



Journal of Testing and Evaluation

Editorial Objectives

The **Journal of Testing and Evaluation** is published bimonthly by ASTM, a nonprofit technical organization that develops and publishes voluntary consensus standards and related information for materials, products, systems, and services. All contributions are peer reviewed prior to publication.

The editorial objectives of this journal are to serve a broad-based audience by:

1. Publishing new technical information derived from the field and laboratory testing, performance, quantitative characterization, and evaluation of these materials, products, systems, and services.
2. Presenting new methods and data and critical evaluations of these methods and data.
3. Reporting the users' experience with test methods and the results of interlaboratory testing and analysis.
4. Providing the scientific basis for both new and improved ASTM standards.
5. Stimulating new ideas in the fields of testing and evaluation.

Technical Editor

Alan Wolfenden
Mechanical Engineering
Department
Texas A&M University
College Station, TX 77843

Editorial Board

James C. Abbott
Procter and Gamble
Company
6100 Center Hill Rd.
Cincinnati, OH 45224

George V. Aseff, Sr.
Law Engineering Testing
Company
396 Plasters Ave., N.E.
Atlanta, GA 30324

Ray Bartnikas
Institut de Recherche
d'Hydro-Quebec
1800 Descente, Ste-Julie,
Varenes, Quebec, Canada
J0L 2P0

Gary Burnell
GEC Turbine Generators Ltd.
Rugby, CV21 2NH
Warwickshire, England

Robert J. Goode
Naval Research Laboratory
Code 6301
Washington, DC 20375

Tibor Z. Harmathy
Division of Building Research
National Research Council
Canada
Ottawa, Ontario, Canada
K1A 0R6

Ben M. Hillberry
School of Mechanical
Engineering
Purdue University
W. Lafayette, IN 47907

William H. Hunley
Naval Architecture Engineering
CASDE Corporation
1150 S. Washington St.
Alexandria, VA 22314

William E. Irwin
Armstrong World Industries, Inc.
2500 Columbia Ave.
Lancaster, PA 17604

Adam Jostsons
Australian Atomic Energy
Commission
Sutherland, N.S.W. 2232
Australia

Morris Lieff
County College of Morris
Route 10 and Center Grove Rd.
Dover, NJ 07801

Theodore J. Louzon
AT&T Bell Laboratories
Whippany Rd.
Whippany, NJ 07981

Donald R. Petersen
Omni Tech International
P.O. Box 2237
Midland, MI 48641

Robert S. Shane
Shane Associates, Inc.
238 Hemlock Rd.
Wynnewood, PA 19096

Everett C. Shuman
307 S. Carl St.
State College, PA 16801

P. Aarne Vesilind
Department of Civil and
Environmental Engineering
Duke University
Durham, NC 27706

Takao Wakamatsu
Building Research Institute
1 Tatehara, Oho-Machi,
Tsukuba-Gun
Ibaraki-Prefecture, Japan

Richard J. Wallace
Daniel Construction Company
Daniel Building
Greenville, SC 29602

Ulf Wickström
Statens Provningsanstalt
P.O. Box 857, S-501
15 Borås, Sweden

The American Society for Testing and Materials is not responsible, as a body, for the statements and opinions advanced in this publication.

Journal of Testing and Evaluation (ISSN 0090-3973) is published bimonthly by ASTM as part of the Testing and Evaluation Series, which includes the *Geotechnical Testing Journal* (published quarterly), *Journal of Composites Technology & Research* (published quarterly), and *Cement, Concrete, and Aggregates* (published semi-annually). Publication and editorial offices are located at ASTM Headquarters, 1916 Race St., Philadelphia, PA 19103.

Subscriptions. *United States and Canada* for 1 year \$40.00 (members \$30.00), for 2 years \$70.00 (members \$52.00), and for 3 years \$90.00 (members \$69.00). *Foreign* for 1 year \$45.00 (members \$34.00), for 2 years \$80.00 (members \$60.00), and for 3 years \$105.00 (members \$81.00). Single copies are \$14.00. To subscribe, please send prepaid order to ASTM, Subscription Dept.—JTE, 1916 Race St., Philadelphia, PA 19103. *Journal of Testing and Evaluation* is indexed regularly by Engineering Index, Inc., and is available on microfilm from University Microfilms, a Xerox Co., Ann Arbor, MI. Second class postage paid at Philadelphia, PA. Copyright 1987 by the American Society for Testing and Materials.

Permission to Copy. The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per-copy fee through the Copyright Clearance Center, Inc., Operations Office, P.O. Box 765, Schenectady, NY 12301, for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. (The per copy fee appears as the last four digits of the code at the bottom of the first page of each article.) This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Further information may be obtained from the Copyright Clearance Center's Administrative Office, 310 Madison Ave., New York, NY 10017 (212/697-2525).

Postmaster. Send Form 3579 to ASTM Headquarters, Subscription Dept., 1916 Race St., Philadelphia, PA 19103.

Change of Address. Please return entire addressing label on wrapper to ASTM, Subscription Dept.—JTE, 1916 Race St., Philadelphia, PA 19103, along with new address.

Editorial Staff

Allan S. Kleinberg, *Senior Assistant Editor*
Bette Grugan, *Secretary, Acquisition & Review*
Kathy Greene, *Manager, Acquisition & Review*
Bill Benzing, *Manager, Editorial*
Janet R. Schroeder, *Managing Editor*
M. Bruce Vieth, *Manager of Production*
Robert L. Meltzer, *Vice-President,*
Publications and Marketing

ASTM Officers

Robert Baboian, *Chairman*
W. DeWayne France, Jr., *Vice-Chairman*
David M. Greason, *Vice-Chairman*
Albert J. Bartosic, *Treasurer*
Joseph G. O'Grady, *President*

Directors

Kenneth E. Benson	John A. Millane
Jack A. Bono	Donald M. Preiss
Richard H. Brown	Kenneth L. Reifsnider
Rebecca A. Cohen	Peter E. Schilling
Emery Farkas	Eberhard L. Schuerer
Howard I. Forman	Richard A. Stimson
John A. Heslip	Paul L. Strigner
Raymond G. Kammer	Conrad J. J. Zellweger
Robert W. Macdonald	

Past Chairmen

Gladys B. Berchtold	Lendell E. Steele
---------------------	-------------------

Committee on Publications

Sheldon W. Dean, <i>Chairman</i>	Larry P. Jackson
James S. Perrin, <i>Vice-Chairman</i>	Peter M. Jarrett
John M. Barsom	W. Steven Johnson
Edward P. Bartkus, <i>Ex-officio</i>	Edwin L. Lewis
Thomas W. Crooker	Leonard Mordfin
Gerald Davis	Kenneth R. St. John
William G. Dukek	Clifford G. Scott
	Frank T. Wagner

Information for Authors

The **Journal of Testing and Evaluation** publishes original articles of the following types:

Full-Length Papers (3000–5000 words)

- Reports of Original Investigations (research and field applications papers).
- Review Articles (state-of-the-art or literature reviews).
- Interlaboratory Research Reports (including data and statistical analysis).
- New Procedures (currently under development by a committee or authored by an individual).
- Case Studies (reports and analyses of noteworthy events or situations).

Shorter Technical Communications (500–1500 words)

- Technical Notes (brief papers on specific topics).
- Research Briefs (advance communications that will be followed by full-length papers).
- Conference Reports (extended abstracts).

Commentary (500–1000 words)

- Discussions of Previously Published Papers.
- Letters to the Editor.
- Invited Editorials.
- Reviews of Books and Standards.

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. 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.

The original manuscript and four clear copies, including original illustrations, should be submitted to Kathy Greene, Manager, Acquisitions and Review, ASTM, 1916 Race St., Philadelphia, PA 19103.