Forensic Engineering 2009

Pathology of the Built Environment



Proceedings of the Fifth Congress on Forensic Engineering

Edited by Shen-en Chen, Alicia Díaz de León, Anthony M. Dolhon, Michael J. Drerup, and M. Kevin Parfitt



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FORENSIC ENGINEERING 2009

Pathology of the Built Environment

PROCEEDINGS OF THE FIFTH CONGRESS ON FORENSIC ENGINEERING

> November 11–14, 2009 Washington, D.C.

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> EDITED BY Shen-en Chen Alicia Díaz de León Anthony M. Dolhon Michael J. Drerup M. Kevin Parfitt



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Preface

These proceedings are a collection of peer-reviewed technical papers presented at the Fifth Congress on Forensic Engineering, held in Washington, D.C. on November 11-14, 2009. The Congress was sponsored by the ASCE Technical Council on Forensic Engineering (TCFE), whose mission is to develop practices and procedures to reduce the number of failures, to disseminate information on failures, and to provide guidelines for conducting failure investigations and ethical conduct. TCFE uses the Forensic Congress to disseminate information on failures and the practices to mitigate failures, and to provide a forum to discuss ethical practice within forensic engineering. The publication of these papers is the result of the dedication and sacrifice of TCFE members who have volunteered many hours. TCFE collaborated closely with ASCE's Technical Council on Wind Engineering, and a number of excellent papers from this important discipline are also included herein. Each paper underwent a peer review process and received a minimum of two positive reviews. All of the papers in this proceeding are eligible for both discussions in the Journal of Performance of Constructed Facilities and ASCE awards.

In addition to paper presentations, the conference included two panel discussions, one forensic engineering education, and another on the potential impact of LEED certification on building performance. The education discussion was preceded by presentation of two papers regarding current university level forensic engineering programs in Ireland and Italy and also focused on a series of educator workshops presented by TCFE's Education Committee over the past several years.

On Wednesday, November 11, 2009, two Pre-Congress workshops were held. They were titled, "Forensic Practices" and "Facade Forensics." These workshops emphasized an interaction and exchange of information among the participants. The "Forensic Practices" workshop was based on the ASCE's *Guidelines for Forensic Engineering Practice*, 2003 and *Guidelines for Failure Investigation*, 1987. This workshop covered issues related to the practice of forensic engineering, including the investigation process, business aspects, and the legal system with an emphasis on the ethical issues. The "Facades Forensics" workshop introduced participants to key features of building facade failures including an historical overview and development of building facades, systems and materials, thermal performance, mechanisms of deterioration and failure, inspection and diagnosis, and repair and restoration.

On Thursday, November 12, 2009, the keynote presentation was given by Henry Petroski, Ph.D., P.E., Dist. M.ASCE, NAE. Dr. Petroski addressed a public event held in the Great Hall of the National Building Museum, which is the one of the great American buildings of the nineteenth century and one of Washington, D.C.'s most spectacular works of public architecture. Dr. Petroski is the Aleksandar S. Vesic

Professor of Civil Engineering and Professor of History at Duke University. Dr. Petroski is a renowned educator, author, researcher, and lecturer. He has achieved eminence for significantly advancing the practice of civil engineering and education. His published works, most notably *To Engineer is Human: The Role of Failure in Successful Design*, has increased the public's understanding of the role of the engineer. In 2008, Dr. Petroski was elected as a distinguished member of ASCE.

Shen-En, Chen University of North Carolina at Charlotte Proceedings Editor-in-Chief Michael J. Drerup, P.E., M.ASCE Exponent, Inc. Congress Chair

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The Steering Committee of the Fifth Congress on Forensic Engineering acknowledges the dedication of its members throughout the planning of the Congress, including Michael J. Drerup, P.E., M.ASCE (Congress Chair and ExCom); Shen-en Chen, Ph.D., P.E., M.ASCE (Proceedings Editor); Leighton Cochran, Ph.D., C.P.Eng., M.ASCE; Alicia E. Diaz de Leon, S.E., AIA, M.ASCE; Anthony M. Dolhon, P.E., M.ASCE; Mohamed Ettouney, Ph.D., P.E., M.ASCE; M. Kevin Parfitt, P.E., M.ASCE; David B. Peraza, P.E., M.ASCE; and Ziad M. Salameh, Ph.D., P.E., M. ASCE.

We also wish to thank the Executive Committeee (ExCom) of the Technical Council on Forensic Engineering, including David B. Peraza, P.E., M.ASCE (Chair); Leonard J. Morse-Fortier, Ph.D., P.E., M.ASCE (Past Chair); Norbert J. Delatte, Jr., Ph.D., P.E., M.ASCE (Past Chair); Anthony M. Dolhon, P.E., M.ASCE; Michael P. Lester, P.E., M.ASCE; and Michael J. Drerup, P.E., M.ASCE.

Throughout the planning process we collaborated closely with ASCE's Technical Council on Wind Engineering (TCWE), and appreciate the many excellent papers on various aspects of this important field included in this volume. TCWE's efforts, led by Leighton Cochrane, Ph.D, were integral to our planning and program development.

The Steering Committee also wishes to thank the authors, presenters, and session moderators, whose efforts form the heart of the Congress; and ASCE Staff, including Verna Jameson, TCFE Coordinator; Elaine Watson, Conference Manager; Donna Dickert, Publications Department; Mr. Patrick Driscoll of MIRA; and others whose names may have been inadvertently omitted.

Finally, we thank our families for their support throughout the planning and review process.

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