CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

High-rise buildings investment projects represent a component of the country’s economy power and a sign of advantage to the country. Malaysia was one of the countries which involved in the progress to establish high rise investment projects. Within this few years, the development of high rise building can be clearly observed especially at Kuala Lumpur, Penang and Johor. The main building construction material was concrete. Concrete had been widely used as it can be casted in different types of shape such as rectangular, circular and hollow shape. Concrete have long service life compare to timber, steel and others materials. Although, concrete able to withstand high compressive strength but it was quasi-brittle material and easily cracked as it was weak in resisting external forces when small stress applies (Z. Wang, Yang, & Wang, 2011). Since, concrete was weak in tensile strength, it will cause sudden tensile failure without warning. In order to improve the weakness of concrete, many types of fibres had been widely used from the past history. The sun-baked bricks reinforced with straw were used to build the Aqar Quf near Baghdad and horsehair for reinforce masonry mortar. Besides that, asbestos fibres had been used for few 100 years, but due to health hazards occur from asbestos fibres, others types of fibres had been replaced (Wafa Labib and Nick Eden).

The first research on the potential of steel fibres to replacing reinforcement rode had been analysed at United States during early 1960s. After that, more details of the research development had been carried out and also applied on industry (Wafa Labib
and Nick Eden). Glass fibre, synthetic fibre, natural fibre and steel fibre can be easily found at market. The mechanical and physical properties were difference for each type of fibre material.

For glass fibre, it had been applied in concrete since late 1950s. However, the ordinary glass fibres, such as borosilicate E-glass fibres, were affected by the cement paste which contain of alkali. Later on, more research and development was focus on producing glass fibres with containing zirconia which able to resist alkali. Hence, it had become the commercialized product and had been widely used in the United States. Currently, the glass fibres reinforced concrete were used for the production of architectural cladding panels for exterior used, many plant manufactured products and pre-packaged surface bonding products were used in housing applications (ACI Committee 544, 2001).

For synthetic fibres such as nylon and polypropylene had been used to mix with concrete but it were not successful as using steel or glass fibres. It was man-made fibres produce from research and development in the petrochemical and textile industries. In recent research, it was find out that synthetic fibre were able to use in construction elements because thin products produced with synthetic fibres able to retain integrity when support high ductility. Nowadays, synthetic fibre reinforces concrete widely used for slabs on grade, floor slabs and stay-in-place forms in multi-story buildings (ACI Committee 544, 2001).

Although there was not much research and development for natural fibre compare to other types of fibre, but recently research and development of natural fibre had been gradually increase. Natural fibre was one of the popular types of fibre which can be easily found from the market. It can be get at low cost and the manpower knows how to apply the technique by using natural fibre. Nowadays, natural fibres can manufacture thin sheet high fibre content fibre reinforces concrete (ACI Committee 544, 2001).

Steel fibres had been widely used compared to others types of fibre in reinforced concrete structures (Heng, R.Y. 2014). The addition of steel fibres or other types of
fibre to concrete was unable to prevent cracking but to control the size of cracks of concrete (Wafa Labib and Nick Eden). Discrete fibres in concrete slabs or pavements were able to change the mechanical properties such as tensile, flexural, ductility, ultimate strength and toughness of the concrete. Many researches carried out study about the behaviour of steel fibre reinforced concrete under impact resistance compare to unreinforced concrete. The tensile and flexural strength of concrete improve by addition of steel fibre.

1.2 PROBLEM STATEMENT

Plain concrete was brittle and poor in tensile strength. The tensile and compressive strength of concrete were not proportional. Typically, plain concrete had the tensile strength from 8% to 15% of its compressive strength. It was easily to get first crack appear when the concrete was applied by high load, hence it will loses the service load. The concrete structure with collapse as it lack of post-peak resistance. The weakness of concrete can be traditionally overcome by adding reinforcing bar or prestressing steel. However, the usage of reinforcing bar or prestressing steel was not environmental friendly. When produced cement and steel, the process involved will emitted carbon dioxide and other types of gas which will cause air pollution. Therefore, by reducing the usage of cement and steel, the rate of global warming and water level rising will decrease.

Steel fibres can be added into concrete mix to minimize the usage of steel while maintain the integrity of concrete structure. Some investigation had been carried out; the reducing of the amount of shear links can be achieved especially in the joint area of reinforced concrete frames when mixed with steel fibre. The investigations showed that applying steel fibres instead of shear reinforcement giving structural benefits such as reducing the construction cost.

The construction of high rise building required large structural components to support the load acting on the structural members. Normally, the design engineer will design the structure with large components to make sure it was able to sustain high load. Therefore, the structural members such as slab, beam and column will be designed in