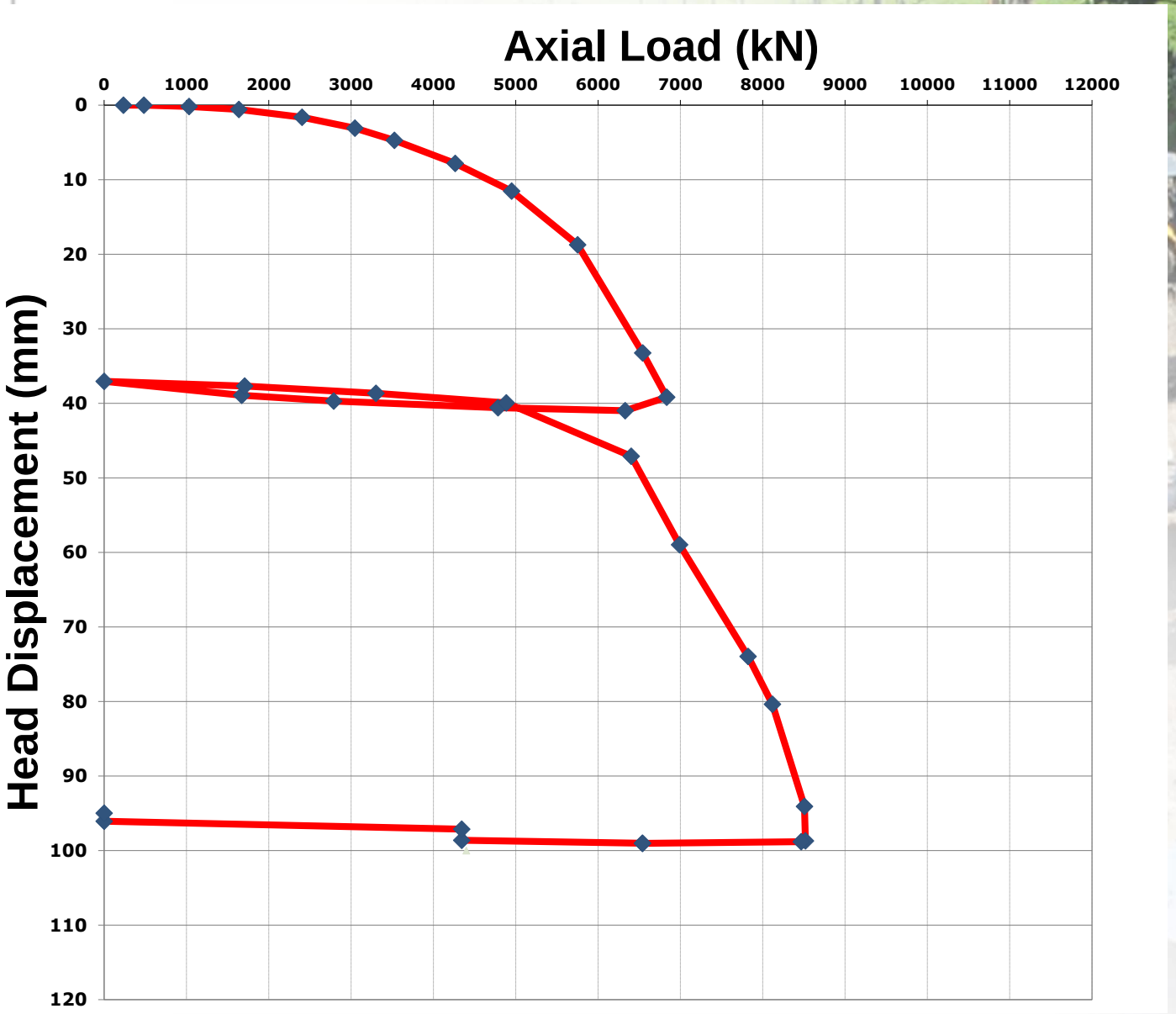


Pile load test

- An unload-reload cycle at a settlement of about 40mm (D/25). There was a problem in one of the reaction piles forcing us to unload, realign the reaction system and resume the test. It was a quick procedure that followed the prescribed recommendation for cycles (4 x 30min stages).

- At the end of the test (settlements higher than 70mm) it was no longer possible to stabilize the load: the rate of settlements was about the rate of pressure from the oil pump. This last stage is more rate controlled than load controlled. In any case the stage was followed for a period of about 2h as initially planned.

Load-displament measurements

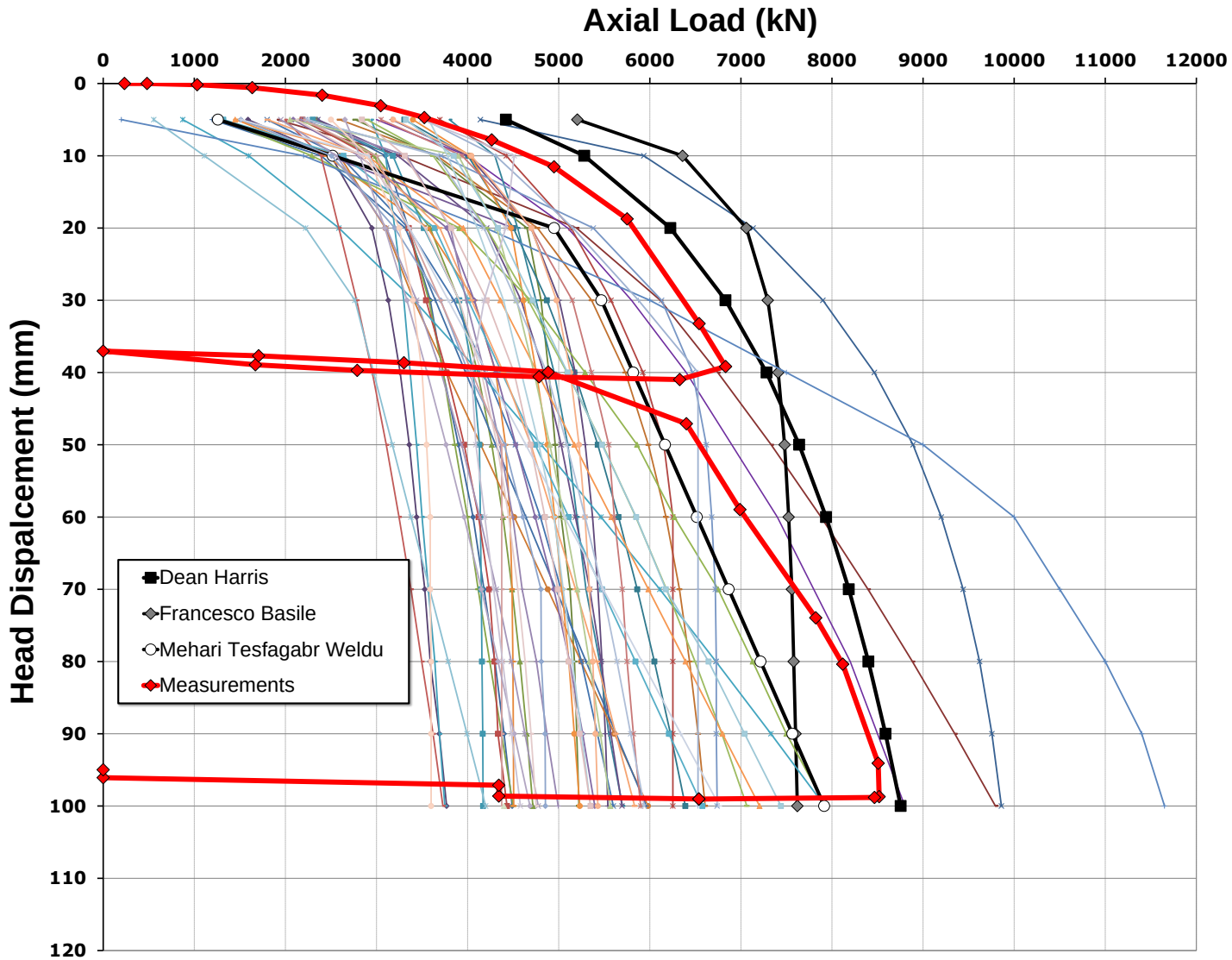


Predictions

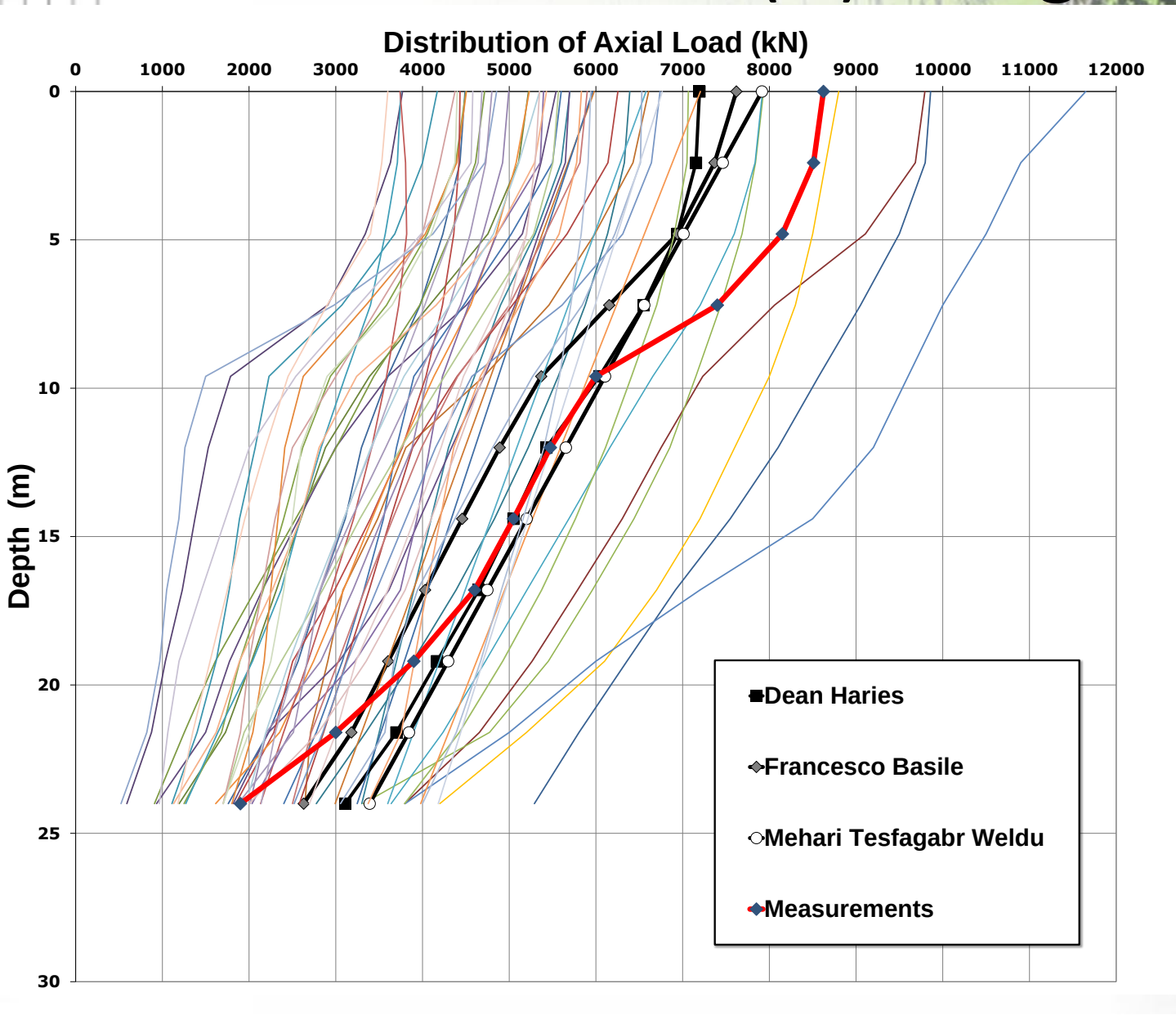
Best prediction is evaluated from the static load bearing behaviour of the bored pile considering 3 criteria:

- ✓ the pile axial load (Q) versus head displacement (w) curve, up to a head displacement of $w/D \geq 10\%$;
- ✓ the shaft (Q_s) and base (Q_b) loads at failure (conventionally fixed at $w/D = 10\%$);
- ✓ the distribution of axial load (N) along the shaft of the pile at failure (N versus depth z, at $w/D = 10\%$);

Axial load x head displacement



Distribution of axial load (*N*) along shaft

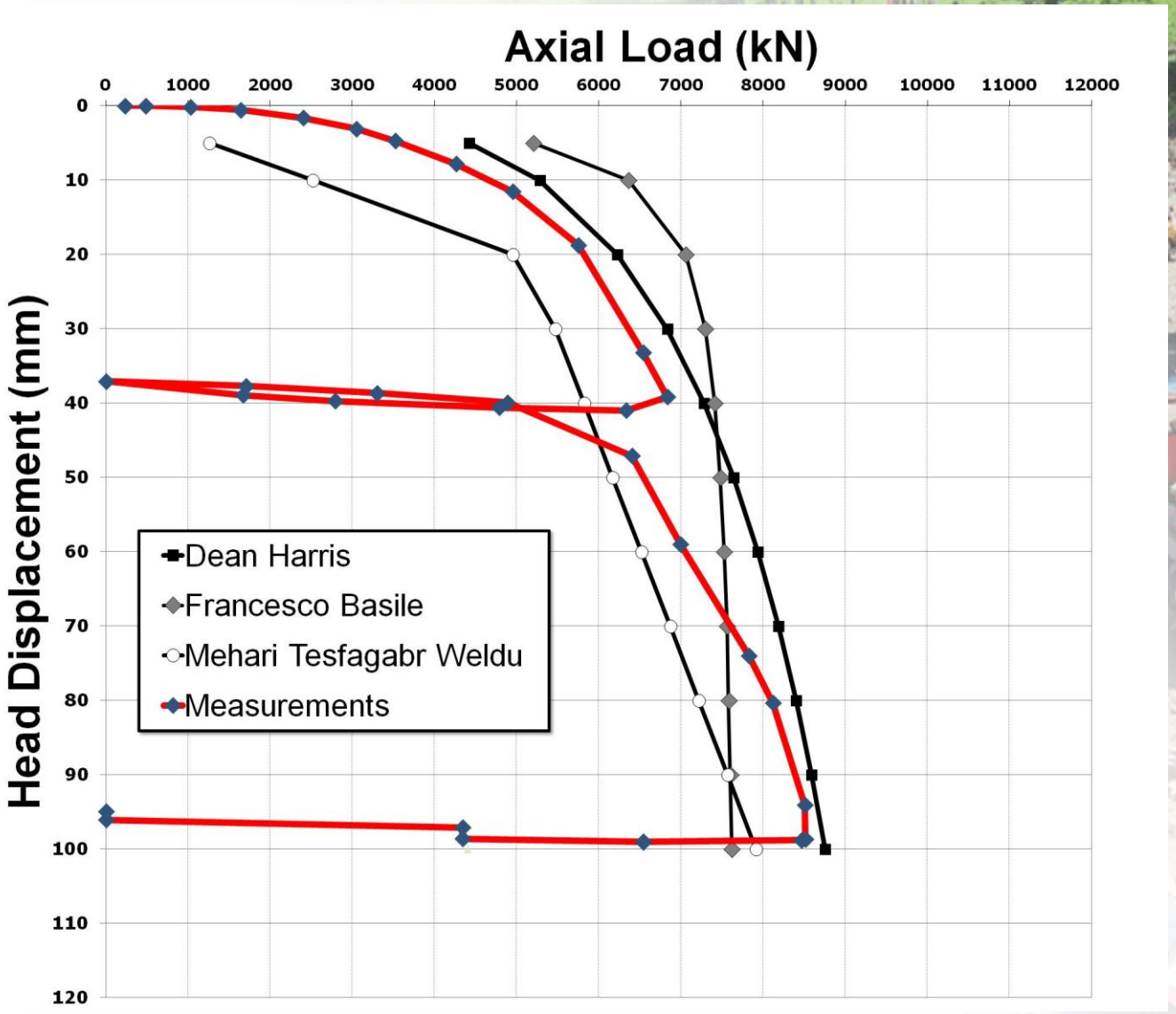


Predictions

Broadly speaking the majority of predictions underestimated the measured shaft load of 670 tons at w/D = 10%.

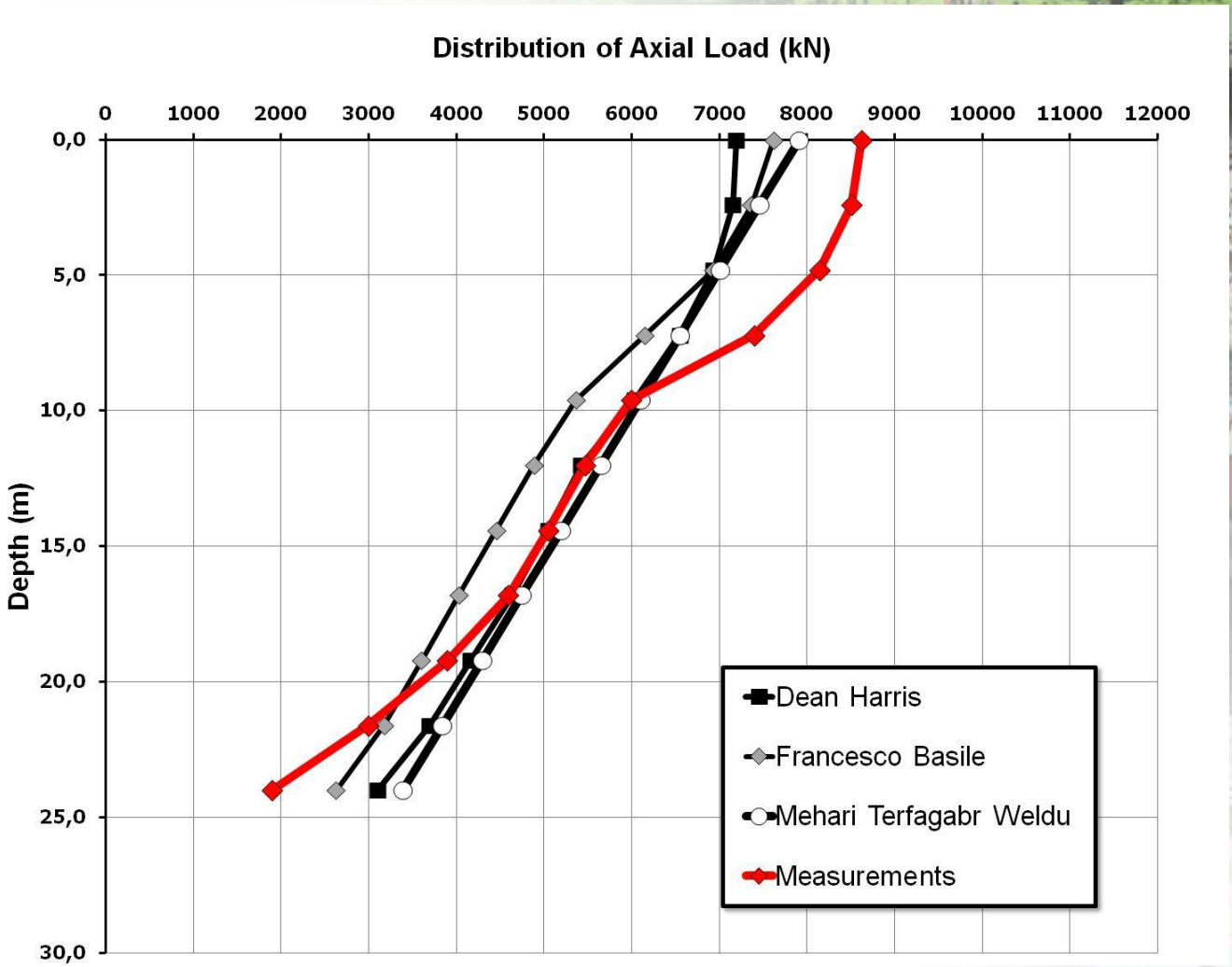
A close inspection of the pile response, in terms of axial load (Q) *versus* head displacement (w) curve and the distribution of axial load (N) along the shaft of the pile at failure (at w/D = 10%), allowed the best predictions to be evaluated.

Axial load x head displacement



Best Predictions

Distribution of axial load (*N*) along shaft



Best Predictions

Best Predictions

The committee selected **3 participants** as winners, considering their ability in predicting simultaneously the axial load (Q) versus head displacement (w) curve, the shaft (Q_s) and base (Q_b) loads at failure and the distribution of axial load (N) along the shaft of the pile at failure.

A **statistical analysis** was run to define the winner. Three competitors ended up having virtually the statistical residual values from measured and estimated loads and displacements.

Best Predictions

- ✓ **Francesco Basile, Geomarc Ltd, Italy**

  The load-settlement response and axial load distribution of the pile have been analyzed using the commercial software Repute (Basile, 2015). Soil stratigraphy from CPT according Robertson & Cabal (2014), base and shaft resistance mainly from LCPC Method (Bustamante & Gianeselli, 1982) and Yong modulus from experience.

- ✓ **Dean Harries, *Geotechnical Specialist, CH2M HILL, USA***

  Effective stress method and estimated soil properties from experience. Calculations for base and shaft resistance checked against LCPC Method (Bustamante & Gianeselli, 1982).

- ✓ **Mehari Weldu, Graduate Student, University of Kansas, USA**

  Shaft and base loads are determined based on CPTU results using the correlation given by Eslami and Fellenius (1997). The elasto-plastic t-z model used to compute (τ-s) and (q_b-s) distributions based on CPT results (Verbrugge, 1981). The soil classification with CPT data (Robertson et al., 1986) and SDMT soil profile log (According ASTM D6635, 2007). Soil parameters from CPTU.

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Pile data at:
http://www.ufrgs.br/araquari-ets/

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