# POLISH ACADEMY OF SCIENCES COMMITTEE OF TRANSPORT

# ARCHIVES OF QUARTERLY TRANSPORT

# **ARCHIWUM TRANSPORTU**

ISSN 0866-9546

volume 44 issue 4 Warsaw 2017 Detailed instructions for authors and contacts to editors can be found on journal's webpage: www.archivesoftransport.com

The Archive of Transport is indexed by the Polish Ministry of Science and Higher Education.

All articles are peer-reviewed by two external reviewers. Reviewers list is published once each year in the last issue of the journal and also on journal's webpage.

Copyright © 2017 by Polish Academy of Sciences.

All rights reserved. No part of this publication may be modified, reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from publisher.

The journal is supported by the Polish Academy of Sciences using funds of the Polish Ministry of Science and Higher Education.



Printed by:

Centrum Poligrafii Sp. z o.o., ul. Łopuszańska 53, 02-232 Warszawa.

Circulation 165 copies.

#### ARCHIVES OF TRANSPORT

# Editor-in-Chief

Marianna Jacyna,

Warsaw University of Technology, Poland;

#### Editorial Committee

Andrzej Chojnacki, Andrzej Szarata, Military University of Technology, Cracow University of Technology, Poland: Poland: Agnieszka Merkisz-Guranowska, Adam Weintrit. Poznan University of Technology, Gdynia Maritime University, Poland: Poland:

#### Editorial Advisory Board

Chairman **Deputy Chairman** Marian Tracz. Jerzy Kisilowski, Cracow University of Technology, Poland; University of Technology and Humanities, Poland;

#### Members

Salvatore Cafiso. Raffaele Mauro. University of Catania, Italy; University of Trento, Italy; Laurence R. Rilett, Jan Celko, University of Zilina, Slovakia; University of Nebraska, USA; Csaba Koren, Efim N.Rozenberg, Széchenyi István University of Applied Sciences, Moscow Institute of Railway Engineering (MIIT), Hungary; Russia: Bogusław Liberadzki, Kumares Sinha. Warsaw School of Economics, Poland; Purdue University, USA;

#### Statistical Editor:

**Editorial Secretary:** Tomasz Ambroziak. Konrad Lewczuk. Warsaw University of Technology, Poland; Warsaw University of Technology, Poland; Jolanta Żak. Emilian Szczepański, Warsaw University of Technology, Poland; Warsaw University of Technology, Poland;

# Linguistic Editor

Joseph Woodburn. University of Bristol, United Kingdom;

#### Associate Editors (Subject Editors)

**Transport Engineering** 

Air Transport

Andrzej Chudzikiewicz,

Jerzy Manerowski, Warsaw University of Technology, Poland;

Warsaw University of Technology, Poland; Radim Lenort.

Jozsef Rohacs.

VŠB-Technical University of Ostrava, Czech Republic;

Budapest University of Technology and Economics, Hungary;

#### **Transport Infrastructure and Management**

#### **Maritime Transport**

Gebhard Hafer.

Zbigniew Burciu,

University of Applied Sciences in Berlin, Germany; Edward Michlowicz.

Gdynia Maritime University, Poland; LU Huaging,

AGH University of Science and Technology, Poland;

Zhejiang Ocean University, China;

#### **Optimization and Algorithmic in Transport**

## **Ecology of Transport**

Tadeusz Nowicki, Military University of Technology, Poland; Askoldas Podviezko. Vilnius Gediminas Technical University,

Jerzy Merkisz, Poznan University of Technology, Poland; Vitalii Naumov. Kharkov National Automobile and Highway

Lithuanian;

University, Ukraine;

#### **Logistics Engineering**

### **Telematics in Transport**

Goran Dukic.

Vladimir Hahanov.

University of Zagreb, Croatia; Tomasz Nowakowski.

Kharkov National University of Radioelectronics, Ukraine:

Wroclaw University of Technology, Poland;

Mirosław Siergiejczyk, Warsaw University of Technology, Poland;

#### Railway Transport

#### Transport Safety

Iurii Domin. Volodymyr Dahl East Ukrainian National University, Ukraine: Andrzei Lewiński.`

Geza Tarnai, Budapest University of Technology and Economics Hungary;

*University of Technology and Humanities, Poland;* 

George P. Sakellaropoulos, Aristotle University of Thessaloniki, Greece;

# Road Transport

#### **Mobility in Transport**

Dusan Malindzak, Technical University of Košice, Slovakia; Juan Carlos Villa, Texas A&M Transportation Institute, USA;

Włodzimierz Choromański, Warsaw University of Technology, Poland; Burford J. Furman. San Jose State University, USA;

#### Editorial Committee Contact:

#### ARCHIVES OF TRANSPORT

Faculty of Transport, Warsaw University of Technology Koszykowa 75, 00-662 Warsaw Poland E-mail: archivessecretary@wt.pw.edu.pl

Phone: +48 22 234-58-55

# **Contents**

Andrii V. Antonov, Victor G. Sychenko
Resource evaluation of friction pair "contact wire – contact strip"
Rafał Burdzik, Bogusław Nowak, Jacek Rozmus, Paweł Słowiński,
Jarosław Pankiewicz
Safety in the railway industry
Mariusz Izdebski, Ilona Jacyna-Gołda, Katarzyna Markowska,
Jakub Murawski
Heuristic algorithms applied to the problems of servicing actors in supply chains
Roland Jachimowski
Review of horizontal transport decision problems in the marine intermodal terminal35
Jerzy Mikulski, Karolina Gorzelak
Conception of modernization of a line section example in the context of a fast
railway connection
Tomasz Nowakowski, Paweł Komorski, Franciszek Tomaszewski
The efficiency of tram articulations compared to vibroacoustic emissions55
Michał Taraska, Remigiusz Iwańkowicz
Multi-objective evolutionary method for cargo arrangement in a loading space65
Remigiusz M. Wojtal, Laurence R. Rilett
Development of a statistically-based methodology for analyzing automatic
safety treatments at isolated high-speed signalized intersections
Zhenfeng Wu, Enyu Yang, Wangcai Ding
Design of large-scale streamlined head cars of high-speed trains and aerodynamic
drag calculation