Infrastructure Interdependencies Identification through Integrated Hazard Analysis
Case study: A Canadian University Campus

University of British Columbia – Infrastructures Interdependencies Simulation (I2Sim) Team

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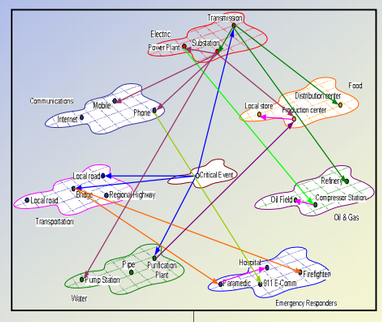
Interdependencies Simulator

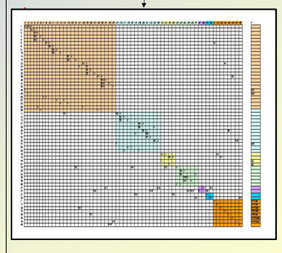
Introduction

The Joint Infrastructures Interdependencies Research Program is a multidisciplinary project to investigate infrastructure interdependencies.

This research presents a methodology for an integral earthquake risk assessment that contributes to enhance the resiliency of critical infrastructures. The presented methodology is a holistic conceptualization of interaction among critical infrastructures affected by a seismic event

Infrastructure Interdependencies Simulator





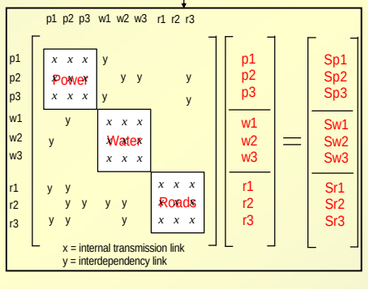
Can be represented by the following equation:

TX=W

T: Transportation matrix

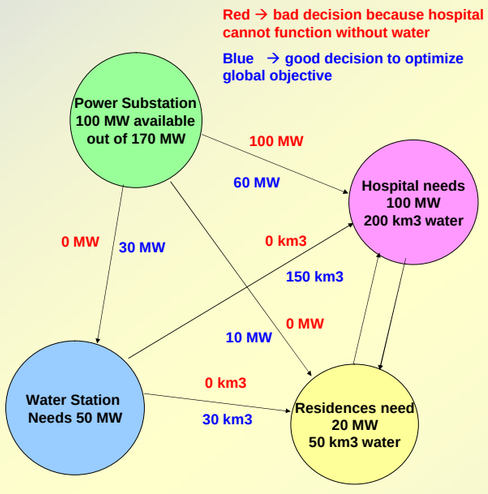
X: Received Goods

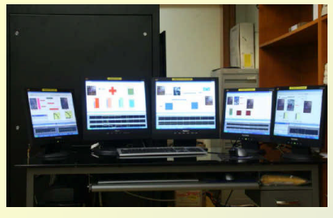
W: Sent Goods



Simulator Results

Input (x)		Internal (m)		Output (y)
Power	Water	Pumps	m	Water
100%	100%	2	1.0	100%
100%	100%	1	0.5	50%
50%	100%	2 or 1	0.5-1.0	50%
0%	100%	2 or 1	0.5-1.0	0%
100%	50%	2 or 1	0.5-1.0	50%
100%	0%	2 or 1	0.5-1.0	0%
0%	0%	2 or 1	0.5-1.0	0%





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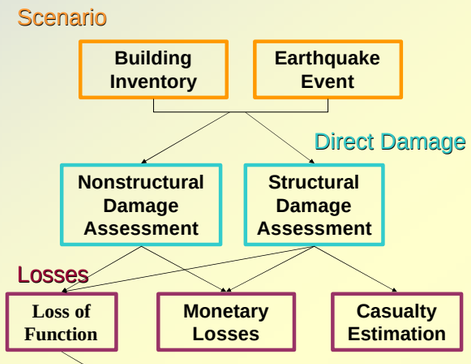
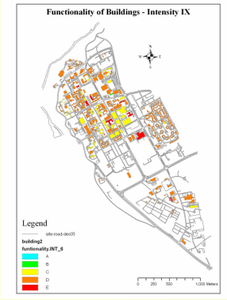
Case Study

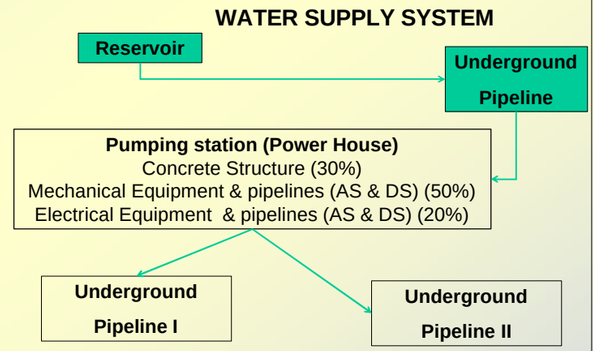
Building Damage Assessment



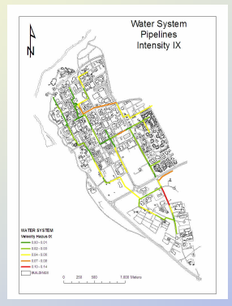


Results of building seismic risk assessment for an Intensity IX earthquake. Many buildings on campus are moderately functional (C) or nonfunctional (D or E) because of structural and nonstructural damage

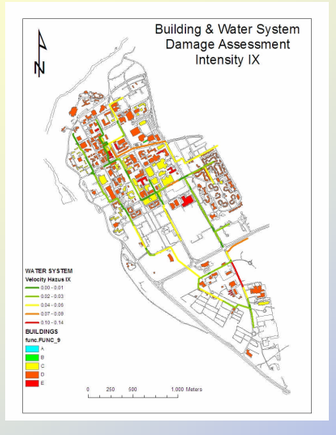
Lifeline Damage Assessment



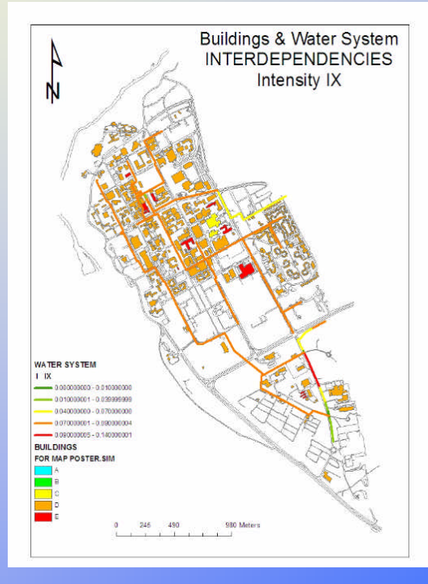
Results of lifeline seismic risk assessment for an Intensity IX earthquake. Critical pipelines providing water from the reservoir to the Pumping Station, and the ones providing water all across the studied location are broken or have leakage problems



Case Study Results



- **Individual assessments show the weakest links in each system**
- **The overlaying of both systems does not reflect the complete picture, because the interdependencies are not taken into account**



- **Interdependencies can have a significant effect on the overall seismic performance of the study area**
- **The I2SIM simulator tool allows these infrastructure interdependencies to be identified**