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EXPERIMENTAL AND STATISTICAL INVESTIGATION ON MECHANICAL PROPERTIES AND IMPACT RESISTANCE OF SYNTHETIC FIBER REINFORCED CONCRETE*

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Abstract– In the current study an experimental/statistical approach addressing key mechanical properties (compressive, tensile and flexural strength) and impact resistance of such new fibers with inclusion of different volume of polyphenylene Sulfide (PPS) fibers has been carried out on 288 specimens. Results from this study revealed that compressive, tensile and flexural strength exhibit a good fit with normal distribution with a coefficient of variation less than 10%. However, impact resistance results were dispersed with no considerable conformity to normal distribution with a coefficient of variation around 40~50%. Additionally, higher percentage of fibers led to higher level of data scatter which may be attributed to the considerable effect of the presence of more fiber-concrete interfaces. Tests also proved a direct correlation between percentage of fibers versus mean and coefficient of variation values. Moreover, based on acquired results a General Linear Model (GLM) was developed for impact resistance of PPS fibers considering fiber content. Required replications of tests considering fiber content and required accuracy were also proposed.

Keywords– Fiber reinforced concrete, PPS fibers, statistical, impact resistance, mechanical properties

1. INTRODUCTION

In recent years, high-strength concrete has been widely used in the world. The term "high strength concrete" refers to concretes with compressive strength of more than 42MPa [1]. In the construction industry, HSC has been beneficially adopted for reinforced pre-casted and pre-stressed products, structures, columns and shear walls of high-rise buildings, etc. High strength concrete and plain concrete are brittle materials [2-3]. Adding fibers is one method which makes concrete less brittle and resistant to cracking [4-5]. Fiber incorporation in concrete enhances many of the engineering properties of these materials such as fracture toughness, flexural strength, and resistance to fatigue, impact, thermal shock and spalling [6-12]. Numerous extensive experiments were carried out by many researchers around the world on the use of fibers in concrete [13-15]. Meanwhile, there have been a few studies on the impact resistance and mechanical properties of fiber-reinforced concrete particularly in statistics sense [16-19]. Little research has been undertaken on the mechanical and impact behavior of HPFRCC materials [20]. Different types of fibers including steel, glass, plastic, etc can be used in concrete. Polyphenylene Sulfide (PPS) is an engineering plastic which is a high-performance thermoplastic and an organic polymer, consisting of aromatic rings linked with sulfides. Synthetic fibers and textiles derived from this polymer are known to resist chemical and thermal attacks. PPS polymer is formed by reaction of sodium sulfide

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