

Strength and Density comparison between Normal Concrete and Light Weight Concrete.

T.Sravana Sandhya¹ Mohammed Hussain²

Department of civil Engineering,

College of Engineering and Technology, Samara University, samara, Afar, Ethiopia.

Abstract: The project deals with the Strength and Density comparison between normal and light weight aggregate concrete (foamed slag). Normal concrete is an artificial conglomerate stone made with Portland cement, water, and aggregates. Light weight concrete can be produced by using air entrain agents or light weight aggregates. in this study we have worked on light weight aggregate concrete and also made the comparison made between normal concrete and light weight concrete. it helps us to reduce the weight and increase the strength and durability.

Key words: normal concrete, foamed slag, strength and durability, light weight concrete.

Introduction:

Present days in the world construction is very challenging and a lot of Civil Engineering structures is developed with new technology. Concrete is versatility, durability, sustainability, and economy have made it the world's most widely used construction material. The importance of concrete in modern society cannot be underestimated. Look around you and you will find concrete structures everywhere such as buildings, roads, bridges, and dams. There is no escaping the impact concrete makes on your everyday life. 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 lessened the dead weight. It is lighter than the conventional concrete. The use of lightweight concrete has been widely spread across countries such as USA, United Kingdom and Sweden. Normal concrete in which common ingredients i.e. aggregate, water, cement are used is known as normal concrete. It is also called normal weight concrete or normal strength concrete. The setting time depending upon moisture in atmosphere, fineness of cement etc. Particularly lightweight concrete is having low density and thermal conductivity. The main advantage is reduction of dead load, faster building rates in construction and lower haulage and handling costs. The study deals with the strength of concrete by using light weight aggregate(foamed slag) with different aggregate proportion. Foamed slag is a synthetic material it will gives the low specific gravity. Moreover it is one type of structural light weight aggregate concrete. the aspect of lightweight aggregate is the porosity and dry unit weight of foamed slag is 650-900kg/m³.

Materials:

Cement- ordinary Portland cement

Aggregate-foamed slag-20mm

Sand-standard

Water-tap water

Mixed procedure-mixer mixing
 Compaction-table vibration
 Curing –moist curing by pounding
 Cube size-15x15x15cm
 Testing of cubes-compressive strength after 28 days

Material Testing:

Cement

1. Standard consistency test:

Standard consistency of a cement paste is defined as that consistency which will permit a vicat plunger having 10 mm dia and 50 mm length to penetrate to a depth of 33-35 mm from top of the mould. As per the test standard consistency result by water with respect to cement to produce standard consistency is 32%.

2. Fineness test

Fineness of cement is nothing but number of particles in cement and its the early setting time of cement. more the fineness less the setting time .

Weight of cement (x)=100grms

Weight of cement retained in 90 μ I.S sieve(y)=7gm

Fineness=(y/x)x100=7grms.

The fineness value should be less than 10%,so it can be used for our study.

Weight of cement=300grms

Water content= 0.85P

P=standard consistency.

Water content=0.85x32%=27.2%of cement

(27.2÷100)x300=81.6grms

3. Setting time:

Determination of the time of setting of concrete, with slump greater than zero, by means of penetration resistance measurements on mortar sieved from the concrete mixture. 1.2 This test method is suitable for use only when tests of the mortar fraction will provide the information required.

Initial Setting Time - The elapsed time, after initial contact of cement and water, required for the mortar (sieved from the concrete) to reach a penetration resistance of 3.43 N/mm² (35 kgf/cm²).

Final Setting Time - The elapsed time, after initial contact of cement and water, required for the mortar (sieved from the concrete) to reach a penetration resistance of 26.97 N/mm² (275 kgf/cm²).

As per IS :269 code for Portland cement initial setting time is min.30minutes,final setting time is max.600minutes.

As per the taken project observation initial setting time=37minutes,final setting time=562minutes.

4. Compressive strength test:

The cross-sectional area of the cube shall be calculated from the measured dimensions. The compressive strength of the cube shall be calculated by dividing the maximum load by the cross-sectional area. Cubes stored in water or a mist chamber shall be tested within one hour of removal from the water or mist chamber, whilst they are still wet. Surface water and grit on the cube shall be wiped off and projecting fins removed. The test shall be made at recognized the age of test specimen.

Table1: Strength and Density for Normal Concrete after 28 days

S.No	Weight(Kg)	Density (Kg/m ³)	Avg.Density(Kg/M ³)	Specimen C.S.A(mm)	Load(KN)	Compressive Strength (N/mm ²)	Avg. Compressive Strength (N/mm ²)
1	6.23	1845	1814.66	150x150	300	13.33	12.24
2	6.10	1807		150x150	275	12.23	
3	6.05	1792		150x150	265	11.78	

Light weight concrete materials:

Cement=20.35kg

Crushed Sand=25.61kg

Foamed Slag=9.3kg

Water=11.2kg

Table2: Strength and Density for Light Weight Concrete after 28 days

S.No	Weight(Kg)	Density (Kg/M ³)	Avg.Density (Kg/M ³)	Specimen C.S.A(mm)	Load(KN)	Compressive Strength (N/mm ²)	Avg. Compressive Strength (N/mm ²)
1	5.92	1754	1671.66	150x150	320	14.22	13.37
2	5.56	1647		150x150	295	13.11	
3	5.45	1614		150x150	288	12.8	

RESULTS AND DISCUSSION:

Lightweight aggregate concrete has been shown by test and by performance to behave structurally in much the same manner as normal weight concrete. For properties which differ, the differences are largely those of degree as per the Experiment above table shows the average light weight concrete strength is 13.37n/mm² and average density is 1671.66kg/m³ and also the average density is more for normal concrete but the compressive strength is less. But the average density is nearly equal to the density of water, so we approach the guide he suggested reduce the quantity of cement it helps us to reduce the density and achieve the economy.

**Figure1: Cube prepared with normal concrete**



Figure2: Cube prepared with light weight aggregate

Figure3: Density comparison between normal and light weight concrete

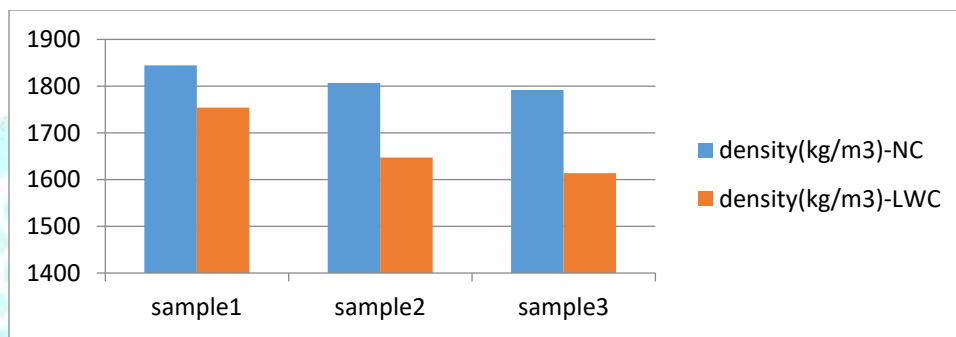
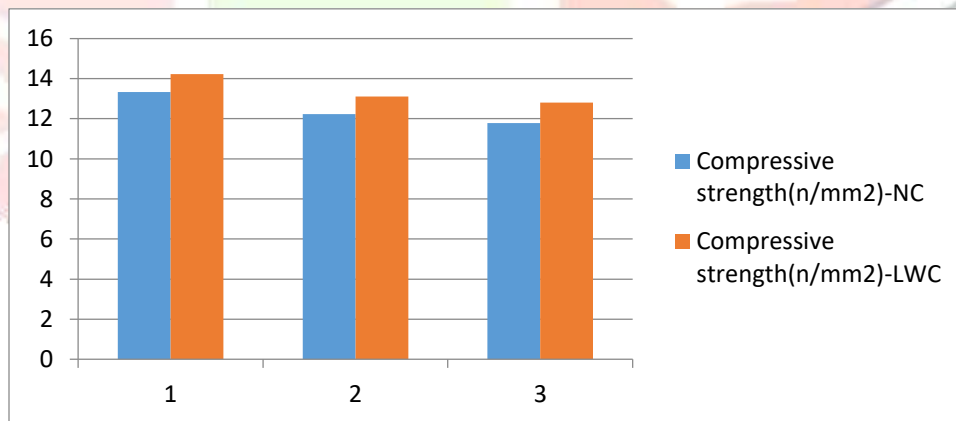


Figure4: Strength comparison between normal and light weight concrete



Conclusion:

In this study shows the strength comparison between normal and light weight concrete. Density is more for normal concrete but the strength is more for light weight concrete. the study showed that using foamed slag as a aggregate ,to produce the more strength .in this study discussed about the density and strength ,other properties like workability,durability,shrinkage and sound insulation properties can be investigated as a further study.

References:

1. A.M.Neville-concrete technology -2nd edition2010.
2. Dhaka Desai “development of light weight concrete civil engineering portal 2014

3. Alia. Akhtaruzzaman, “Behaviour of Foamed Slag Concrete”

4.P. Sundar Kumar, M.J .Ratna Kanth Babu, K. Sundara Kumar and K. Satish Kuma, Experimental Study on Lightweight AggregateConcrete” International Journal of Civil Engineering Research Volume 1, Number 1 (2010)

5. university of kansas center for research, inc. lawrence, kansas june 1997,:effects of aggregates”.

