PMT NET LIMIT PRESSURE $p_l^*$ AND PRECONSOLIDATION PRESSURE $\sigma'p$
GEOTECHNICAL ENGINEERS WHEN THEY WANT TO BE RELEVANT FOR THE ASSESSMENT OF SOIL SETTLEMENT HAVE:

- TO KNOW IF SOIL IS SATURATED OR NOT

- FOR SATURATED SOILS AND SOILS HAVING A SIGNIFICANT CONTENT OF FINES, TO KNOW FOR EACH LAYER

- INITIAL VOID INDEX VALUE \( e_c \)
- COMPRESSION INDEX \( C_c \)
- SWELLING INDEX \( C_s \)
- PRECONSOLIDATION PRESSURE \( \sigma'p \)
- CREEP INDEX \( C_\alpha \)
HAVING A LOOK AT AN OEDOMETER GRAPH

WE CAN MAKE APPEAR EQUIVALENT STRESS VALUE $\sigma^{'}_{\text{eq}}$.

WE WRITE $C_c$ VALUE IN THREE MANNERS AND $C_s$ IN ONE AS:

\[
C_c = \frac{\epsilon_{\text{ONC}} - \epsilon_p}{\log \frac{\sigma^{'}_p}{\sigma^{'}_{vo}}} = \frac{\epsilon_{\text{OSC}} - \epsilon_p}{\log \frac{\sigma^{'}_p}{\sigma^{'}_{eq}}} = \frac{\epsilon_{\text{ONC}} - \epsilon_{\text{OSC}}}{\log \frac{\sigma^{'}_p}{\sigma^{'}_{vo}}} \tag{1}
\]

\[
C_s = \frac{\epsilon_p - \epsilon_{\text{OSC}}}{\log \frac{\sigma^{'}_p}{\sigma^{'}_{vo}}} \tag{2}
\]

Fig. 1
AND THEN

\[ C_C - C_S = \frac{e_{ONC} - e_{OSC}}{\log \frac{\sigma'_P}{\sigma'_{vo}}} \]

AND COMPARING (3) AND SECOND PART OF (1):

\[ \log \frac{\sigma'_{eq}}{\sigma'_{vo}} = \frac{C_c - C_S}{C_c} \log \frac{\sigma'_P}{\sigma'_{vo}} \]

OR

\[ \sigma'_{eq} = \sigma'_{vo} \left( \frac{\sigma'_P}{\sigma'_{vo}} \right)^{\frac{C_c - C_S}{C_c}} \]

FOR \( C_s \approx 0.2 \ C_c \), WE WILL OBTAIN A PRODUCT, WE MEET VERY OFTEN IN SOIL MECHANICS:

\[ \sigma'_{eq} = \sigma'_{vo}^{0.2} \sigma'_P^{0.8} \]
INTEREST OF CPT₀ PROFILE

MAYNE (2009) PROPOSED IN ALEXANDRY CONGRESS A VERY INTERESTING RELATION BETWEEN $\sigma_p'$ AND $q_T - \sigma_v$:

$$\sigma_p' = 0.33 (q_T - \sigma_v)^m \text{ in kPa}$$

(7)

Fig. 2
WE HAVE PROPOSED TO SLIGHTLY MODIFY THIS RELATION AS:

$$\sigma'_w^{0.25} \sigma'_p = (q_T - \sigma_v)^m \text{ en kPa}$$  \hspace{1cm} (8)

WITH FOR 0 – 400 μ SOILS:

$$m \neq \frac{W_L + 0.14}{W_L + 0.233}$$  \hspace{1cm} (9)

AND FOR COARSE SOILS:

$$m \neq \frac{VB_{OD} + 4.5}{VB_{OD} + 6}$$  \hspace{1cm} (10)

$VB_{OD}$ BLUE METHYLENE VALUE OF TOTAL SOIL

$D$ SMALLER DIAMETER OF THE BIGGER STONES

Jean-Claude GRESS
FOR PMT Tests, WE HAVE SHOWN (2012) THAT WE HAD:

\[ pl^* \neq (q_T - \sigma_v)^{0.8} \text{ en kPa} \] \hspace{1cm} \text{IN Kpa}

\[ pl^* = \text{NET LIMIT PRESSURE} \]

\[ q_T - \sigma_v = \text{CONE RESISTANCE CORRECTED FOR PORE PRESSURE EFFECTS MINUS IN SITU TOTAL VERTICAL STRESS} \]

WE CAN THEN WRITE THAT:

\[ \sigma'_{vo}^{0.25} \sigma'_p = pl^*^{1.25m} \text{ en kPa} \]

\[ \text{IN Kpa} \]

AND THEN

\[ \sigma'_{eq} = \sigma'_{vo}^{0.2} \sigma'_p^{0.8} = pl^*^m \text{ en kPa} \]

\[ \text{IN Kpa} \]

OF COURSE A VERY INTERESTING RELATION FOR SATURATED SOILS BUT BE AWARE THAT \( m \) VARIES QUICKLY

Jean-Claude GRESS
WE HAVE SHOWN (2012) THAT WE HAD:

\[ Cu \# (pl^*)^{0.7} \text{ in kPa} \]  

\[ Cu = \frac{pl}{5.5} \]  

\[ Cu = 0.072 + \frac{pl^*}{8} \quad \text{si } 0.4 < pl^* < 1 \text{ MPa} \]  

\[ Cu = 0.147 + \frac{pl^*}{15} \quad \text{si } pl^* > 1 \text{ MPa} \]  

(14)
WE CAN THEN WRITE

\[ C_u = \left( \sigma'_v \sigma'_p \right)^{0.7/m} \text{ in kPa} \]  \hspace{1cm} (15)

INTERESTING TO COMPARE WITH THAT WELL KNOWN OF JAMIOKOLWSKI:

\[ C_{u1} = \lambda_{c1} \sigma'_v^{0.2} \sigma'_p^{0.8} \]  \hspace{1cm} (16)
IT WILL BE ALWAYS IMPORTANT TO HAVE A PARALLEL PROFILE OF SOIL PHYSICAL IDENTIFICATION PARAMETERS AS:

DENSITY, WATER RETENTION CONTENT, LIQUIDITY LIMIT, BLUE METHYLENE VALUE, GRANULOMETRY AND SO ON.

WE HAVE SHOWN (2012), THAT WE HAD:

$$\log \sigma'_p = 5,25 - 0,25 \log \sigma'_v - 4 \frac{W_{sc} - 0,075}{W_L - 0,075} \text{ en kPa}$$ (17)

WITH:

$$W_{sc} = \left(\frac{1}{\gamma_d} - \frac{1}{\gamma_s}\right) \times \gamma_w$$ (18)

IT IS ANOTHER INTERESTING WAY TO HAVE AN IDEA OF THE EXPECTED VALUE OF $\sigma'_p$ AND IT'S VARIATION WITH DEPTH.
FOR UNSATURATED SOILS:

- WE WILL HAVE TO KNOW THE VARIATION OF SUCTION WITH WATER CONTENT (FILTER PAPER METHOD OR ARYA AND PARIS METHOD FOR EXAMPLE)

- USE FREDLUND FORMULAE:

\[
\tau_{ff} = C' + (\sigma_v - u_a) \tan \phi' + (u_a - u_w) \tan \phi d
\]

\[
\tau_{ff} = \tau_{ff \ SAT} + s \tan \phi d
\]

- USE FOR EXAMPLE OBERG AND SALFOURS RELATION:

\[
tg \phi d \# S tg \phi'
\]

S LEVEL OF SATURATION \( \phi \) LONGTERM ANGLE OF FRICTION TO MAKE CORRECTIONS ON \( pI^* \) OR \( q_T - \sigma_v \) VALUES
CONCLUSION:

PMT TESTS, HAVING NO DIFFICULTY TO PERFORM THEM AT THE DESIRED DEPTH, DOUBLED WITH A SOIL IDENTIFICATION PROFILE, APPEAR TO BE GOOD TOOLS TO CHARACTERIZE THE EVOLUTION WITH DEPTH OF PRECONSOLIDATION PRESSURE VALUES, WHICH KNOWLEDGE WE NEED FOR SETTLEMENT ASSESSMENT.
THANK YOU
FOR YOUR ATTENTION