Two-stage Optimization of Pre- and Post-event Activities for Enhanced Resiliency of Transportation Networks

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Ensuring the resilience of critical infrastructure systems when facing disruptions is of the greatest importance to the engineers, stakeholders and decision makers. Providing the optimal strategy to strengthen the infrastructure systems performance before disruptions and to rapidly recover systems after disruptions requires a rigorous decision-making process. To enhance the system resilience, a multi-objective and two-stage stochastic programming model is developed, which could minimize the network-level cost and the mean risk by considering both pre- and post-event maintenance actions. To account for the effects of different improvement strategies, this model is tested under various disruption scenarios which, to spotlight uncertainty, have been assigned different occurrence probabilities. In this model, the pre-event activities represent bridge retrofit that could contribute to increasing the robustness and redundancy of the network system. The post-event activities are the bridge repair and recovery on the basis of the resilience-enhancing effects advanced by the pre-event actions. The consequential optimization is the optimal social-economic outcomes by considering different construction and disruption scenarios and the indirect costs associated with the system.

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