CHAPTER I

INTRODUCTION

1.1. Background

Reinforced concrete is one of the most common construction materials for building. As a construction material concrete have many advantages such as relatively cheap, high compressive strength, easy to produce, accessible material and low maintenance. These days the world has discovered a new generation of concrete known as Ultra High-Performance Fiber Reinforced Concrete (UHPFRC). UHPFRC have a superior property when compare to other concrete material. Because of this it is important to introduce this kind of material in Indonesia construction. According to Wang et al. (2015) despite the superior properties UHPC is generally costly and cannot replace the conventional concrete in most applications where the conventional mixtures can economically meet the performance criteria. This material is also hard to produce because of its complicated raw material. To reduce the possibility of failure, a need to establish computational model to analyze and provide realistic assessments of the strength, stiffness, and ductility of existing structures.

UHPFRC have a compressive strength of more than 120 Mpa. According to Sugano et al. (2007) the use of UHPFRC can allow more taller building, more effective design of section with smaller size member, and enlarge the usable area of building. Wang et al. (2016) stated with higher compressive strength and

ductility UHPFRC is suitable for heavy loaded structural component, for example in column. Reinforced column is one of the key components of a structure building, because it is the component to withstand axial load from the whole structure and connected it to the foundation. The behavior of reinforced column can be affected by the type of concrete and the column reinforcement bar especially transverse reinforcement. Transverse reinforcement can enhance the compressive strength and strain of column. This happened due to the confinement that the column gets from column transverse reinforcement. The increase of transverse reinforcement number and strength can increase the compressive strength and ductility of UHPFRC column (Heshe and Nielsen, 1992; Sugano et al. 2007; Hosinieh et al. 2015).

Computational model of UHPFRC column have been done by several researcher using Finite Element Model (FEM) in the past years. To model UHPFRC column it is important to pick FEM that can well represent the behavior of column and UHPFRC. According to Wang et al. (2016) FEM that is suitable to model column are using the fiber Elements. Fiber element can represent more accurate important aspect such as divided section of concrete and steel bar, the interaction of axial load and biaxial bending moment, and the confinement of concrete core. One of the Fem platform that utilize fiber element are Opensees. Numbers of studie have use OpenSees to model column. The result show Opensees can provide response that is consistent with experimental data (Wang et al. 2016; Wong, 2018; Wang et al. 2019). In this study a 3 model of UHPFRC column with different cylinder compressive strength will be modeled using OpenSees. The model result will be calibrated with laboratory experimental result of Sugano et al. (2007).

1.2. Research Formulation

Concrete is one of the common materials that are often used in construction. There are many types of concrete that can be used in construction, one of the most advance concrete is UHPFRC. The behaviors of UHPFRC is still being studied until this time. UHPFRC have high production cost and not easy to make, there for applying it in construction is very challenging. Numerical studies using finite element method (FEM) are considered more economical, faster, and the result tend to be more rigorous than laboratory test. Accurate computational model need to be made to analyze the behavior of UHPFRC before applying in construction. This study, author will model UHPFRC under axial load using Finite Element Method (FEM), in form of stress and strain. The result will be calibrated with Sugano et al. (2007) experimental result. Computational model will be executed in a Finite element software of OpenSees.

1.3. Research objective

To Model the stress-strain behavior of UHPFRC reinforced column under Axial Load using Opensees platform and calibrate the numerical stress-strain result with Sugano et al. (2007) experimental result

1.4. Research Scope and Limitation

In the study conducted in this report, the following research limitations were set below:

- Modeling is done using the finite element Opensees software.

- Material Parameter in this study is based on the experimental result of Sugano et al. (2007).
- This study only calibrates the stress-strain result of an axial loaded reinforced concrete column.
- This study only use 1 type of column dimension.
- The output of this study is the stress-strain curve of the model.

1.5. Research Benefit

The results of this final project study are expected to make readers know the effects of confinement toward the behavior of UHPFRC column. In addition, it is expected that this study can be a reference in conducting numerical modeling and parametric study, so the research using numerical simulations can be done accurately and provide precise predictions, same as the results obtained in laboratory tests.