Addressing the Challenges of Uncertainty Affecting Last-Mile Distribution in Disaster Relief

The study of Disaster Relief has received increasing attention for the better part of 20 years, and particularly in the wake of high-visibility storms like Hurricanes Harvey and Irma, there is little need to provide justification for the field as an area of interest. This presentation will summarize an ongoing effort to study one particular aspect of Disaster Relief, namely last-mile distribution in the face of uncertain supply. This body of work forms the bulk of my dissertation which I completed last year along with my co-author and mentor Dr. Emmett Lodree, a full Professor at the University of Alabama.

My dissertation follows the three paper model, so my presentation will highlight components of each paper and weave them together into the overarching thrust of my research. The first paper has already been published in *Transportation Research Part E: Logistics and Transportation Review.* titled *Dispatching policies for last-mile distribution with stochastic supply and demand*. The goal of this paper is to characterize practical, easy-to-use dispatching policies that can provide high-quality results for a practitioner operating in the field, meaning that the results could be used to help educate practitioners and inform them how to manage vehicles while responding to a disaster event.

This study, however, demonstrates the computational difficulties in solving realistic problem instances with Dynamic Programming, motivating the use of Approximate Dynamic Programming techniques for the remaining two papers, which is an unfamiliar class of problem-solving techniques even within my own discipline. So, my dissertation contains a detailed overview of Approximate Dynamic Programming as it relates to our problem, but this discussion is beyond the scope of the research symposium, so I will provide only the barest overview possible, in a manner that a diverse audience can follow.

This brings us to the second paper, *Vehicle dispatching policies for last-mile distribution in a disaster relief supply chain network*, which extends the distribution network from the first study to a scenario with two Staging Areas, strengthening the practical application of the work. We are primarily interested in seeing how the results from the model with one Staging Area apply to the expanded model. The third paper, tentatively titled *Vehicle dispatching policies for varying numbers of vehicles and staging areas in a disaster-relief supply chain network*, continues this trend, further generalizing the two-Staging Area network to include various combinations of vehicles and staging areas. As a consequence, it is largely computational and compares various solution approaches as applied to the different distribution networks, so I will keep this discussion high-level to appeal to a broad audience. I will conclude with an overview of the future directions that I intend to explore going forward.

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