

Abstract

ANALYSIS OF VOLUNTEERED GEOGRAPHIC INFORMATION FOR IMPROVED SITUATIONAL AWARENESS DURING NO-NOTICE EMERGENCIES

Christopher E. Oxendine, PhD

George Mason University, 2013

Dissertation Director: Dr. Nigel Waters

During a terrorist attack, evacuees face uncertain risks when deciding which route to utilize while trying to evacuate. Immediately following an attack, information is very limited or non-existent. Emergency services personnel are responsible for finding and notifying evacuees of impending danger, and minimizing evacuation risk is crucial to limiting additional loss of life, especially in densely populated areas. One of the challenges for evacuees and emergency services personnel is sharing and collecting information. Recently, mobile phones and social media (e.g. Twitter, Facebook, and others) have provided a global platform for sharing information about terrorist events and a medium for emergency services personnel to collect Volunteered Geographic Information (VGI). It is highly recommended that Emergency planners use VGI to supplement their decision making, notification processes, and response and recovery. With over 5 billion mobile phones world-wide, VGI can potentially contribute data that supports risk modeling and evacuation planning. The mass adoption of mobile phones provides citizens and emergency personnel with alternate methods of communication (i.e. voice, SMS, mobile applications, and access to social media). GPS accuracy on mobile phones continues to improve which further facilitates planning and response by emergency service personnel. This research provides two models. The first

model is a multi-objective, multi-criteria model that analyzes mobile phone location data and seeks to minimize risk encountered by evacuees and distance traveled. The study area for the first model is Manhattan, New York City. Risk and distance traveled is determined for the evacuation routes and is modeled in a Geographic Information System (GIS) to determine optimum evacuation routes. The second model analyzes social media to determine risk to evacuees during a simulated terrorist attack at George Mason University. Individual terrorists attacks are modeled and then combined based on time of incident. High-risk areas are modeled for multiple terrorist attacks providing first responders with increased situational awareness. The second model in this research improves situational awareness immediately following a terrorist scenario and the first model provides a multi-objective, multi-criteria method for reducing risk to evacuees. This research contributes to improved evacuation routing and visualization of risk during emergencies and increases situational awareness of first responders and citizens.