MULTI-PHASED CRITICALITY ANALYSIS AND PREDICTION

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Homeland Security efforts have been primarily focused on procurement of emergency equipment continuing a reactive, response oriented tradition historically proven ineffective in large-scale disasters. To date, infrastructure analysis and predictive modeling for disaster impacts are largely academic studies with little operational relevancy. Hindsight has shown that broad predictions and warnings of damage have not improved local planners' and emergency managers' capability. An operational process is needed whereby local decision makers can understand and predict the time-phased, dependency-driven impact of regional infrastructure failures.

An in-depth assessment of regional infrastructures, resulting in the prediction of cascading effects of infrastructure failures, will enable better decision making. For example, an emergency manager is faced with an explosion at a water treatment plant. The immediate reaction is to get the injured to the nearest hospital trauma center. However, the missing information for the emergency manager is which hospitals will soon be impacted by the loss of the failed plant. Taking injured to an impacted hospital sets up a new crisis when the hospital must be evacuated due to lack of water. Understanding these interdependencies allows the manager to make informed decisions, stopping these failure cascades by proactive actions.

Strategic Planner Integrating Regional Infrastructure Technology (SPIRIT) uses a multi-staged solution to this issue. First, each infrastructure segment is analyzed to identify the nodes critical to its mission. These segments are then plotted geospatially to show their interdependencies. SPIRIT then predicts infrastructure failures based on relational models. Nodal criticality and failure are shown chronologically to reflect the eventual depletion of back-up systems, and so emphasizes proactivity. After a complex grading process, the results are simplified into a color-coded system that allows a decision maker to look at impacted nodes and recognize situational trends.