CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Reinforced concrete (RC) is a composite material made up of concrete which consists of a mixture of Portland cement, sand, aggregates, additives with water and steel reinforcement. Today’s in this twenty-first centuries; our city landscape is mainly constructed from reinforced concrete due to its high relative compressive and tensile strength and provides long lifespan with low maintenance cost. This statement is significantly displayed by the icon building, Central Market, Kuala Lumpur which was constructed since year 1930s as wet market and being undergone the adaptive reuse process which transformed its function into handicraft and cultural center which leading it toward to be one of the famous tourists attraction till now.

The design service life of a reinforced concrete structure generally estimated as 100 years. However, in the real case, due to several factors such as weathering, ageing effect, insufficient maintenance and increased external loadings applied to the structures has deteriorated its structural capability. For an instance, formation of cracks on the surface of RC beam has weakened its strength and instigates corrosion to reinforcement which later led to partially or total failure of the structure (Wang J. et al., 2014).

This situation has concern the safety of the public when the condition of the building has deteriorated. In order to solve this issue, method to rehabilitate partially-failed reinforced concrete beam has widely discuss and practice in the construction industry. Therefore, in this chapter, the background, problem statements, objectives,
scopes and significance of this research study will be discussed. It will focus on the topics of rehabilitation of partially failed reinforced concrete beam by bolting aluminum coil which served as external plate reinforcement to regain its structural capability.

1.2 BACKGROUND OF STUDY

As a future civil engineer, we are exposed to knowledge regarding the structural behaviour of the reinforced concrete structural elements which included beams, columns, slabs and others. Although the design life span for the reinforced concrete structure is about 100 years, however due to weathering, insufficient maintenance, overloading and other factors, existing reinforced concrete structures may have loss its structural capability before reaching the ultimate designed lifespan. For an instance, the concrete may have expressed its partially failure mode-deflection or formation of cracks on its surface when it has undergone additional loadings to the extent that are not covered in the designed safety factors before the final failure takes place (Alaee & Karihaloo, 2003). Therefore, several strengthening methods should be implemented on this partially-failed reinforced concrete beam before final failure may take places.

One of the most commonly used solutions to implement on partially-failed RC beam is external strengthening as it is convenient to the owner or publics to rehabilitate the existing beam. According to the research study-Flexural strengthening of RC beam by bolted side plates (BSP) that carried out by Siu, Wing Ho in year 2009, bolted a steel plate to the both side of beam was one of the solutions to solve this issue as it would boost up the ductility, shear and flexural strength of the existing beam. It is also provides additional free space for erection of scaffolding which serves as prop support. Instead of placing steel plate on the both side of the beam, it is suggested that fibre reinforced-polymeric composite system can be bolted at the beam’s soffit which imitate the sandwich structure to be applied on RC beam to repair partially-failed RC beam (Mosallam et al., 2015).

Thus, in this study has focused on rehabilitation of partially-failed reinforced concrete (RC) beam by bolting aluminium coil to the soffit of the beam which imitates
the semi-sandwich structure in order to improve its structural capability to comply with the standard requirement.

1.3 PROBLEM STATEMENT

Flexural strength is the ability of the material to sustain loadings before it reaches partially or totally failure. Our city landscape is mainly constructed from reinforced concrete due to its high relative compressive and flexural strength and provides long lifespan with low maintenance cost.

However, reinforced concrete buildings are often exposed to loading from external surrounding such as vibration of machinery and equipment, wind action, heavy rainfall and others that applied on it (Lee & Barr, 2004). This may lead to decrease in fatigue life of the structure where deflection or cracks may be observed from the structural element which served as a good warning to the owner or publics before it has reached total failure (Ahmed et al., 2014). Therefore, upgrading and strengthening method need to be applied to the partially-failed element to improve its structural performance.

Based on the problem statement, this research study will be focused on the suitability of rehabilitation of partially-failed reinforced concrete beam by bolting aluminium coil beneath the beam to determine whether it can enhance the flexural and other characteristics of the existing beam or not.

1.4 OBJECTIVES

The objectives of this study are:

1. To investigate the flexural behaviour of partially failed RC beam strengthen with aluminium coil on the soffit of the beam
2. To compare the flexural strength between partially failed RC beam strengthen with aluminium coil and conventional RC beam (control RC beam)
3. To determine relationship of load applied to the deflection and pattern of cracking of the reinforced concrete beam