

# **Location and Emergency Inventory Pre-Positioning for Disaster Response Operations: Min-Max Robust Model and a Case Study of Yushu Earthquake**

**Wenjun Ni**

Department of Industrial and Manufacturing Systems Engineering, Faculty of Engineering,  
The University of Hong Kong  
Hong Kong  
niwenjun@connect.hku.hk

**Jia Shu**

Department of Management Science and Engineering, School of Economics and Management,  
Southeast University  
Nanjing, Jiangsu, China  
jshu@seu.edu.cn

**Miao Song**

Department of Logistics and Maritime Studies, Faculty of Business,  
The Hong Kong Polytechnic University  
Hong Kong  
miao.song@polyu.edu.hk

## **Abstract**

Pre-positioning emergency inventory in selected facilities is commonly adopted to prepare for potential disaster threat. In this paper, we simultaneously optimize the decisions of facility location, emergency inventory pre-positioning, and relief delivery operations within a single-commodity disaster relief network. A min-max robust model is proposed to capture the uncertainties in both the left- and right-hand-side parameters in the constraints. The former corresponds to the proportions of the pre-positioned inventories usable after a disaster attack, while the latter represents the demands of the inventories and the road capacities in the disaster-affected areas. We study how to solve the robust model efficiently and analyze a special case that minimizes the humanitarian cost. The application of the model is illustrated by a case study of the 2010 earthquake attack at Yushu County in Qinghai Province of PR China. The advantage of the min-max robust model is demonstrated through comparison with the deterministic model and the two-stage stochastic model for the same problem. Experiment variants also show that the robust model outperforms the other two approaches for instances with significantly larger scales.

## **Keywords**

Disaster Relief; Facility Location; Network Flow; Inventory Pre-positioning; Min-max Robust Optimization