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Estimating of Torsional Capacity of Self Compacting concrete Beams

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ABSTRACT

This paper expresses the effects of silica fume, super plasticizer and GFRP on the torsional strength of self-compacting concrete (SCC) beams. SCC and control concrete mix designs in this study are based on 20 different mixes with the water-cement ratios of 0.35 and 0.45. For Torsion tests, beams with the dimensions of 40 × 10 × 10 cm were casted. To determine the compressive strength and Pundit tests, Cubic specimens with the dimensions of 10 × 10 × 10 cm and standard cylindrical specimens with the dimensions of 15 × 30 cm height were made and cured for 28 days before testing. The obtained experimental results show that the effect of silica fume in w/c=0.45 was more than the other on torsional capacity was. The torsional strength of concrete beams with GFRP was increased about 43%. The error of estimating the compressive strength of concrete by pundit test was 2%. In addition, the existing equations for estimating the torsional strength of ordinary concrete can be used for Self Compacting concrete.

KEYWORDS

SCC, Torsional Strength, Compressive Strength, Super plasticizer, Silica Fume, Pundit.

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1 –INTRODUCTION

Self-compacting concrete was first suggested by Professor Hajime Okamura in 1986 in Japan. This type of concrete was built in 1988 in the workshop and acceptable results in terms of physical and mechanical properties of concrete provided. Compacting concrete refers to concrete that flows under its own weight and according to the high flow, without the need for compression and vibration, comfortably in any form or by any form of reinforcement density take homogeneous form of the case. In the field of torsional resistance of ordinary and reinforced concrete, people like Chalioris, CE [3, 16], Hii AKY [4, 5], Jing M, Raongjant [6] have worked, and some researches on different sections of concrete beams in terms of torsional resistance are done.

It has been less attention to torsional resistance of self-compacting concrete in rectangular sections. In this research, experimental investigations on torsional resistance of self-compacting concrete are executed and the results are compared to the ones obtained from conventional concrete. Moreover, investigating the effects of silica fume and super plasticizers on torsional strength of self-compacting concrete are the purposes of this article.

2– METHODOLOGY

To make the laboratory sample, 16-compacting concrete mix design in accordance with Table 10 is used and 4-control concrete mix design was also made.

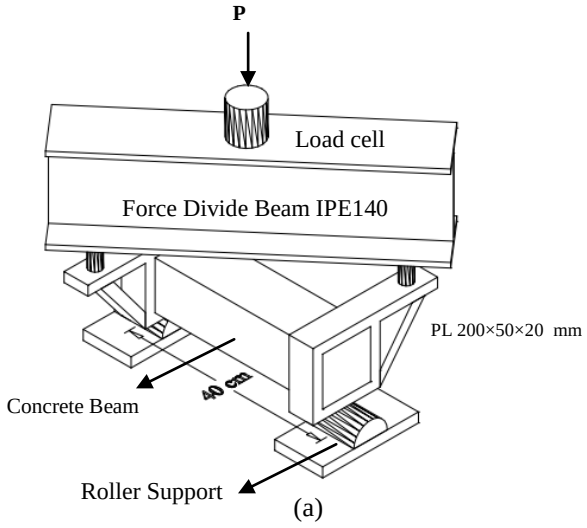
The cube samples with dimensions of 10 × 10 × 10 cm and standard 30 × 15 cm cylindrical specimens To determine the Self-Compacting concrete compressive strength were made.

Beam samples with dimensions of 10 × 10 × 40 cm to estimate the torsional strength of self-compacting concrete were used. Samples were removed from the molds after 24 hours and until testing (In a period of 28 days) Stored in wet conditions.

The following tests were performed on samples made:
1- Compressive Strength
2- Ultrasound test
3- Torsional resistance test in accordance with the figure

In each test, three samples were used for each mix design.

In addition, concrete beams using GFRP reinforcing fibers were re-tested to study the increase of torsional strength. In this research, concrete beams using GFRP fibers and special resin was strengthened [14, 20]. Samples were completely wrapping with GFRP fibers.



(a)

(b)

Figure1: (a) Technical properties of concrete torsion strength test machine, (b) Devices made by the author for torsion strength testing

3- CONCLUSION

In this study, the following results have been obtained:

- Torsional strength of self-compacting concrete can be calculated from the equations presented by Iranian concrete building codes.
- Reducing the water to cementitious materials ratio in self-compacting concrete reduced the effect of silica fume in increasing the torsional strength.
- Increasing the amount of super plasticizer up to 1%, increased the torsional strength, and higher values of super plasticizers reduces the torsional resistance.
- The maximum error for predicting the strength of concrete with ultrasonic waves was about 2%.
- FRP fibers wrapped around the beams increased the torsional strength of concrete up to 45%.

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