International Journal of Advance Research in Science and Engineering
Volume No.07, Issue No.10, October 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

REVIEW ON COMPARISION OF MIX DESIGN OF CONCRETE BETWEEN IS CODE METHOD AND ACI METHOD

Udit Narayan Shakya[1], Vivek Singh Chauhan[2],

Sunny Kumar Gupta[3], Vineet Mishra[4]

[1,2,3,4] DEPARTMENT OF CIVIL ENGINEERING , NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY , UTTAR PRADESH , INDIA

ABSTRACT

In this paper a comparison of mix design procedures of IS method - Concrete mix proportioning guidelines *(Bureau of Indian Standards-I.S.10262- 2009)and ACI method (ACI 211, 211.1-91, reapproved -2002)* is presented and combining the test results of these methods, "function equations based design of normal concrete mixes" is proposed. It was observed that the water-cement ratio is highest in the BS method, whereas lowest in the IS method. The water-content is nearly identical in IS and ACI methods. The IS method uses highest amount of cement,The percentage of fine aggregate is highest in ACI method and lowest in IS method. The fine aggregate content in ACI method appears to be more consistent and it also contributed to the increased strength. As a result, the quantity of cement content obtained appears to be insufficient to completely coat all the aggregate particles and bind them together. The mixes designed by IS method and ACI method achieved the target mean strength, which indicate that these methods are consistent.

I. INTRODUCTION

Concrete mix design is a well established practice around the world. Most of the countries have standardized their concrete mix design methods. In the recent years concrete has undergone rapid remarkable development. Continuing researches on mix design procedures standardized by different countries, impact of variability of ingredients on properties of concrete in fresh and hardened state, and use of different supplementary and recycled materials are going on worldwide. The ISand ACI methods of concrete mix design are mostly based on empirical relations, charts, graphs, and tables developed through extensive experiments and investigations using their own locally available materials. Though all these methods in general follow the same basic principle in selection of mix design parameters, but some procedural differences exist in each of these methods.

"The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required strength, durability, and workability as economically as possible that satisfies the job requirements is termed as the concrete mix design".

II. LITERATURE REVIEW

A. Rajesh Kumar .et al."Characteristic Study on Pervious Concrete" (2015)

The main aim of his review study was to study the effect of different sizes of aggregate and thedifferent mixes on the properties of pervious concrete. As the pervious concrete can be the solution for increasing infiltration of water into the ground and decreasing the runoff due to its porous nature. From review it was studied that the strength of pervious concrete get decreased as compared to conventional concrete. And alsocan be concluded that the 12 mm size aggregate is appropriate for preparing pervious concrete. For mix design of pervious concrete, the IS code method can be used but a definite method is not available and it was found that the pervious concrete gives better results imparting super plasticizer.For the best result it can be suggested that to keep cement to aggregate ratio as 1:3

If the voids ratio increases, compressive strength & flexural strength values are reduced. The compressive strength of pervious concrete with 12mm size aggregates are more compared to 20mm size aggregates.

B. Santhosh R1 .et al. concluded that

A. Design of concrete mixes as per Indian Standard method IS 10260: 2009

The basic assumption made in the mix design is that compressive strength of workable concretewas governed by the water/cement ratio. In this method, water/ cement ratio is selected depending on the grade of concrete and type of exposure. Water content is selected on the basis of nominal coarse size aggregate and slump. And volume of coarse aggregate depends on the zone of fine aggregate as per IS 383 and nominal maximum size of aggregate The batch weight of the material per unit volume is calculated by absolute volume method. There are various other factors which affect the property of concrete such as the grade of cement, quantity of cement, water, aggregate size, and shape, hence the guidelines mentioned in proportioning of concrete should be considered only as a basis of trial which can be changed.

B. Design of concrete mixes as per American Concrete Institute Standards Method ACI 211.1-1991. The American concrete institute recommends a method of mix design considering the most economical use of available materials to produce concrete of desirable workability, durability, and strength. The ACI mix proportioning method is suitable for normal and heavyweight concrete. The ACI method presumes that the workability of a mix with given maximum size of well-graded aggregates is dependent upon the water content, amount of air entrained and certain chemical admixture, but largely independent of the mix proportions particularly the amount of cementing material. The method also assumes that the optimum ratio of the bulk volume of coarse aggregates to the total volume of concrete depends only on the maximum size expressed as the fineness modulus. The water-cement ratio is selected based on the strength and durability requirement .knowing the volume of water, coarse aggregates, and cement, the quantity of fine aggregates required is determined by the absolute volume method, allowing for the quantity of air entrained in the mix. However, the final mix proportion should be established by trial and necessary adjustments required for the field mix

C. Mitul K Monpara1 .et al.(2018) was concluded that

1) Water-cementratio: The water-cement ratio is more for ACI and minimum for IS method.

2) Water content: water content for M15 grade of concrete is more for ACI and minimum in IS method.

3) Cement content: cement content will be less in ACI and maximum in IS method for M15 and M30 grade of concrete but for M45 as maximum quantity of cement is restricted to 450 kg/m3 in IS method minimum cement content will be by ACI method.

4) 4) Fine Aggregate content: The fine aggregate content will be less in ACI and maximum in IS method

5) Coarse Aggregate content: for M15 concrete coarse aggregate content is minimum for ACI method and maximum for IS method

D. Deepa A. Sinha .et al.

Concrete mix design is the process of choosing suitable ingredient of concrete and determining their relative quantities with the object of producing as economically as possible concrete of certain minimum properties, notable workability, strength and durability. It should be explained that an exact determination of mix proportions by means of table or computer data is generally not possible. The main objective of the study was to design M25 concrete mix and find the compressive strength using different mix design methods like IS10262-1982, IS 10262-2009, ACI method .

(Alccofine has unique properties to enhance the ‘performance of concrete' in fresh and hardened stages due to its much finer particle size. Alccofine is manufactured by some controlled conditions with special technique to produce micro fine size. Alccofine is generally two types one is low calcium silicate which is Alccofine 1203 and other is high calcium silicate which is Alccofine 1101.).It increased the strength and worability of the concrete.

E. **Annadurai .et al. (2014)**

They developed mix design for high strength concrete with silica fume and high range water reducing admixture. Five mixes were designed, one mix was treated as a basic mix without silica fume and 0.5% High Range Water Reducing and remaining four mixes were designed with micro silica quantities varied from 5 to 9% of cement and HRWR varied between 0.6 to 0.9% with increment of 0.1%, for each mix two cylinders were cast and tested after 28 days and results showed that replacement of cement with micro silica 9% and HRWR 0.9% gives the maximum compressive strength.

F. Popat D. Kumbhar .et al. (2012) FOR HPC was concluded that in

1.IS Code Method

1. Gives lesser proportion of fine aggregates for the mix which causes the harshness in the mix.

2. Method does not incorporate the provision of more than one admixture (IS: 10262-2009).

3. The strength may not be achieved for HPC greater than M50.

4. The coarse to fine aggregate ratio could be between 1.40 to 1.60 for better workability.

2. Modified ACI Method

1.The method gives very high slump value due to high content of SP which results in reduction of strength.

2.The SP dosage is required to be reduced suitably to control the workability of the mix

III. CONCLUSIONS

Based on the above discussion following conclusions can be drawn:

(i) The IS method of concrete mix design (IS 10262:2009) is almost in line with ACI method (ACI 211.1) and is applicable for design of Ordinary and Standard grades of concrete only. It is also applicable for design of light weight and heavy weight concrete. This standard also permits use of supplementary materials such as chemical and mineral admixtures. Provisions of IS 456:2000 are applicable for durability requirements with all types of exposure conditions.

(ii) This method suggests computing the quantities of fine aggregate and a coarse aggregate from the yield equation, which is based on the concept, that volume of concrete is summation of absolute volumes of its ingredients. .

(iii) The ACI method of mix design is applicable for design of normal and /or heavy concrete, and mass concrete mixes. This standard is not applicable for light weight aggregate concrete and for special admixtures for concrete products manufacture. This method is also not applicable for using condensed Silica fume. The ACI method of mix proportioning is applicable for normal and heavy weightconcrete having 28-days cylinder compressive strength of 45MPa and slump ranges of 25 to 100 mm.

(iv) The ACI method is based on determining the coarse aggregate content based on dry coarse aggregate bulk density and fineness modulus of sand. This method also gives separate tables for air-entrained concrete. This method gives separate values of water and sand content for maximum size of aggregate up to 150 mm. Hence this method is most suitable for designing plum concrete. It also gives separate values for 12.5 & 25 mm down coarse aggregate

(v) ACI method of concrete mix design appears to be most suitable for medium as well as high strength concrete. This method is also most suitable for air- entrained concrete as well as plum concrete.

IV. ACKNOWLEDGEMENTS

This research was supportedbyNIET COLLEGE GREATER NOIDA. We thank our colleagues from NIET COLLEGE who provided insight and expertise that greatly assisted the research. We thank our HOD for assistance with project, and MR.SIDDHARATH JAIN , PROFESSOR Civil Department for guidance as mentor that greatly improved the paper.

REFERENCES

1 IS: 10262-1982 and 10262-2009- Concrete Mix Proportioning- Guidelines : Bureau of Indian Standards, Manak Bhavan,9 Bahadur Shah Zafar Marg, New Delhi-110002

2 IS: 456- 2002- Plain And Reinforced Concrete – Code of practice, (Fourth Revision): Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-110002

3 .IS: 2386-1963, Part I to VII- Methods of test for aggregates for concrete ,(Eleventh Reprint August 1997) : Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi-110002

4. ACI : 211.1-91, (reapproved 2002) - Standard Practice for selecting proportions for normal, heavyweight, and mass concrete : American Concrete Institute .

5. International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD) ISSN: 2249-6866 Vol.2, Issue 1 Mar 2012 20-56 © TJPRC Pvt. Ltd.

6 .Rajesh Kumar* Volume 6, Issue 6, June (2015), Pp. 165-176 Article Id: 20320150606017 International Journal of Civil Engineering and Technology (IJCIET) © IAEME: www.iaeme.com/Ijciet.asp

7 .International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887 Volume 5 Issue XI November 2017- Available at www.ijraset.com ©IJRASET (UGC Approved Journal): All Rights are Reserved 586 "A review of Concrete Mix Designs"Santhosh R1 , Dr.P.Shivananda2

8. IJSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 02, 2018 | ISSN (online): 2321-0613 ACI Mitul K Monpara1 Amit J Gujarati2 Jugal Mistry3(2018)

9. "Flexural Behavior of Hybrid Fiber Reinforced High Strength Concrete"A. Annadurai [1*], A. Ravichandran IJST

10 .INTERNATIONAL JOURNAL OF CIVIL AND STRUCTURAL ENGINEERING Volume 3, No 1, 2012ISSN 0976 – 4399, Popat D. Kumbhar, Pranesh B. Murnal (2012) FOR HPC