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No Fine Lightweight Concrete-Review Paper

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A B S T R A C T

The main objective of this project is to develop traditional or conventional concrete and simultaneously motivate the people about light weight concrete. This focuses on tests such as Compressive test only. The results obtained are interesting and useful to compare the results with that of traditional concrete. The main focus of this concrete is to low density and thermal conductivity, ultimately there Is reduction of dead load, faster building rate in construction and lessen haulage and handling costs. No-fine concrete is produced by using ordinary Portland cement, coarse aggregates, and water. This concrete is tested for its properties, such as slump value, porosity and compressive strength. The results showed that porosity has significant effect on compressive strength of no-fine concrete. The normal concrete has a density of 2500 kg/ m3, the major contributions to the density of concrete is the high specific gravity of coarse aggregate. In the present study, an attempt has been made to partially replaced coarse aggregate and fully replaced fine aggregate by lighter weight material to achieve concrete of lighter density. Coarse aggregate was replaced by blast furnace slag in various trial percentages. This concrete is mix with different ratios of aggregate/cement and it helps find different properties like chemical, physical and mechanical.

Keywords: Lightweight concrete (No fine), blast furnace slag, strength, properties, density.

Introduction

No-fines concrete also known as pervious, permeable, or enhanced porosity concrete (EPC) is a special type of highly porous concrete. No-fines concrete usually consists of Ordinary Portland Cement (OPC), uniform sized coarse aggregate and water ratio. The lack of fine aggregate makes no-fines concrete there is only coarse aggregate, cement, and water. It has lighter and more porous material than traditional concrete. Often generally coarse aggregate size 10 to 20 mm are used. No-fines concrete naturally allows porous for better air circulation and drainage, which makes an ideal material for construction in areas prone to heavy rainfall or flooding. No-fines concrete is becoming popular because of some of the advantages it possesses over the conventional concrete. The single sized aggregates make a good no-fines concrete, which in addition to having large voids and hence light in weight, also offers architecturally attractive look. No-fines concrete is a form of lightweight porous concrete. It is a two-phase material – single sized coarse aggregates, surrounded by a coating of thin layer of cement paste, without any fine aggregates. Thus, the coarse aggregates are in point-to-point contact with each other through a small fillet of cement paste, holding particles together and giving strength of concrete.

Normal concrete has a density of 2500 kg/m^3 while densities range from 1800, 1700, 1600 down to 300 kg/m^3. Compressive strengths range from up to 40 Mpa down to almost zero for the really low densities. Generally, it has more than excellent thermal and sound insulating properties, a good fire rating, is non-combustible and features cost savings through construction speed and ease for handling.

Use of blast furnace slag

Concrete is the most important component used in the construction industry throughout the world, where the fine aggregate is generally natural sand. The use of sand in construction activities results in the excessive mining. Due to excessive mining, natural resources are getting exhausted; results in increase in scour depth and sometimes flood possibility. Thus, it is becoming inevitable to use alternative material in concrete. The replacing coarse aggregate with blast furnace slag. Slag is a by-product generated during manufacturing of steel. Primarily the slag consists of calcium, magnesium, manganese and aluminium silicates in various combinations. The cooling process of slag is responsible mainly for generating different types of slags required for various end use consumers**.**

Literature Survey

Pravin S Patil **et.al,** in this research paper the use of different size of aggregate also have greater impact on the ultimate strength as SET-B (16 mm) size aggregate gives more strength than other sizes of SET-A (10 mm). The porosity of No-fine concrete is largely affected by the smaller size of coarse aggregate used in concrete mix. Concrete mix containing 10 mm size aggregate shows higher porosity in comparison to concrete mix a containing 16 mm size aggregate. From the project study they conclude that there is a considerable saving of 12.95% in amount for construction of $1m^3$. From the project it clarifies that No-fine concrete can be easily use for the application of parking pavements, footpath pavements, tennis ground, rural areas with low volume traffic as per IRC. [1]

K Satham Ushane et.al, in this research paper the ultimate strength of no-fines concrete is of the range between 5 N/mm2-12 N/mm2.From the investigation, the most economical mix with high strength identified was 1:6 mix ratios with 12 mm aggregate and 0.45% water content. The cost of manufacturing of no-fines concrete blocks were 3.5-5 rupees but for nominal concrete blocks it was 4.5-6.5rupees. Hence, the no-fines concrete blocks were more economical than nominal concrete blocks. The market for building block is growing at a rapid rate, especially in the areas where burnt bricks are not easily available or of poor quality. Unfortunately, rigorous scientific studies have not been made on the strength, durability and economy of concrete building blocks. Lightweight concretes can either be lightweight aggregate concrete, foamed concrete or Autoclaved Aerated Concrete (AAC). Such lightweight concrete blocks are often used in mason's house construction, because of their less density and self-weight, it helps for faster construction. [2]

T Abadjieva et.al, in this research paper the results of an investigation to determine the performance characteristics of concrete mixes made without fine aggregates. Single sized course aggregates fraction 13.5-19 mm from Kgale Hill quarry and Ordinary Portland cement were used in the experiments. Concrete mixes with different aggregate/cement and water/cement ratios were prepared to find an optimum mix yielding the highest strength. The density and strength properties of the investigated no-fines concrete are lower than that of normal weight concrete, but sufficient enough for structural use. For practical purposes mixes with aggregate/cement ratio 6:1 and 7:1 were recommended. The suggested mixtures could be used for cast in situ walls in low-rise, low cost housing (later plaster externally to reduce air and water permeability), drainage layers and paving after more extensive research. [3]

L JiaHao et.al, in this research paper the application of no-fines concrete has been introduced to construction industries specially pavement construction. Due to its high porosity behaviour, the relative density of no fines concrete is lower than normal concrete of 2400kg/m3 which also helps in reducing dead. the main focus on physical and mechanic study for no-fines concrete has been studied and reviewed. The relative density of no-fines concrete can be varying in different mix proportion used during mixing. It is gradually decreasing with the increment of aggregates/cement ratio together with water/cement ratio. weight in the design. For porosity aspect of no-fines concrete, the volume of void can be affected by size of aggregates. Few results showed that the porosity percentage of no-fines concrete ranged between 27% to 36%. Also, the permeability increased as the porosity increased in no-fines concrete. The higher the volume of aggregates, the higher the compressive strength of no-fines concrete the optimum compressive strength of no-fines concrete achieved is 11.25MPa which is still considered low strength concrete compared to normal concrete characteristic strength. Therefore, with compiling all the properties of concrete, it is not suitable to acts as building structural member as its capacity to resist stress is low, but it is a good alternative material for pavement as its voids in concrete helps in reducing pavement surface runoff purpose. [4]

Yuwadee Zaetang et al, in this study, the use of lightweight aggregate (LWA) for making lightweight pervious concrete (LWPC) was presented. Diatomite (DA) and pumice (PA) were used as natural LWAs in pervious concretes. Three cement paste contents of 15%, 20%, and 25% by volume were used. The results were compared to those of LWPC containing recycled LWA from autoclaved aerated concrete (RA). The results indicated that the use of DA, PA, and RA as coarse aggregates in pervious concrete could reduce the density and thermal conductivity about 3–4 times compared with previous concrete containing natural aggregate. The densities were 558–775 kg/m3. [5]

Ms.S. Geethanjali et.al in this study paper discusses the combos of pervious concrete with diverse substances like Polypropylene fiber and Super Plasticizer. Various tests like compressive strength, Flexural strength and Split Tensile strength tests are executed to observe the strength traits of Pervious concrete. The strength of the mixes like plain pervious concrete, mix with polypropylene fiber and concrete mix with both Polypropylene and Superplasticizer are in comparison. Compressive strength of the concrete attained at an age of 7 days is about 60-75% of the compressive strength of the concrete attained at an age of 28days. The compressive strength of Polypropylene mixed pervious concrete is increased when compared to plain pervious concrete, when the fiber is added to the concrete at a rate of 0.6% of the weight of cement. The increase in strength is because of the Polypropylene fiber in pervious concrete enhances the bonding between the coarse aggregate and cement paste. [6]

Kiran Babanappa Thombre et.al in this study the size of coarse aggregate taken for the study was 10 mm, 20 mm and a size varying from 10 to 20 mm. Cement contents used was 250 kg/m3, 275 kg/m3 and 300 kg/m3. The main aim of this study was to investigate the strength and workability of various mixes of No-Fines concrete and to propose an optimum proportion for desired strength and workability of porous concrete. Also, study focuses on the effect of particle size of coarse aggregate on the strength and workability of No-Fines concrete. Compressive strength and the workability of the porous concrete primarily depends upon the particle sizes of coarse aggregate, voids ratio and the cement content. Grading of the coarse aggregate in the No-Fines concrete largely influences its workability and strength. Uniformly graded coarse aggregate gives better results than Single graded aggregates. Decreased in the size of coarse aggregate decreases the voids ratio while increases the workability and its compressive strength. No-Fines concrete with uniformly graded course aggregate sizes from 10 mm to 20 mm gave the maximum strength and moderate workability at 10% voids ratio. [7]

Perla Mounika et.al, in this study this the runoff of the agricultural and indoors town roads is improved, water tables of those areas decreased and as current ground improvement techniques are used to beautify the secure bearing ability of ground. No fines concrete is the pleasant alternative to reap those necessities. In many advanced nations, the usage of No fines or pervious concrete for the development of pavements, vehicle parks and driveways are turning into popular. The impact of the above elements on the density, compressive, and tensile strength had been studied experimentally. The permeability of no fines concrete is extra because it having more voids. The power of no-fines concrete is a good deal while compared to ordinary concrete, however enough for structural use of pathways, parking areas etc the density and strength properties of the no fines concrete is investigated at lower than that of normal weight concrete, but sufficient enough for structural use. For practical purposes mixes with cement/aggregate ratio 1:3 and 1:6 at water/ cement ratio is 0.4 were recommended. To minimize hazard to the natural surroundings on which roads are built, in particular in city are as, permeable concrete has appropriate capability to make an advantageous contribution to sustainable street creation and life cycle control. [8]

Nura Muhammad Ali et.al, in this study reviews the studies conducted using recycled lightweight concrete aggregate and the finding revealed that; despite the satisfactory performance and waste reduction potential, concrete manufactured using recycled Lightweight concrete aggregate displayed lower performance compared to standard concrete. Therefore, more research is necessary towards improving the performance of recycled lightweight aggregate concrete. Recycled lightweight concrete aggregates have been shown to lower the mechanical properties and performance of recycled lightweight aggregate concrete and concrete in general. Despite this lowered quality, it is significant to reduce the negative environmental impact resulting from disposal of lightweight concrete. Hence, more detailed research is needed where different admixtures and careful alterations are employed towards improving the performance of this type of concrete. More research on the influence of lightweight concrete aggregate on concrete properties such as shrinkage, crack formation, CO2 absorption, fire resistance, acid resistance, and chloride ion resistance are required to have compressive data for further research. [9]

Research gap

1) Reduction in dead loads making savings in foundations and reinforcement.

2) Savings in transporting and handling precast units on site.

3) Improved thermal properties. Improved fire resistance.

4) it is a good alternative material for pavement as its voids in concrete helps in reducing pavement surface runoff purpose.

5) To reduce the density and thermal conductivity

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