Comparative Study on Manufacturing And Development of Lightweight Concrete

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Abstract- *Lightweight concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities such as ability and lessened the dead weight. It is lighter than the conventional concrete. The main specialties of lightweight concrete are its low density and thermal conductivity. Its advantages are that there is a reduction of dead load, faster building rates in construction and lower haulage and handling costs. The use of lightweight concrete has been widely spread across countries such as USA, United Kingdom and Sweden. The use of cost effective construction materials has accelerated in recent times due to the increase in the demand of light weight concrete for mass applications.*

Keywords- lightweight concrete, comparative study, construction materials, faster building rates.

I. INTRODUCTION

Concrete can be considered no more than a mixture of cement as a binder, water, aggregate (fine and coarse) and admixtures (chemicals or minerals or both)[1]. Admixtures are used to improve the performance of the concrete. This could include adjusting setting time or hardening, modifying the properties of the hardened concrete, reducing water required in the concrete, reducing the cost of concrete construction. Today, concrete remains the manufactured construction material more known and more utilized in the world, whether in the construction of the buildings, bridges, viaducts, airports, roads, railways, tunnels, stadia and other civil engineering infrastructures[2]. Concrete is the second most used substance on earth after water. Its advantages include: high compressive strength, good workability, good durability properties (resistant to freezing, chemical resistant, wear resistant, low permeability, resistant to alkali-silica reaction and so on), easy handling and molding, easy transportation from the place of mixing to place of casting before initial set takes place, longevity, resilience and its disadvantages include: low tensile strength, low thermal and acoustics insulation, its heaviness. Among its constituents, the aggregates occupy up to 75% of concrete volume [3]. In order to remedy or mitigate or overcome these weaknesses or disadvantages or limitations of concrete, for example to reduce or decrease its heaviness or its density or its weight and make the buildings lighter, another variety of concrete called lightweight concrete appeared at the beginning of the 20th century in the developed countries of Europe such as France, Germany and the USA and of Asia such as Japan, former USSR and other countries . In the field of construction, the reduction of the self-weight of lightweight concrete appears technically and economically [4]. The reduction of the density of lightweight concrete induces lower dead load to concrete structures, consequently saving on transportation and handling costs[5].

Additionally, the lower density of lightweight concrete exhibits superior heat and thermal insulation, fire resistance as well as reducing risk of earthquake damage[6].

Lightweight concrete can be defined as a type of concrete which includes an expanding agent in it that increases the volume of the mixture while reducing the dead weight. It may also be defined as: Concrete which uses lightweight aggregates [8].

Density of this concrete is considerably low 300kg/m to 1850kg/m3) when compared to normal concrete. It May consist of lightweight aggregates , sand, clay, foamed slag, clinker, crushed stone, aggregates of organic and inorganic foaming agent, coconut shell ,Quarry dust palm oil shell ,and fly ash like waste recycled materials etc[9].

II. OBJECTIVES

1. To understand the Lightweight concrete and level of application in construction industry.
2. To compare the properties, characteristics of different types of LWC.
3. To know that the different LWC'S on the basis of ingredients used and requirements of construction industry.

III. MATERIALS USED TO MAKE LWC

Table 1: Materials Used To Make LWC

Sr. No.	Materials Used
1	Oil Palm Shell (OPS)
2	Fly Ash Pellets As Coarse Aggregates
3	Foam By Foaming Agents
4	Palm Oil Clinker
5	Agricultural and Industrial Waste
6	Fly Ash, Cement, Foam, Glass
7	Fly Ash, Quarry Dust, Coconut Shells
8	Silica Fume, Clay Aggregates, PVA
9	Cameroonian Charcoal

IV. METHODOLOGY

4.1 Percentage Replacement of Coarse Aggregate

Table 2: Percentage Replacement of Coarse Aggregate

Sr. No.	% Replacement Of Coarse Aggregate	Optimum % Replacement For Maximum C.S.
1	10,15,20,50	15
2	Up to 100	100
3	40,60,80,100	40
4	25,50,75,100	25
7	25,50,75,100	25
8	25,50,75,100	25
9	25,50,75,100	25

V. RESULTS

5.1 Density

Table 3: Density

Sr. No.	Density (Kg/m^3)
1	1700-2185
3	1201-1600
4	<1900
6	400-1800
7	2518-3170
8	1445-2078
9	1422.445 Average

5.2 Compressive Strength

Table 4: Compressive Strength

Sr. No.	Compressive Strength(N/mm^2)
1	17.01-17.7
2	27.73-47.45
3	15-25.5
4	17-25
5	28
6	18-20
7	20-28
8	7.8-34.6
9	2.48-5.08

VI. DISCUSSION

1) Partial replacement of C.A by Fly Ash Pellets gives maximum compressive strength than others.
2) Partial replacement of C.A by materials up to optimum value gives maximum compressive strength and durability and further replacement reduces.
3) 100% replacement of C.A by Fly Ash Pellets possible, hence use of this economical and solves problem of dumping wastage Fly Ash.

4) Use of Foam in LWC gives less density than others hence Density is inversely proportional to addition of foam percentage in LWC.
5) Partial Replacement of all ingredients of concrete-C.A , cement , sand gives more density than only one or two ingredients replacement .
6) Generally Flexural strength is about 13% of Compressive strength for normal Concrete but LWC made by using OPS gives 14 % Flexural strength.

VII. CONCLUSION

1) Due to use of Industrial, Agricultural waste and recycled materials in LWC are economical and solves problem of dumping of wastage.
2) LWC exhibits superior heat and thermal insulation, fire resistance and reducing risk of earthquake damage.
3) Due to low Compressive strength LWC used in where external Force is minimum and Due to good sound absorption it's used in acoustic structures.

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