

## Corrigé – Caractérisation d'un sol argilo-sableux

### Données

- Masse humide indiquée "saturé" ( $M_t$ ) = 360 g
- Masse sèche ( $M_s$ ) = 276 g
- Cylindre ( $D = 50 \text{ mm}$  ;  $h = 100 \text{ mm}$ )
- Masse volumique des grains ( $\rho_s$ ) = 2.650 gr/cm<sup>3</sup>
- Granulométrie :
  - 20 % > 2 mm
  - 45 % entre 2 mm et 0,075 mm
  - 35 % < 0,075 mm
- Limites d'Atterberg :  $WL = 48 \%$  ;  $WP = 22 \%$

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### 1) Teneur en eau pondérale

$$M_w = M_t - M_s = 360 - 276 = 84 \text{ [gr]}$$

$$w \text{ [%]} = M_w / M_s = 84 / 276 = 0,30 = 30 \%$$

### 2) Volumes et indices des vides

#### a) Volume total de l'échantillon

$$V_t = \frac{\pi D^2}{4} L$$

$$V_t = 196,35 \text{ [cm}^3\text{]}$$

#### b) Masse volumique et indice des vides,

$$\rho = \frac{M_t}{V_t} = \frac{360}{196,35} = 1,833 \text{ [} \frac{\text{gr}}{\text{cm}^3} \text{]}$$

$$\rho_d = \frac{M_s}{V_t} = \frac{276}{196,35} = 1,405 \text{ [} \frac{\text{gr}}{\text{cm}^3} \text{]}$$

Avec

$$V_t = V_v + V_s$$

Et

$$V_s = \frac{Ms}{\rho_s}$$

Donc

$$V_v = V_t - V_s = 196,35 - 104,15 = 92,20 \text{ [cm}^3\text{]}$$

Après

$$e = \frac{V_v}{V_s} = 0,885 \text{ [-]}$$

c) porosité

$$n = \frac{e}{1 + e} = 0,4695 \text{ [-]} = 47\%$$

### 3) Degré de saturation

Sol sature.

$$V_t = 196,35 \text{ [cm}^3\text{]}$$

$$V_v = n * V_t = 92,24 \text{ [cm}^3\text{]}$$

$$S_r = \frac{V_w}{V_v} = \frac{84}{92,24} = 91,07 \text{ [%]}$$

### **4) Granulométrie et classification USCS**

Fraction grossière (> 0,075 mm) = 65 % ⇒ **sol grossier** (Plus de 50% du matériau retenu a une taille supérieure à 0,075 mm)

Parmi le grossier : sable = 45 %, gravier = 20 % ⇒ **sable dominant** (Plus de 50 % de la fraction grossière est constituée de sable)

Comme fines > 12 % (ici 35 %), ce sera une classe **avec argile/limon**.

Classification USCS : sable argileux ⇒ **SC (clayey sand)**

Major divisions (1)	Subdivisions (2)	USCS symbol (3)	Typical names (4)	Laboratory classification criteria (5)	
Coarse-grained soils (More than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines	Less than 5% fines*	$C_u \geq 4$ and $1 \leq C_c \leq 3$
		GP	Poorly graded gravels or gravelly sands, little or no fines	Less than 5% fines*	$C_u < 4$ and/or $1 > C_c > 3$
		GM	Silty gravels, gravel-sand-silt mixtures	More than 12% fines*	Minus No. 40 soil plots below the A-line
		GC	Clayey gravels, gravel-sand-clay mixtures	More than 12% fines*	Minus No. 40 soil plots on or above the A-line
	Sands (50% or more of coarse fraction passes No. 4 sieve)	SW	Well-graded sands or gravelly sands, little or no fines	Less than 5% fines*	$C_u \geq 6$ and $1 \leq C_c \leq 3$
		SP	Poorly graded sands or gravelly sands, little or no fines	Less than 5% fines*	$C_u < 6$ and/or $1 > C_c > 3$
		SM	Silty sands, sand-silt mixtures	More than 12% fines*	Minus no. 40 soil plots below the A-line
		SC	Clayey sands, sand-clay mixtures	More than 12% fines*	Minus No. 40 soil plots on or above the A-line
Fine-grained soils (50% or more passes the No. 200 sieve)	Silt and clays (liquid limit less than 50)	ML	Inorganic silts, rock flour, silts of low plasticity	Inorganic soil	$PI < 4$ or plots below A-line**
		CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, etc.	Inorganic soil	$PI > 7$ and plots on or above A-line**
		OL	Organic silts and organic clays of low plasticity	Organic soil	$LL$ (oven dried)/ $LL$ (not dried) $< 0.75$
	Silt and clays (liquid limit 50 or more)	MH	Inorganic silts, micaceous silts, silts of high plasticity	Inorganic soil	Plots below A-line
		CH	Inorganic highly plastic clays, fat clays, silty clays, etc.	Inorganic soil	Plots on or above A-line
		OH	Organic silts and highly plastic organic clays	Organic soil	$LL$ (oven dried)/ $LL$ (not dried) $< 0.75$
Peat	Highly organic	PT	Peat and other highly organic soils	Primarily organic matter, dark in colour, and organic odor	

### 5) Limites d'Atterberg

Indice de plasticité :

$$IP = WL - WP = 48 - 22 = 26\%$$

Plasticité : Plastique.

Indice de plasticité	Degré de plasticité
$0 < I_p < 5$	Non plastique (l'essai perd sa signification dans cette zone de valeurs)
$5 < I_p < 15$	Moyennement plastique
$15 < I_p < 40$	Plastique
$I_p > 40$	Très plastique

Compressibilité probable : moyenne ( $LL = 48\%$ ).

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**6) Discussion**

**Risques** : tassements, compressibilité moyenne, sensibilité à l'eau, possible retrait-gonflement.

**Utilisations** : fondations superficielles possibles (contrainte modérée et contrôle de l'eau), remblais compactés, mais attention pour ouvrages sensibles → essais complémentaires requis.

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