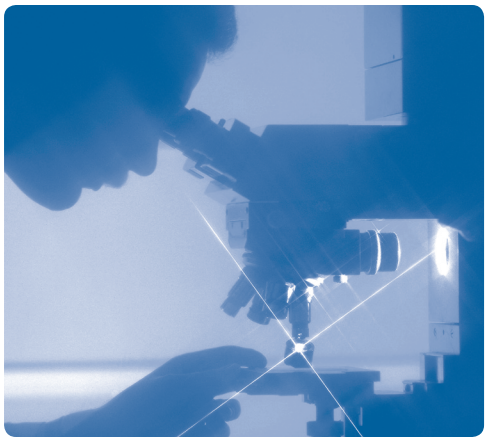
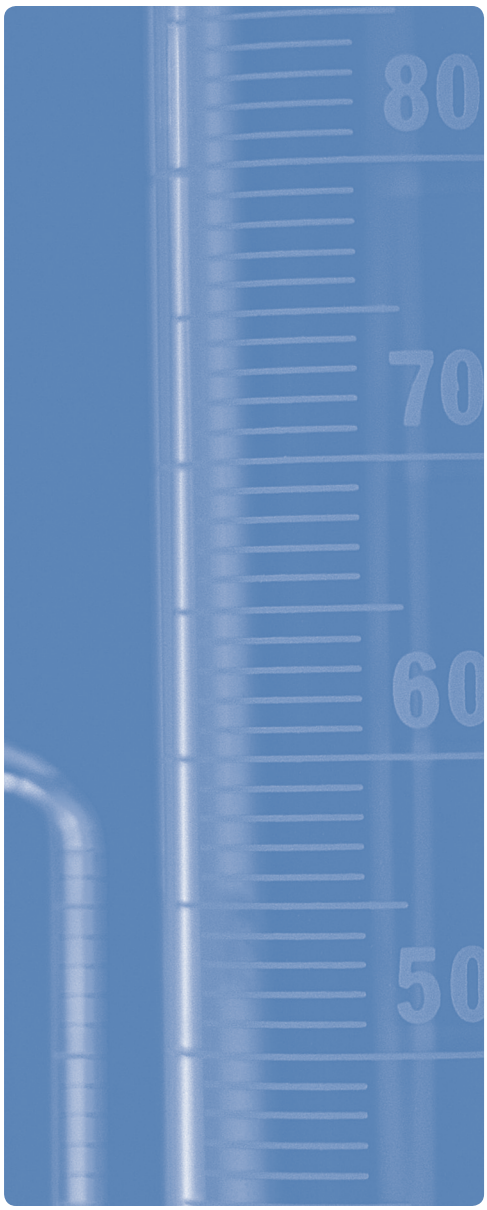
A MULTIDISCIPLINARY FORUM FOR APPLIED SCIENCES AND ENGINEERING





Journal of Testing and Evaluation

Contents:

SPECIAL SECTION ON SUSTAINABLE TRANSPORTATION INFRASTRUCTURE AND MATERIALS
Guest Editor: Hao Wang

i **Overview**

1297 **Linking Ecology and Service Function in Scenic Road Landscape Planning: A Spatial Analysis Approach**
Xiaochun Qin, Shengnan Cui, and Shu Liu

1313 **Evaluation of Soil Saver Walls on Aquatic Organism Passage Through Box Culverts**
Madan Neupane, Robert L. Parsons, Jie Han, David A. Parr, and James A. Jacobe

1321 **Laboratory Investigation of Microsurfacing Asphalt Modified with Nanosilica and Nanoclay Combined with polyethylene fibers**
Ameneh Otadi and Javad Tanzadeh

1333 **Desaturation for Liquefaction Mitigation Using Biogas Produced by *Pseudomonas stutzeri***
Erxing Peng, Dingwen Zhang, Wenbo Sun, and Guangyin Du

1343 **Optimization of Laboratory Preparation of the Emulsified Bioasphalt with Two Emulsifiers**
Xi Chen, Hainian Wang, Qinghua Wang, Xu Yang, and Zhanping You

1355 **Effects of Internal Structure on Anisotropic Creep Behavior of Asphalt Mixture Based on User-Defined Three-Dimensional Discrete Element Method**
Deyu Zhang, Tao Ma, Xunhao Ding, Weiguang Zhang, and Xiaoming Huang

1366 **Rutting Evaluation of Alaskan Asphalt Pavement Containing Sustainable Materials**
Sheng Zhao and Jenny Liu

1376 **Nature-Inspired Bridge Scour Countermeasures: Streamlining and Biocementation**
Junliang Tao, Junhong Li, Xiangrong Wang, and Ruotian Bao

1391 **Evaluation for VOF Simulation of Flow Field in Asphalt Foaming Chamber Based on Volume Fraction**
Fu-Min Liu, An-Lin Wang, and Zhen-Sheng Fu

1399 **Nondestructive Evaluation of Solid Pharmaceutical Products Using Wavelet Transformations and Multispectral Data**
Fahima Tahir, Muhammad Abuzar Fahiem, Saima Farhan, and Huma Tauseef

1411 **Seismic Isolation Characteristics of a Friction System**
Biao Wei, Peng Wang, Xuhui He, and Lizhong Jiang

1421 **Review of Design, Construction, and Capabilities of an Air Bladder Load Test Facility (ABLTF) at BCERL for Structural Experimental Enclosure Studies**
Ali M. Memari, Thomas Kuczynski, and Ryan L. Solnosky

1434 **Dynamic Fracture Characterization of Cantilever Structure Specimens with V-Notch Tips**
Zhongwen Yue, Wang Zhang, Yao Song, Qingwen Hu, and Luzhou Xie

1443 **An Optical Fiber Sensor Method for Simultaneously Monitoring Corrosion and Structural Strain Induced by Loading**
Jianghong Mao, Fangyuan Xu, Weiliang Jin, Qian Gao, Yidong Xu, and Chen Xu

1452 **Synthesis and Performance Evaluation of Epoxy Resin–Modified Shape Memory Polyurethane Sealant**
Dongya Shen, Shuang Shi, and Tao Xu

1462 **Improved Threat Identification Using Tonemapping of High-Dynamic-Range X-ray Images**
Jack L. Glover, Lawrence T. Hudson, and Nicholas G. Paulter

1468 **Testing the Image Quality of Cabinet X-ray Systems for Security Screening: The Revised ASTM F792 Standard**
Jack L. Glover, Ronald E. Tosh, Lawrence T. Hudson, and Nicholas G. Paulter

(Contents continued on back cover)

ASTM INTERNATIONAL

Volume 46, Number 4
July 2018
Coden: JTEVAB

Published bimonthly by ASTM International | 100 Barr Harbor Drive | PO Box C700 | W. Conshohocken, PA 19428-2959

ASTM INTERNATIONAL

EDITOR-IN-CHIEF

Dr. M. R. Mitchell
Mechanics & Materials, LLC
4447 Acrete Lane
Flagstaff, AZ 86004, USA

EDITORIAL OBJECTIVES

The *Journal of Testing and Evaluation* is published in six issues per year by ASTM International, a nonprofit technical organization that develops and publishes voluntary consensus standards and related information for materials, products, systems, and services.

Some issues, in whole or in part, may be Special Issues focused on a topic of interest to our readers.

Contributions are peer reviewed prior to publication.

EDITORIAL SERVICES—SUBMISSIONS

Sara Welliver

Supervisor, Peer Review Services
Journal of Testing and Evaluation Editorial Offices
J&J Editorial Services
201 Shannon Oaks Cir #124
Cary, NC 275511, USA
Tel: (919) 650-1459 ext. 210
E-mail: astm@jjeditorial.com

PURPOSE AND SCOPE

The editorial objectives of the Journal of Testing and Evaluation is to serve a broad-based audience by:

- Publishing new technical information derived from the field and laboratory testing, performance, quantitative characterization, and evaluation of these materials, products, systems, and services.
- Presenting new methods and data and critical evaluations of these methods and data.
- Reporting the users' experience with test methods and the results of interlaboratory testing and analysis.
- Providing the scientific basis for both new and improved ASTM International standards.
- Stimulating new ideas in the fields of testing and evaluation.
- Including papers, technical notes, letters to the editor, discussions of previously published papers, and book reviews as contributions.

POSTMASTER: Send address change to ASTM International—JTE, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

Printed in the U.S.A.

EDITORIAL BOARD

Dr. Ali Abolmaali
University of Texas at Arlington
Arlington, TX, USA

Dr. Aziz Amoozegar
North Carolina State Univeristy
Raleigh, NC, USA

Dr. Patricia Annis
University of Georgia
Athens, GA, USA

Dr. Farhad Aslani
University of Western Australia
Crawley, WA, Australia

Dr. Nemkumar Banthia
University of British Columbia
Vancouver, BC, Canada

Dr. Neal S. Berke
Tourney Consulting Group, Ltd.
Kalamazoo, MI, USA

Dr. Filippo Berto
University of Padua, Italy, and Norwegian University of Science and Technology
Trondheim, Norway

Dr. Krishna Prapoorna Biligiri
Indian Institute of Technology
Kharagpur, West Bengal, India

Dr. Laura Bix
Michigan State University
East Lansing, MI, USA

Dr. Andrew F. Braham
University of Arkansas
Fayetteville, AR, USA

Dr. Andreas Brunner
Empa, Swiss Federal Labs
Switzerland

Prof. Andrea Carpinteri
University of Parma
Parma, Italy

Dr. Wen-Ruey Chang
Liberty Mutual Research Institute for Safety
Hopkinton, MA, USA

Dr. Dar-Hao Chen
Texas Dept. Of Transportation
Austin, TX, USA

Dr. Haiqiang Chen
Xiamen University
Fujian, China

Dr. Kuen-Suan Chen
National Chin-Yi University of Technology
Taiwan

Dr. Richard A. Coffman
University of Arkansas
Fayetteville, AR, USA

Dr. Tong Cui
Qualcomm Packaging
San Diego, CA, USA

John S. Dick
Alpha Technologies
Akron, OH, USA

Prof. Ying Fang
Xiamen University
Xiamen, China

Dr. Piotr Gas
AGH University of Science and Technology
Krakow, Poland

Dr. Yu-Ning Louis Ge
National Taiwan University
Taipei, Taiwan

Dr. T. Russell Gentry
Georgia Institute of Technology
Atlanta, GA, USA

Dr. Meng Guo
Beijing University of Technology
Beijing, China

Dr. Rajeev Kumar Gupta
University of Akron, Akron, OH, USA

Dr. Marcelo Hirschler
Mill Valley, CA, USA

Mr. Hui-Min Huang
NIST
Gaithersburg, MD, USA

Dr. Xiaoming Huang
Southeast University
Nanjing, China

Dr. Jiancheng Jiang
University of North Carolina, Charlotte
Charlotte, NC, USA

Dr. Tao Jiang
University of Connecticut Health Center
Farmington, CT, USA

Dr. Thomas Jones
Alcoa Howmet Corp.
Whitehall, MI, USA

Dr. Sreeramesh Kalluri
Ohio Aerospace Institute
Brook Park, OH, USA

Dr. Sivakumar Kandasami
Larsen & Toubro Construction
Chennai, India

Dr. Xin Kang
TerraSense Geotechnical Lab
Totowa, NJ, USA

Dr. Vistasp M. Karbhari
University of Texas at Arlington
Arlington, TX, USA

Dr. Yong-Rak Kim
University of Nebraska-Lincoln
Lincoln, NE, USA

Dr. Govindaraju Kondaswamy
Massey University
Palmerston, North New Zealand

Dr. Brandon Krick
Lehigh University
Bethlehem, PA, USA

Dr. Chaker Larabi
University of Poitiers
Poitiers, France

Dr. Gang Li
Xi'an Jiaotong University
Shaanxi Province, China

Dr. William Luecke
National Institute of Standards and Technology
Gaithersburg, MD, USA

Douglas C. Meier
National Institute of Standards and Technology
Gaithersburg, MD, USA

Mr. Thomas F. O'Connor
Milan, MI, USA

Dr. William T. Riddell
Rowan University
Haddonfield, NJ, USA

Mr. John Riegel, III
R3 Technology, Inc.
Springfield, VA, USA

Dr. Roberto Sabatini
RMIT University
Melbourne, VIC, Australia

Dr. Rajarshi Saha
Bridgelux, Inc.
Livermore, CA, USA

Dr. Christopher G. Scott
Lubrizol Corporation
Wickliffe, OH, USA

Dr. Steven J. Shaffer
Bruker Nano Surfaces Division
San Jose, CA, USA

Dr. Suraj Sharma
University of Georgia
Athens, GA, USA

Dr. Ranganath K. Shastri
Plastics Solutions
Midland, MI, USA

Dr. Punith Veeralinga Shivaprasad
Clemson University
Clemson, SC, USA

Dr. Cy (Chor-yiu) Sin
National Tsing Hua University
Hsinchu, Taiwan, R.O.C.

Dr. Stein Sture
University of Colorado, Boulder, CO, USA

Dr. Julian Tao
University of Akron, Akron, OH, USA

Dr. Ingrid Tomac
University of California, San Diego
San Diego, CA, USA

Dr. Sabrina Vantadori
University of Parma
Parma, Italy

Dr. Matthieu Vignes
Massey University Manawatu
Palmerston North, New Zealand

Dr. Hao Wang
Rutgers, The State University of New Jersey
Piscataway, NJ, USA

Dr. Jinfeng Wang
Zhejiang University
Hangzhou, China

Dr. Shuying Wang
Central South University
Hunan, China

Dr. Xuexin Wang
Xiamen University
Xiamen, China

Dr. Shaopeng Wu
Wuhan University of Technology
Wuhan, China

Dr. Shenghua Wu
University of South Alabama
Mobile, AL, USA

Dr. Feipeng Xiao
Clemson University
Clemson, SC, USA

Dr. Ming Xiao
The Pennsylvania State University
University Park, PA, USA

Dr. Xiong (Bill) Yu
Case Western Reserve University
Cleveland, OH, USA

Prof. Menglan Zeng
Hunan University
Changsha, Hunan, China

Dr. Xibin (Bill) Zhang
Monash University, Caulfield East
Victoria, Australia

Overview

This issue contains a special section with selected papers from the 2017 International Conference on Transportation Infrastructure and Materials (ICTIM) held in Qingdao, China, 9–12 June 2017. The conference was jointly organized by the International Association of Chinese Infrastructure Professionals (IACIP) and the Qingdao University of Technology (QUT).

Coverage includes the latest development in the field of sustainable transportation infrastructure and materials with various research topics. Presentations, for example, are given on the evaluation of design of box culverts, mitigation of soil liquefaction using biogas, nature-inspired bridge scour countermeasures, evaluation of foaming process of warm mix asphalt, optimized preparation of emulsified bio-asphalt, laboratory investigation of micro-surfacing asphalt with nano-additives and fibers, discrete element modeling of asphalt concrete, rutting evaluation of asphalt pavement with sustainable materials, and consideration of ecology and service function in scenic road design.

Special Section Editor
Hao Wang, PhD, Associate Professor
Rutgers, The State University of New Jersey

Copyright © 2018 by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.

EXECUTIVE COMMITTEE

Dale F. Bohn, Chairman
Taco van der Maten, Vice Chairman
Andrew G. Kireta, Jr., Vice Chairman
John R. Logar, Chairman of Finance and Audit Committee
Ralph M. Paroli, Past Chairman
D. Thomas Marsh, Past Chairman
Katharine E. Morgan, President

DIRECTORS

Ferdinando E. Aspesi
Dale F. Bohn
Joannie W. Chin
Cesar A. Constantino
Oliver S. Delery, Jr.
William Ells
John Fletcher
R. James Galipeau
John Germaine
William C. Griese
Alan Kaufman
Andrew G. Kireta, Jr.
John R. Logar
D. Thomas Marsh
R. Christopher Mathis
Katharine E. Morgan
Deryck M.S. Omar
Ralph M. Paroli
Irving S. Scher
Arman Shakkaliyev
James A. Tann
Vicky Taylor
Taco van der Maten
Jeff Weiss
Terry O. Woods

INFORMATION FOR AUTHORS

For details regarding paper submission go to http://mc04.manuscript-central.com/astm-jote.

The subject matter must not be of a speculative nature and the contents must not include materials of an advertising nature. The paper must not be seriously defective as to literary form and structure, continuity of thought, and clarity of expression. The substance of the paper should not have been published previously in the open literature.

Authors preparing papers for submittal should observe the conventions of style explained in the ASTM Style Manual. Since the journal does not request page charges, the author is expected to conform to these standard conventions for style and the inclusion of complete references and high-quality figures. SI units are to be used throughout; if data were not measured in SI units, a note should appear to that effect and the original units should be included in parentheses after the SI units.

IN APPRECIATION OF THE REVIEWERS

The high quality of the papers that appear in this publication is a tribute not only to the obvious efforts of the authors represented but to the unheralded, though essential, efforts of their reviewers. It is to the reviewers dedication to upholding the high standards of their profession that this note pays tribute. On behalf of ASTM International and the authors as well, we acknowledge with appreciation their important contribution to the success of this journal.

COMMITTEE ON PUBLICATIONS

Dee Magnoni, Chairman
William J. Likos, Vice Chairman
Dale F. Bohn, ex officio
Jay Bhatt
K. Russell DePriest
Nikhil Gupta
John E. Haddock
Jason H. Ideker
M. R. Mitchell
Richard W. Neu
Majdi A. Othman
Suzanne Pecore
Sudarsan Rachuri
George E. Totten
W. Jason Weiss

Journal of Testing and Evaluation (ISSN 0090-3973) is published in six issues per year by ASTM International. Some issues, in whole or in part, may be Special Issues forcused on a topic of interest to our readers. The views expressed in this journal are not those of ASTM International. The data and opinions appearing in the published material were prepared by and are the responsibility of the contributors, not of ASTM International.

Copyright © 2018 by ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. All rights reserved. This material may not be reproduced or copied, in whole or in part, in any printed, mechanical, electronic, film, or other distribution and storage media without the written consent of the publisher.

Subscriptions include two formats-online access only or online access plus printed volumes. Individual subscriptions: $273.00 for 1 year online access and $391.00 for 1 year online access plus printed volumes. Institutional subscriptions (one geographic site via IP access): $422.00 for 1 year online access and $629.00 for 1 year online access plus printed volumes. Single copies are $55.00. For multi-site subscription and pricing, please contact Sales or call 1-877-909-ASTM. To subscribe, please send prepaid order to ASTM International, Customer Service, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or visit www.astm.org.

Photocopy Rights: Authorization to photocopy items for internal, personal, or educational classroom use, or the internal, personal, or educational classroom use of specific clients, is granted by ASTM International provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/

Periodicals postage paid at W. Conshohocken, Pa., and at additional mailing offices.

Copyright © 2018 by ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, USA.

1478 **Studying the Statistics of Natural X-ray Pictures**
Praful Gupta, Jack L. Glover, Nicholas G. Paulter Jr., and Alan C. Bovik

1489 **Determination of Trace Elements in High Purity Silver Granules Using Sector Field Inductively Coupled Plasma Mass Spectrometry**
S. Swarupa Tripathy, Swati, Rajiv K. Saxena, and Nahar Singh

1498 **A Novel Approach to Evaluating the Performance of Physical Fitness by Combining Statistical Inference with the Radar Chart**
Yun-Tsan Lin, Tsang-Chuan Chang, and Kuen-Suan Chen

1508 **Seal Strength Evaluation of Flexible Plastic Films by Machine Testing and Human Peeling**
Somporn Nilmanee, Tunyarut Jinkarn, Lerpong Jarupan, Supachai Pisuchpen, and Alaster Yoxall

1518 **Effects of Injection Molding and Storage Conditions on Polypropylene Copolymer**
Zehra S. Kalkan-Sevinc and Michael T. K. Ling

1527 **Guidance for Investigating Calcite Precipitation by Urea Hydrolysis for Geomaterials**
B. S. Shashank, James M. Minto, Devendra Narain Singh, Gráinne El Mountassir, and Charles W. Knapp

1539 **Experimental Study on Lime and Fly Ash–Stabilized Sintered Red Mud in Road Base**
Jiaming Zhang and Chang Li

1548 **Fragmentation Evolution and Fractal Characteristics of Deep Rocks by Lab Compression-Shear Tests**
Shuyun Zhu, Yun Wu, and Liangliang Lu

1559 **Effect of Closely Spaced Twin Tunnel Construction beneath an Existing Subway Station: A Case Study**
Xu Zhang, Chengping Zhang, and Jianchen Wang

1574 **Dynamic Response of Shallow-Buried Tunnels under Asymmetrical Pressure Distributions**
X. L. Jiang, F. F. Wang, H. Yang, P. Y. Lian, J. Chen, J. Y. Niu, and G. C. Sun

1591 **Behavioral Characteristics of Group Batter Piles According to Pile Inclination and Action Direction under Statically Lateral Loads**
Gi-Chun Kang and Jiseong Kim

1610 **Modification Mechanism and Performance of Qingchuan Rock Asphalt–Modified Asphalt**
Limin Li, Zhaoyi He, Weidong Liu, Jianqing Jiang, and Cheng Hu

1622 **An Innovative Method for Interpretation of Asphalt Boil Test**
Akhtarhusein A. Tayebali, Abhilash Kusam, and Christopher Bacchi

1636 **A Test Protocol for Evaluating Absorption of Joints in Concrete Pavements**
M. Tiznobaik and M. T. Bassuoni

1650 **Experimental Study on the Impact Properties of Concrete Bridge Pier Reinforced with Stainless Steel Rebar**
Guoxue Zhang, Ziqing Chen, Juan Lu, Shixiang Xu, and Xiwu Zhou

1659 **Evaluation of a Procedure for Determining the Converted Strength of Calcium Aluminate Cement Concrete**
Matthew P. Adams, Racheal D. Lute, Edward G. Moffatt, and Jason H. Ideker

1673 **Effects of Process Parameters on the Surface Roughness of Stainless Steel 316L Parts Produced by Selective Laser Melting**
Derahman Nur Aqilah, Ab Karim Mohd Sayuti, Yusof Farazila, Dambatta Yusuf Suleiman, Mohd Amran Nor Amirah, and Wan Badiuzaman Wan Nur Izzati

1684 **Theoretical Prediction of Forming Limit Diagrams for B1500HS Steel at Elevated Temperature Based on Modified Arrhenius and M–K Models**
Hongli Hou, Huiping Li, and Lianfang He

1698 **Fatigue Crack Growth Testing and Evaluation for Aluminum Alloys at Temperatures of 25°C and −70°C**
M. D. Liu and J. J. Xiong

1708 **Pitting Formation in Concave-Convex Gears Manufactured from AISI 8620 Steel**
Mahir Uzun, Mehmet Mehdi Münis, and Hayrettin Düzcükoğlu

1715 **Relationship between Computed Rate Constants and the Variability in Maturity-Based Strength Predictions**
Chang Hoon Lee and Kenneth C. Hover

1728 **A New Mixed Poisson Distribution: Modeling and Applications**
Mina Habibi and Akbar Asgharzadeh

TECHNICAL NOTE

1741 **Alternative Setup Apparatus to Test ASTM A944-10 Beam-End Specimens**
Basso Trujillo Pasquale, René Malo, and Marc Jolin

Journal of Testing and Evaluation **is online.**

TAKE ADVANTAGE OF THESE BENEFITS:

Search Papers and Authors
View Abstracts
View Table of Contents
Download Individual Papers
IP access is available

For information, visit: www.astm.org