



IGS Technical Note

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Geotechnical Services

CPT & Piezocone & SCPT
Dilatometer & SDMT
Seismic Dilatometer
Vane Shear
Tee-Bar
Push-Sampling
Piezometer Installation
In Situ Permeability

Some of the Field Fleet



Minnie - Mini-Jack-Up



how good is a CPT test?

In a training seminar I run, I express my opinions that:

- a) One strength of CPT is the sensitivity of the equipment – push gently by hand on the cone tip or sleeve and the numbers change – so hey “this thing must be good”.
- b) One weakness is the sensitivity of the equipment – thinking that “this thing must be good” makes some people believe that hey “this thing really is good”.

How good should a CPT be? This is covered in ISO 22476-1-2012, pretty much deemed to be the “benchmark” standard, see its Table 2 - “Application Classes”. To summarise, this table shows that “it depends” on the soil and the purpose of the test.

Let’s talk here just about soft soils, and for simplicity just about Cone Resistance – similar comments apply to Sleeve Friction, Pore Pressure and Net Area Ratio.

ISO 22476-1-2012 specifies that for *Application Class 1*, ie for confident profiling and design in soft soils, Cone Resistance, taking all things into account, must be measured to an accuracy of <35kPa or <5% of the measured value. Whichever is the larger.

This means that a CPT undertaken to Application Class 1 may indicate undrained strength of soft clay to an accuracy of around +/- 2-3kPa. If you want better accuracy than this then the calibration & test process, taking all things into account, must exceed Application Class 1. ISO 22476-1-2012 makes reference to this possibility.

taking (some) things into account?

At IGS we calibrate in five increments below 1MPa for a 25MPa or 100MPa cone – we bias our calibration accuracy to this softer soil range.

1 To achieve Application Class 1, Cone Resistance must be very accurate in the range zero-to-400kPa. Only one of six different recent CPT manufacturer’s calibrations I have seen calibrate this range. The others terminate/plot above 5-10MPa (!!!!!).

CPT load cells cannot and do not perfectly hold their required super-precise very low range calibrations. Frequent re-calibration is needed. Standards do not properly address this – ISO 22476-1-2012 is vague/misleading on this matter.

At IGS we calibrate before and after every job; every week on longer jobs. We compare re-calibrations one to another.

2

IGS does not agree with this aspect of the ASTM standard.

3 The ASTM standard (God bless it) basically deems it not worthwhile to calibrate below 20% of the CPT range – ie do no calibration in the soft soils range).

All modern standards specify cone diameters varying from 36mm to 35.3mm – this permitted diameter variation introduces a possible Cone Resistance variation of 4% - not much left of the +/-5% allowed under Application Class 1!!!

At IGS we measure the cone dimensions and use the “actual” size of tip and sleeve in our calibration calculations.

4

In the above I am not suggesting that perfection is achievable, no matter how hard anyone strives. IGS does not claim perfection. But we do claim to be honest and to be working hard to narrow the gap between perfection and what we can achieve, by following 1, 2 and 4 above, with our lovely linear Geomil (self-calibratable) cones.

reducing geotechnical uncertainty

100MPa Compression Piezocone Calibration Report

No: C10CFIIP.C12019

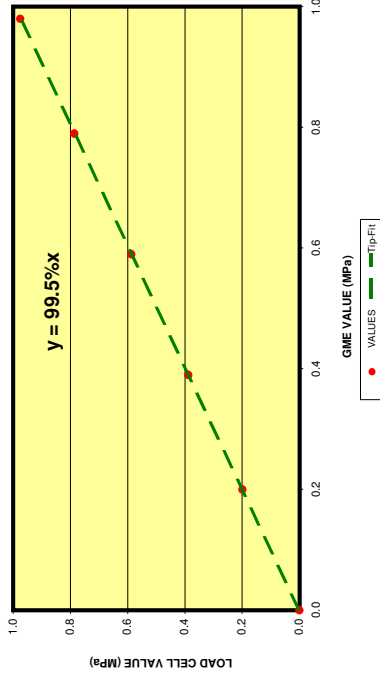
This cone has been re-calibrated. Use appropriately-dated calibration file. "Actual" cone dimensions used.

Tip Details Area (sq cm) 10.05 Capacity (MPa) 100 Cal Date 19/02/2018

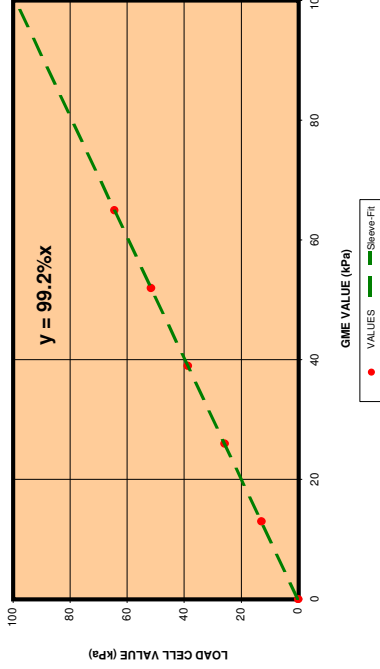
Sleeve Details Area (sq cm) 151.17 Capacity (kPa) 1000 Cal Date 19/02/2018

Piezo Details Capacity (kPa) 5000 Cal Date 19/02/2018

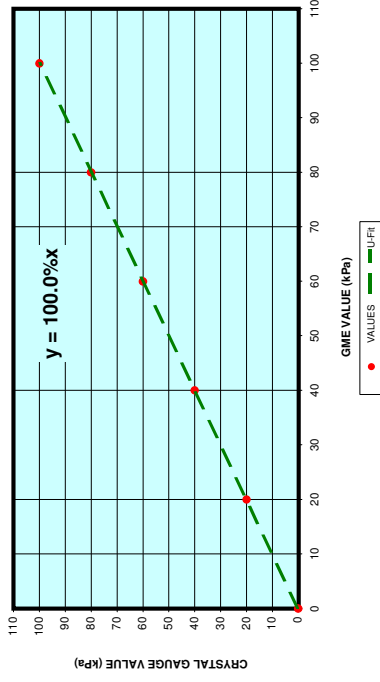
Zero to 1.0MPa (bottom 1% of range)



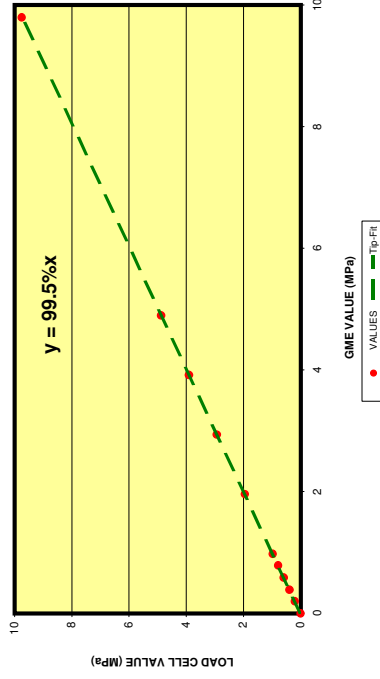
Zero to 100kPa



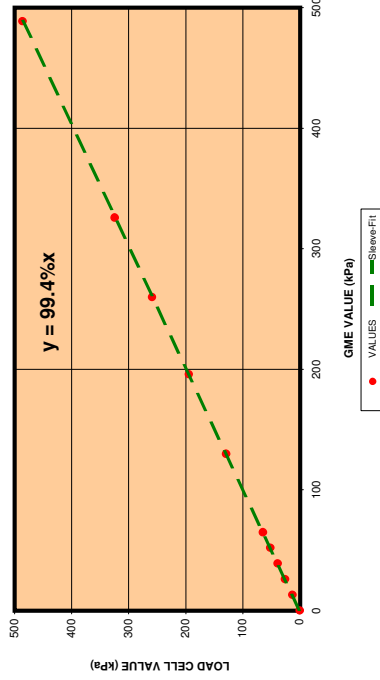
Zero to 100kPa



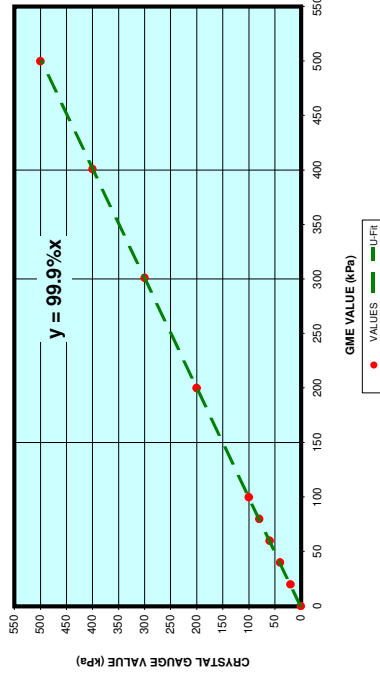
Zero to 10MPa (10% of range)



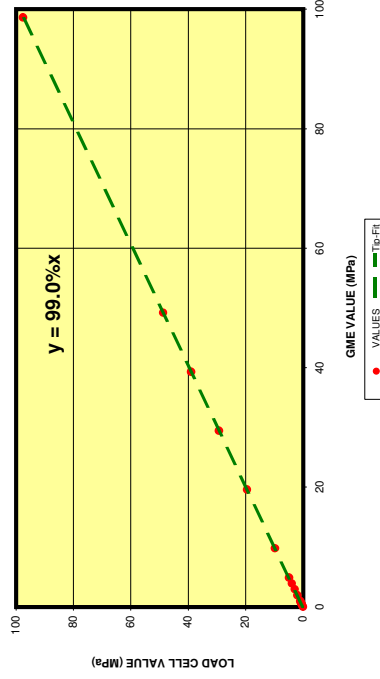
Zero to 500kPa



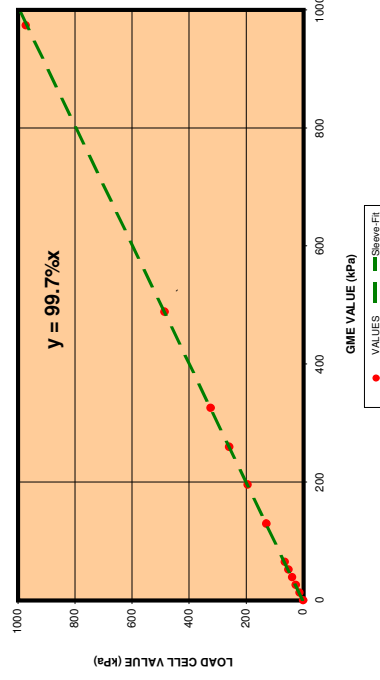
Zero to 500kPa



Zero to 100MPa (100% of range)



Zero to 1000kPa



Zero to 3500kPa (red Y = Net Area factor - NAF)

