EXPLANATION OF IGS's CPT TEST CATEGORIES

Revised 25 November 2014

At IGS we define "quality service" as being satisfactory implementation of the class or type of test required by the client, to suit their particular needs.

Note that**:**

- It is certainly not high quality to fail to meet any particular client's technical expectations.
- Equally though, neither is it high quality to provide a class or type of test that a client neither needs nor wants for their particular application. Particularly, for instance, if that class or type of test takes longer and/or costs more than a less costly test that would otherwise have fully suited the client's needs.

As we offer a range of different CPT test Categories, all of "high quality" for their particular application, it is convenient to tabulate these and define a system of test designation (ie test-category-name) to assist in communicating with clients and helping them direct IGS as succinctly as possible in regard to their needs.

There is no international or Australian standard that we can usefully follow in preparing this categorisation system so we have prepared our own hierarchy of test categories and self-designated these as tabulated below.

The classification system has evolved from our own experience with our own clients and is a reflection of our own current opinions.

We would appreciate any feedback from any client and advise that the classification system might evolve with time and with hoped-for constructive client feedback.

TEST CATEGORIES

Name	Brief Description (and client role)	Typical Application	Methods Typically Employed by IGS Operator
IGS-1S or IGS-1C	**Standard Piezo Cone Testing** Client must (pre-testing) brief IGS on their choice of category. Little or no client involvement is required during testing progress. Objective is good quality data, including good pore pressure response. However, if pore pressure response problems evolve in any "difficult" test zone, time is not squandered trying to solve them. Typically a client is hoping for reasonably high productivity using this method.	For use when clients want a reliable soil profile and to establish design parameters to historically-normal levels of client expectation. May be the base test type chosen for a known soft clayey soil project for overall site profiling. With IGS-1, good quality pore pressure response is usually achieved and normal dissipation tests can be made.	Usually a 100MPa cone is used; either an S-Type cone or a C-Type cone. These are discussed in an attached IGS Technical Note. 1S denotes an S-Type cone, 1C denotes a C-Type cone. Cone is carefully prepared to ensure best reasonably achievable piezo saturation and absence of trapped or dissolved air. Pore pressure measurements are made as test progresses. If soil behaviour spoils piezo response in some zones, test penetration is paused (but only briefly) to promote "catch up". Should difficult soil layers be encountered (eg gravely bands or hard fissured layers causing tilt), test type IGS-1S can sometimes be carefully continued – at discretion of IGS operator.
IGS-2S or IGS-2C	**Non-Piezo-Cone Testing** Client must (pre-testing) brief IGS on their choice of category. Little or no client involvement is required during testing progress. As cone does not have a piezo-element, cone preparation is much simpler and quicker – leads to higher project productivity.	For use when clients want a reliable soil profile and to establish design parameters at "site characterisation" level. But pore pressure response is not required. May be the base test type chosen for a variable or unknown soil type for overall site profiling. IGS recommends this if budget control is critical and site characterisation is the objective.	Usually a 100MPa cone is used; either an S-Type cone or a C-Type cone. These are discussed in a following Technical Note. 2S denotes an S-Type cone, 2C denotes a C-Type cone. Should difficult soil layers be encountered (eg gravely bands or hard fissured layers causing tilt), test type IGS-2S can sometimes be carefully continued – at discretion of IGS operator.
IGS-3S or IGS-3C	**Special-Class Testing.** Client must (pre-testing) brief IGS on their choice of category. Client must advise IGS of their expectations, as test productivity may sometimes be reduced using this method. Objective is best possible pore pressure response in "difficult" ground, but still maintaining modestly high productivity. Client might intervene during progress to shift test type to IGS-4, accepting lower test productivity that results in this shift.	Typically used at targeted locations after site characterisation by IGS-1 or IGS-2 testing. If client wishes to obtain inputs into determination of soil parameters to a "specially" high level he will more likely choose IGS-3C. Typical objectives may be assessment of soil properties for design of embankments or preloads over soft to firm and stiffer clay-type foundation soils. Dissipation tests should be achieved to a high standard.	Either an S-Type cone or a C-Type cone can be used. These are discussed in a following Technical Note. 3S denotes an S-Type cone, 3C denotes a C-Type cone. Cone capacity is selected to suit the ground being targeted; eg 100MPa or 25MPa* or 10MPa* (*C-Type only) cone choice is made. Pore pressure measurements are closely watched as test progresses. If soil behaviour spoils piezo response in any zones, test penetration is stopped while response monitoring continues. If piezo "recovers" in (say) 10-15 minutes test penetration is re-started. If piezo does not "recover" in (say) 10-15 minutes, test penetration might also be started but client accepts consequences of possible zones of reduced pore pressure response. (Note that client can "up-grade" to IGS-4 if desired).
IGS-4C	**Quasi-Research Class Testing**. Client must be closely engaged in decision process as in extreme conditions test productivity may be quite low using this method. Objective is best possible pore pressure response in "difficult" ground, more-or-less regardless of productivity.	Typically used at targeted locations after site characterisation by IGS-1 or IGS-2 testing. Client wishes to obtain inputs into determination of soil parameters to the highest practically achievable level. Typical objectives may be assessment of preconsolidation pressure of very soft clays, or assessment of preload progress based on qc or qt parameters. Dissipation tests should be achieved to best possible standard.	Cone capacity is selected to suit the ground being targeted (eg 100MPa or 25MPa or 10MPa cone choice is made). C-Type compression cone is used. Pore pressure measurements are closely watched as test progresses. If soil behaviour spoils piezo response in any zones, test penetration is stopped while response monitoring continues. If piezo "recovers", test penetration is re-started. If piezo does not "recover", cone may be pulled out, hole may be water-filled and test may be recommenced with a re-prepped cone.
"Seis" eg IGS-3C-seis	**Seismic CPTu** Client must (pre-Establishment) brief IGS on their choice of seismic CPTu. Little or no client involvement is required during testing progress. Seismic CPT at IGS is available at present in the form of a 15cm^2 C-Type cone.	Used when the client wants a seismic shear wave velocity profile as well as the usual CPTu (piezo-cone) test outputs. Testing can follow any one of the procedures described above for Categories 1C, 3C or 4C.	In addition to the processes described above, the CPT push is halted at agreed intervals (typically 0.5m or 1.0m - but can be any) and subjected to a seismic shear wave generated at the ground surface by one of IGS's shear wave hammers. The shear wave signal is received by the cone's geophone and processed.

a discussion

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

Esme – 10-20t all-terrain

Beryl – 15t 4 wheel drive

Eunice – 20t 6x4 bogey

Minnie - Mini-Jack-Up

An Update On CPT Types Available at IGS

IGS offers a number of different CPT Types:

- 10cm^2 compression cones - both piezo & non-piezo - 100MPa, 25MPa & 10MPa
- 15cm^2 compression cones - piezo - 100MPa including seismic & conductivity modules
- 15cm^2 subtraction cones - both piezo & non-piezo - 100MPa

All of these are of high quality from reputable manufacturers (Geomil and Vertek).

Every cone is in-house calibrated and adjusted by IGS to give the best possible data.

A Discussion Worth Having

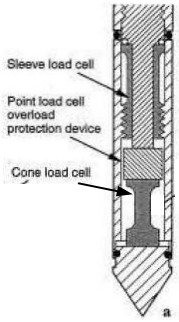
There is a perception (a myth??) that subtraction cones (hereinafter S-Type) are inferior in quality compared to compression cones (hereinafter C-Type).

At IGS we say *"that all depends on how you define quality"*. One useful definition is that *"quality means satisfying or exceeding the client's needs"*. What do you need?

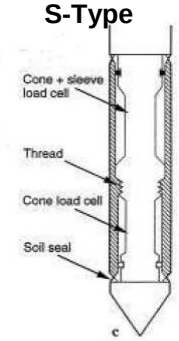
The table below forms a conversation about the characteristics of C-Type vs S-Type, based on IGS's experience with calibrating and operating both types over more than a decade, for various clients and projects, with many differing needs to be satisfied or exceeded.

- Both C-Type and S-Type can be piezo or non-piezo. If piezos the piezometer elements are the same in each - there is no difference in the accuracy of pore pressure readings made by either cone type.
- Each cone type has a load cell 100% focused on measurement of tip resistance - there is no difference in the accuracy of tip readings made by either C-Type or S-Type cones.
- In a C-Type cone the sleeve load cell is sized to suit the sleeve load capacity of the cone. This must arguably make it at least potentially more sensitive than determination of sleeve resistance by an S-Type cone; a small load cell is used to measure a small load. However it also limits the sleeve capacity available and in hard and dense soils this can "refuse" a test long before tip capacity is reached.
- In an S-Type cone the sleeve friction is determined by subtracting the reading of one large load cell from that of another large load cell. This must arguably make it at least potentially less sensitive than determination of sleeve resistance by a C-Type cone. However in an S-Type cone there is effectively no limit to the sleeve capacity and thus in hard and dense soils deeper tests are typically possible.
- There is no doubt that an S-Type cone is more stable during a test and during a job, showing less "drift" and less need for adjustment or repair during the calibration process. It is also much stronger and more durable physically and hence less damage/drift prone.

C-Type



S-Type



Comparison of Calibrations

The attached two sheets are typical run-of-the-mill calibrations from IGS's calibration and adjustment lab; one for an S-Type cone and one for a C-Type cone. There is no practical difference between these two calibrations - in fact the sleeve of this particular S-Type cone is a trace better than that of the C-Type cone. Both are excellent.

The bottom line: IGS can make S-Type tests at lower cost than C-Type, due to the S-Type's robustness. IGS's future pricing will reflect this difference. As always it will be your choice - we will test as you like to the highest quality possible - using always fresh calibrated cones, of your chosen type.

reducing geotechnical uncertainty

100MPa Subtraction Piezocone Calibration Report

This cone has been re-calibrated. Use appropriately-dated calibration file

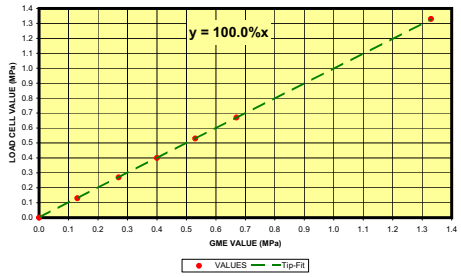
No: S11103

Tip Details Area (sq cm) 15 Capacity (MPa) 100 Cal Date 7/11/2014

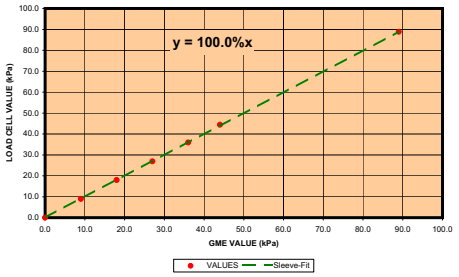
Sleeve Details Area (sq cm) 225 Capacity (kPa) 6667 Cal Date 7/11/2014

Piezo Details Capacity (kPa) 5000 7/11/2014

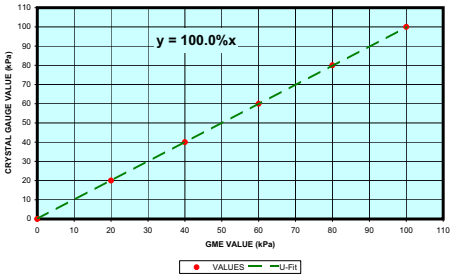
Zero to 1.33MPa (bottom 1.3% of range)



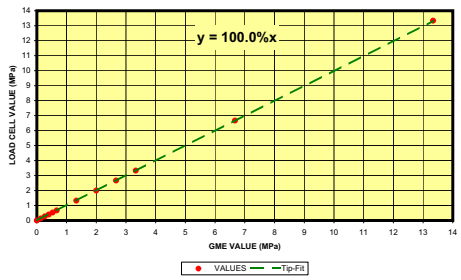
Zero to 89kPa (bottom 1.3% of range)



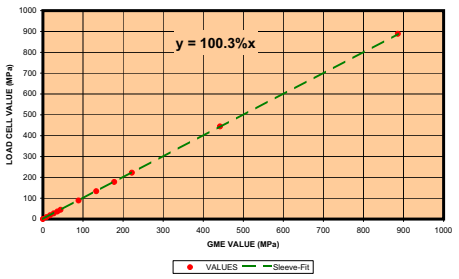
Zero to 100kPa



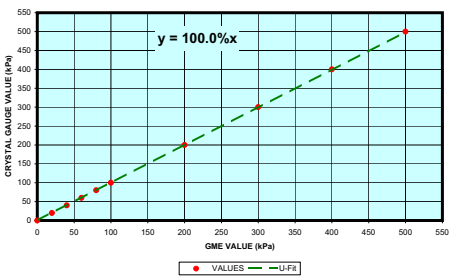
Zero to 13.33MPa (13% of range)



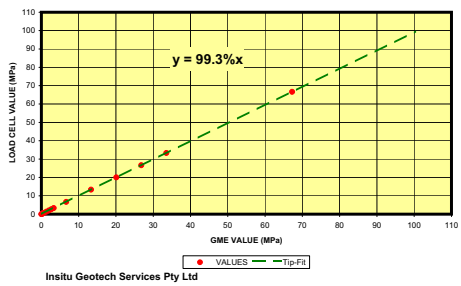
Zero to 889kPa (13% of range)



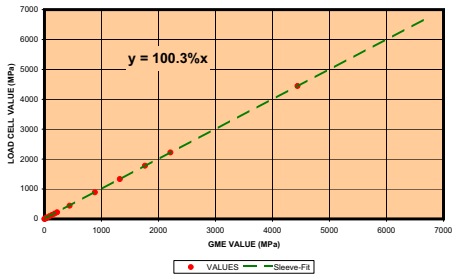
Zero to 500kPa



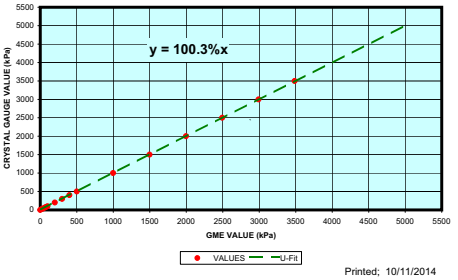
Zero to 100MPa (100% of range) - extrapolated beyond 67MPa



Zero to 6667kPa (100% of range) - extrapolated beyond 4444kPa



Zero to 5000kPa - extrapolated beyond 3500kPa



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100MPa Compression Piezocone Calibration Report

This cone has been re-calibrated. Use appropriately-dated calibration file

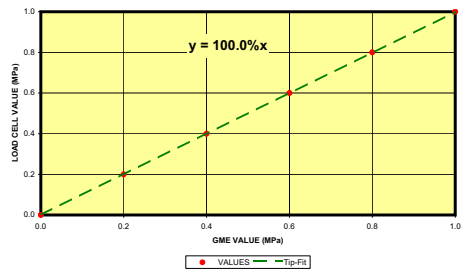
No: C10CFIIP.C11036

Tip Details Area (sq cm) 10 Capacity (MPa) 100 Cal Date 28/10/2014

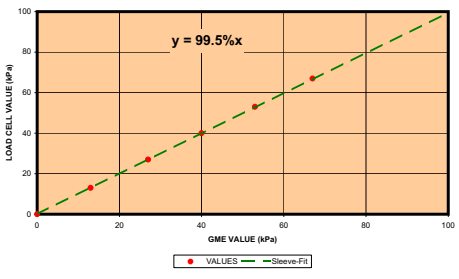
Sleeve Details Area (sq cm) 150 Capacity (kPa) 1500 Cal Date 28/10/2014

Piezo Details Capacity (kPa) 5000 Cal Date 28/10/2014

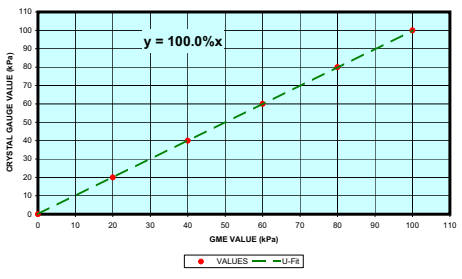
Zero to 1.0MPa (bottom 1% of range)



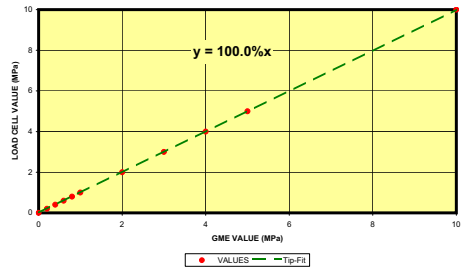
Zero to 100kPa



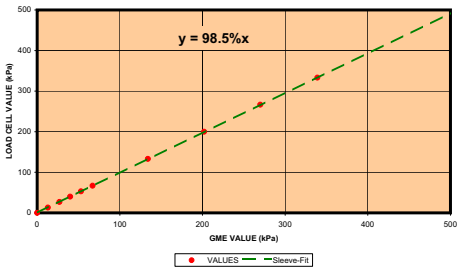
Zero to 100kPa



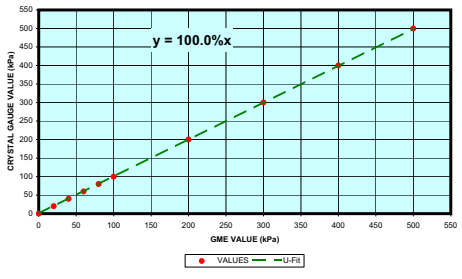
Zero to 10MPa (10% of range)



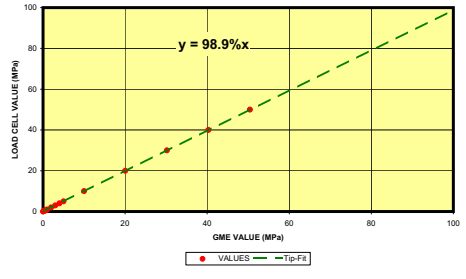
Zero to 500kPa



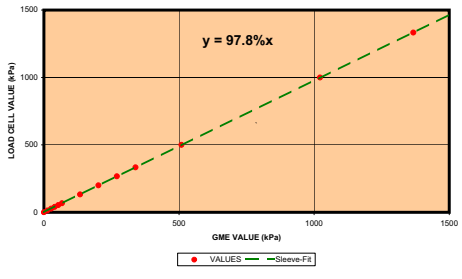
Zero to 500kPa



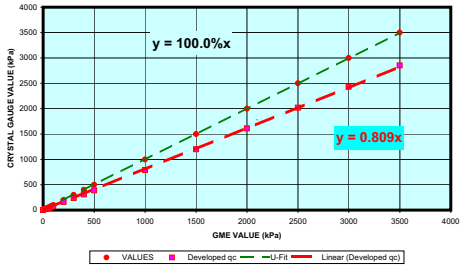
Zero to 100MPa (100% of range)



Zero to 1500Pa (extrapolated past 1333kPa)



Zero to 3500kPa (Red Y = Naf)



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