INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

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SPECIAL ISSUE FOR
NATIONAL LEVEL CONFERENCE
"Recent Trends and Development in Civil Engineering"

IMPROVISING SHAPE OF STEEL FIBER

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Accepted Date: 27/01/2018; Published Date: 01/03/2018

Abstract: During recent years, steel fiber reinforced concrete has gradually advanced from a new, rather unproven material to one which has now attained acknowledgment in numerous engineering applications. Lately it has become more frequent to substitute steel reinforcement with steel fiber reinforced concrete. The applications of steel fiber reinforced concrete have been varied and widespread, due to which it is difficult to categorize. The most common applications are tunnel linings, slabs, and airport pavements. In these experiments we had improvised the shape of steel fiber available in the market and we conducted tests on it.

Keywords: Steel Fiber, Fibers, Concrete, Compressive Strength, Shapes Of Steel Fiber

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Access Online On:

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How to Cite This Article:

Vinay Jaisinghani, IJPRET, 2018; Volume 6 (7): 376-383

PAPER-QR CODE

INTRODUCTION

The materials used for making Modified steel fiber concrete specimens are steel fibers the source material, aggregates, plasticizer, and water. Steel fibers are fiber used in concrete which are short and closely spaced and are typically added to concrete in low volume dosage and are used in reducing plastic shrinkage cracking and improved strength. Xorex Fibers comply with ASTM A820 requirements. Typical lengths: 1.0", 1.5" and 2.0"(25, 38mm and 50mm), but also can produce 0.75" and 2.5".Commonly used to improve concrete toughness, shear strength, and impact resistance. Concrete reinforcement fibers reduce concrete cracking due to reduce shrinkage. Typical applications: Dams. Spillways, Bridge Girders. Piers, Locks. Tunnels, Precast concrete, etc. Can be used in either wet or dry mix shotcrete. Xorex Fibers reinforced concrete are less expensive than hand-tied rebar, while still increasing the tensile strength many times; shape, dimension and length of fiber are important to consider. Xorex Fibers can only be used on surfaces that can tolerate or avoid corrosion and rust stains. Materials, mixing, and testing procedures should comply with the applicable sections of ASTM C 1116/C 1116M and ASTM C 1436.

Fiber Length 1.0" 1.5" and 2.0" in (25, 38 mm and 50 mm).Equivalent Diameter 0.045" (1.14 mm).Available Aspect Ratio 22, 34 and 44.Tensile Strength 140-180 Kpsi (966-1242 MPa)

CHEMICAL ELEMENTS	C	Si	Mn	P	S
Specification (%)	<0.15%	<0.30	<0.95	<0.070	<0.050
Test Result (%)	0.08	0.05	0.86	0.016	0.013

FIBER Dia:=.04" (1.0mm)	SIZE ASPECT RATIO
1.0" Length (25mm)	25
1.25" Length (25mm)	30
1.5" Length (25mm)	38
2.0" Length (25mm)	50

Table-2 Fiber size and aspect ratio

Locally available crushed stones of 10 mm and 20 mm aggregates were used as coarse aggregates. Local river sand was used as fine aggregate in the concrete mixtures.

Sieve	Retain	Retain	Cumulative	Passing
	gm	%	%	%
10 mm	0	0	-	10
4.75 mm	6	3	3	97
2.36 mm	38	19	21	79
1.18 mm	54	27	48	52
600	31	15.5	63.5	36.5
300	43	21.5	85	15
150	10	5	90	10
Pan	20	10	100	0

Table-3 Sieve analysis of fine aggregate

In order to study the effect of super-plasticizer, the other test parameters such as mix composition, curing period, curing time etc. were kept constant.

Tests were therefore performed to study the effect of adding commercially available naphthalene-based super-plasticizer. The addition of super-plasticizer improved the workability of the fresh concrete but had very little effect on the compressive strength up to about two percent of this admixture to the mass of fly ash. Beyond this value, there is some degradation of the compressive strength.

Naphthalene based super-plasticizer Sodium Naphthalene Formaldehyde was cited by the chemical synthesis of non-air-type super-plasticizer. Chemical Name naphthalene sulfonate formaldehyde condensate, which for the dispersion of cement particles have a strong role. Pandemic on the state of preparation of concrete, there are early strength, high strength requirements of in-situ concrete and to the system components, there is a good use of effects, the overall advancement and improvement of various properties of concrete.

Naphthalene based superplasticizer Na2SO4 in accordance with its products, the level of content can be divided into high-concentration products (Na2SO4 content of "3%), the concentrated products (Na2SO4 content of 3%~10%) and low-concentration products (Na2SO4 content of "10%).[2] Most naphthalene superplasticizer synthetic plants possess the Na2SO4 concentration at 3% or less capacity, and some advanced enterprises may even be controlled at below 0.4%.[1]

PROCEDURE OF CONCRETE FLEXURAL STRENGTH

Step1 - Prepare the test specimen by filling the concrete into the mould in 3 layers of approximately equal thickness. Tamp each layer 35 times using the tamping bar as specified above. Tamping should be distributed uniformly over the entire crossection of the beam mould and throughout the depth of each layer.Step2 - Clean the bearing surfaces of the supporting and loading rollers , and remove any loose sand or other material from the surfaces of the specimen where they are to make contact with the rollers.[1]

Photograph-2 flexural strength test machine
(Source:http://www.matest.com/Cms_Data/Import_Data_Image/Prodotto/_542_C090-03N%20flexural%20machine%20150kn%20servoplus1.jpg)

Step3 - Circular rollers manufactured out of steel having cross section with diameter 38 mm will be used for providing support and loading points to the specimens. The length of the rollers shall be at least 10 mm more than the width of the test specimen. A total of four rollers shall be used, three out of which shall be capable of rotating along their own axes. The distance between the outer rollers (i.e. span) shall be 3d and the distance between the inner rollers shall be d. The inner rollers shall be equally spaced between the outer rollers, such that the entire system is systematic.[2]

Step4 - The specimen stored in water shall be tested immediately on removal from water; whilst they are still wet.[2] The test specimen shall be placed in the machine correctly centered with the longitudinal axis of the specimen at right angles to the rollers. For moulded specimens, the mould filling direction shall be normal to the direction of loading.

Step5 - The load shall be applied at a rate of loading of 400 kg/min for the 15.0 cm specimens and at a rate of 180 kg/min for the 10.0 cm specimens.[1]

The Flexural Strength or modulus of rupture (**fb**) is given by

fb = pl/bd2 (when **a** > 20.0cm for 15.0cm specimen or > 13.0cm for 10cm specimen)Where,a = the distance between the line of fracture and the nearer support, measured on the center line

of the tensile side of the specimenb = width of specimen (cm)d = failure point depth (cm)l = supported length (cm)p = max. Load (kg)[1]

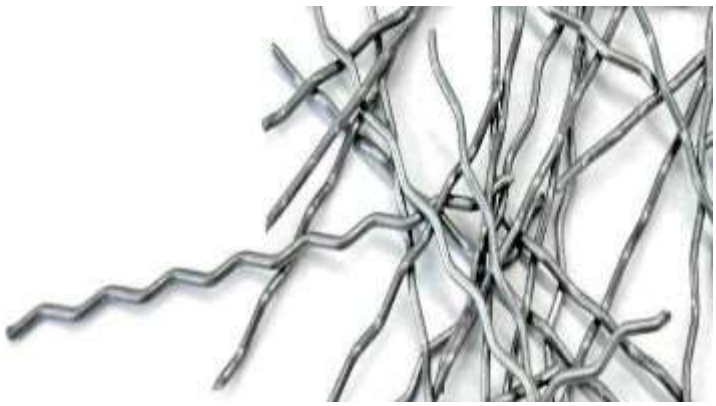
Mix Design

A-1	Stipulations for Proportioning	
1	Grade Designation	M30
2	Type of Cement	OPC 53 grade confirming to IS-12269-1987
3	Maximum Nominal Aggregate Size	20 mm
4	Minimum Cement Content (MORT&H 1700-3 A)	310 kg/m^3
5	Maximum Water Cement Ratio (MORT&H 1700-3 A)	0.45
6	Workability (MORT&H 1700-4)	50-75 mm (Slump)
7	Exposure Condition	Normal
8	Degree of Supervision	Good
9	Type of Aggregate	Crushed Angular Aggregate
10	Maximum Cement Content (MORT&H Cl. 1703.2)	540 kg/m^3
11	Chemical Admixture Type	Super plasticiser Confirming to IS-9103

SHAPE OF STEEL FIBRE

Tabix

TABIX has been designed such from the point of view of amplitude and wave length that the workability is good for aspect ratios up to 45 and remains satisfactory for aspect ratios up to 60.[4]



Photograph-3 Tabix Steel Fiber (source-https://www.sciencedirect.com/science/article/pii/S0950061811002558)

SHAPE STEEL FIBRE

Shape steel fibre is designed in such a way that it acts as a binder between the concrete. Hook end steel fibres and tabix steel fibres were reshaped as V shape steel fibres and were placed in the concrete according to volume of it.Above mentioned tests were conducted on it. [4]

Test results for 28 days curing		
Volume	Shape Cube casted	Avg.TestResults N/mm2
1% steel fiber	V Shape	23.45
2% steel fiber	V shape	26.89
No steel fiber	-	22.32
Test results for 28 days curing		
Volume	Shape Cube casted	Avg.TestResults N/mm2
1% steel fiber	V Shape	29.45
2% steel fiber	V shape	33.89
No steel fiber	-	27.32

CONCLUSION

Thus, from this project we had concluded that:- Adding 1% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.04% within 7 days. Adding 1% of V shape steel fiber in concrete of mix design m30 increases strength of it by 1.05% within 7 days. Adding 2% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.10% within 7 days. Adding 2% of V shape steel fiber in concrete of mix design m30 increases strength of it by 1.20% within 7 days. Adding 1% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.20% within 14 days. Adding 2% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.24% within 14 days. Adding 1% of V shape steel fiber in concrete of mix design m30 increases strength of it by 1.22% within 14 days. Adding 2% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.41% within 14 days. Adding 1% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.29% within 28 days. Adding 2% of hook end steel fiber in concrete of mix design m30 increases strength of it by 1.34% within 28 days. Adding 1% of V shape steel fiber in concrete of mix design m30 increases strength of it by 1.33% within 28 days. Adding 1% of V shape steel fiber in concrete of mix design m30 increases strength of it by 1.48 % within 28 days.

This shows that V shape steel fiber gave better results compared to hook end steel fiber which is available in the market. Strength of concrete is increased after adding V shape steel fiber

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