

Comparison of Shear Design Provisions of Structural Concrete Members Used in Various Approaches

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Abstract

As multiple one-way shear design provisions for structural concrete members appeared in the recent decades and have been adopted by various design codes, it is important to assess how the design would be influenced by these approaches. A few approaches were selected from the most widely used national code provisions and other relationships proposed by researchers. This paper overviewed the mechanisms of shear resistance considered in each approach, and a thorough review and summarization was made. The application of the three principles of shear design in each approach is discussed. The factors affect the concrete and the steel contributions in each approach are compared. And the influence of prestressing force on shear resistance is also studied.

Keywords: shear design provisions; design database; shear resistance; mechanisms; concrete contribution; shear reinforcement

1 Introduction

Over the past few of decades, multiple one-way shear design theories for structural concrete have been developed and adopted by different national codes^[1]. Since 1990s, there have also been quite a few types of approaches proposed by independent researches. In accordance with the research approach, a review and evaluation was conducted of existing models and approaches for shear design. The following shear design procedures including the most widely used national code provisions and other relationships proposed by researchers were selected and simplified after a thorough review and evaluation:

ACI 318-11 (2011)^[3]

CSA A23.3-04 (2010)^[5]

Model Code (2010)^[4]

Eurocode EC2 1992-1-1 (2003)^[7]

German Code DIN 104501 (2008)^[6]

Japanese Code JSCE Standards (2007)^[2]

Chinese Code GB 50010 (2010)^[8]

The shear design approach developed by Frosch et al (2007)^{[9] [10]}

The shear design approach developed by Hsu et al (2014)^[11]

The shear design approach developed by Bazant et al (2014)^{[12] [19]}