AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
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SHEAR BEHAVIOR OF SELF COMPACTING HIGH STRENGTH CONCRETE DEEP BEAMS

BY

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STATEMENT

This thesis is submitted to Ain Shams University, Cairo, Egypt, for the degree of Master of Science in Civil Engineering (Structural).

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AIN SHAMS UNIVERSITY
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Title of the thesis:

SHEAR BEHAVIOR OF SELF COMPACTING HIGH STRENGTH CONCRETE DEEP BEAMS

The prime objective of this research is to improve the understanding of the behavior of self compacting high strength concrete deep beams failing in shear, and to study the size effect in self compacting high strength concrete and to evaluate the effect of orthogonal reinforcement on the shear capacity of deep beams and on size effect. Furthermore, we studied the various proposed procedures for predicting the shear strength of deep beams.

In order to achieve these general aims, the following specific objectives are proposed:

- To contribute to the understanding of the mechanism of shear strength in reinforced concrete deep beams with and without shear reinforcement and how the use of self compacting concrete may affect them.
- Experimental program is suggested to study different parameters studied in the thesis and to show their effect on the shear strength of the studied beams.
- Verification of shear strength results using empirical equations from literature.

The thesis is divided into seven chapters. In Chapter 2, a state of the art is presented, in which different conceptual models and shear design procedures for evaluating the failure shear strength of reinforced concrete deep beams with and without web reinforcement are introduced. Moreover, the basic characteristics of self compacting high strength concrete are pointed out and previous experimental research is summarized.

In order to better understand the response of self compacting high strength concrete deep beams that fail in shear, twelve deep beam specimens were designed to ensure shear failure. In Chapter 3 the details of beam specimens, material properties, instrumentation and the testing procedure used are carefully described.

The results obtained from the experimental campaign carried out at the Concrete Research Laboratory at Ain-Shams University are presented and discussed in Chapter 4. The influence of each design parameter is studied separately, and test results are compared with different shear approaches. These results will be discussed in full details in chapter 5.

In Chapter 6, shear design methods based on the observed behavior are reviewed for self compacting high strength concrete deep beams with and without web reinforcement, attempting, however, to point out differences and to keep it simple enough to make it suitable for implementation in a code of practice.

Finally, Chapter 7 presents general and specific conclusions, together with recommendations for future research.

The most important conclusion were :

- Self compacting high strength concrete deep beams exhibited size effect which is reduction in the ultimate shear stresses with the increase of the height of the deep beam, in the same manner as high strength concrete and ordinary strength concrete that's why such behaviour should be considered in the design equations.

- The orthogonal web reinforcement enhanced the ultimate shear strength of the tested deep beams, but it did not remove the size effect, the ultimate shear capacity of the section decreased with the increase of the depth in the same manner exhibited by specimens with no orthogonal web reinforcement when the height varied from 500 mm to 900mm.

- On comparing the effect of the vertical web reinforcement and the horizontal web reinforcement on size effect, it was found that the latter had greater effect on decreasing the impact of increasing the depth on the ultimate shear stress of the tested deep beams.

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