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Theme 4: Advancement in Sustainable Construction Techniques

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Influence-Depth of the Tensile Capacity of Ground Anchors Folding Type in Cohesive Soils

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1 INTRODUCTION

In some coastal areas of Indonesia, many soft soil deposits are found in both coastal areas, offshore waters, and land. Specifically, for buildings in coastal and offshore areas, many resource use activities need to build infrastructure such as doc floats, mooring dolphins, floating breakwaters, offshore floating platforms, floating houses, floating houses and so on. All these buildings require solutions to maintain the stability of the buildings to be built, both temporary and permanent. The main problem for buildings on the beach or offshore is the problem of structural stability due to the movement of seawater both vertically due to tides and horizontal movements due to currents, wind and waves. To maintain stability due to the vertical movement of buoyancy (uplift), we need a restraint structure known as anchors.

The development of anchor shapes and models that are easy to install with a large load capacity needs to be developed. In particular, for the use of anchors on cohesive soils that have large thicknesses, it is possible to innovate using foldable type anchors. The use of foldable type anchors on cohesive soils assuming that the anchoring element will be expanded when the position of the element has reached a predetermined depth. In the first stage of development of this foldable type anchor, a series of tests will be conducted on the density variation in soft soil conditions, and variations in the extent of the anchoring element. To obtain the maximum tensile strength, it is necessary to study the tensile capacity of the tensile capacity at the depth, under certain soil density conditions and variations in the extent of the anchor element, in order to get the magnitude of the anchor attraction to plan.

2 LITERATURE STUDY

Tensile strength of the foldable type anchorage model on cohesive soil which is a modification of the solid circle anchor by performing a series of model tests in the laboratory. The folding anchor model selected consists of 4 (four) sheets.

The study of the variation of the type of anchorage and the adequacy in the field was carried out by Datta (Datta et. al., 1989), the traction capacity of star-shaped anchoring plates in compacted cohesive soils, by Abdul (Jamaluddin, 2013), analyzed the star-shaped anchor model removal capability which is a modification of the massive circle-shaped plate anchoring by performing a series of tests on model in the laboratory.

3 RESEARCH MODEL TEST DESIGN

3.1 Basic Properties and Mechanical Properties of Soil

The study began with a basic soil test and mechanical characteristics to determine the basic classification of the research object.

3.2 Physical Model Test Design

The physical model test was carried out in the Soil Mechanics Laboratory of the Department of Civil Engineering, Hasanuddin University, Gowa Regency, as shown in Figures 1 and 2.

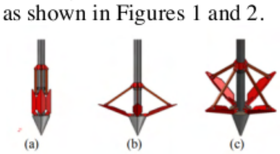

Fig. 1. Folding Type Anchor Design, (a) Folded Anchor, (b) Interface of Opened Anchor, (c). 3D View of Opened Anchor

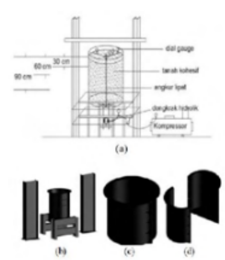

Fig. 2. Column Test Design, (a) Varied Anchor Depth, (b) Column Test Apparatus, (c) Column Model Test in 3-Dimensional View, (d) Column Mold in Opened Condition.

Modeling the anchor tensile test using the column test box test, giving density variations in order to observe the tensile strength of the anchor. Das (Das,1990) summarizes a number of published laboratory and field test results to determine the tensile strength of anchors for short-term conditions in soft ground:

$$Q_u=Q_o+W_a+Fs \quad (1)$$

Where: Q_u = Gross traction capacity of the anchor, Qo = Pull-up Capacity, Wa = Effective weight of the anchor and Fs = mud suction force which are functions of Cu and k.

Value of Qo according to Vasic (1971)

$$Qo = A\,(\gamma H+Fc.Cu) \quad (2)$$

Where: A = Area of anchor's plate, γ = Wet density of soil, Fc = Break out factor and Cu = Undrained Cohesion

Furthermore, Fc is a function of Cu and the ratio of anchoring. referred to Das (Das, 1990):

$$Fc = n(H/D) \leq F^*c = 9 \quad (3)$$

N value ranged between 2 – 5,9 depends on Cu value. For each integrated anchor model with a depth of 120 cm with variations at qc = 15-30 kg / cm^2, qc = 30-40 kg / cm^2. The density in the test column of the test column is measured using a hand penetrometer. After that, he is allowed to stay in the test. The tensile test is performed using a tool with a tensile test tool diagram as shown in Figure 2. After being observed, then analyzed the tensile capacity for all anchor models tested. The result can be determined from the behavior of load relationship with the tensile strain during the tests.

4 RESULT AND DISCUSSIONS

Based on the initial design of the study, the soil used as a test medium is a cohesive soil. On the basis of the results of the examination of the soil characteristics, the following soil parameters are produced:

Water Content = 23,25%; Specific Gravity (Gs) = 2,62; Liquid Limit = 63,58%; Plastic Limit = 34,21%; Plasticity Index = 31,26; Sieve Analysis 83,2% passes through sieve No. 200.

Anchor model test results. Based on the design of the anchors tested in this study which consisted of 3 types of depths, namely depths of 30 cm, 60 and 90.

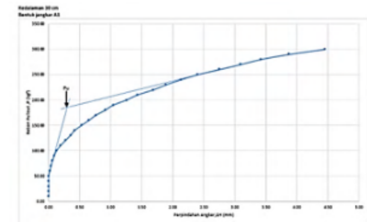

Fig. 3. The graph of the determination of the tensile capacity for 30 cm of depth.

Table 1. The test results of the limit tensile capacity.

No	Anchor Type	Pu (Kgf)		
		30 cm	6 cm	90 cm
1	Folded	158	506	535

5 CONCLUSIONS

Based on the results of the model tests carried out in the laboratory, it is concluded as follows:

- A decrease in traction capacity at lower depths.
- Planting depth has limitations on the efficiency of increasing traction capacity.

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