UNCONFINED COMPRESSIVE STRENGTH OF LIME-TREATED ARIAKE CLAY WITH FOAMING WASTE GLASS

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1. INTRODUCTION

Foaming waste glass, a newly produced material from waste glass has been found some applications in civil engineering. Study on the utilization in the improvement of soft soil was also preliminarily reported. In the paper, unconfined compressive strength properties of lime-treated Ariake clay with the foaming waste glass (LAG) were studied to investigate the possibility of the replacement of lime with foaming waste glass as an alternative stabilizer for the improvement of Ariake clay. This was completed by a series of tests in the laboratory at Saga University. The effects of lime and foaming waste glass on the unconfined compressive strength of the lime-treated Ariake clay with foaming waste glass were discussed and compared. An empirical relationship between the deformation modulus and the strength from the study was obtained.

2. EXPERIMENTAL DETAILES

The properties of the coarser foaming waster glass used in the study were listed in Table 1. Most of the foaming waster glass used are 4.75 mm to 2 mm in size, which were obtained from crushing by compaction rammer the coarser size foaming waste glass of 70-40 mm in diameter. The voids of the foaming waster glass are discontinuous. Properties of Ariake clay were listed in Table 2.

All the samples for tests were made in cylinder moulds by hand vibrating so that the compaction states for all the test samples are similar. The object of the vibrating is to dispel as much as possible the inside air out of the mixture. Sample sizes are 5 cm in diameter and 10 cm in depth. A mixing machine was employed to blend all the mixture in order to have them mixed uniformly. Samples of the LA were blended by mixing Ariake clay with lime for 10 minutes. Samples of the LAG were made by mixing LA with foaming waste glass for another 10 minutes. The additive content was defined by the ratio of the dry mass of the additive to the dry mass of the natural clay, expressed as a percent.

Table 1 Properties of the coarser foaming waste glass

Dry unit density (g/cm^3)	0.355
Wet unit density (g/cm^3)	0.355
Size of particle (mm)	4.75
Average CBR (%)	30.9
Unconfined compressive strength (MPa)	3.5

Table 2 Physical properties of Ariake clay

Natural water content (%)		110-130
Density of particle (g/cm^3)		2.54
Grade (%)	Grave	0.0
	Sand	37.0
	Silt	44.0
	Clay	19.0
Liquid limit (%)		89.5
Plastic limit (%)		39.6
Plastic index		49.9
Ig. loss (%)		7.4

3. TEST RESULTS

Figure 1 shows the lime influence on the q_u of LAG and LA (content of foaming waste glass=0 %, in LAG case) mixture after 7 days curing. Figure 2 shows the variation of the q_u of the LAG mixture with content of foaming waste glass after 7 days curing.

As was observed in Figure 1 that when a content of lime 5 % was added, the q_u of the LAG mixture is about 0.7 MPa. Any addition of foaming waste glass has little influence on the q_u. When the lime content increase as high as 10 %, the q_u of the LAG mixture increase rapidly up 1.3 MPa and also increases significantly with the increase of foaming waste glass. Further addition of lime content in the mixture changes the q_u a little slowly.

The results of the influence of foaming waste glass on q_u are as follows: for a lower lime content case, 5 %

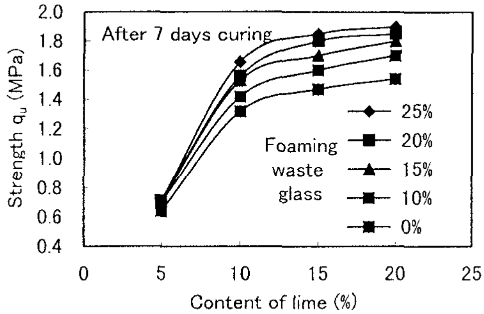

Figure 1 Influence of lime content on q_u

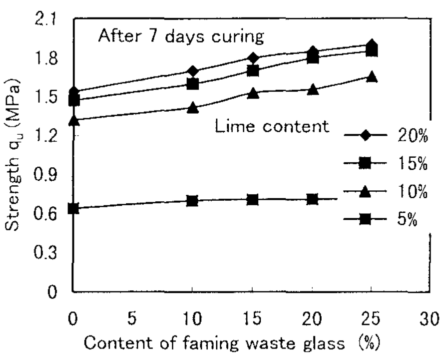

Figure 2 Influence of foaming waste glass on q_u

in the study, a 10 % increase in q_u was achieved by a 10 % addition of foaming waste glass. But only 1.5 % change in q_u was observed for a further increase of foaming waste glass up to 25 %. However, as a higher lime content upon 10 %, a 10 % increase in q_u was achieved for 10 % increase of foaming waste glass, and 20 % increase in q_u for up to 25 % increase of foaming waste glass. The results after 28 days curing, show a 24 % increase in q_u for 10 % addition of foaming waste glass, a 40 % increase in q_u for 25 % addition of foaming waste glass. Figure 3 shows the influence of curing date on the q_u.

Figure 4 is the empirical result of the relationship between the deformation modulus E_{50} and q_u of the LAG mixture. E_{50} is defined by the ratio of the half maximum unconfined compressive strength to the corresponding strain. An exponent curve is used to fit the tested data. It was indicated that the relation can be represented well by the exponent curve see in Figure 4.

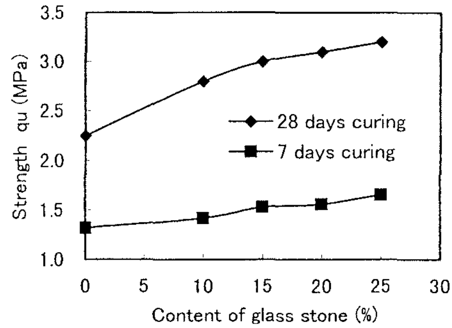

Figure 3 Influence of curing data on q_u

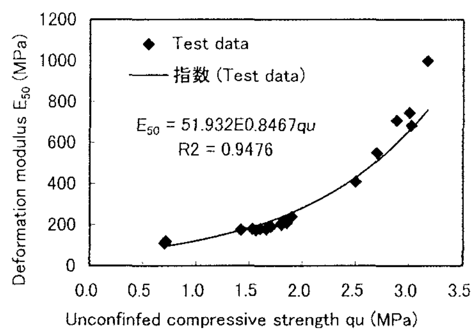

Figure 4 Relationship between E_{50} and qu

4. CONCLUSIONS

The influence of foaming waste glass on the q_u of the LAG mixture is potential, especially when lime in the mixture is higher and curing date is longer. It is possible to replace part of lime with foaming waste glass for improvement of Ariake clay.

The deformation modulus and unconfined compressive strength of the LAG mixture can be fitted by exponent curve well. It was indicated the mixture has a strong deformation modulus in the later stage.

5. RFRERENCES

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