ECONOMIC DESIGN OPTIMIZATION OF PREFABRICATED VERTICAL DRAIN CONSTRUCTION

Final Project Report

As one of the requirements to receive Bachelor Degree

of Universitas Atma Jaya Yogyakarta

By:

ALVIN SANTO PUTRA

17 13 16787

INTERNATIONAL CIVIL ENGINEERING PROGRAM

FACULTY OF ENGINEERING

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VALIDATION SHEET

Final Project

ECONOMIC DESIGN OPTIMIZATION OF PREFABRICATED VERTICAL DRAIN CONSTRUCTION

By:

ALVIN SANTO PUTRA

Student ID Number: 171316787

Has been checked and approved by:

Yoyakarta,……..

Supervisor,

Dr. Luky Handoko, S.T., M.Eng.

Approved by:

Department Head of Civil Engineering

(Ir. AY. Harijanto S., M.Eng., Ph.D.

VALIDATION SHEET OF EXAMINERS

Final Project

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Has been examined and approved by:

Name	Signature	Date
Chief	……	…….
Secretary	……	…….
Member	……	…….

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Author, the one whom signed below:

Name	: Alvin Santo Putra
Student Number	: 171316787
Area of Concentration	: Geotechnical Engineering

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Yogyakarta, June 2021

Author,

Alvin Santo Putra

PREFACE

The author would like to thank the Almighty God for His guidance and blessing so that this final project could be done and the author could write this report based from it.

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Yogyakarta, June 2021

Alvin Santo Putra

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ABSTRACT

ECONOMIC MODEL OPTIMIZATION OF PREFABRICATED VERTICAL DRAIN CONSTRUCTION, Alvin Santo Putra, Student ID Number 171316787, year of 2021, Geotechnical Engineering, International Civil Engineering Program, Department of Civil Engineering, Universitas Atma Jaya Yogyakarta

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Soft soil, a soil which is considered as poor soil as it has low shear strength, low permeability, and time-dependent settlement causing consolidation phenomena, currently exist in major parts of unused land. In order to solve consolidation problem in soft soil, ground improvement method called vertical drain has been developed. One of the better methods of ground improvement is called Prefabricated Vertical Drain (PVD), as it could resist shear load from the soil and considered cheaper compared to other alternatives. However, in practice, the installation of PVD is still producing high amount of overall construction cost, which may raise it up to 30%. Thus, in order to minimalize the fluctuation of cost in construction cost, optimization of PVD is being researched in this Study.

Optimization in construction is a method that consider the optimum performance of structure, indicated by fulfilling design criteria needed for the structure, while producing least cost possible for the project. In this study, the optimization performed is exact optimization solution for PVD installation. The optimization used PVD dimension length and spacing to determine the minimum cost as optimization target, with design criteria of Degree of consolidation reaching ≥95% in one year period. The process of optimization will then be coded using MATLABR2013a, using data from previous study regarding optimization of PVD.

The result of the optimization in this study is an economic model of PVD modelled in MATLAB software, with the dimension of length = 33 m and spacing = 2 m, resulting in 95.2% of Degree of Consolidation in half year period. Furthermore, sensitivity study is also being performed, to determine which soil properties affect PVD installation cost, in order to choose the most optimum soil treatment for other projects. The sensitivity study determines that the soil properties affecting PVD installation cost the most comes from soil Coefficient of Volume Change (Mv) and Vertical Coefficient of Permeability (kV).

Keywords: Prefabricated Vertical Drain, Optimization Method, Cost Estimation