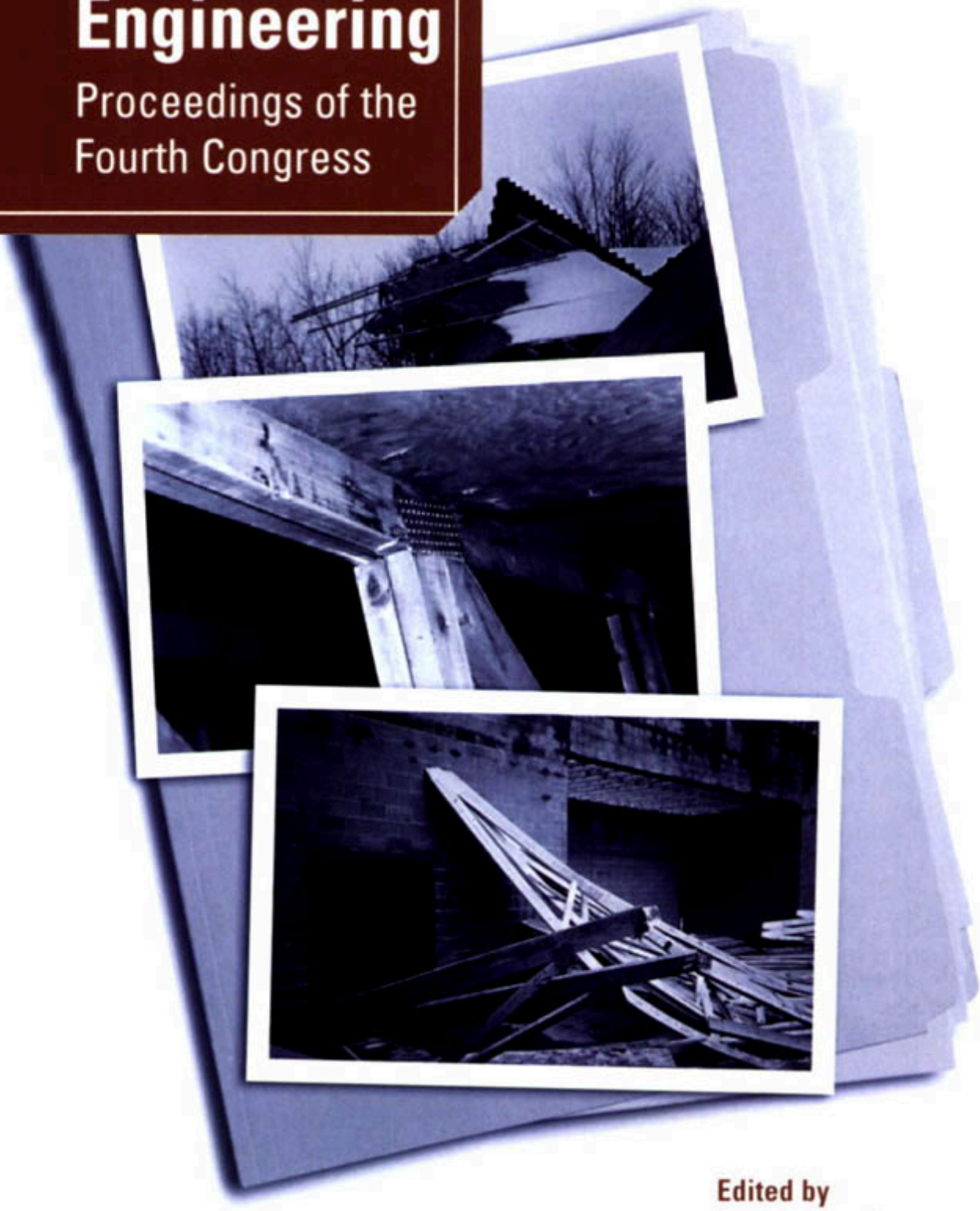
Forensic Engineering

Proceedings of the Fourth Congress



Edited by
Paul A. Bosela
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Preface

These proceedings consist of the set of papers presented at the Fourth Forensic Engineering Congress, held in Cleveland, Ohio, October 6-9, 2006. The Congress was organized by the ASCE Technical Council on Forensic Engineering (TCFE), whose mission is to apply engineering principles to investigate failures and performance problems of engineered facilities, and to develop practices and procedures to reduce the number of future failures. TCFE uses the Forensic Congress to disseminate information on failures and practices to mitigate failures, and to provide a forum to discuss ethical practice within the field of forensic engineering.

The publication of these papers is the result of many hours of volunteer labor by active members of TCFE. Each paper completed a peer review process and received a minimum of two positive reviews. All papers in this proceedings are eligible for both discussion in the Journal of Performance of Constructed Facilities and possible ASCE awards.

The editors of these proceedings would like to acknowledge the TCFE EXCOM Chairman Kevin Rens, TCFE members, authors, reviewers, session moderators, ASCE staff and other individuals who contributed to the success of this congress. In addition, the editors would like to thank Nehal Desai and Ayan Ghosh, Civil Engineering Graduate Students at Cleveland State University (CSU) for their help in providing assistance in managing the organizational process, and the faculty and staff at CSU. Finally, we would like to thank Angela Bosela and Lynn Delatte for their support while we were working on this project.

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Plenary Session

Forensic Study of New Orleans Hurricane Protection in Katrina

Moderated by Dr. Paul F. Mlakar, U.S. Army Corps of Engineers (USACE)

Hurricane Katrina was one of the strongest storms to hit the coast of the United States in the past century. The magnitude of the destruction, the extensive damage to the hurricane protection system, and the catastrophic failure of a number of structures raised significant questions about the integrity of the flood protection system prior to the storm and the capacity of the system to provide future protection, even after repairs. Immediately following the storm, the USACE established the Interagency Performance Evaluation Task Force (IPET) to provide credible and objective answers to these technical questions. The work of IPET involved ten tasks, each of which was studied by a team led jointly by an expert from USACE and an expert from an external organization. Comprised of some 150 individuals from 50 organizations, these teams provided a diversity and depth of knowledge and experience. A continuous detailed review of IPET was provided by an external review panel under the auspices of ASCE and an independent panel of the National Research Council is providing further strategic oversight and synthesis of the findings. The IPET released its report on June 1, 2006. The session consists of three presentations on the forensic aspects of the study as follows:

The Hurricane Protection System – Dr. John J. Jaegar, USACE

The state of the hurricane protection was established through a comprehensive search of the design documents and a thorough physical inspection. This infrastructure, consisting of levees and floodwalls, was generally built as designed. Unfortunately this was done piecemeal over a period of decades rather than as an integrated system all at once. The criteria used a Standard Project Hurricane dating to 1959 that did not encompass all the information now available regarding the hurricane hazard. Some sections of the protection were lower than intended due to an inaccurate relation between the geodetic datum and mean sea level and the variable and considerable subsidence in the area.

The Storm Loading - Drs. Bruce A. Ebersole and Donald T. Resio, USACE

The hurricane loading was studied through widespread physical observation, state-of-the-art numerical analyses, and physical modeling. Hurricane Katrina generated water levels that for much of the system significantly exceeded the design criteria. Detailed hydrodynamic analyses showed that dynamic forces were a significant portion of the total forces experienced. Overtopping by waves generated very high velocities over the crest and back sides of the levees, leading to a high potential for scour and erosion. Contrary to some early speculation, the southeast trending leg of the Mississippi River Gulf Outlet had little influence on the water levels in the Inner Harbor Navigation Canal.

The Levee Response - Drs. Reed L. Mosher and Michael K. Sharp, USACE

The response of the levees was examined by limit equilibrium analyses, finite element calculations, and physical models in the centrifuge. In spite of loadings in excess of the design conditions, many sections of the protection performed well. Some 46 breaches occurred due to overtopping and erosion. Unfortunately 4 additional breaches were caused by foundation failures in floodwalls at water elevations less than the design level that were induced by the formation of a gap along the canal side of the floodwalls.

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