## GEOTECHNICAL ENGINEERING (May / June 2017)

No. : Date : .

(·) (·)	same	normal stress	r = 200 k fa						
	pent	shear stress	→ 150kPa	Υ.					
	pur		→1801cB						0
4 10	i) san	=) c'=0		ъ. н. т.	ii) inction	angle a	t ultim	cte state	of dense
A Last	JUNIC	No. State	1		sand	a luse	sand	's fretion	angle.
Caller March		$L = O_{in} ta$	$in \phi'$		¢		= 26.1	270	0
1		d'= 36.87°	,		autiment	e, densed	001	37	
		L = 41.99°							
		D							
	TA 65				A				
		and the second second							
	9	×	_	- loose	-expud			~	
	at week		·	" dense		1			
	0/7665							7	
ē 1 - 1	į į			<b>→</b>	()), ()(), ()				
12 10 CT.	1.1	Sheer a	heplacient		anny ess				
						2.12		2 - C. S.	
	4. 8								
	Advantage?								
	- Charter	ge=		nicle to	anal at				
	> grmpb	ge= ound new	atively 811	mple to	archot	d dimite	-1 <u>1</u>		
	> gimps -> norm	ond rek al and 8	atively 811 hear stre	mple to	avelvot mæsvre	d directly	↓·		K -
	> 91mpl → norm → inpos	ore= ond relained al and biographics and a plane	atively 811 hear stre strain c	ruple to a spec work ond	aveliot wasva	d directu	L .		
	> gimple → norm → impos	ore = <u>ound nek</u> <u>cl and s</u> cd a plane	atively 811 hear stree strain c	nuple to a sees were ond	avoliōt wæsvre	d directly	L •		
	> 91mpb → norm → impos Disach	ond nek al and s al a plane integes.	atively 811 hear strein c	nuple to a	avoluōt wæsvra	d directly	▶•		
	<ul> <li>&gt; 91mpb</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; jimpos</li> <li>Disachn</li> <li>&gt; feylu</li> </ul>	ore 2 ound new al and 8 2d a plane Integes. re plane	atively 811 huar stru strain c rs forced	naple to eses were onds	avelvōt wæsvre	d directly	· · · · · · · · · · · · · · · · · · ·		
2 2 2 2 2	<ul> <li>&gt; Mimple</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; fisachn</li> <li>&gt; feylu</li> <li>&gt; drain</li> </ul>	ond new al and even antages. re plane age isn't	atively 811 huar strein c strain c strain c strain c controlled	nple to sees were onds L.	avolist wæsvre	d directly	×		
ð	<ul> <li>&gt; 91mpb</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; jesachn</li> <li>&gt; feislu</li> <li>&gt; drain</li> <li>&gt; lector</li> </ul>	ond rek al and 8 ad a plane integes. re plane age isn't stress o	atively 811 huar stru strain c strain c rs forceol controlleo rot baccon	nple to sees wore onds L.	avelvot wæsvre	d directly	ו		
2	<ul> <li>&gt; 91mpli</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; fisachn</li> <li>&gt; feylu</li> <li>&gt; decter</li> </ul>	ore 2 ound new 21 and 8 22 a plane antages. re plane are plane age isn't stress of	atively 811 hear stre strain c strain c strain c rs forced controlled wot brocon	nple to sses were onds L.	avolust	d directly			
) () ()	<ul> <li>&gt; 91mpb</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; foylu</li> <li>&gt; foylu</li> <li>&gt; drain</li> <li>&gt; lector</li> <li>&gt; Gz =</li> </ul>	ond relation and and a antages. re plane antages. re plane age isn't stress i soolefa	atively 811 huar stru strain c strain c strain c rs forcon controlleo wot brocon	nple to eres were ond <u>r</u>	avelist	d directly			
( ( ( ( ( ( ( ( ())))))	> gimple > norm > impos >	ore 2 ound new al and 8 2d a plane antages. re plane age isn't stress of 200/cfa 55%	atively 811 hear stre strain c strain c rs forced controlled tot bracon	nple to sees wore onds	avelust	d directly			
6: i)	> gimple > gimple > norm > impose	ond new and and a antages. re plane antages. re plane antages. antage	atively 811 hear stre strain c rs Porced controlled wit Encion 800 N	nple to n enes were onds	avelist	d directly			
ب ج ا ا	<ul> <li>&gt; 91mpb</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; fisachn</li> <li>&gt; fisachn</li> <li>&gt; fisachn</li> <li>&gt; fisachn</li> <li>&gt; fisachn</li> <li>&gt; dirain</li> <li>&gt; lecter</li> <li>) (1 = maxo</li> <li>, (1 = maxo</li></ul>	ore - ord nek al and 8 ad a plane integes. re plane age isn't stress i sookfa. 55% ustal local = - s. Aneor = s.	atively 811 buar stru strain a strain a rs Brood controlleo rot bracon 800 N	nple to eres were ond <u>r</u>	avelist	d directly	el B		
( ) )	<ul> <li>&gt; Rimple</li> <li>&gt; norm</li> <li>&gt; inorm</li> </ul>	antages. re plane plane antages. re plane antages. re plane	atively 811 hear stre strain c strain c rs Porceol controlleo wot brocon soo un 2 ss of fc	where $t_{0}$ is the set of the	avelist wassing	d directly	el B		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
6: i)	<ul> <li>&gt; 91mpls</li> <li>&gt; norm</li> <li>&gt; impose</li> <li>&gt; im</li></ul>	ore - ord rek al and rek al and rek and rek	atively 811 huar stru strain c strain c rs Porceol controlleo wit bracon 800 N 800 N 000 mm <sup>2</sup> ss of fe Pa + 200	$\frac{uple to}{uses}$	avelist wassing	d directly	et B No	400 00	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
( ) )	<ul> <li>&gt; 91mpls</li> <li>&gt; norm</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; impos</li> <li>&gt; feylu</li> <li>&gt; drain</li> <li>&gt; lector</li> <li>&gt; ()</li> <li>&gt; ()</li> <li>= max</li> <li>Crosss</li> <li>Normal</li> </ul>	ond new al and so antages. re plane antages. re plane antages. re plane ape isn't setness i soolePa soolePa soolePa soolePa s. Aneor = s arral strue Of = 400k = 6000	atively 811 hear stre strain a rs forced controlled with bracon 800 N 800 N 800 N 2000 mm <sup>2</sup> ss of fa Pa + 200 kla	$\frac{uple to}{uses word}$	avelust wassura	d directly	el B	400 00 7 eh	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
b: )	> 91mpls > norm > impose	ge = ound new cl and even cl and even cl and even cl a plane antages. re plane age isn't verse verse verse verse 200kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa 55% 100kPa	atively 811 hear stre strain c strain c strain c xs forced controlled with baccon 800 N 000 mm <sup>2</sup> ss of fe Pa + 200 kla -2000 = 40	nple to sees wore onds 	avelist wassing o EPa	$\frac{d  directly}{1}$	х х х х х х х х х х х х х х х х х х х	$\frac{1}{10000000000000000000000000000000000$	
<u>ک</u> (	> 91mple > norm > impose	ge = ound new al and so antages. re plane antages. re plane age isn't stress i sookla 55% ubtal local = s. Anear = so axtal stre $O_1 = 400k$ = 600 q = 600	atively 811 hear stre strain a strain a rs forced controlled tot bracon 800 N 6000 mm <sup>2</sup> ss of fa Pa + 200 kla -2000 = 40	nple to sees wore onds c. c. c. c. c. c. c. c. c. c. c. c. c.	avelist massura	$\frac{d}{directu}$	200 200 200	$\frac{1}{4000000}$	
b: )	> 91mpls > norm > impose	ge = 0 ge = 0 ge = 0 ge = 0 ge = 1 ge =	atively 811 huar stre strain c strain c xs forced controlled with baccon 800 N 000 mm <sup>2</sup> ss of fe Pa + 200 kla -2000 = 40	nple to sees wore onds c. c. c. c. c. c. c. c. c. c. c. c. c.	avelist wassing o E Pa	$\frac{d  directly}{a}$	200 50° 50°	$\frac{1}{C_{f}} = \frac{1}{C_{f}}$	
<u>b</u>	> 91mpli > norm > norm > impos pisach → drain → drain → lector ) (2 = naw Cross · rurman - - - - - - - - - - - - -	ge = ound new al and 8 al and 8 ad a plane integes. re plane age isnt stress i sookfa 55% what lood = 35% axial strict $0^{2}_{1} = 400k$ = 600 $0^{2}_{2} = 600$	atively 811 hear stre strain c strain c rs forced controlled tot bracon 800 N 000 mm <sup>2</sup> ss of fe Pa + 200 kla -2000 = 40	vience = 40	avelist massing o E Pa	$\frac{d}{directu}$	$\frac{1}{200}$	$\frac{1}{1}$	n β Wella ces β
6 7) 7)	> 91mpli > norm > norm > impos Disach → drain → drain → lecter ) (V3 = main Crosse. Normal 	ge = 0 ge = 0 ge = 0 ge = 0 ge = 1 ge =	atively 811 huar stre strain c strain c xs forced controlled wot known so or trolled wot known 800N 000 mm <sup>2</sup> ss of fe Pa + 200 kla - 2000 = 40	nple to sees wore onds L. L. L.	avelist wassing colored	a directly ii) (ii	200 200 200 50° 50°	$\frac{c}{c}$ $\frac{c}{400}$ $\frac{c}{00}$ $\frac{c}{c} = sin$ $\frac{c}{R} = li$ $\frac{c}{R} = li$ $\frac{c}{R} = li$	$\beta$

Date : ..... iv) effective freati Instion angle => p'= 30 V) worder content at the erel of the test deenecses. as  $w = \frac{M_{W}}{M_{S}}$ , NC suil will be compacted at end of the test which depresses the wid ratio and this denesting water anderd pupp = 130kPa ¢'=30° c.) 031' = 200 - 130 = 70 03 f = 2000 sin \$' 6, 1-sing 210 03 a=(210-76)/2 = 70 6/a Vi = 210 6Pa 2.) a.) No Rankine's  $\frac{1-\sin\phi'}{2}$ Jw=10 6N/m2 KA = ltsing'  $O_{\mu}' = \frac{1}{3} O_{2}'$   $O_{2,4m}' = \frac{1}{3} \times 18$   $= \pm 7$ ī  $\frac{0^{2}}{216} = 6 \times 18$ 0/4 Hm = 2 Valc = 29-33 29.83+2 1×2 + 20\*2 Thus = 24 = 121-33 t ×. Alla -Clui

No. :

ù) 0 H=0=-201 Unest = 72×6/2 = 216 A.GM = + - 2 Cu = 6(18)-2(18) 6 = 72 72 iii) ~ A will be the same as total struggle ado not refuned 61 water pressure b·) B=L=10 2 2=5 m = n = 2В  $\begin{array}{r} I_{r} = 0.232 \\ \Delta U_{2,H} = 40 \times 0.232 = 928 \\ \Delta U_{2,B} = 13.92 \\ \Delta U_{2} = 23.2 \ \text{eVel}. \end{array}$ A

No. : Date : ùĩ .33 + tan (33 10 1060 1030 0.988 = ailme. iv) Fellenius Nesultant intership force = 0 assume  $X_1 - X_2 = 0$ assume forces acted in parellel direction. Bushop 7 different. comptions bereir A an sol the difference with  $M_i - W_i \cos \alpha_i^2 = 0$  $M_i^2 + \alpha_i l_i^2 - W_i \cos \alpha_i^2 = 0$ Ni'= Wiwski -uili Nr) =  $G' La + tan \phi' \Xi$ (Wicos X; 2 Wisindi animal st i pilos Hos . er'h Z Uni

4)

a.i.
-Cover soil with temporary surcharge
-Cause soil to consolidate, thus improving settlement and strength properties
-Once desired properties have been obtained, surcharge is removed
-Typically 3 to 8 m thick

## ii. consolidation, process reduces porewater pressure

- As **σ'= σ-u**
- If u decreases, σ' increases
- And if  $\sigma$ ' increases, shear strength increases
- b.i. silt content < 12-15% clay content < 3 %
- ii. loose sand can be densified using vibro compaction.Density is a factor of sand strength propertyAs density of loose sand increases, the shear strength will be increased
- c.i. At low water content, water acts as lubricant, allowing particles to be packed closer, resulting a higher dry density

At high water content, water starts to replace particles as particles cant be packed anymore

closer by means of water.

As unit weight of water is lower than soil particles, the dry unit weight decreases as water content increases above the optimum

Dry of optimum – particles are arranged in flocculated manner.
 Wet of optimum – particles are arranged in oriented fabric manner

Dry :

- higher shear strength even with the same dry unit weight
- higher hydraulic conductivity

Wet :

- lower hydraulic conductivity

d.

i. Horizontal drains helps to dissipate porewater pressure and lower ground water table

- As **σ'= σ-u**
- If u decreases,  $\sigma$ ' increases
- And if  $\sigma$ ' increases, shear strength increases

ii. piezometer can be installed before the installation of horizontal drains

initial ground water level can be determined

after the installation of the horizontal drains, piezometers can be used to record the changes in ground water table. Thus, observing the performance of the horizontal drains.

Date : No. : Date : .....  $\ell \cdot$ Dr = 0.3 <u>luno - li;</u> lunar - linin lmax-em emax = 0.9 emm = 0.2 0.2 = 0.9 R:=0.72 lp = 0.3( ii) eina the a lun thick loss coul fill 18 vibro compaction method can be used for the devolucition process can be done by inserting vibratary probe into ground. atthem 2 must community used -> terra probe and whorthat both method devaly the send fill using vibration method. neers -Uni