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AN EXPERIMENTAL INVESTIGATION OF DESIGN OF M50 CONCRETE BY USING LATHE WASTE AND DRINK CAPS AS FIBERS

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ABSTRACT

Generally concrete is strong in compression and weak in tension. To increase tensile strength for this purpose fibers are used in concrete and increases its tensile strength, fiber reinforced concrete using waste materials is a systematic procedure. In that case designing M50 mix and the design mix is done using the Code IS 10262-2009.In that the water-cement ratio is taken as 0.4 and in this first conventional mix taken and in that there are increase an admixture content of 0.25,0.5, 0.75& 1% mix and in that the 0.5% admixture has greater strength than the remaining mixes so 0.5% admixture and 0.4% water cement ratio is taken as greater strength. And the admixture content is taken in the cement content only and these are tested for cubes, cylinder and prisms. These tests are calculated for 7days & 28daysand the greater strength ratios of admixture and water cement ratio is used for adding fibers. In this experiment BASF is used as admixture. The fibers are drinking bottle caps and lathe mission waste. In drink bottle caps first the caps are softened and then these are cutting with 3mm width and 10mm length and this is cutting in uniform length and the lathe waste also in the same dimensions. And the mixes of drink caps in 0.25%, 0.5%, 0.75%, 1%. In total volume of the mixture and this mixes of lathe waste is also same as drink caps in total volume of mixture and the strength are calculated for 7days & 28days and these strength is compare with conventional mix which is greater than that mix in this for fibers of 0.25% drink caps has maximum strength.

Keywords: Drinking Bottle Caps, Lathe Waste, Fiber Reinforcement, M50 Concrete .

Introduction

Plain concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the propagation of such micro cracks, eventually leading to brittle fracture of the concrete. It has been recognized that the addition of small, closely spaced and uniformly dispersed fibers to concrete would act as crack arrester and would substantially improve its static and dynamic properties. This type of concrete is known as fiber reinforced concrete. Fiber reinforced concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed suitable fibers. Continuous meshes, woven fabrics and long wires or rods are not considered to be discrete fibers.

The concept of using fibers as reinforcement is not new.

Fibers have been used as reinforcement since ancient times. Historically, horsehair was used
in mortar and straw in mud bricks.
In the early 1900s, asbestos fibers were used in concrete. In the 1950s, the concept of composite materials came into being and fiber-reinforced concrete was one of the topics of interest.
By the 1960s, steel fibers, glass fibers (GFRC), and synthetic fibers such as polypropylene fibers were used in concrete.

Materials and Methods:

Advancements in technology enhance not only human comforts but also damage the environment. Use of metals as containers has become popular and safe now, especially to carry the liquids. In spite of the inherent advantages and disadvantages existent in its disposal. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Hence an attempt has been made in the present investigations to study the influence of addition of waste materials like lathe waste, soft drink bottle caps.

Density of lathe waste: 6.23KN/m3

Density of drink caps: 14.18KN/m3

Specific gravity of lathe waste: 6.116

Specific gravity of drink caps: 5.677

The materials which are used in our project are getting from local areas.
Cement - Port land cement 53 Grade
Fine-aggregates – From Eluru.
Coarse-aggregates - From Eluru.
Admixture – Admixture is one of the main important component in experimentation it develop the workability of the concrete. The admixture used is 'BASF'. It is super plasticizer.

Fibers- Two types of fibers

1. Drink bottle caps
2. Lathe machine waste

Preparation of fibers for the Project

The steps involved for the preparation of fibers used in the project.

1. Collection

The fibers collecting from different sources.

2. Softening

The fibers Drink bottle caps and Lathe waste not in a straight. First softening the materials by using hammer.

3. Cutting

After softening the materials, the materials are present in non-uniform shapes. When adding the non-uniform fibers it will effects on the workability of the concrete. By avoiding that problem we are cutting the fibers in uniform. Cutting the fibers in uniform shapes. Cutting the fibers with 3 mm width and 10 mm length by using sniper.

Results:

Mix design for m50 grade concrete:

- Target mean strength = fck + t*S

  = 50+1.65*6=59.9
- Water cement ratio = 0.4 (From IS 456-2000) For m50 design mix
- Cement content = not less than 400kg/m3 for 0.4 w/c ratio
- Water content =0.4*c =0.4*400=160liters
- fine and coarse aggregate content
  - Vfa =[w+ c/Sc+1/p(Fa / SFa)]1/1000
  - 0.98=[160+400/3.15+1/0.335(Fa/2.4)]1/1000
  - Fa =600.43
  - Vca =[w+ c/Sc+1/1-p(Ca / SCa)]1/1000
  - 0.98=[160+400/3.15+1/(1-0.335)(Ca/2.4)]1/1000
  - Ca =1120

  Where P =0.335 C =400kg W =160lit Sca =2.527 Sfa = 2.4 P= 0.335 Sc=3.15

MIX PRPORTIONS Cement: F.A: C.A=1:1.5:2.8

Experiments conducted and Results

Without admixture: for trail mix purpose we are not using admixture to know the strength difference between these concrete
Casted date = 19-1-2017 W/C = 0.4%
Admixture = 0% fibers = 0%

Slump = 46 mm

Specimen	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*984*	*8.69*	*43.73*	
Cu-2	*782*	*8.33*	*34.75*	
Cu-3	*828*	*8.42*	*36.8*	
Cu-4	*1183*	*8.27*		*52.5*
Cu-5	*1369*	*8.33*		*60.8*
Cu-6	*1246*	*8.34*		*55.37*
Cy-1	*220*	*13.2*	*12.4*	
Cy-2	*200*	*13.18*	*11.3*	
Cy-3	*208*	*13.28*	*11.77*	
Cy-4	*253*	*13.2*		*14.3*
Cy-5	*246*	*13.16*		*13.9*
Cy-6	*248*	*13.4*		*14.09*

0.25% admixture:

To increase the strength and workability of concrete we use BASF as admixture.
Casted date = 22-1-2017 W/C = 0.4%
Admixture = 0.25% fibers = 0%

Slump = 56 mm

Specimen	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*1043*	*9.02*	*46.35*	
Cu-2	*1094*	*8.74*	*48.62*	
Cu-3	*1058*	*8.84*	*47.02*	
Cu-4	*1373*	*8.73*		*61.02*
Cu-5	*1287*	*8.87*		*57.2*
Cu-6	*1264*	*8.65*		*56.15*
Cy-1	*235*	*13.32*	*13.35*	
Cy-2	*254*	*13.1*	*14.43*	
Cy-3	*242*	*13.2*	*13.7*	
Cy-4	*265*	*13.2*		*15.05*
Cy-5	*250*	*13.33*		*14.23*
Cy-6	*249*	*13.15*		*14.14*

For 0.5% admixture:

Casted date = 20-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0%

Slump = 66 mm

Specimen	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*952*	*8.52*	*42.31*	
Cu-2	*1143*	*8.56*	*50.8*	
Cu-3	*1048*	*8.46*	*46.5*	
Cu-4	*1334*	*8.5*		*59.28*
Cu-5	*1323*	*8.49*		*58.8*
Cu-6	*1330*	*8.46*		*59.1*
Cy-1	*213.7*	*13.11*	*12.14*	
Cy-2	*228*	*13.03*	*12.95*	
Cy-3	*218*	*13.10*	*12.3*	

Cy-4	292	13.13		16.59
Cy-5	287	13.61		16.3
Cy-6	284	13.5		16.13

For 0.75% admixture:

Casted date = 23-1-2017 W/C = 0.4%
Admixture = 0.75% fibers = 0%

Slump = 90 mm

Speci men	Load (KN)	Weight (Kg)	7days Strength (N/mm2)	28days Strength (N/mm2)
Cu-1	1004	8.78	44.62	
Cu-2	945	8.79	42	
Cu-3	958	8.8	42.57	
Cu-4	993	8.74		44.13
Cu-5	968	8.81		42.68
Cu-6	1038	8.82		46.15
Cy-1	225	13.32	12.78	
Cy-2	221	13.18	12.55	
Cy-3	224	13.2	12.75	
Cy-4	233	13.25		13.23
Cy-5	219	13.17		12.44
Cy-6	224	13.18		12.72

For 1% admixture:

Casted date = 21-1-2017 W/C = 0.4%
Admixture = 1% fibers = 0%

Slump = 130 mm

Speci men	Load (KN)	Weight (Kg)	7days Strength (N/mm2)	28days Strength (N/mm2)
Cu-1	1004	9.25	44.62	
Cu-2	764	9.26	33.65	
Cu-3	828	9.29	36.8	
Cu-4	1148	9.28		51.02
Cu-5	1216	9.27		54.04
Cu-6	1189	9.26		52.84
Cy-1	202	13.46	11.47	
Cy-2	225	13.49	12.78	
Cy-3	208	13.46	11.8	
Cy-4	248	13.44		14.09
Cy-5	252	13.48		14.31
Cy-6	256	13.49		14.54

Addition of Fiber:

In this we are adding drink caps with a uniform length of 10mm and breadth of 3mm. These drink caps are added with different percentages like 0.25, 0.5, 0.75 and 1%

These strengths are calculated using the compression testing machine And different tests are conducted like slump cone test, split tensile test and flexural test.


For 0.25% drink caps:
Casted date = 05-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.25% (drink caps)

Slump = 50 mm

Speci men	Load (KN)	Weigh t (Kg)	7days Strength (N/mm2)	28days Strength (N/mm2)
Cu-1	1348	8.76	59.91	
Cu-2	1294	8.85	57.51	
Cu-3	1256	8.88	55.82	
Cu-4	1468	8.92		65.24
Cu-5	1386	8.96		61.6
Cu-6	1522	8.86		67.64
Cy-1	240	13.51	13.6	
Cy-2	252	13.48	14.31	
Cy-3	273	13.2	15.51	
Cy-4	301	13.34		17.1
Cy-5	292	13.5		16.59
Cy-6	289	13.32		16.4

0.5% drink caps:
Casted date = 07-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.5% (drink caps)

Slump = 60 mm

Specim en	Load (KN)	Weight (Kg)	7days Strength (N/mm2)	28days Strength (N/mm2)
Cu-1	1084	8.83	48.1	
Cu-2	1260	9.05	56	
Cu-3	1104	9.11	49.06	
Cu-4	1314	8.55		58.4
Cu-5	1109	8.65		49.2
Cu-6	1289	8.45		57.28
Cy-1	244	13.47	13.86	
Cy-2	248	13.35	14.09	
Cy-3	252	13.45	14.31	
Cy-4	245	13.49		13.9
Cy-5	255	13.48		14.48
Cy-6	259	13.33		14.71

0.75% drink caps:

Casted date = 08-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.75% (drink caps)

Slump = 58 mm

Speci men	*Load (KN)*	*Weigh t (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*1085*	*8.83*	*48.2*	
Cu-2	*1064*	*8.76*	*47.3*	
Cu-3	*1012*	*8.85*	*44.9*	
Cu-4	*1204*	*8.92*		*53.5*
Cu-5	*1185*	*8.94*		*52.6*
Cu-6	*1163*	*8.93*		*51.6*
Cy-1	*230*	*13.2*	*13.06*	
Cy-2	*234*	*13.51*	*13.2*	
Cy-3	*238*	*13.6*	*13.5*	
Cy-4	*248*	*13.4*		*14.09*
Cy-5	*252*	*13.34*		*14.3*
Cy-6	*256*	*13.39*		*14.5*

1% drink caps:

Casted date = 09-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 1% (drink caps)

Slump = 90 mm

Speci men	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*1004*	*8.78*	*44.62*	
Cu-2	*945*	*8.79*	*42*	
Cu-3	*958*	*8.8*	*42.57*	
Cu-4	*993*	*8.74*		*44.13*
Cu-5	*968*	*8.81*		*42.68*
Cu-6	*1038*	*8.82*		*46.15*
Cy-1	*225*	*13.32*	*12.78*	
Cy-2	*221*	*13.18*	*12.55*	
Cy-3	*224*	*13.2*	*12.75*	
Cy-4	*233*	*13.25*		*13.23*
Cy-5	*219*	*13.17*		*12.44*
Cy-6	*224*	*13.18*		*12.72*

0.25% lathe waste:

Casted date = 13-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.25% (lathe waste)

Slump = 70 mm

Speci men	*Load (KN)*	*Weigh t (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*900.1*	*8.61*	*40.02*	
Cu-2	*892*	*8.60*	*39.64*	
Cu-3	*889.7*	*8.59*	*39.54*	
Cu-4	*1121*	*8.84*		*49.8*
Cu-5	*1059*	*8.75*		*47.06*
Cu-6	*1027*	*8.82*		*45.64*
Cy-1	*185*	*13.24*	*10.5*	
Cy-2	*198*	*13.26*	*11.25*	
Cy-3	*201.6*	*13.23*	*11.45*	
Cy-4	*208*	*13.28*		*11.81*
Cy-5	*220*	*13.23*		*12.5*
Cy-6	*210*	*13.26*		*11.93*

0.5% lathe waste:

Casted date = 13-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.5% ((lathe waste)

Slump = 67 mm

Speci men	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*1043*	*8.90*	*48.8*	
Cu-2	*1094*	*8.86*	*42.6*	
Cu-3	*1058*	*8.84*	*41.95*	
Cu-4	*1373*	*8.77*		*49.5*
Cu-5	*1287*	*8.86*		*55.6*
Cu-6	*1264*	*8.75*		*59.02*
Cy-1	*235*	*13.4*	*12.16*	
Cy-2	*254*	*13.46*	*12.95*	
Cy-3	*242*	*13.53*	*13.21*	
Cy-4	*265*	*13.57*		*13.23*
Cy-5	*250*	*13.53*		*13.4*
Cy-6	*249*	*13.59*		*13.63*

0.75% lathe waste:

Casted date = 14-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 0.75% (lathe waste)

Slump = 66 mm

Speci men	*Load (KN)*	*Weight (Kg)*	*7days Strength (N/mm2)*	*28days Strength (N/mm2)*
Cu-1	*1002*	*8.76*	*44.5*	
Cu-2	*960*	*8.85*	*42.6*	
Cu-3	*944*	*8.92*	*41.9*	
Cu-4	*1097*	*8.63*		*48.7*

Cu-5	962	8.75		42.8
Cu-6	942	8.64		41.8
Cy-1	222	13.51	12.6	
Cy-2	215	13.2	12.1	
Cy-3	228	13.35	12.9	
Cy-4	258	13.46		14.6
Cy-5	255	13.41		14.48
Cy-6	258	13.44		14.6

1% lathe waste:

Casted date = 15-1-2017 W/C = 0.4%
Admixture = 0.5% fibers = 1% (lathe waste)

Slump = 65 mm

Speci men	Load (KN)	Weight (Kg)	7days Strength (N/mm2)	28days Strength (N/mm2)
Cu-1	941.6	8.79	41.84	
Cu-2	964	8.74	42.84	
Cu-3	1003	8.75	44.58	
Cu-4	1110	8.73		49.3
Cu-5	1112	8.81		49.4
Cu-6	1148	9.07		51.02
Cy-1	226	13.56	12.84	
Cy-2	212	13.48	12.04	
Cy-3	203	13.52	11.53	
Cy-4	266	13.54		15.11
Cy-5	255	13.42		14.48
Cy-6	272	13.62		15.45

Conclusions:

Fiber reinforced concrete can be used advantageously over normal concrete pavement. From this project we can conclude that, fiber reinforced concrete give more test results. For the same design grade of concrete the fiber reinforced concrete give high strength values than compared to normal mix

By using this fiber reinforced concrete we can increase the tensile characteristics of concrete and increase the impact and abrasion resistance

The initial cost of fiber reinforced concrete is high and 15 to 20% is counter balanced by the reduction in maintenance

By adding fibers to the concrete we can decrease waste and it is reused.

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