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A humanitarian logistics model to minimize earthquake losses in large-scale situations

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Abstract—Logistics is the core operation of every relief operation. Because of this matter, humanitarian logistics has attracted lots of attention in recent years. There are some differences between humanitarian and commercial logistics. To decrease humanitarian losses, a perfect relief logistics operation should prepare sufficient amount of relief supplies immediately aftermath of the catastrophe. One of the most significant problems which will occur aftermath of an earthquake is failure of transportation infrastructures. To model this issue and evaluate its corresponding results, we destroy percentage of network's link each time. In this paper, we propose a non linear mixed integer multi-depot location-routing model to minimize losses in a humanitarian logistics operation by considering transportation network failure and penalty cost of unsatisfied demands. We have proposed an efficient variable neighborhood search (VNS) method to solve the model. An imaginary network as a large scale example is used to implement the model and proposed VNS method. The numerical analysis shows the capabilities of the model to handle the large scale relief operations by considering the special characteristics of a relief operation.

Keywords—component; humanitarian logistics, transportation network failure, non-linear mixed integer multi-depot location-routing, variable neighborhood search, large scale example

I. INTRODUCTION

Disasters, be man-made or natural have always affected humans. To be able to cope with disasters, every country and international NGO try to prepare itself to minimize humanitarian lost in a disaster. According to disaster management system cycle, any disaster management system consists of four main phase: mitigation, preparedness, response and recovery. Mitigation and recovery phases are not considered in this paper. In preparedness phase, various plans and solutions are devised to react efficiently in case a disaster occurs, for instance location of distribution centers or depots. Response phase is an operational phase which relief goods, personnel and equipments should be dispatched to affected areas aftermath of a disaster. Also in response phase a reverse flow of injured people is incurred in relief operation.

"Humanitarian logistics is the process of planning, implementing, and controlling the efficient, cost- effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people. The function encompasses a range of activities, including preparedness, planning, procurement, transport, warehousing, tracking and tracing, and customs clearance" [1]. As we can understand from above definitions, humanitarian logistics has some differences with commercial logistics in its nature. In this problem we