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CONFINEMENT MODEL FOR CONCRETE IN CIRCULAR AND SQUARE FRP-CONCRETE-STEEL DOUBLE-SKIN COMPOSITE COLUMNS

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ABSTRACT

This paper presents a new design-oriented model for predicting the ultimate failure conditions of concrete in fiber-reinforced polymer (FRP)-concrete-steel double-skin tubular columns (DSTCs). An experimental test database consisting of all the axial compression test results for DSTCs available in the published literature is presented and used to assess the performance of four existing models to predict the compressive strength and ultimate axial strain of concrete in DSTCs. A new concrete confinement model that incorporates the failure mode of the inner steel tube is proposed. Both the strength and strain predictions of the proposed model are in close agreement with test results to an accuracy better than the existing models.

KEYWORDS: Fiber-reinforced polymer (FRP); Concrete; High-strength concrete (HSC); Composite columns; Confinement; Stress-strain relations.

1. INTRODUCTION

The use of fiber-reinforced polymer (FRP) composites as a confinement material for concrete has received a great deal of attention over the past two decades. Initially research focused on the use of the material in retrofitting applications of concrete columns [e.g. (1-15)]. More recently, the focus has turned to the application of FRP composites for the development of new high-performance composite structural systems. As one of the most promising of these structural systems, concrete-filled FRP tubes (CFFTs) have been investigated extensively [e.g. (13-24)].

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