



PROGRAM : NATIONAL DIPLOMA
: CONSTRUCTION MANAGEMENT &
QUANTITY SURVEYING
SUBJECT : **SOIL MECHANICS 2A**
CODE : **CSM331**
DATE : WINTER SSA EXAMINATION 2018
20 JULY 2018
DURATION : (SESSION 1) 8:00 – 11:00
WEIGHT : 40 : 60
FULL MARKS : 70
TOTAL MARKS : 70

EXAMINER : MR M SHUPING
MODERATOR : MR F THAIMO 2251A
NUMBER OF PAGES : 3 PAGES AND 4 ANNEXURES

INSTRUCTIONS

ANSWER ALL QUESTIONS.

NON-PROGRAMMABLE SCIENTIFIC CALCULATORS MAY BE USED.
THE USE OF ALPHA-NUMERIC CALCULATORS IS PROHIBITED.

REQUIREMENTS

GRAPH PAPER

QUESTION 1

List the boundary particle sizes, according to the MIT system, for gravel, sand, silt and clay.

[4]

QUESTION 2

2.1 Name three (3) components of the typical South African soil profile. (3)

2.2 Describe two (2) problem soils (6)

2.3 Weinert's N-value is used to predict the type of Pedogenic material within a certain climatic environment. Which pedogenic material can be expected where:

a) $N > 5$

b) $N < 5$

(2)

[11]

QUESTION 3

A sample of saturated clay has a mass of 1524 g and a dry mass of 1052 g. The specific gravity of the solid particles is 2,7. Determine the water content, void ratio, porosity and saturated unit weight.

What would be the water content of this soil if the degree of saturation was 90% at the same void ratio.

[13]

QUESTION 4

The particle size distribution of a soil shows 20% gravel, 40% sand and 10% silt. Using the Figure in Annexure A, determine the textural classification of this soil.

[7]

QUESTION 5

Figure1 in Annexure B shows a particle size distribution curve. Laboratory tests showed the liquid limit and plastic limit values of this soil to be 44 and 35 respectively. Using this information, determine the following:

5.1 The AASHTO system classification symbol. Details of this classification are given in Annexure C (10)

5.2 The proportion of the soil comprising silt and clay (according to the MIT soil separate limits). (2)

5.3 The Uniformity Coefficient (C_u); the Coefficient of Curvature (C_c); and the Grading Modulus (GM) (5)

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- 5.4 The Activity of the whole sample. (3)

[20]

QUESTION 6

A soil profile description is shown in Figure2 (Annexure D). List ten (10 omissions or errors in the description.

[10]

QUESTION 7

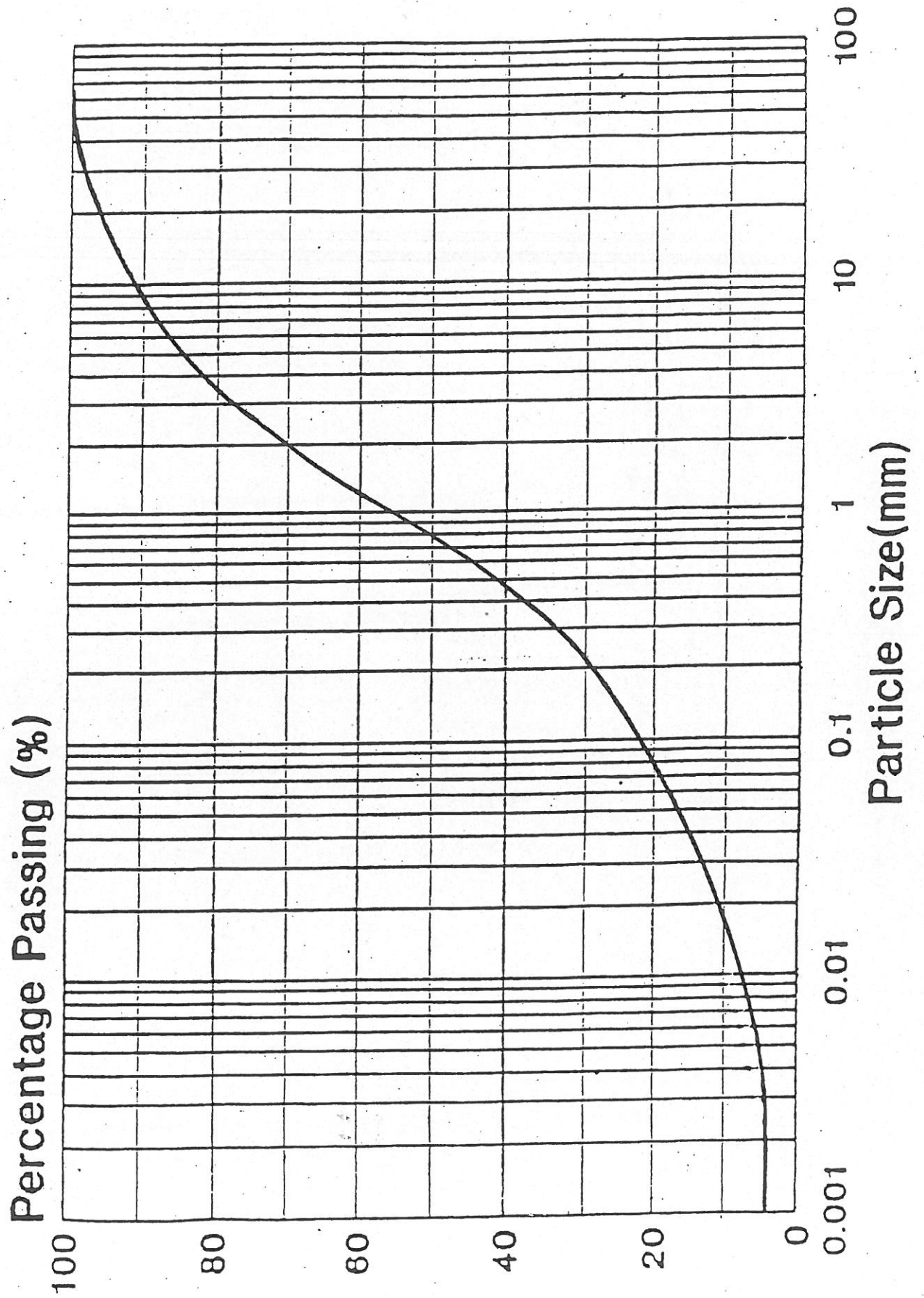
- 7.1 During a linear shrinkage test, a 150 mm long soil sample shortened to a length of 143,5 mm after drying. Calculate the linear shrinkage of this sample. (3)
- 7.2 Give an equation that can be used to check whether the linear shrinkage value calculated is reasonable if the Plasticity Index (PI) is known. (2)

[5]

PARTICLE SIZE DISTRIBUTION CURVE

ANNEXURE B

FIGURE 1



ANNEXURE C

General classification		Granular materials (35% or less of total sample passing No. 200)						
Group classification	A-1			A-2				
	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	
Sieve analysis (percent passing)								
No. 10 (2 mm)	50 max.							
No. 40 (0.425 mm)	30 max.	50 max.	51 min.					
No. 200 (0.075 mm)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	
Characteristics of fraction passing No. 40								
Liquid limit				40 max.	41 min.	40 max.	41 min.	
Plasticity index	6 max.		NP	10 max.	10 max.	11 min.	11 min.	
Usual types of significant constituent materials								
	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand				
General subgrade								
3	Excellent to good							

General classification		Silt-clay materials (more than 35% of total sample passing No. 200)			
Group classification	A-4	A-5	A-6	A-7 A-7.5* A-7.6*	
Sieve analysis (percent passing)					
No. 10 (2 mm)					
No. 40 (0.425 mm)					
No. 200 (0.075 mm)	36 min.	36 min.	36 min.	36 min.	
Characteristics of fraction passing No. 40					
Liquid limit	40 max.	41 min.	40 max.	41 min.	
Plasticity index	10 max.	10 max.	11 min.	11 min.	
Usual types of significant constituent materials					
	Silty soils		Clayey soils		
General subgrade rating					
Fair to poor					
* For A-7.5, $PI \leq LL - 30$					
* For A-7.6, $PI > LL - 30$					

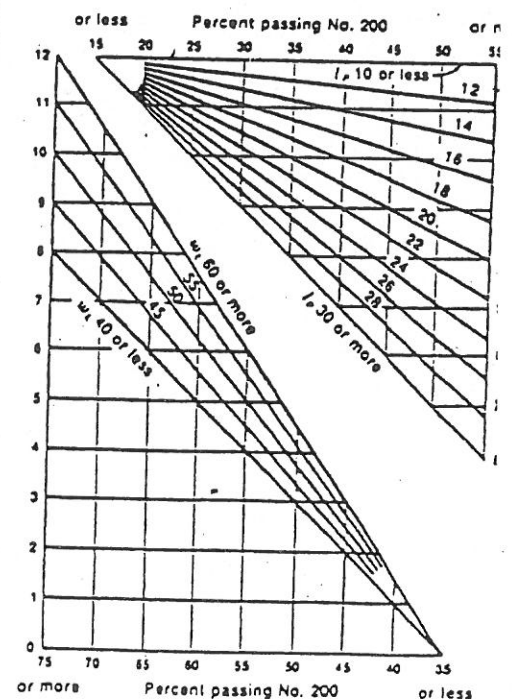


Chart to obtain group index of a soil. Group index equals sum of readings on both vertical scales.

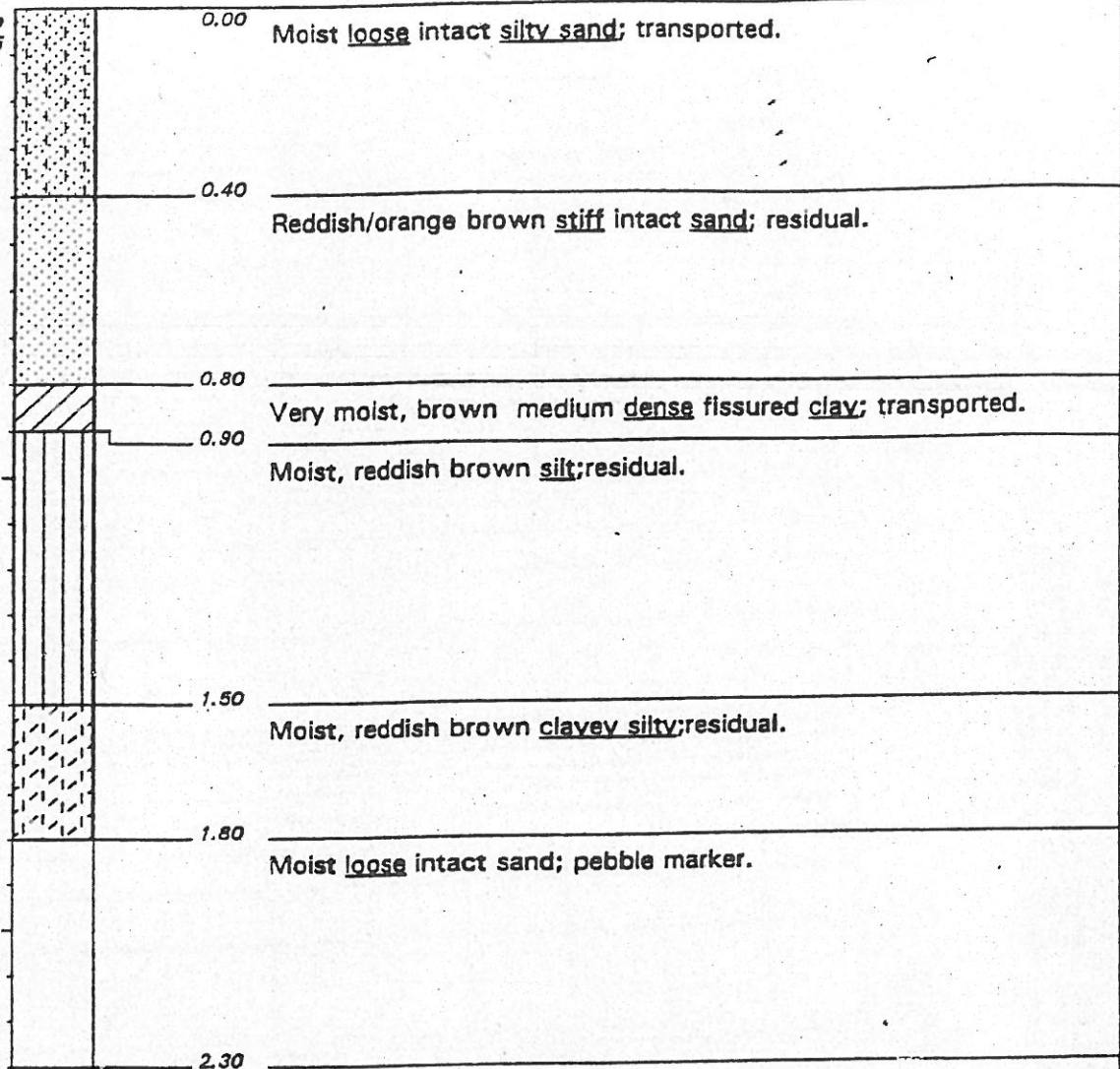
ANNEXURE D

HOLE No: TH 1
Sheet 1 of 1

FIGURE 2

JOB NUMBER: 000

Scale
1:15



NOTES:

- 1) Trench not excavated to refusal - TLB at limit of reach.

CONTRACTOR : Mr TRENCH
MACHINE : TLB
DRILLED BY :
PROFILED BY : MR PRO FILER
TYPE SET BY :
SETUP FILE : STANDARD.SET

INCLINATION : VERTICAL
DIAM : 600mm WIDE TRENCH
DATE :
DATE : 30 May 2003
DATE : 04/01/80 10:18
TEXT : B:\FIGURE2.PRO

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TH 1