DETERIORATION DEPTH OF CEMENT TREATED CLAY UNDER SULFATE EXPOSURE

Final Project Report

As one of the requirements to receive bachelor degree of

Universitas Atma Jaya Yogyakarta

By:

Thea Pradita

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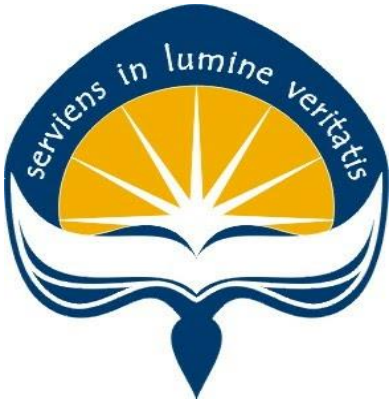

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APPROVAL

Final Project

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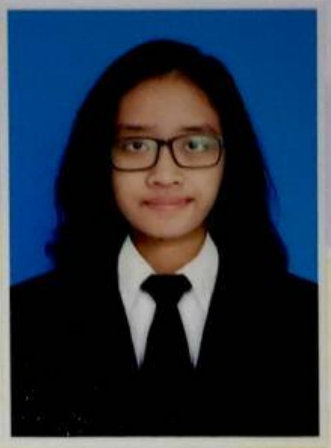

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Yogyakarta, July 2018

Author,

Thea Pradita

PREFACE

The research is one of the requirements of fulfilling bachelor degree of Universitas Atma Jaya Yogyakarta. The background of the research is to overcome the problem of structure construction above soft marine clay. Soft clay has a very low strength. It is even more severe when soft clay is located in marine area which is considered as one of the corrosive environments. Soft clay that is initially very poor in strength, is also containing sulfate if it is located in marine area. Thus making it as a very weak ground. To overcome the problem, soil improvement is needed. Soil deep mixing is one of the techniques on improving the ground. Artificial marine clay is made by adding $MgSO_4$ into lumpur sidoarjo or Lusi that is very high in water content. The clay is then mixed with cement to represent the deep mixing state and thus cured for certain periods. Penetration test is done afterwards in order to obtain the tip resistance.

Chapter I of the report contains the introduction before getting into research's references in Chapter II which is literature review. Chapter III contains all the basic theory on writing the report. Chapter IV is methodology, which explains the method or steps on doing the research. Chapter V covers laboratory test result that is then analyzed in chapter VI. The last section is Chapter VII which is conclusion and suggestion. Author realizes that the report is not perfect and thus author apologize profusely.

Yogyakarta, June 23rd 2018

Author

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ABSTRACT

DETERIORATION DEPTH OF CEMENT TREATED CLAY UNDER SULFATE EXPOSURE, Thea Pradita, Student ID Number 14 13 15385, year of 2018, Geotechnical Engineering, International Civil Engineering Program, Department of Civil Engineering, Universitas Atma Jaya Yogyakarta.

One of a major problem in geotechnical field is soft soil because of its low strength. In order to be able to build a structure above soft soil, soil improvement has to be done. Deep mixing is one of soil improvement implementation. Deep mixing is done by forming soil pile of cement treated clay with in-situ mixing. However, when soft soil is located in marine area that is considered as an extreme environment, the seawater may cause corrosion to the soil pile. Sulfate is one of the chemical content in seawater that is corrosive. Thus, the objective of the paper is to know about how severe the deterioration of soil pile with variation of cement content (c_c), water content (w_c), and curing time (t) after the pile exposed to sulfate. Magnesium sulfate is used to represent sulfate with the content of 10% which is uniform for all piles. The exposure is represented by the immersing of soil pile onto soil-sulfate mixture for 7, 14, 28, and 56 days. The deterioration of the pile is investigated using penetration test. The output of penetration test is in the form of cone penetration resistance (R) vs penetration depth (d) graph. The result of the test shows that deterioration depth decreases as the increase of cement content, and the decrease of water content. Furthermore, the on the undeteriorated zone, the resistance (R_{reff}) increases along with the increase of c_c. In addition, Ca^{2+} and Mg^{2+} ion investigation is also done in order to know the content of ion from the surface of the pile up to 1.5 cm below. It shows that the deeper, the more Ca^{2+} exists. In contrary to that, Mg^{2+} decreases as the depth increases. This indicates deterioration at the surface area which exposed to seawater.

Key Words: Sulfate Exposure, **Cone Penetration Resistance, Deterioration Depth, Magnesium Sulfate.**

GLOSSARY

R or F	: Cone/ tip/ penetration resistance (N)
d	: Penetration depth (mm)
w_c	: Soil water content (%)
c_c	: Cement content (%)
d_n	: Deterioration depth (mm)
R_{reff}	: Reference cone resistance (N)
α,β,γ	: Matlab constants
C	: Cement content (kg/m^3)
t	: Curing time (days)
w_{ct}	: Theoretical water content (%)
w_{cf}	: Final water content (%)
W_s	: Weight of soil (kg)
W_w	: Weight of water (kg)
W_c	: Weight of cement (kg)