CHAPTER I

INTRODUCTION

1.1. Background

Recent earthquake disasters in Indonesia have shown that casualties due to earthquake were mostly caused by damage on buildings. Therefore, a building must perform well during earthquake, i.e., strong enough to resist the earthquake force or if the building is damaged, building occupants should be safe.

Retrofitting of reinforced concrete (RC) structures can lead to increased stiffness, strength, and failure deformation. Some structures cannot be kept closed for longer downtime required for reconstruction. Retrofitting is the efficient method which can be adopted to combat all these defiance. If seismic energy is dissipated at locations that make the structure unable to satisfy the equilibrium of forces, collapse is inevitable

Considering the past Earthquakes, a strong need for the retrofitting of the existing buildings has been felt. Existing structures need strengthening in the following circumstances:

1. Buildings have not been designed and detailed to resist seismic forces
2. Buildings might have designed for seismic forces, but as per old seismic codes.
3. The lateral strength of the building does not satisfy the seismic forces as per the revised seismic zones or designed base shear.
4. Construction is apparently of poor quality.

5. There have been additions of change of use of building with increased vulnerability.

Seismic retrofitting can be defined as the addition or modifications adopted to an existing structure in order to strengthen it and enable it to withstand the expected earthquake loads in that region. There are various types of retrofitting methods in practice. These can be broadly divided into global and local retrofitting techniques.

Global retrofitting means the strengthening is done to the structure as a whole and the results can be seen in the structural performance. Some of the examples of global retrofitting are addition of shear walls, addition of steel braces, addition of infill wall, mass reduction etc. The local retrofitting techniques stand for those techniques which are applied on individual members such as beams or columns of the structure which need intervention and aim to improve the performance characteristics of these members. This need not lead to change in the performance of the structure as a whole. Examples of such techniques are jacketing of beams, columns or footings using concrete jacketing, steel jacketing etc. The jacket increases both the flexural strength and the shear strength of the beam or the column.

Several different approaches are available for engineers to strengthen existing reinforced concrete (RC) structures, all being motivated by the need to increase the structure performance. The use of externally bonded fibre-reinforced polymer reinforcement (EBR-CFRP) systems offers several

advantages, relative to existing techniques such as steel plating and section enlargement, to enhance the capacity of existing structural members

Externally bonded CFRP systems consist of a composite fabric made of fibers (typically carbon or glass) and an epoxy resin as a binding matrix. The composite fabric, which is comprised of one or more plies or sheets, is externally bonded to the relevant exterior surface of the RC structure using epoxy resin. CFRP spike anchors are a particularly effective type of anchorage devices as they can be applied to a wide variety of structural forms that have been strengthened with CFRP composites

The behavior and capacity of CFRP anchors have received research attention over at least the last decade. Several predictive models that are largely semi-empirical in nature, have been developed although an internationally recognized design methodology has not yet been developed.

1.2. Problem Statement

Analyze an existing structure by doing non-linear seismic assessment and provide mixed retrofitting technique by using reinforce concrete jacketing wrapped by CCFRP based on the updated code ASCE 41-17

1.3. Objective

The Objective of this study are:

- To predict and provide more accurate analysis for a building to overcome the seismic hazard in the future
- To know the improved strength and performances of the local retrofitting technique applied

- To provide data and application of retrofitting technique for contractor in Indonesia and for further studies of Non-Linear Seismic Assessment

1.4. Research Limitations

- Existing building which is already designed by the structure consultant and already operating in Jakarta
- Focus on retrofitting using the local retrofitting for column by using Concrete Jacketing wrapped by CFRP without considering any global retrofitting method.
- Analysed by using Seismobuild Program to improve the capacity strength and performances of local retrofitting members
- Neglect the application and cost

1.5. Research Benefits

This research will give a result data for the usage of contractor and consultant in Indonesia to compare with another local retrofitting methods to be applied in Indonesia. The data from the non-linear analysis provided can be useful to give a consideration of increased strength by using the Jacketing with CFRP method. The result also serves as a guidance for an advanced research to improve the performance of the old or non-detailed seismic building in Indonesia.

1.6. Originality of Final Project

The scope of work in this paper is based on the user experience in assessing the building while doing an internship at one of the structure consultant office in Indonesia and supported by the theory of the structural analysis such as concrete and steel while studying in the university. The method used in this paper is based on the research of Mieczysław Kami*ń*ski et.al (2014) about the RC jacketing strengthened by CFRP wrap to be applied in the real structure or to act as a milestone of knowledge improvement and development for researcher in Indonesia.