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EXPERIMENTAL STUDY ON HIGH STRENGTH CONCRETE WITH POLYPROPYLENE FIBER

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ABSTRACT: The present day world is witnessing the construction of very challenging and difficult civil engineering structures. Concrete made with Portland cement has strong compressive strength but it has weak tensile strength and it tends to be brittle. Also cracks start to develop as soon as concrete is placed and before it has properly hardened which may lead to weakening of concrete structures, fracture and failure and general lack of durability. Thus this Project is aimed at reducing the aforementioned shortcomings of concrete to increase its applicability and performance. Addition of fibers also leads to a reduction in shrinkage cracking. We have used Polypropylene as the fiber. Polypropylene fiber, also known as polypropylene or PP, is a synthetic fiber, transformed from 85% propylene, and used in a variety of application.

It is used in many different industries, Polypropylene Fiber Reinforced Concrete is an embryonic construction material which can be described as a concrete having high mechanical strength, stiffness and durability. Polypropylene fiber reduce the plastic shrinkage crack area due to their flexibility and ability to conform to form. The addition of 0.1% by volume of fibers is found effective in reducing the extent of cracking by a factor of 5-10. The extent of crack reduction is proportional to the fiber content in the concrete. But in this project for phase I study conventional concrete grade of M30 and M40 and each series consists of cubes, cylinders and prisms as per IS standard. A series of tests were carried out to find out the compressive strength at the age of 28 days.

Key Words: Concrete, River and cement, polypropylene fiber, admixtures

1.1 GENERAL

The fiber dispersion into concrete is one of the techniques to improve the building properties of concrete. Polypropylene fibers are synthetic fibers obtained as a by-product from textile industry. These are available in different aspect ratios and are cheap in cost. Polypropylene fibers are characterized by low specific gravity and low cost. Its use enables reliable and effective utilization of intrinsic tensile and flexural strength of the material along with significant reduction of plastic shrinkage cracking and minimizing of thermal cracking. It provides reinforcement and protects damage of concrete structure and prevents spalling in case of fire. The fibers

Are manufactured either by the pulling wire procedure with circular cross section or by extruding the plastic film with rectangular cross-section. They appear either as fibrillated bundles, mono filament. The fibrillated polypropylene fibers are formed by expansion of a plastic film, which is separated into strips and then slit. The fiber bundles are cut into specified lengths and fibrillated. In monofilament fibers, the addition of buttons at the ends of the fiber increases the pull out load. Cracks play an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding polypropylene fibers to concrete. Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from further opening. In order to achieve more deflection in the beam, additional forces and energies are required to pull out or fracture the fibers. 2 This process, apart from preserving the integrity of concrete, improves the load carrying capacity of structural member beyond cracking. In this project polypropylene fibers of blended (24mm, 40mm, 55mm) type is used. The project deals with the effects of addition of various proportions of polypropylene fiber on the properties of concrete in fresh and hardened state. An experimental program was carried out to explore its effects on workability, compressive, flexural, split tensile strength and modulus of elasticity of concrete.

The character of the concrete is determined by quality of the paste. The key to achieving a strong, durable concrete rests in the careful proportioning, mixing and compacting of the ingredients. Numerous tests are performed on wet concrete such as workability tests such as compaction factor test and slump test. The tests on hardened concrete are destructive test while the destructive test includes compressive test on concrete cube for size (150 x 150 x

150) and split tensile strength on concrete cylinder (150 mm ø x300mm) as per IS: 516 – 1959.

1.2 OBJECTIVES

The primary objectives of this investigation were to determine the benefits of using Polypropylene fiber.

To study about high strength concrete using Polypropylene fiber and M sand.

Discuss about various properties of high strength concrete using Polypropylene fiber and M sand.

1.3 SCOPE

This project is used to increase the strength of the concrete it used to reduce the high cost of the concrete. To know the purpose of the polypropylene fiber with cement.

LITERATURE REVIEW

Saman Khan4 etl, represents comparative experimental study on mechanical performance of polypropylene fiber reinforced concrete (PFRC) under compression and split tensile loading. The cube compressive strength and cylinder split tensile strength of conventional concrete and polypropylene fiber reinforced concrete were determined in the laboratory. The M25 and M30 grades of concrete mixes and polypropylene mono-filament macro-fibers of length 35 mm at volume fractions of 0.0%, 0.5%. 1.0%, 1.5%, 2.0%, 2.5% and 3.0% were used in the research. All specimens were tested at curing age of 28 days. In this paper the relationship between cube compressive strength and cylinder split tensile strength for conventional and polypropylene fibre reinforced concrete were established and compared with standards. The study suggested the significant improvement in compressive and tensile strength for concrete mixes reinforced with polypropylene fibres. The samples with added polypropylene fibres of 1% and 1.5% showed better results in comparison with the others.

Priti A. Patel1, Dr. Atul K. Desai2 and Dr. Jatin A. Desai3 Polypropylene fibres dose not disperse properly in the mixing water. Addition of fibres to dry mix was found to be more practical. The presence of fibres in concrete alerts the failure mode of material. It is found that the failure mode of plain concrete is mainly due to spalling, while the failure mode of fibre concrete is bulging in transverse directions. Compressive strength of material increases with increasing fibre content. Strength enhancement ranges from 8% to 16% for PFRC. Strength enhancement in splitting tensile strength due to polypropylene fibre addition varies from 5% to 23%. Split tensile strength at 28'days is approximately 50% higher than 7 day's strength. During the test it was visually observed that the PFRC specimen has grater crack control as demonstrated by reduction in crack widths and crack spacing. The flexural strength increases with increasing fibre content. The maximum increase in flexural strength of PFRC is 36%. The percentage increase in shear strength of the polypropylene fibre mix varies from 23% to 47%. This is because of fibres enhances the load carrying capacity of mix.

Milind V. Mohod[1] It have done different test on concrete for different conditions like control curing & irregular condition, from this it has been seen that for the irregular condition initially have more compressive strength than control curing condition but as the days advances it loses its strength or do not give satisfactory strength as compare to curing condition . Hence for a better strength it may conclude that the curing is an essential parameter. The polypropylene fibers (PPF) reduce early age shrinkage and moisture loss of the concrete mix even when low volume fractions of PPF are used. It was concluded that the increasing percentage volume of fiber added into the concrete would lead the workability decreased. High volume dosage rate above 1.0% showed that the concrete was significantly stiff and difficult to compact. However it also reduced the bleeding and segregation in the concrete mixture.

Imtiaz Ahmed Memon a, Ashfaque Ahmed Jhatial a,b*, Samiullah Sohu b,c, Muhammad Tahir Lakhiar b, Zahid Hussain b,c Through the last hundred years, Concrete has established itself as one of the major construction and building materials. This has been mainly due to its excellent durability and availability and ease of moulding concrete into any desired shape. Though concrete has various advantages, it is known to strong under compression but relatively weak under tensile stresses. Concrete possesses limited ductility while offering little resistance to abrasion and cracking [1]. Therefore, over the years, researchers have used various materials to reinforce the concrete to withstand such tensile stresses.

MATERIALS TO BE USED

CEMENT

PPC of 53 grades in one lot was procured and stored in air tight container. The cement used was fresh i.e. used within three months of manufacture. It should satisfy the requirement of IS12262. The properties of cement are determined as per IS4031:1968 & results are tabulated.

AGGREGATES

A fine aggregate obtained from the river is used for experimental purpose. The less amount of clay and silt (<3% by weight). The hire from silt, clay, salt and organic

material and it was clean and dry. It is of size retained in 1.19 micron sieve. The coarse aggregate is strongest and porous component of concrete. Presence of coarse aggregate reduces the drying shrinkage and other dimensional changes occurring on account of movement of moisture. The coarse aggregate used passes in 19 mm and retained in 11.4mm sieve. It is well graded (should of different particle size and maximum dry packing density and minimum voids) and cubical in shape.

WATER

Ordinary drinking water available in the construction laboratory was used for casting all specimens of this investigation. Water helps in dispersing the cement even, so that every particle of the aggregate is coated with it and brought into ultimate contact with the ingredients. It reacts chemically with cement and brings about setting and hardening of cement. It lubricates the mix and compact property. Potable water, free from impurities such as oil, alkali acids, salts, sugar and organic materials were used. The quality of water was found to satisfy the requirement if IS 456-2000.

The ordinary water consist of many micro-organisms which will leads to the change in pH value which does not effect the construction activity. pH of the tap water has been checked in our laboratory. The pH of the tap water tested is about **7.5**.

POLYPROPYLENE FIBERS

Polypropylene Fibres Polypropylene is available in two forms, monofilament fibers and film fibers. Monofilament fibers are produced by an extrusion process through the orifices in a spinneret and then cut to the desired length. The newer film process is similar except that the polypropylene is extruded through a die-that produces a tubular or Performance of Polypropylene Fibre. This film is then slit into tapes and uniaxially stretched. These tapes are then stretched over carefully designed roller pin systems which generate longitudinal splits and these can be cut or twisted to form various types of fibrillated fibers. The fibrillated fibers have a net-like physical structure. The tensile strength of the fibers is developed by the molecular orientation obtained during the extrusion process. The draw ratio (final length/initial length), a measure of the extension applied to the fiber during fabrication, of polypropylene fibers is generally about eight. Polypropylene has a melting point of 165 degrees C and can withstand temperatures of over 100 degrees C for short periods of time before softening'.

CONCLUSION

Based on the experiment conducted the following observation were made hence some conclusion .the use of polypropylene fibre has increased in recent years due to the property of the fibre to eliminate some defects in concrete

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