

**KEITH A. PORTER**  
**CURRICULUM VITAE**

**CONTACT INFORMATION**

University of Colorado at Boulder, <http://spot.colorado.edu/~porterka>, [keith.porter@colorado.edu](mailto:keith.porter@colorado.edu) and SPA Risk LLC, Denver CO, [www.sparisk.com](http://www.sparisk.com), [kporter@sparisk.com](mailto:kporter@sparisk.com), +1-626-233-9758.

**EDUCATION**

STANFORD UNIVERSITY: Ph.D., Structural Engineering, 2000  
UNIVERSITY OF CALIFORNIA, BERKELEY: M.Eng. Structural Engineering, 1990  
UNIVERSITY OF CALIFORNIA, DAVIS: B.S. Civil Engineering, 1987

**ACADEMIC AND PROFESSIONAL HISTORY**

UNIVERSITY OF COLORADO BOULDER; Research Professor; 2007-present (part time)  
SPA RISK LLC, Denver CO; Principal; 2005-present (part time)  
CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena CA; George W. Housner Senior Researcher; 2000-2007  
EQE INTERNATIONAL, San Francisco CA, and New York NY; Principal Engineer; 1990-1997 (risk management)  
T.Y. LIN INTERNATIONAL, San Francisco CA; Project Engineer; 1987-1988 (structural design)  
CONTINENTAL HELLER CORPORATION, Sacramento CA; Project Engineer; 1986-1987 (construction contracting)

**ACADEMIC RESEARCH**

I specialize in natural hazard risk to individual facilities and infrastructure systems. I pioneered a second-generation performance-based earthquake engineering (PBEE-2) methodology that measures structural performance in terms of dollars, deaths, and downtime. The method has become the core of a FEMA-funded guideline document FEMA P-58 that brings PBEE-2 to professional practice. I directed the GEM Global Vulnerability Consortium, and through it extended PBEE-2 to create analytical vulnerability functions for classes of buildings. I developed methods to use PBEE-2 to estimate downtime of critical facilities and to estimate deaths and nonfatal injuries without the recourse to judgment on which FEMA P-58 relies. I study human factors in natural disasters, most recently public preferences for the seismic performance of new buildings, time required to perform self-protective actions in earthquakes, and engineering ethical requirements for establishing building code performance. I study options, cost-effectiveness, and policy implications of natural-hazard mitigation. For example, I have been the chief engineer of the USGS' 2008 Southern California ShakeOut scenario, 2011 California ARkStorm scenario, 2013 SAFRR Tsunami Scenario, and the 2017 HayWired earthquake planning scenario. I led the calculations of benefits and costs for San Francisco's mandatory soft-story retrofit ordinance. I led the design and calculations of the so-called 4:1 benefit-cost study for the US Congress, a study that has become the most often-cited benefit-cost study of natural hazard mitigation in the U.S. I currently serve as principal investigator of a \$1 million update of that study. I study miscellaneous issues in natural-hazard risk. Examples include the first scholarly engineering study of demand surge; methods to develop fragility functions for PBEE-2; and model-order-reduction techniques to simplify models with nominal random variables, especially the Uniform California Earthquake Rupture Forecast (UCERF) versions 2 and 3. Much of my research crosses disciplinary boundaries, and I work frequently with economists, sociologists, seismologists, geographers, and experts in other subject areas, in both academia and professional practice.

**PROFESSIONAL EXPERIENCE**

I have worked for 30 years in catastrophe risk management, structural engineering, and construction contracting, with emphasis on risk management. Clientele include Fortune 1000 firms (especially finance, insurance, and real estate), the World Bank, the North American Treaty Organization, government agencies at the international, federal, state, and local levels, utilities, and nonprofits such as the Applied Technology Council and the Earthquake Engineering Research Institute. My international consulting work has included multihazard risk in 9 African countries, Japan, Kazakhstan, Nepal, and Turkey. Earlier in my career I designed seismic retrofit measures for commercial and industrial facilities, highway and railway bridges for foreign and state governments, and very early on performed construction contracting of commercial and institutional buildings.

**SERVICE TO THE UNIVERSITY, PROFESSION, & SOCIETY**

National Institute of Building Sciences Multihazards Mitigation Council Board of Directors

ASCE student chapter faculty advisor, 2011-present

Tau Beta Pi student chapter faculty advisor, 2012-2016

Member, Editorial Board, *Earthquake Spectra* 2013-present

Earthquake Engineering Research Institute (EERI)

Steering Committee, Collection and Management of Earthquake Data.

Panel to draft *Securing Society against Catastrophic Earthquake Losses, a Research and Outreach Plan*

Special Projects and Initiatives Committee, 2006-2008

Consortium of Universities for Research in Earthquake Engineering (CUREE)

American Society of Civil Engineers

Secretary, Executive Committee, Council on Disaster Risk Management (CDRM), Technical Council on Lifeline Earthquake Engineering (TCLEE)

Former Chair, Seismic Risk Committee, Technical Council on Lifeline Earthquake Engineering (TCLEE)

Member, Seismic Risk Committee, Technical Council on Lifeline Earthquake Engineering (TCLEE), 2002-

Trainer, *FEMA National Earthquake Technical Assistance Program (NETAP)*, *FEMA 154*, *ATC-20*, *ROVER*, *FEMA 395*, *FEMA 767*. Train engineers, building officials, and other building professionals nationwide in the use of these procedures for pre- and post-earthquake building safety screening and incremental seismic rehabilitation.

CU SESM Seminar Series. Includes webcasts & advertising to university and Denver professional community.

CU SESM Faculty Search Committee 2012-2013.

*Earthquake Spectra* Editorial board 2014-present, guest editor of special issue on the Great Southern California ShakeOut, 2010, reviewer of 1-3 articles per year

*Natural Hazards Review*. Guest editor of special issue on the ARkStorm Scenario, 2014, responsible editor 1-3 articles per year, reviewer of 1-3 articles per year.

*Earthquake Engineering and Structural Dynamics*. Reviewer of 1-2 articles per year.

Engineering Coordinator, *USGS Southern California Multihazards Demonstration Project (MHDP) ShakeOut Scenario*, 2006-2008. ShakeOut activities involve 25 million people worldwide. ShakeOut led to strengthening Southern California's drinking water supply, firefighting preparedness, and power resilience.

Engineering Coordinator, *USGS Southern California Multihazards Demonstration Project (MHDP) ARkStorm Scenario*, 2009-2010. ARkStorm has been used by California state and county governments to prepare for severe winter storms.

Engineering Coordinator, *USGS Science Application for Risk Reduction (SAFRR) Tsunami Scenario*, 2011-2013. The scenario will be used by state and local governments and major ports to prepare for tsunamis

Engineering Coordinator, *USGS Science Application for Risk Reduction (SAFRR) HayWired Scenario*, 2014-2017. The scenario will be used by state and local governments and major ports to prepare for urban earthquakes

Lead Technical Consultant, *FEMA's Rapid Observation of Vulnerability and Estimation of Risk (ROVER)*, 2007-2013. ROVER is free mobile software for building departments, building professionals, and others to perform pre- and post-earthquake building safety screening by automating the FEMA 154 and ATC-20 procedures on mobile devices. ROVER has been acquired by 1,600 users.

Co-lead, National Institute of Building Sciences (NIBS) Multihazards Mitigation Council (MMC) study for Congress, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, 2004-2005. *Mitigation Saves* produced the estimate of \$4 saved per \$1 spent by FEMA during 1993-2003, and helped to support the continuation of the Hazard Mitigation Grant Program (HMGP), Project Impact, and the Flood Mitigation Assistance Program. Porter helped design the estimation procedure, led efforts to collect and analyze the data, and personally calculated the 4:1 figure.

Principal Investigator, National Institute of Building Sciences (NIBS) Multihazards Mitigation Council (MMC) study for FEMA, *Natural Hazard Mitigation Saves version 2: An Independent Study to Assess the Future Savings from Mitigation Activities*, 2016-2018

Public speaking. I speak frequently to the public and to risk professionals on disaster risk management. Some examples include the American Association for the Advancement of Science, American Bar Association, Association of Contingency Planners, Business Resumption Management Association, California Emergency Services Association, Caltech Earthquake Research Affiliates, East Bay Municipal Utility District Engineers Forum, International Insurance Society, Lloyd's Market Academy, National Institute of Building Sciences, Pacific Earthquake Engineering Research Center, Pasadena Professionals in Real Estate,

## KEITH A. PORTER CURRICULUM VITAE

Phi Beta Kappa, RIMS Risk Management Society, Rotary Club, SoCalFirst, Structural Engineers Association of Northern California, Structural Engineers Association of Southern California, Structural Engineers Association of San Diego, Understanding Risk, US Army Northern Command, and US Geological Survey Seminar Series.

### FUNDERS

Notable research sponsors and consulting clients include the National Institute of Building Sciences (NIBS), Willis Ltd., the US Geological Survey (USGS), Applied Technology Council (ATC), Federal Emergency Management Agency (FEMA), Kajima Corporation, Pacific Earthquake Engineering Research (PEER) Center, Consortium of Universities for Research in Earthquake Engineering (CUREE), North Atlantic Treaty Organization (NATO), California Earthquake Authority (CEA), Mitsui-Sumitomo Corporation, World Bank, Southern California Edison, Turkish Prime Ministry, Southern California Earthquake Center (SCEC), Cambridge Architectural Research (UK), and Multidisciplinary Center for Earthquake Engineering Research (MCEER).

### REGISTRATION

Professional Engineer, California (C 50402)

### HONORS AND AWARDS

National Chi Epsilon Civil Engineering Honor Society, 2013  
GW Housner Postdoctoral Fellowship (Caltech), 2000-2001  
ARCS Scholar (Achievement Rewards for College Scholarships) 1999-2000  
Haresh Shah Family Fellow (Stanford University) 1997-1998  
Outstanding Graduate Student Instructor award (UC Berkeley) 1989-1990  
Regents Fellow (UC Berkeley) 1988-1989  
Tau Beta Pi (UC Davis) 1987

### TEACHING EXPERIENCE

UNIVERSITY OF COLORADO AT BOULDER, 2010-, Instructor (occasional, with various colleagues)  
CALIFORNIA INSTITUTE OF TECHNOLOGY, 2000 and 2003, Instructor (Statics, Survey of Earthquake Engineering)  
STANFORD UNIVERSITY, 2000, Teaching Assistant  
UNIVERSITY OF CALIFORNIA, BERKELEY, 1989-1990, Graduate Student Instructor (Outstanding GSI award)

### ADVISEES

Alimoradi, A., 2011. Postdoctoral Scholar, now Assistant Professor, Southern Methodist University.  
Beesam, V., 2013-2014. MS student.  
Bonstrom, H., MS, 2010-2011 (with Ross Corotis).  
Bretl, D., 2013-2014. MS student.  
Bullock, Z., 2016-present. PhD student (with Shideh Dashti and Abbie Liel).  
Cho, I.H., 2012-2014. Postdoctoral Scholar, now Assistant Professor, Iowa State University Ames  
Dirksen, R., 2013-2014. MS student.  
Farokhnia, K., 2010-2013. PhD.  
Ghosh, S., 2015-present, PhD student  
Hobbs, D., 2012-2013. BS/MS.  
Isteita, M., 2014-present. PhD candidate  
Kim, B.R., 2013. PhD student.  
Mitrani-Reiser, J., 2004-2007. PhD (with James Beck). Now Associate Professor Johns Hopkins.  
McGowan, S. MS, 2008-2009. Now FEMA Staff Scientist.  
Olsen, A., 2008-2011. Postdoctoral Scholar.  
Park, G., 2014-2015. MS student.  
Perkins, E., 2010-2011, MS.  
Ramer, K., 2010-2011. MS, now a practicing structural engineer.  
Shaikhutdinov, R., 2001-2004, PhD (with James Beck).

## PATENTS

USPTO Non-provisional Application No. 10/862,185, “Method, Computer Program Product, and System for Risk Management,” a process to estimate expected annualized loss to a facility as a result of earthquakes, using a scenario loss estimate and site hazard factor.

USPTO Non-provisional Application No. 11/173,054, “A Method and Software Application for Calculating the Site Economic Hazard Coefficient and Economic-Basis Event Shaking Intensity from Gridded Hazard Data,” software to implement patent 1.

## PUBLICATIONS

### *Theses*

1. Porter, K.A., 2000, *Assembly-Based Vulnerability of Buildings and its Uses in Seismic Performance Evaluation and Risk-Management Decision-Making*, Doctoral Dissertation, Stanford University, Stanford, CA, ProQuest Co., Ann Arbor MI, pub. 99-95274, 196 pp., <http://wwwlib.umi.com/dissertations/preview/9995274>
2. Porter, K.A., 1990, *Experimental Investigation of Single-Plate Shear Connectors with Short Slotted Holes*, Master’s Thesis, University of California, Berkeley

### *Archival Journal Articles*

3. Bullock, Z., S. Dashti, A.B. Liel, K. Porter, Z. Karimi, and B. Bradley, (ND). Ground motion prediction equations for arias intensity, cumulative absolute velocity, and peak incremental ground velocity for rock sites in different tectonic environments. *Bulletin of Seismological Society of America*, Accepted May 2017
4. Porter, K., E. Field and K. Milner, 2017. Trimming a hazard logic tree with a new model-order-reduction technique. *Earthquake Spectra*, preprint, <http://earthquakespectra.org/doi/pdf/10.1193/092616EQS158M>
5. Davis, M., and Porter, K., 2016. The public's role in seismic design provisions. *Earthquake Spectra*. 32 (3), 1345-1361, <http://dx.doi.org/10.1193/081715EQS127M>
6. Porter, K.A., 2016. Safe enough? A building code to protect our cities and our lives. *Earthquake Spectra* 32 (2), 677-695. <http://dx.doi.org/10.1193/112213EQS286M>
7. Cho, I.H., & Porter, K., 2016. Modeling building classes using moment matching. *Earthquake Spectra*, 32(1), 285-301. <http://earthquakespectra.org/doi/10.1193/071712EQS239M>
8. Hariri-Ardebili, M.A., Saouma, V.E., and Porter, K.A., 2016. Quantification of seismic potential failure modes in concrete dams. *Earthquake Engineering & Structural Dynamics* 45: 979–997. <http://dx.doi.org/10.1002/eqe.2697>
9. Porter, K., 2016. Preparing for the big one. *Journal of the National Institute of Building Sciences*, 4 (5), 16-19
10. Porter, K., 2015. Seismic fragility of traction elevators. *Earthquake Engineering & Structural Dynamics* 45 (5) 819-833, <http://dx.doi.org/10.1002/eqe.2689>
11. Porter, K., and Davis, M., 2015. Not safe enough: the public’s expectations of seismic performance. *Journal of the National Institute of Building Sciences* 3 (5) 22-25
12. Cho, I.H., and K.A. Porter, 2015. Three-stage multiscale nonlinear dynamic analysis platform for building-level loss estimation. *Earthquake Spectra* 31 (2), 1021-1042, <http://earthquakespectra.org/doi/abs/10.1193/092712EQS293M> [viewed 16 Sep 2015]
13. Cho, I. and K. Porter, 2013. Structure-independent parallel platform for nonlinear analyses of general real-scale RC structures under cyclic loading. *Journal of Structural Engineering*, [http://ascelibrary.org/doi/abs/10.1061/\(ASCE\)ST.1943-541X.0000871](http://ascelibrary.org/doi/abs/10.1061/(ASCE)ST.1943-541X.0000871)
14. Cho, I.H., and K.A. Porter, 2013. Modeling building classes using moment matching. *Earthquake Spectra*. <http://earthquakespectra.org/doi/abs/10.1193/092712EQS293M> [viewed 11 Dec 2014]
15. Bonstrom, H., R. Corotis, and K. Porter, 2012. Overcoming public and political challenges for natural hazard risk investment decisions. *IDRiM Journal* 2 (1), 1-23, <http://www.sparisk.com/pubs/Bonstrom-2012-IDRIM-Investment.pdf>
16. Porter, K.A., and K. Ramer, 2012. Estimating earthquake-induced failure probability and downtime of critical facilities. *Journal of Business Continuity & Emergency Planning*, 5 (4), 352-364, <http://www.sparisk.com/pubs/Porter-2012-JBCEP-Downtime.pdf>
17. Porter, K.A., E.H. Field, and K. Milner, 2012. Trimming the UCERF2 hazard logic tree. *Seismological Research Letters*, 83 (5), 815-828 <http://www.sparisk.com/pubs/Porter-2012-SRL-Tree-trim.pdf>

18. Porter, K., G. Johnson, R. Sheppard and R. Bachman, 2011. Response to discussions of fragility of mechanical, electrical and plumbing equipment. *Earthquake Spectra*, 27 (1), 229-233
19. Porter, K.A., K. Hudnut, S. Perry, M. Reichle, C. Scawthorn, and A. Wein, 2011. Foreword. *Earthquake Spectra* 27 (2), 235-237 <http://www.sparisk.com/pubs/Porter-2011-ShakeOut-Foreword.pdf>
20. Porter, K.A., L. Jones, D.A. Cox, J. Goltz, K. Hudnut, D. Mileti, S. Perry, D. Ponti, M. Reichle, A.Z. Rose, C.R. Scawthorn, H.A. Seligson, K.I. Shoaf, J. Treiman, and A. Wein, 2011. The ShakeOut Scenario: a hypothetical  $M_w$ 7.8 earthquake on the Southern San Andreas fault. *Earthquake Spectra* 27 (2), 239-261, <http://www.sparisk.com/pubs/Porter-2011-Shakeout.pdf>
21. Porter, K.A., and R. Sherrill, 2011. Utility performance panels in the ShakeOut scenario. *Earthquake Spectra* 27 (2), 443-458, <http://www.sparisk.com/pubs/Porter-2011-ShakeOut-Panels.pdf>
22. Olsen, A., and K.A. Porter, 2011. What we know about demand surge: a brief summary. *Natural Hazards Review* 12 (2), 62-71 <http://www.sparisk.com/pubs/Olsen-2011-NHR-WWKADS.pdf>
23. Jaiswal, K., D. Wald, and K. Porter, 2010. A global building inventory for earthquake loss estimation and risk management. *Earthquake Spectra* 26 (3) 731-748, <http://www.sparisk.com/pubs/Jaiswal-2010-PAGER-inventory.pdf>
24. Porter, K.A., 2010. Cracking an open safe: uncertainty in HAZUS-based seismic vulnerability functions. *Earthquake Spectra*, 26 (3) 893-900, <http://www.sparisk.com/pubs/Porter-2010-Safecrack-COV.pdf>.
25. Porter, K.A., G. Johnson, R. Sheppard, and R.E. Bachman, 2010. Fragility of mechanical, electrical, and plumbing equipment. *Earthquake Spectra*, 26 (2) 451-472, <http://www.sparisk.com/pubs/Porter-2010-MEP-fragility-1.pdf>
26. Porter, K.A., 2009. Cracking an open safe: more HAZUS vulnerability functions in terms of structure-independent intensity. *Earthquake Spectra*, August 2009, <http://www.sparisk.com/pubs/Porter-2009-Safecrack-MDF.pdf>
27. Porter, K.A., 2009. Cracking an open safe: HAZUS vulnerability functions in terms of structure-independent spectral acceleration. *Earthquake Spectra*, May 2009, <http://www.sparisk.com/pubs/Porter-2009-Safecrack-Casualty.pdf>
28. Wald, D., K.W. Lin, K. Porter, and L. Turner, 2008. ShakeCast: automating and improving the use of ShakeMap for post-earthquake decision-making and response. *Earthquake Spectra*, 24 (2), 533-553, <http://www.sparisk.com/publications.htm>
29. Ching, J.Y., K.A. Porter, and J.L. Beck, 2008. Propagating uncertainties for loss estimation in performance-based earthquake engineering using moment matching. *Structure and Infrastructure Engineering*. Accepted 13 Aug 2006. <http://www.tandf.co.uk/journals/titles/15732479.asp>
30. Porter, K.A., 2007. Fragility of hydraulic elevators for use in performance-based earthquake engineering. *Earthquake Spectra*, 23 (2), May 2007, <http://www.sparisk.com/publications.htm>
31. Porter, K.A., R.P. Kennedy, and R.E. Bachman, 2007. Creating fragility functions for performance-based earthquake engineering. *Earthquake Spectra*, 23 (2), 471-489, <http://www.sparisk.com/publications.htm>
32. Rose, A., K. Porter, N. Dash, J. Bouabid, C. Huyck, J.C. Whitehead, D. Shaw, R.T. Eguchi, C. Taylor, T.R. McLane, L.T. Tobin, P.T. Ganderton, D. Godschalk, A.S. Kiremidjian, K. Tierney, and C. Taylor West. 2007. Benefit-cost analysis of FEMA hazard mitigation grants. *Natural Hazards Review*, 8(4), 1-15; 2007 <http://www.sparisk.com/pubs/Rose-2007-NHR-BCA.pdf>
33. Goulet, C., C. Haselton, J. Mitrani-Reiser, J. Beck, G. Deierlein, K. Porter, and J. Stewart. 2007. Evaluation of the seismic performance of a code-conforming reinforced-concrete frame building - from seismic hazard to collapse safety and economic losses. *Earthquake Engineering and Structural Dynamics*. 36 (13), 1973-1997 <http://www.sparisk.com/pubs/Goulet-2007-EESD-Benchmark.pdf>
34. Porter, K.A., J. Mitrani-Reiser, J.L. Beck, and J.Y. Ching, 2006. Near-real-time loss estimation for instrumented buildings. *The Structural Design of Tall and Special Buildings* 15 (1): 3-20. <http://www.sparisk.com/pubs/Porter-2006-SDTSP-Realtime.pdf>
35. Porter, K.A., K. Shoaf, and H. Seligson, 2006. Value of injuries in the Northridge Earthquake. *Earthquake Spectra*, 22 (2): 555-563, May 2006. <http://www.sparisk.com/pubs/Porter-2006-VOI.pdf>
36. Porter, K.A., C.R. Scawthorn, and J.L. Beck, 2006. Cost-effectiveness of stronger woodframe buildings. *Earthquake Spectra* 22 (1), February 2006, 239-266, [http://scitation.aip.org/journals/doc/EASPEF-ft/vol\\_22/iss\\_1/239\\_1.html](http://scitation.aip.org/journals/doc/EASPEF-ft/vol_22/iss_1/239_1.html) [09 Mar 2006], <http://spot.colorado.edu/~porterka/Porter-2006-CWF.pdf>
37. Ching, J.Y., J.L. Beck, K.A. Porter, R.V. Shaikhutdinov, 2006. Bayesian state estimation method for nonlinear systems and its application to recorded seismic response. *Journal of Engineering Mechanics*, April 2006.

38. Ching, J., J.L. Beck, and K.A. Porter, 2006. Bayesian state and parameter estimation of uncertain dynamical systems. *Probabilistic Engineering Mechanics*, 21 (2006) 81-96, <http://www.sparisk.com/pubs/Ching-2006-PEM-Bayesian-state-estimation.pdf>
39. Porter, K.A., J.L. Beck, R.V. Shaikhutdinov, S.K. Au, K. Mizukoshi, M. Miyamura, H. Ishida, T. Moroi, Y. Tsukada, and M. Masuda, 2004. Effect of seismic risk on lifetime property value. *Earthquake Spectra*, 20 (4), Nov 2004, 1211-1237. <http://www.sparisk.com/pubs/Porter-2004-LPV.pdf> [viewed 2 Dec 2012]
40. Porter, K.A., J.L. Beck, and R.V. Shaikhutdinov, 2004. Simplified performance-based earthquake engineering estimation of economic risk for buildings. *Earthquake Spectra*, 20 (4), 1239-1263, <http://spot.colorado.edu/~porterka/Porter-2004-EQS-Simplified.pdf>
41. Porter, K.A., J.L. Beck, and R.V. Shaikhutdinov, 2002. Sensitivity of building loss estimates to major uncertain variables. *Earthquake Spectra*, 18 (4), 719-743, <http://www.sparisk.com/pubs/Porter-2002-Sensitivity.pdf>
42. Porter, K.A., A.S. Kiremidjian, and J.S. LeGrue, 2001. Assembly-based vulnerability of buildings and its use in performance evaluation. *Earthquake Spectra*, 17 (2), 291-312, <http://www.sparisk.com/pubs/Porter-2001-ABV.pdf>

**Conferences, Workshops, Seminars, and Trade Journals**

43. Porter, K., 2017. When addressing epistemic uncertainty in a lognormal fragility function, how should one adjust the median? Paper 2617, *Proc., 16<sup>th</sup> World Conference on Earthquake Engineering*, Santiago Chile, January 9 to 13, 2017 <http://www.sparisk.com/pubs/Porter-2016-16WCEE-Rotation-point.pdf>
44. Karimi, Z., Bullock, Z., Dashti, S., Liel, A., and Porter, K., 2017. Influence of soil and structural parameters on liquefaction-induced settlement of foundations. *Proc. 3rd International Conference on Performance-based Design in Earthquake Geotechnical Engineering (PBD-III)*, Vancouver BC July 16-19, 2017
45. Porter, K., 2016. Not safe enough: the case for resilient seismic design. *2016 SEAOC Convention Maui HI, October 12 – 15, 2016*. <http://www.sparisk.com/Porter-2016-SEAOC-Resilience.pdf>
46. Porter, K., 2015. 3D or median map, convincing engineers that a physics-based model can be better for earthquake scenarios. *American Geophysical Union Annual Meeting, San Francisco CA Dec 2015*
47. Porter, K., S. Hellman, and A. Hortacsu, 2015. FEMA ROVER version 2 and ROVER ATC-20, mobile earthquake safety software. *ATC & SEI Second Conference on Improving the Seismic Performance of Existing Buildings and Other Structures, San Francisco CA December 10-12, 2015*
48. Lizundia, B., S. Durphy, M. Griffin, W. Holmes, A. Hortacsu, B. Kehoe, K. Porter, and B. Welliver, 2015. Third edition update of FEMA P-154: rapid visual screening for potential seismic hazards. *ATC & SEI Second Conference on Improving the Seismic Performance of Existing Buildings and Other Structures, San Francisco CA December 10-12, 2015*
49. Porter, K., 2015. *Not Safe Enough: Consequences of the Life-Safety Seismic Design Objective for New Buildings*. CVEN 4147 University of Colorado Boulder Thu 19 Nov 2015
50. Porter, K., 2015. *Dollars, Deaths, and Downtime: Understand Your Building's Seismic Risk and How to Evaluate It*. SEAOSC Strengthening Our Cities Summit 5 Nov 2015, Los Angeles, CA
51. Porter, K., 2015. SAFRR and the HayWired Scenario. *Touro University Emergency Medicine Symposium, Vallejo CA October 11, 2015*
52. Porter, K., 2015. *Not Safe Enough: Unintended Consequences of Life-Safety Seismic Design, and Other Lessons of the HayWired Scenario*. Seminar at the Pacific Earthquake Engineering Research (PEER) Center, 7 Oct 2015
53. Porter, K., 2015. *Lessons of the HayWired Scenario: Performance of New Buildings, Public Expectations, and 3-D Ground-Motion Maps*. Structural Engineers Association of Northern California October Dinner Meeting, San Francisco, CA, 6 Oct 2015
54. Porter, K., 2015. *Not Safe enough? Unintended Consequences of Life-safety Seismic Design*. Seminar at Colorado State University Ft Collins, 24 Sep 2015
55. Porter, K., 2015. *Not Safe enough? Unintended Consequences of Life-safety Seismic Design*. Seminar at California Institute of Technology, 8 Jun 2015
56. Porter, K., 2015. *Safe Enough? The Seismic Performance of New Buildings*. Structural Engineering and Mechanics of Materials Seminar, University of California, Berkeley, 27 April 2015
57. Porter, K., 2015. *Safe Enough? The Seismic Performance of New Buildings*. A webinar for the Association of Bay Area Governments, 30 March 2015
58. Porter, K., 2015. *ARKStorm: the Other Big One*. Association of Contingency Planners, Concord CA, 10 February 2015

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59. Porter, K., 2015. Reformulating building codes for community and private sector resilience. *Building Innovation 2015, Creating High Performing Resilient Communities, 6-9 January 2015, Washington DC*
60. Porter, K., 2015. Lifeline interaction & lack thereof, observations from USGS SAFRR's HayWired scenario. *Building Innovation 2015, Creating High Performing Resilient Communities, 6-9 January 2015, Washington DC*
61. Cho, I.H. and K.A. Porter, 2014. Three-stage multiscale nonlinear dynamic analysis platform for building-level loss estimations. *Proc. Tenth U.S. National Conference on Earthquake Engineering, July 21-25, 2014, Anchorage AK*
62. Porter, K.A., and A. Wein, 2014. Advances in tsunami risk assessment and risk mitigation. *Proc. Seismological Society of America 2014 Annual Meeting, Anchorage AK, 2 May 2014*
63. Porter, K.A., 2014. What if? Scenarios for managing disasters & building resilience. *39th Annual Natural Hazards Research and Applications Workshop, Broomfield CO, 24 Jun 2014*
64. Porter, K.A., 2014. Safe enough? How codes protect lives but not cities. *39th Annual Natural Hazards Research and Applications Workshop, Broomfield CO, 24 Jun 2014*
65. Porter, K.A., 2014. Safe enough? How building codes protect our lives but not our cities. *Multihazard Mitigation Council Symposium: Life-Cycle Performance: Moving Forward to More Resilient Communities. Washington DC, 7 Jan 2014.*
66. Porter, K., and I.H. Cho, 2013. Characterizing a building class via key features and index buildings for class-level vulnerability functions. *11<sup>th</sup> International Conference on Structural Safety and Reliability (ICOSSAR). June 16-20, 2013, New York.*
67. Noh, H.Y., K. Porter, D. Lallemand, and A. Kiremidjian, 2013. Treatment of uncertainties in the GEM vulnerability functions. *11<sup>th</sup> International Conference on Structural Safety and Reliability. June 16-20, 2013, New York.*
68. Porter, K.A., L. Jones, S. Ross, J. Borrero, J. Bwarie, D. Dykstra, E.L. Geist, L. Johnson, S. Kirby, K. Long, P. Lynett, K. Miller, C. Mortensen, S. Perry, G. Plumlee, C. Real, L. Richie, H.K. Thio, A. Wein, P. Whitmore, R. Wilson, N. Wood, 2013. USGS Science Application for Risk Reduction (SAFRR) tsunami scenario. *Proc. ASCE COPRI Ports '13, Seattle WA Aug 25-29, 2013*
69. Porter, K.A., 2013. Safe enough? How the building code protects our lives but not our cities. *Cherishing Our Past, Preserving Our Future; Phi Beta Kappa Northern California Association 26th Asilomar Conference February 15-18, 2012*
70. Porter, K.A., 2012. Is the code giving us the performance we (will) want? *Invited plenary presentation to SEAOSC Buildings at Risk, Los Angeles CA, 11 Oct 2012*
71. Porter, K.A., 2012. ROVER for End-to-End Seismic Risk Management. *SEAOSC Buildings at Risk, Los Angeles CA, 11 Oct 2012*
72. Porter, K.A., and M. Latham, 2012. Business continuity risk to data centers in earthquakes. *Proc., Contingency Planning and Management Conference & Expo West, Grapevine TX 10 Oct 2012*
73. Porter, K.A., and M. Latham, 2012. Can your data center survive an earthquake? How to know your risk. *Datacenterknowledge.com, October 10, 2012. [www.datacenterknowledge.com/archives/2012/10/10/managing-seismic-risk-of-downtime/](http://www.datacenterknowledge.com/archives/2012/10/10/managing-seismic-risk-of-downtime/)*
74. Farokhnia, K., and K.A. Porter, 2012. Estimating the non-structural seismic vulnerability of building categories. *Proc. 15<sup>th</sup> World Conference on Earthquake Engineering, Lisbon, 24-28 Sep 2012, paper number 3900, <http://www.sparisk.com/pubs/Farokhnia-2012-15WCEE-Nonstructural.pdf>*
75. Porter, K.A., K. Farokhnia, I.H. Cho, T. Rossetto, I. Ioannou, D. Grant, K. Jaiswal, D. Wald, D. D'Ayala, A. Meslem, E. So, A.S. Kiremidjian & H.Y. Noh, 2012. Global vulnerability estimation methods for the Global Earthquake Model. *Proc. 15<sup>th</sup> World Conference on Earthquake Engineering, Lisbon, 24-28 Sep 2012, paper number 4523, <http://www.sparisk.com/pubs/Porter-2012-15WCEE-GEM-Vulnerability.pdf>*
76. Porter, K.A., and K. Ramer, 2012. A performance-based earthquake engineering method to estimate downtime in critical facilities. *Proc. 15<sup>th</sup> World Conference on Earthquake Engineering, Lisbon, 24-28 Sep 2012, paper number 4504, <http://www.sparisk.com/pubs/Porter-2012-15WCEE-Downtime.pdf>*
77. Bevington, J., R. Eguchi, C. Huyck, H. Crowley, F. Dell'Acqua, G. Iannelli, C. Jordan, J. Morley, M. Wieland, S. Parolai, M. Pittore, K. Porter, K. Saito, P. Sarabandi, A. Wright, and M. Wyss, 2012. Exposure data development for the Global Earthquake Model: inventory data capture tools. *Proc. 15<sup>th</sup> World Conference on Earthquake Engineering, Lisbon, 24-28 Sep 2012*
78. Jaiswal, K., W. Aspinall, D. Perkins, D. Wald and K. Porter, 2012. Use of expert judgment elicitation to estimation seismic vulnerability of selected building types. *Proc. 15<sup>th</sup> World Conference in Earthquake Engineering, Lisbon, 24-28 Sep 2012 (paper # 4542)*

## KEITH A. PORTER CURRICULUM VITAE

79. Porter, K.A., 2012. LFRD, PBEE-1, and PBEE-2: Why do performance-based earthquake engineering and where is it headed? *A professional lecture for Principles of Seismic Design Denver CO, Tuesday 17 July 2012*
80. Corotis, R.B., H. Bonstrom, and K. Porter, 2012. Overcoming public and political challenges for natural hazard risk investment decisions. *Invited keynote, Proc. Asian-Pacific Symposium on Structural Reliability and its Applications (APSSRA12)*, Singapore, 23-25 May 2012
81. Porter, K.A., and K. Cobeen, 2012. Informing a retrofit ordinance: a soft-story case study. *Proc. 2012 Structures Congress, Chicago IL, March 29-31, 2012.*
82. Porter, K., B. Bell, and N. Pereira, 2011. Free, fast building seismic safety inspection software for smartphones. *Building Safety Journal Online*, 56-62, December 2011, International Code Council, <http://www.bsji-digital.com/bsj/201112?pg=56#pg56>
83. Porter, K.A., and C. Scawthorn, 2011. The Tohoku Earthquake and its implications for the US. *International Insurance Society 47th Annual Seminar, Toronto, 22 Jun 2011.*
84. Porter, K.A., 2011. Development and limitations of next-generation performance-based earthquake engineering in catastrophe risk models. *The 2nd Conference (IDRiM2011) of the International Society for Integrated Disaster Risk Management*. 15 July 2011, University of Southern California, Los Angeles CA.
85. Porter, K.A., 2011. ShakeOut, Tohoku & their implications for Canada. *National Insurance Conference of Canada*, Vancouver, 27 Sep 2011.
86. Porter, K.A., 2011. Community Action Plan for Seismic Safety – the soft-story program. *SEAOSC Buildings at Risk Earthquake Loss Reduction Summit, Putting Earthquake Loss Mitigation Solutions into Practice*. Structural Engineers Association of Southern California, University of Southern California, Los Angeles, 13 Oct 2011.
87. Porter, K.A., 2010. Rapid Observation of Vulnerability and Estimation of Risk (ROVER): end-to-end seismic risk management software. *Proc. 9<sup>th</sup> US/10<sup>th</sup> Canadian Conference on Earthquake Engineering, Toronto Canada, 25 – 29 July 2010, paper 1781*, <http://www.sparisk.com/pubs/Porter-2010-9USN10CCEE-ROVER.pdf>
88. Porter, K.A., 2010. The ShakeOut earthquake scenario: from the scientist's perspective to the citizen's. *American Association for the Advancement of Science Annual Meeting, San Diego, 18 – 22 Feb 2010*, <http://www.sparisk.com/pubs/Porter-2010-AAAS-ShakeOut.pdf>
89. Porter, K.A. and K. Cobeen, 2009. Loss estimates for large soft-story woodframe buildings in San Francisco. *Proc. ATC & SEI 2009 Conference on Improving the Seismic Performance of Existing Buildings and Other Structures. Dec 9-11, 2009, San Francisco, CA.*
90. Porter, K.A., S. Hellman, T. McLane, and C. Carlisle, 2009. End-to-end seismic risk management software. *Proc. ATC & SEI 2009 Conference on Improving the Seismic Performance of Existing Buildings and Other Structures. Dec 9-11, 2009, San Francisco, CA.*
91. Samant, L.D., K. Porter, K. Cobeen, L.T. Tobin, L. Kornfield, H. Seligson, S. Alejandrino, and J. Kidd, 2009. Mitigating San Francisco's soft-story building problem. *Proc. ATC & SEI 2009 Conference on Improving the Seismic Performance of Existing Buildings and Other Structures. Dec 9-11, 2009, San Francisco, CA.*
92. Porter, K.A., S. Hellman, D. Wald, K.W. Lin, 2009. Free, open source, end-to-end seismic risk management software. *SSA 2009 Annual Meeting*, Monterey, CA, 8 Apr 2009.
93. Porter, K.A., 2008. The ShakeOut scenario, a hypothetical M7.8 Southern San Andreas Fault earthquake. *Structure Magazine*, December 2008, <http://www.structuremag.org/article.aspx?articleID=812>
94. Porter, K.A., 2008. Fatality models for PAGER. *SSA 2008 Annual Meeting*, Santa Fe, NM, 17 Apr 2008
95. Porter, K.A., 2008. Tools of the Trade: AGORA, OpenRisk, ROVER, and other Open Source Efforts. *National Earthquake Conference*, Apr 22-26, 2008, Westin Hotel, Seattle WA
96. Porter, K.A., 2008. Mitigation Saves: FEMA Spent \$3.5B and Saved \$14B. *National Earthquake Conference*, Apr 22-26, 2008, Westin Hotel, Seattle WA
97. Porter K.A. and C Scawthorn, 2007. OpenRisk: open-source risk software and access for the insurance industry. *1st International Conference on Asian Catastrophe Insurance (ICACI)*, Kyoto University, Dec 3-4, 2007. <http://spot.colorado.edu/~porterka/Porter-2007-ICACI-OpenRisk.pdf>
98. Porter, K.A., 2007. OpenRisk: open-source risk estimation software. *Natural Hazards Center 2007 Annual Hazards Workshop*, July 8-11, 2007. <http://www.risk-agera.org/pubs/Porter-2007-Boulder-OpenRisk.pdf>
99. Porter, K.A., D. Wald, T. Allen, and K. Jaiswal, 2007. An empirical relationship between fatalities and instrumental MMI. *1st International Workshop on Disaster Casualties*, Kyoto University, Nov 28-29, 2007. <http://spot.colorado.edu/~porterka/Porter-2007-Empirical-PAGER.pdf>
100. Mosqueda, G., K.A. Porter, J. O'Connor, and P. McAnany, 2007. Damage to engineered buildings and bridges in the wake of Hurricane Katrina. *Proc. SEI Structures Congress*, May 16-19, 2007, Long Beach CA.



- [http://www.succeednow.org/asce07/Program/Abstracts/1135\\_MCEER-Katrina\\_Abstract\\_ASCE2007\\_\(1\).pdf](http://www.succeednow.org/asce07/Program/Abstracts/1135_MCEER-Katrina_Abstract_ASCE2007_(1).pdf) [11 Jul 2007], <http://www.sparisk.com/pubs/Mosqueda-2007-SEI-Katrina.pdf> [11 Jul 2007]
101. Porter, K.A., R. Hamburger, and R. Kennedy, 2007. Practical Development and Application of Fragility Functions. *Proc. SEI Structures Congress*, May 16-19, 2007, Long Beach CA. <http://www.sparisk.com/pubs/Porter-2007-SEI-fragility.pdf>
  102. Porter, K.A., J. Mitrani-Reiser, J.L. Beck, and J. Ching, 2006. Smarter structures: real-time loss estimation for instrumented buildings. *Proc. 8<sup>th</sup> National Conference on Earthquake Engineering*, paper 1236, 18-22 April 2006, San Francisco, CA.
  103. J. Mitrani-Reiser, C. Haselton, C. Goulet, K. Porter, J. Beck, and G. Deierlein, 2006. Evaluation of the seismic performance of a code-conforming reinforced-concrete frame building - Part II: loss estimation. *Proc. 8<sup>th</sup> National Conference on Earthquake Engineering*, 18-22 April 2006, San Francisco, CA.
  104. Mosqueda, G. and K.A. Porter, 2006. Preliminary conclusions: assessing damage to engineered buildings in the wake of Hurricane Katrina. *Structural Engineer*, February 2006, 20-26, <http://spot.colorado.edu/~porterka/>
  105. Porter, K.A., C.R. Scawthorn, and J.L. Beck, 2005. Cost-effectiveness of stronger woodframe buildings. *Proc. International Symposium on Earthquake Engineering Commemorating the Tenth Anniversary of the 1995 Kobe Earthquake (ISEE 2005)*, Kobe, Japan, January 13-16, 2005. [http://keithp.caltech.edu/Porter et al \(2005\) ISEE.pdf](http://keithp.caltech.edu/Porter_et_al_(2005)ISEE.pdf)
  106. F. Jalayer, J.L. Beck, K.A. Porter, and J.F. Hall, 2005. Application of the subset simulation method in predicting the seismic response of an existing RC frame structure. *Proc 9<sup>th</sup> International Conference on Structural Safety and Reliability*, Rome, Italy, June 2005.
  107. J.Y. Ching, J.L. Beck, and K.A. Porter, 2005. Bayesian state and parameter estimation using particle filters. *Proc 9<sup>th</sup> International Conference on Structural Safety and Reliability*, Rome, Italy, June 2005.
  108. Porter, K.A. and J.L. Beck, 2004. Simplified PBEE to estimate economic seismic risk for buildings. *Performance-Based Seismic Design [PBSD] -- Concepts and Implementation*, Bled, Slovenia, June 28-July 1, 2004, Pacific Earthquake Engineering Research (PEER) Center, Richmond, CA
  109. Porter, K.A., J.L. Beck, and R.V. Shaikhutdinov, 2004. Simplified estimation of economic seismic risk for buildings. *Proc. 13<sup>th</sup> World Conference on Earthquake Engineering, Vancouver, BC*, August 1-6, 2004, Paper No. 1755.
  110. Shaikhutdinov, R.V., J.L. Beck, and K.A. Porter, 2004. Comparative study of different methods of structural damage assessment. *Proc. 13<sup>th</sup> World Conference on Earthquake Engineering, Vancouver, BC*, August 1-6, 2004, Paper No. 1678
  111. Jalayer, F., J.L. Beck, K.A. Porter, and J.F. Hall, 2004. Effects of ground motion uncertainty on predicting the response of an existing RC frame structure. *Proc. 13<sup>th</sup> World Conference on Earthquake Engineering, Vancouver, BC*, August 1-6, 2004, Paper No. 2007
  112. Ching, J.Y., J.L. Beck, and K.A. Porter, 2004. Application of Bayesian state estimation in real-time loss estimation of instrumented buildings. *Proc 13<sup>th</sup> World Conference on Earthquake Engineering, Vancouver, BC*, August 1-6, 2004, Paper No. 1092.
  113. Ching, J.Y., J.L. Beck, and K.A. Porter, 2004. Real-time Bayesian state estimation of dynamical systems using stochastic simulation. *Proc. 9<sup>th</sup> ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability. Albuquerque NM*. July 2004.
  114. Ching, J.Y., J.L. Beck, and K.A. Porter, 2004. Real-time Bayesian damage detection for uncertain dynamical systems. *Proc. 17<sup>th</sup> ASCE Engineering Mechanics Conference (EM2004)*, June 13-16, 2004, University of Delaware, Newark, DE
  115. Porter, K.A., 2003. An overview of PEER's performance-based earthquake engineering methodology. *Proc. Ninth International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP9) July 6-9, 2003, San Francisco, CA*. Civil Engineering Risk and Reliability Association (CERRA), <http://spot.colorado.edu/~porterka/>
  116. Beck, J.L., K.A. Porter, and R.V. Shaikhutdinov, 2003. Simplified estimation of life-cycle costs. *Proc. 3<sup>rd</sup> International IABMAS Workshop on Life-Cycle Cost Analysis and Design of Infrastructure Systems, Lausanne, Switzerland, March 2003*, published as D.M. Frangipol, ed., 2004. *Life-cycle Performance of Deteriorating Structures: Assessment, Design, and Management*. American Society of Civil Engineers, Reston VA, <http://www.worldcat.org/oclc/53285153>
  117. Porter, K.A., 2002. Learning from earthquakes: a survey of surveys. Keynote paper, *EERI Invitational Workshop: An Action Plan to Develop Earthquake Damage and Loss Data Protocols, September 19th and 20th, 2002, Doubletree Hotel, Pasadena, California*, Earthquake Engineering Research Institute, Oakland, CA, <http://keithp.caltech.edu/Lfe.htm>

118. Beck, J.L., K.A. Porter, R.V. Shaikhutdinov, 2002. Accounting for seismic risk in financial analysis of property investment. *NZSEE 2002 Conference, Napier, New Zealand, March, 2002*
119. Porter, K.A. and A.S. Kiremidjian, 2001. Verifying performance-based design objectives using assembly-based vulnerability. *Structural Safety and Reliability, ICOSSAR 2001, Newport Beach, California, USA, June 17-22 2001*, A.A. Balkema, Lisse, the Netherlands, <http://spot.colorado.edu/~porterka/>
120. Porter, K.A., A.S. Kiremidjian, J.G. LeGrue, and S.A. King, 2000. A building damage estimation model for business recovery. *Proc., 12<sup>th</sup> World Conference on Earthquake Engineering, January 30 – February 4, 2000*, New Zealand Earthquake Commission, Auckland, NZ, paper 2821
121. Scawthorn, C., K.A. Porter, and G.S. Johnson, 1999. Seismic reliability assessment of critical lifeline equipment. *Proc. 5th U.S. Conference on Lifeline Earthquake Engineering, Seattle Washington, August 12-14, 1999*, American Society of Civil Engineers, Reston, VA
122. Porter, K.A., and C. Scawthorn, 1998. Appropriate seismic reliability for critical equipment systems – an approach based on regional analysis of financial and life loss. *Proceedings of Seminar on Seismic Design, Retrofit, and Performance of Nonstructural Components, ATC 29-1*, Applied Technology Council, Redwood City CA, 393-421
123. Porter, K.A., C. Scawthorn, C. Taylor, and N. Blais, 1998. *Appropriate Seismic Reliability for Critical Equipment Systems: Recommendations Based on Regional Analysis of Financial and Life Loss*. Technical Report MCEER-98-0016, MCEER, Buffalo, NY, 104 pp.
124. Porter, K.A., A.R. Scott, M. Johnson, C. Scawthorn, and H. Ryland, 1993. Training local officials in rapid visual screening of seismically hazardous buildings. *Proceedings of the 1993 National Earthquake Conference: Earthquake Hazard Reduction in the Central and Eastern United States: A Time for Examination and Action; Memphis, Tennessee, May 2-5, 1993*. Central United States Earthquake Consortium, Memphis TN, 1993, Volume I, 675-684.
125. Porter, K.A., C. Scawthorn, D.G. Honegger, T.D. O'Rourke, and F. Blackburn, 1992. Performance of water supply pipelines in liquefied soil. *Proc. 4th US-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems, Los Angeles, August 19-21, 1991*, Eguchi, R.T., ed., National Institute of Standards and Technology, Gaithersburg, MD, 3-17.
126. Friedman, L., K.A. Porter, and C. Scawthorn, 1992. Use of logic tree analysis for earthquake emergency planning in critical facilities. *Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area; California State University, Hayward, March 25-29, 1992*. Borchardt, G. et al., eds. California Department of Conservation, Division of Mines and Geology, Sacramento, CA, 469-473
127. Scawthorn, C., K.A. Porter, M.M. Khater, D. Seidel, D. Ballantyne, H.T. Taylor, R.D. Darragh, and C. Ng, 1992. Utility performance aspects, liquefaction study, Marina and Sullivan Marsh areas, San Francisco, California. *Proceedings from the Fourth Japan-US Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures for Soil Liquefaction; Tokai University Pacific Center, Honolulu, May 27-29, 1992, Report NCEER 92-0019*. Hamada, M. and O'Rourke, T.D., eds., National Center for Earthquake Engineering Research, State University of New York, Buffalo, NY, volume I, 317-333.
128. Scawthorn, C.R., K.A. Porter, D.P. O'Sullivan, and S.K. Harris, 1992. Consequence analyses for the Cities of Fremont, Hayward, and San Leandro. *Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area; California State University, Hayward, March 25-29, 1992*. Borchardt, G. et al., eds., California Department of Conservation, Division of Mines and Geology, Sacramento, CA, 513-517.

**Reports, Book Chapters, and Other Publications**

129. Hudnut, K.W., Wein, A.W., Cox, D.A., Perry, S.C., Porter, K.A., Johnson, L.A., & Strauss, J.A. 2017. The HayWired scenario—how can the San Francisco Bay region bounce back from or avert an earthquake disaster in an interconnected world? In Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H*, Ch A, 1-15, <https://doi.org/10.3133/sir20175013v1>.
130. Aagaard, B.T., Boatwright, J.L., Jones, J.L., MacDonald, T.G., Porter, K.A., & Wein, A.W., 2017. HayWired scenario mainshock ground motions. In Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Earthquake Hazards: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H*, Ch C, 27-36, <https://doi.org/10.3133/sir20175013v1>.
131. Wein, A.M., Felzer, K.R., Jones, J.L., and Porter, K.A., 2017. HayWired scenario aftershock sequence. In Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Earthquake Hazards: U.S.*

- Geological Survey Scientific Investigations Report 2017–5013–A–H, Ch G, 91–112, <https://doi.org/10.3133/sir20175013v1>.
132. Porter, K.A., 2017. HayWired scenario three-dimensional numerical ground-motion simulation maps. In Detweiler, S.T., and Wein, A.M., eds., *The HayWired Earthquake Scenario—Earthquake Hazards*: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, Ch H, 115–126, <https://doi.org/10.3133/sir20175013v1>.
133. Porter, K., and Jones, J., 2017 (expected), California Delta levee performance in the HayWired scenario in Wein, A., ed., *The HayWired earthquake scenario: U.S. Geological Survey 2016–1128–?*, 15 p., <http://dx.doi.org/10.3133/20161128?>
134. Porter, K.A., 2017 (expected), Societal consequences of current code performance objectives, in Wein, A., ed., *The HayWired Earthquake Scenario: U.S. Geological Survey Open-File Report 2015–1128–X*, 32 p., accepted for publication 29 Dec 2015
135. Porter, K.A., 2017 (expected), Not safe enough—A survey of public preferences for the seismic performance of new buildings in California and the New Madrid Seismic Zone, in Wein, A., ed., *The HayWired earthquake scenario: U.S. Geological Survey Open-File Report 2015–1128–X*, 39 p., Accepted for publication 29 Dec 2015
136. Porter, K.A., 2017 (expected), Three-dimensional physics-based ground-motion maps for disaster scenarios, in Wein, A., ed., *The HayWired Earthquake Scenario: U.S. Geological Survey Open-File Report 2015–1128–X*, 16 p., accepted for publication 7 Dec 2015
137. Perry, S.C., Blanpied, M.L., Burkett, E.R., Campbell, N.M., Carlson, A., Cox, D.A., Driedger, C.L., Eisenman, D.P., Fox-Glassman, K.T., Hoffman, S., Hoffman, S.M., Jaiswal, K.S., Jones, L.M., Luco, N., Marx, S.M., McGowan, S.M., Mileti, D.S., Moschetti, M.P., Ozman, D., Pastor, E., Petersen, M.D., Porter, K.A., Ramsey, D.W., Ritchie, L.A., Fitzpatrick, J.K., Rukstales, K.S., Sellnow, T.S., Vaughn, W.L., Wald, D.J., Wald, L.A., Wein, A., and Zarcadoolas, C., 2016, *Get Your Science Used—Six Guidelines to Improve Your Products*: U.S. Geological Survey Circular 1419, 37 p., <http://dx.doi.org/10.3133/cir1419>
138. Porter, K., and Walton, E., 2016. *Developing Screening Criteria for Buildings at Risk from Seismic Damage*. Structural Engineering and Structural Mechanics Report Series 16-06, University of Colorado Boulder, 17 p. <https://goo.gl/A9Ok2Y>
139. Porter, K.A., Field, E., and Milner, K., 2016. *Trimming the UCERF3-TD Hazard Tree with a New Probabilistic Model-Reduction Technique*. Structural Engineering and Structural Mechanics Report Series 16-05, University of Colorado Boulder, 26 p., <https://goo.gl/YqO4Zh>
140. Porter, K., 2016. *How Many Injuries can be Avoided Through Earthquake Early Warning and Drop, Cover, and Hold On?* Structural Engineering and Structural Mechanics Report Series 16-04, University of Colorado Boulder, 32 p., <http://www.colorado.edu/ceae/node/1096/attachment>
141. Porter, K., 2016. *An Earthquake Urban Search and Rescue Model Illustrated with a Hypothetical Mw 7.0 Earthquake on the Hayward Fault*. Structural Engineering and Structural Mechanics Report Series 16-03, University of Colorado Boulder, 155 p., <http://www.colorado.edu/ceae/node/1094/attachment>
142. Porter, K., 2016. *Damage and Restoration of Water Supply Systems in an Earthquake Sequence*. Structural Engineering and Structural Mechanics Report Series 16-02, University of Colorado Boulder, 116 p., <http://www.colorado.edu/ceae/node/1092/attachment>
143. Porter, K., 2016. *Not Safe Enough—A Survey of Public Preferences for the Seismic Performance of New Buildings in California and the New Madrid Seismic Zone*. Structural Engineering and Structural Mechanics Report Series 16-02, University of Colorado Boulder, 39 p., <https://goo.gl/Nvxd30>
144. Applied Technology Council, 2015. *FEMA P-154: Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Third Edition*, Federal Emergency Management Agency, Washington, DC, 388 pp. <https://www.fema.gov/media-library/assets/documents/15212> [viewed 14 Apr 2015]
145. Applied Technology Council, 2015. *FEMA P-155: Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation, Third Edition*, Federal Emergency Management Agency, Washington, DC, 206 pp. <https://www.fema.gov/media-library/assets/documents/15212> [viewed 14 Apr 2015]
146. Porter, K., K. Farokhnia, D. Vamvatsikos, and I. Cho, 2015. *Analytical Derivation of Seismic Vulnerability Functions for Building Classes and Nonstructural Components, Emphasizing Highrise Buildings*. Global Vulnerability Consortium, Pavia Italy, 64 pp., <http://www.sparisk.com/pubs/Porter-2015-GVC-Vulnerability.pdf>
147. Porter, K., 2015. A beginner’s guide to fragility, vulnerability, and risk. *Encyclopedia of Earthquake Engineering*. Springer-Verlag Berlin Heidelberg, DOI 10.1007/978-3-642-36197-5\_256-1, 29 p.
148. Porter, K., W. Byers, D. Dykstra, A. Lim, P. Lynett, J. Ratliff, C. Scawthorn, A. Wein, and R. Wilson, 2013. The SAFRR tsunami scenario—physical damage in California. Chap. E in Ross, S.L., and Jones, L.M., eds.,

- The SAFRR (Science Application for Risk Reduction) Tsunami Scenario*. U.S. Geological Survey Open-File Report 2013–1170, 168 p., <http://pubs.usgs.gov/of/2013/1170/e/>.
149. Ross, S.L., L.M. Jones, K. Miller, K.A. Porter, A. Wein, R.I. Wilson, B. Bahng, A. Barberopoulou, J.C. Borrero, D.M. Brosnan, J.T. Bwarie, E.L. Geist, L.A. Johnson, S.H. Kirby, W.R. Knight, K. Long, P. Lynett, C.E. Mortensen, D.J. Nicolsky, S.C. Perry, G.S. Plumlee, C.R. Real, K. Ryan, E. Suleimani, H. Thio, V.V. Titov, P.M. Whitmore, and N.J. Wood, 2013. SAFRR (Science Application for Risk Reduction) Tsunami Scenario—executive summary and introduction. U.S. Geological Survey Open-File Report 2013–1170–A, in Ross, S.L., and Jones, L.M., eds., *The SAFRR (Science Application for Risk Reduction) Tsunami Scenario*. U.S. Geological Survey Open-File Report 2013–1170, 17 p., <http://pubs.usgs.gov/of/2013/1170/a/>
150. Cho, I.H. and K.A. Porter, 2013. *Three Techniques for Modeling Building Classes using Moment Matching*. SESM 13-01, Structural Engineering and Structural Mechanics Program, Department of Civil Environmental and Architectural Engineering, University of Colorado Boulder, <http://www.sparisk.com/pubs/Cho-2013-SESM-building-classes.pdf>
151. (ATC) Applied Technology Council, 2012. *Seismic Performance Assessment of Buildings Volume 1 – Methodology FEMA P-58-1*. Federal Emergency Management Agency, Washington DC, <http://goo.gl/QN8AQz>
152. Olsen, A.H. and K.A. Porter, 2011. *On the Contribution of Reconstruction Labor Wages and Material Prices to Demand Surge*. SESM-11-1, Department of Civil Environmental and Architectural Engineering, University of Colorado at Boulder, <http://www.sparisk.com/pubs/Olsen-2011-SESM-Demand-Surge.pdf>
153. Porter, K., A. Wein, C. Alpers, A. Baez, P. Barnard, J. Carter, A. Corsi, J. Costner, D. Cox, T. Das, M. Dettinger, J. Done, C. Eadie, M. Eymann, J. Ferris, P. Gunturi, M. Hughes, R. Jarrett, L. Johnson, H. Dam Le-Griffin, D. Mitchell, S. Morman, P. Neiman, A. Olsen, S. Perry, G. Plumlee, M. Ralph, D. Reynolds, A. Rose, K. Schaefer, J. Serakos, W. Siembieda, J. Stock, D. Strong, I. Sue Wing, A. Tang, P. Thomas, K. Topping, and C. Wills, 2011. *Overview of the ARkStorm Scenario*. U.S. Geological Survey Open-File Report 2010-1312, 183 pp. and appendices, <http://pubs.usgs.gov/of/2010/1312/>
154. Olsen, A.H. and K.A. Porter, 2010. What We Know about Demand Surge. Department of Civil Environmental and Architectural Engineering, University of Colorado Boulder, SESM-10-1, <http://www.sparisk.com/pubs/Olsen-2010-CU-WWKADS.pdf>
155. Porter, K.A., H. Ishida, K. Torisawa, and M. Miyamura, 2010. *Enhancing Nonstructural Fragility Analysis for Essential Facilities*. Consortium of Universities for Research in Earthquake Engineering, Richmond CA, <http://www.sparisk.com/pubs/Porter-2010-CK7-Downtime.pdf>
156. K.A. Porter and C. Scawthorn, 2009. *Development of Open Source Seismic Risk Modeling Framework*. Final Technical Report, award 07HQAG0002, US Geological Survey, Reston VA, <http://earthquake.usgs.gov/research/external/>
157. K. S. Jaiswal, D. J. Wald, P. S. Earle, K. A. Porter, M. Hearne, 2011. Earthquake casualty models within the USGS Prompt Assessment of Global Earthquakes for Response (PAGER) system. In R. Spence, E. So, and C. Scawthorn, eds, *Human Casualties in Earthquakes*. Advances in Natural and Technological Hazards Research Volume 29, 2011, pp 83-94
158. Perry, S., D. Cox, L. Jones, R. Bernknopf, J. Goltz, K. Hudnut, D. Mileti, D. Ponti, K. Porter, M. Reichle, H. Seligson, K. Shoaf, J. Treiman, and A. Wein, 2008. *The ShakeOut Earthquake Scenario—a Story that Southern Californians are Writing*. US Geological Survey Circular 1324 and California Geological Survey Special Report 207. US Geological Survey, Reston VA. <http://pubs.usgs.gov/circ/1324/> [30 May 2008]
159. Jones, L.M., R. Bernknopf, D. Cox, J. Goltz, K. Hudnut, D. Mileti, S. Perry, D. Ponti, K. Porter, M. Reichle, H. Seligson, K. Shoaf, J. Treiman, and A. Wein, 2008. *The ShakeOut Scenario*. U.S. Geological Survey Open-File Report 2008-1150 and California Geological Survey Preliminary Report 25, <http://pubs.usgs.gov/of/2008/1150/> [22 May 2008]
160. Porter, K., R. Graves, E. Reis, and P. Somerville, 2007. *Index Woodframe Houses and their Response to Puente Hills Scenario Earthquakes*. USC-SCEC/CEA Technical Report #9 for Milestone 3d, Southern California Earthquake Consortium, Los Angeles CA.
161. Mosqueda, G. and K. Porter, 2007. *Engineering and Organizational Issues Before, During, and After Hurricane Katrina, Damage to Engineered Buildings and Lifelines from Wind, Storm Surge and Debris in the Wake of Hurricane Katrina*. MCEER-07-SP03, MCEER, Buffalo, NY, 54 pp.
162. Hattis, D.B., W.I. Whiddon, Crandell, J.H., M. Greene, W. Koffel, J. McJury, K. Porter, and K. Powell, 2007. *A Methodology for Identifying, Discussing, and Analyzing the Costs and Benefits of Code Changes that Impact Housing*. A Report for US Department of Housing and Urban Development. Building Technology Incorporated, Silver Spring, MD. 107 pp. <http://www.sparisk.com/pubs/Hattis-2007-Code-BCA.pdf>

163. Rose, A., K. Porter, N. Dash, J. Bouabid, C. Huyck, J.C. Whitehead, D. Shaw, R.T. Eguchi, C. Taylor, T.R. McLane, L.T. Tobin, P.T. Ganderton, D. Godschalk, A.S. Kiremidjian, K. Tierney and C. Taylor West, 2006. *Benefit-Cost Analysis of FEMA Hazard Mitigation Grants*. No 06-02, Working Papers from Department of Economics, Appalachian State University. <http://econ.appstate.edu/RePEc/pdf/wp0602.pdf>.
164. Porter, K.A., and C Scawthorn, 2007. *Open-Source Risk Estimation Software*. Southern California Earthquake Center (SCEC), Los Angeles, CA, <http://www.risk-agera.org/archive.htm>
165. Porter, K.A., S Krishnan, and X. Xu, 2006. *Analysis of Simultaneous Operational Failure of Critical Facilities Due to Earthquake, for a California Utility*. Report EERL 2006-01, California Institute of Technology, Pasadena, CA, <http://resolver.caltech.edu/CaltechEERL:EERL-2006-01>
166. (NIST) National Institute of Standards and Technology, 2006. *Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report*. NIST TN-1476. Gaithersburg, MD.
167. Ganderton, P.T., L. Bourque, N. Dash, R. Eguchi, D. Godschalk, C. Heider, E. Mittler, K. Porter, A. Rose, L.T. Tobin, and C. Taylor, 2006. Mitigation generates savings of four to one and enhances community resilience: MMC releases study on savings from mitigation. *Natural Hazards Observer*, 30 (4) March 2006 <http://www.colorado.edu/hazards/o/mar06/mar06a.html> [09 Mar 2006]
168. (NIBS) National Institute of Building Sciences, 2005. *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, Washington, DC.
169. Porter, K.A., J.L. Beck, J.Y. Ching, J. Mitrani-Reiser, M. Miyamura, A. Kusaka, T. Kudo, K. Ikkatai, and Y. Hyodo, 2004. *Real-Time Loss Estimation for Instrumented Buildings*, Report EERL 2004-08, California Institute of Technology, Pasadena, CA, <http://resolver.caltech.edu/CaltechEERL2004-08>
170. Porter, K.A., 2004. *A Survey of Bridge Practitioners to Relate Damage to Closure*, Report EERL 2004-07, California Institute of Technology, Pasadena, CA, <http://resolver.caltech.edu/CaltechEERL:EERL-2004-07>
171. Ching, J., J.L. Beck, K.A. Porter, and R.V. Shaikhutdinov, 2004. *Real-time Bayesian State Estimation of Uncertain Dynamical Systems*, Report EERL 2004-01, California Institute of Technology, Pasadena, CA, <http://resolver.caltech.edu/CaltechEERL:2004-01>
172. Porter, K.A., 2003. *Evaluating Premium Incentives for the California Earthquake Authority*, California Institute of Technology, Pasadena, CA
173. (EERI) Earthquake Engineering Research Institute, 2003. *Securing Society Against Catastrophic Earthquake Losses, A Research and Outreach Plan in Earthquake Engineering*, Oakland, CA, 76 pp., <http://www.eeri.org/research/Researchplan01-03.pdf>
174. Ching, J.Y., K.A. Porter, and J.L. Beck, 2003. *Uncertainty Propagation and Feature Selection for Loss Estimation in Performance-Based Earthquake Engineering*, EERL Report No. 2003-03, California Institute of Technology, Pasadena, CA
175. Porter, K.A., 2002. Life-safety risk criteria in seismic decisions. *Acceptable Risk Processes: Lifelines and Natural Hazards, Monograph No. 21*, C.E. Taylor and E. VanMarcke, eds., American Society of Civil Engineers, Technical Council for Lifeline Earthquake Engineering, Reston, VA, <http://spot.colorado.edu/~porterka/>
176. Porter, K.A., 2002. Seismic vulnerability. Chapter 21, *Handbook of Earthquake Engineering*, W.F. Chen and C.R. Scawthorn, eds., CRC Press, Boca Raton, FL
177. Porter, K.A., J.L. Beck, and R.V. Shaikhutdinov, 2002. *Investigation of Sensitivity of Building Loss Estimates to Major Uncertain Variables for the Van Nuys Testbed*, PEER Report 2002/03, Pacific Earthquake Engineering Research Center, Richmond, CA
178. Porter, K.A., J.L. Beck, H.A. Seligson, C.R. Scawthorn, L.T. Tobin, and T. Boyd, 2002. *Improving Loss Estimation for Woodframe Buildings*, Consortium of Universities for Research in Earthquake Engineering, Richmond, CA, 136 pp., <http://resolver.caltech.edu/caltechEERL:2002.EERL-2002-01> (main report) and <http://resolver.caltech.edu/caltechEERL:2002.EERL-2002-02> (appendices)
179. Beck, J.L., K.A. Porter, R. Shaikhutdinov, S. K. Au, T. Moroi, Y. Tsukada, and M. Masuda, 2002. *Impact of Seismic Risk on Lifetime Property Values, Final Report*, Consortium of Universities for Research in Earthquake Engineering, Richmond, CA, <http://resolver.caltech.edu/caltechEERL:2002.EERL-2002-04>
180. Porter, K.A., C. Scawthorn, C. Taylor, N. Blais, 1998. *Appropriate Seismic Reliability for Critical Equipment Systems: Recommendations Based on Regional Analysis of Financial and Life Loss*, MCEER-98-0016, Multidisciplinary Center for Earthquake Engineering Research, State Univ. of New York, Buffalo, NY, 104 pp.
181. T. Larsen, K.A. Porter, M. Zadeh, C. Van Anne, and C. Scawthorn, 1996. *Impact of Hurricane Andrew on Performance, Interaction, and Recovery of Lifelines*. Grant BCS-9224819, National Science Foundation, Washington, DC, 257 pp, <http://www.sparisk.com/pubs/Larsen-1996-Andrew-lifelines.pdf>

## KEITH A. PORTER CURRICULUM VITAE

182. Porter, K.A., G.S. Johnson, M.M. Zadeh, C.R. Scawthorn, and S.J. Eder, 1993. *Seismic Vulnerability of Equipment in Critical Facilities: Life-Safety and Operational Consequences*, NCEER-93-0022, Multidisciplinary Center for Earthquake Engineering Research, State Univ. of New York, Buffalo, NY, 364 pp.
183. Scawthorn, C.R., K.A. Porter, and F.T. Blackburn, 1992. Loma Prieta, California Earthquake of October 17, 1989, strong ground motion and ground failure, marina district: performance of emergency-response services after the earthquake. *Loma Prieta, California Earthquake of October 17, 1989: Marina District*, USGS Professional Paper 1551-F. O'Rourke, Thomas D, ed., US Government Printing Office, Washington DC, F195-F215.