Resilient Cities and Structures 2 (2023) A1

Contents lists available at ScienceDirect

Resilient Cities and Structures

journal homepage: www.elsevier.com/locate/rcns

Editorial

Editorial: Integrated modeling of cities to improve natural hazards resilience

Comprehensive resilience modeling of an entire city or community requires infrastructure models spanning from suites of building archetypes to water and electric power networks, further combined with models of population and the economy. To aid the development of system-level models and databases to support community resilience decision-making, a multi-disciplinary team (e.g., engineering, economics, and social sciences) is needed.

In 2015, the U.S. National Institute of Standards and Technology (NIST) funded the Center of Excellence for Risk-Based Community Resilience Planning (CoE), a fourteen university-based consortium of almost 100 collaborators. Van de Lindt et al. [1] in this Special Issue explains the scientific theory behind the state-of-the-art platform being developed by the CoE, which is known as the Interdisciplinary Networked Community Resilience Modeling Environment (IN-CORE). IN-CORE enables communities, consultants, and researchers to set up complex interdependent models of an entire community and to predict resilience and explore "what if" scenarios for potential policies, which makes it a powerful technology to improve city or community resilience; particularly to explore new policies before a hazard event occurs. Various testbeds were developed based on the IN-CORE platform for a number of different hazards. Mazumder et al. [2] expanded on existing models and develop a novel framework to predict post-disaster trajectories for kindergarten through high school (K-12) students faced with a major disaster. Findings highlight the disparate outcomes households with children face after major disasters and can be used to aid decision-making to reduce future disaster impacts on students. The analysis was integrated into IN-CORE and is now available to scientists and engineers. Enderami et al. [3] introduces a step-by-step development procedure for establishing virtual community resilience testbeds using platforms such as IN-CORE and DesignSafe-CI and propose a systematic schema for analysing community-level disaster impacts, disruption, and recovery processes.

In addition to quantifying physical impacts of disasters, the social disruptions and emergency services are also of vital importance for community and urban resilience. Nofal et al. [4] present an integrated approach to quantify the socio-physical disruption following hurricane-induced multi-hazards by considering the physical damage and functionality of the built environment along with the population dynamics over time. Anwar et al. [5] proposed a community-level performance enhancement approach that focuses on optimizing the long-term resilience and sustainability of community building portfolios, taking into account socioeconomic and environmental consequences under recurrent seismic hazards. Wolf et al. [6] propose an innovative geospatial data management workflow that uses high-resolution spatial and temporal data to assess the impact of heavy rainfall on the transport network and identify districts and roads prone to various types of incidents during different storm phases. The results can help emergency services navigate more efficiently to an accident during similar future events, supporting the overall city resilience. Finally, Mowll et al. [7] introduced a 'Planning Emergency Levels of Service' (PELOS) framework, which presents service delivery goals for infrastructure providers during and after an emergency event to achieve resilience.

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https://doi.org/10.1016/j.rcns.2023.08.003