A Methodology for the Identification of Critical Locations in Infrastructures

by

Douglas M. Lemon

Submitted to the Department of Nuclear Engineering
on April 30, 2004, in partial fulfillment of the
requirements for the Degree of Master of Science in
Nuclear Engineering

ABSTRACT

The extreme importance of critical infrastructures to modern society is widely recognized. These infrastructures are complex, interdependent, and ubiquitous; they are sensitive to disruptions that can lead to cascading failures with serious consequences. Protecting the critical infrastructures from terrorism, human generated malevolent attack directed toward maximum social disruption, presents an enormous challenge. Recognizing that society cannot afford the costs associated with absolute protection, it is necessary to identify the critical locations in these infrastructures. By protecting the critical locations society achieves the greatest benefit for the protection investment. This project examines a screening methodology for the identification of critical locations in infrastructures. The framework models the infrastructures as interconnected digraphs and employs graph theory and reliability theory to identify the vulnerable points. The vulnerable points are screened for their susceptibility to a terrorist attack, and a prioritized list of critical locations is produced. The prioritization methodology is based on multi-attribute utility theory, and involves various disciplines including quantitative risk assessment and decision analysis. The methodology is illustrated through the presentation of a portion on the analysis conducted on the community of the Massachusetts Institute of Technology.

Thesis Supervisor: George Apostolakis
Title: Professor of Nuclear Engineering

Acknowledgements