CHAPTER I

INTRODUCTION

1.1.General Background

Every people need to build a house for make them safe from any other external conditions and things that it can be happen in the world. So, the house should be strong, safe and comfortable for people. Not only house, people need another great building for work, control the health of human, hang out, and so on. If the building is strong people feels safe and if people feels safe it means that people will feel comfortable to live or doing something in that building.

Build a building is not simple, people should prepare the materials and construct step by step. Before preparing the right materials, people should know the mechanics properties of material whether it is strong or not for the building, environmental friendly or not, has a bad effect for the structure of the building or not and so on.

There are several materials that should be prepared before constructing the building such as steel, concrete, iron, rock, water, sand, gravel and so many other materials. Every single material should have a good quality and should be strong enough for the building.

Concrete is one of the important materials for buildings. Concrete should be strong enough and have a good quality. To make good quality of concrete, people

should find right materials that will be used. "*So far we know concrete is the most popular building material, composed of the main composition of the rock (aggregate), water, and portland cement (commonly called cement only.*" *(Hardjito, 2002)*

Now, people meet some problems in utility of Portland cement for concrete. The first attention about cement is gas emissions; GHG (carbon dioxide) produced in the cement production process. To produce 1 ton of cement, the emissions that produced also 1 ton. The emissions released to the atmosphere will make global warming. This condition makes Davidovits (1970) from France was started to do a research about material that used for pyramid because a lot of building include pyramid in Egyptian can last a long time and there is no global warming or emission problem because of the materials.

People thought that Pyramid is like Borobudur Temple that construct by bricks. But, Davidovits (1979) proves that Pyramid is different with Borobudur Temple. From the research of Davidovits (1970) raise the result that chemical structure and the material structure that used for build a Pyramid was same with the material of the geopolymer concrete.

In geopolymer concrete people replace cement with fly ash. So, the material will be environmental friendly. Geopolymer concrete is said environmental friendly because fly ash comes from the combustion of stone embers that have no toxic solvents. During this time, fly ash (the small size of particles and therefore easy to fly in the air) not more properly used or only used as a heap.

Irresponsibility dumping potentially threatens environmental sustainability, fly ash can easy to fly and make air pollution. Particles of heavy metals that contain in fly ash can also easily soluble and contaminate the water sources. To dissolve the elements silicon and aluminum in the fly ash people will use alkali activators. Alkali activators containing sodium hydroxide and sodium silicate or a potassium hydroxide and potassium silicate will be calcium in the geopolymer concrete. This material from fly ash and alkali activators will mixed with aggregate and be a geopolymer concrete. So, this concrete would not using cement again. This fly ash and the calcium will be mixed together become a stronger chain. In this paper the writer tries to replace fly ash by metakaolin and silica fume to test the compressive strength and modulus of elasticity of the geopolymer base on those two materials.

Metakaolin is a dehydroxylated form of the kaolin. Kaolin is a clay mineral, with the chemical composition $Al_2Si_2O_5(OH)_4$. *"Metakaolin was taken from Gunung Kidul County, province of Yogyakarta. In this research metakaolin was also burnt at 500° Celcius during 25 minutes. Metakaolin burnt at 500° celcius contain of* $SiO_2 + Al_2O_3 + Fe_2O_3$*."(Lisantono and Hatmoko, 2012)*

Silica fume is the material which has same composition with metakaolin. Both of them consist of silica and calcium with the different proportion. The reason of using 2 materials (metakaolin and silica fume) is because the silica fume is just an addition to make the concrete stronger after the NAOH decrease the strength

of the metakaolin. The silica fume is an addition because between metakaolin and silica fume the highest value of Si is silica fume, it is better to make the silica fume as the addition.

1.2. Problem Statement

Based on the background above the problem statement is:

- "What is the effect of the metakaolin and silica fume to the compressive strength of the geopolymer concrete?"
- "How many percent of metakaolin that will be used to make a strong geopolymer concrete?"

1.3. Problem Limitation

In order to focus on a specific problem, there must be some limitation in this final project, such as:

1. Geopolymer concrete with metakaolin and silica fume as the main materials
2. The size of the specimens will be 70mm x 140mm and 150mm x 300mm.
3. The tests that will be done are compressive strength and modulus elasticity.

4. The percentages of metakaolin in the specimen that will be tested are 25%, 50% and 75% from the weight of concrete.
5. The addition of silica fume will be 5% of the weight of concrete.
6. Concentration of NaOH will be 12 M
7. Percentage of NaOH : Na_2SiO_3 is 2:1
8. Ratio of Alkali Activator to the aggregate is 1:3
9. Curing method of the geopolymer concrete is dry curing. The concrete will be put into the oven as long as 24 hours with the heat of the oven is 80°C.
10. The process of making geopolymer concrete.
11. The analysis based on the research.

1.4.Objectives

The objectives of this final project are:

- To examine the geopolymer concrete
- To give an information about the differences between ordinary concrete and geopolymer concrete.
- To explain to the reader about the advantage of geopolymer concrete.
- To give an information about "how to make geopolymer concrete"

1.5.Final Project Originality

There are some topics about geopolymer concrete with fly ash and superplasticizer in the library of Universitas Atmajaya Yogyakarta. But, the topic about “Geopolymer Concrete with Metakaolin and Silica Fume” has never been used on any other final project before.