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A Review Paper on Performance of SCC Containing Lime Stone Powder and Quarry Dust

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Abstract: ***Self-Compacting Concrete (SCC) is highly flow able, stable concrete that can spread readily into place and fill the formwork without any consolidation and without undergoing any significant segregation. In recent years, self-compacting concrete has gained wide application in the construction industry. The present paper explores the recent innovations in self-compacting concrete containing Lime Powder and Quarry Dust. The aim of the paper is to compile the recent innovations in SCC, study their effect on the properties of SCC and establish a benchmark for further research work in this regard.***
Keywords: Self-compacting concrete, Lime Stone powder, Quarry dust, VMA, Workability

I. INTRODUCTION

Self-compacting concrete (SCC) is considered as a concrete which can be placed and compacted under its self-weight with little or no vibration effort, and which is at the same time cohesive enough to be handled without segregation or bleeding of fresh concrete. SCC mixes usually contain super plasticizer, high content of fines and/or viscosity modifying additive (VMA). Whilst the use of super plasticizer maintains the fluidity, the fine content provides stability of the mix resulting in resistance against bleeding and segregation.

The development of self-compacting concrete (SCC) has been one of the most important development in the building industry. The purpose of this concrete concept is to decrease the risk due to human factor. The use of SCC is spreading worldwide because of its very attractive properties. Self-compacting concrete has properties that differ considerably from conventional slump concrete. SCC is highly workable concrete that can flow through densely reinforced and complex structural element under its own weight and adequately fill all voids without segregation, excessive bleeding, excessive air migration or other separation and materials and without the need of vibration or other mechanical consolidation. The use of SCC is considered to have a number of advantages as:

Faster placement Better consolidation around reinforcement.

Easily placed in the walled element. Improves the quality, durability and reliability of the concrete structures.

Reduces the total time of construction and the cost. Lime stone powder

Limestone powder (LP) is produced as by-product of limestone crushers. Large volumes of this powder are accumulated and it is a big problem. Utilization of this by-product may solve the problems related to disposal, environmental pollution and health hazards. Limestone powder has been used to produce cement in some countries, and in the recent specification, it is mentioned that up to 35% of limestone powder can be added to produce Portland limestone cement and Portland composite cement.

The use of limestone powder in concrete, particularly in SCC, has been widespread in Sweden and France, where limestone powder is stored in silos alongside the cement in ready-mix concrete plants. The addition of fine limestone powder can significantly improve the workability of self-compacting concrete. The SCC mixes containing fine limestone powder showed improved fresh properties, higher than expected compressive strength and excellent surface finish.

Quarry Dust The reduction in the sources of natural sand and the requirement for reduction in the cost of concrete production has resulted in the increased need to identify substitute material to sand as fine aggregates in the production of concretes especially in Concrete. Quarry dust, a by-product from the crushing process during quarrying activities is one of such materials. Granite fines or rock dust is a by-product obtained during crushing of granite rocks and is also called quarry dust.

II. LITERATURE REVIEW

Gritsada Sua-iam et al. carried out Study on Novel ternary blends of Type 1 Portland cement, residual rice husk ash, and limestone powder to improve the properties of self-compacting concrete. On that study, they made SCC by replacing cement with lime stone powder as a 20% replacement, rice husk ash as a 20% replacement and 10% lime stone powder, 10% rise husk ash as a combine replacement. Test result shows that the LS improved workability more than RHA did and produced a concrete with workability

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equal to or better than the control. The concrete samples containing RHA generally exhibited lower compressive strength than did the concrete samples containing LS [1].

D.W.S. Ho et al. carried out Study on the use of quarry dust for SCC applications. On that study, it was found that the quarry dust, as supplied, could be used successfully in the production of SCC. Compared to the use of limestone powder, both paste and concrete studies confirmed that the incorporation of granite fines required a higher dosage of super plasticizer for similar yield stresses and other rheological properties [2].

Beata Łaz´niewska-Piekarczyk examined the Effect of viscosity type modifying admixture on porosity, compressive strength and water penetration of high performance self-compacting concrete. The results presented in the paper showed that SPs and VMAs from different sources cannot be used interchangeably, even if they appear to have a similar chemical composition.[3]

P. Raghava et al. carried out Study on macro level properties of SCC using GGBS and lime stone powder. On that study, they made SCC by replacing cement with GGBS in percentages like 10, 20, 30, 40, 50 and by taking the optimum mix with GGBS, lime stone powder is blended to mix in percentages like 5, 10, 15, 20 as a partial replacement to cement. Test results shows that the SCC mix with combination of 30% GGBS and 15% limestone powder gives maximum compressive strength and fresh properties are also in the limits prescribed by the EFNARC [4].

B. Beeralingegowda et al. examined the the Effect of Addition of Limestone Powder on the Properties of Self-compacting Concrete. On that study, cement content in the SCC mix is replaced with various percentages of limestone powder (LP) (0 to 30%), the fresh and hardened properties and the durability characteristics of SCC such as acid attack and chloride attack are studied. The experimental results were validated by regression analysis. They observed that limestone powder can be effectively used as a mineral additive in SCC. Maximum increase of 17.74 per cent in compressive strength has been observed at 20 percent replacement of cement by limestone powder compared with reference concrete. Increase in splitting tensile at 20% replacement of cement by limestone powder show maximum increase of 18.91% compared with reference mix [5].

R. Kumar et al. had studied on An Experimental Study on Performance of Self Compacting Concrete Containing Lime Stone Quarry Fines and Fly Ash cement was replaced with different %age of fly ash i.e. 10%, 15%, 20%, 25%, 30%, 35% in the control mix and reference mix from the above replacement levels containing 35% replacement of cement by fly ash with higher slump value of 704 mm was selected for further investigation of partial replacement of sand by lime stone quarry fines in varying percentages of 10%, 20%, 30%, 40%, 50%, 60%. It was concluded that the replacement of lime stone quarry fines up to 40% in sand with 35% fly ash replacement in cement increases the compressive strength up to 28.37%, split tensile strength up to 28.47%, and flexural strength up to 30.86%, in comparison to the reference mix at the age of 28 days [6].

B.H.V. Pai et al. examined the Self Compacting Concrete Containing Shell Lime. On that study, they observed that strength of the mix with 20%, 25%, 30% shell lime replacement is maximum and reaches a 28-day compressive strength of approximately 50MPa and while the split tensile and flexural strength of SCC with shell lime as pozzolana is also more by 20%, as compared to all cement SCC [7].

H.A.F. Dehwah carried out Study on the Mechanical properties of self-compacting concrete incorporating quarry dust powder, silica fume or fly ash. The results of a study conducted to evaluate the mechanical properties of self-compacting concrete (SCC) prepared using quarry dust powder (QDP), silica fume (SF) plus QDP or only fly ash (FA). The results indicated that the mechanical properties of SCC incorporating QDP (8–10%) were equal to or better than those of SCC prepared with either SF plus QDP or FA alone [8].

III. CRITICAL REMARKS

Following critical remarks can be drawn from the literature review:

The LS improved workability and compressive strength more than RHA did and produced a concrete with workability equal to or better than the control.

The quarry dust, as supplied, could be used successfully in the production of SCC. Compared to the use of limestone powder, both paste and concrete studies confirmed that the incorporation of granite fines required a higher dosage of super plasticizer for similar yield stresses and other rheological properties.

Super plasticizers and Viscosity modifying admixtures from different sources cannot be used interchangeably, even if they appear to have a similar chemical composition.

Up to 20% limestone, powder gives maximum compressive strength and fresh properties are also in the limits prescribed by the EFNARC.

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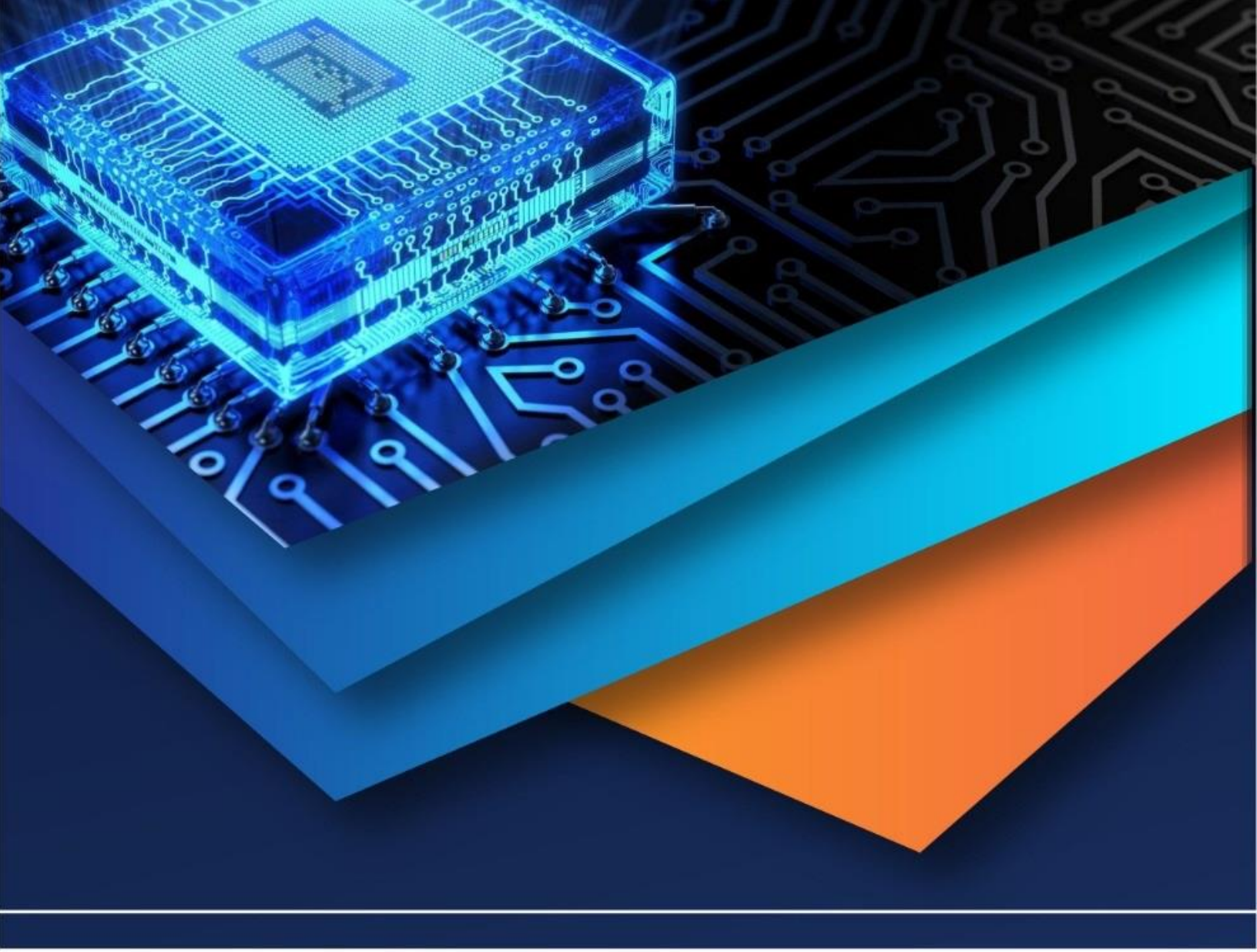
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The mechanical properties of SCC incorporating Quarry Dust Powder were equal to or better than those of SCC prepared with either Silica Fume plus Quarry Dust Powder or Fly Ash alone.

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