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Evaluation of shear design procedures for reinforced concrete beams with shear reinforcement.

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Design procedures of standards ideally should be safe, simple, rational, general and also accurate. One of the design procedures which does approach this ideal is flexural designing for reinforced concrete beams. Unfortunately mechanism of shear transfer across a concrete beam has not been understood as yet. At present, most of the major codes still use the Truss Approach for designing of slender beams. During the last three decades several theories have been forwarded to give a more rational approach to shear designing. But none of these seem to have resolved the issue by producing results relating theory to practice or experiment.

The principal objective of this study is to carry out a state of the art review and to evaluate the shear design approaches. Design procedures of five major codes namely US (ACI -2002), Canadian (CSA -1994), British (BS8110 -1997), Australian (AS 3600 -2001), Japanese (JSCE -1986) and a design procedure based on Shear Friction have been evaluated in this study. Test results of more than 250 slender beams which have been exhumed from literature have been used for the evaluation. Thirteen parameters were identified as parameters that influence the accuracy of the shear predictions. The influence of these parameters has been examined using a Multinomial Logistic Regression analysis.

Equation 11.5 of ACI code was found to give the most accurate predictions compared to the other methods. Nevertheless, the results of multinomial logistic analysis shows that this method significantly tends to over estimate shear strength when effective depth of the beam increases. Further it was identified that BS and Australian codes have a tendency to under estimate shear strength when linking spacing to effective depth ratio (s/d) decreases. Also this study shows that the Japanese code has a significant tendency to underestimate shear strength when breath of the beam and shear span to effective depth ratio (a/d) decreases. There is yet another tendency of Japanese code to under estimate shear strength when percentage of longitudinal tensile steel increases. It was identified that the Canadian code also tends to under estimate the shear strength when percentage of longitudinal tensile reinforcement increases.

This study shows that Shear Friction Method leads to excessively conservative shear designs. It was identified that major codes have failed to correctly identify the influence of some parameters on the shear strength. As a result of this, the accuracy of predictions of major codes considerably depends on the variation of those parameters

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