EXPANSIVE SOIL IMPROVEMENT OF GLAGAHAGUNG VILLAGE, PURWOHARJO SUB-DISTRICT, BANYUWANGI DISTRICT, WHICH IS CHEMICALLY STABILIZED

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Preliminary

- Purwoharjo District Chief Secretary stated that about 80 percent of the land condition of its territory, is “moving soil”.
- Many homes were found with a mildly damaged condition due to the condition of this land.
- The assumption based on field observations, "moving soil" referred to by him is characterized as expansive soil.

Preliminary

(a)

(b)

(c)

Documentation on damage to houses, (a). broken column, (b) broken beam, (c) cracked wall.

Preliminary

- Based on laboratory tests, SNI 03-6795-2002, Chen (1988), Snethen (1977), Seed (1962) were used to determine the level of soil expansivity.

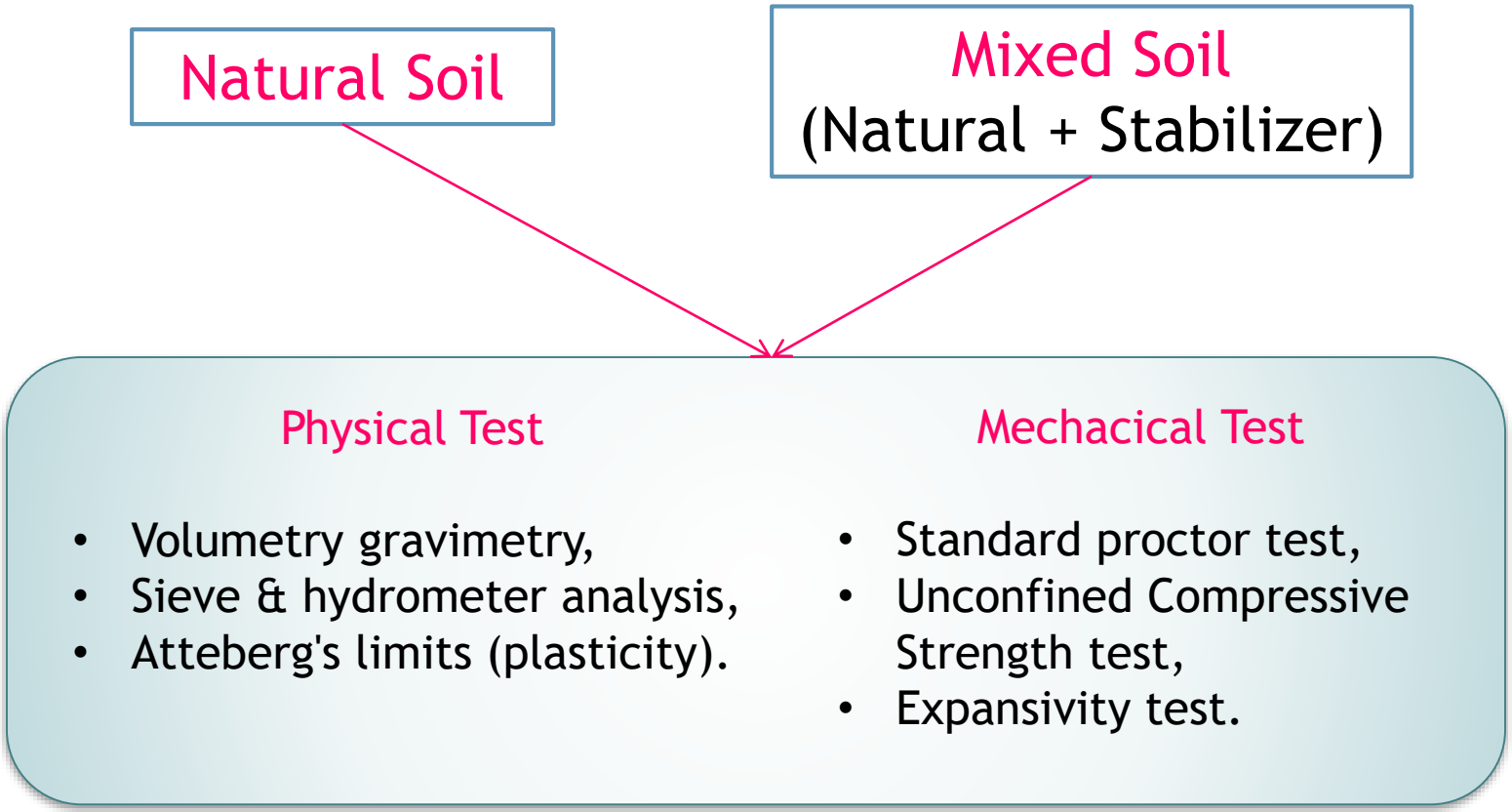
Activity	Atteberg's Limits		Swelling Criteria			
	LL	PI	Chen	Snethen	Seed	SNI-03-6795-2002
1,508	90,86	53,89	Very High	High	Very High	High

- The results above show that the soil has a high level of expansion.

Preliminary

- This study is done to reduce the level of expansiveness in the soil, by means of chemical reactions using wood charcoal ash and salt.
- Of the two stabilizers given, will be compared changes in physical and mechanical properties.
- The optimum condition of the percentage of use of each stabilizer material will also be known.
- The best stabilizer material recommendations for use of some of these stabilizers are also known.

Physical and Mechanical Properties Test



Percentage of Stabilizer

- The percentage of stabilizer materials is determined based on previous studies.
- The use of various percentages of stabilizers is intended to determine the optimum level of the stabilizer material.
- Taken from previous research and logical assumptions, the content of stabilizers for wood charcoal 5%, 15%, 25%, 35%, and salt 5%, 10%, 15%, 20%, 25% of natural soil dry weight.

Preparation Result

Chemical Reaction

Chemical elements of natural soil-based laboratory test.

Chemical elements	Result (%)
SiO_2	65.52
Al_2O_3	15.23
Fe_2O_3	11.88
MgO	1.21
CaO	0.32

Chemical elements of wood charcoal powder-based laboratory test.

Chemical elements	Result (%)
C	22.83
SiO_2	12.53
Al_2O_3	8.21
Fe_2O_3	0.87
MgO	0.35
CaO	0.32
P_2O_5	0.15

$$SiO_2 + C + H_2O \rightarrow Si + CO_2 + H_2O$$

Salt (NaCl)

$$SiO_2 + {}_2NaCl + H_2O \rightarrow Na_2SiO_3 + {}_2HCL$$

Physical Parameter Result and Analysis

Soil properties index test results.

Stabilizer Type	Stabilizer Percentage (%)	Wc (%)	LL (%)	PL (%)	IP (%)	Pass No. 200 (%)	GI	Classification	
								AASTHO	USCS
Natural Soil	0	40.45	87.99	41.99	46.00	96.5	56.397	A-7-5	CH
Salt	5	37,33	90,86	36,97	53,89	96,54	35,79	A-7-6	CH
	10	31,61	58,60	36,27	22,34	81,70	8,23	A-7-6	MH
	15	30,23	44,00	28,58	15,42	91,60	4,15	A-7-6	ML
	20	29,65	42,35	27,13	15,23	93,80	4,12	A-7-6	ML
	25	28,11	41,00	27,02	13,98	93,80	3,14	A-7-6	ML
Wood Charcoal	5	30.52	56.50	23.50	33.00	78.85	27.07	A-7-6	CH
	15	26.74	53.50	28.87	24.63	59.07	12.88	A-7-6	CH
	25	22.16	48.40	32.86	15.54	48.79	5.21	A-7-5	ML
	35	20.20	45.25	30.05	15.20	46.93	4.36	A-7-5	ML

Wood charcoal

$$SiO_2 + C + H_2O \rightarrow Si + CO_2 + H_2O$$

Salt (Nacl)

$$SiO_2 + {}_2NaCl + H_2O \rightarrow Na_2SiO_3 + {}_2HCL$$

Physical Parameter Result and Analysis

- Globally, it can be compared that there is a drastic decline of all parametric values.
- The more content the stabilizer adds, the parameter value will decrease.
- Except on the plastic limit of wood charcoal stabilizer, and pass sieve number 200 of the salt stabilizer.
- The possibility of such behavioral differences is due to changes in chemical compounds of the mixture.
- Such as changes in chemical compounds into Si and 2HCL.
- In the classification of USCS there is an increase in grain and changes in plasticity properties from CH to ML

Physical Parameter Result and Analysis

Expansivity test results.

Stabilizer Type	Percentage of Stabilizer (%)	Ac	LL (%)	IP (%)	Criteria			
					Chen	Snethen	Seed	SNI-03-6795-2002
Natural Soil	0	1,508	87.99	46.00	Very High	Very High	High	Very High
Salt	5	1,101	90,86	53,89	Medium	High	Low	Medium
	10	1,082	58,60	22,34	Medium	Medium	Low	Low
	15	0,360	44,00	15,42	Medium	Medium	Low	Low
	20	0,378	42,35	15,23	Medium	Low	Low	Low
	25	0,325	41,00	13,98	Medium	Low	Low	Low
Wood Charcoal	5	0.944	56.50	33.00	Medium	Medium	Low	Medium
	15	0.704	53.50	24.63	Medium	Medium	Low	Medium
	25	0.388	48.40	15.54	Medium	Low	Low	Low
	35	0.338	45.25	15.20	Medium	Low	Low	Low

Based on all the addition of stabilizers it can be concluded that the more stabilizer addition, will change the soil plasticity properties from high to low

Mechanical Parameter Result and Analysis

Mechanical parameter test results

Stabilizer	Percentage Stabilizer (%)	Wc opt (%)	γd Max (gr/cm3)
Natural Soil	0	28	1.189
Salt	5	26	1.31
	10	24	1.35
	15	23	1.425
	20	21.4	1.225
	25	20.8	1.29
Wood Charcoal	5	24.8	1.038
	15	34.7	0.978
	25	34.8	0.978
	35	24.7	0.978

Mechanical Parameter Result and Analysis

- Based on the table above, the more salt sabilizer addition, the more decreasing the value of water content.
- The optimum dry weight becomes larger than the original soil and appears to have a peak at a rate of 15%.
- In charcoal stabilizers, there is an increase in water content as the stabilizer material increases. This has an effect on decreasing the value of optimal dry weight...

Analysis of the Best Mixture Selection of Stabilizers

- The best mixture selection is based on determining the mechanical parameters and then the physical parameters.
- Soil dry weight can represent the density of a soil, therefore this parameter becomes the main determinant.
- Then it is followed by the determination of the increase of soil classification.

Analysis of the Best Mixture Selection of Stabilizers

- Based on both stabilizer materials, salt is the best stabilizer to use.
- This is because the highest optimum dry weight is located on a salt stabilizer of 1.425 gr/cm3.
- In addition, soil classification has shown that this mixed soil has a low plasticity, thereby reducing the expansive soil problem.

Consclusion

- Natural soils are classified on High Clay (CH) at USCS and have a high level of expansion.
- Globally, it can be compared that there is a drastic decline of all parametric values.
- All the addition of stabilizer material to the natural soil, causing a percentage decrease in pass filter 200 number.
- The most obvious increase of the soil grains can be seen from soil classification [from high clay (CH) to low silt (ML)]
- Based on both stabilizer materials, salt is the best stabilizer to use.