International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 02, February-2015

Influence of Specific Gravity on Weight of Proportions of Concrete

Mohammed Abas Abdela Salem[a]
[1]Department of Civil Engineering, Sam Higginbotom Institute of Agriculture Technology & Sciences, Allahabad , India

R. K. Pandey[b]
[2]Department of Civil Engineering, Sam Higginbotom Institute of Agriculture Technology & Sciences , Allahabad, India,

***Abstract*—Variation in proportions of concrete cube with cement-water ratio, concrete mix and standard cube size (15 cm * 15 cm * 15 cm), were experimentally investigated. The cube was casted and cured at 3 different locations, different specific gravities, in India. All the cubes for each location were having the same variations of cement-water ratios. It was observed that weight of cubes after 28 days of curing found to be varying from each location. It was noticed that the main cause in variations in weight of proportions of concrete mix found to be specific gravity of coarse aggregate. Specific gravity plays an important role in weight of proportions of concrete and considers the main factor used to measure strength and quality of material. It can be stated that specific gravity plays an important role in determining the compressive strength and quality of concrete mix.**

Keywords—specific gravity; compressive strength of concrete; proportions of concrete; aggregates content;

I. INTRODUCTION

Aggregate is a filling natural materials generally extracted and crushed, using mechanical crushing machines, from rocks. It contains 60% to 75% of total volume of concrete. The weight of aggregates in concrete is depending upon its packed size distribution and voids. Void content in concrete mix affect both water and mortar requirement. The increase in void content leads to increase in water followed by mortar in concrete mix. Void content is ranging from 30% to 45% and from 40% to 50% for coarse and fine aggregate respectively and it can be reduced by packing and using variations of aggregate sizes.

Specific gravity of coarse aggregate is the ratio of mass of a unit volume of coarse aggregate to the mass of same volume of water at specified temperature (23C). it is dimensionless value and consider the major factor to evaluate the strength and the quality of materials. The specific gravity of aggregates is commonly ranging from 2.6 to 3.0. Specific gravity is used to separate deleterious particles, lighter than other particles, from good aggregates. It is used in calculating the solid volume of aggregates in concrete mix.

Determination of the porosity of the aggregate is often necessary. Porosity defines as a ratio of the volume of the pores to the total volume of a material. Measuring the volume of pores in any material is difficult. Correlation between pores and bulk solid materials is a necessary and can be achieved using specific gravity of it. Using specific gravity in concrete mix is important to correlate the voids and the solid bulk of aggregates and to determine the volume of proportions of concrete.

II. METHODOLOGY

A. Work Materials and Specimens Preparation

The materials used in this investigation are cement, gavel and water. All-in aggregates size distributions, mixed sand and gravel, were determined by sieve analysis from which grading limit was achieved. The grading limits of all-in aggregates confirm a suitable grading distribution which leads to suitable workability and durability.

B. Experimental Test Procedures

Mix proportions of 1:1.5:3 was determined for each location by using cement, fine aggregates and coarse aggregates respectively. A 4 kg of cement was added to 6 kg and 12 kg of fine and coarse aggregates. Water was added to cement by weight to form cement-water ratios of 1.3, 1.4, 1.5, 1.6, 1.7 and 1.8. The whole was mixed into paste. Meanwhile, the cubic moulds of concrete were oiled to ease the de-molding process late.

The concrete was then poured into cubes according to its cement-water ratio and placed for 2 minutes on vibration machine to remove the tapped air from the concrete. The cubes were then covered with polythene to prevent evaporation process.

After 24 hours of sitting time, the cubes were de-molded and placed in curing water tank for 28 days. The cubes were then crushed using crushing machine to determine the compressive strength of concretes.

III. RESULTS AND DISCUSSION

Table I shows the variation of the strength of concrete mixes with specific gravity and cement-water ratios. It was observed that the higher the specific gravity the higher the proportions of concrete. However, the higher cement-water ratio leads to the less density and weight of concrete. In addition, the cement and water content were observed to increase cement-water ratio. As a result, the specific gravity is considered the main factor of determination the quality and weight of concrete.

The plot of water content of concrete mixes with variations of cement-water ratio and specific gravity is shown in Figure (1). Figure (2) shows the plot of cement content with variations of cement-water ratio and specific gravity. Figure (3) and Figure (4) show the plots of density and aggregates of concrete versus cement-water ratios and specific gravity of concrete mix..

TABLE I. VARIATIONS OF WEIGHT, DENSITY, AND COMPRESSIVE STRENGTH OF CONCRETRE MIXES WITH SPECIFIC GRAVITY AND CEMENT-WATER RATIO

S/N	Cement-Water Ratio	Specific gravity	Cube weight (g)	Cube Density (g/cm^3)	Crushing load (kg)	Concrete Strength (kg/cm^2)
A1	1.3	2.6	8201	2.430	39600	176
A2	1.4	2.6	8195	2.428	41625	185
A3	1.5	2.6	8184	2.425	42750	190
A4	1.6	2.6	8178	2.423	44550	198
A5	1.7	2.6	8171	2.421	49050	216
A6	1.8	2.6	8161	2.418	52650	234
B1	1.3	2.8	8714	2.582	31500	176
B2	1.4	2.8	8701	2.578	32400	185
B3	1.5	2.8	8687	2.574	33750	190
B4	1.6	2.8	8674	2.570	35325	198
B5	1.7	2.8	8660	2.566	36450	216
B6	1.8	2.8	8643	2.561	37800	234
C1	1.3	3.0	9214	2.730	39600	176
C2	1.4	3.0	9197	2.725	41625	185
C3	1.5	3.0	9177	2.719	42750	190
C4	1.6	3.0	9156	2.713	44550	198
C5	1.7	3.0	9133	2.706	48600	216
C6	1.8	3.0	9113	2.700	52650	234

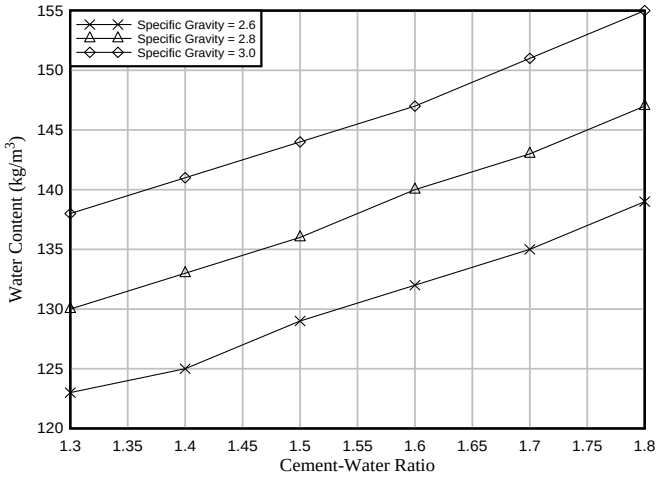

Fig. 1. Plot of Water Content of Concrete vs. Cemen-Water Ratio and Specific Gravity

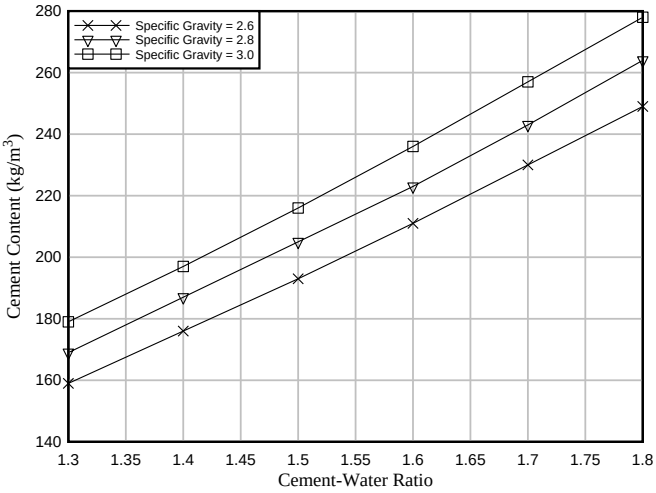

Fig. 2. *Plot of Cement Content of Concrete vs. Cement-Water Ratio and Specific Gravity*

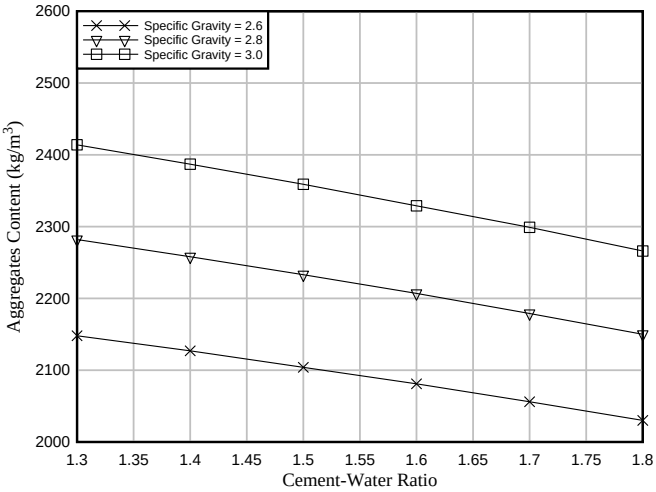

Fig. 3. Plot of Aggregates Content of Concrete vs. Cement-Water Ratio and Specific Gravity

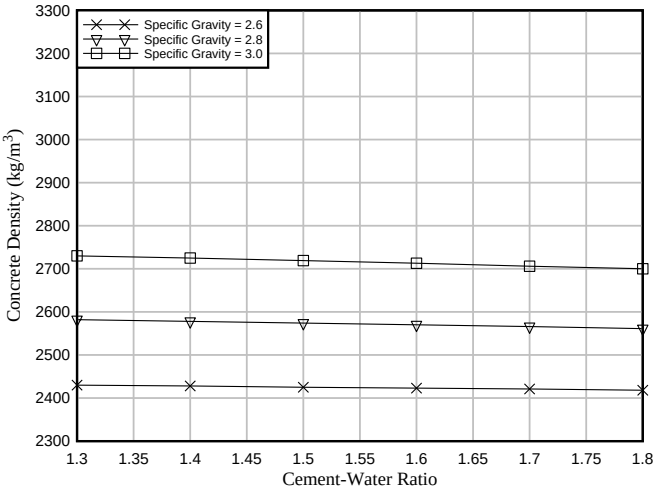

Fig. 4. Plot of Density of Concrete vs. Cement-Water Ratio and Specific Gravity

IV. RECOMMENDATION

The use of suitable specific gravity along with cement-water ratio in concrete mix can determine and evaluate the expected weight, quality and strength of concrete mix. By this concept, quality of concrete mix is related to its specific gravity.

REFERENCES

[1] Indian Standard code practice for Methods of Test for Aggregates for Concrete, IS: 2386(part)-1963.

[2] W.H. Mosley, J.H. Bungey (2000), Reinforced Concrete Design, 5rd ed., Macmillan Publisher Limited, London, UK, 2000.

[3] Indian Standard code practice for Specification for coarse and fine aggregates from natural sources for Concrete, IS: 383:1970.

[4] P,K, Mehta, P.J. Monteiro (2013), Concrete: Microstructure, Properties, And Materials, 4rd ed., McGraw-Hill Profissional, New York, US, 2013.

[5] P.G. Omotola, O.I. Idowu (2011),"Effect of water-cement Ratios on the Compressive Strength and Workability of Concrete and Lateritic Concrete Mixes", The Pacific Journal of Science and Technology, Vol 12, No 2, November 2011, pp 99-105.M.