A Review On "Proficiency In Testing Of Mechanical Properties Of Cement"

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Abstract- *Proficiency Testing (PT) is the evaluation of participant performance against pre-established criteria by means of inter laboratory comparisons. Testing laboratories verify their test procedures and testing capability for reliable results among different laboratories. In this study a proficiency testing (PT) scheme is developed for comparability assessment of results of Physical testing of cement. It is based on preparing of a test sample as received from authorized laboratory tested in the same conditions as prescribed in in respective BIS standards for every PT participant. Material Testing Laboratory is pilot laboratory and after test conducted results are collected by all and are evaluated results including associated measurement uncertainties. Then the collected results evaluated according to ISO 17043, 2010 are reported by each laboratory as a part of the proficiency test report. Z-scores of the participant laboratories are presented. This paper deals only with review of proficiency in testing of mechanical properties of cement.*

Keywords- Proficiency Testing, cement testing.

I. INTRODUCTION

Proficiency Testing is one of the important tools to determine the technical competence of the Testing. It allows the participants to detect unsuspected errors and deficiencies in their methodology. Physical properties of cement as Standard Consistency, Initial Setting Time, Final Setting Time, Soundness (by Le Chatlier Method), Fineness (by Blain's Air Permeability), and Density.

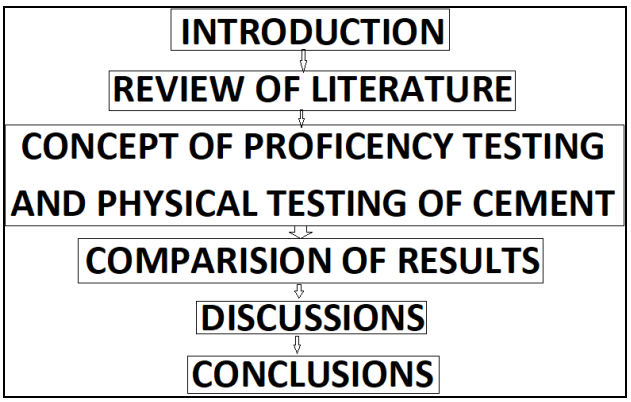
Objectives of the Study

1. To understand the concept Proficiency testing of physical testing of cement with appropriate standards.
2. To test the cement with various test and recording of observation.
3. To compare the results of physical properties of cement tested by their respective combined Z scores.
4. To discuss the results and findings of the proficiency testing of cement.

Scope of the Study

It is observed that Proficiency Testing is one of the important tools to determine the technical competence, hence testing methods as well as testing personnel will be identified hence improved as well.

Flow of the Study



Altough this paper limits upto review of the literature.

II. LITERATURE SURVEY

SANJAY YADAV , 2008, Author gives the results of the proficiency testing (PT) accomplished for 17 laboratories, accredited by National Accreditation Board for Testing and Calibration of Laboratories (NABL). The measurements were performed in the pressure range 10-70 MPa using pressure dial gauge as an artifact. Only laboratories having best measurement capabilities 0.25 % or coarser than 0.25 % of fullscale pressure were included in this PT. The program started in May 2006 and completed during October, 2007. The comparison was carried out at 10 arbitrarily chosen pressure points i.e. 10, 20, 30, 40, 45, 50, 55, 60, 65 and 70 MPa. The results thus obtained show that out of the total 159 measurement results, 135 (84.91 %) are found in good agreement with the results of the reference laboratory. The relative deviations between laboratories values and reference values are well within 0.15 % for 75 measurement points, 0.25% for 108 measurement points and 0.50% for 148 measurement points. The difference of the laboratories values with reference values are found almost well within the uncertainty band of the reference values at 71.07 %

measurement results, within their reported expanded uncertainty band at 62.26% measurement results and within the combined expanded measurement uncertainty band at 84.91 % measurement results. Overall, the results are considered to be reasonably good, being the first proficiency testing for most of the participating laboratories. [1]

Arif Sanjid M , 2008, Surface finish of products indicates the quality of machining process in manufacturing industry. Surface texture measurements provide index of quality of manufacturing stability. National Physical Laboratory, New Delhi, India (NPLI) maintains reference surface roughness standards and measuring equipment and established traceability in surface roughness measurement rendering the surface roughness calibration services. National accreditation board for testing, calibration laboratories (NABL) conducted proficiency testing (PT) program among NABL accredited laboratories for the measurement of surface roughness standard and groove depth. NPLI coordinated the PT Program and acting as reference laboratory among ten accredited laboratories. A technical protocol is designed in line with internationally adopted method. Results are analyzed statistically by arithmetic mean methods. The performance of the laboratories is described using the calculated normalized error (En) value as an index.[2]

Hong Huang , 2011, Author describes the statistical tools such as descriptive statistics, full factorial design and analysis of source of variation were used to identify the potential factors that impact the validity of testing method for determining the strength of cement. The results showed that personal error impacted both accuracy and precision of test greatly. Experimental time associated with temperature fluctuation resulted in strength variation but did not impact the precision of test in all curing ages. Different compactions did not impact the precision of test but resulted in the strength variation on 3 d and 28 d significantly. Different methods for the initial moist air curing significantly impacted the precision of testing method and resulted in the strength variation of cement on 1 d. [3]

Wolfram Schmidt , 2013, Author study is on African cement infrastructure which he says is quite complex. Apart from Northern Africa and South Africa in particular, cement plants are scarce resulting in highly unstable cement pricing. Clinker and cement are imported from overseas, e.g. from Portugal, Turkey, Pakistan, Indonesia, and China. Imports are typically determined by the lowest price, and as a result the countries of origin of products vary regularly yielding large scatter of properties. Quality control and a good quality infrastructure are thus of utmost importance for the safety of the populace, an issue, which is actually often neglected. With funding of the German Metrology Institute (PTB) and support of the SPIN project, a proficiency testing scheme for cement testing according to EN 196 was set up for African laboratories. Proficiency testing schemes, also called round robins, are interlaboratory performance comparisons allowing participants to evaluate themselves against pre-established criteria. They are a powerful tool to help laboratories improve their performance as well as demonstrate their competences to accreditation bodies or customers. 26 laboratories from 20 nations, 18 of which from Africa, participated. The BAM Federal Institute for Materials Research and Testing acted as coordinator and provider of the scheme. The aim of the round robin was to interpret the submitted data further beyond the pure statistic analyses. The data provided a positive picture of the performance of the participants in general, but it also exhibited a number of technical fields that need improvement. The general results of the scheme and analyses identified strengths and weak points based on the submitted and non submitted data as well as on discrepancies from the EN 196 procedures during measurements. The application of EN standards for material testing is critically discussed and since quality infrastructure is also always an issue between industrial and political stakeholders, suggestions for the mitigation of the identified shared problems. [4]

Cheikh Zemri 2020, suggests that the use of blast furnace slag during the manufacture of cement is assumed to mitigate CO2 emissions. Generally, the amount of blast furnace slag in the slag cement (CEMIII) ranges between 36 % and 95 %. Slag cement is suitable for the production of all concrete classes, such as the large-scale civil engineering projects (roads, tunnels, bridges). In the case of tunnels, evaluating the performance of concrete exposed to high temperatures will be of great interest. This paper deals with the mechanical properties of cement pastes and mortars made with an ordinary Portland cement (CEMI) and slag cement (CEMIII) subjected to temperatures up to 650 C. For this purpose, the test specimens were cured for 90 days and then subjected to four different temperatures (160, 300, 400 and 650 C) at 1 C/min. Following the 1 h of thermal load, the specimens were examined once their temperature cooled down to room temperature. Measurements were taken for mass loss, permeability, residual compressive strength and modulus of elasticity for each temperature. The test results demonstrated that permeability increases with temperature, and it follows an exponential type formula for both types of mortar. Where there is more loss of permeability in MIII mortars than in MI mortars. The residual compressive strength of all specimens increased up to 160 C and decreased with further increase in temperature. This decrease is more significant when the temperature exceeds 400 C. For all heating temperatures, the

samples made from the slag cement (CIII and MIII) show higher residual compressive than those made with Portland cement (CI and MI). Furthermore, it was found that at all exposure temperatures the modulus of elasticity of all samples was more reduced compared to the compressive strength. In conclusion, we can say that when using slag cement, the samples show a good mechanical behaviour (compressive strength and modulus of elasticity) at high temperatures and also for permeability. [5]

Tehmina Ayub, Sadaqat Ullah Khan 2014, advises thatmany researchers addressed the deficiencies of concrete and some of them made significant efforts to improve the performance of concrete, especially permeability and durability of concrete as these are the immense concerns of the researchers. The existing literature related to pozzolanic concretes shows that the use of mineral admixtures reduces the porosity of concrete if cement content is partially replaced by mineral admixture; therefore, the demand of blended cement has increased globally to produce denser to impermeable concretes [1], along with improving the strength of concrete such as compressive, tensile, and flexure ones. On one side, these mineral admixtures enable concrete to exhibit greater resistance against harmful solutions (e.g., acid and chemicals, etc.), freezing and thawing, chloride ion penetration, sulphate attack and carbonation, and so forth and, on the other side, they are important contributors for sustainable environment as partial replacement of cement and often called as “less energy intensive cementitious materials” [2]. Use of mineral admixtures is such an advantage that some cement companies have started manufacturing fly ash cement. Fly ash has also been used as a partial replacement of fine aggregate and has been recommended for structural use [3]. Among several available types, the most commonly used mineral admixtures are fly ash (FA), silica fume (SF), ground granulated blast furnace slag (GGBS), metakaolin (MK), and rice husk ash (RHA). Researchers well reviewed the properties of mortar and/or concrete containing different mineral admixtures [2, 4–6]; for example, MKin the literature has been demonstrated as an effective pozzolan exhibiting greater durability and resistance against solutions from harmful wastes due to improved pore configuration [7]. Moreover, researchers also compared the properties of few mineral admixtures; for example, Mehta and Gjørv [8] compared the properties of Portland cement concrete containing condensed silica fume (SF) and fly ash (FA), Jianyong and Yan [9] and B´agel [10] compared SF and ground granulated blast furnace slag (GGBS), Justice et al. [11] and Poon et al. compared SF and MK, and Nehdi et al. [13] compared SF and rice husk ash (RHA). Poon et al. [12] compared the results of high-performance cement pastes containing MK with ordinary Portland cement (OPC) pastes and those containing SF and FA. Despite such a profound literature available, a combined review and comparison among pozzolanic concretes partially containing FA, SF, GGBS, MK, and RHA is missing, which is deemed needed. [6]

As per Malik Arooj 2019, this paper provides a critical review by studying the various research works conducted on concrete by performing Non-Destructive testing and Destructive Testing and thereby comparing the strength obtained from the both the types of tests which can determine the potential durability of the concrete. As a result the main conclusion of this study shall be firmly confined within the comparison of strengths only retrieved from testing methods, research papers, and topics centred on Non-destructive Testing/Destructive Testing methods. The present study helped us to arrive at a conclusion where we can further find the best testing method system that shall be applicable for various concrete structures and as well as in the concrete industry. [7]

Sakshi Gupta 2018, suggests that concrete is the oldest and most important construction material in the world. Testing of the concrete specimen plays and important role to know about the strength, durability and condition of the structure. The work will present a detailed comparison between the destructive tests and non-destructive methods. This work focuses on comparing the destructive and non-destructive testing which can determine the potential durability of the concrete. This work helped us to reach a conclusion where we can further find the best testing method system that shall be applicable for various concrete structures as well as in the concrete industry. [8]

III. LITERATURE GAP

This paper is about review of similar literature in proficiency testing in physical parameters of cement. Past authors have various studies based on iter-laboratory comparisons in various material as concrete, NDT, and suggested methods of comparison. This study will further deal with testing of cement in defined environmental conditions and hence comparison of results with the rest laboratories which will be specific study in proficiency testing of cement.

IV. CONCLUSION

Proficiency testing scheme on the testing of cement exhibits positive results. Most laboratories try to show a sound performance. Influences of the environmental temperatures and of slight deviations from the standard equipment is major is major criteria of deviations.

V. ACKNOWLEDGMENT

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