AIN SHAMS UNIVERSITY
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SHEAR STRENGTH AND MINIMUM SHEAR REINFORCEMENT OF T-BEAMS

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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.

The work included in this thesis was carried out by the author in the Department of Civil Engineering (Structural Division), Ain Shams University, from 2006 to 2010.

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

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ABSTRACT

The shear resistance of reinforced concrete beams has been a well-known research subject over the last several decades. The study of shear resistance in the case of T-beams, however, is limited. In international codes such as ACI Building Code, the Egyptian code and the Euro-code, the shear force in a T-beam is assumed to be carried only by its web. This simplified assumption, however, which has prevailed in the shear design practice, is necessary.

This thesis focused on studying the influence of changing the upper flange width of the T-beams and changing of the shear span-depth ratio (a/d) on the shear behavior of reinforced concrete beams. The shear behavior of reinforced concrete T-beams was evaluated and characterized both experimentally and analytically.

The thesis experimental program consists of a total of five reinforced concrete T-Section beams with ordinary strength and minimum shear reinforcement tested under static loading conditions. The behavior of the tested specimens was compared to a beam specimen of rectangular section reinforced with the same shear reinforcement.

The analytical investigation focused on using the strut and tie method in the evaluation of shear strength of the T-section beams. The results of the analytical program were compared to that of the experimental program. The analysis was extended to include detailed comparisons with various domestic and international codes and standards.

Research findings indicate that shear strength of T-beams is higher than the shear strength of the rectangular beams, but presence of flange or increasing it for beams having the same shear span to depth ratio does not reduce shear crack width and does not significantly affect stirrups strain, while decreasing shear span to depth ratio for beams having the same flange width reduce shear crack width and affect significantly stirrups strain. Analysis shows that the ACI 318-05 and ECP 203-2007 design codes can conservatively be used for the design reinforced concrete T-beams; also analysis shows that using the Strut-and-Tie method can be used to predict well the shear strength of reinforced concrete T-beams.

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