



Venice
International
University

Venice International University
VIU Summer School
Critical Infrastructure Resilience
July 18-22, 2022

Schedule:

Morning: 9:30 – 12:30, with a coffee break from 10:45 to 11:00.

Afternoon: 13:30 – 16:30

Faculty

Erdem Ergin, Tor Vergata University of Rome (Coordinator)
Carlo Giupponi, Università Ca' Foscari Venezia
Jonas Johansson, Lund University
Christian Zulberti, Enel Foundation
Alessio Marcelli, e-distribuzione
Federico Carturan, RiskApp
Stefano Salata, Izmir Institute of Technology
Albert Chen – University of Exeter

Course outline

M1 – Resilience framework and CI concept
M2 – Solution 1 – Build a scenario
M3 – Impacts & ranking criticality
M4 – Hazard Impact on CI and services
M5 – Solution 2 – Crisis management timeline
M6 – Network resilience across the energy infrastructure
M7 – Decision-making under uncertainty
M8 – Cascading impact evaluation
M9 – Spatial understanding of CI
M10 – Solution 3 – Recovery strategy

Day 1 – Monday July 18

9:15 am *Registration*

Morning: Erdem Ergin, Tor Vergata University of Rome

Module 1 – Resilience framework and CI concept

The first session will provide essential information on the concepts of critical infrastructure and resilience. The session will therefore include a discussion on the structural changes affecting our society as a whole and the drivers of risk. The session will then look at the challenges of building resilience and how critical infrastructure is a strategic entry point.

Afternoon: Erdem Ergin, Tor Vergata University of Rome

Module 2 – Build a scenario

This session will introduce the second practical solution for CI risk assessment and/or crisis management. Participants will work in groups to develop a series of scenario for their CI. They will choose a hazard (whether natural or man-made), identify its frequency and intensity, and then discuss the potential impact on the baseline. The scenarios will lead to a discussion on risk assessment and crisis management decisions.

Day 2 – Tuesday July 19

Morning: Jonas Johansson, Lund University

Module 3 – Impacts & ranking criticality

This session will explore ways to understand the complexities involved with our society's interconnected critical infrastructures and challenges related to addressing their resilience. It will share concrete case studies of past events, such as the European power blackout in 2006, the Eyjafjallajökull Volcanic Eruption in 2010, and the Hurricane Sandy in 2012, and a comparative assessment of infrastructure resilience through empirical failure data. Based on these case studies and other research findings, insights into the effect of interdependencies and cascading impacts are given, e.g. key characteristics to consider and geographical and temporal aspects of different types of critical infrastructures. It will further explore on approaches to rank the importance of assets and infrastructures. The session will also highlight some insight towards the resilience of flows supplied by critical infrastructures during the pandemic based on a case study in Sweden.

Afternoon: Albert Chen, University of Exeter

Module 4 – Hazard impact on critical infrastructure and services

The functioning of the modern community relies on synchronized operations of multiple critical infrastructure and services. During hazard crisis, critical infrastructure/services play an even more crucial role to safeguard the public from the threats of disasters and fulfil the essential needs throughout the difficulties. The session will explore the dependencies and interconnectivities between critical infrastructures/services, how do hazards affect their operations, and potential consequences of their failures. With the improved understanding of the dynamics between various systems, adaptation strategies and countermeasures will be developed to enhance the resilience of critical infrastructure/services against disaster risks.

Day 3 – Wednesday July 20

Morning: Erdem Ergin, Tor Vergata University of Rome

Module 5 – Crisis management timeline

This session will introduce the third practical solution for CI crisis management. Standard emergency plans include list of actions and a task division, but they fail to indicate the order of actions. This often creates confusion and leads to unnecessary harm and damage. The idea of building a timeline for the aftermath has proven very useful as it allows to make some critical decisions before the impact. Hence saving time and resources. Participants will work in groups to develop a timeline for the CI and the scenario they have worked on.

Afternoon (14:15 – 16:45): Christian Zurberti, Enel Foundation and Alessio Marcelli, e-distribuzione

Module 6 – Network resilience across the energy infrastructure

The session starts with an introduction on resilience and infrastructure management, delivered by Christian Zurberti, Deputy Director of Enel Foundation. It is followed by a case study delivered by Alessio Marcelli, Head of network planning for e-distribuzione, on Resilience of Distribution Systems against extreme weather events.

Day 4 – Thursday July 21

Morning: Carlo Giupponi, Università Ca' Foscari Venezia

Module 7 – Decision-making under uncertainty

In this session the resilience concept will be applied in the context of how climate change can affect the performance of critical infrastructures and in particular to the case of flood risk in the design of airport infrastructures. A conceptual framework will be proposed, and operational solutions will be presented with a case study. Both quantitative and qualitative information are considered for the design of robust plans, i.e. plans that could be resilient to expected climate change impacts. Acquired information are managed in a multi-criteria analysis decision support system, making use of data mining techniques to identify preferable solution within a set of alternative ones.

Afternoon: Federico Carturan, RiskApp

Module 8 – Cascading impact evaluation

This session will cover the methodologies currently used to perform a critical infrastructures risk assessment, in particular the literature sources suitable to get downtimes due to natural events will be reviewed, a methodology to collect the expert judgement used to adapt the data points from literature to specific infrastructures will be analyzed. Moreover, obtaining the correct hazard scenario is another key activity for a proper CI risk assessment, a survey of the best references for earthquakes, flooding, high temperature, sea level rise etc. will be presented. The general framework of a computational risk assessment will be presented and, subsequently, an interactive exercise of risk assessment will be conducted on a selected CI element using the aforementioned methodology.

Evening – 19:00: *Social dinner at “Birraria La Corte” Restaurant, Venice historic city center*

Day 5 – Friday July 22

Morning: Stefano Salata, Izmir Institute of Technology

Module 9 – Spatial understanding of critical infrastructure

Designing a resilient system is one of the main targets to cope with disaster emergencies. Nevertheless, the resilience concept itself can be slippery if not adequately downscaled to its practical implementation through the system's adaptation. This session will present how to mainstream resilience through the definition of vulnerability and multirisk analysis. Some study cases will be used to set the framework of tools and methodologies that can support the decision making during urban planning. The spatial assessment of sensitivities, hazards and vulnerabilities will shape the analytical framework of the course while sharing with the participants some practical and interactive info.

Afternoon: Erdem Ergin, Università degli Studi di Roma “Tor Vergata”

Module 10 – Recovery strategy

Crises are powerful agents of change. They can wipe out years of efforts, but they can also serve to accelerate positive change if dealt with properly. Past disaster experience indicate that decision-making is the single most important factor for building resilience through crises. This session will present a key decision-making tool, the recovery strategy. It is commonly used by organizations to properly assess the impact, the uncertainties, the taken actions. And then to guide decisions for CI management.

