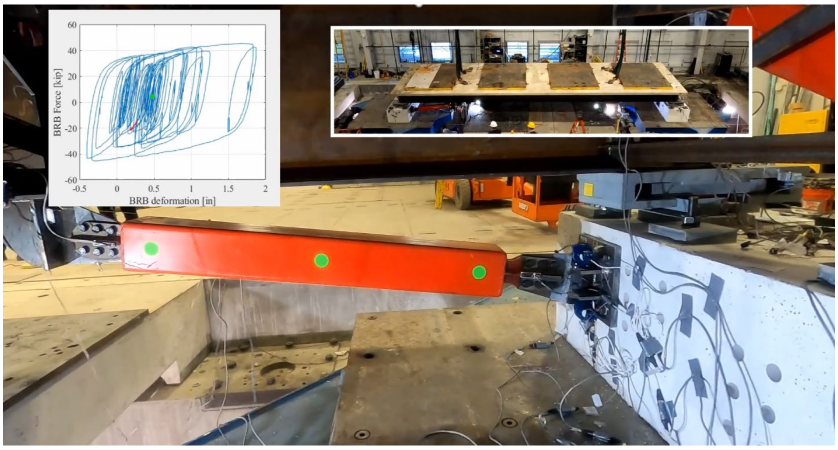
Building Bridges to Achieve a Resilient Society

Michel Bruneau
Department of Civil, Structural, and Environmental Engineering, University at Buffalo, USA

The concept of resilient infrastructure, formulated nearly two decades ago, has been progressively endorsed over the years. This has happened in parallel with an at-large shift towards resilience across many disciplines. Two critically important steps to achieve a resilient society is to *literally* and *figuratively* build bridges.

Literally, this means building the resilient bridges that are key to ensure a resilient infrastructure. Past disasters have repeatedly demonstrated the devastating economic impact that can ensue following collapse of a bridge (recall the Francis Scott Key Bridge collapse in Baltimore in early 2024). Towards achieving earthquake-resilient bridges, the author has proposed a bi-directional ductile diaphragms concept consisting of Buckling Restrained Braces (BRBs) to achieve damage-free columns and displacements demands that can be easily accommodated by conventional expansion joints. This behavior of this ductile diaphragm concept was investigated and a design procedure was formulated. Then, shake table testing of a 40’ long bridge span specimen having various configurations of bi-directional diaphragms experimentally demonstrated that the resilience objective can be achieved using this design strategy. The resilient bridge was able to withstand multiple earthquake excitations. The video of one such test is provided in Figure 1 by scanning the QR code (the bridge specimen was typically subjected to earthquake excitations in all directions, but this particular video is of a test during which the bridge specimen was only subjected to longitudinal earthquake excitation, allowing to more clearly observe extreme BRB elongation during an earthquake exceeding the design level).

Figuratively, this means taking steps to inform the general population of what it takes to achieve a resilient society, and of all the barriers and obstacles toward that goal (because we are all in this together). As such, the book “The Blessings of Disaster” (Figure 2) has been written as a “bridge” to connect with the general public. Drawing on knowledge from multiple disciplines and bringing together observations from extreme events like Japan’s Kobe earthquake and category 5 hurricanes in the American South, along with thoughtful and practical solutions, this book provides a thorough examination of the challenges that face today’s (and tomorrow’s) world. It is an entertaining and often counter-intuitive book that shows how we can think in better ways about disasters, to strengthen and extend our existence, and thus collectively achieve a resilient society. This was done because having an informed public is (to use mathematical terminology) is a “*necessary condition*” to achieve a resilient society – recognizing that it is not a “*sufficient condition*”.



Scan QR code to see video

Figure 1. Shake Table Test of Resilient Bridge Specimen.

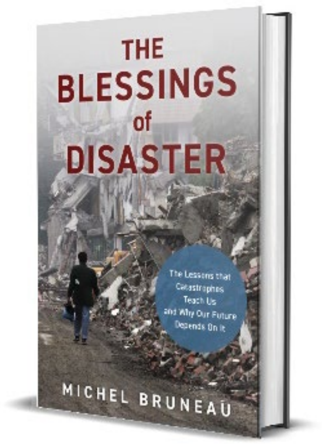


Figure 2. The Blessings of Disaster.