

Resilience of Infrastructure Networks

Abstract

The highly urbanized Hong Kong society depends heavily on the proper functioning of various infrastructure networks such as water, power, gas, transportation and communication.

Under normal conditions, infrastructure may be taken for granted, but its failures can result in loss of life and billions of dollars. Such failures may be caused by natural disasters, human-made disasters, equipment malfunctions, or any combination thereof. Moreover, failure in one infrastructure can disrupt other parts of the same system, and/or other infrastructures. The likelihood of such cascading failures rises with our ever-increasing connectivity and dependence on information and communication technology (ICT).

Successful research in this topic will provide a guide for government policy makers and infrastructure designers, builders and operators on how to cost effectively construct and maintain infrastructure networks that are resilient to disasters, as well as to plan resources and processes to be used when a disaster strikes.

This grand challenge involves the understanding of all types of disasters (their causes and attributes), the characteristics of the various infrastructures and their vulnerability to disasters, risk identification and management as well as causes of infrastructure failures and their socio-economic consequences, data acquisition and management, and how to achieve resiliency in a cost effective way before, during and after failures occur. Resilience requires redundant resources in flexible configuration and sufficient resources to promptly repair failures. There is a significant gap between the available and the needed knowledge in this area which is very well recognized worldwide (e.g., Program Solicitation, NSF 15-531, USA).

Hong Kong and the region already have strong expertise in power systems, ICT, earthquake engineering, cyber security, mathematics, social sciences and environment studies. It is important for Hong Kong to build on these existing strengths and stimulate research, collaboration and innovations in emerging areas that are key to designing resilient infrastructure networks.