

# NEW HORIZONS 2023



IX International Symposium

## NEW HORIZONS 2023

*of transport and communications*

24-25 November

University of East Sarajevo  
Faculty of Transport and Traffic Engineering Doboј



## BOOK OF ABSTRACTS



[www.novihorizonti.sf.ues.rs.ba](http://www.novihorizonti.sf.ues.rs.ba)

IX International Symposium NEW HORIZONS 2023  
of Transport and Communications

*Organizer:*

**University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj**

*Co-organizers:*

Faculty of Transport and Traffic Engineering, University of Belgrade;

Faculty of Technical Sciences, University of Novi Sad,

Faculty of Technical Sciences Bitola, University of St. Kliment Ohridski

Faculty of Traffic and Communications, University of Sarajevo

The Faculty of Technical Sciences in Kosovska Mitrovica

**BOOK OF ABSTRACTS**

- NH 2023 -

Edited by:

PhD Zoran Čurguz

PhD Bojan Marić

PhD Mirko Stojčić

MSc Vladimir Malčić

Doboj, 2023

© 2023

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without prior written permission from the publisher.

Publisher:

University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj

Circulation: 200

CIP - Каталогизација у публикацији  
Народна и универзитетска библиотека  
Републике Српске, Бања Лука

656.1/.2(048.3)(0.034.4)

INTERNATIONAL Symposium New Horizons of  
Transport and Communications (9 ; 2023 ; Doboj)

Book of abstracts / IX International Symposium  
New Horizons 2023 of Transport and Communications,  
Doboj, 2023 ; edited by Zoran Čurguz ...[et al.] ;  
organizer/organizator University of East Sarajevo,  
Faculty of Transport and Traffic Engineering Doboj. -  
Doboj : Faculty of Transport and Traffic Engineering,  
2023. str.75

Системски захтјеви: Нису наведени. - Abstracts.

ISBN 978-99976-12-04-5

COBISS.RS-ID 139368961

## PROGRAM COMMITTEE

*Alphabetically:*

Jiří AMBROS	Transport Research Centre, Czechia
Boris ANTIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Ibrahim Ahmed BADI	University of Misurata, Department of Mechanical Engineering, Libya
Milan BANIC	University of Niš, Faculty of Mechanical Engineering, Serbia
Milorad BANJANIN	University of Novi Sad, Faculty of Technical Sciences, Serbia
Ivan BELOŠEVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Vuk BOGDANOVIĆ	University of Novi Sad, Faculty of Technical Sciences, Serbia
Nebojša BOJOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Branislav BOŠKOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Ranko BOŽIČKOVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Mirjana BUGARINOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Alem ČOLAKOVIĆ	University of Sarajevo, Faculty of Traffic and Communications
Zoran ČURGUZ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Slavko ĐURIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Tihomir ĐURIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Ratko ĐURIČIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Hamed FAZLOLLAHTABAR	University of Science and Technology Babol, Department of Industrial Engineering, Iran
Draženko GLAVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Miloš IVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Dragoslav JANOŠEVIĆ	University of Niš, Faculty of Mechanical Engineering, Serbia
Goran JAUŠEVAC	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Gordana JOTANOVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Dragan JOVANOVIĆ	University of Novi Sad, Faculty of Technical Sciences, Serbia
Predrag JOVANOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Jadranka JOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Pavle KECMAN	Allianz, The Netherlands
Miroslav KOSTADINOVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Nikola KRSTANOSKI	University of St. Kliment Ohridski, Faculty of Technical Sciences Bitola, Macedonia
Krsto LIPOVAC	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Bojan MARIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Dejan MARKOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Goran MARKOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Peter MARTON	University of Žilina, Faculty of Management Science and Informatics, Slovakia
Boško MATOVIĆ	University of Montenegro, Faculty of Mechanical Engineering, Montenegro
Aleksandar MIĆOVIĆ	University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica
Suzana MILADIĆ TEŠIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Sanjin MILINKOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Miloš MILOŠEVIĆ	University of Niš, Faculty of Mechanical Engineering, Serbia

Milan MILOTIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Petar MIROSAVLJEVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Dušan MLADENOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Snežana MLADENOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Markos PAPAGEORGIOU	Technical University of Crete, School of Production Engineering and Management, Greece
Norbert PAVLOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Dragan PERAKOVIĆ	University of Zagreb, Faculty of Transport and Traffic Sciences, Croatia
Dalibor PEŠIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Goran PETROVIĆ	University of Niš, Faculty of Mechanical Engineering, Serbia
Miloš PLJAKIĆ	University of Priština, Faculty of Technical Sciences, Kosovska Mitrovica, Serbia
Đorđe POPOVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Aleksandar RIKALOVIĆ	University of Novi Sad, Faculty of Technical Sciences, Serbia
Andreas SCHÖBEL	Vienna University of Technology, Institute of Transportation, Austria
Marko SLAVULJ	University of Zagreb, Faculty of Transport and Traffic Sciences, Croatia
Siniša SREMAC	University of Novi Sad, Faculty of Technical Sciences, Serbia
Dušan STAMENKOVIĆ	University of Niš, Faculty of Mechanical Engineering, Serbia
Aleksandar STEVANOVIĆ	University of Pittsburgh, Civil and Environmental Engineering, SAD
Aleksandar STJEPANOVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj
Mirko STOJČIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj
Gordan STOJČIĆ	University of Novi Sad, Faculty of Technical Sciences, Serbia
Marko SUBOTIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Marko ŠEVROVIĆ	University of Zagreb, Faculty of Transport and Traffic Sciences, Croatia
Snežana TADIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Ilija TANACKOV	University of Novi Sad, Faculty of Technical Sciences, Serbia
Slaven TICA	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Marko VASILJEVIĆ	University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Bosnia and Herzegovina
Slavko VESKOVIĆ	University of Belgrade, Faculty of Transport and Traffic Engineering, Serbia
Milan VUJANIĆ	Adriatic University Bar, Faculty of Traffic, Communications and Logistics Budva, Montenegro
Jianhong WU	Beijing Jiaotong University, School of Economics and Management, China
George YANNIS	National Technical University of Athens, Greece
Milan ZLATKOVIĆ	University of Wyoming, Department of Civil and Architectural Engineering, SAD

## ORGANIZING COMMITTEE

Bojan MARIĆ, chair  
Mirko STOJČIĆ, co-chair  
Ratko ĐURIČIĆ  
Marko VASILJEVIĆ  
Aleksandar STJEPANOVIĆ  
Goran KUZMIĆ  
Tanja PETROVIĆ  
Vladimir MALČIĆ  
Sanja SIMIĆ  
Milan EREMIJA  
Željko VIDOVIĆ

## CONTENTS

### INVITED LECTURES

#### ROAD PAVEMENT CONSTRUCTION TECHNOLOGY TAKING INTO ACCOUNT THE COMPOSITION OF THE ASPHALT GRANULOCONCRETE MIXTURE

Konstantin Andrianov

Anatoliy Zubkov ..... 2

#### CAPACITY BUILDING IN HIGHER EDUCATION IN THE FIELD OF TRANSPORTATION OF A DANGEROUS GOODS IN THE WESTERN BALKAN COUNTRIES – DGTRANS

ERASMUS+

Aleksandra Petrović..... 2

### PLENARY PAPER

#### RAILWAY STATIONS: CAPACITY & PERFORMANCE ASSESSMENT OF TRACK LAYOUTS

Ivan Belošević..... 4

### INVITED PAPER

#### THE METHOD OF THE RESEARCH LOOP OF TELETRAFFIC IN THE STRUCTURE OF THE SYSTEM OF PUBLIC URBAN PASSENGER TRANSPORT

Milorad Banjanin, Radenka Bjelošević, Milan Vasiljević, Mirko Stojčić, Aleksandar Đukić ..... 6

### PAPERS

#### PREMIUM ROAD MARKINGS: ONE TIME HIGHER EXPENSE FOR LOWER OVERALL COST

Tomasz E. Burghardt, Anton Pashkevich..... 9

#### THE IMPORTANCE OF DRIVER FATIGUE MANAGEMENT IN TRANSPORT COMPANIES

Jelica Davidović, Dalibor Pešić, Boris Antić..... 10

#### INVESTIGATION OF THE INFLUENCE OF PASSENGER VEHICLE TIRES ON BRAKING EFFICIENCY

Darius Astrauskas..... 11

#### IMPORTANCE OF ECO-DRIVING AND DIFFERENCE IT MAKES IN FUEL CONSUMPTION

Manvydas Bagavičius ..... 12

#### IMPROPER AND INSUFFICIENT COMPLIANCE WITH THE REGULATIONS AND RULES IN ROAD TRAFFIC AND THE IMPACT OF THAT FAILURE ON THE SAFETY OF TRAFFIC PARTICIPANTS

Dragana Agić, Muhamed Barut, Fuad Klisura, Mustafić Ibrahim ..... 13

#### INTELLIGENT TRANSPORTATION SYSTEMS AS A SOLUTION FOR REDUCING FATAL CRASHES

Dragan Radovanović ..... 14

#### TEMPORAL ANALYSIS OF TRAFFIC ACCIDENTS WITH PEDESTRIANS IN KRAGUJEVAC

Veselinka Jokić, Miloš Pljakić ..... 15

#### IMPACT ANALYSIS TECHNICAL CONDITION OF VEHICLES ON ROAD SAFETY

Vojislav Krstić, Bojan Marić, Aleksandar Mićović, Radoje Jovanović..... 16

VIDEO SURVEILLANCE FOR AUTOMATIC NUMBER PLATE RECOGNITION AND DETECTION OF TRAFFIC VIOLATIONS AND COORDINATED OPERATION OF TRAFFIC LIGHTS IN SPEED REDUCTION MEASURES AS AN IDENTIFIABLE FACTOR IN THE CAUSE OF A TRAFFIC ACCIDENT	
Miroslav Derikonjić, Đorđe Fazekaš, Bogdan Radin .....	17
SEIZURE OF VEHICLES AS A PROTECTIVE MEASURE AGAINST MULTIPLE TRAFFIC OFFENDERS	
Goran Bošnjak, Milan Salamadija.....	18
APPLICATION OF INFRASTRUCTURE SAFETY MANAGEMENT WITH SPECIAL ATTENTION TO THE M10 ROAD IN MONTENEGRO	
Vladimir Ilić, Dragan Jovanović, Milanko Damjanović, Radoje Vujadinović, Boško Matović ..	19
LEGAL BASIS AND REGULATIONS FOR THE IMPLEMENTATION OF ROAD WORK ZONES IN THE REPUBLIC OF SERBIA	
Dalibor Pešić, Aleksandra Obradović.....	20
ANALYSIS OF PARENT'S INFLUENCE ON CHILDREN'S BEHAVIOR IN TRAFFIC	
Boris Antić, Vojislav Krstić, Dragan Stanimirović, Aleksandar Mićović, Mesud Ajanović .....	21
VEHICLE FLOW AS A CRITERION FOR THE IMPLEMENTATION OF LIGHT SIGNALING	
Bojana Ristić .....	22
BL BUSTRACKER: A DISTRIBUTED SYSTEM FOR BUS TRACKING	
Drazen Brdjanin, Danijela Banjac, Dragan Jovic, Filip Stojakovic, Aleksandar Bosancic .....	23
EXPERIMENTAL INVESTIGATION OF OPTIMAL FLEXIBLE PAVEMENT MODELS FROM GRAINED ASPHALT COMPONENTS OF USED PAVEMENT	
Edis Softić, Marko Subotić, Elvir Jusić, Željko Stević .....	24
PROBLEMS AND PROPOSED SOLUTIONS FOR THE PLANNING OF PUBLIC TRANSPORT IN BITOLA	
Vaska Atanasova, Marija Stojanoska, Nikola Krstanoski.....	25
THE FACTORS ASSOCIATED WITH DRIVING UNDER THE INFLUENCE OF ALCOHOL	
Emir Smailović, Dalibor Pešić, Boris Antić, Nenad Marković .....	26
IMPROVING THE EFFICIENCY OF LOCAL COMMUNITY VEHICLE FLEETS	
Pavle Gladović, Božo Ilić, Vesko Lukovac, Vladimir Popović.....	27
MODEL FOR RESEARCH AND ANALYSIS OF TRAFFIC SAFETY CONDITIONS FOR TRACTOR DRIVERS IN THE REPUBLIC OF SERBIA	
Đorđe Vranješ, Bojan Marić, Goran Tričković, Zdravko Tarlać .....	28
EVALUATION OF THE COMPATIBILITY FACTOR OF THE VEHICLE COLLISION PROCESS IN REAL TRAFFIC ACCIDENTS	
Goran Mihaljčić, Bojan Mihaljčić, Vuk Bogdanović, Tihomir Đurić.....	29
HOW TO IMPROVE THE PASSIVE SAFETY OF ROADS?	
Demeter Prislan .....	30
COMPARATIVE ANALYSIS OF DATA OBTAINED FROM THE DIGITAL TACHOGRAPH, DRIVER'S CARD AND TRAVEL ORDERS PN-3	
Đorđe Popović, Saša Petrović, Tihomir Đurić, Slaviša Gačić .....	31
COMPARISON OF ROLLER BRAKING FORCE RESULTS ON THE SAME VEHICLE AT TWO DIFFERENT VEHICLE INSPECTION STATIONS	
Đorđe Popović, Slaviša Gačić, Saša Petrović, Adaleta Skula .....	32

<b>THE CHOICE OF TYRES AS A SAFETY FACTOR IN TERMS OF ACTUAL AND DISPLAYED SPEED</b>	
Sanja Rakić, Zoran Ristikić, Miroslav Pavlović, Miloš Ninković.....	33
<b>ELECTRIC VEHICLE POWERTRAIN DESIGN</b>	
Zoran Ristikić, Svetko Milutinović, Milan Eremija, Miroslav Pavlović, Ernad Ajanović .....	34
<b>INFLUENCE OF THE APPLICATION OF BIODIESEL FUEL ON THE DRIVE AND ENVIRONMENTAL CHARACTERISTICS OF INTERNAL COMBUSTION ENGINES</b>	
Milan Eremija, Snežana Petković, Pero Dugić, Zoran Ristikić, Svetko Milutinović .....	35
<b>ROAD MOTOR VEHICLE FIRES AND IMPACTS ON THE ENVIRONMENT</b>	
Dragiša Đorđić, Slavko Đurić, Milan Milotić, Džana Dubinović .....	36
<b>MODELING THE DISTRIBUTION OF DANGEROUS AIR-POLLUTANTS AND IT SUPPORT IN TRAFFIC ACCIDENTS</b>	
Venezija S. Ilijazi, Jelena S. Lamovec, Stevo K. Jaćimovski, Jovan P. Šetrajčić .....	37
<b>ELECTRIC VEHICLES</b>	
Aleksandar Mićović, Živorad Ristić, Vojislav Krstić, Slobodan Makragić .....	38
<b>IMPACT OF MOTOR VEHICLES ON THE ENVIRONMENT</b>	
Zoran Ćurguz, Ivan Krstić, Miroslav Kostadinović, Siniša Božićković, Božidar Krstić .....	39
<b>POSSIBILITIES FOR DETERMINATION OF THE OPTIMAL STRATEGY FOR PREVENTIVE MAINTENANCE OF THE VEHICLE ELECTRICAL EQUIPMENT USING MULTI-CRITERIA OPTIMIZATION</b>	
Zoran Ćurguz, Ivan Krstić, Miroslav Kostadinović, Božidar Krstić .....	40
<b>THE INFLUENCE OF CALL CENTER ON LOGISTICS PROCESSES</b>	
Amel Kosovac, Elvedin Hasanović, Adisa Medić .....	41
<b>IMPLEMENTATION AND POSSIBILITIES OF BUILDING CITY LOGISTICS IN THE AREA OF THE CITY MUNICIPALITIES OF THE CITY OF SARAJEVO</b>	
Amel Kosovac, Elvedin Hasanović, Adisa Medić .....	42
<b>RELOCATION LOGISTICS: FLOWS, STAKEHOLDERS AND SERVICES</b>	
Snežana Tadić, Miloš Veljović, Veljko Vidojević, Mladen Krstić, Slobodan Zečević.....	43
<b>CROSS – DOCKING CONCEPT IN INTERMODAL TRANSPORTATION</b>	
Mladen Krstić, Biljana Mićić, Snežana Tadić, Slobodan Zečević .....	44
<b>THE IMPACT OF MICRODEPOTS ON THE EFFICIENCY OF URBAN DISTRIBUTION</b>	
Stevan Veličković, Jelena Milutinović, Biljana Grgurović, Slavica Radosavljević .....	45
<b>REGARDING THE MATTER OF TARE-PIECE CARGO STORAGE CAPACITY</b>	
Ilesaliev D.I., Ismatullaev A.F., Mustanov O.G.....	46
<b>ANALYSIS AND CONCLUSIONS ON THE IMPACT OF TRANSPORT CONTAINERS ON TRANSPORTATION CONDITIONS</b>	
Ilesaliev D.I., Svetashev A.A., Ismatullaev A.F., Shikhnazarov J.A.....	47
<b>SPECIFICITIES OF REGENERATIVE BRAKING AND RECOVERY OF ELECTRICAL ENERGY FOR ELECTRIC BUS</b>	
Slobodan Mišanović .....	48
<b>FORENSICS OF PORSCHE CARRERA GT FIRE CASE PRESENTATION</b>	
Vojkan M. Zorić, Jovan P. Šetrajčić .....	49



IMPACT OF THE IMPLEMENTATION OF DIGITAL AUTOMATIC COUPLING ON WORKING CONDITIONS OF SHUNTING STAFF	
Adrian Wagner, Fabián Figueroa Valle, Frank Michelberger .....	50
ENERGETIC COMPARISON OF LOCAL FREIGHT SERVICE WITH DUAL-SOURCE VEHICLES	
Martin Chýle .....	51
ASSESSMENT OF TERMINAL STATIONS OPERATION: AN INTEGRATED METHODOLOGY	
Gabriele Malavasi, Stefano Ricci .....	52
RAIL FACTOR AND ITS PERCEPTION IN SMALLER REGIONS – LOVOSICE CASE STUDY	
Stanislav Metelka, Vít Janoš.....	53
A SUSTAINABLE ALTERNATIVE FOR RAILROAD NOISE BARRIER	
Hirut Grossberger, Lukas Stock, Frank Michelberger, Andrea Jandl – Rieger.....	54
BUILDING A COMMUNITY OF RAILWAY SCIENTIFIC RESEARCHERS AND ACADEMIA	
Peter Márton, Armando Carrillo Zanuy .....	55
FUZZY-FMEA APPROACH FOR RISK ANALYSIS OF SWITCH ELEMENTS	
Milivoje Ilić, Norbert Pavlović, Ivan Belošević .....	56
MODEL OF REGULATION OF THE RAILWAY TRANSPORT MARKET IN BOSNIA AND HERZEGOVINA	
Ratko Đuričić, Nermin Čabrić, Danijela Despotović, Vladimir Malčić .....	57
REVIEW TO THE STRUCTURE OF TRACK ACCESS CHARGES FOR SMALL RAILWAY NETWORKS	
Vladimir Malčić, Branislav Bošković, Mirjana Bugarinović, Ratko Đuričić .....	58
IDENTIFICATION OF CRITERIA FOR RESILIENCE ASSESSMENT OF THE PUBLIC RAILWAY OPERATOR IN OPEN RAILWAY MARKET CONDITIONS	
Tihomir Subotić, Branislav Bošković.....	59
NON - CONTACT MEASUREMENT OF TRACK GEOMETRY PARAMETERS	
Mladen Žarković, Željko Mitrović, Lazar Mosurović, Jovo Steljić, Filip Šćekić .....	60
SAFETY OF PASSENGERS ON PLATFORMS IN RAILWAY STATIONS AND STOPS	
Zdenka Popović, Luka Lazarević, Jaroslav Matuška.....	61
THE RELATIONSHIP OF THE EFFICIENCY INDEX OF EUROPEAN RAILWAYS AND THE QUALITY OF THE RAILWAY INFRASTRUCTURE	
Drago Pupavac.....	62
RAIL TRAFFIC SAFETY BASED ON ADVANCED INTERNET TECHNOLOGIES	
Zoran G. Pavlović, Veljko Radičević, Marko Bursać, Miloš Milanović, Nevena Veljović.....	63
DYNAMICS OF EXECUTION OF EVENTS IN THE PROCESS STRUCTURES OF THE TRAFFIC INSPECTION	
Aleksandar Đukić, Radenka Bjelošević, Milan Vasiljević, Milorad Banjanin, Mirko Stojčić.....	64
APPLICATION OF DIGITAL SOLUTIONS IN POSTAL SERVICES	
Biljana Grgurović, Slavica Radosavljenić, Jelena Milutinović, Stevan Veličković .....	65
THE USE OF BIG POSTAL DATA AS A NEW BUSINESS OPPORTUNITY FOR POSTAL OPERATORS	
Jelena Milutinović, Slavica Radosavljenić, Biljana Grgurović, Stevan Veličković .....	66

TELEMATICS SYSTEMS IN DANGER GOOD TRANSPORT Aleksandar Stjepanović, Miroslav Kostadinović, Goran Kuzmić, Mario Radonjić, Milana Sredojević .....	67
APPLICATION OF RFID TECHNOLOGY IN IDENTIFICATION AND MEASUREMENTS - CASE STUDY ATHLETIC RACE Žarko Jovanović .....	68
MODEL OF MONITORING LINUX BASED PLATFORM IN LARGE CORPORATE NETWORK Sanja Jevtić, Dragan Jevtić, Marko Bursać, Marija Zajeganović .....	69
MODEL OF CYBER-PHYSICAL SYSTEM FOR TRACKING AND PREDICTION OF POSTAL DELIVERY TIMES Mirko Stojčić, Đorđe Popović, Maid Husić, Nataša Đalić, Tanja Kostadinović .....	70
TECHNICAL ASPECTS OF APPLICATION OF ELECTRONIC SIGNATURE IN BUSINESS SYSTEMS Salih Husaković, Bojana Ristić .....	71
IMPLEMENTATION OF A SENSOR SYSTEM IN TRAFFIC BASED ON THE ZIGBEE PLATFORM Tanja Kostadinović, Amer Sarajlić, Aleksa Mirčetić .....	72
PROPOSAL FOR THE TECHNICAL SOLUTION OF INTELLIGENT LIGHT SIGNALING Tanja Kostadinović, Darko Spasojević, Svetko Milutinović, Vanja Vanovac .....	73
CONCENTRATION OF ECONOMIC ACTIVITIES OF THE REPUBLIC OF SRPSKA AND THEIR INFLUENCE ON EMPLOYMENT AND STRATEGIC DECISIONS Siniša Božičković, Cviko Jekić, Goran Mitrović, Adaleta Skula, Željka Filipović .....	74



## **INVITED LECTURES**

**ROAD PAVEMENT CONSTRUCTION TECHNOLOGY TAKING INTO  
ACCOUNT THE COMPOSITION OF THE ASPHALT GRANULOCONCRETE  
MIXTURE**

**Konstantin Andrianov**

**Anatoliy Zubkov**

*Tambov State Technical University, Department "Town planning and roads", gsiad@mail.tambov.ru.*

---

**CAPACITY BUILDING IN HIGHER EDUCATION IN THE FIELD OF  
TRANSPORTATION OF A DANGEROUS GOODS IN THE WESTERN BALKAN  
COUNTRIES – DGTRANS ERASMUS+**

**Aleksandra Petrović**

*University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Department of Traffic and Transport,  
aleksandra.petrovic@pr.ac.rs*

## **PLENARY PAPER**

## RAILWAY STATIONS: CAPACITY & PERFORMANCE ASSESSMENT OF TRACK LAYOUTS

Ivan Belošević

University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
i.belosevic@sf.bg.ac.rs

---

**Abstract:** Stations have a key role in the smooth functioning of railways as they often limit the rail network capacity. Interrelations between track layouts and operational performances are important for reducing bottleneck effects and need to be assessed within the planning and design process, either for new lines or lines under reconstruction. This paper reviews approaches used to gain comprehensive knowledge about the quality of station track layouts. In the literature, the assessment of track layouts has been considered primarily with respect to capacity analysis as a single-criterion approach. Apart from many single criterion approaches directed to measure track occupancy and optimize capacity utilization, additional aspects could be incorporated to obtain various measures of complexity and robustness for track layouts emphasising operational, safety and/or cost efficiency. Developed methods provide an improved understanding of the trade-offs between track layout complexity and costs. The applicability of developed models is demonstrated using syntactic data and realistic case studies on the Serbian railway network.

**Key words:** stations, rail network capacity, track layouts, capacity analysis, operational performances

---

## **INVITED PAPER**



## THE METHOD OF THE RESEARCH LOOP OF TELETRAFFIC IN THE STRUCTURE OF THE SYSTEM OF PUBLIC URBAN PASSENGER TRANSPORT

Milorad Banjanin<sup>a</sup>, Radenka Bjelošević<sup>b</sup>, Milan Vasiljević<sup>c</sup>, Mirko Stojčić<sup>b</sup>, Aleksandar Đukić<sup>c</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Philosophy Pale, Alekse Šantića 1, Pale 71420, Bosnia and Herzegovina,  
milorad.banjanin@ff.ues.rs.ba

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia  
and Herzegovina, bjelosevicradenka@gmail.com, mirko.stojcic@sf.ues.rs.ba

<sup>c</sup> Bosnia and Herzegovina, milanvasiljevic84@gmail.com, djukicaleksandar1990@gmail.com

---

**Abstract:** The system of public urban passenger transport (JGTP) is most often presented in the literature as an open, complex or very complex organizational-technological system for the production of transport services. It is emphasized that the functioning of JGTP takes place in the conditions of stochastic changes in the state of meeting the transport needs and demands of its users. It is preferred that the objective function, structure and functioning are particularly important features of this system, where it can be seen that these features deserve a more thorough determination. In this paper, the fact that JGTP is an engineering system that represents a complex matrix of hardware and software structural components and their elements in intra-system and extra-system interactions is apostrophized. This means that the structure of the system is given by hardware and software, which leads to the conclusion of its multidimensionality. Structural dimensions are the target function or mission of the system, organizational, functional, communication-interactional, informational-spatial and shopping structure. In all the mentioned dimensions, the role of communication systems and processes is indispensable. The task of the objective function is to maintain the fully structured JGTP system in full operational readiness, functional capability and reliability during operation to achieve optimal production and economic effects of the transport service in a stochastic environment with which the system is in intensive multimodal interactions. Organizational structure implies a formal system of people's roles and their relationships in the execution of various tasks or roles that, through the use of resources, cooperate with each other to achieve the organization's goals. The factors of the organizational structure are its area of activity, contents, time horizon, information system, integration processes and flows. In principle, the functional structure is defined by actions, activities, events, transactions, transactional events and processes performed by the system in the conversion of inputs into outputs that are the subject of process analysis of the system. The objective function requires a functional structure of the JGTP system that is open, flexible and extensible with stochastic change of state and organizational-technological adaptation to the needs of users in meeting transport needs through a product called optimal transport service. The information-spatial structure of the JGTP system is determined by the totality of semantic representations, especially in the elements of contractual relations in the production and provision of transport services, in licenses, authorizations, concessions, line contracts for the transport of passengers, etc., in the set of information technologies, information and communication technologies are of particular importance with material, energy, information and value flows on the spatial information infrastructure (PII) platform. PII consists of data registers that can be spatial, transport, administrative, and the main use of PII is in creating a single access point for tasks that use spatial information. In PII, transport objects are identified with an adequate degree of accuracy of descriptive data, ie object metadata, which include the form and structure, size and value of each registered object in the system. The communication-interaction structure of the JGTP system enables coordination of activities, control of flows and actions, motivation and behavior of people, reactive, co-active and proactive interactions of the entire organization, which are specified by the communication analysis of the system. The strategic concept of managing the transport system and processes is based on the platform of transmission, presentation, sharing and exchange of information, documents, applications, programs and other

---

---

*entities of distributed systems between numerous participants and above all the role holders in the JGTP system. , streaming and background network traffic in the JGTP system. It is a longitudinal, transferal and diagonal platform of the target function, structure and functioning of the JGTP system.*

*The research loop method, which is used in this paper, is inductive and starts from the task from the tele-traffic theory to configure the optimal man-machine systems based on the knowledge of the user-passenger requirements and the behavior of JGTP in the transport space. The basic steps in the research loop are observation of the real JGTP system in a stochastic and deterministic context, modeling of data flows and telecommunication traffic, model testing, data validation and model verification. User needs and requirements, ie. of passengers are modeled with the statistical properties of traffic. When the verification does not provide precise and accurate values of the model, one or more iteration procedures are performed by returning to the modeling phase.*

**Key words:** *public urban passenger transport system, objective function of the system, multidimensional structure, transport space, passenger behavior, research loop, teletransportation theory, teletraffic classes-conversational, interactive, streaming and background, information-spatial infrastructure*

---

## **PAPERS**

## PREMIUM ROAD MARKINGS: ONE TIME HIGHER EXPENSE FOR LOWER OVERALL COST

Tomasz E. Burghardt<sup>a</sup>, Anton Pashkevich<sup>b</sup>

<sup>a</sup> M. Swarovski GmbH, Wipark, 14. Straße 11, 3363 Neufurth, Austria, tomasz.burghardt@swarco.com

<sup>b</sup> Politechnika Krakowska, ul. Warszawska 24, 31-155 Kraków, Poland, anton.pashkevich@pk.edu.pl

---

**Abstract: Objectives.** Road markings are critical elements of road infrastructure that must be correctly maintained for proper function. Different road marking materials provide dissimilar functional service life; hence, selection of more durable solutions may bring long-term lower costs even if initially they are more expensive. Because typical maintenance policy, seeking minimisation of the one-time expense, fails to account for the recent emergence of premium materials with enhanced durability, this analysis was envisaged as a demonstration that long-term perspective should be more advantageous for the taxpayers. **Approach.** Based on results from previous field assessment of functional service life of road markings, expenses for materials required to maintain them for 20 years were calculated. The evaluated scenarios comprised standard and premium materials. **Results.** The utilisation of premium road marking materials was associated with significantly higher initial prices. However, due to meaningfully prolonged functional service life furnished by them, the cost differences disappeared from long-term perspective. Better visibility of the premium road markings would be additional unquantified benefit. **Contribution.** The results confirm that the policy of using in tenders the lowest price for one-time road marking event is inappropriate. Taxpayers would benefit from long-term performance contracts, given high quality demands are assured through appropriate supervision.

**Key words:** road maintenance policy, glass beads, retroreflectivity, functional service life, visibility

---

## THE IMPORTANCE OF DRIVER FATIGUE MANAGEMENT IN TRANSPORT COMPANIES

Jelica Davidović<sup>a</sup>, Dalibor Pešić<sup>a</sup>, Boris Antić<sup>a</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
jelicadavidovic@sf.bg.ac.rs, d.pesic@sf.bg.ac.rs, b.antic@sf.bg.ac.rs

---

**Abstract:** About 3% of traffic accidents with fatalities occurred due to the influence of fatigue on drivers in the previous five years in the Republic of Serbia. If only traffic accidents involving commercial vehicles are analyzed, that percentage is higher and amounts to about 5%. Considering the specificity of fatigue measurement, it is considered that this percentage is significantly higher than the official statistics. Fatigue is a significant influencing factor on the safety of professional drivers in traffic and can be managed at the company level. Numerous studies have determined the most influential factors on driver fatigue. The quantity and quality of sleep have the greatest influence on driver fatigue. This paper shows the importance of driver fatigue management in transport companies on a case study implemented in selected transport companies. The results of the research show that fatigue can be managed, but that awareness about it is still insufficiently developed in transport companies.

**Key words:** fatigue, road traffic safety, road safety management

---

## INVESTIGATION OF THE INFLUENCE OF PASSENGER VEHICLE TIRES ON BRAKING EFFICIENCY

Darius Astrauskas

*Šiauliai State University of Applied Sciences, Faculty of Business and Technologies, Lecturer of Transport Engineering  
Department, Aušros ave. 40, LT-76241 Šiauliai, Lithuania, d.astrauskas@svako.lt*

---

**Abstract:** Traffic safety has long been considered a major international problem. Road traffic safety depends on activities in various areas: education of drivers and other road users, road quality and technical condition of cars. Tires are one of the most important components of a car. **Objectives:** Investigate the influence of car tire types on braking efficiency during the summer. The main tasks are formulated to achieve the goal: 1. Determine which tires are used on cars during the summer; 2. Determine the braking efficiency of a car with different types of tires in summer road conditions. **Approach:** In this paper, the characteristics of the adhesion coefficient have been analyzed and experimental studies have been carried out in order to determine: the condition and type of tires in use; influence of tire types on braking efficiency. An analysis of the types of used car tires was carried out by means of observation. The adhesion coefficient of summer and winter car tires was determined by testing. **Results** The difference in braking acceleration when braking a car moving at a speed of 50 km/h with winter tires corresponds to a 2,89 m longer braking distance than with summer tires.

**Key words:** tire-road interaction, tire types, braking efficiency, deceleration acceleration, adhesion coefficient

---

## IMPORTANCE OF ECO-DRIVING AND DIFFERENCE IT MAKES IN FUEL CONSUMPTION

**Manvydas Bagavičius**

*Šiauliai State University of Applied Sciences, Faculty of Business and Technologies, Lecturer of Transport Engineering  
Department, Aušros ave. 40, Šiauliai, LT-76241, Lithuania, m.bagavicius@svako.lt*

---

**Abstract:** *Research examines the fuel consumption of a gasoline engine. Eco-driving is described in theoretical terms. The making of an additional fuel tank system is described which is used to accurately determine fuel consumption. Routes A-E have been developed and tested by driving the car conventionally and in accordance with the principles of eco-driving. Fuel consumption for all routes was obtained and fuel savings were calculated. The application of eco-driving principles on routes A – E has reduced fuel consumption by 42.39%. The ecological and financial benefits of eco-driving have been calculated and it shows that by using eco-driving rules everyone can contribute to the reduction of air pollution and also save money in the process.*

**Key words:** *eco-driving, ecology, fuel consumption, petrol engine, fuel system*

---

## IMPROPER AND INSUFFICIENT COMPLIANCE WITH THE REGULATIONS AND RULES IN ROAD TRAFFIC AND THE IMPACT OF THAT FAILURE ON THE SAFETY OF TRAFFIC PARTICIPANTS

**Dragana Agić<sup>a</sup>, Muhamed Barut<sup>a</sup>, Fuad Klisura<sup>a</sup>, Mustafić Ibrahim<sup>a</sup>**

<sup>a</sup> Institute for Economic Engineering LLC, Vatrogasni put 3, 72000 Zenica, Bosnia and Herzegovina, dragana.a@ipi.ba, muhamed.b@ipi.ba, fuad.k@ipi.ba, edukacija@ipi.ba

---

**Abstract:** *Non-compliance with traffic regulations and rules by all road traffic participants is a daily occurrence, and a large number of them are not even aware of the degree of value of this non-compliance, as well as the consequences that may arise as a result. Some non-compliances are ignored even by the officials who are authorized to register and sanction them. This paper will give some basic examples of non-compliance and the possible consequences of that non-compliance, with the aspiration to find ways to solve this problem by pointing it out.*

**Key words:** *traffic, non-compliance, solution*

---



## INTELLIGENT TRANSPORTATION SYSTEMS AS A SOLUTION FOR REDUCING FATAL CRASHES

Dragan Radovanović

Elementary School "Vuk Karadžić", Kosovsko-metohijskih brigada 1, Sočanica 38217, Serbia, draganr29@gmail.com

---

**Abstract: Objectives.** This paper aims to show the new ideas and approaches of the Intelligence Transportation System (ITS) to reduce the number of fatal crashes on the roads. The second objective is to show the state of this issue in the Republic of Serbia and propose a methodology for predicting this type of traffic crash. **Approach.** We use a literature review to find the latest ideas in the subject area with practical examples applied in the European Union. We also use the SARIMA method for time series forecasting to predict the number of fatal crashes in the Republic of Serbia for the next two years. **Results.** The SARIMA method shows acceptable accuracy in predicting fatal crashes with an error of 7.01. **Contribution.** This paper presents innovative ideas that can lead to further improvements in this very important area of our daily lives. It is also shown that the prediction of traffic crashes could be done as time series forecasting.

**Key words:** traffic engineering, traffic safety, time series forecasting

---

## TEMPORAL ANALYSIS OF TRAFFIC ACCIDENTS WITH PEDESTRIANS IN Kragujevac

Veselinka Jokić<sup>a</sup>, Miloš Pljakić<sup>a</sup>

<sup>a</sup> University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Knjaza Milosa no. 7, 38220 Kosovska Mitrovica, Serbia, veselinka.jokic\_91@yahoo.com, milos.pljagic@pr.ac.rs

---

**Abstract:** Walking is one of the means of movement of the population, however, in the last few years, there has been an increasing number of traffic accidents in which pedestrians are killed. Due to the growing trend of traffic accidents in Serbia, in this paper we performed a temporal analysis of traffic accidents with pedestrians in the area of the city of Kragujevac, for the observed period of 2015-2021. We used ABS pedestrian accident statistics, based on the number of pedestrians killed and seriously injured. Results: Analyzing the data on pedestrian fatalities, we saw that the highest number of pedestrian fatalities occurred in 2016, after which there was a downward trend in fatalities until 2019, but then there was an increase in pedestrian fatalities in Kragujevac. We found that most pedestrians are killed in January and December in winter conditions. When we looked at the number of fatalities by day of the week, we concluded that most pedestrians are killed on Sunday and Saturday, due to the fatigue of drivers and pedestrians, celebrations, going to the city, the effects of alcohol,... Time analysis of pedestrian fatalities by period of the day led to the conclusion that most pedestrians are killed in the afternoon and evening period (12-24h). Analyzing traffic accidents by hours of the day, we concluded that the highest number of pedestrians were killed at 5-6 p.m. The number of seriously injured pedestrians has a growing trend, increasing over the years until 2018, after which it begins to decline slightly. We found that the most seriously injured pedestrians were in July and September, the most seriously injured pedestrians were on Saturday. By analyzing seriously injured pedestrians according to the period of the day, we concluded that there were most of them in the afternoon period (12-6 p.m.), as well as by hours, there were most of them at 5 p.m. Given that the number of injured pedestrians in the world is increasing, it is necessary to apply more complex statistical models, in particular, it is necessary to pay more attention to seriously injured pedestrians who, as a result of traffic accidents, lose their lives in the hospital.

**Key words:** Pedestrian, Accidents, Road safety, Kragujevac

---

## IMPACT ANALYSIS TECHNICAL CONDITION OF VEHICLES ON ROAD SAFETY

**Vojislav Krstić<sup>a</sup>, Bojan Marić<sup>b</sup>, Aleksandar Mićović<sup>a</sup>, Radoje Jovanović<sup>c</sup>**

<sup>a</sup> University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Knjaza Milosa no. 7, 38220 Kosovska Mitrovica, Serbia, vojislav.krstic@pr.ac.rs, aleksandar.micovic@pr.ac.rs

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bojan.marić@sf.ues.rs.ba

<sup>c</sup> Road Traffic Safety Agency, Bulevar Mihajla Pupina 2, 11070 Belgrade, Serbia, radoje.jovanovic@abs.gov.rs

---

**Abstract:** Low level's stability and handling of road vehicles is often the cause of the adverse effects of traffic, which greatly reduces the level of traffic safety. There are many causes that can lead to a reduced level's stability and handling of road vehicles, and therefore the level of traffic safety. The paper is dedicated to the attention and analysis of mogućnosti poboljšanje stability and maneuverability of the vehicle, not only in terms of construction and maintenance, but also in terms of exploitation of vehicles. Problems disorder will vehicles are particularly pronounced in vehicles with a high center of gravity position, especially with buses, trucks with special superstructures and panel van, tank vehicles. In this work, attention posvrćena primarily those vehicles.

**Key words:** traffic safety, vehicles, vehicle stability, vehicle handling.

---

## VIDEO SURVEILLANCE FOR AUTOMATIC NUMBER PLATE RECOGNITION AND DETECTION OF TRAFFIC VIOLATIONS AND COORDINATED OPERATION OF TRAFFIC LIGHTS IN SPEED REDUCTION MEASURES AS AN IDENTIFIABLE FACTOR IN THE CAUSE OF A TRAFFIC ACCIDENT

Miroslav Derikonjić<sup>a</sup>, Đorđe Fazekas<sup>a</sup>, Bogdan Radin<sup>a</sup>

<sup>a</sup> Company "Selma" Subotica, Beogradski put 58, 24000 Subotica, Serbia, micy@selma.rs

---

**Abstract:** *The speed of movement of traffic participants is one of the main manifestations of traffic accidents and therefore represents one of the key areas in which action should be taken in order to increase traffic safety. Through this example, we want to show the synthesis and joint action of the coordinated operation of traffic lights and the video surveillance system for automatic recognition of license plates and detection of traffic violations as multiple measures and ways of influencing the reduction of the speed of movement of traffic participants as a recognizable factor in the occurrence of a traffic accident. The installed video surveillance system for preventive, as well as repressive purposes, was used to monitor and document the number of vehicles moving at the prescribed speed, which was designed through the establishment of coordinated operation of traffic lights, as well as the number of vehicles that exceeded the permitted-limited speed of movement in the time period in which the observation was made. By analyzing the results, it can be concluded that the applied measures have proven to be effective and that the overall values are improving over time. However, it has been shown that there is room to improve the results, reduce the speed to expected, safe values, primarily through training and education, and if this does not bring results, through coercion and sanctions.*

**Key words:** *vehicle speed, traffic lights, detection of traffic violation*

---

## SEIZURE OF VEHICLES AS A PROTECTIVE MEASURE AGAINST MULTIPLE TRAFFIC OFFENDERS

Goran Bošnjak<sup>a</sup>, Milan Salamadija<sup>b</sup>

<sup>a</sup> Bosnia and Herzegovina, goranbosnjak97@gmail.com

<sup>b</sup> Ministry of Internal Affairs of the Republic of Srpska, Desanka Maksimović Boulevard 4, Banja Luka, Bosnia and Herzegovina, milan.salamadija@mup.vladars.net

---

**Abstract:** Improving the state of traffic safety should be a priority for all subjects dealing with this issue. In traffic safety, we have preventive and repressive measures that are used to reduce the negative consequences of traffic. Part of the traffic participants who, by committing traffic offences, pose a risk to all other conscientious traffic participants, are repeat repeat offenders. Then, when measures such as fines, protective measures prohibiting driving a motor vehicle and penalty points do not give results against multiple returnees committing the most serious offenses, the confiscation of the vehicle is resorted to. This paper will discuss the confiscation of vehicles as a protective measure, i.e. the legal basis and results in practice so far. The authorized internal affairs body of the Republic of Srpska, as well as the courts, carry out procedures related to confiscation of vehicles as objects of traffic violations, all with the aim of acting on multiple returnees, i.e. improving the state of traffic safety and achieving special and general prevention.

**Key words:** traffic safety, protective measures, recidivists

---

## APPLICATION OF INFRASTRUCTURE SAFETY MANAGEMENT WITH SPECIAL ATTENTION TO THE M10 ROAD IN MONTENEGRO

Vladimir Ilić<sup>a</sup>, Dragan Jovanović<sup>b</sup>, Milanko Damjanović<sup>a</sup>, Radoje Vujadinović<sup>a</sup>, Boško Matović<sup>a</sup>

<sup>a</sup> University of Montenegro, Faculty of Mechanical Engineering, Bulevar Džordža Vašingtona bb, 81000 Podgorica, Montenegro, vladimiri@ucg.ac.me, milanko@ucg.ac.me, radojev@ucg.ac.me, boskom@ucg.ac.me

<sup>b</sup> University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, draganj@uns.ac.rs

---

**Abstract:** As part of this work, field research was carried out, which included traffic safety inspection on the M10 highway, Budva-Cetinje section, in the town of Zabrdje. The M10 highway is the road with one of the highest traffic volumes in Montenegro. Previously, a predictive model of road accidents had been developed for the main roads in the territory of Montenegro, which identified this section as one of the risky ones. Poisson regression model (PRM) and negative binomial model (NBM) were used to predict the number of traffic accidents. The results showed that with an increase in the value of AADT and the number of traffic lanes (BT) and a decrease in the value of the average vehicle tracking time interval (GAP), the probability of traffic accidents on highways in Montenegro also increases. With the negative binomial model, it was shown that the international roughness index (IRI) has no statistical significance. By traffic safety inspection, several problems were identified that can be linked to the observed road direction and its environment. As the key, one can single out the wrongly directed transverse slope of the roadway in one of the horizontal curves, which belongs to the section on which the inspection was carried out.

**Key words:** road safety inspection, predictive models of traffic accidents, traffic accidents

---

## LEGAL BASIS AND REGULATIONS FOR THE IMPLEMENTATION OF ROAD WORK ZONES IN THE REPUBLIC OF SERBIA

Dalibor Pešić<sup>a</sup>, Aleksandra Obradović<sup>b</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
d.pesic@sf.bg.ac.rs

<sup>b</sup> Beograd, Serbia, a.obradovic998@gmail.com

---

**Abstract:** *Managing a system or process means taking management measures to bring the current state of the System closer to the desired state. In most cases, when carrying out works on certain sections of the road, there is no alternative direction to which traffic flows can be diverted, so in that case the work zone becomes a potentially dangerous place. The part of the work zone that is the most risky for the occurrence of traffic accidents, especially with fatal consequences, is the construction site itself, as well as the narrowing area itself.*

*The transition from the normal traffic regime, without interruptions and unusual situations, to the traffic regime in the work zone must be gradual, clearly marked and noticeable. In the Republic of Serbia, there is a Rulebook on how to regulate traffic on roads in the work zone, which clearly defines what is meant by safely marked work zones, from the traffic aspect.*

*The goal of the Republic of Serbia, which is not a member of the European Union, is to adapt its rules and criteria, that is, to bring them closer to the already existing rules applied by the members of the European Union.*

**Key words:** *regulations, traffic safety, road work zone*

---

## ANALYSIS OF PARENT'S INFLUENCE ON CHILDREN'S BEHAVIOR IN TRAFFIC

**Boris Antić<sup>a</sup>, Vojislav Krstić<sup>b</sup>, Dragan Stanimirović<sup>c</sup>, Aleksandar Mićović<sup>b</sup>, Mesud Ajanović<sup>c</sup>**

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
b.antic@sf.bg.ac.rs

<sup>b</sup> University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Knjaza Milosa no. 7, Kosovska Mitrovica 38220,  
Serbia, vojislav.krstic@pr.ac.rs, aleksandar.micovic@pr.ac.rs

<sup>c</sup> Ministry of Transport and Communications of Republika Srpska, Trg Republike Srpske 1, Banja Luka 78000,  
d.stanimirovic@msv.vladars.net

<sup>d</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia  
and Herzegovina, mesud.ajanovic@sf.ues.rs.ba

---

**Abstract:** *Children's safety in traffic can be increased by increasing the awarenesses, knowledge and behavior of parents as the main support in raising children. The joint engagement of parents, educators and the local community is necessary, along with serious and systematic work in order to improve the situation.*

**Key words:** *traffic safety, children, parents*

---



## VEHICLE FLOW AS A CRITERION FOR THE IMPLEMENTATION OF LIGHT SIGNALING

**Bojana Ristić**

*University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bojana.ristic@sf.ues.rs.ba*

---

**Abstract:** *Management on the city traffic network relies mostly on the application of light signals that are the backbone of the urban traffic management system. Nowadays, the introduction of traffic lights at intersections has become a challenge for traffic experts, especially in larger cities, or roads with a large number of traffic lanes and intensive motorized traffic. Therefore, the criteria in the world that are used for the implementation of traffic lights at intersections are very important for making objective decisions about the need to introduce traffic lights. The choice of regulation method, as a rule, always depends on the traffic intensity, ie the size of the flow requirements. This paper will analyze the criteria based on the size of the flow, which are contained in the manuals used in different countries in the case when it is necessary to make a decision on the need to introduce light signaling.*

**Key words:** *flow size criterion, intersections, regulation*

---

## BL BUSTRACKER: A DISTRIBUTED SYSTEM FOR BUS TRACKING

**Drazen Brdjanin<sup>a</sup>, Danijela Banjac<sup>a</sup>, Dragan Jovic<sup>b</sup>, Filip Stojakovic<sup>a</sup>, Aleksandar Bosancic<sup>c</sup>**

<sup>a</sup> University of Banja Luka, Faculty of Electrical Engineering, Patre 5, 78000 Banja Luka, Bosnia and Herzegovina,  
drazen.brdjanin@etf.unibl.org, danijela.banjac@etf.unibl.org, filip.stojakovic1@gmail.com

<sup>b</sup> Bravo Systems LLC, Kralja Alfonsa XIII 14, 78000 Banja Luka, Bosnia and Herzegovina, dragan\_jovic1221@outlook.com

<sup>c</sup> A-Solution Aleksandar Bosančić SP, Dimitrija Tucovića 10, 79000 Prijedor, Bosnia and Herzegovina,  
aleksandar.bosancic@hotmail.com

---

**Abstract:** The paper presents "BL BusTracker" – a distributed system for bus tracking in public transportation in the city of Banja Luka, Bosnia and Herzegovina. "BL BusTracker" enables real-time bus tracking, calculating and estimating the arrival times for bus stops in urban as well as rural areas. The system is integrated with other pre-existing systems for tracking vehicles in several independent transportation companies and extracts all necessary data from these systems. This data is further aggregated and used to display in mobile passenger applications for tracking public transportation, as well as for additional data analysis and monitoring. An open concept enables easy horizontal system scaling and inclusion of additional transportation companies, as well as the implementation of different software clients.

**Key words:** public transportation, tracking vehicles, mobile passenger application

---

## EXPERIMENTAL INVESTIGATION OF OPTIMAL FLEXIBLE PAVEMENT MODELS FROM GRAINED ASPHALT COMPONENTS OF USED PAVEMENT

Edis Softić<sup>a</sup>, Marko Subotić<sup>b</sup>, Elvir Jusić<sup>a</sup>, Željko Stević<sup>b</sup>

<sup>a</sup> University of Bihać, Technical Faculty, Irfana Ljubijankića bb, 77000 Bihać, Bosnia and Herzegovina,  
edis.softic@bih.net.ba, jusic.elvir@gmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, marko.subotic@sf.ues.rs.ba, zeljko.stevic@sf.ues.rs.ba

---

**Abstract:** *In order to define the optimal choice of technology of processing recycled material from the pavement to the maximum usable volume of the same binder with the addition of cement and foamed bitumen was carried out experimental analysis of the impact of the priority parameters. Given that is selected as the main, granule metric composition recycled unit of pavement for different coverage amounts and specific types of binders their analysis for the different types of recycled crash mass with the possibility of adding a new unit, which would be the aim to comply with the prescribed curve given in international regulations on the principle of “Wirtgen 2004”. Results of the research led to the optimal variant mixture stabilization layer of pavement which consists largely of recycled materials from the deteriorated pavement enhanced with a relatively small amount of new aggregate with the addition of minimal stabilization funds from the cement and foamed bitumen. The characteristics of the tested samples are defined by using the indirect tensile strength and density of samples. These parameters were crucial for an assessment of the technical correctness and usability patterns in bituminous layers of new pavement.*

**Key words:** *cold recycling of pavement, the indirect tensile strength, bonding materials*

---

## PROBLEMS AND PROPOSED SOLUTIONS FOR THE PLANNING OF PUBLIC TRANSPORT IN BITOLA

Vaska Atanasova<sup>a</sup>, Marija Stojanoska<sup>a</sup>, Nikola Krstanoski<sup>a</sup>

<sup>a</sup> University of St. Kliment Ohridski, Faculty of Technical Sciences, Bitola, 7000, Macedonia, vaska.atanasova@uklo.edu.mk,  
marijastojanoska3112@gmail.com, nikola.krstanoski@uklo.edu.mk

---

**Abstract:** *Due to the modern way of life, many cities face the harmful impact of traffic processes reflected in aut centrality, traffic congestion, lack of parking spaces and green areas, which, in turn, all together affect the economic, ecological and health aspects of society. Public transport as a type of transport that can help a lot in building the policy for a sustainable urban transport system. If public transport offers a high quality of transport service and attracts a greater number of trips to the city, then the city would have a chance to withstand the pressure of the car and its constant need for new high-capacity traffic facilities, the negative impacts on the environment would be reduced, i.e. the quality of living in the city would increase, and in order to satisfy that goal, it is necessary to carry out constant field research, through surveys and interviews of the users of the services, in order to understand the problems they face and propose their solutions . This paper will show the problems faced by the users of public transport in Bitola and a proposal of solutions to improve services.*

**Key words:** *public transport, survey, users, Bitola.*

---

## THE FACTORS ASSOCIATED WITH DRIVING UNDER THE INFLUENCE OF ALCOHOL

Emir Smailović<sup>a</sup>, Dalibor Pešić<sup>a</sup>, Boris Antić<sup>a</sup>, Nenad Marković<sup>a</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
e.smailovic@sf.bg.ac.rs, d.pesic@sf.bg.ac.rs, b.antic@sf.bg.ac.rs, n.markovic@sf.bg.ac.rs

---

**Abstract:** One of the goals research of driving under the influence of alcohol (DUI) is to create conditions on the basis of which it would be possible to describe DUI. In this study, a meta-analysis of DUI-related factors was performed. In the first step, a ScienceDirect database search was performed. Two terms were used for the search: "alcohol and crash" and "DUI and crash". The research included in the meta-analysis from the mentioned journals had to satisfy the condition that there is a connection between a factor and DUI. All factors that can be related to alcohol were observed: driving style, characteristics of the driver, time and place of driving, characteristics of the vehicle, etc. By searching more than 1,000 studies in this field, a odds ratio was created to connect factors and DUI. The odds ratio of connectivity (OR) represents the strength of the connection between a particular factor and the DUI. By applying the mentioned methodology, a conclusion was reached on the connection between factors and DUI, on the basis of which it is possible to describe and typify DUI drivers in traffic. When it comes to driver behavior, the most important predictors of DUI are speeding, not using a seat belt, driving without a driver's license and previous DUI. The results of this study can be valuable for further development of the legislation related to drink-driving..

**Key words:** DUI, alcohol drinking, risk factors, driver behaviors'

---

## IMPROVING THE EFFICIENCY OF LOCAL COMMUNITY VEHICLE FLEETS

Pavle Gladović<sup>a</sup>, Božo Ilić<sup>a</sup>, Vesko Lukovac<sup>b</sup>, Vladimir Popović<sup>c</sup>

<sup>a</sup> Rico training centre, Arčibalda Rajsa 27, 11000 Beograd, Serbia, anaipavle@gmail.com, ricocentre@gmail.com

<sup>b</sup> University of Defence, Military Academy, Generala Pavla Šturma 1, 11000 Belgrade, Serbia, lukovacvesko@yahoo.com

<sup>c</sup> Academy of Technical-Educational Vocational Studies, Aleksandra Medvedeva 20, 18000 Niš, Serbia ,  
msv.popovic@gmail.com

---

**Abstract:** *The fleet of passenger vehicles of the municipality/city consists of official - passenger vehicles and vehicles for carrying out the activities of public companies, public institutions, organizations and public utility companies founded by the local community. The formation of a centralized fleet of vehicles (CVR) would enable: improvement of effectiveness vehicle fleet, maintenance management of vehicles, rationalization of vehicle use, standardization, control, manner of vehicle use and manner of activities related to the vehicle fleet, as well as management of vehicle exploitation costs. The vehicle management system serves to manage vehicles, simplify maintenance and fleet management, vehicle cost tracking and reporting. With it, small fleets get better insight into fuel consumption through tracking and reporting on vehicle idle time, usage management and trip tracking. The paper describes the procedure for the formation of the CVP and the effects achieved by the introduction of such a system in the institutions of the local community.*

**Key words:** *centralized fleet, efficiency, effectiveness, rationalization*

---

## MODEL FOR RESEARCH AND ANALYSIS OF TRAFFIC SAFETY CONDITIONS FOR TRACTOR DRIVERS IN THE REPUBLIC OF SERBIA

**Dorde Vranješ<sup>a</sup>, Bojan Marić<sup>b</sup>, Goran Tričković<sup>c</sup>, Zdravko Tarlać<sup>a</sup>**

<sup>a</sup> Institute BIT, Patrijarha Pavla br. 8, lokal br. 8, 22304 Novi Banovci, Serbia, djordjevranches@yahoo.com, zdravkotarlać00@gmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bojan.marić@sf.ues.rs.ba

<sup>c</sup> Academy of Technical and Art Applied Studies Belgrade, Department of School of Railway Transport, Zdravka Čelara 14, Belgrade, 11 000, Serbia, goran.trickovic@vzs.edu.rs

---

**Abstract:** *The focus of the research was on traffic accidents involving tractor drivers that occurred in the Republic of Serbia from 2010 to 2022. The accidents involving tractor drivers who were either involved or caused accidents and their consequences (the number of fatalities and injuries) were analyzed, along with the study of material damage. In the territory of the Republic of Serbia from 2010 to 2022, there were 7,724 traffic accidents involving tractors, including 558 accidents with fatalities, 3,713 accidents with injuries, and 3,453 traffic accidents resulting in material damage. The basic prerequisites for the safe participation of tractors in traffic are the adherence to traffic procedures, well-trained tractor drivers, and tractors that are adequately equipped and in good condition (lights, driver's cabin).*

**Key words:** tractor, traffic accident, traffic safety

---

## EVALUATION OF THE COMPATIBILITY FACTOR OF THE VEHICLE COLLISION PROCESS IN REAL TRAFFIC ACCIDENTS

**Goran Mihaljčić<sup>a</sup>, Bojan Mihaljčić<sup>b</sup>, Vuk Bogdanović<sup>c</sup>, Tihomir Đurić<sup>d</sup>**

<sup>a</sup> Veljka Mladenovića bb, 78000 Banja Luka, Bosnia and Herzegovina, goranmihaljcic@hotmail.com

<sup>b</sup> VIII Kuljanska 8, 78000 Banja Luka, Bosnia and Herzegovina, bojanmihaljcic@hotmail.com

<sup>c</sup> University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21102 Novi Sad, Serbia, vuk@uns.ac.rs

<sup>d</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, tihomir.djuric@sf.ues.rs.ba

---

**Abstract:** *The aim goal of this study is to demonstrate the way insurance appraisers, although they generally do not possess sufficient professional knowledge to carry out special analyzes of the compatibility of the vehicle collision process whose end goal is determining the credibility of the traffic accident, could, based on the knowledge and professional experience they do possess, recognize certain illogicalities in the documentation submitted with the compensation claim, and value and get the percentage of the probability of realization of the traffic accident in question. This study presents an example of evaluating the compatibility factor of the vehicle collision process in a real traffic accident. The result of the evaluation showed a high probability that the traffic accident in question had not occurred in the manner shown by investigative documentation, soon after that a detailed analysis of the compatibility of the vehicle collision process was performed, on the basis of which it was confirmed that it was indeed a simulated traffic accident. If appraisers from insurance companies were trained to use the method of evaluating the compatibility factor of the vehicle collision process, throughout their everyday work on discovering simulated traffic accidents, it would result in a reduction of falsely filed compensation claims, which would bring significant financial savings to insurance companies.*

**Key words:** *traffic accident, traffic accident expertise, insurance fraud, fraud prevention*

---



## HOW TO IMPROVE THE PASSIVE SAFETY OF ROADS?

**Demeter Prislan**

*ICC DEMETER PRISLAN S.P., Dobravica 44, 1292 Ig, Slovenija, demeter.prislan@siol.net*

---

**Abstract:** *In order to achieve the safest possible condition of the road, we should first of all free it from the various dangers that are in its area. As a hazard or lateral disturbance, we mean any object that can, in the event of a vehicle impact, cause fatal and serious consequences for the passengers in the vehicle. A smaller tree with a diameter of 10 cm or more, various public lighting poles and poles as carriers of traffic signals, fixed objects in the immediate vicinity of the roadway, sharp curves, near a precipice or rock in cuts and the like can also pose a danger. In order to improve the safety situation, we act in such a way as to remove them, if possible, to replace them with ones that are not harmful to human life, or to protect them with vehicle retention systems, thus to prevent possible contact of the vehicle with danger. This work primarily concentrates on the use of passively safe poles, crash cushions and the end terminals of guardrails.*

**Key words:** *passively safe poles, crash cushions, end terminals of barriers, EN 12767, EN 13173*

---

## COMPARATIVE ANALYSIS OF DATA OBTAINED FROM THE DIGITAL TACHOGRAPH, DRIVER'S CARD AND TRAVEL ORDERS PN-3

**Dorde Popović<sup>a</sup>, Saša Petrović<sup>b</sup>, Tihomir Đurić<sup>a</sup>, Slaviša Gačić<sup>b</sup>**

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, djdjpopovic1970@gmail.com, tihomir.djuric@sf.ues.rs.ba

<sup>b</sup> Inspectorat of the Republic of Srpska, Banja Luka 78000, Bosnia and Herzegovina, s.petrovic85@gmail.com, slavisa.gacic86@gmail.com

---

**Abstract:** *This paper explains the importance of using a digital tachograph in road motor vehicles and a comparative analysis of the data obtained from the control report and travel orders for the cargo and combined motor vehicle PN-3. The digital tachograph enables the monitoring of the driver's work with regard to several important criteria, such as the duration of driving the vehicle, the distance traveled, the speed of movement, the value and frequency of the vehicle's deceleration and acceleration, as well as rest time during the execution of work tasks. Continuous driving of a motor vehicle by the driver results in carelessness, which can cause serious consequences for the safety of all road users. The contribution of the driver's work records from the digital tachograph is not only reflected in the monitoring of his work, compliance with legal regulations regarding working hours, mandatory breaks during the working day, but also in significant opportunities for the prevention of traffic accidents in road traffic.*

**Key words:** *analysis of driver's working hours, mileage, traffic safety*

---

## COMPARISON OF ROLLER BRAKING FORCE RESULTS ON THE SAME VEHICLE AT TWO DIFFERENT VEHICLE INSPECTION STATIONS

Đorđe Popović<sup>a</sup>, Slaviša Gačić<sup>b</sup>, Saša Petrović<sup>b</sup>, Adaleta Skula<sup>c</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, djdjpopovic1970@gmail.com

<sup>b</sup> Inspectorat of the Republic of Srpska, Banja Luka 78000, Bosnia and Herzegovina, slavisa.gacic86@gmail.com, s.petrovic85@gmail.com

<sup>c</sup> Mixed Secondary School Tešanj, Patriotske lige 61, 74260 Tešanj, Bosnia and Herzegovina, adaleta.skula94@gmail.com

---

**Abstract:** A technical inspection of a vehicle is a process of checking its safety technical correctness and ecological suitability of the vehicle. This inspection includes the examination of key on the vehicle systems and parts such as brakes, lights, tires, engine, and others. Its aim is to ensure that the vehicle meets the technical requirements and is able to participate safely on public roads. The aim of the research was to compare the results of braking forces on the rollers on the same vehicle at two different stations and to statistically analyze the data from the technical inspections of vehicles in the Republic of Srpska.

**Key words:** road safety, vehicle technical reliability, vehicle technical inspection, vehicle, inspection station

---

## THE CHOICE OF TYRES AS A SAFETY FACTOR IN TERMS OF ACTUAL AND DISPLAYED SPEED

Sanja Rakić<sup>a</sup>, Zoran Ristikic<sup>b</sup>, Miroslav Pavlovic<sup>b</sup>, Miloš Ninković<sup>a</sup>

<sup>a</sup> Bosnia and Herzegovina, rakicsanja04@gmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, zoran.ristikic@sf.ues.rs.ba, miroslav.pavlovic@sf.ues.rs.ba

---

**Abstract:** Tyres are one of the key factors in the active safety of a vehicle, and the choice of prescribed tyres is of great importance for the proper functioning of other vehicle systems and subsystems. Considering the known techniques for measuring and displaying vehicle speed, it is obvious that a change in tyre pressure will lead to a change in the dynamic radius of the wheel, which has an impact on the relationship between the actual and displayed vehicle speed. Using precise laboratory measuring devices, measurements were made of the deviation of the displayed speed in relation to the actual one, as well as the change in speed with the change in tyre pressure. Tests of vehicles, fitted with prescribed tyres, showed that the displayed speed is higher than the actual speed, which is in accordance with ECE regulations. The research led to the conclusion that with a change in speed there is also a change in the dynamic radius of the wheel, which legality of change needs to be further investigated. From the aspect of traffic safety, great importance should be attached to the dimensions of the tyre, i.e. their compatibility with the given vehicle, because they directly affect the driver in terms of the displayed and actual vehicle speed.

**Key words:** vehicle, tyre pressure, chassis dynamometer

---

## ELECTRIC VEHICLE POWERTRAIN DESIGN

**Zoran Ristikić<sup>a</sup>, Svetko Milutinović<sup>a</sup>, Milan Eremija<sup>a</sup>, Miroslav Pavlović<sup>a</sup>, Ernad Ajanović<sup>b</sup>**

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, zoran.ristikic@sf.ues.rs.ba, s.milutinovic@hotmail.com, milan.eremija@sf.ues.rs.ba, miroslav.pavlovic@sf.ues.rs.ba

<sup>b</sup> Bosnia and Herzegovina, ernad\_ajan@hotmail.com

---

**Abstract:** *The increase in the effects of the greenhouse, to which the emission of exhaust gases from vehicles powered by internal combustion engines has caused the application of drive systems of vehicles of a different construction. Electric vehicle drives have several advantages over conventional vehicle drives. The advantages are primarily related to the more favorable torque characteristic of the electric motor, better degree of useful effect and more favorable maintenance due to the much simpler construction of the electric motor. The development of power electronics in the last three decades has enabled the application of higher-power electronic circuits for managing the operating parameters of electric motors. The paper describes different constructions of drive systems of electric vehicles and solutions of controlling drive motors of electric vehicles. In order to analyze the drive of electric vehicles, the construction of a practical model of an electric vehicle powered by a DC motor is described. Motor drive control is performed via a transistor h-bridge using pulse-width modulation. Logical control of the drive is done through the Arduino nano 328p controller, and the vehicle is powered by two lithium-ion batteries. In addition to the above, the wave diagrams of the control system of the electric vehicle model are presented in the paper.*

**Key words:** *Electric vehicles, drive systems, DC motor control, Arduino controller*

---

## INFLUENCE OF THE APPLICATION OF BIODIESEL FUEL ON THE DRIVE AND ENVIRONMENTAL CHARACTERISTICS OF INTERNAL COMBUSTION ENGINES

Milan Eremija<sup>a</sup>, Snežana Petković<sup>b</sup>, Pero Dugić<sup>c</sup>, Zoran Ristikić<sup>a</sup>, Svetko Milutinović<sup>a</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, milan.eremija@sf.ues.rs.ba, zoran.ristikic@sf.ues.rs.ba, s.milutinovic@hotmail.com

<sup>b</sup> University of Banja Luka, Faculty of Mechanical Engineering, Vojvode Stepe Stepanovića 71, 78000 Banja Luka, Bosnia and Herzegovina, snezana.petkovic@mf.unibl.org

<sup>c</sup> University of Banja Luka, Faculty of Technology, Vojvode Stepe Stepanovića 73, 78000 Banja Luka, Bosnia and Herzegovina, pero.dugic@tf.unibl.org

---

**Abstract:** The use of bio-fuel, i.e. fuels of biological origin, in engines with internal combustion becomes more and more attractive from the point of view of saving energy and reducing gases they cause the appearance of the greenhouse effect as well as the reduction of air pollution. Code diesel engine as a bio-fuel, most work is done on the use of biodiesel fuel and its mixture with diesel fuel. The goal of the research is to reach conclusions about the possibilities of using biodiesel fuel in a mixture ratio with fossil diesel in internal combustion engines as its influence on the driving and environmental characteristics of the engine. Laboratory testing for operational purposes was conducted within the engine testing laboratory, which is equipped with an AVL Dyno engine brake. Laboratory testing monitored the parameters in terms of power, torque, fuel consumption and engine smoke, using diesel fossil fuel and the mixture ratio of biodiesel. The obtained results indicate that the use of biodiesel fuel results in a decrease of power and torque. Also, the use of biodiesel causes an increase a fuel consumption and the degree of blackening. The importance of the work is reflected in the possibility of using biodiesel fuel as well as its impact on the driving and environmental characteristics of the internal combustion engine.

**Key words:** driving characteristics of the internal combustion engine, biodiesel fuel, environmental characteristics of the internal combustion engine, fossil diesel fuel

---

## ROAD MOTOR VEHICLE FIRES AND IMPACTS ON THE ENVIRONMENT

**Dragiša Đorđić<sup>a</sup>, Slavko Đurić<sup>b</sup>, Milan Milotić<sup>b</sup>, Džana Dubinović<sup>c</sup>**

<sup>a</sup> Independent University of Banja Luka, Faculty of Ecology, Veljka Mladjenovica 12e, 78000 Banja Luka, Republika Srpska, Bosnia and Herzegovina, zastitad@gmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, slavko.djuric@sf.ues.rs.ba, milan.milotic@sf.ues.rs.ba

<sup>c</sup> Bosnia and Herzegovina, dzana\_dubinovic@hotmail.com

---

**Abstract:** Road motor vehicle fires are becoming an increasingly significant factor endangering the safety of people and the environment, especially with the increase in the number of serious traffic accidents, mostly on highways, with the largest participation (75%) of older vehicles in mentioned fires. Determining the cause of a vehicle fire requires multidisciplinary and a high level of technical expertise. The multi-criteria analysis presented in this paper provides an overview of road motor vehicle fire incidents, which occurred on the roads of parts of Europe (Croatia, Sweden) and America (USA), in certain time periods. The largest number of vehicle fires occurred on passenger, followed by cargo road motor vehicles. Vehicle fires most often started in the area of the engine, chassis or wheels. The main causes of vehicle fires were mechanical and electrical failures. The probability of a fire occurring in a vehicle that is 10 or more years old is significantly higher than in a vehicle that is up to 3 years old. Vehicle fires in the USA cause more deaths than apartment fires. Most of the victims in vehicle fires were male. Although most road vehicle fires lead to relatively minor environmental pollution, specific situations in sensitive areas can lead to more serious consequences for the environment and human health. Gaseous emissions (HCl, SO<sub>2</sub>, VOC, PAH and PCDD/PCDF) in case of fire of passenger road vehicles are significant, which produce negative impacts on the environment.

**Key words:** fire, causes, vehicles, traffic, environment

---

## MODELING THE DISTRIBUTION OF DANGEROUS AIR-POLLUTANTS AND IT SUPPORT IN TRAFFIC ACCIDENTS

Venezija S. Ilijazi<sup>a</sup>, Jelena S. Lamovec<sup>b</sup>, Stevo K. Jaćimovski<sup>b</sup>, Jovan P. Šetrajčić<sup>c</sup>

<sup>a</sup> University Metropolitan, Belgrade, Serbia, venezija.ilijazi@metropoliten.ac.rs

<sup>b</sup> University of Criminal Investigation and Police Studies, Zemun, Belgrade, Serbia, jelena.lamovec@kpu.edu.rs,  
jacimovskis@gmail.com

<sup>c</sup> Academy of Sciences and Arts of the Republic of Srpska, Banja Luka 78000, Bosnia and Herzegovina,  
jovan.setrajcic@gmail.com

---

**Abstract:** *Eliminating the consequences of harmful gas emissions is part of the risk management process aimed at monitoring the crisis situation, restoring and rehabilitating the environment, restoring it to its original state, as well as eliminating the danger of the possibility of an accident recurrence. The subject of the research is the contribution to the application of modeling in the emission of hazardous substances in situations that occur during accidents during the transportation of hazardous and volatile substances, e.g. tankers on highways or rail transport. There are several models that allow the calculation of the distribution of the ground concentration of air pollution in the area around the pollution source. Modeling of the spatial and temporal spread of air pollution is used as a basic mathematical and IT support tool for early response and management with the aim of precise weather warning, and to prevent threats to the living world, property, environment and natural resources. The paper provides a solution to the problem of calculating the spread of excess air pollution in which larger or larger amounts of hazardous substances are emitted into the atmosphere. The result is a software solution that enables the recognition of the intensity, scope and consequences of the caused danger and is a contribution to monitoring the movement of air pollution in the entire contaminated area after the accident, as well as the assessment of the final range of the caused pollution.*

**Key words:** *transport accident, air pollution, mathematical-informatics modeling, spatial and temporal distribution of air pollution*

---



## ELECTRIC VEHICLES

Aleksandar Mićović<sup>a</sup>, Živorad Ristić<sup>b</sup>, Vojislav Krstić<sup>a</sup>, Slobodan Makragić<sup>c</sup>

<sup>a</sup> University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Knjaza Milosa no. 7, Kosovska Mitrovica 38220, Serbia, aleksandar.micovic@pr.ac.rs, vojislav.krstic@pr.ac.rs

<sup>b</sup> Insurance Association of Serbia, Trešnjinog cveta 1g, 11150 Beograd, Serbia, zivorad.ristic@uos.rs

<sup>c</sup> Auto Visit LLC, Milošev Kladenac 14B, 11000 Beograd, Serbia, autovisitdoo@gmail.com

---

**Abstract:** *The share of electronics as well as energy occupies an increasing percentage in the value of vehicle sales. Therefore, in everyday life, but also in the business environment (maintenance, vehicle exploitation, forensic expertise), we are faced with a large number of labels (abbreviations), mostly in English, which denote a certain important performance of a passenger car. We can give an example that due to the lack of knowledge of the exploitation of electric vehicles, a potential buyer of a new car may be greatly mistaken and, due to the lack of knowledge of terms, buy a mild hybrid or pay significantly more for a plug-in hybrid even though he lives in a building and does not have where to charge it.*

*That is why it is extremely important, especially for mechanical and traffic engineers who are in contact with this area of motor vehicles, to be familiar with the types of electric vehicles and hybrids, as well as various designations, i.e. acronyms (abbreviations made up of the initial letters of a name or name).*

**Key words:** *Electric Conveyance vehicles, Hybrid electric vehicle*

---

## IMPACT OF MOTOR VEHICLES ON THE ENVIRONMENT

**Zoran Ćurguz<sup>a</sup>, Ivan Krstić<sup>b</sup>, Miroslav Kostadinović<sup>a</sup>, Siniša Božicković<sup>a</sup>, Božidar Krstić<sup>b</sup>**

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, zoran.curguz@sf.ues.rs.ba, miroslav.kostadinovic@sf.ues.rs.ba, sinisa.bozickovic@sf.ues.rs.ba

<sup>b</sup> University of Kragujevac, Faculty of Engineering, 6, Sestre Janjic Str. 34000 Kragujevac, Serbia, bkrstic@kg.ac.rs

---

**Abstract:** *The number of registered vehicles in the world today is increasing day by day. The necessity of their application, and the benefit from that application, is an undeniable fact. However, the exploitation of a huge number of vehicles also leads to numerous side effects: Increased level of noise and its harmful effect on the environment; Harmful effect of exhaust emissions on the environment;... The paper presents the results of the analysis of the impact of vehicles in the environment from the aspect of exhaust emissions.*

**Key words:** *vehicle, exhaust emission, traffic safety*

---

## POSSIBILITIES FOR DETERMINATION OF THE OPTIMAL STRATEGY FOR PREVENTIVE MAINTENANCE OF THE VEHICLE ELECTRICAL EQUIPMENT USING MULTI-CRITERIA OPTIMIZATION

Zoran Čurguz<sup>a</sup>, Ivan Krstić<sup>b</sup>, Miroslav Kostadinović<sup>a</sup>, Božidar Krstić<sup>b</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, zoran.curguz@sf.ues.rs.ba, miroslav.kostadinovic@sf.ues.rs.ba

<sup>b</sup> University of Kragujevac, Faculty of Engineering, 6, Sestre Janjic Str. 34000 Kragujevac, Serbia, bkrstic@kg.ac.rs

---

**Abstract:** This work presents a possibility to find the optimal solution for the maintenance of the vehicle electrical equipment when the criteria are maximal availability and minimal maintenance costs. With regular formed models of maintenance, it is possible to do optimisation regarding the use of the best maintenance system. If all the important requirements and limits are previously given, then it is possible to solve this kind of problem. The basis of the methodology is the reliability parameters of the analysed electrical equipment for vehicles, from the aspect of failure appearance, to real conditions of exploitation and costs of maintenance. These two criteria lead to several solutions for vehicle electrical equipment assembly maintenance; therefore, it was necessary to apply the multi-criteria optimization.

**Key words:** vehicle electrical equipment; maintenance cost; multi-criteria optimization; reliability and availability; vehicle

---

## THE INFLUENCE OF CALL CENTER ON LOGISTICS PROCESSES

Amel Kosovac<sup>a</sup>, Elvedin Hasanović<sup>b</sup>, Adisa Medić<sup>a</sup>

<sup>a</sup> University of Sarajevo, Faculty of Traffic and Communications Sarajevo, Zmaja od Bosne 8, Sarajevo 71000, Bosnia and Herzegovina, amel.kosovac@fsk.unsa.ba, adisa.medic@fsk.unsa.ba

<sup>b</sup> BIHAMK Assistance LLC, Skenderija 23, Sarajevo 71000, Bosnia and Herzegovina, elvedin.hasanovic@gmail.com

---

**Abstract:** By introducing and implementing modern information and communication technologies into logistic systems, direct influence is exerted on logistic costs, as well as on specific processes and operator activities. The call center is a central hub of advanced customer relations and serves as a perfect technological solution for enhancing the efficiency of logistic processes. The paper describes the technologies for building call centers, the scalability of the system and additional options in accordance with the needs of companies. The functionalities and advantages of using call centers in logistics are described. The division of call centers according to different criteria and the functionality and advantages of logistics call centers were also mentioned.

**Key words:** call centre, functionality and benefits, logistics processes, logistics systems

---

## IMPLEMENTATION AND POSSIBILITIES OF BUILDING CITY LOGISTICS IN THE AREA OF THE CITY MUNICIPALITIES OF THE CITY OF SARAJEVO

Amel Kosovac<sup>a</sup>, Elvedin Hasanović<sup>b</sup>, Adisa Medić<sup>a</sup>

<sup>a</sup> University of Sarajevo, Faculty of Traffic and Communications Sarajevo, Zmaj od Bosne 8, Sarajevo 71000, Bosnia and Herzegovina, amel.kosovac@fsk.unsa.ba, adisa.medic@fsk.unsa.ba

<sup>b</sup> BIHAMK Assistance LLC, Skenderija 23, Sarajevo 71000, Bosnia and Herzegovina, elvedin.hasanovic@gmail.com

---

**Abstract:** This paper aims to identify optimal areas for the construction of major logistics and auxiliary centers with a focus on areas of Sarajevo City based on the analysis of several factors described in the paper. In addition to overpopulation and the lack of space required for this project, significant roles in making the final decision have transportation infrastructure and connectivity, location size, price, land condition as well the distance of the location from the populated part of the city. All of these parameters examined in this paper. The municipalities of Novi Grad and Novo Sarajevo meet the criteria for construction, specifically at the location of the Novi Grad municipality in the Rajlovac business zone and the area of the Novo Sarajevo municipality. However, areas of the Stari Grad and Centar municipalities do not meet the necessary criteria for the construction of these centers. The paper provides suggestions for potential construction locations in the territory of two municipalities of Sarajevo City and guidelines for future research regarding the potential locations in other cities of Bosnia and Herzegovina.

**Key words:** logistics centers, Sarajevo city, business zones, construction of centers

---

## RELOCATION LOGISTICS: FLOWS, STAKEHOLDERS AND SERVICES

Snežana Tadić<sup>a</sup>, Miloš Veljović<sup>a</sup>, Veljko Vidojević<sup>a</sup>, Mladen Krstić<sup>a</sup>, Slobodan Zečević<sup>a</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
s.tadic@sf.bg.ac.rs, m.veljovic@sf.bg.ac.rs, veljkovidojevic21@gmail.com, m.krstic@sf.bg.ac.rs, s.zecevic@sf.bg.ac.rs

---

**Abstract: Objectives.** The objective of this paper was to theoretically establish relocation logistics as an important and still insufficiently researched area. **Approach.** This objective was achieved with the help of the original reflections of the author, but taking into account the way of establishing and structuring other areas of logistics. **Results.** In the paper, the structuring and description of certain categories of relocation flows, stakeholders and services in this area was carried out. **Contribution.** The paper's main contribution is the definition of the structure of relocation logistics, as an insufficiently researched area of logistics, and the theoretical framework for its future research.

**Key words:** relocation logistics, structure, flows, stakeholders, services

---

## CROSS – DOCKING CONCEPT IN INTERMODAL TRANSPORTATION

Mladen Krstić<sup>a</sup>, Biljana Mičić<sup>b</sup>, Snežana Tadić<sup>c</sup>, Slobodan Zečević<sup>d</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
m.krstic@sf.bg.ac.rs, s.tadic@sf.bg.ac.rs, s.zecevic@sf.bg.ac.rs

<sup>b</sup> Bosnia and Herzegovina, biljana\_mcc@yahoo.com

---

**Abstract: Objectives.** Optimization of the goods flows in intermodal transport (IT), consolidation, as well as cost reduction along the supply chain are the parameters which are continuously highlighted in business strategies. To achieve IT efficiency, it is necessary to ensure the connectivity of the traffic network and the terminal. One of the intersections in the supply chain where consolidation takes place with great optimization of time, space and costs are the Cross-Docking (CD) terminals. Therefore the objective of this paper is to investigate the applicability of CD concept in IT. **Approach.** To do so, a literature review with an emphasis on CD concept, CD terminals, smart CD terminals and their application in IT is provided. **Results.** Implementation of the CD concept in CD terminals helps to achieve significant improvements in the form of inventories reduction, stimulation of hauled goods flows, reduction of delivery time, reduction of warehouse costs, space required for warehousing, as well as the effects of timely exchange of information along the supply chain. Therefore the main result of this paper is the comprehensive overview of the CD concept and its implementation in IT. **Contribution.** The fundamental contribution of the paper is to demonstrate the significance of the CD concept in IT, focusing on the achieved optimization of time, space and costs.

**Key words:** cross-docking, concept, intermodal transport, optimization

---

## THE IMPACT OF MICRODEPOTS ON THE EFFICIENCY OF URBAN DISTRIBUTION

Stevan Veličković<sup>a</sup>, Jelena Milutinović<sup>a</sup>, Biljana Grgurović<sup>a</sup>, Slavica Radosavljević<sup>a</sup>

<sup>a</sup> Academy of Technical-Artistic Vocational Studies Belgrade, Department of High ICT, Belgrade 11000, Serbia,  
stevan.velickovic@ict.edu.rs

---

**Abstract:** *The need for more efficient city distribution brings into focus new transport and logistic solutions. Many countries are turning towards a strategy of sustainable development. Green delivery vehicles, micro-mobile vehicles, shared mobility, micro-depots are just some of the possible solutions aimed at more efficient delivery while simultaneously reducing the emission of harmful gases, noise, and city traffic jams. The goal of the paper is to indicate the impact that the application of micro-depots has on increasing the efficiency of urban distribution, as well as their importance for sustainable development. The results were extracted based on the analysis of domestic and foreign literature in the field of city logistics and location problems. The paper shows the efficiency of urban distribution using micro-depots in cooperation with green and micro-mobile delivery vehicles. The work indicates the necessity of a new approach to urban distribution based on the optimal location of micro-depots and the application of new solutions in the field of transportation.*

**Key words:** *sustainable development, urban distribution, micro-depots*

---



## REGARDING THE MATTER OF TARE-PIECE CARGO STORAGE CAPACITY

Ilesaliev D.I.<sup>a</sup>, Ismatullaev A.F.<sup>a</sup>, Mustanov O.G.<sup>a</sup>

<sup>a</sup> Tashkent State Transport University, Uzbekistan, [ilesaliev@mail.ru](mailto:ilesaliev@mail.ru)

---

**Abstract:** *Mathematical models are proposed that establish the relationship between the individual parameters of the warehouse of packaged goods. The models were used in the study of the mutual influence of parameters on each other, and the storage capacities of tare-piece cargo were also determined.*

**Key words:** *tare-piece cargo, rack, pallet, warehouse, storage area, storage capacity*

---

## ANALYSIS AND CONCLUSIONS ON THE IMPACT OF TRANSPORT CONTAINERS ON TRANSPORTATION CONDITIONS

Ilesaliev D.I.<sup>a</sup>, Svetashev A.A.<sup>a</sup>, Ismatullaev A.F.<sup>a</sup>, Shikhnazarov J.A.<sup>a</sup>

<sup>a</sup> Tashkent State Transport University, Uzbekistan, ilesaliev@mail.ru

---

**Abstract:** *The main purpose of this study is to substantiate the optimal method of organizing transportation for various parameters of packaged goods, transport containers and containers. The methodology of the study is based on the analysis and summation of existing methods and approaches to the collection of initial information, as well as methods of its processing when choosing the most effective method of transportation of packaged goods. The practical significance of this study lies in the possibility of increasing the load capacity of containers when implementing its results. This means that based on the findings, it is possible to optimize the transportation of single-piece cargo, using containers more efficiently and increasing their carrying capacity. This can lead to lower transportation costs, increased productivity, and more efficient use of resources.*

**Key words:** *research, transportation organization, unitized cargoes, transport packaging, containers, research methods, analysis, information processing, rational approach, load capacity, practical significance*

---

## SPECIFICITIES OF REGENERATIVE BRAKING AND RECOVERY OF ELECTRICAL ENERGY FOR ELECTRIC BUS

Slobodan Mišanović

JKP GSP "Beograd", Knežinje Ljubice 29, Belgrade 11000, Serbia, slobodan.misanovic.gsp.co.rs

---

**Abstract:** *Electric buses (E-buses) are increasingly used in many cities around the world. In addition to the environmental benefits of use, electric buses have many times higher energy efficiency compared to conventional buses, as a result of the greater degree of efficiency of the propulsion system and the possibility of recovering electricity in the deceleration and braking phase. The paper will present the principle of operation and the theoretical basis of regenerative braking and electricity recovery in the braking phase. In the example of the work of the Higer KLQ6125GEV3 e-bus on the EKO1 line in Belgrade, the effects of electricity recovery in real working conditions will be shown.*

**Key words:** *E-bus, regenerative braking, electricity recovery, energy efficiency*

---

## FORENSICS OF PORSCHE CARRERA GT FIRE CASE PRESENTATION

Vojkan M. Zorić<sup>a</sup>, Jovan P. Šetrajčić<sup>b</sup>

<sup>a</sup> Megatrend University, Faculty of Civil Aviation, Belgrade, Serbia, vzoric@megatrend.edu.rs

<sup>b</sup> Academy of Sciences and Arts of the Republic of Srpska, Banja Luka 78000, Bosnia and Herzegovina,  
jovan.setrajcic@gmail.com

---

**Abstract:** *The paper presents the method of determining the circumstances of the cause of the fire on the passenger vehicle "Porsche Carrera 5.7 GT Cabrio", which was destroyed by fire. Analyzes were made as to whether the vehicle spontaneously combusted, that is, whether the fire occurred due to the lack of a hidden vehicle defect, or is such a possibility ruled out? The analysis was done on the circumstance of whether the vehicle have caught fire due to the contact of its front part with the wall on the side of the road. Also, the expert report showed whether it was possible for the vehicle to catch fire while driving due to the fault of the driver.*

**Key words:** *forensics, accident, passenger vehicle*

---

## IMPACT OF THE IMPLEMENTATION OF DIGITAL AUTOMATIC COUPLING ON WORKING CONDITIONS OF SHUNTING STAFF

Adrian Wagner<sup>a</sup>, Fabián Figueroa Valle<sup>a</sup>, Frank Michelberger<sup>a</sup>

<sup>a</sup> Carl Ritter von Ghega Institut – St. Pölten University of Applied Sciences, Campus – Platz 1, St. Pölten, 3100, Austria,  
adrian.wagner@fhstp.ac.at

---

**Abstract:** *The requirements for supply chains have changed significantly in the last decades, due to demands or challenges in competition. However, not only the requirements but also the technologies underwent a change. If we consider rail freight transport, digital systems for wagon data admission or route planning system are currently implemented. The freight wagons themselves, however, have remained in basic principles of the 19th century. For example, they do not have a power supply or a continuous data line to ensure the train integrity or supply sensors on the wagons with power. It is also necessary to couple and uncouple the screw couplings manually. Today coupling and uncoupling wagons is a physically demanding work and not without danger. Here, the use of a Digital Automatic Coupling (DAC) could have a positive impact of the operating procedure and reduce occupational risks. In the context of this work it is examined, how the implementation of the DAC influences the staff. For this purpose, conventional processes are analyzed and the effects of the DAC are examined. It is shown, how the various tasks and the responsibilities are shifted between different workers, like shunting staff and train drivers.*

**Key words:** *Shunting, Digital Automatic Coupling, work environment, Freight traffic*

---

## ENERGETIC COMPARISON OF LOCAL FREIGHT SERVICE WITH DUAL-SOURCE VEHICLES

Martin Chýle

CTU in Prague, Faculty of Transportation Sciences, Horská 3, 121 00 Prague, chylemar@fd.cvut.cz

---

**Abstract:** *The article focuses on the options for the operation of regional freight trains with regard to the reduction of local emissions and maximizing the operational efficiency. These trains are often operated on electrified lines with a higher gradient (up to 35 %) and with the possibility of exiting onto non-electrified lines and sidings without catenary, which generate significant additional costs for train operation. Increased emissions are also a negative effect. There are many lines and possibilities of use in this kind of operation within the European railway network. In the first part of the article the basic categorization of dual-source locomotives and their suitability for various operating modes is mentioned. The vehicle market situation is also analysed and manufacturers' approaches are defined. In the second part, examples of freight locomotives deployment on selected railway lines in Czechia are used to calculate the energy and cost saving potential of replacing a vehicle with diesel traction with a dual-mode (electric-diesel or electric-battery) locomotive in all sections equipped with overhead catenary. The benefits and negatives of using these possible solutions are described. Significant savings in the use of a traction-dependent vehicle can be achieved for example by using regenerative brake and returning the electricity produced back to the catenary when running downhill. However, cooperation with the infrastructure manager is also needed – he must adapt his railway lines to the operation of such a vehicles. Finally, general recommendations for operational deployment are formulated on the basis of which the replacement of a conventional vehicle by a dual or pure electric vehicle can be considered.*

**Key words:** *regional freight transport, energy consumption, hybrid locomotive, last mile*

---

## ASSEMENT OF TERMINAL STATIONS OPERATION: AN INTEGRATED METHODOLOGY

Gabriele Malavasi<sup>a</sup>, Stefano Ricci<sup>a</sup>

<sup>a</sup> Sapienza università di Roma, DICEA, Development & Innovation in Transport Systems, Via Eudossiana 18, 00184, Roma, IT,  
gabriele.malavasi@uniroma1.it , stefano.ricci@uniroma1.it

---

**Abstract:** *The paper explains an integrated methodology for the operational assesment of a terminal station, starting from the complexity of trains and routes management due to the extension of the dwell time required for the reversing manoeuvre. The original research introduces an integrated methodology to assess the operational modes of the stations and their best management. The analysis is based on three methodological steps corresponding to partial subproblems and their sequential merging represents the integration. The application to the important case of study of the Santa Maria Novella station in Florence completes the work.*

**Key words:** *railway, traffic, capacity, simulation, manoeuvres*

---

## RAIL FACTOR AND ITS PERCEPTION IN SMALLER REGIONS – LOVOSICE CASE STUDY

Stanislav Metelka<sup>a</sup>, Vít Janoš<sup>a</sup>

<sup>a</sup> CTU in Prague, Faculty of Transportation Sciences, Department of Logistics and Management of Transport, Horská 3,  
Praha 2, 128 03, Czechia, metelsta@fd.cvut.cz, janos@fd.cvut.cz

---

**Abstract: Objectives.** The paper aims to observe the passengers' attitude towards modal choice regarding the rail factor, a possible preference of the rail-based public transport modes in otherwise similar transport supply conditions. The existence of the rail factor is surveyed regarding the tolerance of the passengers towards the expected longer station approach times or travel times with the regional railway line to be reintroduced in comparison to the existing regional bus lines. **Approach.** Before the reintroduction of the railway line no. 113 Most - Lovosice, an online survey with the passengers along the line was conducted. The respondents were asked about modal choices regarding their requirements on the operation frequency and conditions of a possible change in favor of rail-based modes. **Results.** The respondents found the train more comfortable, and it is likely to be chosen for the unspecified general journey. However, the regional train should not be considerably slower than the competing bus should the passengers switch in favor of the train. **Contribution.** The collected SP data combined with the RP data (transport survey) form the basis for a determination of the rail factor role in regional transport as shown with the case study of the reintroduced line no. 113.

**Key words:** regional railway line, modal choice, modal attractivity, travel time

---



## A SUSTAINABLE ALTERNATIVE FOR RAILROAD NOISE BARRIER

Hirut Grossberger<sup>a</sup>, Lukas Stock<sup>a</sup>, Frank Michelberger<sup>a</sup>, Andrea Jandl – Rieger<sup>b</sup>

<sup>a</sup> Carl Ritter von Ghega Institute for Integrated Mobility Research, University of Applied Sciences St. Poelten, 3100 Austria,  
hirut.grossberger@fhstp.ac.at

<sup>b</sup> Institute of History of Art, Building Archaeology and Restoration, Technical University of Vienna, A-1040, Austria

---

**Abstract:** Noise barriers are structures that inhibit the direct transmission of airborne noise emitted by traffic. They play an important role along railroad lines to protect residential areas from high noise pollution. Noise barriers are currently made of very energy-intensive materials such as concrete, glass, aluminum, impregnated wood, etc. In addition to the high costs and large amount of energy input during construction, a recycling process is rarely possible when the noise barriers should be replaced or demolished. Therefore, it is necessary to develop inexpensive and sustainable alternatives. With its low primary energy requirement, regional availability and complete recyclability, loam can be a best suitable alternative. Loam is produced in large quantities as excavated material during railroad and road construction. Hence, rather than disposing excavated material expensively, the direct utilization of it should be found out. In addition, loam offers an optimum sound insulation because of its mass and porous surface. The study identified and compared possible noise barriers techniques using loam. This contribution gives insight into (i) the building techniques could be suitable for noise barriers; (ii) the standards and regulatory frameworks as well as (iii) lifecycle costing and advantage of loam noise barrier as compared to the conventional ones.

**Key words:** railway infrastructure, loam, circular economy, excavated soil

---

## BUILDING A COMMUNITY OF RAILWAY SCIENTIFIC RESEARCHERS AND ACADEMIA

Peter Márton<sup>a</sup>, Armando Carrillo Zanuy<sup>b</sup>

<sup>a</sup> University of Žilina, Univerzitná 8215/1, Žilina, 01026, Slovakia, peter.marton@uniza.sk

<sup>b</sup> EURNEX e.V. Eurnex Rail Research Network of Excellence, Hardenbergstrasse 12, Berlin, 10623, Germany, acarrillo@eurnex.eu

---

**Abstract:** EU-Rail (Europe's Rail Joint Undertaking) is the new European partnership on rail research and innovation established under the Horizon Europe (HEU) programme. EU-Rail is the Shift2Rail joint undertaking successor. EU-Rail goals are defined in the Multi-Annual Work Programme (MAWP). There are plenty of innovation activities covered by the MAWP. Last but not least EU-Rail's expected activity is to promote exploratory research and paradigm shifts activities in railway research. Cooperation of railway scientific researchers and academia is included in activities related to the development of PhDs programmes. This paper provides initial information about the Academics4Rail project that started in September 2023.

**Key words:** Horizon Europe, railway research, doctoral study programme

---

## FUZZY-FMEA APPROACH FOR RISK ANALYSIS OF SWITCH ELEMENTS

Milivoje Ilić<sup>a</sup>, Norbert Pavlović<sup>a</sup>, Ivan Belošević<sup>a</sup>

<sup>a</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
m.ilic@sf.bg.ac.rs, norbert@sf.bg.ac.rs, i.belosevic@sf.bg.ac.rs

---

**Abstract:** *Switches are key elements of railway infrastructure. Its moving parts change position depending on whether the upcoming running should be done in straight or in diverging. With a larger number of trains, their load increases, which affects the increased wear of parts, as well as the need for more frequent maintenance. In practice, derailments often occur at switch areas, therefore it is so important from the safety aspect. In this paper, the elements of the switch were considered as technical systems that can fail and lead to an incident situation. The approach of risk analysis of technical systems was applied to determine the scenario of switch failure. First, the switch was decomposed into basic elements that were evaluated by experts with linguistic fuzzy estimates depending on the risk factors. For this purpose, the FMEA method was used, which defines the risk factors: the severity of the defect occurrence, the probability of the defect occurrence, and the ease of failure detection. These factors are considered as criteria in the next step of the process of multi-criteria decision-making using the TOPSIS method. The aim of the work is to find out which are the critical elements based on the TOPSIS method and to rank them. The results of the work show that the risk analysis approach can be successfully applied in the detection and ranking of switch elements, as well as in the search for new design solutions in the strategy of their maintenance and construction.*

**Key words:** *switch, multicriteria decision making, risk analysis, FMEA, TOPSIS*

---

## MODEL OF REGULATION OF THE RAILWAY TRANSPORT MARKET IN BOSNIA AND HERZEGOVINA

Ratko Đuričić<sup>a</sup>, Nermin Čabrić<sup>b</sup>, Danijela Despotović<sup>c</sup>, Vladimir Malčić<sup>a</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, ratko.djuricic@sf.ues.rs.ba, vladimir.malcic@sf.ues.rs.ba

<sup>b</sup> University of Sarajevo, Faculty of Traffic and Communications Sarajevo, Zmaj od Bosne 8, Sarajevo 71000, Bosnia and Herzegovina, nermin.cabric@fsk.unsa.ba

<sup>c</sup> University of Business Academy, Geri Karoljica 1, 21000, Novi Sad, Serbia, danijela.despotovic@pravni-fakultet.info

---

**Abstract:** Bosnia and Herzegovina's determination to develop a open railway service market creates an obligation on the part of the state to establish a legislative framework that ensures equal realization of entrepreneurial rights among all participants. The process of liberalization railway transport market in Bosnia and Herzegovina began back in 2005 with the Act on Railways, which for the first time regulates the issue of opening the railway services market through the establishment of the Regulatory Board. Since the adoption of the Act in 2005, secondary legal regulations of the European Union have changed significantly, which implied the amendments of the Act on Railways, but it has never been done. This paper presents regulatory bodies and offers way of regulation of the open railway transport market with the aim of upgrading the Act on Railways, i.e. the Regulatory Board, all for the purpose of liberalizing the railway market in Bosnia and Herzegovina.

**Key words:** Acquis communautaire, regulatory body, liberalization, railway mark

---

## REVIEW TO THE STRUCTURE OF TRACK ACCESS CHARGES FOR SMALL RAILWAY NETWORKS

Vladimir Malčić<sup>a</sup>, Branislav Bošković<sup>b</sup>, Mirjana Bugarinović<sup>b</sup>, Ratko Đuričić<sup>a</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, vladimir.malcic@sf.ues.rs.ba, ratko.djuricic@sf.ues.rs.ba

<sup>b</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, b.boskovic@sf.bg.ac.rs, mirab@sf.bg.ac.rs

---

**Abstract:** Through strategic documents, directives, and regulations of the European Union, a comprehensive legal framework has been established for the development of track access charges models as a crucial tool for regulating the railway transport market. The determination of the structure, economic principles, and amount of these charges is entrusted to each country within the unified European railway space. The objective of this paper is to encompass the specific structures of track access charges, establish a classification of charge components, and elucidate the incentives and signals that certain infrastructure managers (IMs) convey to operators and stakeholders in the transport market. To achieve the aforementioned objectives, this paper investigates the Network Statements of infrastructure managers in the countries within the unified European railway space (documents published by IMs on their respective websites, where the methodologies for track charges are indicated). Through a comparative analysis, we will discern the various charge structures based on types, complexity, and the costs they cover. This research will assist infrastructure managers in making more informed decisions regarding the selection of track access charges structures for railway infrastructure usage.

**Key words:** track access charges, structure, infrastructure manager, transport market

---

## IDENTIFICATION OF CRITERIA FOR RESILIENCE ASSESSMENT OF THE PUBLIC RAILWAY OPERATOR IN OPEN RAILWAY MARKET CONDITIONS

Tihomir Subotić<sup>a</sup>, Branislav Bošković<sup>b</sup>

<sup>a</sup> Bosnia and Herzegovina, subotic.tihomir@gmail.com

<sup>b</sup> University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia,  
b.boskovic@sf.bg.ac.rs,

---

**Abstract:** *Enabling private companies to access the railway transport market will compel the incumbent railway operator to adopt market-oriented way of thinking in order to remain a relevant player within it. The moment of opening the railway transport market represents an undesired scenario in business, or a disruption for the incumbent, and as such can be observed through the lens of the resilience concept. The research aims to review literature in the field of organizational and business resilience to identify criteria that would serve to assess the resilience of the incumbent in the open railway transport market conditions. The results manifest in defining factors that influence organizational and business resilience in general, and identifying criteria for assessing the organizational and business resilience of the incumbent railway operator in open railway market conditions.*

**Key words:** *resilience concept, criteria, competitiveness, railway transport market*

---

## NON - CONTACT MEASUREMENT OF TRACK GEOMETRY PARAMETERS

Mladen Žarković<sup>a</sup>, Željko Mitrović<sup>b</sup>, Lazar Mosurović<sup>a</sup>, Jovo Steljić<sup>a</sup>, Filip Ščekić<sup>a</sup>

<sup>a</sup> Directorate for Railways, Nemanjina 6., Belgrade 11000, Serbia, zarkovic.mladen11@gmail.com,  
lazar.mosurovic@raildir.gov.rs, jovo.steljic@raildir.gov.rs, filip.scekic@raildir.gov.rs

<sup>b</sup> Infrastructure of Serbian Railway, Nemanjina 6, Belgrade 11 000, Serbia, zeljcom@gmail.com

---

**Abstract:** *With the tendency to develop and improve the railways, increasing the speed on the railways and the requirements for increasing the throughput of the railways due to the increase in the volume of traffic, the challenges of maintaining the railway infrastructure also grow proportionally. By non-contact measurement of track geometry parameters and analysis of measurement results, it is possible to create high-quality plans and management strategies for the maintenance of the railway infrastructure in a short time and take timely measures to eliminate registered errors on the track. On that way, safety will be raised to a significantly higher level, unplanned track closures will be avoided, regular traffic will be enabled and the costs of inadequate and unplanned maintenance of the railway infrastructure will be reduced.*

**Key words:** *railway infrastructure, railroad maintenance, measuring systems, superstructure, rails*

---

## SAFETY OF PASSENGERS ON PLATFORMS IN RAILWAY STATIONS AND STOPS

Zdenka Popović<sup>a</sup>, Luka Lazarević<sup>a</sup>, Jaroslav Matuška<sup>b</sup>

<sup>a</sup> University of Belgrade, Faculty of Civil Engineering, Bulevar kralja Aleksandra 73, 11120 Belgrade, Serbia,  
zdenka@grf.bg.ac.rs, llazarevic@grf.bg.ac.rs

<sup>b</sup> University of Pardubice, Faculty of Transport Engineering, Studentská 95, Pardubice, Czech Republic,  
Jaroslav.Matuska@upce.cz

---

**Abstract:** Modern railway infrastructure should provide the competitiveness and sustainability of passenger traffic. The essential requirement is to ensure the accessibility of railway infrastructure and vehicles for all categories of passengers. The paper presents the technical specifications of interoperability that have to be met by platforms in new and reconstructed railway stations and stops. The safety of passengers moving and staying on the platform is considered. The term safe and dangerous zone on the platform is defined. The influence of the staircase and elevator position on the required width of the platform is analyzed. Guidelines are given for determining the content and minimum width of the platform safe zone in new and reconstructed stations. Safety requirements for all passengers, including disabled persons in wheelchairs and persons with temporarily and permanently reduced mobility, are included in the considerations. The presented guidelines are applicable in the design of new stations and reconstruction.

**Key words:** accessibility, interoperability, persons with reduced mobility

---



## THE RELATIONSHIP OF THE EFFICIENCY INDEX OF EUROPEAN RAILWAYS AND THE QUALITY OF THE RAILWAY INFRASTRUCTURE

Drago Pupavac

Polytechnic of Rijeka, Vukovarska 58, 51000 Rijeka, Croatia, drago.pupavac@veleri.hr

---

**Abstract:** European national rail systems face the challenge of maintaining high performance in periods of crisis and increased austerity. Despite budget constraints, several countries have recently adopted ambitious investment plans for their national rail systems, encouraging and enabling their transformation. Investments in the modernization and improvement of the quality of railway infrastructure are accompanied by the liberalization of the railway market, all with the aim of increasing the efficiency of railway transport. Accordingly, this paper investigates the relationship between the efficiency of European railways on the one hand and the liberalization of railway traffic and the quality of railway infrastructure on the other. The main finding of this paper points to the absence of a connection between the liberalization of railway transport and the efficiency index of railways, that is, the existence of a statistically strong and positive connection between the quality of railway infrastructure and the efficiency index of European railways. Investing in the construction and modernization of railway infrastructure is imposed as a *conditio sine qua non* of raising the level of efficiency of European railways to a higher level.

**Key words:** railway traffic, liberalization of the railway market, quality of railway infrastructure, efficiency index of European railways

---

## RAIL TRAFFIC SAFETY BASED ON ADVANCED INTERNET TECHNOLOGIES

**Zoran G. Pavlović<sup>a</sup>, Veljko Radičević<sup>a</sup>, Marko Bursać<sup>a</sup>, Miloš Milanović<sup>a</sup>, Nevena Veljović<sup>a</sup>**

<sup>a</sup> Academy of Technical and Art Applied Studies Belgrade, Department of School of Railway Transport, 24 Starine Novaka St, Belgrade 11000, Serbia, zoran.pavlovic@vzs.edu.rs, veljko.radicovic@vzs.edu.rs, marko.bursac@vzs.edu.rs, milos.milanovic@vzs.edu.rs, nevena.veljovic@vzs.edu.rs

---

**Abstract:** *The safety of railway traffic is directly related to the transportation and infrastructural capacities of the carrier, as well as what it applies from the available information and communication technologies. Today, the functioning of railway companies is unthinkable if the existing computer and network infrastructure is not improved with innovative advanced internet technologies. Currently, the European Train Control System (ETCS) is in use on the route Belgrade - Novi Sad, which is the basis for the regularity and regulation of traffic at a speed of 200 km/h. In the near future, the Novi Sad - Subotica railway will be modernized, as well as Belgrade - Niš, so that there is a need to maximize safety in all segments of traffic and transport. The aim of this paper is to present an innovative model for increasing safety on high-speed railways, which is based on block chain technologies. The model envisages the protection of information in all internet transactions between telecommunication devices (signals, balises), employees of the dispatch center who communicate with the train staff. The significance of the work is reflected in the methodological development of an innovative model for improving safety on high-speed railways.*

**Key words:** *railway security system, block chain, innovative model of electronic business*

---

## DYNAMICS OF EXECUTION OF EVENTS IN THE PROCESS STRUCTURES OF THE TRAFFIC INSPECTION

Aleksandar Đukić<sup>a</sup>, Radenka Bjelošević<sup>b</sup>, Milan Vasiljević<sup>a</sup>, Milorad Banjanin<sup>c</sup>, Mirko Stojčić<sup>b</sup>

<sup>a</sup> Bosnia and Herzegovina, djukicaaleksandar1990@gmail.com, milanvasiljevic84@gamil.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bjeloševicradenka@gmail.com, mirko.stojcic@sf.ues.rs.ba

<sup>c</sup> University of East Sarajevo, Faculty of Philosophy Pale, Alekse Šantića 1, Pale 71420, Bosnia and Herzegovina, milorad.banjanin@ff.ues.rs.ba

---

**Abstract:** *The focus of the research in this paper belongs to the tasks, processes, events, activities and actions of the traffic inspection with the goal of improving flows in the traffic system and safety in road traffic. Traffic inspection is discursively designated as a specialized function of the traffic system in a certain geo-area, and it is organizationally situated most often as a unit of the state inspectorate or the republican administration for inspection affairs responsible for the field of traffic. The management of the execution of events in the process structures of the traffic inspection is based on the connection of data from the diary of the execution of events in road traffic that functions in the geo-area of Republika Srpska, Bosnia and Herzegovina. For this purpose, the paper presents an exploratory business research project in which an ensemble of traffic inspectors participates, who in a functionally designed diary for the execution of events investigate and connect data types with actions, activities, cases, the host and executor of the event, the object on which traffic inspection events are performed, the location and time interval of the execution of the event, the importance and periodicity of certain types of events. Related data are processed, selected and edited into process models with the aim of creating a big data basis for the formation of a digital platform that enables the automation of traffic inspection business processes.*

**Key words:** *traffic inspection jobs, types of knowledge of individual inspectors, related data, action, activity, event, process, event inspection log*

---

## APPLICATION OF DIGITAL SOLUTIONS IN POSTAL SERVICES

**Biljana Grgurović<sup>a</sup>, Slavica Radosavljević<sup>a</sup>, Jelena Milutinović<sup>a</sup>, Stevan Veličković<sup>a</sup>**

<sup>a</sup> Academy of Technical and Art Applied Studies Belgrade, Department of High School of Information and Communication Technologies, Zdravka Čelara 16, Belgrade 11000, Serbia, biljana.grgurovic@ict.edu.rs, slavica.radosavljevic@ict.edu.rs, jelena.milutinovic@ict.edu.rs, stevan.velickovic@ict.edu.rs

---

**Abstract:** *The traditional role of postal operators is changing. The default high competition from private courier companies is supplemented by another type of competition - digital alternatives. Aside from the possibility of the loss of a part of the market, cost-effectiveness is one of the main drivers of digitalization. Although the use of new technologies is never a low investment to begin with, it justifies its use in the long term. The authors aim to present an overview of the possibilities of moving digital transformations from the danger zone into the zone that simplifies and improves the work of postal systems and allows them to remain relevant factors in the industry. Based on several trends that have emerged in the postal industries in developed countries, as well as based on the current method of operations of postal operators in Serbia, the paper offers suggestions for new technologies that could be applied in this area.*

**Key words:** *postal services, digital transformation*

---

## THE USE OF BIG POSTAL DATA AS A NEW BUSINESS OPPORTUNITY FOR POSTAL OPERATORS

Jelena Milutinović<sup>a</sup>, Slavica Radosavljević<sup>a</sup>, Biljana Grgurović<sup>a</sup>, Stevan Veličković<sup>a</sup>

<sup>a</sup> Academy of Technical and Art Applied Studies Belgrade, Department of High School of Information and Communication Technologies, Zdravka Čelara 16, Belgrade 11000, Serbia, jelena.milutinovic@ict.edu.rs, slavica.radosavljevic@ict.edu.rs, biljana.grgurovic@ict.edu.rs, stevan.velickovic@ict.edu.rs

---

**Abstract:** The transfer of information, and transportation of goods, and passengers at the national and international level represent a picture of the social and economic activities of the population of the observed area, while the values of measurable standardized socio-demographic and economic parameters indicate local specificity. In this paper, the authors examine how different traffic flows are interconnected, as well as potential connections between traffic flows and measured indicators. Special attention is paid to postal services, taking into account their presence in every, even the smallest community, based on the concept of universal postal service. Passive data collection in the postal sector on a daily basis requires significantly fewer resources than a comprehensive survey of socio-demographic parameters. The paper considers the possibility of using and analyzing postal data as a new business opportunity in the field of business process optimization, the development of new services, and cooperation with big users and government organizations.

**Key words:** postal data, postal services, socio-economic indicators, transport

---

## TELEMATICS SYSTEMS IN DANGER GOOD TRANSPORT

Aleksandar Stjepanović<sup>a</sup>, Miroslav Kostadinović<sup>a</sup>, Goran Kuzmić<sup>a</sup>, Mario Radonjić<sup>b</sup>, Milana Sredojević<sup>b</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, aleksandar.stjepanovic@sf.ues.rs.ba, miroslav.kostadinovic@sf.ues.rs.ba, goran.kuzmic@sf.ues.rs.ba

Bosnia and Herzegovina, marioadonjic87@gmail.com, milanasredojevic13@gmail.com

---

**Abstract:** *The transport of hazardous materials is one of the most demanding types of transport and as such requires constant monitoring and control of the entire transport process. By applying modern information and communication technologies in the form of telematics systems, it is possible to constantly monitor the transport process in real time. The paper analyzed the possibilities of implementing telematics systems for the control and monitoring of the transport of dangerous goods. A proposal for the realization of the system with the use of microcontroller devices based on Arduino Uno is given. The GPS global positioning system was used for tracking, and the GPRS mobile data exchange system was used for data exchange.*

**Key words:** *telematics systems, danger goods, microcontroller control*

---

## APPLICATION OF RFID TECHNOLOGY IN IDENTIFICATION AND MEASUREMENTS - CASE STUDY ATHLETIC RACE

**Žarko Jovanović**

*Bosnia and Herzegovina, jovanoviczarko@live.com*

---

**Abstract:** *The paper presents the application of the RFID system in identification and measurement during the organization of mass events - from the aspect of a case study of an athletic race with several different distances with a joint mass start. The basic elements of the measurement system are presented and its functionality as well as the advantages and potential weaknesses of the system are described. Through the analysis of the obtained results of measuring the time of all participants in the 5 and 10 km race, the capabilities of the RFID system were tested and concrete conclusions were drawn. The application of this technology in the future will be primary and through technological progress the functionalities will be improved and the capacities of such systems based on RFID as well as combined with new modern technological solutions will be increased.*

**Key words:** *RFID tag, RFID antenna, measurement, identification, mass events*

---

## MODEL OF MONITORING LINUX BASED PLATFORM IN LARGE CORPORATE NETWORK

Sanja Jevtić<sup>a</sup>, Dragan Jevtić<sup>b</sup>, Marko Bursać<sup>a</sup>, Marija Zajeganović<sup>c</sup>

<sup>a</sup> Academy of Technical and Art Applied Studies Belgrade, Department of School of Railway Transport, Zdravka Čelara 14, Belgrade, 11 000, Serbia, sanja.jevtic@vzs.edu.rs, jevtic.sanja@gmail.com, marko.bursac@vzs.edu.rs

<sup>b</sup> Infrastructure of Serbian Railway, Nemanjina 6, Belgrade 11 000, Serbia, dragan.jevtic@srbrail.rs

<sup>c</sup> Academy of Technical and Art Applied Studies Belgrade, Department of School of Information and Communication Technologies, Zdravka Čelara 16, Belgrade, 11 000, Serbia, marija.zajeganovic@ict.edu.rs

---

**Abstract:** *The fast development of new services and devices and the increase of network threats demand a flexible network and good detection of various events in the network. This paper deals with a possible model (setup) of threat detection in an extensive network using Linux based platform. The aim is to monitor the network's security in a real-time environment by detecting some of the preselected events. The outcome of this model is expected to be a clearer understanding of the weak points in the network configuration.*

**Key words:** *Security Onion, Suricata, threat hunting, network traffic inspection*

---



## MODEL OF CYBER-PHYSICAL SYSTEM FOR TRACKING AND PREDICTION OF POSTAL DELIVERY TIMES

Mirko Stojčić<sup>a</sup>, Đorđe Popović<sup>a</sup>, Maid Husić<sup>b</sup>, Nataša Đalić<sup>a</sup>, Tanja Kostadinović<sup>b</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, mirko.stojcic@sf.ues.rs.ba, djdjpopovic1970@gmail.com, djalic.natasa@gmail.com

<sup>b</sup> Bosnia and Herzegovina, maid.mh986@gmail.com, kostadinovictanja1@gmail.com

---

**Abstract:** The main research focus in this paper is directed towards the creation of a proposed model of a cyber-physical system for continuous tracking of the location of postal items and prediction of their delivery time. The research is motivated by increasingly rigorous user requirements for quality of service (QoS) and expectations when sending and receiving shipments via express mail, but also due to increasingly fierce competition. In addition to the proposed topology of the CPS model, under the supervised learning paradigm, several models have been created for the prediction of shipment delivery times based on machine learning techniques: Artificial Neural Networks (ANN), Support Vector Machine (SVM), Classification and Regression Trees (C&R Tree). Data for a sample of 11,000 shipments for March 2022 was provided by the public company JP BH Post based on an officially sent request. For training and testing the model, 1100 data were used, which were structured into input-output vectors, and the research results confirm very good predictive performance.

**Key words:** Prediction, mail items, CPS, ANN, SVM, C&R Tree

---

## TECHNICAL ASPECTS OF APPLICATION OF ELECTRONIC SIGNATURE IN BUSINESS SYSTEMS

Salih Husaković<sup>a</sup>, Bojana Ristić<sup>b</sup>

<sup>a</sup> Bosnia and Herzegovina, sale\_brat@hotmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bojana.ristic@sf.ues.rs.ba

---

**Abstract:** *The application of a qualified electronic signature is the result of the application of information technologies (IT) in business. A wide range of innovations in the field of information technology and finance increases competition on the market and thus improves business processes in its environment by doing business with its economic entities and the financial sector. It is unquestionable that digitization is an accelerator of economic, social and political development of every country. The electronic signature represents a key component in the direction of the digitization of BiH society, which, in the long term, would have a positive impact on the business framework and the overall development path of BiH. The paper is based on the hypothesis that a qualified electronic signature is safer than a handwritten signature, and that it is faster in exchange during market communication and has a positive effect on the speed and efficiency of each process. The goal of this work is to clearly define the concepts of electronic signature, qualified electronic signature and to define the key eligibility requirements related to certification bodies.*

**Key words:** *digitization, qualified signature, certification authorities*

---

## IMPLEMENTATION OF A SENSOR SYSTEM IN TRAFFIC BASED ON THE ZIGBEE PLATFORM

Tanja Kostadinović<sup>a</sup>, Amer Sarajlić<sup>a</sup>, Aleksa Mirčetić<sup>a</sup>

<sup>a</sup> Bosnia and Herzegovina, kostadinovictanja1@gmail.com, amer\_sarajlic@hotmail.com, aleksaktdoboj@gmail.com

---

**Abstract:** This paper presents a sensor system that could be implemented in cars and on roads, based on the ZigBee platform. The elements of that system are presented, with special reference to the MC1322x microcontroller as the basic element of the ZigBee platform. Although ZigBee is still not widely used in the field of traffic, the potential it provides and individual tests have shown enviable results, so it can be expected that ZigBee devices will soon become an integral part of all roads and cars. Based on this, a possible method of applying the ZigBee wireless sensor network in traffic is presented, with the aim of increasing safety and reducing the number of traffic accidents.

**Key words:** ZigBee, Wireless Sensor Networks, Sensor Systems

---

## PROPOSAL FOR THE TECHNICAL SOLUTION OF INTELLIGENT LIGHT SIGNALING

**Tanja Kostadinović<sup>a</sup>, Darko Spasojević<sup>a</sup>, Svetko Milutinović<sup>b</sup>, Vanja Vanovac<sup>a</sup>**

<sup>a</sup> Bosnia and Herzegovina, kostadinovictanja1@gmail.com, darko\_ug91@hotmail.com, vanjavanovac91@gmail.com

<sup>b</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, s.milutinovic@hotmail.com

---

**Abstract:** *There are a large number of different intelligent transport systems, whose function directly depends on user needs. In this paper, the possibilities for application of intelligent light signaling, i.e. intelligent traffic lights, are considered. Intelligent light signaling greatly benefits both traffic safety and the acceleration of traffic flow.*

**Key words:** *ITS, intelligent traffic lights, intelligent roads*

---

## CONCENTRATION OF ECONOMIC ACTIVITIES OF THE REPUBLIC OF SRPSKA AND THEIR INFLUENCE ON EMPLOYMENT AND STRATEGIC DECISIONS

Siniša Božićković<sup>a</sup>, Cviko Jekić<sup>b</sup>, Goran Mitrović<sup>c</sup>, Adaleta Skula<sup>d</sup>, Željka Filipović<sup>e</sup>

<sup>a</sup> University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, sinisa.bozickovic@sf.ues.rs.ba

<sup>b</sup> Economic Faculty, University of East Sarajevo, Studentska 11, 76100 Brčko, Bosnia and Herzegovina, cviko.jekic.efb@gmail.com

<sup>c</sup> Drina Insurance Inc. Milići, Branch Bijeljina, Intersection Gavril Principa 1 i Filipa Višnjića 1, 76300 Bijeljina, Bosnia and Herzegovina, goran.mitrovic@drina-osiguranje.com

<sup>d</sup> Mixed Secondary School Tešanj, Patriotske lige 61, 74260 Tešanj, Bosnia and Herzegovina, adaleta.skula94@gmail.com  
Bosnia and Herzegovina, zeljka.josic1999@gmail.com

---

**Abstract:** The concentration of economic activities is a consequence of economic policy in every society. Over the past two decades of this century, the concentration of economic activities has increased in the Republic of Srpska. Concentration has led to an increase in employment in certain economic regions, which has created disparities in the development of regions. Three economic activities have the greatest importance in achieving the economic development of the Republic of Srpska, namely: Agriculture, forestry and fishing (A), Manufacturing industry (C) and Wholesale and retail trade, repair of motor vehicles and motorcycles (G). According to the data of the Republic Institute of Statistics, in 2020, the aforementioned activities significantly contributed to the creation of the gross domestic product of 31.58%. These three activities represent a reliable sample for evaluating the impact of concentration on the number of employees in the Republic of Srpska. In the paper, the concentration index of the mentioned economic activities will be investigated, which will evaluate the impact of concentration on the number of employees in the economic regions of the Republic of Srpska. The Herfindal-Hirschman index is used as a measure of concentration. The results of the research can be useful to the strategic management of the Republic of Srpska when creating decisions on the development of individual economic activities, as well as when creating the economic development policy of the Republic of Srpska.

**Key words:** concentration, economic activities, economic regions, Herfindal-Hirschman index

---

IX International Symposium of transport and communications  
NEW HORIZONS 2023

CONFERENCE SPONSORS



ВЛАДА  
РЕПУБЛИКЕ СРПСКЕ

