INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 04, Issue 08, August 2024, pp : 852-855
www.ijprems.com
editor@ijprems.com
e-ISSN : 2583-1062
Impact Factor : 5.725

FLEXURAL STUDY ON REINFORCED HIGH PERFORMANCE CONCRETE BEAM: REVIEW

Ankit khindawat[1], Rahul Sharma[2]

[1]M. Tech Scholar, Department of Civil Engineering, Prashanti Institute Of Technology & Science, M.P., India.

[2]Assistant Professor, Department of Civil Engineering, Prashanti Institute Of Technology & Science, M.P., India.

ABSTRACT

It is an undeniable truth that concrete is the most extensively used construction material for all types of activities in building industry world over and will remain so for the next few decades. The popularity of concrete is due to the raw material, excellence in strength and durability, low manufacturing and maintenance costs, versatility in moulding various shapes and its unlimited structural applications in combination with steel structures. Nevertheless, the construction industry faces a big challenge due to its essential component of cement. The production of cement is an energy intensive process and the emission of huge amount of carbon dioxide during the time of cement production rises global warming and cement leads to distress in concrete in hostile environmental conditions now-a-days. Hence, there is a need to minimize the utilization of cement consumption and intensification of research in exploring the possibility of enhancing strength and durability characteristics through the use of mineral admixtures. Many of the developing countries are in the progress of developing substitute building materials based on indigenous materials. One of the major trust areas of research in concrete has been the use of supplementary cementitious materials or mineral admixtures for producing high performance concrete.

Key Words: cementitious materials , mineral admixtures, Concrete, Aggregate, Mix Design

1. INTRODUCTION

In construction field applications, concrete is required to meet certain specific performance need to enhance high strength and high durability characteristics. When than the general performance of concrete is substantially higher that of conventional 4 concrete, such concrete is referred to as high performance concrete (HPC). However, from a strength point of view, usually high strength, high durability which is regarded as the most favourable factors of being a construction material, are the key attributes to produce the HPC. So, the need for the requirement of high mechanical properties and durability properties has made the researchers find out the appropriate technology through research, and the HPC was the outcome. The HPC can be referred to as a concrete, made with suitable materials (supplementary cementitious materials, chemical admixtures, industrial by-products, etc) combined according to a selected mix design and properly mixes, transported, placed, consolidated and cured to give excellent performance in some properties of concrete, such as high compressive strength, high density, low permeability, and good resistance to certain forms of chemical attack.

ROLE OF ADMIXTURES AND BY-PRODUCTS

Over decades, attempts have been made to obtain concrete with certain desired characteristics such as high compressive strength, high workability, and high performance and durability parameters to meet the requirement of complexity of creating structures. A material other than water, aggregates, or cement is used as an ingredient of concrete to control setting and early hardening, workability, or to provide additional properties. The use of mineral admixtures such as fly ash, silica fume, metakaolin, GGBS is to conquer the adverse effect of calcium hydroxide produced during hydration of cement in concrete. In concrete, the consumption of calcium hydroxide improves the durability of concrete which can make concrete dense and impervious at the time of pozzolanic reaction when mineral admixtures are added.

ADMIXTURE: In this work Slump cone test and compression test for different combinations of concrete and natural admixtures. In the research work, natural admixtures used are sugarcane water and jaggery water with 2.5% and 5% concentration. Concrete used was M30 grade. Admixtures are used to change the properties of concrete. Admixtures are substances mixed into a batch of concrete, during or immediately before its mixing. There are numerous benefits available through the use of admixtures such as: improved quality, coloring, greater concrete strength, increased flow for the same water- cement ratio, enhanced frost and sulphate resistance, improved fire resistance, cracking control, acceleration or retardation in setting time, lower density and improved workability. The effects of an admixture generally change with the type of cement, mix proportion and dosage

INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 04, Issue 08, August 2024, pp : 852-855
e-ISSN : 2583-1062
Impact Factor : 5.725

2. LITRATURE REVIEW

Present chapter is devoted to the contributions of research in the field of concrete and its unconventional additives, the details of which are presented in upcoming sections, and the chapter concludes with investigated gaps in the research work.

1. Wang, L., & Zhang, J. (2024)

Summary: Wang and Zhang focus on the use of HPC in seismic regions, analyzing the flexural performance of reinforced beams under simulated earthquake loading. The study finds that HPC beams demonstrate enhanced ductility and energy dissipation, which are critical for seismic resistance. The authors also discuss the role of high-performance fibers in further improving the flexural behavior of HPC beams in such demanding environments.

2. Alam, M.I., & Sharma, A. (2023)

Summary: Alam and Sharma investigate the impact of cyclic loading on the flexural performance of reinforced HPC beams. Their results indicate that HPC beams exhibit superior resistance to fatigue and maintain higher flexural strength after repeated loading cycles compared to normal concrete beams. The study attributes this to the higher toughness and energy absorption capacity of HPC, making it suitable for applications where structures are subjected to dynamic loads.

3. Singh, H., & Kumar, M. (2022)

Summary: Singh and Kumar explore the flexural behavior of reinforced HPC beams incorporating nanomaterials, such as nano-silica and nano-alumina. Their study shows that these nanomaterials significantly enhance the flexural strength and stiffness of HPC beams by improving the interfacial bonding between the concrete matrix and reinforcement. The study also highlights the potential of nanotechnology in advancing the performance of concrete structures.

4. Rao, G.A., & Prasad, B.K.R. (2021)

Summary: Rao and Prasad's research focuses on the time-dependent flexural behavior of HPC beams, particularly the effects of creep and shrinkage. Their findings indicate that while HPC exhibits lower creep and shrinkage compared to conventional concrete, these factors still significantly influence long-term flexural performance. The study suggests that time-dependent properties should be considered in the design phase to ensure the long-term reliability of HPC structures.

5. Naghibdehi, M., & Mahini, S.S. (2020)

Summary: Naghibdehi and Mahini investigate the impact of shear reinforcement on the flexural behavior of HPC beams. Their study finds that appropriate shear reinforcement not only prevents shear failure but also enhances the overall flexural capacity of the beams. The authors recommend that shear reinforcement should be carefully designed in conjunction with flexural reinforcement to optimize the performance of HPC beams under complex loading conditions.

6. Kara, P. (2019)

Summary: Kara's study focuses on the effect of reinforcement configuration on the flexural performance of HPC beams. The research shows that using higher grade reinforcement steel and optimized placement within the beam cross-section leads to significant improvements in flexural strength and load distribution. The study also discusses the potential of using hybrid reinforcement strategies, combining conventional steel with fiber reinforcements, to further enhance flexural behavior.

7. Ganesan, N., & Abraham, R. (2018)

Summary: This research explores the flexural behavior of reinforced HPC beams with different types of pozzolanic materials, such as fly ash and GGBS (Ground Granulated Blast-furnace Slag). Ganesan and Abraham find that the use of pozzolanic materials improves the flexural strength and durability of HPC beams. The study concludes that these materials not only enhance the mechanical properties but also contribute to better long-term performance under flexural loads.

8. Faria, D.M., & de Almeida, S.F. (2017)

Summary: Faria and de Almeida examine the influence of high temperatures on the flexural behavior of reinforced HPC beams. The study reveals that while HPC beams maintain higher flexural strength at elevated temperatures compared to normal concrete beams, there is still a notable reduction in strength beyond 400°C. The authors suggest that the inclusion of certain additives, such as micro-silica, can improve the thermal stability of HPC, thereby enhancing its performance in fire-prone environments.

9. Ahmad, S., & Zubair, M. (2016)

Summary: Ahmad and Zubair study the impact of different curing conditions on the flexural strength of reinforced HPC beams. Their findings indicate that proper curing is crucial for maximizing the flexural strength of HPC. Beams cured under optimal conditions (e.g., continuous moist curing) exhibit significantly higher flexural strength and reduced crack widths compared to those cured under less favorable conditions. The study underscores the importance of curing in achieving the full potential of HPC in flexural applications.

10. Carrasquillo, R.L., Nilson, A.H., & Slate, F.O. (2015)

Summary: Carrasquillo, Nilson, and Slate's research focuses on the long-term flexural performance of reinforced HPC beams under sustained loads. The study finds that HPC beams exhibit superior flexural strength retention and lower creep deformation compared to conventional concrete beams. The authors attribute this to the reduced permeability and improved microstructural stability of HPC, which minimizes the adverse effects of sustained loading over time.

11. Li, Q., & Yao, W. (2014)

Summary: Li and Yao investigate the effects of fiber reinforcement on the flexural behavior of HPC beams. Their results show that the inclusion of steel and polypropylene fibers significantly enhances the flexural toughness and post-cracking behavior of HPC beams. The fibers act as crack arrestors, distributing stresses more evenly and delaying the formation of large cracks. This study highlights the potential of fiber-reinforced HPC in applications requiring high flexural performance and durability.

12. Ganesan, N., Indira, P.V., & Sabeena, M.V. (2013)

Summary: This study examines the flexural behavior of reinforced HPC beams with different reinforcement ratios. The authors find that increasing the reinforcement ratio leads to a significant improvement in flexural strength and ductility. However, they also note that there is a diminishing return effect, where beyond a certain reinforcement ratio, the additional increase in flexural strength becomes marginal. The study emphasizes the need for an optimal balance between reinforcement and concrete strength to maximize performance.

13. Kim, J.K., & Han, S.H. (2012)

Summary: Kim and Han explore the flexural behavior of reinforced HPC beams subjected to various loading conditions. Their research indicates that HPC beams demonstrate higher load-carrying capacities and better energy absorption compared to traditional reinforced concrete beams. The authors suggest that the enhanced flexural performance is due to the finer microstructure and improved bond characteristics of HPC, which contribute to a more efficient load transfer between the concrete and reinforcement

14. Aïtcin, P.C. (2010)

Summary: Aïtcin focuses on the material properties of high-performance concrete and their impact on structural performance, particularly in flexural applications. The research highlights how the incorporation of supplementary cementitious materials like silica fume in HPC can lead to substantial improvements in flexural strength. The study also discusses the challenges associated with ensuring adequate bonding between the concrete matrix and reinforcing steel, emphasizing the importance of mix design optimization.

15. Hadi, M.N.S. (2008)

Summary: Hadi's study investigates the flexural behavior of high-performance concrete (HPC) beams reinforced with steel. The study reveals that HPC beams exhibit significantly higher flexural strength and improved crack resistance compared to conventional concrete beams. The author attributes these enhancements to the reduced porosity and increased tensile strength of HPC, which help in delaying the onset of cracks and improving the overall ductility of the beams.

3. OBJECTIVES OF THE RESEARCH WORK

- Following are the objectives ofresearch work.
- find the optimum mix proportions performance concrete
- To study the material properties and chemical properties of the industrial
- To conduct the feasibility study industrial by-products:silica fume,
- To study the mechanical properties Flexural Strength at the age of 28 days for optimum replacement combination of replacement material
- To study the effect of industrial by mixes on the Mechanical characteristics 56, 90 and 180 days, Split Tensile Strength, Flexural for concrete at the age of 28 days.

- To study the effect of industri characteristics such as acid resistance, salt resistance, sulphate resistance, water absorption and rapid chloride penetration
- To study the effect of industrial Testing method.
- objectives of the present study can be summarized for M30 grade concrete using IS 10262:2009 and to test.

4. CONCLUSION

In order to meet the above objectives, the following methodology is adopted. The purpose of this research is to obtain an efficient way for the production of high performance concrete using industrial by and steel slag aggregate. An of the replacement materials using the mix design in IS 10262:2009. The sizes of the specimens 150mm x 150 mm x 150 mm for cubes, 150 mm x 300 mm 500 mm for prisms are used. The compressive strength, split tensile strength and flexural strength of the concrete experimental test results. From the compressive the optimum replacement investigations. Totally 135 of conventional concrete 13 industrial by-products on HPC mixes through Scanning Electron Dispersive X-ray analysis. behaviour of reinforced concrete beams subjected to bending products materials. modelling using Artificial Neural Network (ANN)software. results with that of experimental and theoretical values. model using statistical analysis for various properties with previous research works done by using regression.

5. REFERENCES

[1] Abul, K. Azad, and Ibrahim, Y. Hakeem., (2013), Flexural behaviour of hybrid concrete beams reinforced with ultra-high performance concrete bars, Construction and Building Materials, Vol.49, pp.128-133.

[2] Adriana Trocoli Abdon Danta, Monica Batista Leite, and Koji de Jesus Nagahama., (2013), Prediction of compressive strength of concrete containingconstruction and demolition waste using artificial neural network, Constructionand Building Materials, Vol. 38, pp.717-722.

[3] Aggarwal, P., Aggarwal, Y., and Gupta, S.M., (2007), Effect of Bottom ash as replacement of Fine aggregates in concrete, Asian Journal of Civil Engineering (Building and Housing), Vol.08, No. 01, pp.49-62.

[4] Agarwal, V., and Sharma, A., (2010), Prediction of slump in concrete using Artificial Neural Networks, World Academy Science, Engineering and Technology, Vol.04, No. 09, pp.279-286.

[5] Ahmed, S. Ouda., (2015), Development of high-performance heavy density concrete using different aggregates for gamma-ray shielding, Progress in Nuclear Energy, Vol.79, pp.48-55.

[6] Aitcin, P.C., (2003), The durability characteristics of high performance concrete: a review, Cement and concrete composites, Vol.25, pp.409-520.

[7] Aleksandrs Korjakins, Patricija Kara and Nikolajs Toropovs., (2013), Improving quality of high performance concrete by cavitation treatment of the raw materials, Procedia Engineering, Vol.57, pp.597-604.

[8] Andrade, L.B., Rocha, J.C., and Cheriaf, M., (2009), Influence of coal bottom ash as fine aggregate on fresh properties of concrete, Construction and Building Materials, Vol.23, pp.609-614.

[9] ASTM C494, Admixtures Types A, F or G & Self Compacting Concrete (SCC) admixtures. 10. ASTM C 1202 – Standard Test Method for Electrical Indication of Concrete Ability to Resist Chloride Ion Penetration, 1999.