DEVELOPMENT OF SELF-COMPACTING CONCRETE USING LIMESTONE POWDER

This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Science

R.Thivakar

Supervised by

Dr.S.M.A.Nanayakkara

Department of Civil Engineering
University of Moratuwa
Sri Lanka

January 2006

DECLARATION

I herewith declare that the work included in the thesis in part or whole has not been submitted for any other academic qualification at any institution.

31/01/2006
Date

R. Thivakar
R.Thivakar

31/1/2006
Date

UOM Verified Signature

Dr.S.M.A.Nanayakkara
Supervisor

ABSTRACT

Self-compacting concrete (SCC) is characterized by high flowability and segregation resistance. With the aid of these properties, SCC can be compacted into all corners of a formwork without using an external source of vibration. Sri Lanka has been in the back front of developing such a constructive material for the use of the local construction industry. This research had focused on the development of SCC using blended cement, which is enriched with limestone powder. Keeping in mind of the properties and the availability of the materials and also the economic factors, limestone powder along with the Ordinary Portland Cement were chosen as the major powder constituents to impart the necessary properties in the concrete to make it self-compactable. The design process in this research devised a novel technique; that is, the process of developing the SCC essentially involved three concomitant stages. In the first stage, paste mixes with relatively high flowability and apparently high cohesiveness were found out using modified flow table test and apparent bleeding of the pastes. The modified flow table test was carried out with some modifications to suit the appropriateness of the tests to the objective of the research. In the second stage, the selected pastes from the first stage were used to produce self-compacting mortar mixes. V-funnel test and mortar blocking tests were carried out in this stage to investigate the flowing ability and viscosity of the mixes. As a result of these tests, optimum concentration of sand and high self-compactable mortar mixes were found out. The concentration of coarse aggregate, which could be used in the initial mix proportioning of the concrete, was found out through a supplementary research. Then the derived mortar mixes were used in the third stage to check the self-compactability of the concrete. U-box test and slump flow tests were performed at this stage to verify the self-compactability characteristics of the concrete. Relatively lower rank SCC was produced in this research. This research concluded that blended cement with limestone powder, such as masonry cement, could be effectively used in producing SCC. Also SCC was produced for limestone powder/OPC ratio equals 0.56. It is highly effective to develop SCC by designing it through three connected stages; that is, by designing the paste, mortar and finally the concrete. Further to this development, a novel technique was discovered to quantitatively ascertain the resistance to segregation of the concrete by using modified L-box test. The developed self-compacting concrete was first put into this test and positive test results were obtained.

LIST OF CONTENTS

PAGE NO.

PAGE NO.

PAGE NO.

PAGE NO.

LIST OF TABLES PAGE NO.

2. LITERATURE REVIEW

3. METHODOLOGY

4. OBSERVATIONS AND ANALYSIS OF RESULTS

PAGE NO.

LIST OF FIGURES **PAGE NO.**

2. LITERATURE REVIEW

3. METHODOLOGY

PAGE NO.

4. OBSERVATIONS AND ANALYSIS OF RESULTS