Summary CPT'10
Regional Reports

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Georgia Institute of Technology
ISSMGE TC10
TC16 - In-Situ Testing

ISSMGE Technical Committee 16
Ground Property Characterization by In-Situ Tests
http://www.webforum.com/tc16

International Society for Soil Mechanics & Geotechnical Engineering
http://www.issmge.org

Core Members (2005-2009):
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1st International Symposium on Cone Penetration Testing (CPT'95)
Linköping, Sweden
Host: K. Rainer Massarsch

2nd International Symposium on Cone Penetration Testing (CPT'10)
Huntington Beach, California, USA
Hosts: Peter K. Robertson
Kelly Cabal
ISSMGE Technical Committee
TC 16 (TC102) - In-Situ Tests

Meeting Today at CPT'10
Monday
10 May 2010
5:30 - 6:30 p.m.
Ballroom
4th International Conference on Site Characterization - 2012
Recife, Brazil (ISC-4)

- Professor Roberto Quental Coutinho
- Federal University of Pernambuco
- Brazilian Soc. Soil Mechanics & Geotechnical Engineering

www.webforum.com/tc16
OUTLINE for Regional Reports

- Introduction: Geography, Topography, Climate, Population
- Geology of Region
- Geotechnical Challenges:
  - Overview of site investigation practices
  - Major issues: settlement, piles, problem soils, seismicity
- Equipment and Procedures
  - Test Standards
  - Special measures or methods
  - Equipment used
  - Percentage use of CPT in region
- CPT Interpretation
  - Soil type and stratigraphy
  - Geotechnical parameters
  - Other derived information
- Applications of CPT
- Summary - Acknowledgments
- References

Dr. Peter K. Robertson
CPT'10 - Summary Regional Reports

World Map by NASA and Japan's Ministry of Economy, Trade, & Industry

9 Regional Reports
CPT

• Current Phase Transformer
• Cross Product Team
• Cellular Paging Teleservice
• Chest Percussion Therapy
• Crisis Planning Team
• Consumer Protection Trends
• Computer Placement Test
• Current Procedural Terminolgy
• Cost Per Treatment
• Choroid Plexus Tumor
• Cardiopulmonary Physical Therapy
• Corrugated Plastic Tubing
• Cumulative Price Threshold
• Cell Preparation Tube
• Central Payment Tool
• Certified Performance Technologist
• Cockpit Procedures Trainer
• **Cone Penetration Test**
• Color Picture Tube
• Critical Pitting Temperature
• Certified Phelbotomy Technician
• Control Power Transformer
• Cost Production Team
• Channel Product Table
• Conditional Probability Table
• Command Post Terminal
Regional Report for Australia - New Zealand

Martin Fahey and Barry Lehane
Univ. of Western Australia
Regional Report for Asia

An-Bin Huang
National Chiao Tung Univ. - Taiwan
Regional Report for Southern Europe

António Viana da Fonseca
Univ. of Porto, Portugal
Regional Report for Eastern Europe

Zbigniew Młynarek
Poznan University, Poland
Regional Report for Northern Europe

Mike Long
University of Dublin, Ireland
Regional Report for Africa and Middle East

Tamer Elkateb
Ains Sham University, Egypt
Regional Report for Nordic Europe

Hjördis Löfroth
Swedish Geotechnical Institute

with
Rolf Sandven
Norway

Carsten Bonde
Denmark

Hannu Halkola
Finland
Regional Report for South America

Roberto Coutinho
Univ. Pernambuco

Fernando Schnaid
Fed. Univ. Rio Grande do Sol Brazil
CPT'10 - Summary Regional Reports

Regional Report for North America

Paul Mayne
Georgia Tech, Atlanta, USA
Standard Penetration Test
Texas Penetration Test
Vane Shear Test
Pressuremeter Test
Cone Pressuremeter
Dilatometer Test
Screw Plate Test
K₀ Stepped Blade
Swedish Weight Sounding
Hydraulic Fracture
Borehole Shear Test

Total Stress Cell
Freestand Torsional Shear
Cone Penetration Test
Piezocone Penetration
Resistivity Piezocone
Seismic Cone
Seismic Flat Dilatometer
T-Bar Penetrometer
Ball Penetrometer
Plate Penetrometer
Plate Load Test

Suspension Logger
Crosshole Geophysical Test
Downhole Test
Spectral Analysis of Surface Waves
Modal Analysis (Rayleigh Waves)
Continuous Surface Waves
Standard Penetration Test with Torque
Large Penetration Test
PiezoProbe Test
Seismic Piezocone Pressuremeter
Helix Probe Test
CPT'10 Summary Report

Types of Electric Cone Penetrometers & Piezocones

- **Electric Friction Cone Penetrometer**
  - $d = 35.7$ mm
  - $h = 134$ mm
  - $f_s$ = sleeve friction
  - $q_c$ = measured cone tip resistance

- **Type 1 Piezocone**
  - $d = 35.7$ mm
  - $u_1$ = face porewater pressure

- **Type 2 Piezocone**
  - $d = 35.7$ mm
  - $u_2$ = shoulder porewater pressure
  - $q_t = q_c + (1-a_n)u_2$
  - Section Area = 15-cm²

- **Type 2 Piezocone**
  - $d = 43.7$ mm
  - $h = 145$ or 164 mm
  - Section Area = 10-cm²

Note: $a_n$ is the normality factor.
CPT'10 Summary Report
Piezocone Sounding from Portsmouth, Virginia

Cone Tip Resistance
$q_t$ (tsf)

Sleeve Friction
$f_s$ (tsf)

Porewater Pressure
$u_2$ (tsf)

Depth (feet)

0 100 200 300 400

0 1 2 3 4

-10 0 10 20 30 40
CPT'10 Summary Report

Piezo-Dissipations from North Carolina DOT

Piezo-Dissipations at Evergreen, North Carolina

- **MONOTONIC**
  - 02D at 13.8 feet (4.2 m)
  - 01D at 24.9 feet (7.6 m)
  - 07D at 27 feet (8.3 m)
  - 08D at 18 feet (5.5 m)

- **DILATORY**

Graph showing measured $u_2$ (kPa) against time (minutes).
CPTU in Mexico City Clay
(data from Cruz, 2004)
Standards for Cone Penetration Testing

- International: IRTP for CPT and CPTU (ISSMGE, 1999)
- Europe: CEN standard EN ISO 22476-12 (2009) for mechanical cone
- Europe: CEN standard EN ISO 22476-1 (2007) for electrical piezocone
- Austria: DIN 4094-1
- France: NF P94-113 CPT and NF P94-119 CPTu
- Germany: DIN 4094-1
- Netherlands: NEN 5140
- United Kingdom: BS1377, BS5930
- Bulgarian Standard (use German DIN 4094-90)
- Czech Standard STN 721033
- Slovakia Standard CSN 721033
- Estonia Reference LBN 207-01
- Latvia Reference LVS 437
- Lithuania Reference LBN 005-99
- Poland: Polish Standard PN-B-04452 (2002)
- Romanian Standard NP 074-2007
- Russia Standards GOST 19912-2001 Code SP 11 105 97
- Egypt: Use British Standards: BS 1377 - Part 9 on In-Situ Testing
- USA and Canada: ASTM D 3441 (mechanical cone); ASTM D 5778 (2007) - electric piezocone
- Sweden: Swedish Geotechnical Society SGF Report 1:93E
- Spain: Reference is the UNE 103-804-93
- Australian National Standard: AS1289.6.5.1-1999
- New Zealand: National Standard NZS 4402.6.5.3:1988
CPT Repeatability Studies

Powell & Lunne (2005, ICSMGE)

12 CPTs at Bothkennar Soft Clay Site, UK
Calibrations of Penetrometers

• Two types of calibrations necessary.
• Load cell verification in compression machine (proving ring) for $q_c$ and $f_s$
• Penetrometer in pressurized triaxial cell to detail porewater effects on geometry to obtain $q_t$ and $f_t \rightarrow a_{net}$ and $b_{net}$
• Pressure triaxial calibrations also verify porewater transducer output.
CPTu Procedures

Porous Element Materials
  • Sintered Metals
  • Ceramics
  • Plastics (disposable)

Saturation:
  • Water
  • Glycerine
  • Silicone fluid
  • Olive Oil

Procedures:
  • Vacuum for 24-hours
  • Pre-saturated elements
  • Prophylactic to maintain fluids

Grease-Filled Slots - (no element)
CPT'10 - Summary Regional Reports

ConeTec, Vancouver

Fugro Penetrometers, Holland
Harpoon Type Cone Penetrometers

"Free-Fall Cone Penetration Test"

- US Navy XDP
- Canadian FFCPT
- German MARUM
CPT'10 - Summary Regional Reports

Harpoon Type Cone Penetrometers
CPT Probes for Centrifuge - Univ. Western Australia

Mini-Cone Penetrometers

T-bar

Ball

Plate

0 50 mm

Main Centrifuge

Drum Centrifuge
Micro-Cone Penetrometers
Kim, Choi, Lee & Lee (GeoFlorida 2010)
Korea University

- Developed FBG Cone Penetrometers
  - Diameter: 1~7mm
  - FBG +S/G sensors
  - Temperature transducer
  - Dual stainless steel tube

FBG = Fibre Bragg Grating sensor
CPT'10 Summary Report - Truck Rigs
CPT'10 Summary Report - Track Rigs
Geoprobe Systems Model 6625 CPT

(courtesy: Troy Schmidt and Tom Christy)

Used as a track rig

Or left on truck carrier
CPT'10 - Special CPT Vehicles
Definition: Rodman in Civil Engineering
CPT'10 - Summary Regional Reports

AutoCoson - Automated robotic CPT system
A.P. van den Berg, Holland
CPT'10 - Special Small CPT Rigs
CPT'10 - Summary Regional Reports

圆锥贯入试验

Chinese CPT Equipment
www.madeinchina.com
CPT'10 - Summary Regional Reports

Railway CPT Deployment
Recent Economic Losses in Our Pensions

NON SEQUITUR
By Wiley
AJC – 14 Nov’08

The NEW GEOTECHNICAL RETIREMENT PLAN
CPT'10 - Summary Regional Reports

Geologic Map of the World:  www.OneGeology.org
NearShore and Offshore CPT Deployment

Fugro Engineers
CPT'10 - Summary Regional Reports

CPT Near Shore Jack-up Platforms

IG5 Jackup
Fugro Seacore
USAE Explorer

Geomil Jackup
iGeotest DS3
IG3 Platform
Offshore CPTs by Dynamic Positioning Ships

Explorer

Fugro

Markab

Bucentaur
CPTU from Gulf of Mexico

Tip Resistance $q_t$ (MPa)

Sleeve Friction $f_s$ (kPa)

Porewater Pressure $u_2$ (MPa)

Depth (m)

$1 \text{ m}_q$
Offshore CPTU Data

normally-consolidated clays

\[ m_q = 56.7 - 0.194 \cdot LL \]
\[ r^2 = 0.8774 \]
\[ n = 11 \]
Onshore and Offshore CPTU Data

\[ \text{Est } \gamma_t = 1.95 \gamma_w \left[ \left( \frac{f_s}{\sigma_{atm}} \right) + 0.01 \right]^{0.06} \left( \frac{\sigma_{vo'}}{\sigma_{atm}} \right)^{0.06} \]

- Onshore Soils
- Offshore Australia
- Offshore Africa
- Offshore North America
- Offshore Mediterranean
- Offshore South America
- Offshore North America
- Offshore North Sea
- Offshore North America
- Offshore Persian Gulf
- Offshore Indian Ocean
- Offshore Australia
- Offshore Baltic
- 1:1 Line

ISFOG 2010
Systems for Seabed Deployment of CPT

- Roson
- Gregg
- Igeotest
- Wison
- Neptune
- Seacalf
- Roson
- Sage Sidewinder
PROD  = Portable Remotely Operated Drill


2000-m water depths
150-m exploration depths below mudline
Continuous Coil Tube Injectors

Gregg Drilling

Sage-Engineering

Louisana Transportation Research Center

iGeotest Neptune
Continuous Coil Tube Injectors

Fluid Design Solutions Inc
Edmonton
CPT'10 Summary Report
Seismic Piezocone Penetration Testing (SCPTu)
SCPTu at Treporti test site
Venice Italy

![Graph showing q_T (MPa), u_b (kPa), FR = f_s/q_t (%), and V_s (m/s) versus depth (m).]
SCPTU in Burswood Clay, Perth
(Schneider, 2007, Univ. Western Australia)
SCPTU at Golden Ears Bridge
ConeTec, Vancouver, BC

Tip q_t (MPa)  |  Sleeve f_s (MPa)  |  Porewater u_2 (MPa)  |  Shear Wave V_s (m/s)

Depth (m)  |  0  |  5  |  10  |  15  |  20  |  25  |  0.0  |  0.1  |  0.2  |  0.3  |   0   |   1   |   2   |   3   |   4   |  0   |  100  |  200  |  300  |  400  |  500  

0  |  10  |  20  |  30  |  40  |  50  |  60  |  70  |  80  |  90  |  100  |
Seismic Piezocone Sounding (SCPTu)
Piedmont Residual Silts in Atlanta, Georgia
HERBERT, ONCE UPON A TIME YOU WERE THE ROCK OF MY WORLD. THEN YOU BECAME THE STONE IN MY SHOE... NOW YOU'RE THE SAND IN MY SANDWICH. GOODBYE.

Saprolitic

Rock → Stone → Sand → Formation of Residuum
CPT'10 - Summary Regional Reports

Books on Cone Penetration Testing (since CPT'95)

Norway  
Canada  
Britain  
The Netherlands  
United States  
Brasil
Holmen Island in Drammen River (Lunne, et al. 2003)

NGI testing: 1956 to 2010 = 54 years
Empirical Interpretation of CPT data

Huang (2010)
Interpretation of CPT by Analytical Methods

Coupled Cavity Expansion-Critical State Model

\[ OCR = 2 \cdot \left[ \frac{1}{1.95M + 1} \left( \frac{q_l - u_2}{\sigma_{vo}'} \right) \right]^{(1/\Lambda)} \]

**Soil Properties:**

- \( M = 6 \sin \phi'/(3 - \sin \phi') \)
- \( \phi' = \text{effective stress friction angle} \)
- \( C_c = \text{compression index} \)
- \( C_s = \text{swelling index} \)
- \( \Lambda = 1 - C_s/C_c \)
- \( I_R = G/s_u = \text{Undrained Rigidity Index} \)
- \( G = \text{shear modulus} \)
- \( s_u = \text{undrained shear strength} \)
Finite Element Modeling of CPT

LSU - Tumay et al. (2008)

Univ. Michigan
Susila & Hryciw (2003)
Discrete Element Modeling of CPT

Jiang, Yu, & Harris (2006)
Univ. Nottingham; Univ. Manchester
Strain Path Modeling of CPTù

MIT E-3 and SPM Dissipation Curves (Whittle, 2005)
Dislocation Analysis of CPTù

Lee, Elsworth, and Hryciw (JGGE 2008)
Soil Parameter Interpretation from CPT

- Coef. Secondary, Cae
- Constrained Mod. D'
- Swelling Index, Cs
- Bearing Ratio, CBR
- Resilient Modulus, MR
- Subgrade Coef, ks
- Rigid Index, IR
- Poisson's Ratio, v
- Horizontal Coef. Ko
- Effective Cohesion Intcpt, c'
- Small Strain Gmax
- Compression Index, Cc
- Permeability, k
- Coef. Consolidation, cvh
- Elastic Modulus, E'
- Overconsolidation Ratio, OCR
- Relative Density, Dr
- Undrained Shear Strength, su
- Effective Friction Angle, $\phi'$

Number of Replies

64 DOTs
CPT Computer Programs for Interpretation

- GEO5 Pile CPT (gintsoftware)
- GLAMCPT (Omer 2006)
- CPeT-IT (geologismiki.gr)
- LPD-CPT (Louisiana State University)
- Conrad (Swedish Geotech Institute)
- CPTINT (Dick Campanella)
- CPTLiq (Geosoftwaresolutions)
- CPT-Log (Geotech.se)
- DCCONE (dc-software.com)
- Edison - SGI
- MFoundation (GeoDelft)
- CPT-Pro (www.geosoft.com.pl)
- P-Class - (LSU and LTRC, Louisiana)
- PL-aid (McTrans at Univ. Florida)
- RapidCPT (dataforensics.net)
- Shake2000 (CPT for soil liquefaction)
- Static Probing (www.geostru.com)
- Unipile (www.unisoftltd.com)
- Georit (Geotech AB)
- CPT7 (GeoMil Equipment)
- ScreenZw (ConeTec)
- CPTGL (Geotech AB reduction)
- Go! (van den Berg)
- Almeid (UWA)
- CPTPlot
- CLIq (geologismiki.gr)
- GeoExplorer (Gouda-Geo Equip)
- SPAS 2009 (geologismiki.gr)
- INSITU (www.geo&soft.com)
- OpenSounding (sourceforge.net)
- PCL-pro (Geotech)
- PlotCPT (GeoMil Equipment)
- SCPT-DAA (Baziw)
- Static Penetrometer (Alpes-Geo)
- LCPC360A (ConeTec)
- FB-Deep (Univ. of Florida)
- Gorilla (A.P. van den Berg)
- NovoCPT 1.2 (novosoftware.com)
Applications of CPT

Frequency of Use

Types of Projects

Sinkholes
Emb Fill Control
Other
Subgrades
Excavations
QC Ground Mod
Seismic
Ret. Wall Design
Soil Liquefaction
Soft soils delineation
R.Wall Fdns
Slopes
Deep Fdns
Embankments
Bridges

36 Respondents
Reasons why DOTs not using CPT

NCHRP 368 (2007)
### Special Methods for CPT in Hard Ground

<table>
<thead>
<tr>
<th>Advancing Technique</th>
<th>Reference</th>
<th>Comments/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy 20-tonne Dead Weight Vehicles</td>
<td>Mayne, et al. (1995)</td>
<td>Increased mass</td>
</tr>
<tr>
<td>Friction Reducer</td>
<td>van de Graaf &amp; Schenk (1988)</td>
<td>Opens large diameter hole before rods</td>
</tr>
<tr>
<td>Cycling of Rods (up and down)</td>
<td>Shinn (1995, personal comm.)</td>
<td>Locally in thin hard zones of soil</td>
</tr>
<tr>
<td>Large 44-mm diameter penetrometer</td>
<td>van de Graaf &amp; Schenk (1988)</td>
<td>Works like friction reducer</td>
</tr>
<tr>
<td>Guide Casing: Double set of rods; standard 36-mm rods supported inside larger 44-mm rods; prevents buckling</td>
<td>Peuchen (1988)</td>
<td>Works well in situations involving soft soils with dense soils at depth</td>
</tr>
<tr>
<td>Drill Out (Downhole CPTs)</td>
<td>NNI (1996)</td>
<td>Alternate between drilling and pushing</td>
</tr>
<tr>
<td>Mud Injection</td>
<td>Van Staveren (1995)</td>
<td>Needs pump system for bentonitic slurry</td>
</tr>
<tr>
<td>Earth Anchors</td>
<td>Pagani Geotechnical Equipment Geoprobe Systems</td>
<td>Increases capacity for reaction</td>
</tr>
<tr>
<td>Static-Dynamic Penetrometer</td>
<td>Sanglerat et al. (1995)</td>
<td>Switches from static mode to dynamic mode when needed</td>
</tr>
<tr>
<td>Downhole Thrust System</td>
<td>Zuidberg (1974)</td>
<td>Single push stroke usually limited to 2 or 3 m</td>
</tr>
<tr>
<td>ROTAP - outer coring bit</td>
<td>Stercks &amp; Van Calster (1995)</td>
<td>Special drilling capabilities through cemented zones</td>
</tr>
<tr>
<td>CPTWD</td>
<td>Sacchetto et al. (2004)</td>
<td>Cone penetration test while drilling</td>
</tr>
<tr>
<td>Sonic CPT</td>
<td>Bratton (2000)</td>
<td>Vibrator to facilitate penetration through gravels and hard zones</td>
</tr>
<tr>
<td>EAPS (enhanced access penetrometer system)</td>
<td>Farrington (2000); Shinn &amp; Haas (2004); Farrington &amp; Shinn (2006)</td>
<td>Wireline systems for enhanced access penetrometer system</td>
</tr>
</tbody>
</table>
Vertek 40-tonne CPT Truck
Static-Dynamic CPT System (AMAP Sols)


Mlynarek (2010)

AMAP Static-Dynamic CPT in Dense Sandstone

Penetration Resistance, qc (MPa)

Depth (meters)

Electric CPT

Static CPT

Dynamic CPT

End CPT at 45 m

Fill Layer

Sandy Gravel with Cobbles and sandy Lenses

Dense Sandstone

Sandstone
CPTs in Mine Tailings - Australia

Marooka 12t tracked CPT rig on red tailings storage with desiccated crust, Kalgoorlie, WA


Fahey & Lehane (2010)
Zelazny Most Copper Tailings Pond
(courtesy Mike Jamiolkowski)

- Maximum dam height: 50.5 m
- Total volume stored: 372x10^6 m^3
- Storage rate: 17.5x10^6 m^3/annum
- Area covered: 14.2 km^2
- Dam’s perimeter: 14.5 km
- Operation time: 1977 throughout 2035
CPT'10 - Summary Regional Reports

Permafrost Regions of Canada
www.ec.gc.ca

Test Site
Laval University
Québec
(LeBlanc & Fortier)

Cone Penetration Rig in Arctic Permafrost
(courtesy ConeTec)
SCPT in Permafrost (LeBlanc - Fortier 2006)

Laval University
Québec
CPTs Halley Research Station - Antarctica
CPT'10 - Summary Regional Reports

CPTs to Measure Strength of Polar Ice - Antarctica

Cone Resistance, $q_c$ (MPa)

Depth (meters)

Adrian McCallum
Scott Polar Research Institute (SPRI)

Lankelma, UK
CPT'10 - Summary Regional Reports

Hand-held electronic cone penetrometers

Rimik CP40 ii digital penetrometer

Spectrum Scout SC 900

Eijkelcamp Digital Penetrometer
CPT'10 - Summary Regional Reports

Hand-held electronic cone penetrometers

Rimik CP40 ii penetrometer

Excellent
Repeatability

Penetration Resistance
New Developments

VisCPT = vision penetrometer (Hryciw 2004)

- Sapphire window
- Visual data acquisition recording system

- Clean Sand
- Silty Sand
- Silty fine Sand
- Silty Clay
New Developments: Full-Flow Penetrometers

- T-bar
- Ball penetrometer
- Plate
- Developed for very soft soils (offshore)

House, Stewart, & Randolph (ISC-1998)
CPT'10 - Full-Flow Penetrometers

- Applicable for very soft soils ($s_u < 10$ kPa)
- Conventional CPT with larger head
- 100-cm$^2$ area (vs. the standard 10-cm$^2$)
- Resolution of load cell improved 10-fold
- Correction for net area minimized
- Direct $q_{t\bar{a}r}$ rather than net (CPT: $q_t - \sigma_v$)
  \[ s_u = \frac{q_{t\bar{a}r}}{10} \]
- Take readings during push and during pullout to investigate cyclic effects and remoulded strength

Randolph (ISC-2, Porto, 2004)
Soil characterisation

- Various penetration tests
  - 15 cm$^2$ piezocone
  - 33 cm$^2$ piezocone
  - Ball penetrometer
  - T Bar
New Developments: Twitch Testing

Chung, Randolph & Schneider (2006, JGGE)

Normalized Resistance, \( q/q_{\text{ref}} \)

Normalized Velocity: \( V = \frac{v d}{c_v} \)

Partially-drained

Undrained

Drained

\( T\)-bar

Ball

Plate

Cone

Watson & Suemasa
Piezocone twitch tests in chamber deposits of clayey sand

(modified after Kim & Salgado 2008)
Frequent-interval and Continuous $V_s$ profiling
Charleston, South Carolina

![GT AutoSeis](image)
Continuous $V_s$ profiling to 45 meters
courtesy Dave Woeller - Conetec
ConeHeads are from ...FRANCE

No Confirmation by the French

Will wait for extraterrestrial CPT report by Jim Mitchell
Parody on "You might just be a redneck"

Comedian defines "redneck" as "a person who gloriously lacks of sophistication"

If you come home from the garbage dump with more than you went in with....... 

...You might just be a redneck

CPT'10 - Geotechnical Parody - - -

You might just be a ConeHead

CPT'10
CPT'10 Parody on "You might just be a redneck"

If you believe that the best means to evaluate $N_{60}$ is from CPT data......

...then you just might be a ConeHead
CPT'10 Parody on "You might just be a redneck"

If you think our professional image may be tarnished by the field drilling crew

....then you just might be a ConeHead
CPT'10 Parody on "You might just be a redneck"

If you believe our professional image may be improved by using CPT

....then you just might just be a ConeHead
If you believe in.....

- Fast
- Economical
- Efficient
- Continuous
- Collection of digital data
- from Multiple Readings
- Logged to your computer

...then you just might be a ConeHead
CPT'10 Parody on "You might just be a redneck"

If you think the Washington monument is a national tribute to cone penetration testing

....then you just might just be a ConeHead
CPT'10 - Summary Regional Reports
CPT'10 - Summary Regional Reports

James K. Mitchell
Univ. California - Berkeley

Dick Campanella
Univ. British Columbia

Peter K. Robertson
University of Alberta

Miguel Pando
Univ. Mayaguez, Puerto Rico

Miguel E. Ruiz
Universidad Nacional de Córdoba, Argentina

5 Generations of ConeHeads

STUDY OF AXIALLY LOADED POST GROUTED DRILLED SHAFTS USING CPT (2005)
4th International Conference on Site Characterization - 2012 Recife, Brazil (ISC-4)

- Professor Roberto Quental Coutinho
- Federal University of Pernambuco
- Brazilian Soc. Soil Mechanics & Geotechnical Engrg.

www.geoforum.com/tc16