DAFTAR PUSTAKA

Adnan Ibrahim, O., Fırat Çabalar, A., & Dafer Abdulnafaa, M. (2018). Improving Some Geotechnical Properties Of An Organic Soil Using Crushed Waste Concrete. In *The International Journal of Energy & Engineering Sciences* (Vol. 3, Issue 3).

Afrin, H. (2017). A Review on Different Types Soil Stabilization Techniques. *International Journal of Transportation Engineering and Technology*, *3*(2), 19. https://doi.org/10.11648/j.ijtet.20170302.12

Behzadipour, H., Ghezelbash, G. R., & Pakbaz, M. S. (2020). Effects of biocementation on strength parameters of silty and clayey sands. *Bioinspired, Biomimetic and Nanobiomaterials*, *9*(1), 24–32. https://doi.org/10.1680/jbibn.19.00002

Cheng, L., Shahin, M. A., Asce, M., & Mujah, D. (2016). *Influence of Key Environmental Conditions on Microbially Induced Cementation for Soil Stabilization*. https://doi.org/10.1061/(ASCE)

Cheng, L., Shahin, M. A., & Cord-Ruwisch, R. (2014). Bio-cementation of sandy soil using microbially induced carbonate precipitation for marine environments. *Geotechnique*, *64*(12), 1010–1013. https://doi.org/10.1680/geot.14.T.025

Das, B. M., Khaled, |, Das, S., Sobhan, _, & Sobhan, K. (2018). *Geotechnical Engineering*. www.cengagebrain.com.

Dhani, N., Gasruddin, A., Hartini, & Baride, L. (2021). Unconfined compressive strength characteristics of overboulder asbuton and zeolite stabilized soft soil. *Civil Engineering Journal (Iran)*, *7*(1), 40–48. https://doi.org/10.28991/cej-2021-03091635

ElMouchi, A., Siddiqua, S., Wijewickreme, D., & Polinder, H. (2021). A Review to Develop new Correlations for Geotechnical Properties of Organic Soils. *Geotechnical and Geological Engineering*, *39*(5), 3315–3336. https://doi.org/10.1007/s10706-021-01723-0

Hardiyatmo, H. C. (2012). *Mekanika Tanah 1: Vol. V* (5th ed.).

Hasriana, Samang, L., Djide, M. N., & Harianto, T. (2018). A study on clay soil improvement with Bacillus subtilis bacteria as the road subbase layer. *International Journal of GEOMATE*, *15*(52), 114–120. https://doi.org/10.21660/2018.52.97143

Jeong, J. H., Jo, Y. S., Park, C. S., Kang, C. H., & So, J. S. (2017). Biocementation of concrete pavements using microbially induced calcite precipitation. *Journal of Microbiology and Biotechnology*, *27*(7), 1331–1335. https://doi.org/10.4014/jmb.1701.01041

Karisma, A. P. (2012, June). *Pengaruh Penggunaan Mikroorganisme Sebagai Bahan Stabilisasi Terhadap Kekuatan Tanah Gambut dengan Uji Triaksial Cu Dan CBR*.

Krebs, R. D., & Walker, R. D. (1971). *Highway Materials*. New York, McGraw-Hill.

L Braja, J. 1, Bahasa, A., & Noor, L. (1998). *Mekanika Tanah (Prinsip-prinsip Rekayasa Geoteknis)*.

Lim, A., Muhammad, D. A., & Lestari, A. S. (2019). Studi Eksperimental Kemampuan Biosementasi Bakteri Lokal pada Tanah Pasir Lepas. *Jurnal Teknik Sipil*, *26*(2), 129. https://doi.org/10.5614/jts.2019.26.2.5

Mahawish, A., Bouazza, A., & Gates, W. P. (2018). Improvement of soft soils using bio-cemented sand columns. *Springer Series in Geomechanics and Geoengineering*, 822–825. https://doi.org/10.1007/978-3-319-97112-4_184

Mujah, D., Cheng, L., & Shahin, M. A. (2019). Microstructural and Geomechanical Study on Biocemented Sand for Optimization of MICP Process. *Journal of Materials in Civil Engineering*, *31*(4). https://doi.org/10.1061/(asce)mt.1943-5533.0002660

Mujah, D., Shahin, M. A., & Cheng, L. (2017). State-of-the-Art Review of Biocementation by Microbially Induced Calcite Precipitation (MICP) for Soil Stabilization. *Geomicrobiology Journal*, *34*(6), 524–537. https://doi.org/10.1080/01490451.2016.1225866

Mukherjee, S., Sahu, R. B., Mukherjee, J., & Sadhu, S. (2019). Application of microbial-induced carbonate precipitation for soil improvement via ureolysis. *Lecture Notes in Civil Engineering*, *14*, 85–94. https://doi.org/10.1007/978-981-13-0559-7_10

Pandiangan, B., & Jafri, M. (2016). *Pengaruh Variasi Waktu Pemeraman Terhadap Daya Dukung Tanah Lempung dan Lanau yang Distabilisasi Menggunakan Semen pada Kondisi Tanpa Rendaman (Unsoaked)*. *4*(2), 2303–2314.

Panguriseng, D. (2017). *Dasar-dasar Teknik Perbaikan Tanah*. https://www.researchgate.net/publication/322343447

Phang, I. R. K., Wong, K. S., Chan, Y. S., & Lau, S. Y. (2018). Effect of microbial-induced calcite precipitation towards tropical organic soil. *AIP Conference Proceedings*, *2020*. https://doi.org/10.1063/1.5062637

Samang, L., Djide, Mn., & Tri Harianto, dan. (2017). *Konferensi Nasional Teknik Sipil 11 Universitas Tarumanagara*.

Sharma, M., Satyam, N., & Reddy, K. R. (2021). Investigation of various gram-positive bacteria for MICP in Narmada Sand, India. *International Journal of Geotechnical Engineering*, *15*(2), 220–234. https://doi.org/10.1080/19386362.2019.1691322

Teng, F., Sie, Y. C., & Ouedraogo, C. (2021). Strength improvement in silty clay by microbial-induced calcite precipitation. *Bulletin of Engineering Geology and the Environment*, *80*(8), 6359–6371. https://doi.org/10.1007/s10064-021-02308-0

Varghese, R., Chandrakaran, S., & Rangaswmay, K. (2021). Geotechnical behaviour of different organic matter on clayey soils. *Geomechanics and Geoengineering*, *16*(4), 288–297. https://doi.org/10.1080/17486025.2019.1670874

DAFTAR LAMPIRAN

Lampiran A- 1. Berat spesifik mineral-mineral penting

Mineral	Specific gravity, G_s
Quartz	2.65
Kaolinite	2.6
Illite	2.8
Montmorillonite	2.65–2.80
Halloysite	2.0–2.55
Potassium feldspar	2.57
Sodium and calcium feldspar	2.62–2.76
Chlorite	2.6–2.9
Biotite	2.8–3.2
Muscovite	2.76–3.1
Hornblende	3.0–3.47
Limonite	3.6–4.0
Olivine	3.27–3.7

Lampiran A- 2. Variasi harga K pada pengujian hydrometer

Temperature (°C)	G_s							
	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
16	0.01510	0.01505	0.01481	0.01457	0.01435	0.01414	0.01394	0.01374
17	0.01511	0.01486	0.01462	0.01439	0.01417	0.01396	0.01376	0.01356
18	0.01492	0.01467	0.01443	0.01421	0.01399	0.01378	0.01359	0.01339
19	0.01474	0.01449	0.01425	0.01403	0.01382	0.01361	0.01342	0.01323
20	0.01456	0.01431	0.01408	0.01386	0.01365	0.01344	0.01325	0.01307
21	0.01438	0.01414	0.01391	0.01369	0.01348	0.01328	0.01309	0.01291
22	0.01421	0.01397	0.01374	0.01353	0.01332	0.01312	0.01294	0.01276
23	0.01404	0.01381	0.01358	0.01337	0.01317	0.01297	0.01279	0.01261
24	0.01388	0.01365	0.01342	0.01321	0.01301	0.01282	0.01264	0.01246
25	0.01372	0.01349	0.01327	0.01306	0.01286	0.01267	0.01249	0.01232
26	0.01357	0.01334	0.01312	0.01291	0.01272	0.01253	0.01235	0.01218
27	0.01342	0.01319	0.01297	0.01277	0.01258	0.01239	0.01221	0.01204
28	0.01327	0.01304	0.01283	0.01264	0.01244	0.01225	0.01208	0.01191
29	0.01312	0.01290	0.01269	0.01249	0.01230	0.01212	0.01195	0.01178
30	0.01298	0.01276	0.01256	0.01236	0.01217	0.01199	0.01182	0.01169

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Lampiran A- 3. Sistem Klasifikasi AASHTO

General classification	Granular materials (35% or less of total sample passing No. 200)						
	A-1			A-2			
Group classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (percentage passing)							
No. 10	50 max.						
No. 40	30 max.	50 max.	51 min.				
No. 200	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 rating	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] A-7-6[b]
Sieve analysis (percentage passing)				
No. 10				
No. 40				
No. 200	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			

[a]For A-7-5, $PI \leq LL - 30$

[b]For A-7-6, $PI > LL - 30$

Lampiran A- 4.. Sistem klasifikasi USCS

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% retained on No. 200 sieve	**Gravels** More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[a]	$C_u \geq 4$ and $1 \leq C_c \leq 3$[c] $C_u < 4$ and/or $C_c < 1$ or $C_c > 3$[c]	GW GP
		Gravels with Fines More than 12% fines[a,d]	$PI < 4$ or plots below "A" line (Figure 5.3) $PI > 7$ and plots on or above "A" line (Figure 5.3)	GM GC
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[b]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[c] $C_u < 6$ and/or $C_c < 1$ or $C_c > 3$[c]	SW SP
		Sands with Fines More than 12% fines[b,d]	$PI < 4$ or plots below "A" line (Figure 5.3) $PI > 7$ and plots on or above "A" line (Figure 5.3)	SM SC
Fine-grained soils 50% or more passes No. 200 sieve	**Silts and clays** Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line (Figure 5.3)[e] $PI < 4$ or plots below "A" line (Figure 5.3)[e]	CL ML
		Organic	$\frac{\text{Liquid limit—oven dried}}{\text{Liquid limit—not dried}} < 0.75$; see Figure 5.3; OL zone	OL
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line (Figure 5.3) PI plots below "A" line (Figure 5.3)	CH MH
		Organic	$\frac{\text{Liquid limit—oven dried}}{\text{Liquid limit—not dried}} < 0.75$; see Figure 5.3; OH zone	OH
Highly organic soils	Primarily organic matter, dark in color, and organic odor			Pt

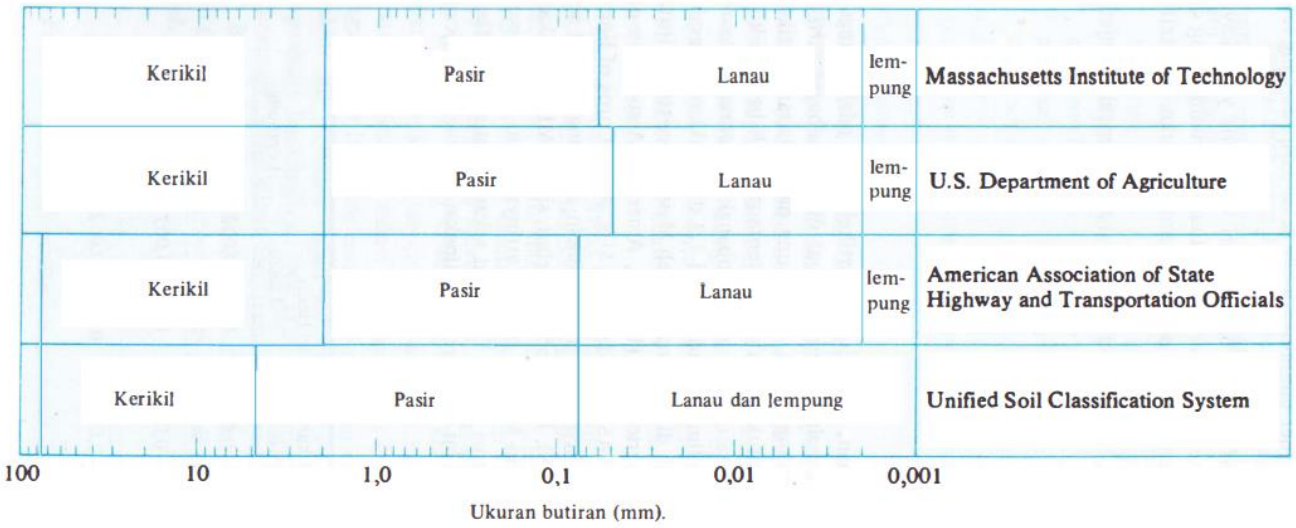
[a]Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

[b]Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

Lampiran A- 5. Perbandingan kelompok tanah sistem AASHTO dan USCS

Soil group in Unified system	Comparable soil groups in AASHTO system		
	Most probable	Possible	Possible but improbable
GW	A-1-a	—	A-2-4, A-2-5, A-2-6, A-2-7
GP	A-1-a	A-1-b	A-3, A-2-4, A-2-5, A-2-6, A-2-7
GM	A-1-b, A-2-4, A-2-5, A-2-7	A-2-6	A-4, A-5, A-6, A-7-5, A-7-6, A-1-a
GC	A-2-6, A-2-7	A-2-4	A-4, A-6, A-7-6, A-7-5
SW	A-1-b	A-1-a	A-3, A-2-4, A-2-5, A-2-6, A-2-7
SP	A-3, A-1-b	A-1-a	A-2-4, A-2-5, A-2-6, A-2-7
SM	A-1-b, A-2-4, A-2-5, A-2-7	A-2-6, A-4	A-5, A-6, A-7-5, A-7-6, A-1-a
SC	A-2-6, A-2-7	A-2-4, A-6, A-4, A-7-6	A-7-5
ML	A-4, A-5	A-6, A-7-5, A-7-6	—
CL	A-6, A-7-6	A-4	—
OL	A-4, A-5	A-6, A-7-5, A-7-6	—
MH	A-7-5, A-5	—	A-7-6
CH	A-7-6	A-7-5	—
OH	A-7-5, A-5	—	A-7-6
Pt	—	—	—

Lampiran A- 6. Batasan-batasan ukuran golongan tanah



Lampiran B- 1. Hasil uji pemeriksaan kadar air tanah asli

PENGUJIAN KADAR AIR

SAMPEL : Tanah Asli
TESTING METHOD : ASTM D 698/ D 1567
LABORATORY : HASANUDDIN UNIVERSITY DATE : Maret2021

Diketahui :	Satuan	A	B
Berat container kosong	gr	7,94	8,23
Berat container + tanah	gr	26,21	31,5
Berat container + tanah setelah dioven	gr	24,53	28,34
Kadar Air	%	10,13	15,71
Kadar Air rata-rata	%	**12,92**	

Lampiran B- 2. Hasil uji pemeriksaan berat jenis tanah asli

PENGUJIAN BERAT JENIS

SAMPEL : Tanah Asli
TESTING METHOD : ASTM D 854-58(72)
DATE : Maret 2021

Sample			-	Tanah Asli	
Uraian	Simbol	Formula	-	A	B
Temperature, T (oC)	T	Diukur	Degree	28,0	28,0
Faktor Koreksi Temperatur	α	Table	-	0,99803	0,99803
Berat Piknometer	Wp	Diukur	Gram	30,06	22,51
Berat Piknometer + tanah	Wps	Diukur	Gram	40,21	32,68
Berat Piknometer + Air	Wpw	Diukur	Gram	77,71	73,43
Berat Pikno + Tanah + air	Wpsw	Diukur	Gram	84,08	79,67
Berat Cawan	Wed	Diukur	Gram	94,42	86,81
Berat Cawan + Tanah Kering	Weds	Diukur	Gram	104,57	96,98
Berat tanah kering	Ws	Weds-Wed	Gram	10,15	10,17
Berat Air	Ww	Ws+Wpw-Wpsw		3,78	3,93
Specific Gravity of Soil	Gs	Ws/Ww	-	2,680	2,583
Average of Gs			-	2,631	

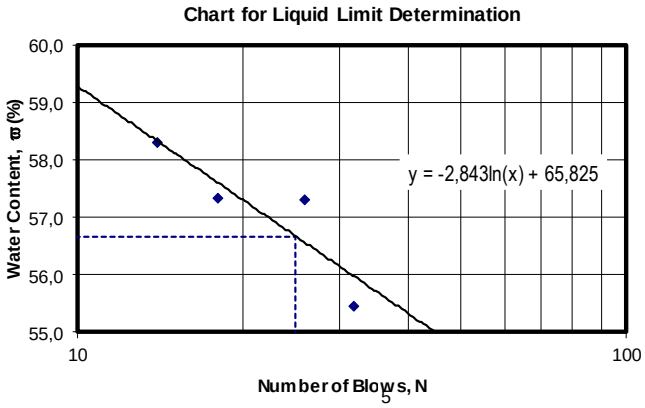
Unitt weight of water = 0,99821

Lampiran B- 3. Hasil uji pemeriksaan Atterberg tanah asli

PENGUJIAN ATTERBERG

SAMPLE : TANAH ASLI
TESTING METHOD : ASTM D 424-59, D 4318-(00), AASHTO T89/T90
LABORATORY : HASANUDDIN UNIVERSITY DATE : APRIL 2021

Sample No.	:										
Depth of Sample	:										
	Unit	Plastic Limit		Liquid Limit							
Test Number	-	1	2	1		2		3		4	
Number of Blows	N	-	-	14		18		26		32	
Container No. or Can No.	-	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2
Weigth of Wet Soil+Can, W1	gram	14,32	14,34	21,00	23,26	21,81	26,27	26,56	28,00	28,12	28,23
Weigth of Dry Soil+Can, W2	gram	13,48	13,28	15,79	17,01	16,16	19,01	19,29	20,21	20,45	20,29
Weigth of Water, Ww=W1-W2	gram	0,8	1,1	5,2	6,3	5,7	7,3	7,3	7,8	7,7	7,9
Weigth of Can, W3	gram	11,4	10,8	6,9	6,3	6,4	6,3	6,9	6,3	6,3	6,3
Weigth of Dry Soil, Ws=W2-W3	gram	2,1	2,5	8,9	10,7	9,8	12,7	12,4	13,9	14,1	14,0
Water Content, w=Ww/Ws*100%	%	40,4	42,2	58,3	58,4	57,6	57,1	58,5	56,1	54,3	56,7
Average of Water Content, w	%	41,31		58,32		57,33		57,33		55,48	



Atterberg Limits	Value
Plastic Limit, PL(%)	41,31
Liquid Limit, LL(%)	56,67
Plastic Index, PI=LL-PL	15,36
Shrinkage Limit, S_L(%)	21,42

Lampiran B- 4. Hasil uji analisa saringan tanah asli

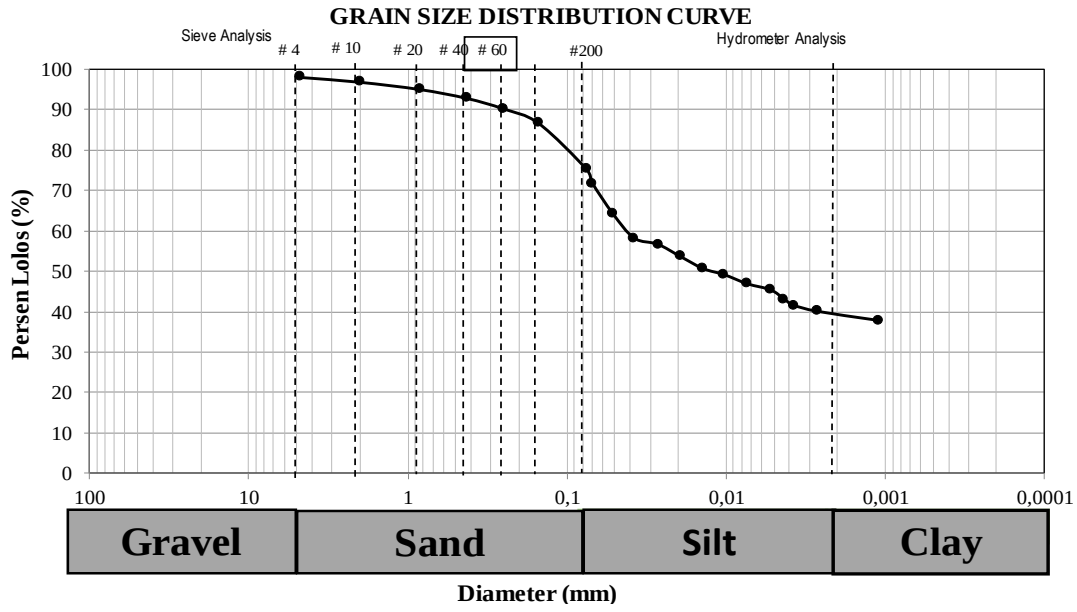
PENGUJIAN ANALISA SARINGAN

SAMPLE : Tanah Asli
TESTING METHOD : ASTM D 424-59, D 4318-(00), AASHTO T89/T90
LABORATORY : HASANUDDIN UNIVERSITY
DATE : MARET 2021

Berat Tanah Kering :	500	gr	Spec. Gravity, Gs :	2,631	T :	28,0	^{0}C

Analisa Saringan						Hydrometer							
Saringan No.	Diameter (mm)	Berat Tertahan (Gram)	Berat Kumulatif Tertahan (gra	Persen Tertahan (%)	Persen Lolos (%)	Waktu (menit)	Pembacaan Hidrometer (R)	Rcp =R+Ft-Fz	% Finer = ((a x Rcp)/Ws)x100% * %Finer #200 # 100	RcL= R + Fm	(L) Kedalaman (cm)	Konstanta (K)	D=K√L/t (mm)
4	4,75	10	10	2	98	0,25	52,00	47,50	71,75	53,00	7,60	0,0125	0,06892
10	2	6	16	3,2	96,8	0,5	47,00	42,50	64,20	48,00	8,40	0,0125	0,05123
20	0,84	9	25	5	95	1	43,00	38,50	58,16	44,00	9,10	0,0125	0,03771
40	0,425	11	36	7,2	92,8	2	42,00	37,50	56,65	43,00	9,20	0,0125	0,02681
60	0,25	13	49	9,8	90,2	4	40,00	35,50	53,63	41,00	9,60	0,0125	0,01936
100	0,15	18	67	13,4	86,6	8	38,00	33,50	50,61	39,00	9,90	0,0125	0,01391
200	0,075	57	124	24,8	75,2	15	37,00	32,50	49,09	38,00	10,10	0,0125	0,01026
Pan	-	376	500	100	0	30	35,50	31,00	46,83	36,50	10,30	0,0125	0,00732
						60	34,50	30,00	45,32	35,50	10,50	0,0125	0,00523
						90	33,00	28,50	43,05	34,00	10,70	0,0125	0,00431
						120	32,00	27,50	41,54	33,00	10,90	0,0125	0,00377
						240	31,00	26,50	40,03	32,00	11,10	0,0125	0,00269
						1440	29,50	25,00	37,77	30,50	11,30	0,0125	0,00111

Berat jenis air terhadap temperatur, g $_{Wet\ T}$	=	0,99627
Faktor Kt = f(Gs,T)	=	0,0125
Temperatur Correction (Ft) = -4.85 + 0.25 T)	=	2,50
Zero Correction (Fz)	=	7,0
Meniscus correction (Fm)	=	1
Gs Correction	=	1,00



Lampiran B- 5. Hasil uji kompaksi tanah asli

PENGUJIAN KOMPAKSI

SAMPLE / SAMPLE NO. : Tanah Asli
TESTING METHOD : ASTM D 698/ D 1567
LABORATORY : HASANUDDIN UNIVERSITY DATE : Maret 2021

Berat tanah	gram	2000	2000	2000	2000	2000	2000
Kadar air mula-mula	%	12,92	12,92	12,92	12,92	12,92	12,92
Penambahan air	ml	100	200	300	400	500	600
Kadar air akhir	%	18,57	24,21	29,86	35,50	41,15	46,80

Berat Isi Basah (Wet density)

No. Mould	-	1	2	3	4	5	5
Berat Mould	gram	1943	1943	1943	1943	1943	1943
Berat tanah basah + Mould	gram	3411	3631	3751	3647	3556	3459
Berat tanah basah, W_{wet}	gram	1468	1688	1808	1704	1613	1516
Volume Mould	cm^3	1004	1004	1004	1004	1004	1004
Berat Volume Basah	gr/cm^3	1,462	1,681	1,801	1,697	1,607	1,510

Kadar Air (Water Content)

No. Container	-	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	5A	5B
Berat tanah basah + Container	gram	39,23	46,27	38,24	34,28	40,94	36,11	51,45	40,54	40,97	37,07	43,97	40,07
Berat tanah kering + Container	gram	33,9	39,72	31,91	28,92	32,92	29,3	39,77	31,86	31,04	28,48	34,3	28,48
Berat air	gram	5,33	6,55	6,33	5,36	8,02	6,81	11,68	8,68	9,93	8,59	9,67	11,59
Berat container	gram	8,61	8,34	8,17	8,28	8,11	8,06	8,06	8,27	7,70	8,30	7,30	8,20
Berat tanah kering	gram	25,29	31,38	23,74	20,64	24,81	21,24	31,71	23,59	23,34	20,18	27	20,28
Kadar air	%	21,08	20,87	26,66	25,97	32,33	32,06	36,83	36,80	42,54	42,57	35,81	57,15
Kadar air rata-rata	%	20,97		26,32		32,19		36,81		42,56		46,48	

Berat Isi Kering (Dry Density)

Berat tanah basah, W_{wet}	gram	1468	1688	1808	1704	1613	1516
Kadar air rata-rata	%	20,97	26,32	32,19	36,81	42,56	46,48
Berat kering $Wdry = \frac{Wwet}{1+\left(\frac{W}{100}\right)}$	gram	1213,48	1336,33	1367,69	1245,48	1131,49	1034,94
Volume Mould	cm^3	1003,94	1003,94	1003,94	1003,94	1003,94	1003,94
Berat isi kering $\gamma dry = \frac{W_{dry}}{V_{mould}}$	gr/cm^3	1,21	1,33	1,36	1,24	1,13	1,03
$\gamma zav = \gamma w/(w+(1/Gs))$	gr/cm^3	1,70	1,55	1,42	1,34	1,24	1,18

Lampiran B- 6. Hasil uji kadar organik pada tanah organik

LABORATORIUM BIOTEKNOLOGI TERPADU PETERNAKAN
FAKULTAS PETERNAKAN
UNIVERSITAS HASANUDDIN
Alamat: Jl. Perintis Kemerdekaan KM. 10 Tamalanrea, Makassar
Email: lab_bioternak@unhas.ac.id

No.Dok.: FSPO-LBTK-UH-12.2

SERTIFIKAT HASIL UJI

No.: 216/T/LBTK-UH/XII/2022

Informasi Pelanggan

Nama Perusahaan/Pelanggan	: Izmi
Alamat Lengkap	: Fakultas Teknik Universitas Hasanuddin
No. Telp./faks./e-mail	: 085256568988
Personel Penghubung	: 081241981874

Informasi Sampel

No. Identitas Laboratorium	: 216/LBTK-RK/XII-2022
Uraian/Matriks Sampel	: -
Kondisi Saat Diterima	: Baik
Tanggal Diterima	: 21/12/2022
Tanggal Pengujian	: 21/12/2022
Tujuan Pengujian	: -

Informasi Hasil Pengujian

No	Kode Sampel	Parameter	Satuan	Hasil
1	Tanah Kompos	Bahan Organik	%	57,75
2	Tanah Kompos	Bahan Organik	%	58,24
3	Tanah Kompos	Bahan Organik	%	58,47

Ket: 1. Kadar air ditetapkan sesuai sampel uji; 2. Selain kadar air, parameter ditetapkan berdasarkan 100% BK; 3. Lembaran sertifikat hasil uji ini tertelusur; 4. Hasil hanya berhubungan dengan contoh yang diuji dan laporan ini tidak boleh digandakan

Makassar, 30 Desember 2022
Devisi Teknis,

Dr. Ir. Syahriani Syahrir, M.Si.
NIP.: 196511121990032001

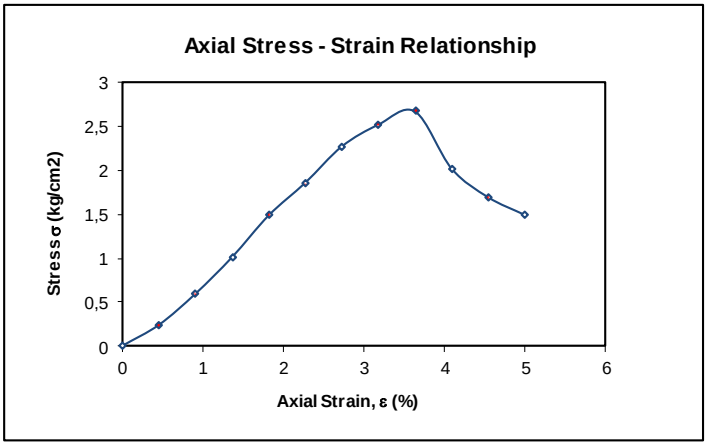
Lampiran B- 7. Hasil uji kuat tekan bebas tanah asli

UNCONFINED COMPRESSION TEST RESULTS

PROJECT	:	SOIL INVESTIGATION REPORT			
SAMPLE	:	TANAH ASLI			
TESTING METHOD	:	ASTM D 2166-66			
LABORATORY	:	GEOTEKNIK UNHAS	DATE	: MEI 2021	

Sample Depth		1	m	Index Properties	Weight of Wet Soil	55,43	gram
Sample Size	Diameter, d	5,50	cm		Weight of Dry Soil	48,23	gram
	Height, h	11,00	cm		Water Content	14,93	%
	Volume	261,34	cm^3		Dry Unit Weight	0,185	$gram/cm^3$
	Area, Ao	23,76	cm^2	Proving Ring Calibration		1,32	kg/div

Axial Deformation		Axial Load & Stress: Axial Load		Axial Load & Stress: Axial Stress		Axial Deformation		Axial Load & Stress: Axial Load		Axial Load & Stress: Axial Stress	
Disp. Reading	Axial Strain	Disp. Reading	Axial Stress	Corrected Area	Stress	Disp. Reading	Axial Strain	Disp. Reading	Axial Stress	Corrected Area	Stress
δh	ε = δh/h	-	P	A = Ao/(1- ε)	σ = P/A	δh	ε = δh/h	-	P	A = Ao/(1- ε)	σ = P/A
(cm)	(%)	(div)	(kg)	(cm^2)	(kg/cm^2)	(cm)	(%)	(div)	(kg)	(cm^2)	(kg/cm^2)
0,00	0,00	0,0	0,00	23,76	0,000						
0,05	0,45	4,3	5,70	23,87	0,239						
0,10	0,91	10,8	14,26	23,98	0,595						
0,15	1,36	18,5	24,35	24,09	1,011						
0,20	1,82	27,3	35,97	24,20	1,486						
0,25	2,27	34,3	45,18	24,31	1,859						
0,30	2,73	42,2	55,49	24,42	2,272						
0,35	3,18	47,0	61,85	24,54	2,521						
0,40	3,64	50,0	65,80	24,65	2,669						
0,45	4,09	38,0	50,01	24,77	2,019						
0,50	4,55	32,0	42,11	24,89	1,692						
0,55	5,00	28,3	37,29	25,01	1,491						



Failure Visualization	
Undisturbed	Remolded

Unconfined Compression Strength, kg/cm^2	
qu =	2,669
< 0,25	Very Soft
0,25 - 0,5	Soft
0,5 - 1,0	Medium
1,0 - 2,0	Stiff
2,0 - 4,0	Very Stiff
> 4,0	Hard

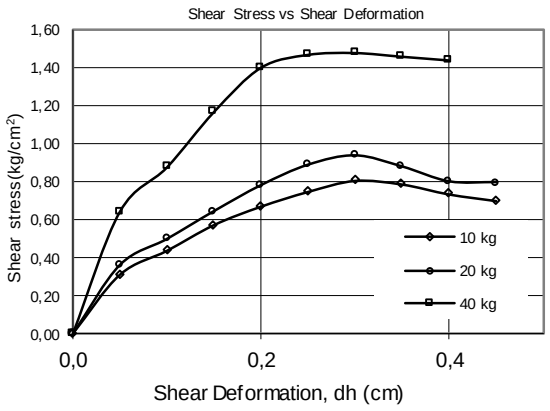
Lampiran B- 8. Hasil uji kuat geser tanah asli

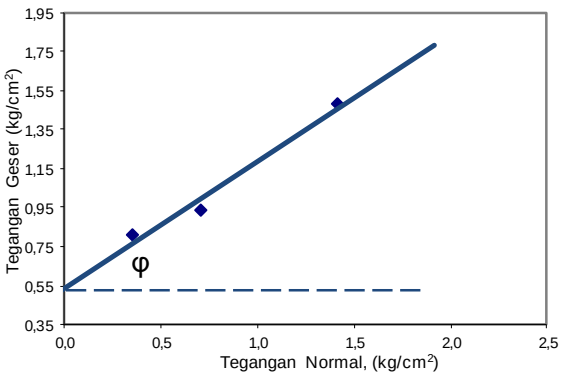
DIRECT SHEAR TEST RESULTS

PROJECT : SOIL INVESTIGATION REPORT
NO SAMPLE : TANAH ASLI
TESTING METHOD : ASTM D 3080-72
LABORATORY : HASANUDDIN UNIVERSITY DATE : MEI 2021

Sample Size :				Proving Ring Calibration	=	0,55	kg/div
Diameter Sample	=	6,00	cm	Displacement Rate	=		kg/div
Height of Sample	=	2,00	cm	c	=	0,53	kg/cm^2
Area of Sample	=	28,27	cm^2	φ	=	33	°

Test No.	Test (1)		Test (2)		Test (3)	
Normal Load	P1 = 10,00 kg		P1 = 20,00 kg		P1 = 40,00 kg	
Normal Stress	σ1 = 0,35	kg/cm^2	σ1 = 0,71	kg/cm^2	σ1 = 1,41	kg/cm^2
Shear Displacement (cm)	Shear Force (kg)	Shear Stress (kg/cm^2)	Shear Force (kg)	Shear Stress (kg/cm^2)	Shear Force (kg)	Shear Stress (kg/cm^2)
0,00	0,000	0,000	0,000	0,000	0,000	0,000
0,05	8,800	0,311	10,175	0,360	18,150	0,642
0,10	12,375	0,438	14,025	0,496	24,750	0,875
0,15	16,225	0,574	18,150	0,642	33,000	1,167
0,20	18,975	0,671	22,000	0,778	39,600	1,401
0,25	21,175	0,749	25,025	0,885	41,525	1,469
0,30	22,825	0,807	26,400	0,934	41,800	1,478
0,35	22,275	0,788	24,750	0,875	41,250	1,459
0,40	20,790	0,735	22,550	0,798	40,700	1,439
0,45	19,800	0,700	22,440	0,794	38,500	1,362





Lampiran B- 9. Rekapitulasi nilai UCT Tanah asli stabilisasi bakteri

REKAP NILAI UCT TANAH + BAKTERI
REKAPITULASI HASIL PEMBACAAN UJI UCT

NILAI QU (kN/m2)

:

		Kultur 2 Hari			
Curing	:	3	7	14	28
Untreated Soil		261,8			
4% Bakteri		1249,6	1586,1	1620,6	1713,8
6% Bakteri		1628,4	1710,8	1855,1	1901,5
8% Bakteri		1082,2	1159,4	1174,9	1262,5

		Kultur 4 Hari			
Curing	:	3,0	7,0	14,0	28,0
Untreated Soil		261,8			
4% Bakteri	:	1610,1	1613,7	1623,4	1774,1
6% Bakteri	:	1638,7	1741,7	1865,4	1953,0
8% Bakteri	:	1195,5	1473,8	1530,5	1705,7
	:				

		Kultur 6 Hari			
Curing	:	3,0	7,0	14,0	28,0
Untreated Soil		261,8			
4% Bakteri	:	1195,8	1232,3	1273,8	1425,4
6% Bakteri	:	1330,7	1372,1	1522,3	1574,1
8% Bakteri	:	994,7	1102,8	1128,5	1241,9

Lampiran B- 10. Rekapitulasi nilai kohesi tanah stabilisasi bakteri

REKAPITULASI NILAI KOHESI TANAH ASLI + BAKTERI					
	Kultur 2 hari				
		3	7	14	28
Cohesi (kN/m2)	Kultur 2 hari 4%	66,06	70,49	80,11	82,77
	Kultur 2 hari 6%	79,29	82,42	88,81	89,24
	Kultur 2 hari 8%	57,37	59,68	65,05	73,58
	Kultur 4 hari				
		3	7	14	28
Cohesi (kN/m2)	Kultur 4 hari 4%	52,97	54,76	62,52	83,39
	Kultur 4 hari 6%	77,71	79,30	83,17	90,85
	Kultur 4 hari 8%	63,21	64,61	74,85	85,35
	Kultur 6 hari				
		3	7	14	28
Cohesi (kN/m2)	Kultur 6 hari 4%	52,83	62,45	64,83	65,99
	Kultur 6 hari 6%	60,22	68,55	74,24	75,54
	Kultur 6 hari 8%	58,34	65,64	70,97	71,61

Lampiran B- 11. Rekapitulasi nilai kompaksi tanah organik

Rekapitulasi nilai berat volume tanah kering dan kadar air optimum tanah organik			
Jenis Material	**Yd(gr/cm³)**	**ɣd (kN/m³)**	**OMC (%)**
Tanah asli	1,36	13,36	32,19
Tanah + 10 % Organik	1,23	12,11	35,04
Tanah + 20 % Organik	1,08	10,55	36,37
Tanah + 30 % Organik	1,03	10,06	38,46
Tanah + 40 % Organik	0,85	8,35	43,75
Tanah + 50 % Organik	0,78	7,68	49,67
Tanah + 60 % Organik	0,74	7,28	52,44

Lampiran B- 12. Rekapitulasi nilai kuat tekan tanah asli dan tanah organik stabilisasi bakteri

Tanah asli **261,81 kN/m^2**

Waktu Pemeraman	**Tanah Asli + Bakteri**	**Tanah Asli + Tanah Organik + Bakteri**					
		10%	**20%**	**30%**	**40%**	**50%**	**60%**
		kN/m^2					
Tanpa Bakteri	-	107,645	40,756	29,016	25,977	19,170	17,249
0	838	68,50	28,40	21,94	10,98	8,49	6,33
7	1411	272,76	126,07	106,18	26,26	22,41	19,22
14	1697	274,88	144,17	122,69	27,68	23,78	21,89
28	1953	287,42	201,61	179,22	45,40	33,45	28,64

Lampiran B- 13. Rekapitulasi nilai kohesi tanah asli dan tanah organik stabilisasi bakteri

Tanah asli **52,48 kN/m^2**

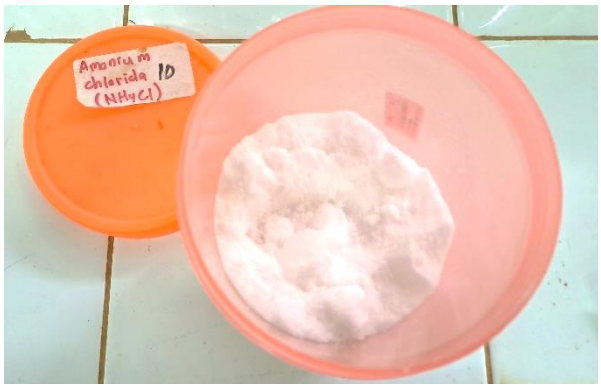
Waktu Pemeraman	**Tanah Asli + Bakteri**	**Tanah Asli + Tanah Organik + Bakteri**					
		10%	**20%**	**30%**	**40%**	**50%**	**60%**
		kN/m^2					
Tanpa Bakteri	-	21,306	11,602	10,558	5,540	4,095	0,743
0	77,71	27,88	18,86	14,33	10,24	6,74	4,48
7	79,30	34,43	27,98	27,08	18,13	14,15	13,09
14	83,17	68,78	30,54	29,83	21,16	19,47	15,56
28	90,85	71,49	54,91	52,32	25,92	21,52	16,23

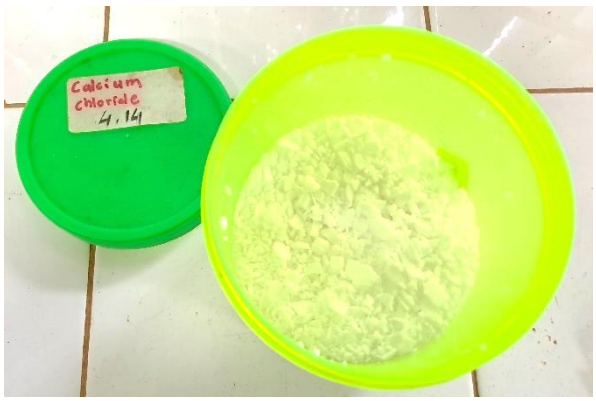
LAMPIRAN C

Lampiran C- 1. Dokumentasi pekerjaan pemadatan standar proctor

Lampiran C- 2. Dokumentasi pengujian atterberg

Lampiran C- 3. Dokumentasi bahan pembuatan larutan bakteri





Lampiran C- 4. Dokumentasi pekerjaan pembuatan sampel tanah

Lampiran C- 5. Dokumentasi pengujian mekanis tanah