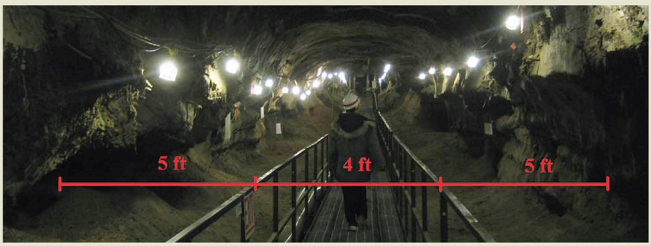
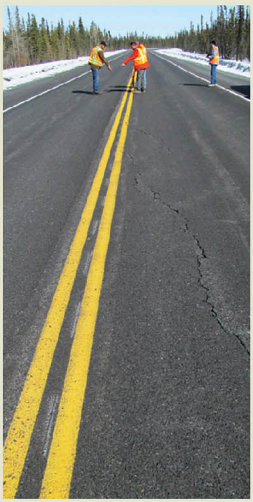
Climatic Effects on Pavement and Geotechnical Infrastructure





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Edited by

Jenny Liu, Ph.D., P.E.; Peng Li, Ph.D.;
Xiong Zhang, Ph.D., P.E.; and
Baoshan Huang, Ph.D., P.E.

CLIMATIC EFFECTS ON PAVEMENT AND GEOTECHNICAL INFRASTRUCTURE

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Preface

Climatic Effects on Pavement and Geotechnical Infrastructure selects 22 papers that represent the latest developments and advances of the impact of various climatic factors, such as freeze and thaw, wet and dry cycle, rainfall, flooding, etc., on designing, building, preserving and maintaining transportation infrastructure.

Many of the selected papers were presented at the International Symposium of Climatic Effects on Pavement and Geotechnical Infrastructure 2013 held in Fairbanks, Alaska, USA from August 4 to 7, 2013. The conference was hosted by the University of Alaska Fairbanks in collaboration with the University of Alaska Anchorage in USA, Tongji University in China, Harbin Institute of Technology in China, Chang'An University in China, International Association of Chinese Infrastructure Professionals (IACIP), the American Society of Civil Engineers (ASCE), and the University of Tennessee, Knoxville in USA.

The papers presented within the *Climatic Effects on Pavement and Geotechnical Infrastructure* Special Technical Publication (STP) are divided into four groups. The first group contains four papers which provide an international perspective on climate change and infrastructure and climate network. The second group of papers contains five papers focused on preservation, maintenance, and operations of pavement and geotechnical infrastructure in correspondence to various climatic conditions. Eight papers are collected in the third group on advancing innovative sustainable materials and design for transportation infrastructure use. Furthermore, five papers on various analysis and evaluation approaches to assess the climatic effects on performance and life of infrastructure are provided.

Two or more reviewers along with the editors evaluated each paper published in this ASCE STP. All published papers are eligible for discussion in the *Journal of Materials in Civil Engineering*, and are eligible for ASCE awards.

We would like to acknowledge the great support from Laura Ciampa and Marvin Oey from the ASCE Construction Institute (CI) that makes it possible for this high quality peer reviewed STP. Most importantly, we would like to thank the peer reviewers who spent their time and efforts in ensuring the exceptional quality of the papers presented within this STP. Without their contributions this publication would not be possible.

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Analysis and Evaluation Approaches

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Impact of Climate Change on Pavement Performance: Preliminary Lessons Learned through the Infrastructure and Climate Network (ICNet)

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ABSTRACT: The Infrastructure and Climate Network (ICNet) was established to develop collaborative networks and platforms needed to integrate the multidisciplinary areas of climate change, pavement design and performance, and economics. Preliminary network activities, described in this paper, have rapidly expanded our knowledge of pavement performance under future climates and provide insights for future research. Specifically, increases in the frequency and/or severity of many types of extreme weather events have already been observed; projected future changes in air temperature, rainfall, sea level rise and hurricanes on pavement performance are significant; and future costs are expected to increase very significantly and non-linearly. Combining these findings, we offer a set of recommendations for future research to address our key research question: *How does climate non-stationarity differentially impact transportation infrastructure design, performance and life span?*

INTRODUCTION

The nation's infrastructure is becoming increasingly vulnerable to damage from changing weather patterns resulting from global climate change. Observations, models, and even paleohydrologic studies identify the potential for changes in climate characteristics that directly impact infrastructure design. Observed and projected future changes in infrastructure-relevant climate characteristics include the average, variability, and extreme values of temperature, solar radiation, snow and rainfall, freeze-thaw cycles, groundwater levels, and streamflow. Increases in sea level and