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Design and Analysis of Torsional Behaviour of RC Beam- Column Joint Wrapped with Aramid Fabric

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Abstract: *This study focuses on investigating the torsional behaviour of reinforced concrete (RC) beam-column joints strengthened with aramid fabric wrapping, a high- performance fiber-reinforced polymer (FRP) composite known for its excellent tensile strength, durability, and corrosion resistance. Beam-column joints are critical components in RC frames that often experience complex stress states, including torsion, especially during seismic or lateral loading events. Traditional RC joints are susceptible to torsional cracking and failure, which can compromise the overall structural integrity. The research aims to enhance the torsional capacity and ductility of these joints by externally strengthening them using aramid fabric wraps. Detailed experimental and analytical investigations are conducted to assess the improvement in torsional resistance due to the addition of multiple layers of aramid fabric, bonded with high-strength epoxy resin. The study includes characterization of material properties, specimen preparation, application of controlled torsional loads, and measurement of torque versus angle of twist responses. Additionally, numerical modeling using finite element analysis validates the experimental results and provides insights into stress distribution and failure mechanisms. The findings demonstrate a significant increase in torsional strength and stiffness of the RC joints wrapped with aramid fabric compared to unwrapped specimens, highlighting the effectiveness of this retrofitting technique. This research contributes to the growing body of knowledge on FRP strengthening of RC structures and offers practical design guidelines for enhancing the seismic resilience and longevity of existing infrastructure*

Keywords: Torsional Behavior, Reinforced Concrete, Beam-Column Joint, Aramid Fabric, Structural Strengthening

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