Society is confronting increasingly complex infrastructure services to meet its needs. The viability of these services is continually challenged by often unknown and unanticipated interconnections among physical, environmental and social systems that comprise these services. As a result, these interactions often initiate cascading failures whose consequences are difficult to manage especially when extreme natural and human-induced events occur.

The nature of these interconnections commonly known as dependencies and interdependencies are defined and presented primarily for lifeline infrastructures – energy, transportation, water, and telecommunications and the services they provide, including food supplies. Patterns and trends from an analysis of selected databases illustrate increasing interconnections between some major infrastructure sectors. The intersection of infrastructure services and extreme weather, climate, and intended and unintended human actions are presented using numerous case-based analyses as a foundation for frameworks to build knowledge of the impacts. How human behavior with respect to the use of infrastructure services can alter and reshape idealized frameworks is introduced. Then, a variety of ways of managing interconnections to reduce vulnerability and consequences in the context of extreme conditions are discussed applicable to a variety of extreme events, that include technological approaches to explicitly detect such interconnections and promote flexible designs as well as social and behavioral approaches to reduce the adverse effects. The methods used in the research draw upon case-based network theory concepts. Sponsors of the research are acknowledged, namely, grants to NYU from the National Science Foundation (“RIPS” and “CRISP” programs), through Arizona State University (URExSRN), and the U.S. Department of Homeland Security through the Critical Infrastructure Resilience Institute at the U. of Illinois.

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Dr. Rae Zimmerman is Research Professor and Professor Emerita of Planning and Public Administration and Director of the Institute for Civil Infrastructure Systems at NYU’s Wagner Graduate School of Public Service, and prior to that she was on the full-time faculty as Professor of Planning and Public Administration. She is an elected Fellow of the American Association for the Advancement of Science and Society for Risk Analysis (SRA) Fellow, past president and recipient of SRA’s outstanding service award (2015). Current professional appointments include membership on the third New York Panel on Climate Change and the National Academies Transportation Research Board critical transportation infrastructure protection committee (Physical Security subcommittee co-chair). Through 2016 she served as an invited member of the National Academies Committee on Pathways to Urban Sustainability: Challenges and Opportunities. Her current research focus combines social science, natural science and engineering perspectives in the area of impacts of extreme events on interconnected infrastructure networks and urban resilience. In these research areas and others, she has been a principal investigator on about three dozen grants, holding other senior positions on about a dozen others, currently including being a member of the NSF-funded UREx SRN led by Arizona State University, co-PI on a U. of Illinois Critical Infrastructure Resilience Institute (CIRI) grant and an NSF-funded “CRISP” grant in the area of interdependent infrastructures. She authored or co-authored about 175 publications and research reports, including two authored books, most recently, Transport, the Environment and Security. She received her B.A. in Chemistry from the University of California (Berkeley), a Master of City Planning from the University of Pennsylvania and a Ph.D in Planning from Columbia University.