University Of Technology
Building and Construction Eng. Dept.
Final Exam 1st Attempt –2013/2014

Subject : Earth Structure **Class: 4th Year**
Branch : Road & Bridges Brunch. **Time : 3 Hours**
Examiner :Dr. Mahmoud R. M **Date : 28/5/ 2014**

Attempt 4 questions only

Q1- A- Discuss **five** of the following with figures:

1- Effect of lime additive on physical properties of clay.
2- Effect of increase in temperature on stability and expansion of soil stabilization with asphalt.
3- Effect of curing time of stabilized soil with cement in unconfined compression strength.
4- The effect of roller coverage's travel speed on amount of compaction with towed vibratory roller.
5- Effect of compaction on soil structure at the dry of optimum, at the optimum and at the wet of optimum.
6- The effect of number of roller passes on dry density at the field for 2 roller passes, 5 roller passes, 15 roller passes and 45 roller passes.

(15 Marks)

B- Discuss the mechanism **two** of the following stabilizing techniques:

1- Preloading for improving soft saturated soil.
2- Heavy tamping (Dynamic compaction) for improving layer of 12 m deep saturated silty sand.
3- Vibro flotation method for improving deep cohesion less soils.

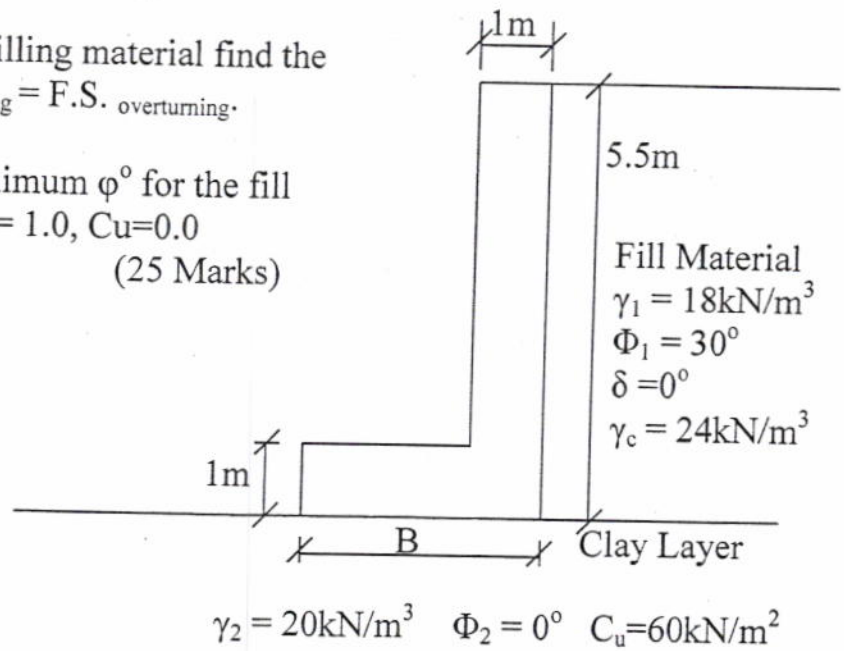
(10 Marks)

Q2- For the retaining wall shown in figure below :

a- If $\varphi = 30^{\circ}$, for the filling material find the width (B) such that $F.S_{sliding} = F.S._{overturning}$.

b- If (B) =4m, find minimum φ° for the fill material such that $F.S_{sliding} = 1.0$, $Cu=0.0$

(25 Marks)



$\gamma_2 = 20kN/m^3$ $\Phi_2 = 0^{\circ}$ $C_u=60kN/m^2$

Q3- A half closed clay layer is 8.0m thick and it can be assumed that $c_v=c_h$. Vertical sand drains 300mm in diameter, spaced at 3m centers in a square pattern, are to be used to increase the rate of consolidation of the clay under the increased vertical stress due to the construction of an embankment. Without sand drains the degree of consolidation at the time the embankment is due to come into use has been calculated as 25%. What degree of consolidation would be reached with sand drains at the same time? (25 Marks)

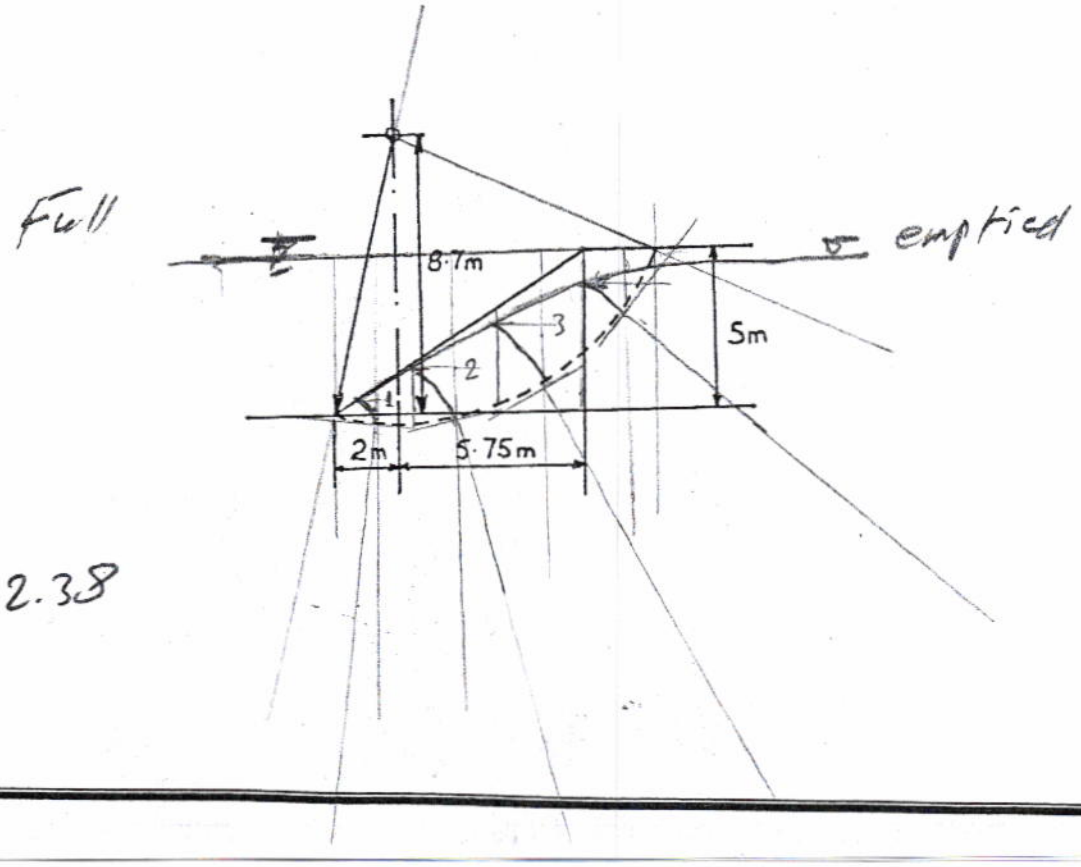
Q4- A- An embankment has a slope of 1 vertical to 2 horizontal. The properties of the soil are: $C=25kN/m^2$,$\varphi=20^\circ$, $\gamma=16\ kN/m^2$, and $H=37m$. Using Taylor's curves, determine the factor of safety F value for the slope. (15 mark)

B- Show the main factors influence the choice of filter material and state the requirement which should be met for filter design criteria. (10 mark)

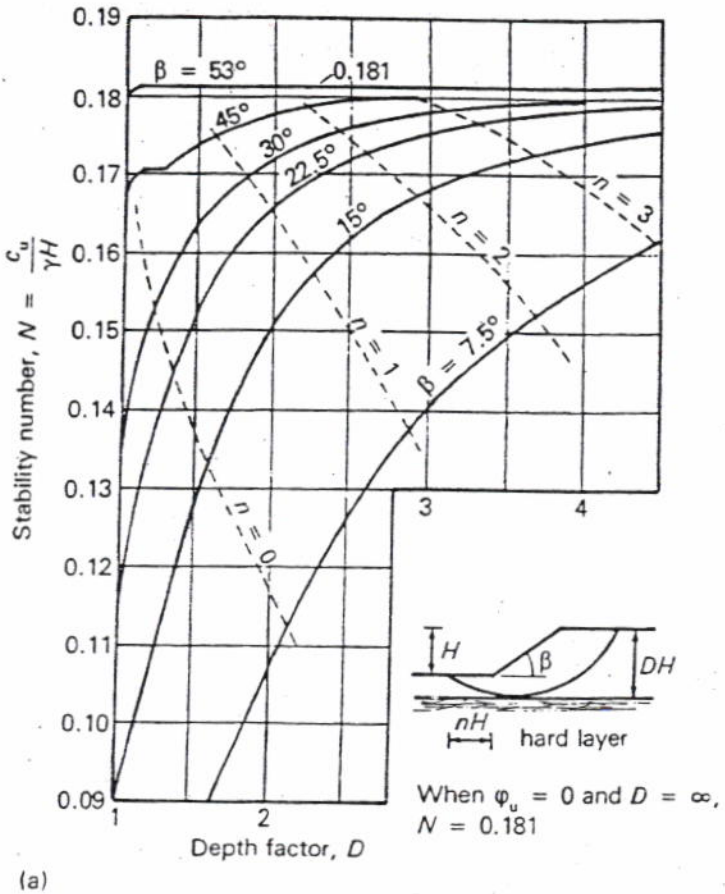
Q5- The cross section of the canal bank is shown in fig. Below. The properties of the soil are : $\gamma_{sat}=20kN/m^3$, $c=10kN/m^2$, $\varphi=15^\circ$
Using the trial slip circle shown and by dividing the sliding soil segment into four vertical slices ,determine the f.s of the bankwhen :
1-the canal is full to the top.
2-the canal is suddenly emptied

$$F=\frac{1}{\Sigma W\sin\alpha}\Sigma\,[c'l + W(\cos\alpha - r_u \sec\alpha)\tan\varphi']$$

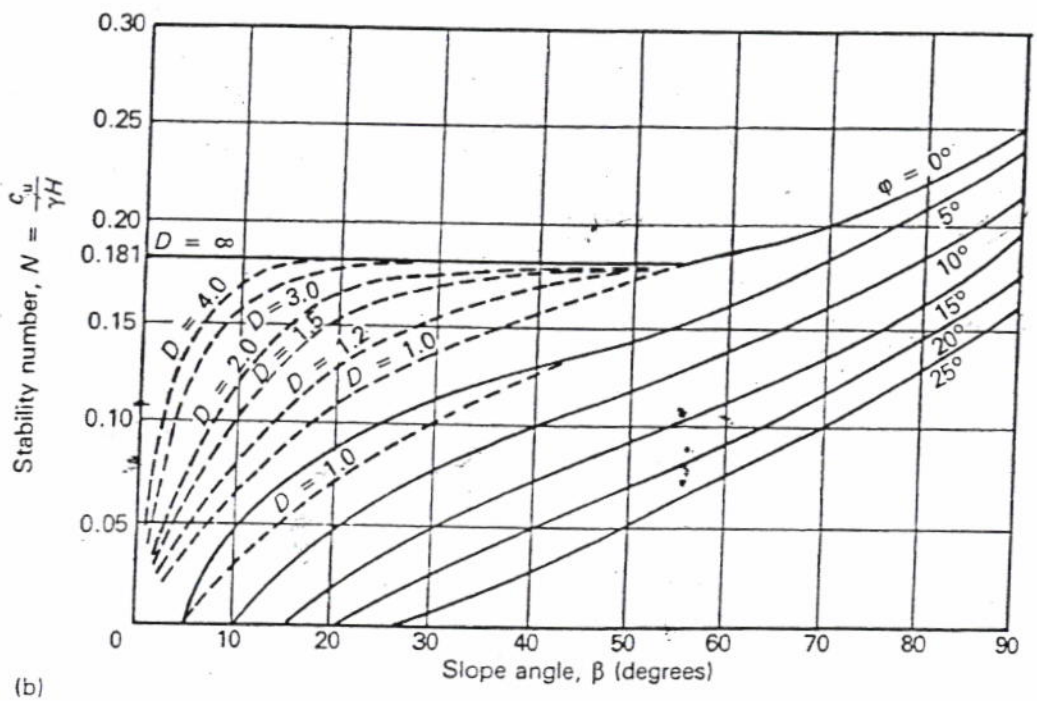
(25 mark)



S.F = 2.38


Stability number, $N = \frac{c_u}{\gamma H}$
Depth factor, D
β = 53°
0.181
45°
30°
22.5°
15°
β = 7.5°
n = 0
n = 1
n = 2
n = 3
H
β
DH
nH
hard layer
When $\varphi_u = 0$ and $D = \infty$,
$N = 0.181$

(a)


Stability number, $N = \frac{c_u}{\gamma H}$
Slope angle, β (degrees)
D = ∞
D = 4.0
D = 3.0
D = 2.0
D = 1.5
D = 1.2
D = 1.0
D = 1.0
φ = 0°
5°
10°
15°
20°
25°

(b)

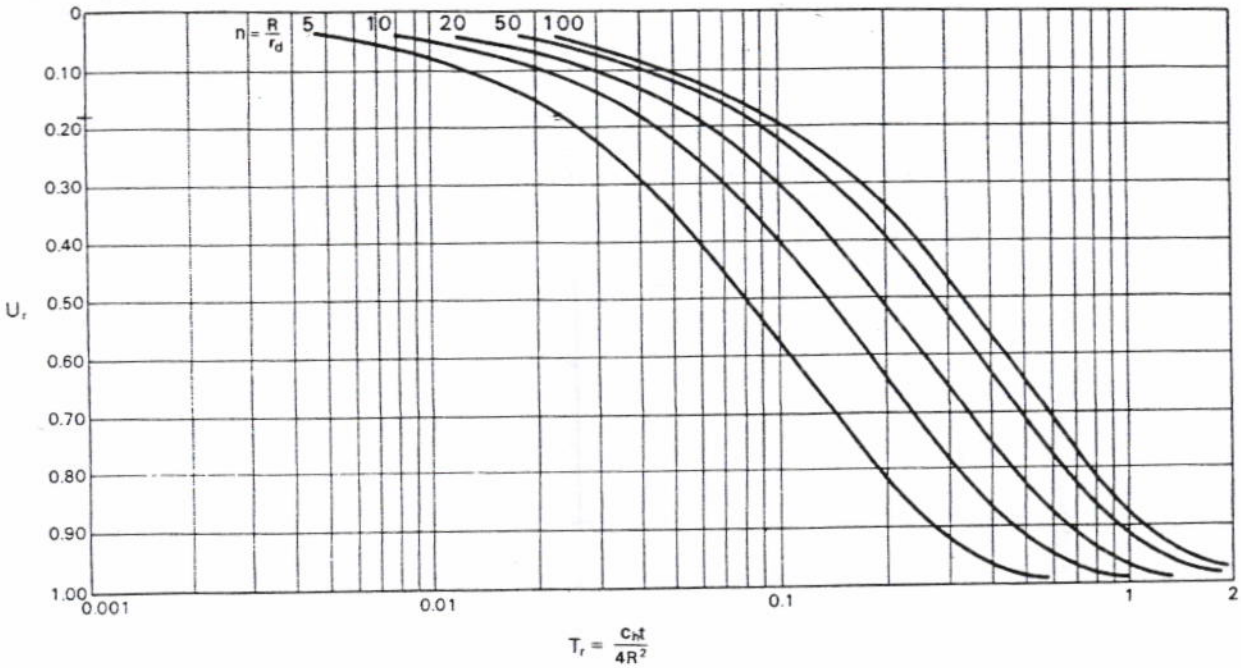


Fig. 7.30 Solution for radial consolidation.

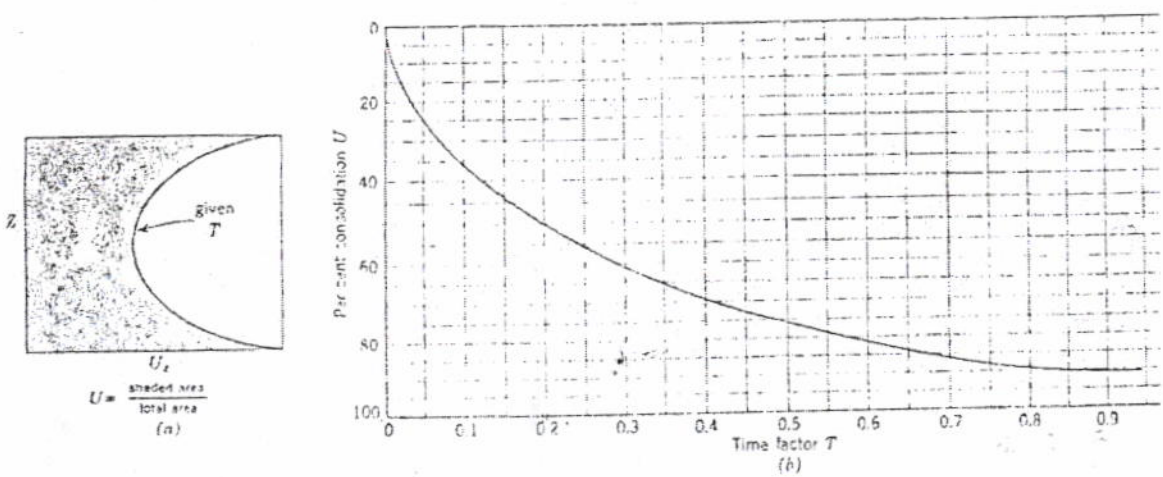


Fig. Average consolidation ratio: linear initial excess pore pressure. (*a*) Graphical interpretation of average consolidation ratio. (*b*) U versus T.

Given: $(1 - U_t) = (1 - U_v) * (1 - U_r)$

$$n = \frac{R}{r_d} \qquad C_v = \frac{T_v\, d^2}{t} \qquad C_h = \frac{T_r\, 4R^2}{t}$$

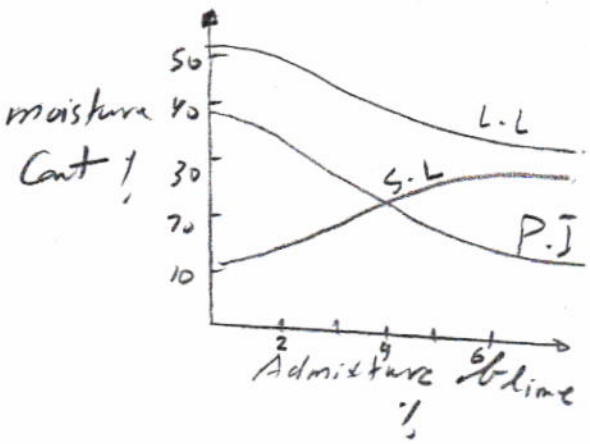
R = 0.564 S (square) R = 0.525 S (triangular)

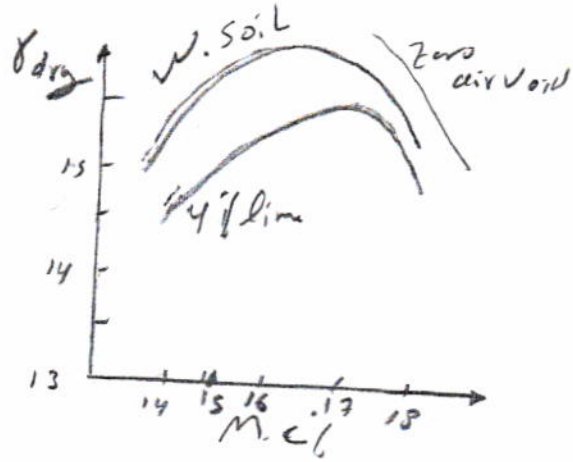
$$T_v = \frac{\pi}{4}(U_{av})^2 \quad \text{for} \quad U_{av} < 60\% \qquad S_{cf} = m_v * \Delta P' * H$$

Final Exam 1st Attempt
2013 - 2014
4th Year Road & Bridge.

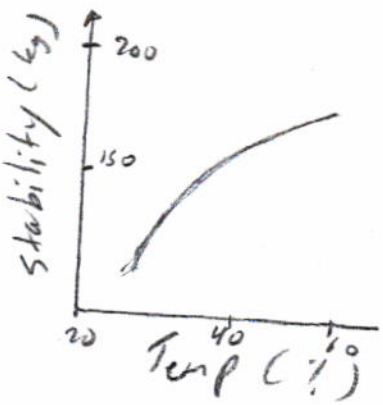
Q. A-

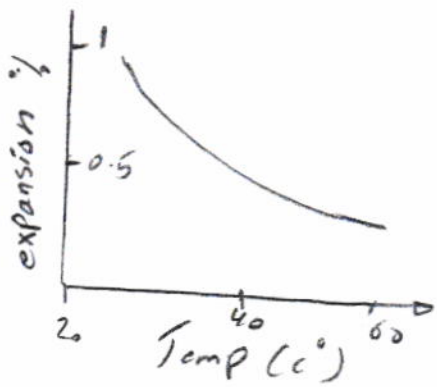
1-



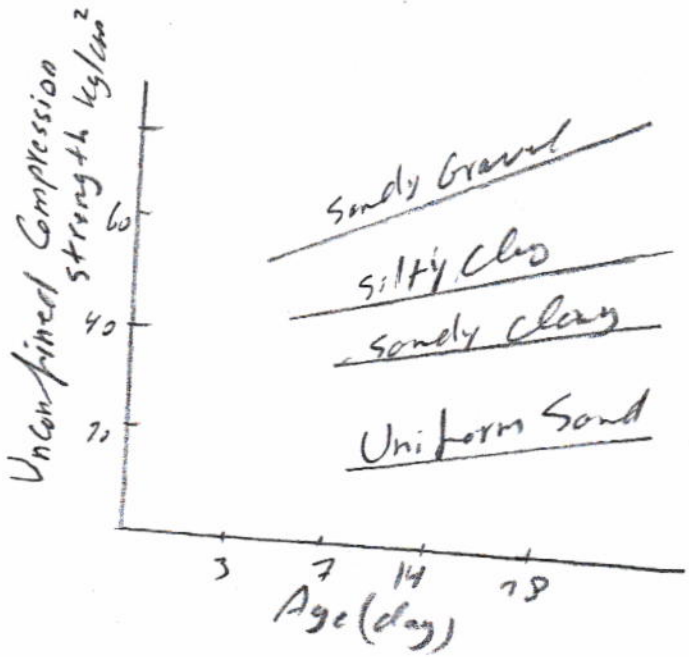


2-

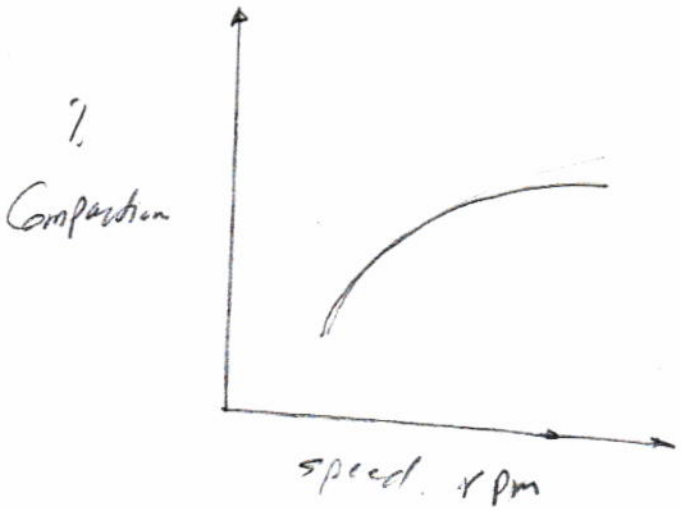




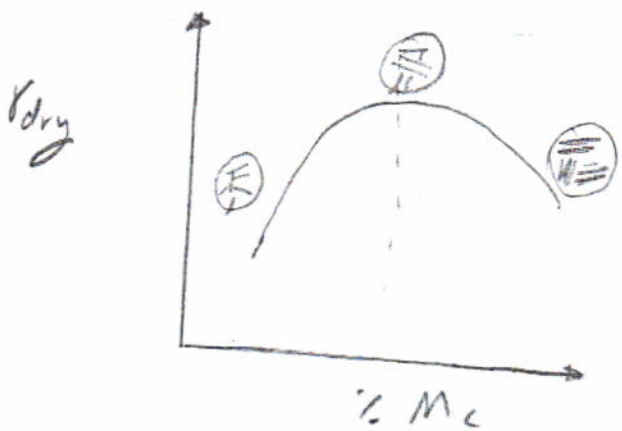
3-



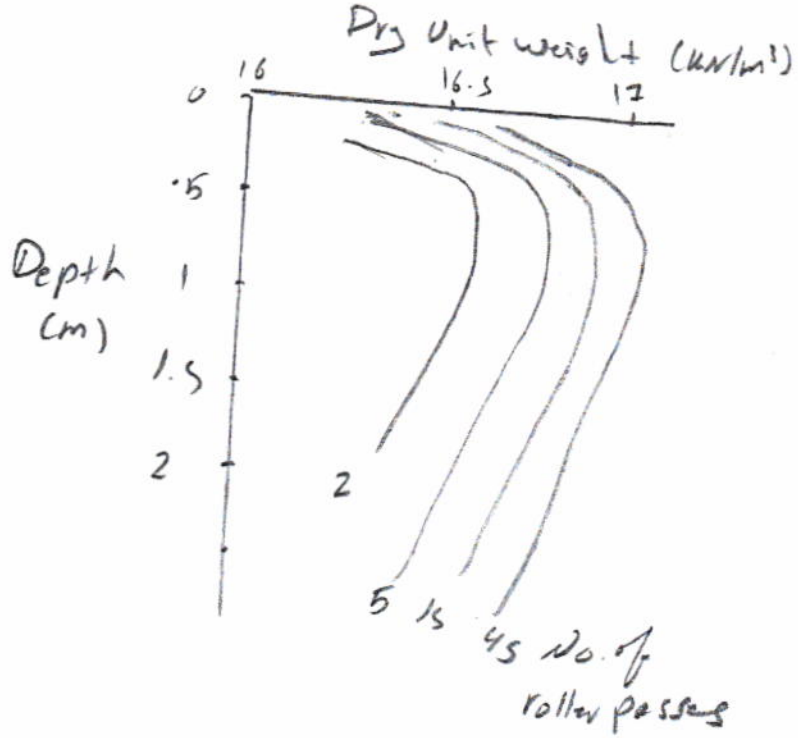
4-


% Compaction
speed rpm

5-


γ_{dry}
A
B
C
% Mc

6-


Dry Unit weight (kN/m³)
16
16.5
17
0
.5
1
1.5
2
Depth (cm)
2
5
15
45
No. of roller passes