URBAN RESILIENCE

COMMUNITY PLATFORM COLLECTIONS

COLLECTION 1: RESILIENCE ENGINEERING CORE CONCEPTS

Resilience Engineering is about how society designs and builds the services and infrastructures that are critical to the resilience of its social-technical-environmental (STE) systems. The measuring of resilience and governance of these systems under uncertainty as well as questions of distributive justice are critical to how we cope as we are confronted by more severe shocks and chronic stresses on these STE systems. The core concepts of resilience engineering provide a foundation for all engineering disciplines in resilience thinking and its principles.

Materials in this collection introduce a range of definitions of resilience and concepts of resilience like robustness, shocks, stresses and uncertainty and STE systems and their main attributes. Many of these concepts originate from complexity theory.

Learning outcomes – students are to be able to:

- Select appropriate working definitions of resilience for a range of scientific disciplines and provide reasoning for why each definition was chosen.
- Define and describe systems thinking for resilience engineering.

COLLECTION 2: DESIGN PRINCIPLES FOR CRITICAL SERVICES AND INFRASTRUCTURES

The design and engineering of critical infrastructure systems that are relevant to urbanizing deltas - transport, water, energy, cyber& ICT, agriculture and urban planning - must take into account the impact of long-term stresses and the intensifying shocks from a range of disastrous events. Materials in this collection familiarize students with these shocks and stresses on various urban subsystems and their components as well as resilience measures and strategies.

Learning outcomes – students are to be able to:

- Explain shocks and stresses on critical services and infrastructures (CSIs) of STE systems resulting from a range of disastrous events
- Describe adaptation, robustness and/or intervention strategies for STE systems

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COLLECTION 3: MEASURING AND MONITORING OF RESILIENT UNDER UNCERTAINTY

Quantifying the resilience of systems vis-a-vis adverse trends and shocks ranging from climate change to extreme weather events is a particular challenge. A specific focus of this collection is on the role of technological innovation and smart cities and the application of different methods for measuring and modelling resilience under uncertainty.

Learning outcomes – students are to be able to:

- Understand and apply processes, methods and tools for measuring, analyzing and monitoring the critical services and infrastructures of complex STE systems.
- Model and assess interdependencies.

COLLECTION 4: GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS OF COMPLEX STE SYSTEMS

Learning outcomes – students are to be able to:

- Assess vulnerable groups, involve stakeholders and governance questions surrounding critical infrastructures, including resilience engineering measures to reduce/absorb shocks and stresses
- Understand and apply tools and methods for analyzing complex governance arrangements and for facilitating meaningful engagement in a multi-actor context

- Design policies, governance arrangements and coordination structures for resilience planning and response addressing policy-making, public private partnerships and civic engagement

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COLLECTION 5: ETHICS OF RESILIENCE

Students will be stimulated to integrate value-driven design and responsible innovation in their planning decision.

Learning outcomes – students are to be able to:

- Integrate values into the design of STE systems and reflect on trade-offs such as resilience vs. robustness, reliability vs. cost

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COLLECTION 6: DUTCH AND INTERNATIONAL CASE STUDIES

Core themes of the cases include climate adaptation and smart cities in the Netherlands and coping with extreme events in urbanizing deltas worldwide. Case materials are organized in 3 levels that build in depth. The case study trend reports (Level 1 basis) provide a comprehensive overview from a socio-technical perspective of the challenges faced by cities in terms of resilience. A select set of trend reports are extended into thematic deep dives (Level 2 deep dives) on key topics of resilience engineering. In addition, Dutch case studies are developed together with municipal partners (Level 3 integration) into an assortment of comprehensive materials including case materials, education guidelines, quiz questions and videos.

Learning outcomes – students are to be able to:

- Explain shocks and stresses on critical services and infrastructures (CSIs) of STE systems resulting from a range of disastrous events
- Describe adaptation, robustness and/or recovery strategies for STE systems.

COLLECTION 7: URBAN RESILIENCE GAMES

Important lessons for students to learn about urban resilience are the interdependencies among our socio-technical and environmental systems. To safeguard the future of our cities, an understanding of the impact of measures taken to cope with shocks and stresses on these systems is needed, all in the context of real-world challenges.

This collection consists of Measure Up: An urban resilience game is serious game developed by the SURF Urban Resilience community that enables future engineers and practitioners to experiment with area-specific resilience measures and approaches in a scenario-based simulation card game that can be adapted to the context of your city. In addition, 10 printable spin-off game concepts are included that were created by TU Delft students from the MSc. Program Applied Earth Sciences.

Learning outcomes – students are to be able to:

- Understand different perspectives of resilience and how they influence key performance indicators and decision making
- Experience the impact of disasters on the environment of the system
- Experience the consequences of different measures on disasters
- Experience how to organize disaster prevention and mitigation
- Experience the consequences of different measures on other systems (counterintuitive effects):
    - effect of measure during implementation and under normal conditions
    - effect of measure to protect one disaster on effects when another disaster happens