

PROCEEDINGS

Probabilistic Model for Shear Strength of RC Shear Walls Based on Improved Strut-and-Tie Model and Bayesian Theory

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ABSTRACT

To accurately estimate the shear strength of reinforced concrete (RC) shear walls with boundary elements and to reasonably describe its probabilistic characteristics, a probabilistic model for shear strength of RC shear walls is proposed based on an improved strut-and-tie model and Bayesian theory. Firstly, the contribution of longitudinal reinforcement in the boundary elements is incorporated into the softened strut-and-tie model, leading to the development of a probabilistic model that accounts for the boundary element effects. Consequently, the shear-resisting mechanisms of the diagonal, vertical, and horizontal struts are comprehensively considered in the analytical expression. Then, using a dataset of 392 experimental specimens, the statistical characteristics of the model parameters, including their empirical distribution types, means, standard deviations, and correlation coefficients, are systematically determined through Bayesian theory and Markov Chain Monte Carlo techniques. The posterior distributions of the parameters are updated iteratively as experimental data are added, exhibiting convergent and stable behavior. Finally, the proposed model is validated by comparing its predictions with experimental results and several traditional deterministic models. The analysis demonstrates that the proposed model not only effectively captures the probabilistic features of shear strength but also enables the calibration of conventional models using confidence intervals and probability density functions. Meanwhile, the proposed mean-value model shows strong agreement with the actual shear strength, with a mean and standard deviation of the predicted-to-measured ratio of 0.95 and 0.31, respectively.

KEYWORDS

Reinforced concrete shear wall; shear strength; boundary elements; Bayesian theory; probabilistic model

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