SOIL **PROPERTIES** FROM IN SITU TESTS by "***TRIANGULATION***"

-UNABLE MEASURE IN SITU **PURE** SOIL PROPERTIES

-RESPONSES IN SITU: **MIXED FUNCTION** *PURE* S.P.

-TO **ISOLATE** *PURE* S.P. : "***TRIANGULATION***"

-say DOMINANT **STIFFNESS**, **STRENGTH**, **STATE STRESS**

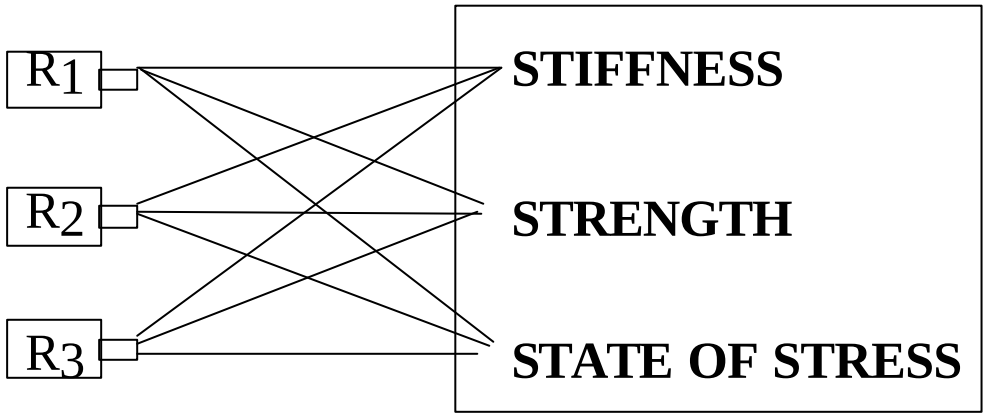
-NEED 3 INDEP. IN SITU RESPONSES R1, R2, R3

$R_1 = f_1$ (M, Strength ,σ_h)
$R_2 = f_2$ (M, Strength, σ_h)
$R_3 = f_3$ (M, Strength, σ_h)

INVERT MATRIX GET

M $= g_1 (R_1,R_2,R_3)$
Strength $= g_2 (R_1,R_2,R_3)$
σ_h $= g_3 (R_1,R_2,R_3)$

TRIANGULATION ≈ 3-Chromia to re-create colors

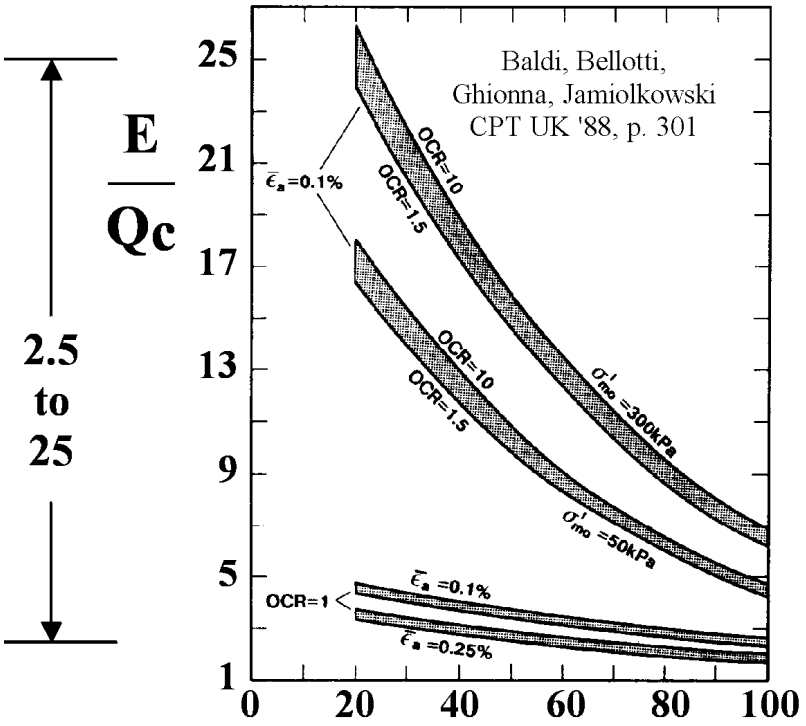


DMT is a TWO-PARAMETER TEST

Makes a lot of difference compared with 1-parameter tests as CPT or SPT (3 would be better, but diminishing returns… Moreover 3rd parameter would be valuable if truly independent - DMT tip $\mathbf{q_D}$ not sure…)

1-parameter test Þ wide UNCERTAINTY

- **1 information : NO MATRIX to INVERT**
- **E=2.5 to 25 Q_C (factor 10) = f(Dr, OCR-s_h)**
- **Impossible get 3 *unknowns* (E, Dr, OCR) from just 1 information (Q_C)**



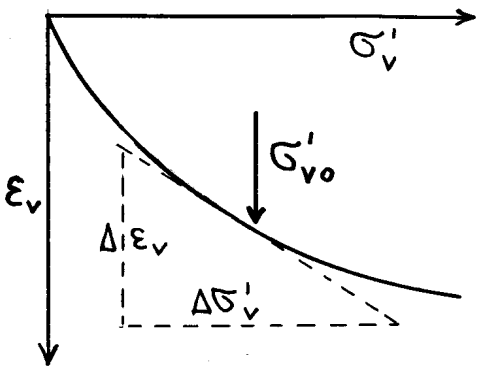
RELATIVE DENSITY D_R (%)

- **If we adopt ave. E= 7 Q_C, E could be off (settlements) by factor 3 (wide).**
- **Jamiolkowski** et al. **conclude (Isopt-1, '88, Vol. 1, p.263) :**

"w/o **Stress History, impossible to select reliable E (or M) from Q_C"**

1. Definition of M (no ambiguity)

$M = Eoed = 1/m_V = \Delta\sigma'_v/\Delta\varepsilon_v$ (at σ'_{vo}).



Vert. drained confined tangent (at σ'_{vo}) modulus

Name : Eoed OK, traditionally measured by oedometer. *Improper* if not by oed (correlations). Hence "M", but same.

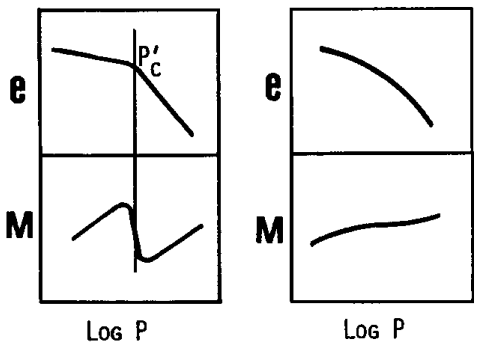
Usual range M_{DMT} **4 - 4000 bar**

2. M for what settlement (initial, 1ry, 2ry) ?

M is just for **primary**. Correlations were established by calibrating vs Eoed (1-D). **M_{DMT} must be treated as if by oedometer**.

Use same methods as with oedometers, including, if applicable, usual corrections (depth, shape, rigidity, possibly Skempton-Bjerrum).

3. May use M = constant if D s 'v large ?



If $\Delta\sigma'_v$ large : σ'_v may exceed p_c. **(?)**

Many structured NC clays (eg some Canadian) : sharp break in e-log p curve ⇒ marked drop in M at p_c. There M_{DMT} may be too high.

But in many common clays, (in most sand?) M accross p_c mild fluctuation, hence M=const. ≈ OK

BACK