

**Proceedings of the International Workshop on
Sustainable Development and Concrete Technology**

International Workshop on Sustainable Development and Concrete Technology

*Beijing, China
May 20–21, 2004*

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Edited by Kejin Wang

Center for Transportation Research and Education
Iowa State University
Ames, Iowa, USA

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Preface

In the past few decades, growing concern over global warming and other significant ecological changes has spurred much debate in all fields of science and engineering. The concrete industry has increasingly been considered one of the largest contributors to these ecological changes. Presently, annual worldwide concrete production is about 12 billion tons, consuming approximately 1.6 billion tons of portland cement, 10 billion tons of sand and rock, and 1 billion tons of water. The production of one ton of portland cement generates approximately one ton of carbon dioxide and requires up to 7000 MJ of electrical power and fuel energy. It is evident that the concrete industry significantly impacts the ecology of our planet.

The International Workshop on Sustainable Development and Concrete Technology is being held to address the role of portland cement concrete materials and construction in sustainable development. The main purpose of the workshop is to promote global interaction and research collaboration for a better understanding of sustainable development as applied to concrete technology. China's economic growth and its impact on the global environment have received a great deal of attention. China is now the world's largest cement producer and consumer. China's cement production in 2003 was over 800 million tons, more than one-third of the world's supply. Sustainable development in China is urgent.

The workshop is sponsored by the National Science Foundation, USA, and co-sponsored by American Concrete Institute International, USA, the Center for Advanced Cement-Based Materials, Northwestern University, USA, and many distinguished organizations in the People's Republic of China. The workshop is organized by Iowa State University, USA, and Tsinghua University, PRC, and hosted by Tsinghua University.

The international workshop includes two major themes: (1) critical issues of sustainable development and emerging technology for "green" concrete and (2) concrete durability and sustainable system. This volume of proceedings contains 31 papers presented at the workshop, about half of which are keynote and invited papers from eminent international experts. In addition to the paper sessions, the workshop includes a panel discussion on the future directions of sustainable development and international collaborations.

A field trip to the Three Gorges Dam is arranged at the end of the workshop, sponsored by China Yangtze Power Corporation Ltd. The project to build the world's largest dam combines a huge amount of construction material consumption with energy generation, natural disaster control, and environment protection issues. It provides a unique case study of sustainable development.

The workshop organizers would like to thank all sponsors, committee members, and hosts who made this workshop possible. Particular appreciation is made to the National Science Foundation (Grant CMS-0307261) and Program Director Dr. Perumalsamy N. Balaguru. Special thanks are also extended to all authors for their contributions and cooperation.

The editor is sincerely indebted to Iowa State University's Department of Civil, Construction and Environmental Engineering and Center for Transportation Research and Education, especially Mr. Mark Anderson-Wilk, for their support in producing this volume of workshop proceedings.

The organizers earnestly hope that this workshop will advance the emerging technologies for production of "green" concrete materials and "green" concrete structures. It is envisioned that the workshop will lead to a significant improvement in integration of infrastructure development with industrial ecology, resource management, information technology, and economy. The workshop will also assist in promoting international collaborations in education, research, and practice for global sustainable development. These proceedings will serve a useful resource for researchers and engineers involved in sustainable development activities.

Surendra P. Shah, Chair
Shuaib Ahmad, Co-chair
Peiyu Yan, Co-chair
Kejin Wang, Co-chair and Editor

Part I

*Critical Issues of
Sustainable
Development and
Emerging Technology
for “Green” Concrete*

Part II

*Concrete Durability and
Sustainable System*