

STABILIZATION OF CLAY BY FLY ASH AND CEMENT

Final Project

By:

**PERDANA KUSUMAH GONDO WIJAYA
Student Number: 00 13 10252**



**ATMA JAYA YOGYAKARTA UNIVERSITY
Faculty of Engineering
Department of Civil Engineering
International S1 Program
2010**

APPROVAL

Final Project

STABILIZATION OF CLAY BY FLY ASH AND CEMENT

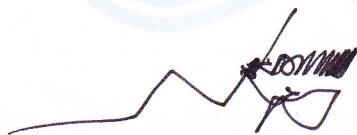
By:

PERDANA KUSUMAH GONDO WIJAYA
Student Number: 00 13 10252

has been approved

Yogyakarta,

**International Program of Civil Engineering
Head**



Ir. Y. Lulie, M.T.

Advisor



Ir. John Tri Hatmoko, M.Sc.

**Department of Civil Engineering
Head**



Ir. Junaedi Utomo, M.Eng.

APPROVAL

Final Project

STABILIZATION OF CLAY BY FLY ASH AND CEMENT

By:

PERDANA KUSUMAH GONDO WIJAYA
Student Number: 00 13 10252

has been examined and approved by the examination committee

		Signature	Date
Chairperson	: Ir. John Tri Hatmoko, M.Sc.		AUG 3 2010
Member	: Ir. Junaedi Utomo, M.Eng.		August 3, 2010
Member	: Ir. Ch. Arief Sudibyo		03 08 2010

ACKNOWLEDGEMENT

The writer would like to express thank to Jesus Christ for grant and blessing so that the final project with the title **STABILIZATION OF CLAY BY FLY ASH AND CEMENT** has completed as a prerequisite for finishing the study at International S1 Program, Civil Engineering Department, Faculty of Engineering, University of Atma Jaya Yogyakarta.

During the process of writing, the writer has received many supports, both directly and indirectly which are consisting of suggestions and instructions. Be aware of supports from many people, the writing process of this final project will not be realized.

At this good opportunity, the writer would like to express thank to:

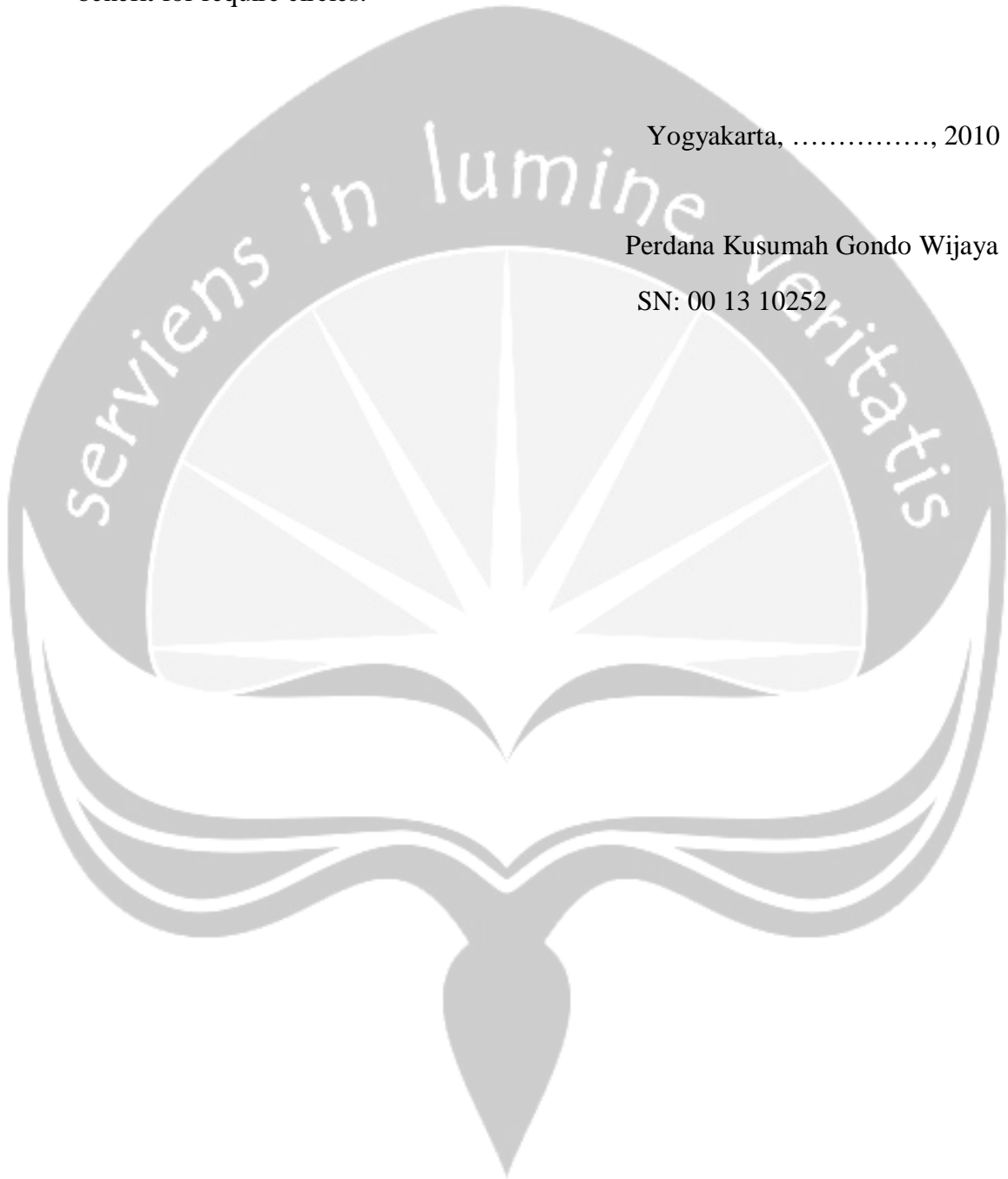
1. Ir. John Tri Hatmoko, M.Sc., as the advisor of this final project, thanks for everything.
2. Ir. Y. Lulie, M.T., as the Head of International S1 Program Civil Engineering of Atma Jaya Yogyakarta University.
3. Sumiyati Gunawan, ST., MT., as the Head of Soil Mechanics Laboratory of Atma Jaya Yogyakarta University.
4. Mr. Harto as the laborant of Soil Mechanics Laboratory of Atma Jaya Yogyakarta University, thanks for helping.
5. Mas Wiko as the officer of International S1 Program Civil Engineering of Atma Jaya University, thanks for helping.
6. Father, Mother, my brother and sister, thanks for keep supporting me.
7. All International Civil Engineering students, especially for Class of 2000 (Cahyo, Budi, Chris, Febry, Arnold, Diwan, Sandy, Riris, Ita, and Tulodho). Thanks for accompanying me in class.
8. All of friends and relatives for supporting.

Finally, the writer realizes that this project is far infallible, whereas the writer has limited and unperfected abilities. Hopefully this final project has benefit for require circles.

Yogyakarta,, 2010

Perdana Kusumah Gondo Wijaya

SN: 00 13 10252



CONTENTS

Title	i
Approval I	ii
Approval II	iii
Acknowledgement	iv
Contents.....	vi
List of tables	ix
List of figures	x
List of appendix	xi
Abstract	xii
CHAPTER I. INTRODUCTION	1
I.1. Background.....	1
I.2. Problem Statement	2
I.3. Problem Limitation	2
I.4. Research Objectives	2
I.5. Research Originality.....	3
CHAPTER II. LITERATURE REVIEWS	
AND BASIC THEORIES	4
II.1. Literature reviews	4
II.2. Basic Theories	9
II.2.1. Fly Ash	9
II.2.1.1. Definition of Fly Ash.....	9
II.2.1.2. Fly Ash Chemical Element Analysis.....	10
II.2.1.3. Physical Attribute And Characteristics.....	11

II.2.1.4. Fly Ash Influence To Soil.....	11
II.2.2. Clay Soil.....	12
II.2.2.1. Clay Soil Definition.....	12
II.2.2.2. Soil Properties	12
II.2.2.3. Clay Soil Characteristics.....	14
II.2.3. Cement	16
II.2.4. Soil Stabilization.....	16
CHAPTER III. RESEARCH METHODOLOGY	17
III.1. Materials And Instruments.....	17
III.1.1. Materials.....	17
III.1.2. Instruments	17
III.2. Research Procedure	21
III.2.1. Materials Test	21
III.2.1.1. Clay	21
III.2.1.1.1. Clay Characteristics Test (Water Content).....	21
III.2.1.1.1. Compaction (Standard Proctor Test).....	22
III.2.1.2. Fly Ash	25
III.2.2. Sample Preparation And Production.....	25
III.2.2.1. Sample Preparation	25
III.2.2.2. Sample Production	26
III.2.3. Curing Time	28
III.2.4. Unconfined Compression (UCS) Test	28
III.3. Research Flow Chart.....	31

CHAPTER IV. RESULT AND ANALYSIS32

IV.1 Material Test Result32

IV.1.1. Clay Characteristics Test Result32

IV.1.2. Standard Proctor Test Result.....33

IV.2 Unconfined Compression Test (UCS) Result.....38

IV.2.1. Clay Soil + Cement38

IV.2.2. Clay Soil + Cement + Fly Ash.....41

CHAPTER V. CONCLUSION AND SUGGESTION44

V.1. Conclusion44

V.2. Suggestion.....45

REFERENCES

APPENDICES

LIST OF TABLES

Table No.	Description	Page
2.1	Fly ash Chemistry Element	10
2.2	Type of Cement	16
3.1	Total sample for UCS test	28
4.1	Water content test	33
4.2	Unit weight	34
4.3	Data for OMC calculation	36
4.4	UCS Test of Clay-Cement Result conclusion	38
4.5	UCS Test of Clay-Cement-Fly Ash Result conclusion	41

LIST OF FIGURES

Figure No.	Description	Page
3.1	Oven	18
3.2	Weight scales	18
3.3	Mold	18
3.4	Split Mold Cylinder	19
3.5	Hammer	19
3.6	Extruder	19
3.7	Caliper	20
3.8	Unconfined Compression test machine	20
3.9	Clay + fly ash mixing	26
3.10	Sample on plastic bag	26
3.11	Sample compaction	27
3.12	Research Flow Chart	31
4.1	Unit weight after water addition	34
4.2	Average moisture content And weight dry volume	37
4.3	Friction Angle Value of Clay-Cement	39
4.4	Shear Strength Value of Clay-Cement	39
4.5	Cohesion of Clay-Cement	40
4.6	Friction Angle Value of Clay-Cement-Fly Ash	42
4.7	Shear Strength Value of Clay-Cement-Fly Ash	42
4.8	Cohesion Value of Clay-Cement-Fly Ash	43

LIST OF APPENDICES

Description
Unconfined Compression Test (UCS) Result



ABSTRACT

STABILIZATION OF CLAY BY FLY ASH AND CEMENT,

*prepared by Perdana Kusumah Gondo Wijaya, SN: 00 13 10252, year of 2010,
Civil Engineering, Engineering Faculty, Atma Jaya Yogyakarta University.*

Research about stabilization of clay with many kind of stabilizers such as cement, lime soil, cane pulp ash has been done. However, study of clay stabilization soil is still interesting subject to be investigated. This research investigated capability of fly ash, as a waste material, with the addition of cement as pozzolanic material, combined with clay soil, to increase the shear strength and cohesion of these clay.

The research was divided into 2 steps of test. The first was to find the OMC (Optimum Moisture Content) condition of clay. This step covered clay characteristics test (water content test) and standard proctor test (compaction method). The second step was Unconfined Compression test (UCS). This test was to find the optimum shear strength and cohesion of clay that was stabilized with fly ash and cement. The percentage of cement which added were 0%, 8%, 12%, and 16%; and the percentage of fly ash which added were: 0%; 12%, 24%, and 36%.

The results of the research were: clay reach the optimum moisture content when added with 901.54 ml of water, and reach the optimum shear strength and cohesion when added with cement as much as 8% of percent and fly ash as much as 12% of percent. Addition of cement and fly ash above that percentages were useless. Another results were shear strength and cohesion reach the optimum value on 14th day of curing time rather than 1st day and 7th days of curing times.

Keywords: Clay, fly ash, cement, water content, optimum moisture content, friction angle, cohesion, shear strength.