EXPERIMENT ON STEEL FIBRE REINFORCED CONCRETE

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EXPERIMENT ON STEEL FIBRE REINFORCED CONCRETE

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ABSTRACT

The various aspects covered are the materials, mix proportioning for M25 grades of concrete. As the concrete is weak in tension, a work has been carried out to investigate the improvement in tensile, shear, flexure, and even compressive strength of concrete and also to investigate the cracking strength and reserve strength of concrete & FRC.M25 grades of concrete have been added to investigate the compressive strength, tensile strength & shear strength of concrete. Steel fibers acts as a bridge to retard their cracks propagation, and improve several characteristics and properties of the concrete. Fibers are known to significantly affect the workability of concrete. The aspect ratio (50) and variable in this study were percentage of volume fraction (0, 0.5, 1.0) of steel fibers. Compressive strength, splitting tensile strength and flexural strength of the concrete were determined for the hardened properties. Their main purpose is to increase the energy absorption capacity and toughness of the material. But also the increase in tensile and flexural strength is often the primary objective. A marginal improvement in the ultimate strength was observed. The addition of fiber enhanced the ductility significantly.

Index Terms: Aspect ratio, Compressive strength, Concrete mix proportioning, Ductility, Shear strength, Steel fibers Tensile strength.

1. Introduction

At the point when the solid is presented to seawater or deicing salts, it will in general reason confined breakdown of the detached film, a wonder named pitting corrosion.This can bring about genuine nearby loss of the bars' cross segment in the influenced areas while encompassing areas remain practically unaffected, if adequate water and oxygen araccessible at the support surface. As indicated by an examination did by Beeby [1] and Tuutti[2], results demonstrated that macrocracks assume a significant job in the vehicle of forceful substances. In the event that architects would fundamentally improve the life expectancy of solid structures they must be controlling these breaks. As an approach to guarantee the toughness of the fortified solid structures, current guidelines characterize themaximum permitted break widths, in view of introduction conditions. Despite the fact that the impact of splits on the inception of consumption has been managed by a few creators, the impact of breaks on solidness, for instance, is still discussed. The main accord among specialists is that if the breaks surpass a specific size, they will negatively affect toughness. Berrocal et al. [3] and Otieno et al. [4] indicated that the utilization of steel fiber strengthened cement (SFRC) is still constrained to mechanical floors, chunks, and asphalts, on the grounds that of the irregular dispersion and direction of the filaments, which lessen the mechanical proficiency when contrasted with ordinary fortifying bars. Since the main examinations on SFRC in the mid 1960s, a noteworthy measure of research has been completed to accomplish a more profound comprehension of the mechanical properties of the material.The significant outcome is that splits can be changed by right strengthened solid individuals in direct pressure. Another investigation done by Abrishami and Mitchell [5] centered because of steel strands on support concrete shafts demonstrated that the transverse breaks were all the more intently what's more, littler contrasted and examples without steel strands. This prompts the way that including strands could adequately control parting splits. In a comparable report closed on the SFRC utilizes by Bischoff [6], it was demonstrated that SFRC is proficient in moving strain across breaks, thus lessening split dispersing and expanding pressure solidifying. The impact of including various kinds of steel filaments on chloride entrance has been concentrated by Mangat and Gurusamy [7] furthermore, examined somewhere else by Buratti et al. [8]. They found that filaments had an inconsequential impact in sound cement. Likewise, when the structures are presented to marine

environments, they do not exhibit any effects to the soundand also elements remain uncracked.The addition of fibres for cracked concrete had amarginaleffect for cracks of less than 0.2mm. This addition becameimportant for cracks of more than 0.5 mm. A critical crackwidth has been estimated to values ranging between 0.10 and 0.25mm, which showed that hybrid fibres would be veryclose to the concrete surface. Some researchers have directedtheir investigations towards the mechanical characterization when fibres are exposed to extreme environments [9]. Thisstudymakes in evidence the fact that the fibres are influencedby external agents, and, consequently, a higher degradationwould be expected Danso et al. [10]. Another study carriedby Hongfang [11] used a simulated impressed currentcathodic protection system with 3% NaCl solution withoutinhibitor. Experimental results showed that, during anodicpolarization, the epoxy was corroded. Kobayakawa et al. [12]investigated the influence of superficial fibres accompaniedby substantial stain rust appearing at the concrete surface.Results showed that reduction of damage in the fibres isthe consequence of reducing the water cement ratio of theconcrete mix as well as limiting the region where fibres areprone to suffering severe corrosion to depths as small as0.2mm [13, 14].The critical chloride content is generally accepted tobe in the range of 0.4–1.0% Cl^- (by weight of cement)for conventional reinforced concrete structures. The criticalchloride content, or chloride threshold value, represents abasic concept used today by most of the current service life models. Mangat and Gurusamy [15] showed that fibresembedded in concrete remained free from corrosion forchloride concentrations up to 1.7% Cl^-.This is in agreementwith the results of Janotka et al. [16] and Ganesan et al. [17]who found that the necessary concentration of chloride toinitiate corrosion in steel fibres was at least 3 times highercompared to conventional reinforcing steel.On the other hand, the experimental investigation carriedout in solutions simulating the concrete pore electrolyte byElsener et al. [18] revealed that the amino alcohol testedcompounds are efficient against steel corrosion. Moreover,their use asmortar admixtures is not detrimental to the physicomechanicalproperties. Triethanolamine (TEA) use at aconvenient concentration equal to 0.5 mL/50mL guaranteedsteel corrosion inhibition inmortar contaminated by sodiumchloride NaCl at 0.5mole/L.The electrochemical impedancespectroscopy technique EIS associated to periodic chlorideconcentration measurements proved the effect of TEAin delaying the corrosion process initiation. Furthermore,its capacity of diffusion through mortar cover was noted.

Plain solid asphalts have low rigidity and strain limit, anyway these basic qualities are improved by fiber expansion, permitting decrease of the asphalt layer thickness [1]. This improvement can be critical and relies upon fiber attributes and measurements [2]. The most noteworthy impact of fiber support is to postpone and control the pliable splitting of cement [3]. In this manner it is found to have noteworthy effect on the asphalt cost because of diminished thickness necessities, less upkeep expenses and longer valuable life [2]. Contrasting and the existence pattern of a black-top street, SFRC asphalts have been accounted for to keep going twice as long [1].

The biggest volume utilization of SFRC has been in air terminal asphalts because of high and harming loads [4]. Steel strands fundamentally improve the effect obstruction of solid creation it an appropriate material for structures exposed to affect loads [5]. SFRC asphalt takes out spring load limitations. It doesn't groove, washboard or push as in black-top roadways; and it gives fuel investment funds to overwhelming vehicles versus black-top asphalts [1]. All the above elements recommend that SFRC asphalts are the most useful asphalt type from a building and efficient forthcoming. Then again, the present significant expense of steel strands in numerous locales may not legitimize their utilization, in spite of the lower life cycle costs accomplished because of decreased support prerequisites [2,3]. To encourage the all-inclusive utilization of SFRC in asphalt development (particularly in creating nations), it is important to create elective wellsprings of minimal effort steel fiber support. This was one of the fundamental destinations of —EcoLanesl [6].

—EcoLanesl was a three-year explicit focused on look into venture (finished in September 2009), supported under the FP6-2005-Transport-4 call 3B of the European Commission. The work program of —EcoLanesl included nine work bundles: four for look into/innovative/advancement exercises, three for exhibition exercises, one for scattering and one for the executives exercises; the venture consortium contained eleven scholastic and modern accomplices from Cyprus, France, Italy, Romania, Turkey and the United Kingdom [7]. The principle point of this undertaking was the turn of events, testing and approval of SFRC asphalts that will contribute towards the key goals of the topical zone of economical surface vehicle, remembering decrease of expenses for the scope of 10–20%, development time by 15% and vitality utilization by up to 40% [6]. Coming up next were among the fundamental goals of the

task. • Development of reused steel tire-line (RTC) fiber support as a prudent option to mechanically created steel strands, utilized regularly in SFRC development (segment 3.1).

2.LITERATURE REVIEW

2.1 Introduction

In this chapter various literatures on strength and durability of silica fume concreteincorporated with marble powder has been surveyed and following facts are reported.Available published literature on silica fume incorporated with marble powder basedconcrete is also briefly reviewed.

2.2 Marble powder (MP)

Hassan A. Mohamadien .et al (2012) – Has taken the necessary steps on Marble powdermaterial (MP) is a fine powder, got as a side-effect of marble amid the sawing and themoulding, and not reusing it because of natural issues on the planet. The likelihood ofusing it and silica rage (S.F) autonomously as midway replacement of cement on mortar were mulled over and surveyed taking into account the degree of the inadequate bond overriding with both marble powder and silica seethe autonomously. Four sorts of mortar mix with same functionality, cement to sand extent of 1:3 and water to cementations materials extent of 0.4 were prepared marble powder and silica fume used as a piece of mixes autonomously, once as a midway replacement of bond content also, another as an extension to the mix degree. Replacement and development extent of both marble powder and silica seethe with solid substance autonomously at 0%, 5%, 10%, 15%, 20%, 30% and 50 % by weight were inspected. The mechanical properties of mortar were evaluated similar to compressive quality at 7 and 28 days and it was watched that the quality upgrades at 7, and 28 days and the most raised headway pace of compressive quality was seen at 15% exchange extent for each the marble powder and silica seethe freely. Results showed that the compressive quality extended by 31.4%, 48.3% at 7, and 28 days R.R.SHRIVASTAVA et al (2012) - The work in this endeavor is to consider the effect of midway replacing of bond with marble powder, and to differentiate it and the compressive nature of standard M30 concrete. We are moreover trying to find the degree of marble powder and silica rage replaced in strong that makes the nature of the strong most prominent. By and by a day's marble powder has transformed into a pollution. Along these lines, by to a limited extent replacing bond with marble

powder, we are proposing a strategy that can be of remarkable use in decreasing sullying all things considered. In this assessment a movement of weight tests were driven on 150mm, 3D square and 150mm x 300mm, tube molded models using a changed test method that gave the whole compressive quality, using silica smoke of consistent 8% with and without marble powder of volume parts 0, 8, 12, and 16% on Ordinary Portland bond concrete. In the midst of quarrying errands as shake pieces and 30% waste delivered in the midst of getting ready. It is being dumped either in contiguous cleanse pits, avenues, and riverbeds, pasturelands, cultivating fields or landfill inciting wide spreading natural pollution. Marble powder contains high calcium oxide substance of over half. The potential usage of marble clean can be an ideal choice for subbing in a cementitious clasp as the reactivity viability increases in view of the proximity of lime. A total of five concrete mixes, containing 0%, 5%, 10%, 15% and 20% midway replacing of bond with marble powder are investigated in the lab. These mixes were attempted to choose compressive quality, split versatility and flexural quality for 7, 28 and 56days. Rohan K et.al (2014) – Has considered the properties of M30 concrete made with various mixes. Properties attempted join compressive quality, flexural quality and split unbending nature preliminary of hardened concrete. Marble clean used as replacement in extent of 0%, 5%, 10%, 15%, and 20% by weight of bond .And in like manner quality was differentiated and standard M30 concrete. This assessment induced that compressive nature of models is extended with development of marble tidy appeared differently in relation to standard concrete up to 15%, what's more, there is an abrupt declination in quality at 20% replacement. The examination says split unbending nature of model augmentations with development of marble tidy up to 15%, and there is an unexpected declination in quality for 20% replacement of bond. Flexural nature of models increases with extension of marble clean up to 15%, and there is abrupt decrease in quality after replacement of 20% cement by marble clean. Thusly it was found that the perfect rate for replacing of security with marble clean is near 15% of the total cement for strong shapes, shafts and barrels. Jashandeep Singh (2015) Has mull over the direct of concrete, having incomplete supplanting of bond with waste marble powder M25 audit for which the marble powder is replaced by a preliminary report was finished and the effect on compressive quality and split tractable quality characteristics (0%, 4%, 8%, 12%, 16%, 20%)was considered.

The outcome of this current assessment shows that the replacing of 12% of bond with waste marble powderretains most noteworthy compressive and versatility. The ideal rate for displacing of marble powder with cement and it is just about 12%cement for the two 3D squares and barrels

and it furthermore limit the costs for advancement with usage of marble powder which is uninhibitedly or productively open even more fundamentally.

CONCRETE MIX AS A SYSTEM

Concrete is by a wide margin the most broadly utilized man-made development material and studies demonstrating that it will keep on being so in the years and decades to come. Such adaptability of cement is because of the way that from the normal fixings, to be specific, concrete, total and water (and once in a while admixtures), it is conceivable to tailor the properties of cement in order to fulfill the needs of a specific circumstance. In the genuine sense, concrete is in this manner the genuine structure material as opposed to the fixings like concrete and totals, which are just middle of the road items. This idea of regarding concrete as an element is represented with the advancement of prepared blended solid industry, where the customer can determine the solid of his needs without making a big deal about the fixings; and further in pre-thrown solid industry where the buyer acquires the completed auxiliary segments fulfilling the exhibition necessities. In this way, regarding concrete in its substance as a structure material. In this setting a solid blend shapes a 'framework'. Concrete blends are additionally described by the way that, not at all like the other regular auxiliary materials like steel, these are for the most part fabricated at site; the inalienable fluctuation of their properties and requirement for legitimate quality control, in this way, become significant contemplations.

Common Portland concrete (OPC) is by a wide margin the most significant sorts of the concrete. The OPC was arranged into three evaluation to be specific, 33 evaluation, 43 evaluation and 53 evaluation depending upon the quality of the concrete at 28 days when tried according to IS4031-1988. Conventional Portland concrete of 43 evaluation of ultratech concretes 50 kg.

3.2Fine totals

It ought to be gone through IS Sieve 4.75 mm.it ought to have wellness modulus 2.50-3.50 what's more, residue substance ought not be over 4%. Coarse sand ought to be either waterway sand or pit sand: or mix of two.

3.3 Coarse totals

It ought to be hard, solid, thick, tough and clean. It must be liberated from vein, follower covering and damaging measure of crumbled pieces, soluble bases, vegetable issues and other

pernicious substances. It ought to be generally cubical shape. Flaky pieces ought to be maintained a strategic distance from. It ought to affirm to IS 2838 (1).

3.4 Water

Water ought to be liberated from acids, oils, soluble bases, vegetables or other natural pollutions. Delicate waters additionally produce more fragile cement. Water has two capacities in aconcrete blend. Firstlyit responds synthetically with the concrete to from the concrete glue where the dormant totals are held in suspension until the concrete glue has solidified. Also, it fills in as a oil in the blend of fine totals and concrete.

Characterization OF CONCRETE MIXES

Concrete blends are ordered in various manners, frequently relying on the sort of details, which are extensively of two kinds; the 'prescriptive' determinations where the extents of the fixings and their attributes (in particular, kind of concrete, most extreme size of total, and so forth.) are indicated, with the expectation that adherence to such prescriptive determination will bring about palatable execution. On the other hand, an 'execution' situated determination can be utilized wherein. The necessities of the attractive properties of cement are indicated (model - quality, usefulness or some other property). In light of the above contemplations, cement can be ordered either as 'ostensible blend' concrete or 'structured blend' concrete as has been determined in IS : 456-2000*.

GRADES OF CONCRETE

Among the numerous properties of solid, its compressive quality is viewed as the most significant and has been held as a record of its general quality. Numerous other building properties of cement give off an impression of being commonly identified with its compressive quality. Concrete is, in this way, for the most part evaluated by its compressive quality. The different evaluations of concrete as specified in IS : 456-2000 and IS : 1343-1980. Evaluations of solid lower than M 15 are not to be utilized in fortifiedconstituents of squashed stones (coarse total), and sand (fine aggregate).A fourth fixing called 'admixtures' is Concrete is a composite material total made out of hydrated concrete (folio), rock or utilized to alter certain particular properties of the solid blend in new and solidified states. By sensible utilization of accessible materials for solid creation and their proportioning, concrete blends are delivered to have the ideal properties in the new and solidified states, as the circumstance requests. The accompanying figure shows a petrographic segment of cement. Note the dispersed coarse totals and the framework encompassing them. The grid comprises of sand, hydrated concrete and little voids.

Fiber REINFORCED CONCRETE Fiber strengthened cement (FRC) is concrete containing sinewy material which builds its auxiliary honesty. It contains short discrete filaments that are consistently appropriated and haphazardly arranged. Strands incorporate steel filaments, glass strands, manufactured filaments and characteristic strands. Inside these various filaments that character of fiber strengthened solid changes with fluctuating cements, fiber materials, geometries, dissemination, direction and densities and furthermore be characterized as a composite materials made with Portland concrete, total, and fusing discrete spasmodic strands. Presently, for what reason would we wish to add such filaments to concrete? Plain, unreinforced concrete is a fragile material, with a low rigidity and a low strain limit. The job of arbitrarily appropriates irregular filaments is to connect over the breaks that create gives some post-splitting "flexibility". On the off chance that the filaments are adequately solid, adequately attached to material, and grant the FRC to convey noteworthy worries over a generally huge strain limit in the post-splitting stage. The genuine commitment of the filaments is to expand the durability of the solid (characterized as some capacity of the territory under the heap versus avoidance bend), under a stacking. That is, the strands will in general increment the resist top burden, and give a lot of vitality ingestion in post-top segment of the heap versus diversion bend.

HISTORY OF FRC.

Verifiably filaments have been utilized to fortify fragile materials since old occasions. Straws were utilized to fortify sun heated bricks; horsehair was utilized to strengthen mortar. In the mid 1900s, asbestos strands were utilized to fortify Portland concrete. Despite the fact that strengthening a weak lattice with discrete filaments is a well established idea, cutting edge utilization of strands in concrete began in the mid 1960s. In the first place, just straight steel filaments were utilized. The significant improvement happened in the zones of pliability and break durability, despite the fact that flexural quality increments were likewise detailed. The law of blend was applied to break down the fiber commitments. It was comprehended that fiber strengthened cement can be intended to acquire a particular malleability or vitality ingestion. Research by Romualdi, Batson, and Mandel in the late 1950's and mid 1960's spoken to the primary critical strides towards improvement of steel fiber fortified cement (SFRC). 1.5.2 Fiber MECHANISMS Fibers work with concrete using two instruments: the separating system and the split crossing over component. The dividing component requires an enormous number of strands all around conveyed inside the solid network to capture any current small scale split that might grow and make a sound break. For run of the mill volume parts of strands, using little width

filaments or miniaturized scale filaments can guarantee the necessary number of filaments for smaller scale split capture. The subsequent system, named split spanning, requires bigger straight strands with satisfactory cling to concrete. Steel filaments are viewed as a prime case of this fiber type, that is, normally alluded to as huge breadth strands or full scale filaments. Advantages of utilizing bigger steel filaments incorporate effect opposition, flexural and rigid qualities, malleability, and crack sturdiness.

Filaments utilized… Although each sort of fiber has been given a shot in concrete and cement, not every one of them can be viably and financially utilized. Every fiber has some trademark properties and constraints. Filaments utilized are Steel strands, Polypropylene, nylons, Asbestos, Coir, Glass, Carbon. The architect may best view fiber fortified concrete as a solid with expanded strain limit, sway opposition, vitality retention, and elasticity. In any case, the expansion in these properties will change from considerable to nil contingent upon the amount and kind of strands utilized; furthermore, the properties won't increment at a similar rate as filaments are included. While steel filaments are presumably the most generally utilized strands for some applications, different sorts of strands are increasingly proper forThin shells and plates have also been constructed using steel fibres. These methods generally modify the internal forces in the member to account for the additional tension from the fibers. When supported by full-scale test data, these approaches can provide satisfactory designs. The major differences in the proposed methods are in the determination of the magnitude of the tensile stress increase due to the fibers and in the manner in which the total force is calculated. Other approaches that have been used are often empirical, and they may apply only in certain cases where limited supporting test data have been obtained. They should be used with caution in new applications, only after adequate investigation. Generally, for structural applications, steel fibers should be used in a role supplementary to reinforcing bars. Steel fibers can reliably inhibit cracking and improve resistance to material deterioration as a result of fatigue, impact, and shrinkage, or thermal stresses. A conservative but justifiable approach in structural members where flexural or tensile loads occur, such as in beams, columns, or elevated slabs (i.e., roofs, floors, or slabs not on grade), is that reinforcing bars must be used to support the total tensile load. This is because the variability of fiber distribution may be such that low fiber content in critical areas could lead to unacceptable reduction in strength.

SHAPES OF STEEL FIBRE ASTM A 820 classifies four different types of fibres based on their manufacture :

1- Cold-drawn wire fibres are the most commercially available, manufactured from drawn steel wire.

2- Cut sheet fibres are manufactured as the name implies by laterally shearing off steel sheets.

3- Melt-extracted fibres are manufactured with a relatively complicated technique where a rotating wheel is used to lift liquid metal from a molten metal surface by capillary action. The extracted molten metal is then rapidly frozen into fibres and thrown off the wheel by centrifugal force. The resulting fibers have a crescent-shaped cross section.

4- Other fibres are manufactured for tolerances in length, diameter, and aspect ratio, as well as minimum tensile strength, and bending requirement. The amount of fibres added to a concrete mix is measured as a percentage of the total volume of the composite (concrete and fibres) termed Vf . Vf typically ranges from 0.1 to 3%. Aspect ratio (l/d) is calculated by dividing fibre length (l) by its diameter (d). Fibres with a non-circular cross section use an equivalent diameter for the calculation of aspect ratio. The present study focuses on steel fibres.

conditions, they don't display any impacts to the sound and furthermore components remain uncracked.

The expansion of filaments for split cement had amarginal impact for breaks of under 0.2mm. This expansion became significant for breaks of more than 0.5 mm. A basic split width has been evaluated to values extending among 0.10 and 0.25mm, which demonstrated that half and half strands would be very

near the solid surface. A few scientists have coordinated their examinations towards the mechanical portrayal at the point when filaments are presented to outrageous situations [9]. This studymakes in proof the way that the filaments are impacted by outer specialists, and, thusly, a higher corruption would be normal Danso et al. [10]. Another examination conveyed by Hongfang [11] utilized a reproduced dazzled current cathodic assurance framework with 3% NaCl arrangement without inhibitor. Test results indicated that, during anodic polarization, the epoxy was eroded. Kobayakawa et al. [12] examined the impact of shallow strands went with by significant stain rust showing up at the solid surface. Results indicated that decrease of harm in the strands is the outcome of diminishing the water concrete proportion of the solid blend just as constraining the district where filaments are inclined to enduring serious consumption to profundities as

little as 0.2mm [13, 14]. The basic chloride content is commonly acknowledged to be in the scope of 0.4–1.0% Cl^- (by weight of concrete) for traditional fortified solid structures. The basic chloride substance, or chloride limit esteem, speaks to a essential idea utilized today by the vast majority of the present help life models. Mangat and Gurusamy [15] demonstrated that strands installed in concrete stayed liberated from erosion for chloride focuses up to 1.7% Cl^-.This is in understanding with the aftereffects of Janotka et al. [16] and Ganesan et al. [17] who found that the essential centralization of chloride to start consumption in steel strands was at any rate multiple times higher contrasted with ordinary strengthening steel. Then again, the trial examination conveyed out in arrangements reenacting the solid pore electrolyte by Elsener et al. [18] uncovered that the amino liquor tried mixes are productive against steel erosion. Besides, their utilization asmortar admixtures isn't negative to the physicomechanical properties. Triethanolamine (TEA) use at a helpful focus equivalent to 0.5 mL/50mL ensured steel consumption hindrance inmortar tainted by sodium chloride NaCl at 0.5mole/L.The electrochemical impedance spectroscopy procedure EIS related to intermittent chloride focus estimations demonstrated the impact of TEA in postponing the consumption procedure inception. Besides, its ability of dispersion through mortar spread was noted. Thusly, TEA can be misused through both preventive what's more, therapeudic methods of utilization [19–21]. This paper planned for deciding the practicality of utilizing steel bars drenched in a chloride arrangement joined with inhibitor to improve the moderately better toughness execution.

3. MODEL

1.1 CONCRETE MIX AS A SYSTEM

Concrete is by far the most widely-used man-made construction material and studies indicating that it will continue to be so in the years and decades to come. Such versatility of concrete is due to the fact that from the common ingredients, namely, cement, aggregate and water (and sometimes admixtures), it is possible to tailor the properties of concrete so as to meet the demands of any particular situation. In the true sense, concrete is thus the real building material rather than the ingredients like cement and aggregates, which are only intermediate products. This concept of treating concrete as an entity is symbolized with the progress of ready-mixed concrete industry, where the consumer can specify the concrete of his needs without bothering about the ingredients; and further in pre-cast concrete industry where the consumer obtains the finished structural components satisfying the performance requirements. Therefore, treating concrete in its entity as a building material. In this context a concrete mix forms a 'system'. Concrete mixes are also characterised by the fact that, unlike the other common structural materials like steel, these are mostly manufactured at site; the inherent variability of their properties and need for proper quality control, therefore, become important consideration

Concrete mixes are classified in a number of ways, often depending upon the type of specifications, which are broadly of two types; the '**prescriptive**' specifications where the proportions of the ingredients and their characteristics (namely, type of cement, maximum size of aggregate, etc.) are specified, with the hope that adherence to such prescriptive specification will result in satisfactory performance. Alternately, a '**performance**' oriented specification can be used wherein. The requirements of the desirable properties of concrete are specified (example - strength, workability or any other property). Based on the above considerations, concrete can be classified either as 'nominal mix' concrete or 'designed mix' concrete as has been specified in IS : 456-2000*.

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1.2 CLASSIFICATION OF CONCRETE MIXES

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1.3 GRADES OF CONCRETE

Among the many properties of concrete, its compressive strength is considered to be the most important and has been held as an index of its overall quality. Many other engineering properties of concrete appear to be generally related to its compressive strength. Concrete is, therefore, mostly graded according to its compressive strength. The various grades of concrete as stipulated in IS : 456-2000 and IS : 1343-1980. Grades of concrete lower than M 15 are not to be used in reinforced concrete works and grads of concrete lower than M 30 are not to be used for pre-stressed concrete works. Similar grading of concrete on the basis of 28 days characteristics strength has also been adopted by ISO and most of the other codes fo particles.

1.4 CONSTITUENTS OF CONCRETE

Concrete is a composite material aggregate composed of hydrated cement (binder), gravels or crushed stones (coarse aggregate), and sand (fine aggregate).A fourth ingredient called 'admixtures' is used to modify certain specific properties of the concrete mix in fresh and hardened states. By judicious use of available materials for concrete making and their proportioning, concrete mixes are produced to have the desired properties in the fresh and hardened states, as the situation demands. The following figure shows a petrographic section of concrete. Note the scattered coarse aggregates and the matrix surrounding them. The matrix consists of sand, hydrated cement and tiny voids.

1.5. FIBRE REINFORCED CONCRETE

Fibre reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibres that are uniformly distributed and randomly oriented. Fibres include steel fibres, glass fibres, synthetic fibres and natural fibres. Within these different fibres that character of fibre reinforced concrete changes with varying concretes, fibre materials, geometries, distribution, orientation and densities and also be defined as a composite materials made with Portland cement, aggregate, and incorporating discrete discontinuous fibres. Now, why would we wish to add such fibres to concrete? Plain, unreinforced concrete is a brittle material, with a low tensile strength and a low strain capacity. The role of randomly distributes discontinuous fibres is to bridge across the cracks that develop provides some post- cracking "ductility". If the fibres are sufficiently strong, sufficiently bonded to material, and permit the FRC to carry significant stresses over a relatively large strain capacity in the post-cracking stage. The real contribution of the fibres is to increase the toughness of the concrete (defined as some function of the area under the load vs. deflection curve), under any type of loading. That is, the fibres tend to increase the strain at peak load, and provide a great deal of energy absorption in post-peak portion of the load vs. deflection curve.

1.5.1 HISTORY OF FRC.

Historically fibres have been used to reinforce brittle materials since ancient times. Straws were used to reinforce sun baked bricks; horsehair was used to reinforce plaster. In the early 1900s, asbestos fibres were used to reinforce Portland cement. Even though reinforcing a brittle matrix with discrete fibres is an age old concept, modern day use of fibres in concrete started in the early 1960s. In the beginning, only straight steel fibres were used. The major improvement occurred in the areas of ductility and fracture toughness, even though flexural strength increases were also reported. The law of mixture was applied to analyze the fibre contributions. It was understood that fibre reinforced concrete can be designed to obtain a specific ductility or energy absorption. Research by Romualdi, Batson, and Mandel in the late 1950's and early 1960's represented the first significant steps towards development of steel fibre reinforced concrete (SFRC).

1.5.2 FIBRE MECHANISMS

Fibres work with concrete utilizing two mechanisms: the spacing mechanism and the crack bridging mechanism. The spacing mechanism requires a large number of fibres well distributed within the concrete matrix to arrest any existing micro-crack that could potentially expand and create a sound crack. For typical volume fractions of fibres, utilizing small diameter fibres or micro fibres can ensure the required number of fibres for micro crack arrest. The second mechanism, termed crack bridging, requires larger straight fibres with adequate bond to concrete. Steel fibres are considered a prime example of this fibre type, that is, commonly referred to as large diameter fibres or macro fibres. Benefits of using larger steel fibres include impact resistance, flexural and tensile strengths, ductility, and fracture toughness.

Fibres used...Although every type of fibre has been tried out in cement and concrete, not all of them can be effectively and economically used. Each fibre has some characteristic properties and limitations. Fibres used are Steel fibres, Polypropylene, nylons, Asbestos, Coir, Glass, Carbon. The designer may best view fiber reinforced concrete as a concrete with increased strain capacity, impact resistance, energy absorption, and tensile strength. However, the increase in these properties will vary from substantial to nil depending on the quantity and type of fibers used; in addition, the properties will not increase at the same rate as fibers are added. While steel fibres are probably the most widely used fibres for many applications, other types of fibres are more appropriate for special applications. Fibre addition in the concrete brings a better control of its cracking and improves its mechanical properties. Particularly, it imparts to the material a post cracking load carrying capacity inducing pseudo ductility, which decreases it fragile character.

1.6 STEEL FIBRE REINFORCED CONCRETE

Thin shells and plates have also been constructed using steel fibres. These methods generally modify the internal forces in the member to account for the additional tension from the fibers. When supported by full-scale test data, these approaches can provide satisfactory designs. The major differences in the proposed methods are in the determination of the magnitude of the tensile stress increase due to the fibers and in the manner in which the total force is calculated. Other approaches that have been used are often empirical, and they may apply only in certain cases where limited supporting test data have been obtained. They should be

used with caution in new applications, only after adequate investigation. Generally, for structural applications, steel fibers should be used in a role supplementary to reinforcing bars. Steel fibers can reliably inhibit cracking and improve resistance to material deterioration as a result of fatigue, impact, and shrinkage, or thermal stresses. A conservative but justifiable approach in structural members where flexural or tensile loads occur, such as in beams, columns, or elevated slabs (i.e., roofs, floors, or slabs not on grade), is that reinforcing bars must be used to support the total tensile load. This is because the variability of fiber distribution may be such that low fiber content in critical areas could lead to unacceptable reduction in strength.

1.6.1 SHAPES OF STEEL FIBRE

ASTM A 820 classifies four different types of fibres based on their manufacture : 1- Cold-drawn wire fibres are the most commercially available, manufactured from drawn steel wire. 2- Cut sheet fibres are manufactured as the name implies by laterally shearing off steel sheets. 3- Melt-extracted fibres are manufactured with a relatively complicated technique where a rotating wheel is used to lift liquid metal from a molten metal surface by capillary action. The extracted molten metal is then rapidly frozen into fibres and thrown off the wheel by centrifugal force. The resulting fibers have a crescent-shaped cross section. 4- Other fibres are manufactured for tolerances in length, diameter, and aspect ratio, as well as minimum tensile strength, and bending requirement. The amount of fibres added to a concrete mix is measured as a percentage of the total volume of the composite (concrete and fibres) termed Vf . Vf typically ranges from 0.1 to 3%. Aspect ratio (l/d) is calculated by dividing fibre length (l) by its diameter (d). Fibres with a non-circular cross section use an equivalent diameter for the calculation of aspect ratio. The present study focuses on steel fibres.

1.6.2 MECHANICAL PROPERTIES OF STEEL FIBRE REINFORCED CONCRETE

The mechanical properties of steel fiber reinforced concrete are influenced by the type of fiber; length-to diameter ratio (aspect ratio); the amount of fiber; the strength of the matrix; the size, shape, and method of preparation of the specimen; and the size of the aggregate. For this reason, mixtures proposed for use in design should be tested, preferably in specimens representing the end use, to verify the property values assumed for design. Most properties are for the lower fiber percentage range. Some properties, however, are given for the higher

fiber percentage mixtures for information in applications where the additional strength or toughness may justify the special techniques required.

2 EXPERIMENTAL INVESTIGATIONS

2.1 PRELIMINARY INVESTIGATION

The constituent materials used in the present experimental work as follows

1. CEMENT

Cement used is Ordinary Portland Cement (OPC 53 grade) as a binding material as per IS 12269-1970. The preliminary tests like normal consistency(33%), specific gravity, intial(50 min) and final(300 min) setting times and compressive strength (59.3 N/ mm^2)are conducted. Sieve analysis for the grading curve and fineness test were conducted as well as the determination of its moisture and with specific gravity (2.89).

2. AGGREGATES

The river sand with zone II, passing through 4.75mm sieve(fine aggregate), the crushed granite, passing through 20 mm and retained on 4.75mm sieve(coarse aggregate), some preliminary tests are conducted as per IS 383-1978.

3. WATER : Portable water as per IS 456-2000.

4. SUPER PLASTICIZER : CONPLAST SP 430 as per IS 9103-1999.

Table 1.

PROPERTY	FINE AGGRGATE (zone-II)	COARSE AGGREGATGE
SPECIFIC GRAVITY	2.63	2.65
WATER ABSOORPTION	1%	0.5%
FITNESS MODULUS	2.5	4.5

2.2 MIX PROPORTIONING-EXPERIMENTAL INVESTIGATION (10262:2009)

Table-2: water cement ratio and mix proportion for different grade

GRADE	WATER CEMENT RATIO	MIX PROPORTION
M25		
M25		
M30		
M40		

CONCRETE SHOULD FLOW LIKE HONEY" As increasing the grade from M30 to M40, it is difficult to work with the materials because the amount of binding material(cement) increases at the same time w-c ratio decreases. So there is a reduction in water amount. Therefore it is very difficult to get good workability, to improve the workability we used the chemical admixture i.e Naphthalene based Super plasticizer –Conplast SP 430 A2-from fosroc chemicals, Bangalore was used to obtain the required workability. The super

plasticizer- Conplast SP 430 A2, 1% of total volume of concrete was used for M40 by trial and error method by reducing 15% of water amount.

2.3 ADDITION OF STEEL FIBERS

In the present work we used a steel fibres with a density of 7850 kg per m^3. we added a steel fibres of 0.5%, 1% and 1.5% of volume of concrete.

2.4 COMPRESSIVE STRENGTH

In the present investigation the cubes were casted with steel fibre reinforcement, and tested. The dimensions of the cube are 150X150X150 mm in accordance to IS 456-2000. The casted cubes kept for curing and tested after 3days, 7days , and 28days and the capacity of concrete cube noted in KN .i.e force(P) by placing on any one side of the cube. The cross sectional area(A) of cube is 225cm^2. Finally the division compressive force by cross sectional area of cube gives the compressive strength of that particular cube. This work is carried out for all grades M20,M25,M30&M40 after 3days, 7days and 28 days. The compressive strength is represented in N/mm^2. The Mathematical representation of compressive strength , σ_c =P/A.

2.5 TENSILE STRENGTH

Generally the split tensile strength will be predicted by using cylinders of diameter 150mm and depth or height of 300m placing longitudinally and applying force by machine. The Mathematical representation of split tensile strength is, σ_T=2P/ΠIhd. In the present investigation the cubes were casted with steel fibre reinforcement, and tested. The dimensions of the cube are 150X150X150 mm in accordance to IS 456-2000. The casted cubes kept for curing and tested after 3days, 7days , and 28days and the capacity of concrete cube noted in KN .i.e force(P) by placing diagonally in the testing machine. The cross sectional area(A) of cube is 225cm^2. Finally the division tensile force by cross sectional area of cube gives the tensile strength of that particular cube. This work is carried out for all grades M20,M25,M30&M40 after 3days, 7days and 28 days. The tensile strength is represented in N/mm^2.

Fig.1 Diagonally placed tesile failure **Fig.2 shear failure**

2.6 SHEAR STRENGTH

Shear strength can be predicted using prism in the laboratory of dimensions 100X100X500. Plain cement concrete prism fails in flexure first but, if it is suitably reinforced to care of that bending moment and flexure tension by providing steel (say 1% of cross section) in the tension zone, than flexural strength is increases and hence the prism fails in shear.If stirrups or shear steel is not provided then the reinforcing bars are insignificant in taking dowel force(i.e shear force). Hence shear strength of concrete can be predicted.

40

3. RESULTS AND DISCUSSION

3.1 COMPRESSIVE STRENGTH RESULTS

TABLE -3: Compressive strength of steel fibre reinforced concrete

GRADE	DAYS OF CURING	COMPRESSIVE STRENGTH (N/mm^2)			
Volume of steel fibres		0%	0.5%	1%	1.5%
M25	3days				
	7days				
	28days				

3.2 TENSILE STRENGTH RESULTS

TABLE-4: Tensile strength of steel fibre reinforced concrete

GRADE	DAYS OF CURING	TENSILE STRENGTH (N/mm^2)			
VOLUME OF STEEL FIBERES		0%	0.5%	1%	1.5%
M25	3days				
	7days				
	28days				

3.3 SHEAR STRENGTH RESULTS

TABLE-5: Shear strength of steel fibre reinforced concrete

GRADE	DAYS OF CURING	TENSILE STRENGTH (N/mm^2)			
VOLUME OF STEEL FIBERES					
M25	3days				
	7days				
	28days				

CONCLUSION

The essential focal point of this paper has been to tentatively assess of compressive quality bounce back mallet and NDT test with marble powder based cement the ends dependent on the restricted perception from the current examination on property of SF solid blend changed by expansion of marble powder, slammed on the outcome introduced over the accompanying end can be drawn. These outcomes propose that, with great quality control of the cementing procedure, 10% to 15% OPC supplanting with SF consolidated with MP could be reasonable for strengthened solid work and 15% to 25% OPC supplanting with SF joined with marble powder for minor works in concrete The most extreme 28 days split elasticity was gotten with 5% SF and10%MP blend. The most extreme 28 days flexural quality was acquired again 5% SF and 10MP blend. High quality cement with MP and SF as admixture offers numerous points of interest as referenced. So it very well may be utilized .

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