Evaluating and optimizing resilience of airport pavement networks

This paper addresses the problem of assessing and maximizing the resilience of an airport's runway and taxiway network under multiple potential damage-meteorological scenarios. The problem is formulated as a stochastic integer program with recourse and an exact solution methodology based on the integer L-shaped decomposition is proposed for its solution. The formulation seeks an optimal allocation of limited resources to response capabilities and preparedness actions that facilitate them. The overall aim is to quickly restore post-event takeoff and landing capacities to pre-event operational levels taking into account operational, budgetary, time, space, and physical resource limitations. Details, such as aircraft size impacts, reductions in capacity due to joint takeoff and landing maneuvers on common runways or bidirectional flows on taxiways, potential for outsourcing repair work, and multi-team response, are incorporated. The mathematical model and solution methodology are embedded within a decision support tool, the capabilities and applicability of which are demonstrated on an illustrative case study. Potential benefits to airport operators are described, including, for example: the tool's utility in suggesting equipment to have at the ready, identifying the critical pavement system components, and vulnerabilities for prioritizing future facility developments.