Self –Consolidating Grout for Masonry Construction

A Thesis
Submitted to the Faculty of Engineering
Ain Shames University for the Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering

Prepared by

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B.Sc. in Civil Engineering, June 2008
Higher Institute of Engineering – El Shorouk Academy

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STATEMENT

This thesis is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Structure Engineering, Faculty of Engineering, Ain Shams University, from November 2009 to May 2015.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

Date: - 25/8 /2015

Signature: - ----------

Name: - ***Mohammed Elsayed Elmasry***

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ABSTRACT
OF M. Sc. THESIS

NAME*: - MOHMED ELSAYED IBRAHIM ELMASRY*

Title: "**Self –Consolidating Grout for Masonry Construction**"
Faculty : Faculty of Engineering, Ain Shams University.
Specialty: Civil Eng., Structural Engineering Dept.

Abstract:

This thesis presents a study on developing self-consolidating grout (SCG) for masonry construction using locally available materials. It presents a brief review on the previous studies carried out on the production of self-consolidating grout (SCG) for masonry applications and the effect of using different materials on the fresh and hardened properties of SCG and its durability performance is reviewed as well.

An experimental program is designed to achieve the objectives of the study and divided into two phases. Phase 1, to develop SCG mixes using different available local materials including Portland cement, natural sand, crushed dolomite as coarse aggregate, silica fume and chemical admixture. The variables considered in this phase include cement content, silica fume dosage, and water to cement ratio. A mix design approach has been developed for SCG mixes for both cases of fine and coarse grouts. The fresh and hardened properties of the developed SCG mixes are presented. Two of the successfully developed SCG mixes (one fine and the other is coarse) are selected and used to grout five masonry walls that are investigated in phase 2. The behavior and performance of these five masonry walls grouted using the selected SCG mixes are investigated throughout the height of 3 m wall assemblies through physical evaluation. Following the mix design approach introduced in the current study, grout mixes that satisfy acceptance criteria for SCG for masonry construction are successfully developed having wide range of strengths that suit different masonry applications.

Keywords:
Self-consolidating grout, conventional grout, masonry walls, masonry construction , fine grout, coarse grout and slump flow.

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Table of Contents

Page

List of Tables

List of Figures

page

page

page

CHAPTER 1
Introduction

Grout is one of the primary components that are used in masonry construction. Conventional grout has different shortcomings since it is difficult to cast and consolidate leading to increase in cost and time of construction. Self-consolidating grout (SCG) is a new concept in the masonry industry where it combines the technology of self-consolidating concrete (SCC) with conventional grout. The SCG availability will make concrete masonry more economical and reduce construction time.

In reinforced masonry construction, conventional grout is one of the primary components that are used to bond reinforcement to masonry, protect reinforcement from corrosion with different exposure conditions, and increase wall ability to carry different loads. Conventional grout has been used in masonry construction for several years, during this period; it has been proved that conventional grout for masonry construction has different shortcomings. Conventional grout is a labor-intensive and time consuming portion of reinforced masonry construction. It is difficult to cast and consolidate in narrow cell voids of hollow block masonry walls where reinforcement exists. Lack of consolidation results in unfilled (hollow) portions of reinforced masonry walls with reinforcement uncovered leading to reduced load capacity and service life for the walls. These shortcomings trigger the need to explore the feasibility of developing self-consolidating grout (SCG) for masonry construction following the successful development, production, and application of self-consolidating concrete (SCC). SCG is a brand new concept in the masonry industry where it combines the technology of SCC with conventional grout. SCG is to be highly flowing, non-segregating grout that has the ability to fill the long, narrow and sometimes highly congested cores of reinforced walls without the need for consolidation and