CHAPTER I

INTRODUCTION

1.1 Background

Self-Compacting Concrete (SCC), which flows under its own weight and does not require any external vibration for compaction, has revolutionized concrete placement. SCC, was first introduced in the late 1980's by Japanese researchers, is highly workable concrete that can flow under its own weight through restricted sections without segregation and bleeding. Such concrete should have a relatively low yield value to ensure high flow ability, a moderate viscosity to resist segregation and bleeding, and must maintain its homogeneity during transportation, placing and curing to ensure adequate structural performance and long term durability. The successful development of SCC must ensure a good balance between deformability and stability.

Self-Compacting Concrete often produced with lesser water-cement ratio yielding early strength and hence faster use of structures. Then, the elimination of vibrating equipment can reduce noise and vibrations. Moreover, to ensure high filling ability and flow without blockage, Self-Compacting Concrete should take lesser coarse aggregate contents and high cement content which can increase the cost and temperature during hydration which leads to creep and shrinkage

In Self Compacting Concrete, it is generally necessary to use superplasticizer in order to obtain high mobility. Moreover, according to Ashar et al (2013), addition of superplasticizer in Self Compacting Concrete will reduce

water content that cause higher durability, in addition to better mechanical integrity of the structure.Adding a large volume of powdered material or viscosity modifying admixture can eliminate segregation.

As coal is burned in a power plant or industrial boiler, its noncombustible mineral content (ash) is partitioned into bottom ash (or slag), which remains in the furnace, and fly ash, which rises with flue gases. Bottom ash is easy to collect since it is removed during routine cleaning of the boilers. The properties of bottom ash make it a good road base and construction material, and, as such, it can be readily given away or sold. Fly ash, on the other hand, is not so easily disposed of. Most fly ash is captured by pollution control devices before release to the atmosphere (Daniels *et al*., 2002).

The use of fly ash as a material for self-compacting concrete is very beneficial because the use of fly ash reduces permeability, bleeding, water demand and the heat of hydration. It also improves workability, however strength development is slower. For every ton of cement that is a manufactured, approximately one ton of carbon dioxide gas, the main greenhouse gas, is released into the environment. From an environmental perspective, one of the benefits of fly ash is that the replacement of large portions of cement with fly ash serves to reduce CO_2 emissions, thus making concrete an even greener material.

To enhance the properties of fresh and harden concrete, the addition of fly ash can be used as partial replacement of cement. Then, the use of fly ash in concrete is very beneficial because it is not only economical from cost but it also improves the fresh and hardened properties of concrete. Usually, the addition of

fly ash is about 10-35% replacement to the cement can helps to maintain the viscosity of concrete resulting to in blockage risk and decreases the superplasticizer requirements.

Indonesia has a very huge amount of fly ash. Ash from combustion stuck in chimney burning coal and bottom ash. Then to use the fly ash, ashes from burning coal and bottom ash are released from burning coal furnace base. Unfortunately, fly ash is only left in ponds around coal fired power plant make up a mountain ash. This condition will raise problem on environment aspect due to the increasing number of fly ash in each year. It is quite plausible that Indonesia has huge reserves of coal, which is about 64 829 million tonnes (Hartono et al, 2009). In this research was purchased from PT. SCG Ready mix Indonesia, Central Business Unit Solo.

1.2 Problem Statement

1. What are the effects of coal fly ash as cement replacement on the mechanical properties of self compacting concrete?
2. What is the optimum fly ash content as cement replacement to improve mechanical properties (compressive strength, flexural strength, modulus of elasticity) on self compacting concrete at 28 days?

1.3. Research Objectives

1. To analyze the effect of fly ash on the mechanical properties of self compacting concrete.

2. To determine the optimum fly ash content as cement replacement in improving mechanical properties on self compacting concrete at 28 days.

1.4 Research Scope

The scope of this research included an examination of:

a. The target of compressive strength of self-compacting concrete is30 MPa at 28 days;
b. Flexural strength, modulus of Elasticity and compressive strengthwas determined
c. Fly ash that was used for this research is class F fly ash
d. Slump Flow test(Fresh concrete)was calculated
e. Variation of fly ash content is 0%, 15% and 35%

1.5 Benefit of Research

1. Practical benefit

The researcher expects that this research can be used as problem solving reference for answering the weakness of conventional concrete with self-compacting concrete.

To researcher: gaining holistic knowledge and skills on investigating the effects of fly ash on mechanical properties of self-compacting concrete by processes, procedures, and techniques together with research conducting capability in laboratory

To decision makers: to use information and data for plan purposes in efficient and economical fly ash utilization.

To societies: Benefit from reduced cost of construction, improved concrete quality (durability, workability, reduced temperature, etc.)

To Environment: Minimize environmental pollution caused by fly ash leftover from coal production

2. Theoretical benefit

The researcher expects that this research can be used as theory contribution for especially the different between self-compacting concrete and conventional concrete.

To academia: By formulation of working principles, guidelines, directions, analysis skills, etc., the academia would be equipped with valuable knowledge. Additionally, this will help to add the literature on related self-compacting concrete modified with fly ash, to improve design specifications in field of engineering related to SCC.