BOOK OF ABSTRACTS

NEW HORIZONS 2021

VIII International Symposium

NEW HORIZONS 2021

of transport and communications

26 - 27 November

www.novihorizonti.sf.ues.rs.ba

University od East Sarajevo
Faculty of Transport and Traffic Engineering
Doboj

BOOK OF ABSTRACTS

Doboj 2021.

VIII International Symposium NEW HORIZONS 2021
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

BOOK OF ABSTRACTS

- NH 2021 -

Edited by:

PhD Bojan MARIĆ
PhD Mirko STOJČIĆ
MSc Vladimir MALČIĆ

Doboj, 2021.

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

Народна и универзитетска библиотека
Републике Српске, Бања Лука

656.1/.2(048.3)

INTERNATIONAL Symposium New horizons 2021 of Transport and Communications (8 ; 2021 ; Doboj)
Book of abstracts / VIII International Symposium New horizons 2021 of Transport and Communications, Doboj, 2021. ; edited by Bojan Marić, Mirko Stojčić, Vladimir Malčić. - Doboj : Faculty of Transport and Traffic Engineering, 2021 ([S. l. : s. n.]). - IX, 39 стр. ; 26 cm

ISBN 978-99955-36-88-6

COBISS.RS-ID 134786049

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 BANIĆ	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
Zoran ĆURGUZ	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
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
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
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
Miloš PLJAKIĆ	Faculty of Technical Sciences, Kosovska Mitrovica, 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
Gordan STOJIĆ	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
Perica GOJKOVIĆ
Aleksandar STJEPANOVIĆ
Suzana MILADIĆ-TEŠIĆ
Tanja PETROVIĆ
Vladimir MALČIĆ
Goran KUZMIĆ
Dunja RADOVIĆ
Sanja SIMIĆ
Eldina MAHMUTAGIĆ
Miroslav PAVLOVIĆ
Željko VIDOVIĆ
Saša OSTOJIĆ

CONTENTS

INVITED LECTURES

CAPACITY ANALYSIS OF UNSIGNALIZED INTERSECTIONS IN DEVELOPING COUNTRIES – AN INDIAN PERSPECTIVE

Mithun Mohan[a]

[a] *National Institute of Technology Karnataka | NITK Surathkal · Department of Civil Engineering, mithun@nitk.edu.in*

Abstract: *Traffic behaviour at unsignalized intersections in India and other developing countries is entirely different from that of developed nations. This renders the popular capacity estimation procedures redundant for unsignalized intersections in developing countries, thus emphasising the need for some unique interventions. With this goal in mind, a gap acceptance-based approach is proposed by analysing the data collected from several Indian intersections. Critical gaps were estimated using the Occupancy Time Method, and the procedure to compute conflicting flows was modified to capture the actual field interactions. A modified version of Harder's model is developed that considers the effect of driver behaviour and intersection geometry..*

TWENTY YEARS SINCE THE INTRODUCTION OF THE TRACK ACCESS CHARGES FOR THE USE OF RAILWAY INFRASTRUCTURE IN EUROPE - TRENDS AND RULES OF TRAIN ACCESS CHARGES LEVEL

Branislav Bošković[a]

[a] *University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, b.boskovic@sf.bg.ac.rs*

Abstract: *The year 2021 as the "European Year of Railways" does not just happened. Namely, this year is marked as the 40th anniversary of the historic Directive 1991/440/EC adoption, which introduced railway reforms in Europe, the railway market opening and introduction competition between railway operators. With the adoption of Directive 2001/14/ EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure, for the first time the basic rules for the infrastructure charging were established, although the market was declared open a decade earlier. Under this directive, states had significant freedom in choosing formula for calculation of access charges and theirs level as well. The paper provides a historical development and overview of the track access charges level for European countries from the publishing Directive 2001/14/EC until today, and the rules and trends research by countries and regions, dependencies from the size and other characteristics of the railway network and traffic type.*

INVITED PAPERS

IMPLEMENTATION OF NEW PARADIGMS OF THE WHOLES IN CYBER-PHYSICAL SYSTEM OF TELECOMMUNICATIONS TRAFFIC AND DIGITAL SERVICES

Milorad K. Banjanin[a], Mirko Stojčić[b]

[a] *Department of Computer Science and Systems, University of East Sarajevo, Bosnia and Herzegovina, milorad.banjanin@ff.ues.rs.ba*

[b] *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*

Abstract: *Today, the New Horizons in Traffic and Communications are in the digital age with the rapid transition of the most important life needs of people into the digital space. Digitization products structure a new era of technological development of application and maintenance of new Cyber-Physical Systems (CPS) of a special type or set of systems with different degrees of their autonomy that achieve common goals by adapting the composed whole to a given ambient intelligent environment. Autonomous units are not necessarily integrated, but they inevitably cooperate functionally and process-wise as a resilient and adaptable ICT ecosystem. New categories of logic problems are most often solved using ANN as the most powerful machine learning technique and an alternative approach compared to conventional computer logic. Modeling and design of CPS are the tasks of engineers of a new profile that is significantly different from the engineers of the classical type. For this purpose, the paper analyzes the implementation of four modern paradigms of the whole: 1) STEM (Science, Technology, Engineering, Mathematics); 2) OSAD (Open Science & Open Access to Open Data); 3) BDTW (Big Data and modern ICT for DWT processing and storage); 4) MOTE (Man, Organization, Technology, Environment) in the modular structuring of CPS, whose inherent and essential complexity of emergent scenarios must take into account the fact that the usual CPS architecture is built by models of physical processes as well as software, computer platforms and networks. In that architecture, special importance belongs to the learning module, decision module and modular networks with several components (LTE, software, social, traffic, transport, IoT...). Between physical processes and network computing, embedded computing calculations are feedback loops through which sensors, actuators, physical dynamics, deep learning algorithms, software failures, network disputes, and communication delays are managed.*

Key words: *CPS, STEM problem unit, OSAD open science resource unit, BDTW big data and data warehouse treatment unit in cloud computing, MOTE business unit, machine and software adaptation in autonomous units of elastic structure, integration of physical processes and computing in adaptable networks, multimodal interaction field network communications, digital services in the structure of CPS*

A GLANCE AT THE TRACK ACCESS CHARGES STRUCTURE

Mirjana Bugarinović[a]

[a] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, mirab@sf.bg.ac.rs*

Abstract: *What the track access charges for the use of railway infrastructure should be based on and how to define the components for their calculation are the questions that immediately arose with the opening of the railway market. Directive 2001/14/EC set up only minimum rules for the structure but not condition or strive for a uniform method for track access charges calculation. After more than 20 years, the issue has changed and is focused on the track access charges structure design and the factors that influence on it. The rules by regions of Europe were especially noted, as well as the share of components in the track access charges. The analysis of the track access charges components includes a combination of criteria such as the size of state and the railway network, the share of transit traffic, the share of passenger and freight traffic, etc. The relationship and influence of the capacity and wear and tears components in the formulas for the calculation of track access charges have been especially researched..*

Key words: *track access charges, structure, railway market*

PAPERS

TRAFFIC SAFETY OF YOUNG DRIVERS IN THE REPUBLIC OF SRPSKA

Bojan Marić[a], Krsto Lipovac[b]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, bojan.maric@sf.ues.rs.ba*

[b] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, k.lipovac@sf.bg.ac.rs*

Abstract: *During the three years (2016., 2017. and 2018. year), approximately 25% of all road deaths in Republika of Srpska were between the ages of 18 and 30. The assumption is that the most endangered category of young people from this age group are young and inexperienced drivers. Therefore, it is very important to analyze in detail traffic accidents and influential factors that contribute to the increased risk of participation of young and inexperienced drivers in traffic. Many countries have paid special attention to the problem of youth suffering in traffic accidents. In the previous period, the risk of traffic accidents in the Republic of Srpska was reduced, but the goals set by the Strategy were not achieved. Several different adverse circumstances have contributed to this, which need to be investigated in detail. The subject of research in this paper is the system of driver training, and especially the risk of young drivers to participate in traffic accidents in the Republic of Srpska. In accordance with the mentioned subject of research, a comprehensive research of vulnerability of young and inexperienced drivers in traffic was realized, which would identify the causes and circumstances of traffic accidents in which this extremely endangered category of traffic participants participates, ie research of the most important elements of driver training system. In this regard, the paper presents a summary of the most important problems that contribute to the risk of young and inexperienced drivers, as well as a system of comprehensive measures and activities to reduce this risk, all with the aim of improving the overall level of traffic safety in Republic of Srpska.*

Key words: *Young drivers, Risk, Driver training sistem*

TRANSPORT IN THE WHIRLPOOL OF THE LOST DECADE

Drago Pupavac[a], Knežević Josip[b]

[a] *Polytechnic of Rijeka, Vukovarska 58, Rijeka 51000, Croatia, drago.pupavac@veleri.hr*

[b] *HŽ Infrastruktura d.o.o., Rijeka, Croatia, josip.knezevic@veleri.hr*

Abstract: *This paper investigates the movement of basic performance indicators in the transport system of the Republic of Croatia (HR) for the period from 2008 to 2020. It's a period of deep crisis in the Croatian economy and a period of survival. The global financial crisis, and then the COVID-19 crisis, with their intensity strongly and negatively affected the general level of economic activities, preventing a greater contribution of transport to economic growth and entering a virtous circle of development. The subject of this paper is focused on quantitative indicators of work in transport, but also on the relationship between transport and the economy in times of crisis. The working hypothesis of this paper is: In the observed period, especially in the specific conditions caused by the COVID-19 crisis, the role of transport as an active promoter of economic growth is missing. The main finding of this paper points to the conclusion that transport in the decade of crisis alleviated the recession to a greater extent than stimulated the economic recovery. The research results are based on methods of analysis and synthesis and methods of descriptive and inferential statistics.*

Key words: *transport, crisis, work indicators, COVID-19, economic growth*

ANALYSIS OF VEHICLE DAMAGE IN PEDESTRIAN TRAFFIC ACCIDENTS

Nenad Saulić[a], Zoran Papić[a], Milan Simeunović[a], Andrijana Jović[a]

[a] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, n.saulic@uns.ac.rs, z.papic@uns.ac.rs, milansim@uns.ac.rs, andrijana.jovic@uns.ac.rs*

Abstract: *Expertises of traffic accidents with the participation of pedestrians are specific from the methodological aspect. In addition to pedestrian injuries, one of the important indicators of vehicle impact speed is the damage and traces on the vehicle caused by the accident. The analysis of these traces is extremely important for determining the circumstances under which the accident occurred. By detailed analysis of damage to the vehicle, it is possible to determine the direction of operation of deformation forces and define the potential position of pedestrians in relation to the vehicle at the time of contact. In addition to the point of contact of the pedestrian's head with the upper parts of the vehicle, an important indicator of the impact speed is the intensity of vehicle damage, ie equivalent vehicles speed used in the collision for deformation work (EES – Energy Equivalent Speed).*

Key words: *vehicle damage, pedestrian traffic accidents, vehicle speed*

IMPACT OF EXITING VEHICLES ON CRITICAL HEADWAY VALUE

Dunja Radović[a], Vuk Bogdanović[b]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, dunja.radovic@sf.ues.rs.ba*

[b] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradović Square 6, 21000 Novi Sad, Serbia, vuk@uns.ac.rs*

Abstract: *Drivers at the roundabout approach estimate the headways between vehicles in the main flow and look for headways large enough to safely enter the roundabout. However, the question arises whether the vehicles that are exiting the roundabout on the same approach also influence the driver's decision to accept a suitable headway for entering the roundabout. Namely, the driver at the minor approach often hesitates to enter the circulating flow until he is sure whether the vehicle from the main stream will continue circulating or it will exit the roundabout. When analyzing the capacity and level of service at classic non-signalized intersections, the influence of vehicles that make a right turn from the main approach and exit onto the minor approach is taken into account. As roundabouts belong to non-signalized intersections, it is necessary to investigate whether and to what extent the exiting vehicles affect the driver's decision from the minor approach to enter the circulating flow, i.e. the capacity of the roundabout approaches. Within the research conducted for the purposes of this paper, the influence of the exiting vehicles on the critical headway estimated by the maximum likelihood method is analyzed.*

Key words: *roundabouts, critical headway, maximum likelihood method*

ANALYSIS OF THE CONDITION OF FIBER BULBS ON MOTOR VEHICLES AFTER TRAFFIC ACCIDENTS

Vojkan M. Zorić[a], Dragan Đurđević[a], Igor J. Šetrajčić[b], Siniša M. Vučenović[c], Jovan P. Šetrajčić[b]

[a] *Megatrend University, The Faculty of Civil Aviation, Belgrade, Serbia, vzoric@megatrend.edu.rs, ddjurdjevic@megatrend.edu.rs*

[b] *Academy of Sciences and Arts of the Republic of Srpska, Republika Srpska, Bosnia and Herzegovina, seki_1976@yahoo.com, jovan.setrajcic@gmail.com*

[c] *University of Banjaluka, Faculty of Natural Sciences and Mathematics, Republika Srpska, Bosnia and Herzegovina, vucenovic.s@gmail.com*

Abstract: Objectives: *The paper presents a unique approach to forensic analysis of the spiral fiber of a motor vehicle light bulb that participated in traffic accidents.* ***Approach:*** *It is known that the condition of motor vehicle bulbs can be an indicator of the cause of traffic accidents. In addition to the condition of the bulb it self – molten glass fragments of a broken balloon on fiber carriers and spiral fibers, the difference in elemental fiber composition in several investigated bulbs of the same vehicles can be key evidence for obtaining an answer to the way the accident happened.* ***Results and Contribution:*** *In the study of the present case, such an analysis was crucial evidence for the court and the originally accused in the present case was acquitted. Previously performed forensic forensic-technical expertise of the subject bulbs was done according to the literary rules, without including those relevant findings that were obtained by detailed forensic integral analysis. This case study is unique and new in the case law of Serbia, and was performed using the method of scanning electron microscopy.*

Key words: *Forensic analysis, traffic accidents, car bulbs, spiral fibers*

PREDICTION OF ACCIDENT USING TIME SERIES METHODS AND MODELS IN SERBIA

Miloš Pljakić[a], Predrag Stanojević[b], Dragan Jovanović[c]

[a] *Faculty of Technical Sciences, University of Priština in Kosovska Mitrovica, Serbia, milos.pljakic@pr.ac.rs*

[b] *Academy of Applied Studies, Department of Road Traffic and Transport, Leposavić, Serbia, stanojevicpredrag@yahoo.com*

[c] *Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia, draganj@uns.ac.rs*

Abstract: Objectives: *The aim of this paper is to predict traffic accidents using time series techniques. Time-series models have a significant role in analyzing the time effects of policy, economic, climate and social conditions on traffic safety. This paper covers the frequency of traffic accidents by months in the period 2011-2020. in order to forecast accidents in the Republic of Serbia. The study observed accidents with fatalities, accidents with injuries, as well as the total number of accidents per month.* ***Approach:*** *The prediction of traffic accidents was carried out using methods and models of time series that predict future events based on historical data. Four time series methods based on central tendency measures as well as non - seasonal and seasonal ARIMA model were used in the paper.* ***Results****: The results showed that seasonal ARIMA models have the best predictive performance for predicting fatal accidents, injured accidents and the total number of accidents.* ***Contribution****: These results can be helpful to all traffic safety entities as well as decision makers in the field of traffic engineering.*

Key words: *accidents, time Series, ARIMA, traffic safety*

ANALYSIS OF PEDESTRIANS' ATTITUDES ABOUT THE LEVEL OF SERVICE AT THE PEDESTRIAN CROSSING IN THE AREA OF THE INTERSECTION WITH A DEFINED EXCLUSIVE PEDESTRIAN PHASE

Boris Antić[a], Mladen Kovač[a], Dalibor Pešić[a], Jelena Divac[a]

[a] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, b.antic@sf.bg.ac.rs, mladenkovac94@gmail.com, d.pesic@sf.bg.ac.rs, jelena.jecy.divac@gmail.com*

Abstract: *In the period from 2010 to 2019, in the city of Belgrade, 452 pedestrians were killed, which is a percentage of 41.2% of all deaths in traffic accidents, observed for the same period. However, new approaches to assessing the state of road safety, in addition to data on traffic accidents, increasingly use indirect indicators of traffic safety,, which more comprehensively defines the influential factors of pedestrian casualties. Surveys of pedestrian attitudes, regarding the application of the exclusive pedestrian phase in the world, have shown that pedestrians believe that this measure is effective in order to increase pedestrian safety. However, the observance of the new mode of operation of light signals by pedestrians also depends on the understanding and acceptance of pedestrians to use the phase provided for pedestrians. In this regard, the implementation of the exclusive pedestrian phase in Toronto (Canada) is followed by the placement of posters, the presence of the police, media campaigns and other activities to inform traffic participants. In order to examine the attitudes of pedestrians, a survey scientific method was used. The paper will present an analysis of pedestrians' attitudes about understanding the functioning of the pedestrian crossing in Belgrade, with a defined exclusive pedestrian phase, but also attitudes regarding the impact on road safety and efficiency (time losses) of this solution. The results presented in the paper should enable the definition of the necessary guidelines in order to implement campaigns and ways of informing traffic participants, especially pedestrians, on the implementation of future pedestrian crossings with a defined exclusive pedestrian phase.*

Key words: *diagonal pedestrian crossing, pedestrian safety, Belgrade*

MICROMOBILITY AND ROAD TRAFFIC SAFETY OF VULNERABLE ROAD USERS

Dušan Mladenović[a], Krsto Lipovac[a], Jelica Davidović[a]

[a] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, d.mladenovic@sf.bg.ac.rs, k.lipovac@sf.bg.ac.rs, jelicadavidovic@sf.bg.ac.rs*

Abstract: *According to the World Health Organization, about half of those killed on world roads are vulnerable road users, including pedestrians, cyclists, two-wheelers and their passengers. According to the OECD report, cities are more likely to be killed in a car or motorcycle accident than micro-vehicles. The aim of this paper is to present the results of the suffering of vulnerable traffic participants in Serbia and to define measures to improve traffic safety with special reference to micro-vehicles.*

Key words: *Micromobility, Road traffic safety, Micro-vehicles*

DRIVING STYLES AMONG PROFESSIONAL DRIVERS IN MONTENEGRO

Boško Matović[a], Dragan Jovanović[b], Milanko Damjanović[a], Spasoje Mićić[c], Demir Đešević[d], Aleksandar Bulajić[e], Miloš Pljakić[f], Svetlana Bačkalić[b]

[a] *Faculty of Mechanical Engineering, University of Montenegro, Bulevar Džordža Vašingtona bb, 81000 Podgorica, Montenegro, boskom@ucg.ac.me*

[b] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradović Square 6, 21000 Novi Sad, Serbia, draganj@uns.ac.rs*

[c] *Ministry of Transport and Communications of the Republic of Srpska, Trg Republike Srpske 1, 78000 Banja Luka, Republika Srpska, Bosnia and Herzegovina, s.micic@msv.vladars.net*

[d] *Ministry of Capital Investments, Rimski trg 45, 81000 Podgorica, Montenegro, demir.djesevic@mki.gov.me*

[e] *Higher Education Technical School of Professional Studies in Novi Sad, Školska 1, 21000 Novi Sad, Serbia, bulajic@vtsns.edu.rs*

[f] *Faculty of Technical Sciences, Kosovska Mitrovica, Knjaza Miloša 7, 38220 Kosovska Mitrovica, Serbia, milos.pljakic@pr.ac.rs*

***Abstract**: The Multidimensional Driving Style Inventory is very prominent instrument for assessing driving styles. Nevertheless, there is a lack of empirical research that utilize the MDSI among professional drivers. The aim of the present study is twofold. Firstly, this study tended to examine psychometric properties and factor structure of the MDSI scale, and to validate it in sample of Montenegrin professional drivers. Secondly, the present research aimed to investigate differences in driving styles among different groups of professional drivers, such as: taxi, bus and truck drivers. The sample consisted of 467 professional drivers aged between 19 and 75 years. Confirmatory factor analysis and one-way ANOVA test were used to analyze data in R Statistics. The results indicated that eight-factor structure of the MDSI was adequate, supporting originally established solution. In addition, the present findings revealed that taxi drivers had a tendency to show more risky and dissociative driving styles compared to other professional drivers. Truck drivers were less prone to show unsafe driving styles. Overall, the current study might play an important role in a process of understanding mechanism of risky driving behavior and injury prevention among professional drivers.*

***Key words:** driving styles, risky driving, professional drivers, instrument, MDSI*

THE IMPACT OF VEHICLE ADVERTISING ON TRAFFIC SAFETY

Stanko Laković[a]

[a] *University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture, Smetanova ulica 17, 2000 Maribor, stanko.lakovic@um.si*

***Abstract:** Product advertising has existed for a long time, since the time of the economy of trade in goods. The mechanisms and tactics used by the seller to attract the buyer have changed over time. This article will present and analyse various propaganda messages of car manufacturers and journalists that significantly affect traffic safety. We'll determine if the ads promote dangerous driver behaviour. We will propose the development of a codex at the state level. The findings of this study could help traffic policymakers understand the state of advertising and do their best to adopt an advertising codex that would help reduce traffic accidents and consequences.*

***Keywords:** advertising codex, car advertising*

SAFETY ON SLOVENIAN ROADS DURING COVID

Stanko Laković[a]

[a] *University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture, Smetanova ulica 17, 2000 Maribor, stanko.lakovic@um.si*

Abstract: *Road safety is one of the most important aspects of road traffic. The quality of life of all citizens depends on the level of road safety.*

The main goal of this study is to investigate the state of road safety during the Covid-19 pandemic. Three different data sets are used in this study: statistical data of the Republic of Slovenia, data on traffic accidents and data on Covid-19 disease.

The results showed that in the Covid-19 period, the total number of accidents in Slovenia decreased significantly compared to the previous five years.

The findings of this study could help policymakers understand the state of road safety during a pandemic and appropriately adjust traffic signs and regulations to help reduce traffic accidents and consequences.

Key words: *traffic safety, Covid-19 pandemic, traffic accident data*

TRANSPORT NETWORK MODELING

Elena – Claudia Lixandroiu[a]

[a] *Transport Engineering Faculty, Polytechnic University of Bucharest, Splaiul Independenţei no. 313, district 6, Bucureşti, zip code: RO-060042, ROMANIA, c.lixandroiu@yahoo.com*

Abstract: *Between the economic development of a region and its transport infrastructure, it was always an interdependence. From the oldest times, the most prosperous regions have been located along important communication routes or at their intersection. The development potential of a region is all the greater as that region has a more developed transport infrastructure. Network modeling is studied as a way to describe a transport system, to obtain information about various aspects of its structural, functional, behavioral, informational, organizational atributes but also to predict its evolution in time. As in all systems, modeling flows and processes in a transport chain is paramount to starting the analysis and it represents the transposition of a studied segment with the help of variables in a schematic representation that provides a practical support for systems analysis.*

Key words: *network modelling, graph, traffic flow*

COMPARATIVE ANALYSIS OF THE METHODOLOGY FOR THE ANALYSIS OF CAPACITY AND SERVICE LEVELS OF TWO-LANE ROADS

Ana Bonić[a], Marko Subotić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Mišića 52, Doboj 74000, Bosnia and Herzegovina, ana.bonic15@gmail.com, marko.subotic@sf.ues.rs.ba*

Abstract: *Two-lane roads in Bosnia and Herzegovina make up over 95% of the road network and take over almost all traffic. Increasing congestion in the traffic network is a consequence of the increased degree of motorization, which is one of the key problems of today. Since the degree of motorization is reflected through the congestion density, a qualitative measure is presented by the Level of Service, which is extremely important for the development of a methodology for analyzing the capacity and level of service of two-lane roads. The methodological approaches that will be analyzed in this paper are the methods from several editions of the American Highway Capacity Manual (HCM-1994, HCM-2000, HCM-2010 and HCM-2016) and the New-classical procedure whose methodology was developed for local conditions. Based on an extensive theoretical analysis, certain differences and deviations in the methods of capacity analysis and Service Level were determined. It is especially important to note that the condition of the road and the radius of horizontal curves are less primary indicators for American experts, which is also the basic essential difference between the new-classical procedure and the HCM methodology*.

Key words: *qualitative indicator, Service level, methodology*

URBAN PLANINIG AND TRAFFIC SAFETY

Aleksandar Pavlović[a], Darija Pavlović[b]

[a] *CIS inženjering doo, Vase Pelagica 42, Odzaci 25250, Serbia, aleks.pavlovic@gmail.com, darija@cisinzenjering.rs*

Abstract*: The purpose of this paper is to point out the interdependence of urban planning and traffic safety. In order to reflect the mutual dependence between urban planning and traffic safety the survey and analysis of the state of traffic safety in local communities and the analysis of urban documentation were performed. After the conducted analyses the dependence between urban planing and the traffic safety was established. Recognition of this mutual relationship can have the huge benefit to the local community and the traffic safety because trought the improvement of urban documentation, we can also improve traffic safety.*

Key words: *:traffic safety, urban planinig*

SAFETY AND RISIK WHEN TRANSPORTING LIQUID FLAMMABLE SUBSTANCES

Vojislav Krstić[a], Boris Antić[b], Božidar Krstić[c]

[a] *Faculty of Technical Sciences, Kosovska Mitrovica, Serbia*

[b] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia*

[c] *Faculty of Engineering University of Kragujevac, Serbia, bkrstic@kg.ac.rs*

Abstract: *Analyzes show the most common causes of accidents in traffic, during the transport of dangerous goods, are: traffic accidents, malfunctions of vehicles, irregularities in the loading of vehicles, irregularities in loading and unloading. Unlike "classic" traffic accidents, traffic accidents involving the existence of hazardous substances can have consequences that go far beyond the place of the accident and can lead to catastrophic situations for the wider environment. A particulary important issue in the transport of dangerous goods is the issue of environmental safety of that transport. The paper highlights the issue of risk in the transport of liquid flammable substances.*

Key words: *motor vehicle, drive unit, special ambient conditions*

APPLICATION OF ENERGY METHOD FOR DETERMINATION OF VEHICLE IMPACT SPEED IN COLLISION WITH STOPPING OR SLOW MOVING VEHICLE IN INTERSECTION

Zoran Papić[a], Nenad Saulić[a], Vuk Bogdanović[a], Andrijana Jović[a]

[a] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, z.papic@uns.ac.rs, n.saulic@uns.ac.rs, vuk@uns.ac.rs, andrijana.jovic@uns.ac.rs*

Abstract: *Energy methods for determination of vehicle impact speed are based on the law of conservation of energy, according to which the total kinetic energy of a vehicle in a collision is equal to the remaining kinetic energy, as well as the energy spent on deformation work. In order to be able to determine the collision speed of one of the vehicles on the basis of this principle, it is necessary to know the speed of the other vehicle that participated in the collision. Intersections represent specific elements of the road on which, in order to realize the intended action of traffic participants, such as turning, lane changing, etc. the driver is forced to start his vehicle from standstill or to adjust the speed of its movement to the planned maneuver. By predicting the collision speed of a vehicle that performs a specific maneuver in slow traffic conditions, applying the law of conservation of energy and with certain simplifications, it is possible to define the collision speed of another vehicle in a very realistic framework.*

Key words: *vehicle, energy, conservation,impact, speed*

THE FUTURE OF LUTI MODELS

Ovidiu Harpalete[a], Șerban Stere[a]

[a] *Politehnica University of Bucharest, Splaiul Independenței 313, Bucharest 060042, Romania, ovidiu20022003@yahoo.com, serban.stere@gmail.com*

Abstract: *The paper is observing some trends in the current land-use/transportation models and points their limits and obstacles. The main question of the study is whether the likely effects of integrated land-use and transport policies can reduce travel demand and how this can be predicted. There is a renewed interest in overcoming implementation issues, as new trends, such as teleworking or autonomous vehicles, are expected to have a substantial influence on land-use patterns. The increase in transport demand should be covered by public transport, cycling and walking, but not by the increase in car traffic. This will be achieved mainly through more concentrated development of land-use. The main conclusion about LUTI integrated modeling is that the best approach is closely related to user needs and analysis and the most promising technique for activity-based transport and land-use modeling is microsimulation, which makes it possible to reproduce the complex spatial behavior of individuals on a one-to-one basis*

Key words: *transport, land-use, feedback cycle, accessibility, relocation, microsimulation*

PREDICTION OF TRAFFIC FLOW ON A MONTHLY LEVEL USING MACHINE LEARNING

Slađana Janković[a], Stefan Zdravković[a], Dušan Mladenović[a], Snežana Mladenović[a], Ana Uzelac[a]

[a] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, s.jankovic@sf.bg.ac.rs, s.zdravkovic@sf.bg.ac.rs, d.mladenovic@sf.bg.ac.rs, snezanam@sf.bg.ac.rs, ana.uzelac@sf.bg.ac.rs*

Abstract: *Automatic traffic counters are used for real-time detection and classification of vehicles on the network of state roads in the Republic of Serbia. Data obtained by automatic traffic counting are used to calculate various indicators of traffic load annually, monthly, daily, and hourly. The aim of this research was to define and verify the methodology of prediction of selected characteristics of the traffic flow intensity, based on the built and applied supervised machine learning models. The proposed methodology was applied in the case study where we predicted maximum and minimum daily traffic on a monthly basis. The case study used data obtained by automatic traffic counting on state roads in the Republic of Serbia, at selected counting points, during the period from 2011 to 2020. Machine learning models have been trained, tested, and applied for prediction using Weka software tool. One of the contributions of the research is to identify machine learning algorithms that have good results in predicting selected traffic load indicators. The best performance was obtained using models based on the following algorithms: IBk (k-Nearest Neighbors), Random Forest, Random Tree, and REPTree.*

Key words: *Weka, automatic traffic counters, k-Nearest Neighbors*

ALGORITHM FOR APPLYING THE SIMPLE RENEWAL MODEL OF A HOMOGENEOUS FLEET THROUGH THE MATLAB INTERACTIVE SOFTWARE PACKAGE

Miladin Rakić[a], Milica Miličić[b], Radoslav Kojić[c]

[a] *City administration of the City of Bijeljina, King Peter I Karadjordjevic Square 1, Bijeljina 76300, Bosnia and Herzegovina, miladinrakic@gmail.com*

[b] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, mmilica@uns.ac.rs*

[c] *Brcko District Government, Boulevard of Peace 1, Brcko 76100, Bosna i Hercegovina, radoslavkojic@gmail.com*

Abstract: *The algorithm for a model of simple renewal of a homogeneous fleet in the MATLAB software package has been developed within this workpaper. Adequate management of transport means, as one of the resources of the vehicle fleet, plays a significant role in improving the efficiency of the transport process and the sustainability of transport in general. The theory of random processes has been used in order to describe the model of fleet unit renewal. By applying the adequate interactive software package MATLAB, complex mathematical models of fleet renewal can be satisfactorily approached by end users, ie closer to the level of management of the transport organization. In this way, their work is facilitated and accelerated, without the need to know complex mathematical devices for describing real processes in transport.*

Key words: *Transport, Fleet Management, Modeling, MATLAB*

WAITING TIME AS AN INFLUENCING FACTOR ON THE GAP ACCEPTANCE PROCESS AT ROUNDABOUTS

Dunja Radović[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, dunja.radovic@sf.ues.rs.ba*

Abstract: *The gap acceptance process is one of the most commonly used techniques for calculating capacity at roundabouts. It is based on time headways/lags that are accepted or rejected by drivers on lower priority approaches. The influence of driver behavior on the capacity of roundabouts can be expressed by the time headway, which is one of the basic traffic flow parameters. This parameter explains the traffic interactions related to the case when a vehicle from a minor approach enters the main stream by flowing into or intersecting one or more main streams. The minimum acceptable headway is the basic parameter for the calculation of the capacity and level of service of the roundabout, and in theory, it is called the critical headway. The critical headway implies the minimum size of the headway in the conflicting flow that allows one vehicle from the minor approach to enter the circulatory stream. The aim of the research conducted in this paper is to determine how the waiting time of a vehicle on the minor approach affects the gap acceptance of vehicles, i.e. the critical headway.*

Key words: *roundabouts, waiting time, critical headway*

RISK ASSESSMENT OF AERO-POLLUTION ACCIDENTS IN TRANSPORTATION USING THE „ALOHA“ MODEL

Stevo K. Jaćimovski[a], Srećko Ilić[a], Jelena Lamovec[b], Siniša M. Vučenović[c], Jovan P. Šetrajčić[d]

[a] *University of Criminal Investigation and Police Studies, Zemun-Belgrade, Serbia, stevo.jacimovski@kpu.edu.rs*

[b] *University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Belgrade, Serbia, jejal@nanosys.ihtm.bg.ac.rs*

[c] *Faculty of Natural Sciences and Mathematics, University of Banja Luka, Banja Luka, Republic of Srpska, Bosnia and Herzegovina, sinisa.vucenovic@pmf.unibl.org*

[d] *Academy of Sciences and Arts of the Republic of Srpska, Banja Luka, Republic of Srpska, Bosnia and Herzegovina, jovan.setrajcic@gmail.com*

Abstract: *Aero pollution is a basic problem of transport traffic, the consequences of which directly affect the global warming of the planet, but also the quality of life. However, a special danger is posed by potential accidents during the transport of certain very dangerous chemicals, which can occur in different geographical environments.* ***Approach:*** *In this research, two accidents of local chemical leakage that occurred in Serbia were used and the consequences and extent of pollution were determined and measured. The extent of these contaminants was then modeled using a model ALOHA (Areal Location Of Hazardous Atmospheres) and corresponding software. Simulations of this type require, in addition to knowledge of the geographical features of the location where the accident occurred, knowledge and prediction of different meteorological conditions.* ***Results:*** *Simulations using the ALOHA model predicted and confirmed the same amount of pollution measured in these two accidents.* ***Contribution:*** *Accidents during the transport of dangerous chemical substances will continue in the future, it is impossible to completely eliminate them, but it is imperative in such cases to act quickly, but also to predict the extent of pollution - which is possible with such modeling.*

Key words: *chemical accidents, pollution modeling, transport of dangerous goods*

COMPARATIVE ANALYSIS OF THE PUBLIC TRANSPORT SYSTEM OF INĐIJA AND STARA PAZOVA

Milan Lazarević[a], Milan Simeunović[a], Pavle Pitka[a], Andrijana Jović[a], Milja Simeunović[a]

[a] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, lmilan@uns.ac.rs, milansim@uns.ac.rs, pitka@uns.ac.rs, andrijana.jovic@uns.ac.rs, mlekovic@uns.ac.rs*

Abstract: *There are certain differences in the character of public transport in larger and smaller cities. In larger cities, urban transport is more pronounced, which takes place in a narrower - continuously built-up area. In smaller cities, as is the case with Stara Pazova and Indjija, suburban transport is more pronounced, which is organized as part of local and intercity transport. Although the same socio - economic and spatial characteristics between the municipality of Stara Pazova and the municipality of Inđija, the characteristics of daily migrations of passengers differ significantly. Analyzing the manner of regulation and conduct of public transport on the territories of the municipality of Stara Pazova and the municipality of Indjija, certain shortcomings in the organization of public transport on their territory were concluded.*

Key words: *public passenger transport, comparative analysis, Indjija, Stara Pazova*

STANDARDS OF THE BUS RAPID TRANSIT SYSTEM OF PASSENGERS IN CITIES

Pavle Gladović[a], Vladimir Popović[b], Vesko Lukovac[c], Milan Stanković[b]

[a] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Square 6, 21000 Novi Sad, Serbia, anaipavle@gmail.com*

[b] *College of Applied Technical Sciences Nis, Serbia, msv.popovic@gmail.com, milanst08@gmail.com*

[c] *University of Defence Belgrade, Military Academy, lukovacvesko@yahoo.com*

Abstract: *The paper presents the structure of applied standards of the Bus Rapid Transit (BRT) system in cities, which are defined with the aim to create a common definition of this system and recognize high - quality BRT corridors around the world. The system also functions as a technical tool to guide and encourage local communities to consider the key characteristics of the best BRT corridors as they move through the design process. Despite the growing prevalence, reputation and success of BRT, many are still unaware of the characteristics of the best BRT corridors and their ability to provide the levels of service that are typical of the metro and subway. Before to the introduction of the BRT standard, there was no common understanding of what is BRT, which caused confusion regarding the concept.*

Key words: *Public Transport of Passengers, Bus Rapid Transit System, Standards, Corridor*

ACTION OF CONTROL OF TECHNICAL CORRECTNESS OF MOTOR VEHICLES ON THE INCREASE OF TRAFFIC SAFETY IN THE REPUBLIC OF SRPSKA

Tihomir Đurić[a], Miroslav Pavlović[a] Vladan Đurić[b], Drago Kovačević[c]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, drtihodj@gmail.com*

[b] *D.O.O. "Interdom" Banja Luka, Republika Srpska, vladandjuric92@gmail.com*

[c] *D.O.O. "3 D Izvor" Gradiska, Republika Srpska, dragokovacevic85@gmail.com*

Abstract: *The technical correctness of vehicles that participate in traffic is directly related to traffic safety and the economic situation in society, ie. drivers, ie vehicle owners are usually not able to adequately maintain their vehicles due to the fact that incomes in the Republika Srpska and BiH are insufficient. Every investment in vehicle maintenance is a direct attack on the budget of one family, and for that reason the owner of the vehicle is forced to allocate the minimum possible amount of money for maintenance. Most often, vehicle owners buy parts for the vehicle that are of poor quality, used parts and even used tires. They are obliged to take the necessary measures so that the vehicles are in good condition and to have the prescribed devices and equipment, the correctness of which contributes to the safe conduct of road traffic and the protection of people and goods. Vehicle tehnical inspection represents one of the most important measures of the social intervention in the area of traffic safety. Within the mechanical inspection, the condition of different parts and devices of the vehicle is controlled, but the biggest significance from the traffic safety aspect has the control of vehicle and steering system. For the analysis of technically correct devices for stopping, control and light-signaling devices, the period from 2003 to 2021 was analyzed and analyzes of results by areas of monitoring were presented.*

Key words: *vehicle technical functionality, traffic safety and vehicle technical examination*

THE CALCULATION OF TRAIN RUNNING TIMES ON A CRITICAL SECTION USING DIFFERENT METHODS - EXAMPLE SOPOT KOSMAJSKI - RIPANJ TUNEL SECTION (REPUBLIC OF SERBIA)

Zorica Milanović[a], Stefan Radojković[a], Dušan Vujović[a]

[a] *Academy of Technical and Art Applied Studies Belgrade, Department School of Railway Transport, Zdravka Celara 14, Belgrade, Republic of Serbia: jazztoall@gmail.com, bmwsteva@hotmail.com, dulevoz@gmail.com*

Abstract: *The calculation of exact train running time is important issue for a precise timetable construction and irremisible task for an economicaly oriented traffic operations planning. The calculation methods used vary from an analitical and grafical to the computer - aided calculation systems and simulation methods. In general, the calculation needs very detailed and accurate algorithms considering the infrastructure parameters and the rolling stock attributes. The more detailed algorithm brings the more precise calculation result. In this paper, one example of train running time calculation using different methods is presented. The railway section choosen is the part of one Serbian railway line. Calculation was performed by analitical, graphical and simulation method using OpenTrack simulation software. Calculation results were compared with the data from the real system. The main goal of the research presented is to initiate usage of modern aproach and methods for the train travel time calculation, especially simulation modeling. The special stress is on permannent improvement of the complex proces of railway traffic operation planning and scheduling.*

Key words: *Railway traffic, Train Running Time, Timetable, Simulation*

BEHAVIOR OF ROAD TRAFFIC PARTICIPANTS AT ACTIVE AND PASSIVE LOCAL RAILWAY CROSSINGS IN SERBIA

Goran Tričković[a], Sandra Kasalica[a], Milan Milosavljević[a], Snježana Rajilić[b], Dušan Jeremić[a]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Railway Studies, Zdravka Celara 14, Belgrade 11000, Serbia, tricko86@gmail.com, sandra.kasalica@gmail.com, mimilan89@gmail.com, jeremicd@gmail.com*

[b] *Bosnia and Herzegovina Railways Public Corporation, Musala 2, Sarajevo, 71000, Bosnia and Herzegovina, snjezana_rajilic@yahoo.com*

Abstract: *A survey conducted on participants in road traffic on the territory of eight settlements in the Republic of Serbia analyzed their behavior when crossing active and passive railway crossings. The aim of this paper is to investigate certain activities that affect the safe behavior of drivers at railway crossings, such as activities related to adjusting the speed of approaching the railway crossing, compliance with traffic signals, half gates violations and activities related to distaractions inside the vehicles.*

Key words: *safety, railway crossings, survey*

THE ROLE OF BLOCK SYSTEMS IN ETCS LEVELS

Sanja Jevtić[a], Marko Bursać[a], Goran Tričković[a], Dragan Jevtić[b]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Railway Studies, Zdravka Celara 14, Belgrade, 11000, Serbia, jevtic.sanja@gmail.com, sanja.jevtic@vzs.edu.rs, markobursac1987@gmail.com, marko.bursac@vzs.edu.rs, tricko86@gmail.com, goran.trickovic@vzs.edu.rs*

[b] *Infrastructure of Serbian Railways, IT department, Nemanjina 6, Belgrade, 11 000, Serbia, dragan.jevtic@srbrail.rs*

Abstract: *Block systems in many countries are in use for quite some time (differing in various parameters – principles of operation, length of track covered,..). Detecting the position of the train and its integrity, they are likely to survive for years to come. They already established a role in ETCS levels 1 and 2, but a significant role emerged in ETCS Level 3 as well. The aim of this paper is to give the specific insight of the use of block systems on different levels of ETCS, including hybrid level 3 (based on fixed virtual block), thus, potentially pointing out the direction to take in substitution of old block systems.*

Key words: *block systems, ETCS levels, fixed virtual block*

MANAGEMENT OF UNEVENNESS OF THE RAIL HEAD – ASPECT OF SUSTAINABLE DEVELOPMENT

Milica Mićić[a], Luka Lazarević[a], Zdenka Popović[a]

[a] *University of Belgrade, Faculty of Civil Engineering, Bulevar kralja Aleksandra 73, 11000 Belgrade, Serbia, mvilotijevic@grf.bg.ac.rs, llazarevic@grf.bg.ac.rs, zdenka@grf.bg.ac.rs*

Abstract: *The paper presents a contemporary approach to the management of short wave unevenness of the rail head surface within the framework of sustainable development of railway infrastructure, considering complex and often opposite requirements of users, railways, economy, environment, social community and transport safety. The extremely important influence of the railway electrification on the sustainability of railway transport was pointed out. The management of the development of short wave unevenness from the aspects of the utilisation of fly ash for the construction of the railway substructure, the impact on the environment, noise and vibration emission, as well as traffic safety was considered. The importance of removing unevenness of the rail head surface by grinding, milling and planing work was emphasized. However, the possible negative impact of rail grinding technology on the environment was also pointed out.*

Key words: *railway, environment, squat, head checking*

SUPERSTRUCTURE TYPES FOR URBAN RAIL SYSTEMS

Zdenka Popović[a], Milica Mićić[a], Luka Lazarević[a]

[a] *University of Belgrade, Faculty of Civil Engineering, Bulevar kralja Aleksandra 73, 11000 Belgrade, Serbia, zdenka@grf.bg.ac.rs, mvilotijevic@grf.bg.ac.rs, llazarevic@grf.bg.ac.rs*

Abstract: *In the urban environment, there is a growing tendency to use urban rail systems for passenger transport, which meet the requirements of European transport policy and significantly contribute to the quality of the environment due to their environmental performance. The paper presents the standard types of track superstructure for urban rail systems that are applied in European cities. The following types of slab track were described in detail: (a) systems with rails continuously laid on cast – in – place concrete beams or slab, (b) monolithic systems with precast reinforced concrete units and added cast – in – place concrete slab, and (c) systems with precast reinforced concrete elements.*

Key words: *railway, track superstructure, slab track, environment*

ASSESSMENT OF THE LEVEL OF SAFETY AT RAILWAY CROSSINGS BY PARTICIPANTS IN ROAD TRAFFIC USING THE FUZZY TOPSIS METHOD

Milan Milosavljević[a], Sandra Kasalica[a], Snježana Rajilić[b], Dušan Jeremić[a], Zoran Pavlović[a]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Railway Studies, Zdravka Celara 14, Belgrade, 11000, Serbia, mimilan89@gmail.com, Sandra.kasalica@gmail.com, jeremicd@gmail.com, Zoran.pavlovic@vzs.edu.rs*

[b] *Bosnia and Herzegovina Railways Public Corporation, Kneza Milosa 105, 74000 Doboj, Bosnia and Herzegovina, snjezana_rajilic@yahoo.com*

Abstract: *Railway crossings are the most sensitive points of contact between rail and road traffic. They represent potentially risky places for accidents and incidents, ie they contribute to endangering traffic, so their monitoring and improvement leads to a comprehensive increase in safety. In this paper, 15 active and passive railway crossings on the territory of eight settlements in the Republic of Serbia are considered. By surveying 225 road traffic participants, who represent decision makers, the six most important criteria were created. The values of the criteria by alternatives are defined by the triangular fuzzy numbers of all decision makers. The aim of this paper is to apply the Fuzzy TOPSIS model to determine which of the observed railway crossings is the safest, and to assess the safety of the railway crossing based on the surveyed traffic participants. Validation of the model results was performed through the analysis of the sensitivity of the solution to the change of the values of the weight coefficients of the criteria.*

Key words: *railway crossing, safety, fuzzy TOPSIS*

FUNCTIONALITY OF SHUNTING YARDS IN A MODERN FREIGHT TRANSPORT SYSTEM – CONSIDERATION OF AUTOMATED ROLLING STOCK INSPECTION

Adrian Wagner[a], Michael Thomasitz[b], Frank Michelberger[a]

[a] *Carl Ritter von Ghega Institut – St. Pölten University of Applied Sciences, Matthias Corvinus – Straße 15, St. Pölten, 3100, Austria, adrian.wagner@fhstp.ac.at , frank.michelberger@fhstp.ac.at*

[b] *Supreme Railway Authority - Federal Ministry Republic of Austria, Climate Action, Environment, Engery, Mobilty, Innovation and Technology Radetzkystrasse 2, Wien, 1030, michael.thomasitz@bmk.gv.at*

Abstract: *With regard to the increasing freight traffic and the resulting greenhouse gases, it is necessary to shift as much traffic as possible to rail. Shunting yards offer the potential to create incentives for modal shift. In the course of this paper, the automation and optimization of a rolling stock inspection was investigated. Interviews with experts and field observations showed that automation steps are possible, especially in visual inspections and in documentation.In addition, an automated brake test and a digitally automated coupling could be used to simplify further processes. The results collected in a small sample could form the basis for further research in a follow-up project. However, it is apparent that the measures can be taken on the infrastructure side, but also on the wagon side. To a large extent, this requires coordination of this interface. Similarly, in an overall consideration of an automated marshalling yard, it would also be possible to investigate the aspects of an automated rolling stock inspection. This would make it possible to make rail freight transport more attractive for transport companies and thus take a further step in the direction of green mobility.*

Key words: *rolling stock inspection, smart marshalling yard, shunting, automatization, freight traffic*

ANALYSIS OF ICT APPLICATION IN RAYWAY ENTERPRISES IN THE DIGITALIZATION PROCESS

Zoran G. Pavlović[a], Zoran Bundalo[a], Veljko Radičević[a], Marko Bursać[a]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Railway Studies, 24 Starine Novaka St., Belgrade, 11000 Serbia, zoran.g.pavlovic@gmail.com, cheminot2@gmail.com, veljkoradi@gmail.com, markobursac1987@gmail.com*

Abstract: *One of the most common questions for researchers in the field of information and communication technologies (ICT) is the representation and application in railway transport companies. ICT infrastructure is developed and represented in all organizational units and units, but it is not sufficiently used. This negative trend can be influenced by the education and expertise of employees as well as the lack of funds. This paper presents an analysis of ICT currently used in railway companies for the realization of everyday business activities as well as the use of technologies that are available to service users to realize their needs. In addition to the above, in order to increase the quality of service, a comparative analysis of models and services used in foreign railway administrations, which generate higher revenues by applying advanced Internet technologies. The aim of this paper is to analyze the current state of ICT application and, based on the results, propose innovative measures based on advanced Internet technologies, in order to improve business in relation to traditional models that are currently in use. The application of ICT and digitalization of business processes in railway companies is the main driver of innovation, modernization, increasing business revenues, competitiveness and development.*

Key words: *railway companies, ICT, digitalization, e-business*

ACCEPTANCE OF AUTOMATED VEHICLES IN THE FUTURE TRANSPORT AND LOGISTICS - RESULTS OF STAKEHOLDERS EVALUATION WORKSHOP FOR SLOVAKIA AND CZECHIA

Manon Feys[a], Evy Rombaut[a], Peter Márton[b], Lieselot Vanhaverbeke[a]

[a] *BUTO - Research group MOBI - Vrije Universiteit Brussel, Pleinlaan 2, Brussel, 1050, Belgium, manon.feys@vub.be, evy.rombaut@vub.be, lieselot.vanhaverbeke@vub.be*

[b] *University of Žilina, Faculty of Management Science and Informatics, Univerzitná 8215/1, Žilina, 010 26, Slovakia, peter.marton@uniza.sk*

Abstract: *The successful implementation of autonomous vehicles and changes in the transport sector in general, will require the engagement and acceptance of stakeholders in the sector. Depending on the scope and the scenarios, different types of stakeholders should be considered. In our paper, we describe the application of the Multi-Actor Multi-Criteria Analysis (MAMCA). The MAMCA allows the explicit inclusion of different stakeholder perspectives in the decision-making process. With this methodology, the stakeholder objectives can be quantified, and scenarios can be evaluated based on different criteria. The analysis results in a scenario ranking for each stakeholder group. We present the results of the MAMCA realised in the frame of stakeholder evaluation workshop for Slovak and Czech stakeholders.*

Key words: *autonomous vehicles, H2020, logistics*

SINGLE RAILWAY INFRASTRUCTURE MANAGER FOR AN INTERNATIONAL RAILWAY CORRIDOR

Kornél Nagy[a]

[a] *European Union Agency for Railways, 120 rue Marc Lefrancq, Valenciennes, 59307, kornel.nagy@era.europa.eu*

Abstract: Objectives *This paper aims to evaluate the current EU legal framework and practice in EU corridor management. The EU unbundling of infrastructure management from railway operations is one of the cornerstones of railway reforms performed from the last decade of the XX century. The expected outcome of these reforms was to create an interoperable railway network within the EU, which would shift freight and passenger traffic from roads and air to railways. This process is driven by harmonisation of operational, safety and technical standards, by implementation of a single traffic management system (ERTMS) and by creation of railway freight corridors. Nevertheless, all these changes and actions did not bring the expected results. The market share of freight traffic transported by rail is stagnating and even decreasing. Railway infrastructure management is fragmented, in most of the cases breaking the routes on national border lines. The implementation of rail freight corridors appears insufficient to fully address this problem. This paper aims to discuss and to give a hypothetical answer to the poor results highlighted by recent reports of the Commission on railway interoperability development.*

Approach *The study is based on market observation and theoretical evaluation of the proposal, using SWOT analysis.* ***Results*** *The study indicates further directions of research and lists hypothetical benefits of the proposed set up, operating rail freight corridors by principles of asset management.* ***Contribution*** *The paper aims at contributing to further assessments of EU policy to boost railway traffic and seeds for thought for countries and private investors where fragmented railway lines/networks could be managed more efficiently by a single railway asset manager driven by economic principles.*

Key words: *railway bond, rail estate, railway asset management, rail freight corridor*

TEN YEARS OF THE REGULATION 913/2010 CONCERNING A EUROPEAN RAIL NETWORK FOR COMPETITIVE FREIGHT

Miroslav Prokić[a]

[a] *University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, miroslav.prokic@yahoo.com*

Abstract: *Motivated by energy efficiency and environmental concerns, efficient rail freight transport has become one of the important priorities of EU transport policymakers. By adopting the White Paper on Transport in 2011 and European Green Deal in 2019, the European Commission has set clear goals related to reducing GHG emissions and reducing oil dependency in transport-related activities. To achieve this, the European Commission has set targets for rail freight transport according to which most of the goods transported by road should be shifted to rail. As a platform for the realization of this target, as part of the EC policy for the improvement of rail freight transport, was adoption of the Regulation 913/2010 concerning a European rail network for competitive freight. This paper provides a brief reminder of the genesis of Regulation 913/2010, an overview of its main results as apparent ten years later, and identifications of future challenges in this field.*

Key words: *rail freight transport, rail corridors, EU policy*

RISK ASSESSMENT OF LEVEL CROSSINGS ON LINE SECTION OSTRUŽNJA-VIJAČANI AND THEIR INFLUENCE ON RAILWAY TRAFFIC SAFETY

Tihomir Subotić[a]**, Amna Rahmanović**[a]**, Marko Vasiljević**[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, tihomir_subotic97@hotmail.com, amna_h@live.com, drmarkovasiljevic@gmail.com*

Abstract: *The main objective of this research is to conduct a level crossing risk assessment on rail line section Ostružnja-Vijačani and determine whether the current level of protection is appropriate. These level crossings are located on territory of municipality Stanari and municipality Prnjavor. Level crossing that are located in Stanari are: Ostružnja, Stanari 2, Stanari 1, Ljeb, and Dragalovci. Level crossings that are located in Prnjavor are: Gradina, Kulaši 1, Kulaši 2, Popovići 1, Popovići 2, Prisoje and Vijačani. For risk assessment, a combination of segments of several known methods (ALCAM, Brainstorming, Checklist...) was used. The fact is that traffic accidents at level crossings are often unpredictable and mostly end in either lost lives or severe injuries and consequences, with significant material damage. Because of this, risk assessment is conducted on listed level crossings.*

Key words: *Risk identification, risk analysis, risk evaluation, safety framework*

ECONOMIC EFFECTS OF VERTICAL SEPARATION IN THE RAILWAY SECTOR

Jovo Steljić[a], Lazar Mosurović[a], Jakša Popović[a]

[a] *Directorate for Railways, Nemanjina 6, 11000 Belgrade, Serbia, jovo.steljic@raildir.gov.rs, lazar.mosurovic@raildir.gov.rs, jaksa.popovic@raildir.gov.rs*

Abstract: *Paper on the topic: Economic effects of vertical unbundling in the railway sector, based on the EVES-Rail study conducted in 2012 in Amsterdam. The study considers the potential impact of different forms of vertical organization on costs and share in the mode of operation. It is designed to assess the main issues that policymakers should pose from an economic point of view when considering whether stricter legislation should be enacted regarding the separation requirements between infrastructure managers and railway undertakings. In this study, we look at the potential impact of different forms of vertical organisation of railway markets on costs and mode share. Three general models are distinguished: Vertical Integration, Holding Company and Vertical Separation.*

The aim of these studies is to assess the potential impact of different forms of partial or complete vertical unbundling in the railway sector in the European context.

Key words: *Reforms, separation, costs, recommendations*

THE CONCEPT OF EFFICIENCY IN ECONOMIC THEORY, EU RAILWAY REGULATION AND DEA METHOD

Marija Selaković[a], Mirjana Bugarinović[a], Branislav Bošković[a]

[a] *University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, marija.selakovic96@gmail.com, mirab@sf.bg.ac.rs, b.boskovic@sf.bg.ac.rs*

Abstract: *Efficiency is the key word for understanding the reasons for restructuring European railways. Interpretations of the concept of efficiency and approach when it comes to European railways are given in EU documents on transport, and dedicated to railways, as well as in EU directives. On the other hand, measuring and improving the efficiency of a company's business is doing by the application of certain methods. The operations research DEA method is most often used for it. The DEA method has its own specifics in the efficiency measurement. The paper presents a comparative analysis of the mentioned approaches in the interpretation of the concept of efficiency and a discussion of the possibility to apply the DEA method for efficiency measurement on the railway.*

Key words: *efficiency, railway, DEA method, restructuring EU*

TRENDS IN THE RAILWAY TRANSPORT OF GOODS BY CONTINENTS

Ivana Matović[a], Branislav Bošković[a]

[a] *University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, imatovic121@gmail.com, b.boskovic@sf.bg.ac.rs*

Abstract: *The main topic of this paper is overview trends in railway transport of goods in a long period by continents and what characteristics these trends have. Does these trends have the same or similar shape and if so, have these trends shifted in time and how much? The answer on this question is the subject of research in this paper. The trends in the transport of goods by rail across continents and comparative analysis are performed as well. Whether based on this shape can be predicted future trends by regions and countries which are late in development and reforms of railwasy is a matter of discussion in this paper.*

Key words: *transport of goods, trend, railway, time series*

NEW APPROACH TO RAILWAY VEHICLE MAINTENANCE MANAGEMENT

Nermin Čabrić[a], Nedžad Branković[b], Ratko Đuričić[c]

[a] *Regulatory Board of Railways of BIH, Doboj 74000, Bosnia and Herzegovina, cabric.nermin@gmail.com*

[b] *PIN.B C&I CONSULTING&INVESTMENT, Sarajevo 71000, Bosnia and Herzegovina, nedzad.brankovic@pin-b.ba*

[c] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, ratkomdjuricic@gmail.com*

Abstract: *The maintenance of rail vehicles is an important part of the railway safety system. A new concept in the maintenance system is the introduction of the term "Safety Critical Components", which is built into the IV railway package.* ***The objectives*** *are to show that the introduction of the ECM clearly defines and more efficiently manages and controls the maintenance system of railway vehicles. The establishment of harmonized maintenance rules encourage competition in the market and in international freight transport.* ***The approach*** *used in writing this work is the experiences and analyzes conducted by the EU Railway Agency and UIC - International Union of Railways after the introduction of the obligation that no one may put into use or use a railway vehicle on the railway, unless it is assigned an ECM and if the body in charge of maintenance as such is recorded in the NVR.* ***The result*** *of the application of the ECM certificate through the system of the register of safety-critical elements helps railway companies and infrastructure managers to more easily operationally manage mobile capacities.* ***The significance*** *of the work is that it shows the role and responsibilities of all participants in railway transport in the maintenance system as a new approach managed by the maintenance of railway vehicles. The method of application of FMECA methods and fault tree in risk management arising from safety critical railway vehicle components are presented.*

Key words: *ECM, Safety Critical Components, FMECA, Tree of error or malfunction...*

SIMULATION OF HIGHER CURRENT HARMONICS FROM NONLINEAR LOADING WITH SMALL POWER

Aleksandar Lazić[a], Branislav Gavrilović[a]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Railway Studies, Zdravka Celara 14, Belgrade, 11000, Serbia, gavrilovicbranislav5@gmail.com*

Abstract: *The problem of generating higher harmonics comes to the fore due to the growing presence of nonlinear consumers in the low voltage distribution network, such as computers and computer equipment, air conditioners, fluorescent lighting, etc. They are sources of higher harmonics whose large number and simultaneous operation can cause significant problems in terms of lowering the quality of electricity.The paper analyzes the influence of higher current harmonics, which are a consequence of nonlinear loading, on the characteristics of an alternating source (the place of Section ETP Belgrade. The research results obtained on the basis of the formed simulation model in the Matlab software package are given.*

Key words: *simulation, nonlinear consumers, higher harmonics*

NEW CONCEPT OF LOCAL PASSENGER TRAFFIC ON THE RAILWAYS OF THE REPUBLIC OF SRPSKA WITH SPECIAL REFERENCE TO RAILWAY STATIONS

Miroslav Đurić[a], Mirnes Požegić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, miicodjuriic@hotmail.com, mirnes.pozegic.96@gmail.com*

Abstract: *Local passenger traffic on the Railways of Republika Srpska has been facing the problem of survival and sustainability on the modern transport market for a long time. The reasons for this are numerous, and one of the main ones is the non-competitive infrastructure. The paper examines certain problems faced by local passenger traffic, and focuses on railway stations, the two largest, Banja Luka and Doboj. In addition, possible directions for overcoming these problems have been defined, which is one of the main goals of this paper. The results were obtained by researching and observing the current situation over a longer period, and we came up with results that can solve the current problem of local passenger traffic, which has been present for a long time on the Railways of Republika Srpska.*

Key words: *railway, passenger traffic, sustainability, railway stations*

SOLUTION OF THE RADIO NETWORK FOR TRAFFIC MANAGEMENT ON THE SIDE RAILWAYS OF THE SERBIAN RAILWAYS

Damir Zaborski[a], Vesna Vićić[b]

[a] *Academy of Technical and Art applied studies Belgrade, Department of Railroad transpor, Zdravka Celara 14, 11000 Belgrade, Serbia, damir.zaborski@gmail.com*

[b] *Serbian Railway Infrastructure, Sector for Electrical Engineering Belgrade, Nemanjina 6, 11000 Belgrade, Serbia, vvicic.vvesna@gmail.com*

Abstract: *The complete digitalization of the communication platform of the Serbian Railways is one of the basic preconditions for entering ERTMS (European Rail Traffic Management System) and this process has started with the modernization of highways by constructing optical infrastructure and implementing GSM-R (Global System for Mobile Communications-Railway) network. On the side lines in remote regions of the Serbian Railways, the construction of optical infrastructure is neither technically nor economically feasible in one step, but it will have been performing partially according to the established priorities in a longer period of time.*

The paper presents a technical solution of the digital radio network for traffic management on the side lines the Serbian Railways, that would ensure continuous communication within the staff on the official positions, in order to conduct railway traffic safely and to automate entire business processes. The proposed solution integrates radio network and radio relay links and guarantes a high degree of reliability and safety in work process. The simulation of the radio network is performed based on topographic data of the radio stations' broadcast locations and using the Radio Mobile software based on the digital terrain model. The digital integrated radio network contains a number of new advanced functions that enable digital mode, the possibility of further expansion, remote control and diagnostics, which reduces troubleshooting time and maintenance and operation costs.

The proposed digital radio network solution is applicable to all critical infrastructural parts of the Serbian Railways.

Key words: *railways, digitalization, radio network*

SERVICE FACILITIES AND RAIL RELATED SERVICES. LEGAL REGULATION AND COMPETENCE OF THE DIRECTORATE FOR RAILWAYS

Branka Nedeljković[a], Lazar Mosurović[a], Vida Jerković[a]

[a] *Directorate for Railways, Nemanjina 6, 11000 Belgrade, Serbia, branka.nedeljkovic@raildir.gov.rs, lazar.mosurovic@raildir.gov.rs, vida.jerkovic@raildir.gov.rs*

Abstract: *Taking into account the importance of non-discriminatory supply of services related to railway freight and passenger transport from the point of view of smooth functioning of the railway services market, this matter needed a more detailed legal regulation. The new Law on Railways transposes the provisions of the relevant European Union rules regulating the access to service facilities and rail related services. Furthermore, it extends the competence of the Directorate for Railways, as a railway regulatory body, to operators of service facilities and rail related services.*

Key words: *service facilities, market, services, regulatory body*

REDUCTION OF RISKS WHILE TRANSPORTING DANGEROUS GOODS THROUGH THE RAILWAY

Vladimir Malčić[a], Branko Milovanović[b], Miloš Ivić[b], Svetlana Čičević[b], Rade Cvijanović[c]

[a] *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*

[b] *University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, b.milovanovic@sf.bg.ac.rs; m.ivic@sf.bg.ac.rs; s.cicevic@sf.bg.ac.rs*

[c] *Railway of RS Doboj, Svetog Save 71, Doboj 74000, Bosnia and Herzegovina,,radecvijanovic@gmail.com*

Abstract: *The transportation of dangerous goods takes up a significant portion in the total volume of transport of goods, both in rail and in other forms of transport. Because of the properties of the goods their transport increases the general danger. The railway, according to its characteristic (isolation of the trail, system closure, high reliability and security which arise from the relation wheel – rail and the regulation of movement units - trains) is the safest form of transport in land traffic. The safe transportation process of dangerous goods requires that all participating members, from the sender to the receiver, know their obligations and tasks and that they fulfil them. In order to reduce the risk and improve the safety of all the dangerous substance transport participants, it is necessary to perform regular checkups on the application of preventive protection measures. Previous experiences on the application of preventive measures, which largely depend on the human factor, show that it is only possible with the existence of constant supervision processes. In this scientific paper the safety aspect of the transport of dangerous goods on the rail network of Republika Srpska Railways (ŽRS) is explained and interpreted. The emphasis is on the place, role and task of the Safety Advisor in the transportation of dangerous goods. In order to comprehend his significance in the implementation of the unobstructed and according to the established rules defined transport process, in accordance with defined legal acts. The suitability of the railway for the transportation of dangerous goods was pointed out, an estimate of the required number of Safety Advisors on the Republika Srpska Railway network was made and the effects of the implementation of the Safety Advisor position in the transport process were looked at.*

Key words: *dangerous goods, risk, railway transport, safety, Safety Advisor, accident*

GOODS AND TRANSPORTATION FLOWS OF SREM ADMINISTRATIVE DISTRICT

Gordan Stojić[a], Siniša Sremac[a], Ilija Tanackov[a]

[a] *Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovica 6, Novi Sad, Serbia, gordan@uns.ac.rs, ilijat@uns.ac.rs, sremacs@uns.ac.rs*

Abstracts: *The paper presents an analysis of goods and transportation flows in the Srem Administrative District. The Srem District is one of seven administrative districts of the autonomous province of Vojvodina, Serbia. The District includes the municipalities of: Inđija, Irig, Pećinci, Ruma, Sremska Mitrovica, Stara Pazova and Šid. Srem Administrative District realizes the exchange of goods in the amount of EUR 1.8 billion.*

The data about foreign trade are given through the quantities of goods and the values of goods that were recorded in import and export in the period from 2012 to 2019, namely with the following data: goods shipment and admission, destinations, the type of the traffic by which goods were transported, the type of goods, the mass of goods (import or export), and the value of goods (in thousand EUR).

Key words: *district, exchange of goods, transport flows, destination, transportation modal*

TRANSPORT DEMAND MODELLING IN NETWORKS WITH FLOWS CONSOLIDATION

Armand – Șerban Stere[a], Ovidiu Harpalete[a]

[a] *University Politehnica of Bucharest, Faculty of Transports, Transport, Traffic and Logistics Department, Splaiul Independenței 313, 060042 Bucharest , Romania, armand_serban.stere@upb.ro, ovidiu20022003@yahoo.com*

Abstract: *The last decades in the transport filed have been marked by a permanent concern of improving this economical sector. One solution can be represented by demand consolidation as it involves coordinating multiple suppliers to ship their goods to a consolidation terminal and collecting requests so that they can be delivered to a single traffic unit for a single destination. The present paper aims to emphasize the importance of transport demand consolidation as an element of improving the efficiency of supply chains in terms of warehouse dimensioning and the optimum number of handling equipments needed. For both problems of transport demand consolidation, mathematical models of queuing systems with numerical examples are considered to show the availability of the models and the effect on the demand consolidation process.*

Key words: *transport demand modelling, networks with flow consolidation, warehouse dimensioning, queuing system*

CROWDSHIPPING CONCEPT FOR THE LAST MILE DELIVERY

Mladen Krstić[a], Snežana Tadić[a], Jovica Smiljković[a], Slobodan Zečević[a]

[a] University of Belgrade, Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade, 11 000, Serbia, m.krstic@sf.bg.ac.rs, s.tadic@sf.bg.ac.rs, smiljkovic52@gmail.com, s.zecevic@sf.bg.ac.rs

Abstracts: *The rapid and continuous development of e-commerce worldwide is one of the main problems in city logistics, because it significantly changes the flow of goods within cities and generates the problems in the goods delivery. The realization of the last mile is certainly the most complex problem of the e-commerce realizatiion and it's considered as one of the most expensive, the least efficient and the most polluting stage of the entire logistics chain. This problem can be solved by promoting sustainable solutions. Recently, the solution for those problems is found in the crowdshipping concept, which is an innovative delivery concept that allows better use of excess transport capacities. Accordingly, this paper deals with this concept and its possible application in the realization of the last mile in e-commerce.*

Key words: *crowdshipping, e-commerce, last mile, city logistics*

HOME DELIVERY TECHNOLOGIES

Snežana Tadić[a], Slobodan Zečević[a], Miloš Veljović[a], Mladen Krstić[a]

[a] University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, s.tadic@sf.bg.ac.rs, s.zecevic@sf.bg.ac.rs, m.veljovic@sf.bg.ac.rs, m.krstic@sf.bg.ac.rs

Abstract: *Home delivery plays an increasingly important role in the context of e-commerce and business-to-customer (B2C) flows development. At the same time, various delivery technologies are being developed. Modes, technologies and means of transport are especially important. Home deliveries are most often performed by road transport (truck, van, pick-up vehicle, passenger vehicle, motorcycle, bicycle, etc.), but can also be realized by water, railway, air transport (drones) and the use of underground systems. This paper provides a comprehensive overview of transport technologies used in home deliveries.*

Key words: *home delivery, last mile, technologies, modes of transport, means of transport*

PREDICTIVE MODELING OF TELECOMMUNICATIONS TRAFFIC PERFORMANCE BASED ON MACHINE LEARNING TECHNIQUES

Mirko Stojčić[a], Milorad K. Banjanin[b]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, mirko.stojcic@sf.ues.rs.ba*

[b] *Department of Computer Science and Systems, University of East Sarajevo, Bosnia and Herzegovina, milorad.banjanin@ff.ues.rs.ba*

Abstract: *Network performance is a key systemic factor influencing the quality of experience of telecommunications service users. Therefore, telecommunication providers must make their prediction on the basis of which the directions of development and expansion of network capacities and resources in the future are determined. The main goal of this paper is to create a model for predicting the downlink user throughput of the LTE network of M:tel provider in the area of Motorway 9th January, as one of the key indicators of network performance. Prediction as a foresight from the present to the future based on data obtained in the past, can be positioned within Cyber-Physical Systems (CPS). The paper presents the CPS model in the geo-space of the motorway 9th January, where, within the cyber component, the emphasis is placed on the learning module. Since the most common techniques and algorithms implemented by this module are based on artificial neural networks, Boltzmann machines, virtual (software) sensors, fuzzy logic, etc., a model for predicting the observed network throughput performance has just been created within this module. In the IBM SPSS Modeler software environment, several predictive models based on machine learning were created using the automatic modeling method, and a multilayer perceptron was chosen as the final model with the smallest relative error.*

Key words: *CPS, prediction, downlink user throughput, LTE, multilayer perceptron, Motorway 9th January*

THE FUTURE OF THE POSTAL SECTOR IN A "SMART" ENVIRONMENT

Mladenka Blagojević[a], Dejan Marković[a], Lana Jovković[a]

[a] *University of Belgrade, Faculty for Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade 11000, Serbia, m.blagojevic@sf.bg.ac.rs, mdejan@sf.bg.ac.rs, lanajovkovic@gmail.com*

Abstract: *In today's digital age, postal services around the world are embracing the digital transformation to improve business processes and meet growing customer demands, in order to ensure commercial sustainability in the future. This paper presents new technologies used in the postal sector precisely to achieve the mentioned goals. The application of new knowledge, machines, software, as well as other innovative solutions that appear in the postal sector is one of the key factors of competitiveness. New, "smart" technologies are reshaping and transforming the postal sector itself. The aim of this paper is to present some of the best experiences in this regard. Through the paper, the technologies of the "smart" environment and the role of the post office in the "Smart City" project are presented.*

Key words: *postal sector, technologies, Smart City*

EXPECTED IMPROVEMENTS OF MOBILE SYSTEMS BY INTRODUCING 5G TECHNOLOGY IN THE TELECOMMUNICATIONS INDUSTRY OF MOBILE SYSTEMS

Amir Adilović[a], Edvin Škaljo[b]

[a] *BNT-TMiH, Machine and Hydraulics factory, Mehmeda Spahe 1, Novi Travnik 72290, Bosnia and Herzegovina, adilovicamir.bnttmih@gmail.com*

[b] *University of Sarajevo, Faculty of Science (Natural Sciences and Mathematics), Zmaja od Bosne 33-35, Sarajevo 71000, Bosnia and Herzegovina, edvin.skaljo@pmf.unsa.ba*

Abstract: *The development of new mobile technologies is expected to improve a set of technical means, organizational and administrative measures and documents, service staff, as well as a set of standards, protocols, methods for wireless voice and data transmission from subscriber to subscriber or from subscriber to information system. This drives economic growth and inclusion in the modern world of digitalization, which achieves a good connection between consumers and companies. The need in the world of digital economy to solve business problems is the need for new mobile technology with low latency, distribution and passability as important features. This technology is the technology of the fifth generation of mobile systems (5G) and is a continuation of 4G, 3G and 2G technology. Observing the global trends of mobile technologies, we will analyze the advantages of this technology through phases, namely: an overview of mobile systems through generations, 5G characteristics, 5G architecture, technical-technological part of 5G and the use of 5G. In addition to the advantages, there are disadvantages due to countries in transition. New technology uses not only new technological, but also software functions. Multiple antennas are used on transceivers to increase signal speed and quality. What is important and the final outcome (result) of this technology is that overloads and delays in signal transmission will be avoided. Such an efficient and reliable network, with better quality of service with new applications and higher speeds is a contribution to the community.*

Key words: *5G, characteristics, architecture, technical-technological elements, use*

INTERNET OF THINGS IN WASTE MANAGEMENT SOLUTION FOR SMART CITIES

Aleksandar Stjepanović[a], Miroslav Kostadinović[a], Goran Kuzmić[a], Mirko Stojčić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, aleksandar.stjepanovic@sf.ues.rs.ba, miroslav.kostadinovic@sf.ues.rs.ba, goran.kuzmic@sf.ues.rs.ba, mirko.stojcic@sf.ues.rs.ba*

Abstract: *A growing number of cities around the globe are testing smart waste management solutions to create higher efficiency systems with keeping their cities clean. Increasing waste generation has become a significant challenge in developing countries. Due to unprecedented population growth and urbanization various problems also occur. In this paper, an IoT-based smart waste bin monitoring waste management system is proposed. This system try to solve the problems associated with management of waste material and the IoT-based waste collection for the smart city. The proposed system is capable in the collection of waste effectively, detection of filling level of waste material. The IoT-based device performs the controlling and monitoring of the electric bins. These devices are wirelessly connected with the central hub to transmit the information about the bins filling level with the existing location.*

Key words: *Smart cities, Internet of Things, waste control system*

SIMULATION OF ALOHA IDENTIFICATION PROTOCOL IN RFID ENVIRONMENT

Jovanović Žarko[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, jovanoviczarko@live.com*

Abstract: *An identification protocol is a set of rules that is needed to communicate between two or more devices. In this case, they are an RFID reader and RF tag. In RFID technology, there are many types of protocols for communication and identification between tags and readers, but the ALOHA identification protocol with its variants will be described here. Use of the ALOHA protocol enables bandwidth expansion when communicating and transmitting information between RFID readers and RF tags that are integrated into the RFID system. The basic division of the ALOHA protocol is into pure Aloha protocol and sloted Aloha protocol. In the MATLAB software package and its add-ons will simulate the transmission of information in the RFID protocol through both variants of the Aloha protocol in order to better understand how it works and communicates between the RFID reader and the RFID tag.*

Key words: *RFID Aloha protocol, Pure Aloha, Sloted Aloha, MATLAB, Simulation*

THE APPLICATION OF CONSOLIDATION CENTERS TO POSTAL SERVICES OPERATIONS

Biljana Grgurović[a], Stevan Veličković[b]

[a] *Academy of Technical and Art Applied Studies Belgrade, Dpt. School of Information and Communication Technologies, Zdravka Celara 16, Belgrade, 11000, Serbia, biljana.grgurovic@ict.edu.rs, stevan.velickovic@ict.edu.rs*

Abstract: *Customers' approach to goods and services has changed with time, and with those changes, the organization of the operations of postal/logistics/transportation companies drastically changed, too. As the population in urban areas increased, e-commerce developed, the number of e-commerce platforms rose, so rose the expectations of customers to receive what they want, when, where, and how they want it. Instead of bulk deliveries to shopping malls or retail stores concentrated in certain urban zones, the practice now encompasses a large number of smaller deliveries to various locations that call for different routes. The downward mileage trend for large deliveries is bound to continue, while the mileage for small deliveries is predicted to abruptly rise. Many companies will have to reexamine and redefine their transportation logistics, since transportation in cities is becoming increasingly difficult, and in certain cases, impossible.*

The purpose of the paper is to show that the demands that postal operators face, especially those that operate in the above-described environment, can be satisfied with a wide choice of consolidator locations, i.e., consolidation centers. The paper will present suggestions for overcoming the problems related to the optimization of the delivery process, easier access to a higher number of individual customers, as well as ensuring access to office spaces in urban zones where it is currently difficult or too costly.

Key words: *location, delivery, postal operators*

RC CIRCUIT AS A DYNAMIC SYSTEM

Slavko Đurić[a], Vesna Mišić[a], Milan Milotić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, slavko.djuric@sf.ues.rs.ba, vesnasmisic@yahoo.com, milanmilotic@yahoo.com*

Abstract: *The paper considers the response to the accumulated energy in the RC circuit. In the circuit, capacitor C is originally charged with voltage U_0. At that moment t = 0 the circuit breaker P is switched on. Using Kirchhoff's laws on circuit elements, a homogeneous differential equation with constant coefficients is obtained with the initial condition $U_C(0)=U_0$. The solution of the differential equation is shown in the exponential form $U_C(t)=U_0 \cdot e^{-t/\tau}$. It is shown that a dynamic system can be formed from this solution. It is shown and vice versa, that from the formed dynamic system one can find an autonomous system (RC circuit equation) whose solution describes the formed dynamic system. It is also shown that a topologically equivalent system whose solutions are defined on the whole set can join the circuit equation.*

Key words: *RC circuit, dynamic system, voltage U_0, Kirchhoff's laws, a topologically equivalent system*

MATERIAL WAREHOUSE MANAGEMENT DATABASE DESIGN

Željko Stjepanović[a], Alen Panić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, stjepanoviczeljko@yahoo.com, alenpanicc@gmail.com*

Abstract: *Data organization is possible in the classical way in the form of individual tables and in the modern way as a set of integrated data in the form of databases. Database design is the most important segment in developing material warehouse management database. Therefore, the goal here is to reach the detailed specification of the overall structure of the database model, i.e. the database logic scheme at the implementation level. This database design includes the creation of a scheme, as well as the translation of data models into structures supported by appropriate software. Additionally, the topic related to the protection and security of data and information is of special importance in this paper and it is necessary to introduce users of this database with the real dangers that are present in modern business, as well as with the protection measures that need to be taken to ensure data security in the Internet environment.*

Key words: *database, material warehouse, database management system, data security*

ALGORITHM FOR ASSESSING THE CURRENT DRIVER'S ABILITY TO DRIVE A VEHICLE BASED ON EYE PARAMETER RECOGNITION

Gordana Jotanović[a], Željko Stojanov[b], Dragan Peraković[c] , Amel Kosovac[d] Aleksandar Damjanović[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, gordana.jotanovic@sf.ues.rs.ba, aleksandar.damjanovic@hotmail.com*

[b] *University of Novi Sad, Technical faculty "Mihajlo Pupin", Djure Djakovica bb, 23000 Zrenjanin, Serbia, zeljko.stojanov@uns.ac.rs*

[c] *University of Zagreb, Faculty of Transport and Traffic Sciences, Borongajska cesta 83a, 10000 Zagreb, Croatia, dperakovic@fpz.unizg.hr*

[d] *University of Sarajevo, Faculty of Transport and Communications, Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina, amelkosovac@gmail.com*

Abstract: *The algorithm presented in the paper deals with the eye parameters recognition (pupils/iris) on the basis of which the driver's current ability to drive is determined. The algorithm can be applied in transport companies, where employers strive for maximum efficiency of professional drivers at work, in order to ensure safe transport of people and goods. The problem is how to recognize in real time a driver who is not capable of driving a vehicle? Daily testing of drivers for alcohol, drugs, illicit drugs and fatigue significantly increases the costs of transport companies. Using an iris/pupil recognition algorithm, we can identify deviant conditions and use them to assess a professional current driver's ability to drive.*

Key words: *Professional driver, eye parameter recognition, Hough's transformation, Canny detection, segmentation*

AUTOMATIC DISCRETIZATION PARAMETERS FOR ASSESSING THE GUILT IN ROAD ACCIDENTS

Goran Jauševac[a], Vladimir Brtka[b], Dalibor Dobrilović[b] Branko Jotanović[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, goran.jausevac@sf.ues.rs.ba, jotan.bra.94@gmail.com*

[b] *University of Novi Sad, Technical faculty "Mihajlo Pupin", Djure Djakovica bb, 23000 Zrenjanin, Serbia, vbrtka@tfzr.uns.ac.rs, dalibor.dobrilovic@tfzr.rs*

Abstract: *The least desired consequence of traffic are traffic accidents. Human race and the environment are the actors of many different complex traffic situations in which they participate with all their characteristics, dimensions and capacities. Based on the expert's findings, the propensity for offenses in the form of speeding and the lack of thoroughness in making decisions are directly related to the increased risk of a traffic accident. One of the essential elements of a traffic accident is an adequate assessment of guilt based on known parameters. The aim of the research is to automate the process of assessing the guilt of traffic accidents, in order to avoid errors or oversights in the assessment. The tasks of this research are the formation of a database of traffic accidents and the discretization of parameters for the assessment of guilt in traffic accidents. The result of the research is the generation of IF… THEN rules for the assessment of traffic accidents based on expert reports. The research was conducted with a special emphasis on assisting the judicial system in making decisions based on expert reports on traffic accidents.*

Key words: *Traffic accidents, traffic expert reports, automatic discretization of parameters, Rough Set Theory*

PERSPECTIVE MIGRATIONS OF ERTMS SYSTEM FROM GSM-R TO LTE TECHNOLOGY IN BIH

Faruk Kubat[a], Popović Goran[b]

[a] *AŽD Praha, s.r.o., Jevrejska 37,78000 Banja Luka, Bosnia and Herzegovina, kubi.azd@gmail.com*

[b] *International University Travnik, Aleja konzula – Meljanac bb, 72270 Travnik, Bosnia and Herzegovina, popovic.goran@yandex.com*

Abstract: *GSM-R (Global System for Mobile Communications for Railways), is an international wireless communication standard for the use of mobile telephony in rail transport. As a sub-system of the European Rail Traffic Management System (ERTMS), it is used for communication between the train and the railway control center. In this paper, we will describe the current state of implementation of this system in some European countries as well as in Bosnia and Herzegovina. We will describe the characteristics of the system and point out its shortcomings, which primarily relate to limited capacity and insufficient support for additional data services. We will analyze the possibilities of migration of this system to the 4G LTE system adapted for railways and especially point out the perspectives of Bosnia and Herzegovina in that sense.*

Key words: *ETCS, ERTMS, GSM-R, LTE*

ANALYSIS OF THE RESULTS OF AUTOMATIC NUMBER PLATE RECOGNITION DEPENDING ON INFLUENTIAL FACTORS

Belmin Avdić[a], Aleksandar Gavrić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, belminavdic@gmail.com, aco1701@gmail.com*

Abstract: *The application of the Automatic Number Plate Recognition (ANPR) system is diverse. In car parks, the system can be used to record vehicle data and charge automatically depending on the parking time. Also, ANPR systems are used to control access on private property, thus increasing the security of the firm and individuals. The aim of this paper is to analyze the test results of the ANPR system implemented in MATLAB code, ie. testing his ability to recognize license plates in different conditions of taking photographs. The test results showed that several factors affect the recognition of the license plate. In order to predictively model the recognition outcome, depending on the influencing factors, an artificial neural network, a multilayer perceptron was created.*

Key words: *ANPR, artificial neural network, predictive model, multilayer perceptron*

EXPLOITATION OF MOTOR VEHICLES AND MOTORS IN SPECIAL AMBIENTAL CONDITIONS

Vojislav Krstić[a], Božidar Krstić[b], Nikola Krstić[c], Mesud Ajanović[d]

[a] *Faculty of Technical Sciences in Kosovska Mitrovica, Serbia*

[b] *University of Kragujevac, Faculty of Engineering, Serbia, bkrstic@kg.ac.rs*

[c] *Faculty of Electronic Engineering Nis. University of Nis, Nis, Serbia*

[d] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, mesud.ajanovic@sf.ues.rs.ba*

Abstract: *Many of the problems that arise when using the vehicle, in special ambient conditions (conditions of reduced temperatures, conditions of elevated temperatures, increased altitudes) forced the vehicle manufacturers to find out methods and means for their removal.*

Based on the research of the behavior of vehicles under different environmental conditions, it comes to the conclusion which conditions it must satisfy for its proper functioning in a particular geographical zone characterized by certain climatic conditions (moderate zone, desert zone, tropical zone and artistic zone).

The paper deals with the problems of exploitation of vehicles in special ambient conditions

Key words: *motor vehicle, drive unit, special ambient conditions*

CONTRIBUTION TO THE DETERMINATION OF VEHICLES BRAKING SYSTEM EFFICIENCY USING MEMS ACCELEROMETERS

Jasmin Šehović[a], Boran Pikula[b]

[a] *Mervik d.o.o., Vilonovo setaliste 10, Sarajevo,71000, Bosnia and Herzegovina, jasmin.sehovic@mervik.ba*

[b]*University of Sarajevo, Mechanical Engineering Faculty, Vilsonovo setaliste 9, Sarajevo,71000, Bosnia and Herzegovina, pikula@mef.unsa.ba*

Abstract: *The aim of vehicles braking system is to ensure that vehicles stop safely and efficiently. The efficiency of the vehicles braking system is tested at the vehicle technical inspection stations, on test lines using rollers or on test lanes using special deceleration measuring devices. This paper presents a device and a method for testing the efficiency of vehicles braking system on a test lane using MEMS (Micro Electro Mechanical System) accelerometers. Measurements were conducted on two vehicles during the braking process. The results were compared to the results obtained using other devices for measuring deceleration on vehicles - decelerometer, and GPS devices. Furthermore, advantages and disadvantages of the introduction of MEMS accelerometers in the context of current legislation of vehicle technical inspection testing in Bosnia and Herzegovina and the European Union are shown.*

Key words: *braking, MEMS accelerometer, braking efficiency, vehicle*

INCORRECTLY DETERMINED TEHNICAL CONDITION (DIAGNOSTICS) AS A CAUSE OF DIESEL ENGINE FAILURE

Zoran Ćurguz[a], Ivan Krstić[b], Božidar Krstić[b], Siniša Božičković[a], Miroslav Pavlović[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, zoran.curguz@sf.ues.rs.ba, sinisa.bozickovic@sf.ues.rs.ba*

[b] *University of Kragujevac, Faculty of Engineering, Serbia, bkrstic@kg.ac.rs*

Abstract: *Inciorrecty determined technical condition (poorly diagnosed) of the propulsion engine led to major problems during operation and maintenance.*

The paper presents the results of research into the causes of failure of one specific diesel engine that failed twice in the same way.

An accurate diagnosis has been made, the cause of the failure has been determined and maintenance procedures have been proposed.

Key words: *motor engine, failure, diagnostic, maintenance*

THE NEED AND SIGNIFICANCE OF LABORATRORY ACCREDITATION AS AN INSPPECTION BODY FOR TESTING VEHICLES FOR THE TRANSPORT OF DANGEROUS GOODS

Zoran Ćurguz[a], Božidar Krstić[b], Ranko Božičković[a], Vojislav Krstić[c]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, zoran.curguz@sf.ues.rs.ba, bozickovicranko@gmail.ba*

[b] *University of Kragujevac, Faculty of Engineering, Serbia, bkrstic@kg.ac.rs*

[c] *Faculty of Technical Sciences in Kosovska Mitrovica, Serbia*

Abstract: *The paper points out the need and importance of respecting the existing international regulations in the field of vehicles for the transport of dangerous goods. The paper also points out the need for accreditation of laboratories according to ISO/IEC 17020 in order to be able to perform profesional inspection of motor vehicles and towed vehicles used for the transport of dangerous goods.The conditions of laboratory accreditation are defined and the methodology of control of motor and trailer vehicles for transport of dangerous goods is defined in accordance with the valid international legal regulations.*

Key words: *accreditation, laboratory, vehicles for transport of dangerous goods, controlling*

INSPECTION OF SPECIAL FUNDS FOR THE TRANSPORT OF PERISHABLE FOODSTUFFS

Zoran Ćurguz[a], Božidar Krstić[b], Ranko Božičković[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, zoran.curguz@sf.ues.rs.ba, bozickovicranko@gmail.ba*

[b] *University of Kragujevac, Faculty of Engineering, Serbia, bkrstic@kg.ac.rs*

Abstract: *The paper analyzed the possibility of creating the necessary conditions for testing special funds for the transport of perishable foodstuffs.*

The analysis was performed based on the requirements of the Agreement on the International Transport of Perishable Foodstuffs and Special Means for their Transport (ATR).

The need and importance of respecting the existing international regulations in the field of special means for transport of perishable foodstuffs was pointed out, as well as the need for

Accreditation of laboratories according to ISO/IEC 1720 in order to perform professional control of special means for transport of perishable foodstuffs.

The conditions for the accreditation of the laboratory have been defined and the methodology for controlling special means for the transport of perishable foodstuffs has been defined in accordance with the valid international legal regulations.

Key words: *Special funds for the transport of perishable foodstuffs, controlling*

METHODS OF REDUCING EMISSIONS OF HARMFUL SUBSTANCES FROM ICE- ENGINES

Milan Milotić[a], Slavko Đurić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, milan.milotic@sf.ues.rs.ba, slavko.djuric@sf.ues.rs.ba*

Abstract: *This work presents the methods used to reduce the emission of harmful substances from the ICE-engines.*

Two basic methods are presented: primary and secondary. The primary group includes: interventions on the fuel and air supply system and flue gas recirculation.

The secondary methods include: the use of fuel with a low mass fraction of sulfur, selective catalytic and selective non-catalytic reductions and reduction of emissions of harmful substances by using plasma.

Key words: *noise, substations, traffic, environmental protection*

ANALYSIS OF THE IMPLEMENTATION OF PROFESSIONAL PRACTICE: A CASE STUDY AT THE FACULTY OF MARITIME STUDIES IN RIJEKA

Livia Maglić[a], Ana Perić Hadžić[a], Valentina Šutalo[a]

[a] *University of Rijeka, Faculty of Maritime Studies, Studentska ulica 2, 51000 Rijeka, Croatia, livia@pfri.hr, ana@pfri.hr, sutalo@pfri.hr*

Abstract: *The paper presents the results of research conducted within the Pandora Project funded by the European Social Fund, which identified and analyzed existing modalities of professional practice at the Faculty of Maritime Studies, analyzed student satisfaction with the current modality of professional practice, analyzed the documentation of professional practice, shortcomings and limitations in the implementation of professional practice and suggested methods of improvement. Proposed methods of improvement were obtained by surveying students and employers. The results show that the organization of professional practice has no logistical-administrative support and is individualized, mechanisms for the evaluation of professional practice are not establish, an insufficient connection of the tripartite student-teacher-employer relationship leads to an underdeveloped mentoring system.*

Key words: *higher education, professional practice, maritime education, professional training, Faculty of Maritime Studies*

BASIC FEATURES OF RIVER TRAFFIC IN THE REPUBLIC OF CROATIA WITH REFERENCE TO THE PORT OF OSIJEK AND THE PORT OF VUKOVAR

Sara Stanišić[a], Ines Kolanović[a]

[a] *University of Rijeka, Faculty of Maritime Studies, Studentska ulica 2, 51000 Rijeka, Croatia, sarastanisic1210@gmail.com, ines@pfri.hr*

Abstract: *The Port of Vukovar and the Port of Osijek are the most important ports in which is realized the traffic on inland waterways in the Republic of Croatia. River ports contribute to the economic development of the Republic of Croatia by participating in the total realized cargo and passenger traffic. This paper will analyze the basic features of river traffic in the Republic of Croatia and the technical and technological features of the Port of Vukovar and the Port of Osijek. The aim of this paper is, by analyzing the available data, to present the current situation, trends in further development of river ports in the Republic of Croatia and the possibility of increasing river port traffic through better integration into the European inland waterway system.*

Key words: *river traffic, technical and technological features, the Port of Vukovar, the Port of Osijek*

IMPACT OF NOISE OF TRANSFORMER STATIONS WITH TRAFFIC CORRIDORS ON THE ENVIRONMENT

Dragiša Đorđić[a], Slavko Đurić[b], Milan Milotić[b]

[a] *Independent University of Banja Luka, Faculty of Ecology, Veljka Mladjenovica 12e, Banja Luka 78000, Republika Srpska, Bosnia and Herzegovina, zastitad@gmail.com*

[b] *University of East Sarajevo, Faculty of Transport and Traffic Engineering, Vojvode Misica 52, 74000 Doboj, Bosnia and Herzegovina, milan.milotic@sf.ues.rs.ba, slavko.djuric@sf.ues.rs.ba*

Abstract: *Noise is becoming an increasingly important factor endangering the environment, with the intensive construction of residential, industrial, power and other facilities, and the increase in the density and intensity of traffic flows. In this paper, the results of noise level measurements at the locations of substations along the traffic corridors of the Republika Srpska (R. Srpska), i.e. Bosnia and Herzegovina (BiH) are analyzed. Based on the measurement results and appropriate comparisons, a conclusion is given on the influence of substations on noise generation, in the living and working environment. Medium voltage substations (35/10 kV/kV) do not represent significant noise generators in the environment.*

Key words: *noise, substations, traffic, environmental protection*

ERLANG'S MULTI-CHANNEL MASS SERVICE SYSTEM MODEL WITH TWO TYPES OF CLIENTS

Vesna Mišić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, vesnamisic@yahoo.com*

Abstract: *In the classical literature in the field of queuing, systems with one type of client are considered. In this paper, the model of Erlang 's multichannel queuing system with two types of clients is considered, and the corresponding mathematical models are presented.*

Key words: *dispersion, probability, binomial distribution, mass service*

CHALLENGES OF DEVELOPMENT AND BUSINESS STRATEGY IN THE CONDITIONS OF THE KOVID 19 PANDEMIC ON THE EXAMPLE - PE "SUBOTICATRANS" SUBOTICA AND AD "SEVERTRANS" SOMBOR

Dejan Gligović[a], Siniša Božičković[b], Slobodan Subotić[b] Duško Laković[c], Dragan Vukasović[a]

[a] *College of Business and Technical Education Doboj, Ozrenskih srpskih brigada 5A, 74000 Doboj, Bosnia and Herzegovina, gligovicdejan@gmail.com, dragan@gmail.com*

[b] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, sinisa.bozickovic@sf.ues.rs.ba, slobodan.subotic@sf.ues.rs.ba*

[c] *Independent University Banja Luka, Veljka Mladjenovica 12e, 71000 Banja Luka, Bosnia and Herzegovina, duskolakovic@gmail.com*

Abstract: *Among the sectors most affected by the crisis due to the Covid 19 pandemic is passenger transport, which can be seen in the drastic decline in the number of passengers, especially in international traffic. The paper is dedicated to the negative consequences of the Coronavirus pandemic on the operations of the transport companies "Suboticatrans" and "Severtrans", the effects of state aid taken by the Government to overcome the negative consequences and the next steps that these companies must take to mitigate the negative effects. caused by the current pandemic. Crisis situations in the company's business affect changes in management style, since the crisis in the company necessarily imposes new challenges on top management of the company, because there are new challenges in business to which management must give an adequate, timely and market-balanced response.*

Key words: *passenger traffic, business, pandemic, financial result*

TRAFFIC NETWORKS AS A FACTOR OF ECONOMIC DEVELOPMENT AND REGIONAL CONCENTRATION OF ECONOMIC ACTIVITIES

Siniša Božičković[a], Cviko Jekić[b], Zumreta Galijašević[c], Milan Eremija[a], Saša Ostojić[a]

[a] *University of East Sarajevo, Faculty of Transport and Traffic Engineering Doboj, Vojvode Misica 52, Doboj 74000, Bosnia and Herzegovina, sinisa.bozickovic@sf.ues.rs.ba, milan.eremija@sf.ues.rs.ba, ostojicsasa310@gmail.com*

[b] *University of East Sarajevo, Faculty of Economics, Studentska 11, 76100 Brcko, Bosnia and Herzegovina, cviko.jekic.efb@gmail.com*

[c] *Braće Pobric broj 36, 74270 Tesanj, Bosnia and Herzegovina, zumreta.galijasevic@gmail.com*

Abstract: *The paper presents research on the regional concentration of economic activity whose share in GDP is the largest in the Republic of Srpska and the density of the transport network as factors of economic development. The largest in achieving economic growth in Republika Srpska three economic activities are important: Agriculture, forestry and fishing (A), Manufacturing industry (C) and Wholesale and retail trade, repair of motor vehicles and motorcycles (G) These activities, according to data for 2019, have a significant share in the creation GDP (32.17%). The Herfindahl-Hirschman index is used as a measure of concentration concentration. The aim of the research is to prove whether the density of the traffic network affected concentration of economic activities, or activities have a certain dispersion towards competitive or comparative advantages of the regions of Republika Srpska. At the same time it will to investigate the density of the traffic network in economic regions. The research results are useful strategic management in creating strategies for the development of individual activities, as well as management that creates policies for economic development of Republika Srpska.*

Key words: *concentration, economic activity, traffic network*