ABSTRACT

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Natural disasters cause significant disruption in road networks, rendering many crucial links unusable. It is important to timely repair the damaged links as they allow transportation of emergency services, relief materials, etc., after disasters. Most of the existing studies that focus on optimal recovery of damaged links after disasters assume that only a single agency is available for repair. Moreover, most of the exiting studies do not consider travel time on links to be a function of traffic flow passing through links and those that do, assume that the traffic flow gets distributed based on user equilibrium each time a link is repaired. However, such a traffic distribution is unrealistic as it assumes that the traffic flow remains the same across all the days for which a link is a repaired and the traffic distribution gets suddenly modified whenever a link is fully repaired. The goal of this thesis is to address these gaps in the literature of disaster recovery. We study the problem of determining the optimal repair scheduling of damaged links so as to minimize the sum of the total system travel time over the repair duration given that multiple repair agencies are available for recovery. Also, we consider a day-to-day traffic flow evolution where the route choices of travelers depend on the travel conditions of the previous day. We formulated this problem as a mixed integer non-linear program. We proposed two solution methodologies to solve the problem: a genetic algorithm and a greedy algorithm. We tested these methodologies under different settings. It is found that these algorithms provide efficient ways for timely repairing road networks after disasters while ensuring that the network performance is maximized.