



# IJP - International Journal of Pavements

Maintenance and Rehabilitation of Pavements and Technological Control

ISSN 1676-2797

## IJP Founders

Waheed Uddin, USA      Center for Advanced Infrastructure Technology (CAIT)

João Virgílio Merighi, BRAZIL

Rita Moura Fortes, BRAZIL



## IJP International Editorial Board

Waheed Uddin, Professor of Civil Engineering & Director CAIT, The University of Mississippi, USA (Chief Editor)

João Virgílio Merighi, Professor, Mackenzie Presbyterian University, São Paulo, Brazil (Assoc Editor)

Rita Moura Fortes, Professor, Mackenzie Presbyterian University, São Paulo, Brazil (Assoc Editor)

Alan R. Woodside, Professor & Director, TRAC, The University of Ulster, Northern Ireland, UK (Assoc Editor)

Ray Brown, Professor Emeritus of Auburn University, U.S. Army ERDC, Vicksburg, MS, USA (Assoc Editor)

Alex Alves Bandeira, Professor of Construction & Structure, Federal University of Bahia – UFBA, Bahia, Brazil

Bouzhid Choubane, State Pavement Evaluation Engineer, Florida Department of Transportation, USA

José Leomar Fernandes Jr., Professor, Civil Engineering, University of São Paulo–São Carlos Campus, Brazil

Tien Fang Fwa, Professor and Director, Center for Transportation Research, National University of Singapore

Dimitrios G. Goulias, Professor, Civil & Environ Engineering, University of Maryland, College Park, USA

Meor Othman Hamzah, Professor, Civil Engineering, Universiti Sains Malaysia, Penang, Malaysia

Kunnawee Kanitpong, Assistant Professor, Civil Engineering, Asian Institute of Technology, Thailand

Tom Kazmierowski, Manager, Materials Engineering & Research, Ministry of Transportation Ontario, Canada

Philippe Lepert, Division Gestion de l'Entretien, Laboratoire Central des Ponts et Chaussées, France

Moshe Livneh, Professor Emeritus, Transport Res Inst, Technion-Israel Institute of Technology, Haifa, Israel

Andreas Loizos, Professor of Pavement Engineering, National Technical University of Athens, Greece

Massimo Losa, Professor of Road, Railway and Airport Construction, The University of Pisa, Italy

David R. Luhr, State Pavement Management Engineer, Washington State Department of Transportation, USA

Antonio Fortunato Marcon, Professor, Civil Eng., Federal University of Santa Catarina, Santa Catarina, Brazil

Thomas Papagiannakis, Professor, Civil & Environ Engineering, The University of Texas at San Antonio, USA

Paulo Pereira, Professor, Civil & Environ Engineering, Universidade do Minho, Guimarães, Portugal

Robert Otto Rasmussen, Vice President & Chief Engineer, The Transtec Group, Inc., Austin, Texas, USA

John Rolt, Chief Research Scientist, Centre for International Development, TRL Limited, UK

Luís de Picado Santos, Professor of Transport Infrastructures, Technical University of Lisbon, Portugal

Osamu Takahashi, Professor, Civil & Environ Engineering, Nagaoka University of Technology, Japan

Rafiqul Tarefder, Assistant Professor, Civil Engineering, Albuquerque, University of New Mexico, USA

Alex Visser, Professor (Emeritus), Department of Civil Engineering, The University of Pretoria, South Africa

Douglas Wilson, Senior Lecturer, Civil & Environ Engineering, The University of Auckland, New Zealand

David Woodward, Head, Highway Engineering Research, The University of Ulster, Northern Ireland, UK

John P. Zaniewski, Asphalt Technology Professor, West Virginia University, Morgantown, West Virginia, USA

Chuanhao Zheng, Professor, College of Highway Engineering, Chang'an University, Xi'an Shaanxi, China

---

Publications Coordinator – João Virgílio Merighi

CAIT Editorial Assistant – CAIT Staff

Copyright © All rights reserved; no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Publisher.

First published January 2002

Printed in Brazil