DEVELOPMENT OF MIX DESIGN PROCEDURES FOR SELF-COMPACTING CONCRETE USING LOCALLY AVAILABLE MATERIALS IN KENYA

BY

NJERU PURITY KARIMI
B.Tech (Hons) Eng. (Moi), Reg. Grad. Eng

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ABSTRACT

Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction. Unlike vibrated concrete, SCC can spread readily into place even in areas of reinforcement concentration resulting in durable concrete structures. Therefore, SCC offers a solution to many of the quality related problems for concrete structures in Kenya which are majorly due to inadequate compaction. However, production with Kenyan materials is still lacking. In this research, the development of the mix design procedure was entirely through applied research and the procedure presented in this report will make SCC to be used with a lot of benefits. Several mixture designs were examined in the laboratory with the goal of creating mixtures with desirable slump flow characteristics that did not require additional consolidation yet provided adequate compressive strength. Crushed stone aggregates were used as the coarse aggregate material and were varied from 30% to 40%. Superplasticiser was used to achieve self compactability and ranged from 0.8-1.5 liters/100kg of cement. Limestone powder was used at the fixed content of 20% of the powder content. River sand was used with content fixed at 40% of the mortar volume. The tests were conducted at the 95% confidence limit through an extensive experimental program. MiniTab Version 15 software was used for design of the experiment and statistical analysis of the results. Statistical models were generated which showed that a quadratic model was adequate. From the results, it was established that with adjustments of the mixture proportions, SCC can be produced successfully using locally available materials. Optimum proportions were then established using the statistical models generated and mix design procedure developed. These proportions were tested in the laboratory and found satisfactory. Eventually, a concrete strength is desired hence the importance of mix design procedures which will easily facilitate the achievement.

Key words: Self-compacting concrete, slump flow, crushed stone aggregates, filler, superplasticiser, concrete strength