240t Optimized Routing Methodology for Hazardous Materials Transportation

Yuanhua QIAO, Mahmoud El-Halwagi, and M. Sam Mannan

The routing of hazardous materials shipments has become an issue of major importance and thus an active area of research due to the increasing public awareness of the potential risks associated with the hazardous materials transportation. The optimal route is hard to select due to the uncertainty and unavailability of various parameters affecting the transportation. This paper presents a new routing model based on risk analysis that decision makers from both industry and government can use to solve hazardous materials logistical problems.

The optimal route for hazardous materials transportation can be obtained by considering the effect of transportation cost, potential risk, emergency preparedness, evacuation planning, and other requirements. Transportation risk is one of the most important factos and needs to be assessed at first. The assessment of transportation risk has to deal with uncertain parameters describing the nature of the truck configuration, operation, environment, and road conditions. Fuzzy logic will be applied to assess two contributors of transportation risk: frequency and consequence. The basic accident frequency data is acquired at first by incorporating available data, then fuzzy Mamdani model is employed to modify the basic accident rate by incorporating those affecting factors not included in the database. The basic consequence obtained from CANARY, a commercially available software, will also be modified by fuzzy Mamdani model to incorporating those uncertain factors.

After the assessment of potential transportation risk, it is input to the “minimum cost flow” model together with transportation cost, emergency preparedness, evacuation planning, and other requirements to obtain the optimal transportation route. Uncertainty arises when incorporating all of those variables in the model because those parameters are not at the same importance level and the importance level is hard to be expressed quantitatively and conveniently. Fuzzy model will be employed to address this problem by assigning different weight to those variables after the set up of fuzzy if- then rules.

Fuzzy model is applied in this paper because it can evaluate uncertainty by taking advantage of knowledge from human experts when no enough data available. This ability is especially important given the complexity of the transportation condition and the availability of human experience about the system. The optimal route can be obtained after the fuzzy logic processing even though uncertainty existence in this system.