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# SHEAR CAPACITY MODELING OF SELF-CONSOLIDATING CONCRETE BEAMS

***A. A. Maghsoudi[1], E. Hosseini Mehrab[2]**
***1- Associate Prof., Civil Eng. Dept., Kerman University, Iran.**
**2- M.Sc. Student, Civil Eng. Dept., Kerman University, Iran.**
Gmail:e.hosseinimehrab@gmail.com
*Email:maghsoudi.a.a@mail.uk.ac.ir

**Abstract**

Development of self-consolidating concrete, SCC is a very desirable achievement in the RC structures for overcoming problems associated with many problems such as congestions of steel reinforcement. This non-vibrating concrete is not affected by the skill of workers, and shape and amount of reinforcing bar arrangement of a structure. Due to high-fluidity and resisting power of reinforcing of SCC, it can be pumped longer distances. In this research, the finite element, F.E modeling of three SCC beams in shear while taking into account, the flexural tensile strength of concrete is performed and the results are compared with the available experimental tested reinforced SCC beams. The stirrups are located at 75 mm apart from the end of beams up to the loading point. The electrical strain gauges have been embedded on the stirrups and their strain readings are taken for every step of load increment. For modeling longitudinal steel bars and concrete, the 2-node and 8-node 3-D elements, are used respectively. The comparison of results obtained by two methods is indicated that a good satisfactory agreement is achieved.

**Keywords: Self-consolidating concrete, Shear capacity, Finite element modeling, Electrical strain gauges.**

## 1. INTRODUCTION

Casting concrete in heavily reinforced sections, such as those in columns and beams in moment-resisting frames in seismic areas and in some repair sections, makes the placement of conventional concrete (i.e., vibrating concrete) quite difficult. Using standard vibration techniques with conventional concrete that is not fluid enough may lead to some surface and structural defects resulting from lack of proper bond development between the concrete and the reinforcement as well as the entrapment of air voids in the concrete. One way to reduce the intensive labor demand for vibration of highly congested reinforced sections is to use the new generation type of concrete called as self-consolidating concrete, SCC which is developed in Japan by Okamura in the late 1980s in order to reach durable concrete structures [1]. Since that time, Japanese contractors have used SCC in different applications. In contrast with the Japan, research in Europe, America and Iran started only recently [2, 3]. Such concrete can spread readily into place and fill the formwork without any mechanical consolidation and with minimum risk of separation of the material constituents.

One of the barriers to the widespread acceptance of SCC is the limited information regarding structural properties of sections cast with SCC, especially while considering the shear capacity of the elements either numerically or experimentally.

The main objective of the study reported herein was to compare the experimental results of shear performance of reinforced SCC beams to that of the F.E modeling [4] while taking into account the flexural tensile strength of concrete $f_r$. The comparison of the results by two methods is indicated that, a good coincidence is available. However, in the experimental phase, the results obtained of three reinforced SCC beams tested by the first author are used. It is remained that the behavior of tested beams with SCC under flexure is reported by [5]. The SCC beams are theoretically designed for shear based on the provision of ACI-08 [6] for conventionally-vibrated concrete. There is no any standard to design the reinforced SCC structures, and therefore the ACI Code validity in shear is testified too.

## 2. MATERIALS

The approach in this research on the development of SCC for casting reinforced beams involved using high paste volume (and low aggregate volume) to promote high deformability and reduce the risk of blockage and segregation during concrete placement. Self-consolidating concrete can be distinguished from conventional concrete not only by its high fluidity but also by its composition. The most important distinctions are: