Behavior of Carbon Fiber Reinforced Concrete Under Impact Loading: A Review

Shila Bobade[1], Ram Chatorikar[2]
[1]Dept of Civil Engineering
[2]Assistant professor, Dept of Civil Engineering
[1, 2] Marathwada Institute of Technology and Engineering, Aurangabad ,Maharashtra, India.

Abstract- *Brittleness and low tensile strength is properties of plain concrete. Plain concrete has the low impact strength due to its low tensile strength. In this era the RCC structure having their own requirement due to structural element subjected to static and dynamic loading. The impact load mainly originates from wing gust, earthquake, projectiles, machines vibrations, etc. And addition of fiber improves the impact strength of concrete was proved. High tensile strength, high modulus of elasticity, low weight these are the properties of carbon fibers. This paper presents the comparative study of behavior of carbon fiber reinforced concrete under impact loading on the basis of past studies.*

Keywords- carbon fiber concrete, compressive strength, drop weight impact test, impact strength,

I. INTRODUCTION

Concrete is widely used material in construction industry because of it is workability and has ability to molded in any shape. But the brittleness and weak in tension is the characteristics of plain concrete. In this era the RCC structure having their own requirement of compressive strength, durability and impact resistance due to concrete structural members subjected to various type of static and dynamic loading i.e. impact loading. Impact load is the load experienced by the structure when moving body stop by the structure. Moving body has kinetic energy this energy transferred to the structure when body comes at rest, this energy dissipation is called as impact energy. Wind gust, projectiles, missiles, machine vibrations, earthquake, these are the main originators of impact energy. Many researchers have shown that addition of fibers greatly improves the energy absorption and cracking resistance of concrete. the addition of fiber improves the strength and toughness of concrete is the big advantage of using fiber reinforced concrete. Carbon fiber has a high tensile strength, high modulus of elasticity, light weight. Drop weight impact for impact resistance of concrete recommended by American concrete institute committee 544 (on fiber reinforced concrete) is the economical and easy to operate.

II. LITERATURE REVIEW

Trevor D. Hrynyk et, al.[2014]- Aim of this research work was to check the behavior of steel fiber reinforced concrete under impact load. In this experiment they constructed seven intermediate scale slabs with slabs contained longitudinal reinforcing bars and constructed with steel fiber contents from 0% to 1.5%. And testing was carried out by using drop weight impact .data from testing were used to find out the performance of steel fiber reinforced concrete in impact resistance. the test result indicate that for increasing the slab capacity steel fiber addition was effective. Also addition of steel fiber was reducing crack width and spacing and mitigating local damaged under impact .also the slab were designed for flexural critical under static loading conditions for observing the response and failure modes that were governed by shear.

Santhi A.S. et, al.[2014]-well known that concrete has a high compressive strength but it is brittleness is the drawback of high strength concrete when it is subjected to impact load. in this study investigate the impact strength of fiber reinforced concrete by using steel fiber at various fraction at 28 days cured plain concrete and fiber reinforced concrete. Used crimped and hooked end steel fiber with 50mm length and aspect ratio of 50 with different volume fraction i.e. 0%,0.5%,1%,1.5% and water cement ratio was 0.42.all experimental test work performed as per drop weight test as per ACI committee 544.thest result showed that the fiber reinforced concrete was effective to increase the impact strength. Also used ultrasonic pulse velocity for determination of reduction of strength under impact load in each specimen for every 3blows.by using regression analysis developed the statistical correlation between ultrasonic pulse velocity and number of blows under impact load. Strength of concrete under impact load accurately predicted by developed regression model.

G. Murali, et, al.[2014]- in this present research work they were find out the empirical relationship between impact energy and compressive strength. All the experimental work carried out for M30 grade of concrete with the use of

crimped and hooked end steel fiber of aspect ratio 50 for four different fraction of steel fiber ranging from 0% to 1.5%. as per ACI 544 committee they used simple, economical, practical drop weight impact testing procedure for impact resistance test. from obtained test data they concluded that the impact resistance of concrete specimen increases with increase in fraction of fibers.

K.Anbuvelan [2014]-Analyzed that due to poor impact resistance, low fracture energy and relatively low tensile strength concrete structure were subjected to static and dynamic loads. in this study attempt was made to investigate the impact resistance of polypropylene fiber with 0.1%,0.2%,0.3% dosage. The mix proportioning made for three grades of concrete and test work performed by drop weight test in accordance with testing procedure suggested by ACI 544committee.on the basis of obtained test data compared the test result of fiber reinforced concrete with conventional concrete. and polypropylene fiber reinforced concrete shows improvement that of conventional concrete.

G.Murali, et, al. [2014]-The purpose **o**f this study was to investigate the impact resistance of fiber reinforced concrete by using drop weight impact test suggested by American concrete Institute committee 544.in this experimental work four set of each series of mix proportioning were prepared for 0%,0.5%,1%,1.5%.fraction of hooked and crimped steel fiber having diameter 1mm and aspect ratio 50.for analyze the test data and impact strength which was presented in terms of reliability function were performed by using two parameters of weibull distribution. with accordance with test result they conclude that the steel fiber changed the failure pattern of concrete from brittle to ductile with increased impact resistance. weibull distribution allows the investigator to describe the impact strength fiber reinforced concrete in terms of safety and reliability limits.

K. Ramesh, et, al.[2013]-The aim of this experiment was study the impact resistance of fly ash reinforced concrete with steel fiber. Fly ash used with replacement of weight of cement ranging varied from 0% to 30% at an interval of each 10% and steel fiber proportion varied from 0% to 1.5% by weight of cement. All specimens tested at 28days, 60days, 90days, of curing period by using drop weight test as per ACI 544.The test results indicated that impact strength of flyash reinforced concrete considerably increases with the curing period after 28 days while impact strength reduced for 28 days curing period. The impact strength was increases in variation of 23% to 252% times that of plain concrete.

H.E.M. Sallam et, al.[2008]-Studied the effect on mechanical properties and impact resistance of normal strength concrete with and without silica fume due to addition of ground waste tire rubber. Two different size of cylinder were tested with 10%,20%,30%, volume fraction of of crumb rubber as a partial replacement of sand. For size effect tested the indirect tension test and for impact resistance drop weight impact test used which was recommended by ACI committee 544. The test result proved that the small decrease in compressive strength cause with replacement of fine aggregate by 10% crumb. Crack resistance under impact was increased with used small size of crumb rubber particles. From test result was observed that failure mode of rubberized concrete under short duration (static and dynamic) was same that of conventional concrete.

Faisal Fouad Wafa[1990] –the present paper described the properties and application of different type of fiber reinforced concrete. Also presented that the result of mechanical properties of concrete with straight and hooked steel fibers. Compressive strength of FRC will be up 15% that of conventional concrete, flexural strength was increased by 2.5 times with addition of 4% fibers, FRC has a 10 to 40percent toughness that of plain concrete, improvement of impact strength depends on the addition of fiber fraction in general which is 5 to 10 times more than plain concrete. Test result showed that the addition of fiber increases the post cracking load carry capacity and ductility of concrete. Using hooked end fiber improved the mechanical properties of FRC. The deformation and cracking under impact loading was much better controls by using FRC that of plain concrete.

Wimal Suaris, et, al.[1983]- the aim this research work was to study the constitutive properties of concrete over wide range of strain rate are required because of rational design of concrete structure subjected to impact and impulsive loading. drop weight instrumented impact testing machine was used for testing of beams of plain concrete and FRC.test result indicated that the energy absorption capacity of fiber reinforced concrete beam was as much as 100 times that of unreinforced beams. This paper present the influence of matrix mix proportions of different types of fibers on impact properties. energy absorption capacity of long and short steel fiber reinforced concrete, polypropylene fiber reinforced concrete and glass fiber reinforced concrete under impact loading was near about 100,14,31 and 7 that of unreinforced beams.

III. CONCLUSION

Concrete is a widely used and intrinsically brittle material. Now a day's concrete structure experienced various types of impact loading. the use of fiber reinforced concrete was found to be advantageous for improvement of

compressive strength, impact resistance and ductility of concrete. Carbon fiber has high tensile strength, light weight, high modulus of elasticity. And drop weight impact test suggested by American Concrete Institute committee 544 is simple, easy to performed and economical.

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