ADVANCED COMPOSITE MATERIALS IN BRIDGES AND STRUCTURES
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MATÉRIAUX COMPOSITES D'AVANT-GARDE POUR PONTS ET CHARPENTES
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EVALUATION OF SHEAR STRESSES IN CONCRETE BEAMS REINFORCED BY FRP BARS

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ABSTRACT

A twelve concrete beams reinforced longitudinally and transversely by steel bars, FRP bars, or a combination of both type of reinforcements are cast and tested to check the applicability of the compatibility truss model and the truss-and-tie model for predicting the shear stresses in these beams.

It was found that when longitudinal and transverse reinforcements are provided with steel bars, the compatibility truss model accurately predicts the shear stresses and when the longitudinal and transverse reinforcements are provided with FRP bars the truss-and-tie model provides a better prediction to the shear stresses. However, when the reinforcements are provided by a combination of steel and FRP bars neither the compatibility truss model nor the truss-and tie model succeeds in predicting the measured shear stresses with reasonable accuracy.

INTRODUCTION

When concrete beams are subjected to high shear stresses they are susceptible to inclined cracks. Customarily, as the longitudinal and transverse reinforcements are provided by steel bars, it is assumed that cracks are small and concrete between cracks transmits shear stresses. This assumption actually forms the basic rule of the compatibility truss model for shear stress computation (MacGregor, 1992 and Wang and Salmon, 1992). However, if the longitudinal and transverse reinforcement are replaced by fiber reinforced plastic (FRP) bars in lieu of