

Infrastructure Interdependence

Characteristic of today's urbanised world is its increasingly intertwined and complex network of roads, railways, underground cables and other above and below ground infrastructure. Infrastructure interdependency studies are concerned with the interconnectedness between crucial infrastructures such as utilities and transport. Many of these systems play a crucial role in emergency response. Movement to and from base, such as a fire station, to the emergency site, is just one example of the many vital areas of interdependence between various systems.

Integrated Model

Proper emergency management requires not only acquisition of (geo-)data, its maintenance and updating, usually carried out by various departments or jurisdictions, but also tools for processing and modelling the data into meaningful information. Infrastructure clearly has a profound spatial dimension, which makes GIS technologies ideal for simulating the complex spatial relationships between important infrastructures, while allowing integration of modelling tools. However, the application of GIS in infrastructure interdependency modelling remains almost untouched.

GIS in Analysis

GIS enables management to access various sources of spatial information, identify relationships between crucial infrastructures, and analyse and visualise potential 'cascade' effects, escalating failure and common-cause damage resulting from an extreme event. One key capability of GIS is calculation of cumulative loss in the case of such an event, but GIS can also provide details as to the type of damage to which vital infrastructure sectors may be vulnerable and which are at risk. GIS also allows for analysis of relevant processes and operations to assess specific vulnerabilities and risks faced by individual or group sectors.

Mimicking Reality

Risk analysis represents a first step in identifying complex interrelationships and dependencies. The next involves their determination using modelling tools. The results can be visualised in a GIS environment as a step towards emergency planning. This allows management to exploit GIS functionality in generating detailed information and to share emergency management data across jurisdictions. GIS also allows for control of the protocols concerning access to information during emergencies. Of course, privacy regulations should be respected and not violated. GIS may also help in prioritisation planning for resource integration during emergencies. Modelling tools should be capable of mimicking complex real-world situations, and a major challenge is presented by the degree to which these models are capable of mimicking extreme events. Another important issue is determination and evaluation of the accuracy and validity of these models, and to what degree decision-makers can trust them.