REVIEW STUDY ON FOAM CONCRETE

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Abstract— **Foam concrete is defined as a light cellular concrete which can be classified as a lightweight concrete having density varies from 400–1800 kg/m^3 with random air-voids created from the mixture of foaming agents in mortar. Foam concrete is recognized for its high Flow ability, low cement content, low aggregate usage, and excellent thermal insulation. Furthermore, the foam concrete is considered as an economical solution in fabrication of large scale lightweight construction materials but due to its low compressive strength it cannot be used as structural members. The paper provides a review to develop structural foam concrete by using cement, fly ash, MSP. This review paper mainly tends to evaluate the structural properties of foamed concrete and then it is expanded to elaborate the improvements in foamed concrete design proportions and selection of constituent materials in order to enrich its performance at fresh and hardened states.**

Keywords: Foam concrete, light weight Concrete, Flow ability, physical properties.

I. INTRODUCTION

About two thousand years ago, the Romans made concrete with small gravel and coarse sand mixed together with hot lime and water. They realized that by adding animal blood into the mix and agitating it, small air bubbles could be formed making the mix more workable and durable and led to manufacture of highly air entrained cement based materials. Aerated concrete is a lightweight concrete in which aeration can be done with the help of air entraining agents like aluminium powder in which air is entrapped in the mortar matrix. Light weight concrete is an important and versatile material in modern construction. It has many and varied applications including multistory building frames and floors, bridges, offshore oil platforms, and prestressed or precast elements of all types. Many architects, engineers, and contractors recognize the inherent economies and advantages offered by this material, as evidenced by the many impressive lightweight concrete structures found today throughout the world. Structural light weight concrete solves weight and durability problems in buildings and exposed structures. Light weight concrete has strengths comparable to normal weight concrete, yet is typically 25% to 35% lighter. Structural lightweight concrete offers design flexibility and substantial cost savings by providing: less dead load, improved seismic structural response, longer spans, better fire ratings, and thinner sections, decreased storey height, smaller size structural members, less reinforcing steel, and lower foundation costs. Lightweight concrete precast elements offer reduced transportation and placement costs. Light weight concrete has density less than conventional concrete that is less than 2000Kg/m^3. Foamed concrete possesses superior properties such as low density which helps to reduce structural dead loads, foundation size, labour, transportation and operating costs. Besides, it enhances the fire resistance, thermal conductivity and sound absorbance due to its textural surface and micro-structural cells. This review paper mainly tends to evaluate the structural properties of foamed concrete and then it is expanded to elaborate the improvements in foamed concrete design proportions and selection of constituent materials in order to enrich its performance at fresh and hardened states. The

primary independent variables were the types and volume fraction of fibers, and the amount of air in the concrete. This paper reviews basic information regarding the mechanical properties of foamed concrete and compares it with normal concrete.

II. LITERATURE REVIEW

The research in the field of Foam concrete has an accelerated growth in the recent years. The study on the various stages of Foam concrete are studied by many researchers, reveal the facts about Foam concrete, thus making it a practically wide applicable. Many research papers were published by various researchers, which show the engineering significance of Foam concrete are studied workability of concrete.

Dhanalakshmi A, and Shahul Hameed M [1], discussed that the utilization of alternative materials, such as quarry dust, and Marble Sludge power (MSP) for HSSCC applications the results of this research provide a strong support for the use of MSP as filler in SCC manufacturing. A maximum of 8% of lime stone powder with silica fume, 30% of quarry dust and 14 % of clinkers was able to be used as a mineral admixture without affecting the self-compact ability. However, a number of clear conclusions have been obtained about the behavior of HSSCC.

Shahul Hameed, M et.al [2], have Conducted experimental study on **a**vailability of natural sand for concrete is on the cry off in the last decades as a result of ecological and environmental limitations. This paper aims to focus chloride penetration study of self compacting green concrete (SCGC) made with industrial wastes i.e. marble sludge powder (MSP) from marble processing, and quarry rock dust (CRD) from stone crushing industries. MSP can be used as filler and helps to reduce the total voids content in concrete. Consequently, this contributes to improve the strength of concrete. An experimental investigation has been carried out to study the combined effect of addition of MSP and CRD on the chloride penetration of SCGC. From the result it is observed that CRD with 15% MSP was more beneficial than river sand for manufacturing SCGC.

Maheshkumar H. Tharkrele [3], revealed conducted experimental study on foam concrete investigation two foam concrete mixtures are produced with and without sand and attempts have been made for selecting the proportions of foam concrete mix for the target plastic density of 1900 kg/m3. 18 cube specimens are prepared and tested for mixtures, then their physical (Density) as well as specific structural(Compressive Strength) properties were investigated, Specific Strength and Percentage Strength gain for foamed concrete is compared with normal weight concrete and the results are reported.

Raman Kumar et.al [4], discussed that the Concrete is the vital segment utilized as a part of the development business all through the universe, where the fine total is common sand. The utilization of sand in development exercises results in the compelling mining. Because of amazing mining, normal assets are getting depleted, results in expansion in scour profundity and now and again surge probability. Along these lines, it is getting to be unavoidable to utilize elective material in concrete. Marble is essential materials utilized as a part of the development business. Marble powder is created from handling plants amid the cleaning and sawing of marble squares and around 20 - 25% of the prepared marble is transform into powder structure. Devastating of the marble powder material from the

marble business is one of the ecological issues overall today. This study is proposed to using Waste marble powder development industry itself as fine total in solid, substitution regular sand. The substitution is done partial and completely in the extent 10% 15% and 20% and its impact on properties cement were calculated.

Aswathy .M [5], revealed Smouldered Brick is one of the imperative development material in the nation. The nation is presently more on looking for natural answers for greener environment. Froth (foam) has great warm and acoustic properties and is additionally ice safe. Foamed cement is the most well-known of all low-thickness cements in creating nations. The utilization of Light-weight Concrete squares gives an appropriate answer for development industry alongside natural conservation. It is created by at first making slurry of Cement + Fly Ash + Water, which is further blended with the expansion of pre-frothed stable froth in a customary solid blender under surrounding conditions. In this paper endeavour to made configuration blend are readied for 4", 6", and 8" of solid piece. This paper demonstrates the outcome on advancement of concrete.

Shibi Varghese et.al [6], discussed that Foamed concrete consists of cement, water, fine aggregate and air voids. It is relatively homogeneous and do not contain coarse aggregate phase. Properties of foamed concrete depend on the type of binder and foaming agent used. Here two types of foaming agents are used – natural and synthetic. A partial replacement of binding material is done with silica fume which provides additional strength compared to foam concrete without silica fume. This paper which based on the foam concrete properties and preparation process analyses the research progress of silica fume effect on performance of foamed concrete.

Ali J. Hamad [7], discussed that **a**erated lightweight concrete have many advantages when compared with conventional concrete such as advanced strength to weight ratio, lower coefficient of thermal expansion, and good sound insulation as a result of air voids within aerated concrete. This paper is attention to classified of aerated lightweight concrete into foamed concrete and autoclaved concrete. Also, it is exhibits the raw materials used in aerated concrete, types of agent, properties and applications. The production method is classified for each foamed and autoclaved concrete. The literature review of aerated lightweight properties is focuses on the porosity, permeability, compressive strength and splitting strength.

Tapeshwar Kalra et.al [8], revealed the fly ash concrete has economical and environmental advantages. It also makes concrete sustainable. In India presently less than 50% of fly ash produced is consumed. Infrastructural Development is at its peak all over the world and is a symbol of growth for any country. The most popular construction material, involves use of cement which is responsible for 7% of total world's carbon dioxide emissions. Carbon dioxide is the main threat in causing global warming of the environment. The attempts have been made to reduce CO2emissions in environment by all possible ways, but cement has not found a suitable replacement for it till date. Fly ash Concrete is an effort in reducing cement content of construction. The paper aims at discussing the use of fly ash concrete in construction as a solution to address two environmental problems - one, disposal of huge amounts of fly ash, by production of thermal power plants, causing environmental degradation through

large areas of landfills and two, high percentage of carbon dioxide emissions in atmosphere from cement industry.

Hanizam Awang et.al [9], have conducted experimental study on foamed concrete with synthetic and natural fibres consisting of AR-glass, polypropylene, steel, kenaf and oil palm fibre. The foamed concrete mixtures produced had a target density of 1000kg/m3 and a mix ratio of (1:1.5:0.45). The fibres were used as additives. The inclusion of fibre was maintained at a volumetric fraction of 0.25 and 0.4%. The water absorption, thermal and shrinkage were determined to study the effect of the fibre on the durability properties of foamed concrete. The results showed that AR-glass fibre has the lowest percentage value of drying shrinkage compared to others.

M.Shahul Hameed [10], discussed that combined effect of addition of MSP and CRD on the strength and durability of SCC. The study on physical, chemical and mechanical properties such as compressive strength and split tensile strength and the durability tests include water absorption test, water permeability, rapid chloride permeability; electrical resistivity and half-cell potential are carried out in this study. From the results it is confirmed that compressive strength increases with increase in percentage replacement of MSP up to 15% of CRD in place of FA. It is found that split tensile strength is directly proportional to the compressive strength. The highest electrical resistivity values were obtained for Normal Concrete with 100% CRD and significant increase in resistivity values for SCC.

A. S. Kanagalakshm [11], have introduced that effect of quarry dust as sand replacement material on compressive strength of foam concrete was conducted. This project was carried out to determine the compressive strength of foam concrete by using quarry dust as partial sand replacement material. This report presents the feasibility of the usage of quarry dust as 10 %, 20 %, 30 %, 40% and 50% for sand in foam concrete. Mix design was formulated and developed for four different proportion of quarry dust in foam concrete. Tests were conducted on cubes to study the compressive strength of concrete made of quarry dust and results were compared with the control foam concrete. It is found that the compressive strength of foam concrete made of quarry dust is nearly 43% more than the control foam concrete. Based on the results of the experimental investigation, it is proposed that burnt clay bricks can be effectively replaced with the foam concrete blocks. Finally cost benefit assessment was done to prove the economy of the foam concrete bricks.

Qin xin [12], discussed based on the foam concrete properties and preparation process analyses the research progress of Blending material, admixtures and fibers' effect on the performance of foamed concrete, puts forward the problem about development and application of the foam concrete in current research, and points out that the sustainable development is the basic idea of the foam concrete further research and application in future.

Dr.G. Balamurugan [13], demonstrated the effect in strength of foam concrete using three different filler materials such as river sand, sea sand and quarry dust with cement. Cement and filler mixed in proportions 1:0, 1:1, 1:2 and 1:3 in weight basis. The foaming agent was added with water and mixed thoroughly. Mixed cement and filler added slowly with this and after certain minutes this gel poured in to the mould of size 19 x 9 x 9 cm to get the brick specimen. The specimens were water cured for 28

days. The compressive strength of this light weight foam concrete bricks at an age of 28 days was obtained at normal temperature. Then the specimens after 28 days curing were heated to 100°C in an oven for 24 hours and tested. Also the specimens kept at 100°C for 24 hours were suddenly immersed in water and subjected to thermoshock and tested for compressive strength. The loss of strength due to thermal and thermo shock effect were compared with conventional concrete (River sand as filler). From the results, it is found that sea sand as well as quarry dust can be used as alternate filler material for natural river sand in foam concrete.

Zhifeng Xu [14], discussed based the seismic behavior of cold-formed steel (CFS) shear walls, cold-formed steel high-strength lightweight foamed concrete (CSHLFC) shear walls with straw boards are proposed. This study conducted tests of six full-scale shear wall specimens to investigate the failure mode, load-bearing capacity, ductility, stiffness characteristic and energy dissipation capacity. The test parameters included HLFC density grade, stud section area, wall thickness and vertical load. Test results indicated that HLFC has greater effect on seismic performance and failure mode of the shear walls. The failure modes were cracking and crushing of HLFC, cracking of straw boards, local buckling of studs, and relative slippage between HLFC and studs, which made the wall exhibit good ductility and energy dissipation capacity. Compressive bearing capacity of HLFC and restrictive effect of HLFC on steel frame increased the shear strength and stiffness. The most effective way of improving seismic performance was to increase wall thickness, followed by increasing HLFC density grade and stud section area, but increasing vertical load had an adverse effect on seismic performance.

M.Shahul Hameed and S. S. Sekar [15], revealed experimental study on feasibility of the usage of quarry rock dust and marble sludge powder as hundred percent substitutes for natural sand in concrete. An attempt has been made to durability studies on green concrete compared with the natural sand concrete. It is found that the compressive, split tensile strength and durability studies of concrete made of quarry rock dust are nearly 14 % more than the conventional concrete. The concrete resistance to sulphate attack was enhanced greatly. Application of green concrete is an effective way to reduce environment pollution and improve durability of concrete under severe conditions.

III.CONCLUSION

1. Foam concrete can be effectively applied in construction industry due to its desirable properties.
2. High performance aerated concrete has considerable potential for practical application.
3. Mechanical properties of foamed concrete depends on the foam volume, type and volume of fiber and the compressive strength is influenced by the shape, size and method of pore formation, age of the sample, direction of loading, characteristics of ingredients used and method of curing.
4. Stable foam concrete mix depends on foaming agents, foam preparation methods, air-voids distribution, materials, mixture design strategies & production methods.
5. The primary variables are types, volume fraction of fibers, and amount of air in the concrete. Collapse and air-void escape can be avoided by adding thickening agent & stabilizing emulsion.
6. Compared to the conventional mixes, inclusion of additives helped to improve both the cement paste microstructure and air-void structure of foamed concrete.

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