Master thesis of *Tsung-Min Huang*

A multi-mode network restoration problem in post-disaster humanitarian logistics management

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This thesis investigates a network restoration problem, the first step in humanitarian logistics management, where the time and resources for restoring broken roads (arcs) are given, and the objective is to access all shelters (nodes) as soon as possible. Compared with literature, we are the first to consider multiple modes of network restoration, including multiple teams and team collaboration. Our proposed integer program formulation is based on the resource constrained project scheduling problem, but is much more challenging since no clear precedence relations can be defined in a general network. Several effective heuristics are proposed to calculate good initial solutions, more accurate estimation on the bounds of planning horizon, and feasible solutions of good qualities efficiently. Computational experiments have been conducted over random network families of grid, tree, and path shapes. The results indicate our proposed sequential segment heuristics that partition the planning horizon into segments and iteratively calculate local optimal schedules for each segment can calculate a good solution of small optimality gap within much shorter time than the integer program.

***Keywords*:** Network restoration, Post-disaster, Humanitarian logistics, Integer programming, Resource constrained, Project scheduling problem

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