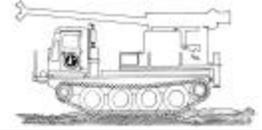




# Minnesota Department of Transportation Geotechnical Section Cone Penetration Test Index Sheet 1.0 (CPT 1.0)



## USER NOTES, ABBREVIATIONS AND DEFINITIONS

This Index sheet accompanies Cone Penetration Test Data. Please refer to the Boring Log Descriptive Terminology Sheet for information relevant to conventional boring logs.

This Cone Penetration Test (CPT) Sounding follows ASTM D 5778 and was made by ordinary and conventional methods and with care deemed adequate for the Department's design purposes. Since this sounding was not taken to gather information relating to the construction of the project, the data noted in the field and recorded may not necessarily be the same as that which a contractor would desire. While the Department believes that the information as to the conditions and materials reported is accurate, it does not warrant that the information is necessarily complete. This information has been edited or abridged and may not reveal all the information which might be useful or of interest to the contractor. Consequently, the Department will make available at its offices, the field logs relating to this sounding.

Since subsurface conditions outside each CPT Sounding are unknown, and soil, rock and water conditions cannot be relied upon to be consistent or uniform, no warrant is made that conditions adjacent to this sounding will necessarily be the same as or similar to those shown on this log. Furthermore, the Department will not be responsible for any interpretations, assumptions, projections or interpolations made by contractors, or other users of this log.

Water pressure measurements and subsequent interpreted water levels shown on this log should be used with discretion since they represent dynamic conditions. Dynamic Pore water pressure measurements may deviate substantially from hydrostatic conditions, especially in cohesive soils. In cohesive soils, water pressures often take extended periods of time to reach equilibrium and thus reflect their true field level. Water levels can be expected to vary both seasonally and yearly. The absence of notations on this log regarding water does not necessarily mean that this boring was dry or that the contractor will not encounter subsurface water during the course of construction.

### CPT Terminology

- CPT .....Cone Penetration Test
- CPTU.....Cone Penetration Test with Pore Pressure measurements
- SCPTU .....Cone Penetration Test with Pore Pressure and Seismic measurements
- Piezocone...Common name for CPTU test

(Note: This test is not related to the Dynamic Cone Penetrometer DCP)

### q<sub>T</sub> TIP RESISTANCE

The resistance at the cone corrected for water pressure. Data is from cone with 60 degree

apex angle and a 10 cm<sup>2</sup> end area.

### f<sub>s</sub> SLEEVE FRICTION RESISTANCE

The resistance along the sleeve of the penetrometer.

### FR Friction Ratio

Ratio of sleeve friction over corrected tip resistance.

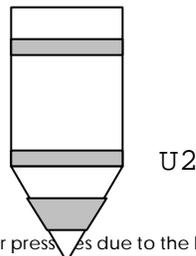
$$FR = f_s/q_t$$

### V<sub>s</sub> Shear Wave Velocity

A measure of the speed at which a seismic wave travels through soil/rock.

### PORE WATER MEASUREMENTS

Pore water measurements reported on CPT Log are representative of water pressures measured at the U2 location, just behind the cone tip, prior to the sleeve, as shown in the figure below. These measurements are considered to be dynamic



water pressures due to the local disturbance caused by the cone tip. Dynamic water pressure decay and Static water pressure measurements are reported on a Pore Water Pressure Dissipation Graph.

### SBT SOIL BEHAVIOR TYPE

Soil Classification methods for the Cone Penetration Test are based on correlation charts developed from observations of CPT data and conventional borings. Please note that these classification charts are meant to provide a guide to Soil Behavior Type and should not be used to infer a soil classification based on grain size distribution.

The numbers corresponding to different regions on the charts represent the following soil behavior types:

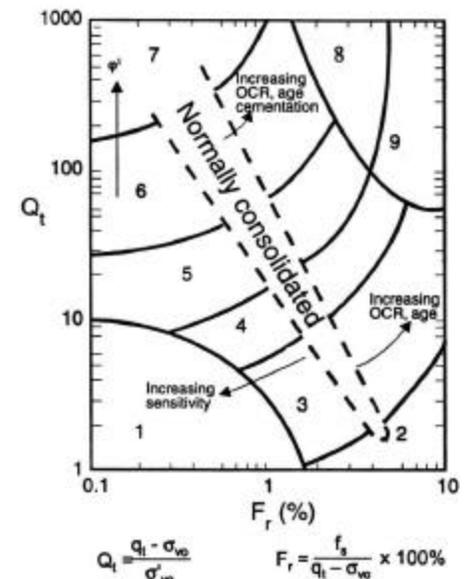
1. Sensitive, Fine Grained
2. Organic Soils - Peats
3. Clays - Clay to Silty Clay
4. Silt Mixtures - Clayey Silt to Silty Clay
5. Sand Mixtures - Silty Sand to Sandy Silt
6. Sands - Clean Sand to Silty Sand
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff, Fine Grained

Note that engineering judgment, and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geomaterials.

The following charts are used to provide a Soil Behavior Type for the CPT Data.

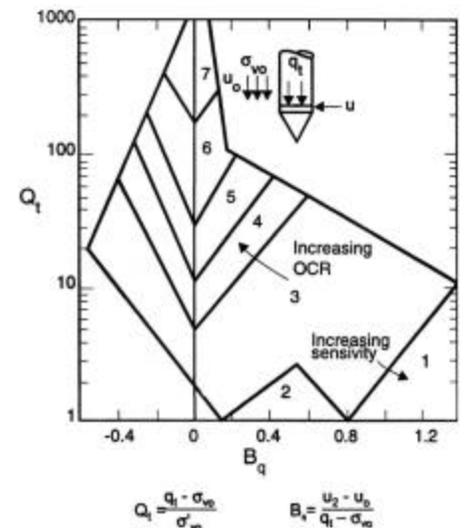
### Robertson CPT 1990

Soil Behavior type based on friction ratio



### Robertson CPTU 1990

Soil Behavior type based on pore pressure



where ...

- $Q_t$ .....normalized cone resistance
- $B_q$ .....pore pressure ratio

$F_r$ .....Normalized friction ratio  
 $s_{vo}$ .....overburden pressure  
 $s'_{vo}$ .....effective over burden  
pressure  
 $u_2$ .....measured pore pressure  
 $u_0$ .....equilibrium pore pressure