09.08

product manual

HS-4210

Digital Static Cone Penetrometer

Introduction

This Manual covers the measurement of bearing capacity using the Humboldt Digital Static Cone Penetrometer (DSCP).

Application

A) This procedure is used to assess the in place strength of undisturbed soil and/or compacted materials. The bearing capacity can be used to estimate CBR (California Bearing Ratio), shear strength of strata, thickness of strata and bearing capacity. It may be used in horizontal or vertical construction applications, such as footings and shallow foundations. Typically it is used to assess material properties to a depth of 762 mm (30 inches) below the surface. With extensions the DSCP can be advanced to greater depths.

B) The operator pushes the DSCP into soil by applying weight to the handles. This is designed to handle applied loads up to 250 lb. Loads higher than this will result in an "overload" reading on display. The penetration rate should be consistent and no eratic loads should be applied vertically or horizontally as this will result in unreliable information and could result in bending of the rod. Through continued use of this tool, correlation charts may be developed on local material to correlate to blow counts, unconfined, *in situ* CBR and other measurements.

C) The Humboldt DSCP can be used to estimate the strength characteristics of fine and grained soils used for construction materials and weak stabilized or modified materials. This may be used to classify cohesive soils in terms of consistency, determining the approximate unconfined compressive strength and the evaluation of shear strength using the penetration principle. These readings do not replace laboratory tests but may be used to obtain needed field data. The Humboldt DSCP should not be used in highly stabilized or cemented materials or for granular materials.

D) The Humboldt DSCP can be used to estimate the strength of *in situ* materials underlying a bound or highly stabilized layer by first drilling or coring an access hole.

NOTE: The DSCP may be used to assess the density of a fairly uniform material by relating to penetration rate on the same material. In this way under compacted or "soft spots" can be identified, even though the DSCP does not measure density directly.

Description

A) The Humboldt DSCP in Figure 1 consists of a large easy to read display, Multiple selectable display units, padded handle grips, 30" dual rod design starter rod with available extensions and a standard 1.5 cm^2 with an angle of 60°cone.

B) Optional DSCP equipment can be found at www.humboldtmfg.com, including:

- 30" Extension Rods
- Replacement Cones 1.5 cm^2
- Optional Cone 3 cm^2
- Field Moisture Ovens
- Augers

Figure 1 – Digital Static Cone Penetrometer

Large Easy to Read Display	lb, psi, psf, tsf, kg/cm^2 or kPa Includes Force Indicator Scale
Maximum Total Load	250 lb, 980 psi, 141,000 psf, 70 tsf, 68 kg/cm^2, 76,000 kPa
Readability Head w/Handles Includes Padded Handles	1 lb, 1 psi, 200 psf, 1 tsf, 1 kg/cm^2, 1 kPa 2 in x 2.5 in x 16 in (5 lb) 1% full scale
Starter Rods	30 in (76 mm)
Power	9v battery
Drive Cone Assy.	1.5 cm^2 with angle of 60° (opt. 3 cm^2 available)
Extensions available	30 in (76 mm)

Procedures

A) Equipment Check

1) Before beginning a test, check to ensure the Drive Rod is straight by rolling the rod on a flat surface. Drive Rod may have been bent if overloaded vertically.

2) The Drive Cone Assembly must be checked to ensure proper movement and that the point is discernable. The point may eventually become rounded depending on the amount of use and types of material tested. The original diameter of the cone is 0.544". Replacement should be considered if the diameter is reduced to 0.528" or if substantial damage occurs to the cone point.

B) Assembling

1) ***Starter Rod:*** Insert starter rod in bottom of head assembly and tighten with 7/16" wrench.

1) ***Extension Rod (if used):*** Attach extension rod either above or below starter rod. (Inside rod on starter rod is shorter than that of extension rod.) Tighten with 7/16" wrench.

2) ***Drive Cone Assy.:*** Attach to lower section and securely tighten with 7/16" wrench.

   a) The standard 1.5 cm^2 Drive Cone Assy. is used in typical low strength fine grained soft soils.

   b) The optional 3 cm^2 Drive Cone Assy. is used in very soft, typically uncompacted materials where readings in psf may fall below 2000 psf. Use of this cone requires that the displayed reading be divided by 2 for the correction.

C) Testing Sequence

1) ***Tare Display:*** This may be done by setting the DSCP on horizontal surface and turning on while allowing weight of head to rest on cone. Unit will tare automatically upon startup. Tare function may also be achieved at any time while unit is on by allowing the unit to stand on horizontal surface while allowing weight of head to rest on cone and pressing the “Tare” button.

2) ***Select Units:*** Units desired for test may be selected by holding down “MAX” button and at the same time pushing the “ZERO” button which will scroll thru the units available.

Procedures *(continued)*

C) Testing Sequence *(continued)*

3) ***Apply Force:*** The DSCP device is held in position, either vertically or horizontally. The operator applies consistent force to handles for cone to penetrates the material. Readings are monitored during penetration to obtain information related to soft spots, averages or peaks. Soil friction on the outside rod is not an influence in the reading. The applied force is read directly from the cone via the inside rod onto the load cell and displayed on the screen.

4) ***Depth of Penetration:*** The depth of penetration will vary with application.

5) ***Refusal:*** The presence of aggregates or rock strata will either stop penetration or deflect the cone. If slight increase in applied force does not get penetration, do not try to force penetration. **Continuing to try to force penetration could result in inaccurate readings and could damage the cone, rod or load cell.**

CAUTION!

- **DO NOT force penetration.**
- **DO NOT rock the DSCP side to side or forward and back in an attempt to achieve penetration or to loosen it from the ground during extraction.**

Correlations

A) Correlation with other tests may be made with the Humboldt DSCP on local materials. Examples are Standard Penetration (blow counts), CBR and Unconfined. Readings of the cone index (Q_c) and soil constants are not absolute. General correlations have been determined as a guide. Additional verification with your local soil type is recommended. **The following calculations should be made using kg/cm² or tsf for your cone index reading.**

Standard Penetration

$Q_c = 4$ "N"

Strength and Cohesion

Q_u = Unconfined Compression (kg/cm²)

C – Cohesion

Correlations *(continued)*

Uniform Clay and Silty Clays

$Q_c = 5\ Q_u$

$Q_c = 10\ C$

Clayey Silts

$Q_c = (10\text{-}20)\ Q_u$

$Q_c = (20\text{-}40)\ C$

CBR = Value (%)

$Q_c = (2.5\text{-}3.3)$ CBR

Maintenance

Testing with the Humboldt DSCP causes wear on the metal parts that make up the device. In order to ensure maximum service life, periodic inspections of the Humboldt DSCP for fatigue or damage are recommended. Any parts found to be fatigued or damaged should be repaired by the manufacturer, or replaced with Humboldt DSCP parts. The Humboldt DSCP should be kept clean and all soil removed from the Drive Rod and Drive Cone Assembly after each use. Lubrication of the inner rod is recommended using a few drops of machine oil. The outer rod should be kept clean and lubricated with oil to aid in penetration and cleanup as well as reducing corrosion.

Calibration available as required.

Humboldt Mfg. Co.
3801 North 25th Avenue
Schiller Park, Illinois 60176 U.S.A.

U.S.A. Toll Free: 1.800.544.7220
Voice: 1.708.456.6300
Fax: 1.708.456.0137
Email: hmc@humboldtmfg.com

Testing Equipment for Construction Materials

HUMBOLDT

www.humboldtmfg.com