Strain Transfer Analysis of Masonry Prisms Reinforced with Bonded Carbon Fiber Reinforced Polymer Sheets

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Abstract:

This study is an investigation of strain transfer between sheet bonded carbon fiber reinforced polymers (FRP) and masonry. Flexural testing results of 23 masonry assemblages reinforced with bonded FRP sheets are presented. Analytical modeling was conducted using flexural theory and a linearly elastic finite element model was generated to corroborate experimental results. Results indicate that bonded FRP sheets, applied in tapes to the face of the masonry, transfer significant tensile strain to the masonry resulting in premature failure of the assemblage. The viscosity of the epoxy and the porosity of various brick types, characterized by initial rate of absorption tests, directly affect the bond of the composite structure and, therefore, the magnitude of strain transfer and failure mode. The response of FRP reinforced masonry prisms can be predicted by simple flexural theory only if the FRP becomes partially debonded, due to the influence of tension stiffening on the masonry with bonded FRP. However, finite element results reveal that the magnitude and distribution of strains can be predicted.

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