

This study presents an integrated operations research framework for optimizing urban bike lane design to enhance safety and traffic efficiency. By formulating a multi-objective optimization model, we consider factors such as connectivity, accident risk minimization, and cost constraints in a congested urban setting. The proposed approach leverages network analysis techniques and simulation-based validation to capture dynamic interactions between cyclists, motor vehicles, and pedestrians. A case study in a mid-sized metropolitan area illustrates how the optimal reconfiguration of bike lanes can reduce travel times and improve safety metrics by over 20%. Our findings provide actionable insights for urban planners and policymakers aiming to foster sustainable and resilient transportation networks.