

ISBN 978-83-975865-2-9

# Transport Problems 2026

## INTERNATIONAL CONGRESS PROCEEDINGS



fot. Wojciech Kamiński

UNDER THE HONORARY  
PATRONAGE OF



Silesian  
University  
of Technology



Polish National  
Association of  
Doctoral Candidates

**KRD**



XVIII INTERNATIONAL  
SCIENTIFIC  
CONFERENCE

24-26.06 2026

Katowice - Łódź

22-23.06.2026

Katowice

XV INTERNATIONAL  
SYMPOSIUM OF YOUNG  
RESEARCHERS



Silesian University of Technology  
Faculty of Transport and Aviation Engineering

# Transport Problems 2026

INTERNATIONAL CONGRESS

## Proceedings

XVIII International Scientific Conference

XV International Symposium of Young Researchers

UNDER THE HONORARY PATRONAGE OF



Silesian University  
of Technology



Polish National  
Association of  
Doctoral Candidates



Transport Problems  
*International Scientific Journal*

ISBN 978-83-975865-2-9

*editor-in-chief*

**A. Sładkowski**

*editorial board*

*M. Bepko, P. Czech, M. Cieśla, T. Haniszewski,  
M. Juzek, W. Kamiński, P. Marzec, G. Wojnar*

*CONFERENCE -  
TABLE OF  
CONTENTS*

*SYMPOSIUM -  
AUTHORS LIST*

*CONFERENCE -  
AUTHORS LIST*

*CONFERENCE &  
SYMPOSIUM  
PROGRAM*

*SYMPOSIUM -  
TABLE OF  
CONTENTS*

*CONFERENCE &  
SYMPOSIUM  
PROCEEDINGS*

*CONFERENCE  
PRESENTA-  
TIONS*

*SYMPOSIUM  
PRESENTA-  
TIONS*

**INTERNATIONAL CONGRESS  
“TRANSPORT PROBLEMS”  
22-26 June 2026  
includes  
XVIII International  
Scientific Conference  
TRANSPORT PROBLEMS**

**TABLE OF CONTENTS**

No.	Author, title	Pages	
		Begin	End
1	Aleksandra BARTOSIEWICZ, Renata PISAREK-BARTOSZEWSKA, Adam KUCHARSKI The efficiency of freight-on-board operations at European airports with data envelopment analysis	<a href="#">1</a>	14
2	Aleksandra BARTOSIEWICZ, Renata PISAREK-BARTOSZEWSKA, Adam KUCHARSKI Environmental performance of passenger aircraft: a multi-criteria TOPSIS-based analysis of the Airbus-Boeing duopoly	<a href="#">15</a>	24
3	Krzysztof BIZOŃ Comparison of fem analysis results and measurement results of the magnetic properties of the EU07 locomotive wheel	<a href="#">25</a>	31
4	Nataliia BONDAR, Jacek STROJNY Conceptual framework for the post-war reconstruction of Ukraine’s transport infrastructure	<a href="#">32</a>	43
5	Piotr F. BOROWSKI Transport enterprises Poland–Eurasia facing challenges: strategy, structure, and environmental protection	<a href="#">44</a>	53
6	Irina BRIUCHOVECKAJA, Inga PIŠČIKIENĖ, Danutė PUODŽIUKIENĖ, Jolanta TURBIENĖ Analysis of relative indicators of freight road transport in Lithuania and pPland in the context of the European Union	<a href="#">54</a>	67
7	Magdalena BSOUL-KOPOWSKA, Aleksandra SKRABACZ, Bartosz KOZICKI Integrated air cargo security management: a systematic literature review and conceptual framework	<a href="#">68</a>	79

No.	Author, title	Pages	
		Begin	End
8	Artur BUDZYŃSKI, Csaba CSISZÁR Interpretable machine-learning framework for identifying at-fault participants in road traffic incidents: a nationwide study from Poland	<a href="#">80</a>	96
9	Andrii BUHA, Victor STEPANENKO, Volodymyr KORNIYUK, Ihor SURINOV, Vladimir TORSKIY Comparative analysis of functional capabilities of AIS aids to navigation and modernization option	<a href="#">97</a>	106
10	Leszek BYLINKO Mobility integration asymmetry: the gap between strategic planning (SUMP) and investment practice in Polish cities	<a href="#">107</a>	119
11	Merab CHELIDZE, Victor ZVIADARI, Tamaz NATRIASHVILI Research on the dynamics of electromagnetic vibrators vibrating in rotational oscillations using mathematical modeling	<a href="#">120</a>	131
12	Janusz CHOJNOWSKI Road freight activity and emission intensity in the European Union: an EU-26 panel analysis of decarbonisation readiness, 2013–2024	<a href="#">132</a>	143
13	Ewa CUKIER, Patrycja GUZANEK, Anna BORUCKA, Joanna ANTCZAK Modelling traffic flow on a selected road segment	<a href="#">144</a>	157
14	Angel DANDIKOV, Toma STANKULOV, Rosen IVANOV, Georgi KADIKYANOV, Gergana STANEVA, Iliana MINKOVSKA Experimental investigation of the behavior of lithium-ion batteries at low temperatures and low discharge current	<a href="#">158</a>	166
15	Kostiantyn DERGACHOV, Oleksandr AIZATSKYI End-to-end neural network architecture for 3D spatial positioning of target uavs in intelligent transport systems via monocular RGB imagery	<a href="#">167</a>	175
16	Rafał DROZDOWSKI, Wojciech HOMIK, Ewelina SENDEK – MATYSIAK Comparative analysis of the total cost of ownership (TCO) of electric vehicles (BEV) and combustion engine vehicles (ICE) in the conditions of energy market instability in Poland (2021–2026)	<a href="#">176</a>	186
17	Wiktoria GAŁECKA, Andrzej HANUSIK Micromobility in X-minute cities: a systematic review of barriers and implementation challenges	<a href="#">187</a>	197

No.	Author, title	Pages	
		Begin	End
18	Dinis GARDETE, Rosa LUZIA, Marcelo RAMOS, Fredy FREIRE, Paulo TORRES Cycling comfort assessment using roughness data collected by smartphone sensors	<a href="#">198</a>	206
19	Victoria GITELMAN, Caroline MATTAR An examination of the effectiveness of red-color marking of public transport lanes	<a href="#">207</a>	215
20	Phridon GOGIASHVILI, Shalva KIRTADZE, Isidore KATCHAKHIDZE, Gocha LEKVEISHVILI, Jumber CHOGOVADZE, David KBILASHVILI, Revaz LEKVEISHVILI Reduction of longitudinal dynamic loads from the trailer of a road train tractor by partial braking of the trailer	<a href="#">216</a>	222
21	Andrej GULIČ Transport infrastructure and spatial development in Slovenia	<a href="#">223</a>	234
22	Tomasz HANISZEWSKI, Michał JUZEK The hierarchy of FEA models for split gears: a comparative study of numerical accuracy and complexity considering hyperelasticity, nonlinearity and lateral protection discs	<a href="#">235</a>	242
23	Iryna HEIETS Air connectivity between Australia and New Caledonia	<a href="#">243</a>	255
24	Gezim HOXHA, Afrim GJELAJ, Rifat KRASNIQI, Shaban THAQI Advanced traffic control through the integration of microcontrollers and sensors	<a href="#">256</a>	263
25	Tomasz IWAN Road transport of dangerous goods in statistical terms. Classic and hybrid threats	<a href="#">264</a>	275
26	Vida JOKUBYNIENĖ, Jūratė LIEBUVIENĖ The growth trend in the number of electric vehicles in Lithuania and its impact on GHG emission reduction targets	<a href="#">276</a>	289
27	Georgi KADIKYANOV, Daniel LYUBENOV, Rosen IVANOV, Zhivko KOLEV, Gergana STANEVA, Iliyana MINKOVSKA Empirical analysis of cars low beam light patterns across generations	<a href="#">290</a>	302
28	Wojciech KAMIŃSKI Determining the factors and the degree of their influence on the passenger flows of the tourist narrow-gauge railway	<a href="#">303</a>	314

No.	Author, title	Pages	
		Begin	End
29	Arkadiusz KAMPCZYK, Grzegorz SIERPINSKI Dynamics of railway cars stream flow at a marshalling yard – the role of the digital railway hub	<a href="#">315</a>	327
30	Maciej KOZŁOWSKI, Andrzej CZEREPICKI, Michał KOZŁOWSKI Selected aspects of using large language models (LLMS) on edge devices for controlling autonomous mobile vehicles	<a href="#">328</a>	334
31	Maksym KUROCHKA, Vitalii NAUMOV, Marek BAUER, Piotr KISIELEWKI A framework for modeling public transport networks using open-source data	<a href="#">335</a>	346
32	Adina Gilda LISANDRU Transport-economic development nexus: horizontal and vertical intercorrelations	<a href="#">347</a>	358
33	Vilma LOCAITIENĖ, Ričardas MALKUS, Vytautas DUBRA Applying an integrated PAWSA-TOPSIS approach to prioritise inland waterway transport system risk factors for enhancing regional seaport connectivity	<a href="#">359</a>	374
34	Aleksander MAZURKOW, Wojciech HOMIK The effect of transverse vibrations on the efficiency of operation of a visible torsional vibration damper	<a href="#">375</a>	380
35	Iliyana MINKOVSKA, Gergana STANEVA, Rosen IVANOV, Georgi KADIKYANOV, Daniel LYUBENOV Presentation of a home photovoltaic installation and covering the electricity needs of a household and an electric car	<a href="#">381</a>	391
36	Kateřina NOVÁČKOVÁ, Teodor BALÁŽ, Zbyšek KORECKI, František RACEK, Tomáš HOIKA Risk analysis of the static vertical laser source from the perspective of the threat to air traffic	<a href="#">392</a>	405
37	Myroslav OLISKEVYCH, Igor TARAN Dependence of satisfied truck parking demand on the location and capacity of parking lots	<a href="#">406</a>	416
38	Sławomir OLSZOWSKI, Oleh KLYUS Analysis of the durability of particulate filters in working machines in terms of operating conditions and technical maintenance	<a href="#">417</a>	428

No.	Author, title	Pages	
		Begin	End
39	Michał PAŁĘGA, Mariusz SALWIN, Tomasz CHMIELEWSKI, Magdalena HRYNIEWICKA Integracja oceny ryzyka zawodowego i modelowania kosztów wypadków w operacjach magazynowych: studium przypadku inycdentów z udziałem wózka widłowego	<a href="#">429</a>	443
40	Velizara PENCHEVA, Asen ASENOV, Ivan GEORGIEV, Svetoslav BABANOV, Vyarka RONKOVA, Maya MARKOVA A forecasting protocol for transport-related urban air pollution with comparison of univariate, seasonal, multivariate and selective dynamic models for PM2.5, PM10, O3 and NO2	<a href="#">444</a>	457
41	Velizara PENCHEVA, Asen ASENOV, Stanimir PENEV, Kalcho PETKOV A spatio-temporal clustering and hotspot identification of urban road traffic accidents: evidence from Ruse, Bulgaria 2021-2025	<a href="#">458</a>	471
42	Agung RIYARDI, Mohd FAHMY-ABDULLAH, Fatchan ACHYANI, Mahameru Rosy ROHMATULLAH Governing the interchange: associating bus station comprehensive regulation with equilibrium	<a href="#">472</a>	479
43	Elkhan SABZIYEV, Tofiq BABAYEV, Khalida MELIKOVA Digital logistics platform of Azerbaijan: a single window approach to trade facilitation and digital transformation of transport corridors	<a href="#">480</a>	489
44	Mariusz SALWIN, Tomasz CHMIELEWSKI, Maria KOCOT, Magdalena MACIASZCZYK, Bartosz BŁASZCZAK, Michał PAŁĘGA Organisational agility in transport – the expectations of the young generation towards modern transport services	<a href="#">490</a>	501
45	Stasys STEIŠŪNAS, Gediminas VAIČIŪNAS, Darius LAURINAVIČIUS Forecasting changes in the track gauge of railway sidings	<a href="#">502</a>	513
46	Svetla STOILOVA, Ivan PULEVSKI A multi-objective optimization approach for trolleybus transportation planning	<a href="#">514</a>	528
47	Bożena SZCZUCKA-LASOTA, Tomasz WĘGRZYN, Bogusław ŁAZARZ, Adam DÓRING, Artur LABUS, Paweł PIOTROWICZ, Krzysztof WILCZYŃSKI, Patrycja LASOTA Regeneration of vehicle alternators using Sn-Bi solders	<a href="#">529</a>	535

No.	Author, title	Pages	
		Begin	End
48	Igor TARAN, Mateusz SZARATA, Kamil KOWALSKI Structural analysis of the Rzeszów railway network using empirical passenger flow data	<a href="#">536</a>	552
49	Stanislav TIMAR Automation of repair queue formation based on key risk indicators	<a href="#">553</a>	557
50	Robert TOMANEK ESG as a management and decarbonisation tool for the municipal sector	<a href="#">558</a>	569
51	Giorgi TUMANISHVILI, Tengiz NADIRADZE, George TUMANISHVILI, Merab KAKHIANI Experimental research of lubricating materials for steering surfaces of wheels and rails	<a href="#">570</a>	575
52	Gocha TUTBERIDZE, Gocha UGULAVA Transport investment and growth transmission channels in Georgia: structural econometric analysis	<a href="#">576</a>	600
53	Tomasz WĘGRZYN, Bożena SZCZUCKA-LASOTA, Bogusław ŁAZARZ, Artur LABUS, Paweł PIOTROWICZ, Adam DÖRING, Marek OŻAROWSKI, Patrycja LASOTA Copper braze welding for bus air conditioning systems	<a href="#">601</a>	607
54	Anna WOŹNICA-HANUSIK Pedestrian accessibility of tram stops: a GIS-based study of the Katowice southern tram line	<a href="#">608</a>	620
55	Xiaozhou YE Effects of free trials on bike-sharing adoption across commuter groups: a motivational stage-based approach	<a href="#">621</a>	644
56	Oleg ZAGURSKIY, Liliya SAVCHENKO, Svetlana ZAGURSKA, Anatolii POHORILYI Assessment of risks of cargo security during road transportation	<a href="#">645</a>	656
57	Mateusz ZAWADZKI, Aneta OCIECZEK, Adam KAIZER Electromobility as an alternative to traditional transport in the context of striving for sustainable development	<a href="#">657</a>	667
58	Janusz SZPYTKO Sustainable development of transport systems and devices	<a href="#">869</a>	873

**INTERNATIONAL CONGRESS  
“TRANSPORT PROBLEMS”  
22-26 June 2026  
includes  
XV International Symposium  
of Young Researchers  
TRANSPORT PROBLEMS**

**TABLE OF CONTENTS**

No.	Author, title	Pages	
		Begin	End
1	Lorenzo BROCCINI, Antonio PRATELLI, Daniele CONTE, Alessandro FARINA, Massimiliano PETRI A sustainable approach to tourism logistics: the “portable” research project	<a href="#">668</a>	681
2	Aleksander CETNAR, Szymon JAROSZ, Michał BIDAS, Wioletta CEBULSKA Analysis of drone propeller damage under operational conditions for selected materials	<a href="#">682</a>	690
3	Tatiana DUDNIK, Aleksander SŁADKOWSKI Analysis of transport flows in a context of political instability	<a href="#">691</a>	700
4	Andrzej FELSKI, Krzysztof JASKÓLSKI, Marek KUBICKI Is the ALPHA Russian radionavigation system still active?	<a href="#">701</a>	716
5	Wasihun KENO, Janusz SZPYTKO Reliability and life-cycle cost assessment of urban bus fleet maintenance strategies using Weibull analysis and multi-criteria decision analysis	<a href="#">717</a>	727
6	Wasihun KENO, Janusz SZPYTKO Leak detection mechanisms in large-format batteries for electrified public mass transport: safety, lifecycle impacts, and system-level integration	<a href="#">728</a>	739
7	Daud KHAN, Katarzyna MARKOWSKA Modeling fuel consumption and transportation emissions in mixed traffic based on driver response	<a href="#">740</a>	750
8	Marcin MICIAK, Nicolas KEPA, Łukasz GERST, Maria CIEŚLA Analysis of air traffic and assessment of the attractiveness and possibilities of aviation training in the Silesian voivodeship	<a href="#">751</a>	761

No.	Author, title	Pages	
		Begin	End
9	Filip NOWAK, Nikola TRAFAS, Maria CIEŚLA Apatial analysis of truck parking areas and attractiveness assessment of highway service areas in southern Poland	<a href="#">762</a>	773
10	Aleksander SŁADKOWSKI, Aman SHAKENOV, Assem UTEGENOVA, Ainura ORUMBASSAROVA, Ivan STOLPOVSKIKH Assessment of the dynamic impact of road defects on the suspension elements of quarry dump trucks	<a href="#">774</a>	789
11	Aleksander SOBOTA, Mateusz JAROSIK Research into the correctness of adopting values for inter-stop travel times – a case study for selected bus lines organised by the metropolitan transport authority	<a href="#">790</a>	797
12	Szymon SURMA, Mateusz JURCZAK, Jerzy ŁUKASIK, Michał MATOWICKI The use of photovoltaics to power crossing systems	<a href="#">798</a>	811
13	Maciej SZKODA, Weronika ŚRENIAWSKA A life cycle cost (LCC) model for urban buses that takes into account long-term operating costs and environmental impact	<a href="#">812</a>	823
14	Komil TURAEV, Daniela BARIĆ, Silvestar GRABUŠIĆ A methodological framework for regional railway dataset development in PTV VISUM : application to the Uzbekistan railway network	<a href="#">824</a>	831
15	Changlin WANG, Xiaoyun TANG, Xuelin WANG, Qian LI, Zhumadil BAIGUNCHEKOV Design and application research of a bionic multi-fingered intelligent gripping system for underwater pipeline inspection robots	<a href="#">832</a>	841
16	Artur WOLAK, Kamil FIJOREK, Radosław WOLNIAK Perceived counterfeit risk and trust architecture in the engine oil market: evidence from a digital automotive community	<a href="#">842</a>	855
17	Tomasz ZONTEK Perceived value and perceived risk as determinants of students' willingness to use ride-sharing services: a PLS-SEM study from Poland	<a href="#">856</a>	868