

## ABSTRACT

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### **Bond and Splice Behavior of a CFRP Strengthening System for Steel Structures**

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This paper summarizes a comprehensive experimental program and finite element modeling study undertaken to investigate the bond and splice behavior of carbon fiber reinforced polymer (CFRP) materials used for strengthening steel structures. The experimental program consisted of six CFRP double-lap shear coupons and ten steel beams which incorporated a CFRP lap-splice joint at midspan. The double-lap shear coupon tests incorporated different plate end configurations in an attempt to reduce the bond stress concentrations and consequently help increasing the joint capacity. The steel beams were tested to investigate the behavior of the splice joints under flexural loading. Splice plate lengths ranging from 200 mm to 800 mm were tested using various plate end configurations including square, reverse tapered and rounded plate ends. Mechanical anchorage of the splice joints, using transverse CFRP wraps and specially fabricated steel clamps, were tested to examine their effectiveness in resisting the peeling stresses. The results of the experimental program indicate that the presence of a reverse tapered plate end can help to significantly reduce the stress concentration and increase the capacity of bonded lap-splice joints. The results also demonstrate that careful detailing of the splice joints and the mechanical anchorage are essential to ensure the effectiveness of the joints.

A 3-D linear finite element analysis is used to model the behavior of the tested beams. The model was capable to accurately predict the bond stress distribution for splice joints with both square and reverse tapered plate ends. The calibrated finite element model was used to study various parameters believed to affect the bond behavior and the splice mechanisms. Based on the research findings, simple design recommendations are proposed to facilitate the proper design of CFRP splice joints for the CFRP strengthening system proposed for steel structures.

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Working Groups

Bond Behaviour of FRP in Structures	
FRP-Strengthened Metallic Structures	X
FRP Bridge Decks	

General Sessions

(Special sessions may be formed for a topic area depending on the number of papers received)

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Strengthening of historical structures	
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