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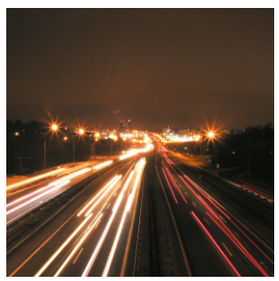
University of East Sarajevo
Faculty of Transport and Traffic Engineering Doboj

BOOK OF ABSTRACTS



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CONTENTS

PLENARY PAPERS

DIGITAL INFRASTRUCTURE FOR THE IMPLEMENTATION OF OPEN SCIENCE AT THE UNIVERSITY

Zoran Ćurguz[a]

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Abstract: *The motivation for the development and presentation of this paper comes from the fact that this, the Seventh International Symposium "New Horizons of Transport and Communications 2019" reached the level of a specific reference in affirmation of the Faculty of Transport and Traffic Engineering in Doboj as an organizational unit of the University of East Sarajevo. Proactive participation of many scientists from the regional and wider European academic space, who promote and exchange the experiences and applications, share scientific and technical knowledge in the field of traffic, transport, logistics and communication, represents a valuable contribution to the development of these fields and problem solving in many modules of the transport system of the Republic of Srpska and BiH. During the recent election activities of the Faculty management for the next mandate period the research results presented in this paper have been transparently verified. Therefore, the content of this review article originally emerged from the Plan and Program for the Development of the Faculty of Transport and Traffic Engineering in Doboj for the mandate period 2019-2023 which has been accepted by the authorities (Faculty scientific council) of the Faculty of Transport and Traffic Engineering in Doboj, and finally confirmed by the authorities of the University of East Sarajevo. The special emphasis is on the development of the infrastructure for the all-day application of digital technologies in the functional and procedural structures in digitizing the artifacts of the publishing activity-books, studies, projects and documents, scientific-research papers of the teachers and students. The digital infrastructure includes building the repository of the bachelor's, master's and doctoral theses, innovative project and application solutions in functional, functionally-equivalent, administrative-logistic and academic-business management process structures in the activities of the Faculty. The platform for the development of the digital infrastructure is essential for the "new horizon" for the implementation of the principles of open science through open access to primary data, open access to the scientific documentation, the scientific communication in the networks of quotations, cocitations, collaborative cooperation in the networks of learning and sharing of knowledge and experience. It is also a platform for improving the vision and strategy for the development of young researchers at the Faculty and University by engaging in teaching-scientific and research-development projects, mobility projects and other forms of strategic and operational functioning in the international scientific communication.*

Key words: *process structures at the Faculty, digital infrastructure, digitization, open science, science networks, repositoriums, primar data, metadata, international science infrastructure, open access*

TOWARD EFFICIENT AND RELIABLE RAILWAY CONNECTIONS IN THE CENTRAL AND SOUTHEASTERN EUROPE

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Abstract: *In this paper, we would like to present several ideas and facts concerning future challenges for the railway network in Central and Southeastern Europe. Unfortunately, the current development of the international passenger and freight railway transport in this region is not very optimistic. The local interest is often prioritized, and global goals of transport policy are in the background. We offer a look backward, when showing the railway connection between Žilina and Doboj based on the timetable from 1916. We compare the development of train connections influenced by different political situations from 1972 and finally, we offer some remarks and recommendations based on the timetables valid in 2019.*

Key words: *railway network, European corridors, interoperability, cross-border transport*

THE POSITION AND ROLE OF TRANSPORT AND TRAFFIC ENGINEERS IN THE PROCESS OF PLANNING AND DESIGN RAILWAY LINES

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Abstract: *Railway lines, due to their, primarily, geometric characteristics, are extremely complex and demanding traffic system, whose process of planning and design takes up a long time. In this process, it is necessary to engage and cooperate with a great number of experts from various fields including experts in transport and traffic engineering. The role of certain professions in certain phases of the planning and design process is different and both by intensity and importance.*

Within the process of planning and design railway lines, the participation of experts in transport and traffic engineering can be viewed in a multifaceted way, from a minor and meaningless to a very significant and crucial one. However, so far their position and role have not been sufficiently clarified and largely dependent on the individual's attitude, regardless of the importance and need. In addition, their ability to solve considered problems is still under suspicion. Therefore, in this paper, an attempt is made to comprehensively observe this problem, and to define the position and role of traffic experts in the process of planning and design railway lines with special emphasize on stations and nodes. The result of this paper should be the clearly defined place and role of transport and traffic engineers in the process of planning and designing railway lines, railway stations and nodes in all individual phases of planning and design.

Key words: *transport and traffic engineers, planning and design, position and role*

ISO 39001 –ROAD TRAFFIC SAFETY MANAGEMENT SYSTEM APROACH

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Abstract: *Although is Decade of Action for Road Safety 2011-2020 almost at the end, the number of deaths in traffic reached 1,35 million during the year 2018. Also, traffic accidents became leading cause of death in population between 5 and 25 years. According to a large number of casualties in traffic, leaders in global road safety improvement pointed to the significance of the introduction and implementation of the standard ISO 39001. Also, scientific papers where are effects and experiences of ISO 39001 implementation analysed became frequent. Standard ISO 39001, as other standards where quality and management are emphasized, has objective to improve the level of road traffic safety, through main issues recognition. Above mentioned is a precondition for succesful management in road traffic safety. One of the key characteristics of the particular standard is implementation for the benchmarking in road safety, where the road safety level could be easily defined, regardless of the region or subject. If Procedure of the ISO standard is carried out, the weakest link by sectors, sub-sectors or elements is simply identified. So discovered segments where interventions are needed, could be treated and road safety level will be increased. In this paper, procedure and guidelines for implementation of the stadnard ISO 39001 will be presented, especially regarding road traffic safety level.*

Key words: *Traffic Safety, Traffic Safety Management, Standard ISO 39001, Benchmarking, System Performance*

SEMANTIC MODELING URBAN TRANSPORT SERVICES

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Abstract: *New horizons in the areas of traffic, transport and communications inevitably illuminate the domains of services which individual designers, manufacturers and service providers offer their customers. The customer is the central entity of the service which is why the modeling of the customer type and the service itself inevitably requires a semantic component as well. Conventionally, urban transport service is a construct or composite concept that integrates customer input, their expectations and requirements that give to the transport provider, the mechanisms for access to and delivery of service, resources and roles responsible for delivery, safety requirements and other parameters. Research on semantic modeling of urban transport services involves multimodal communication between human and software agents. This points to the fact that in addition to contentual, contextual parameters of the service are also very important.*

The role of semantic modeling is to extend the traditional modeling approaches, which are mainly at the conceptual level, to the external or contextual level of information processing. The essence of semantic modeling of information resources (data, information and knowledge) is in the data models which are annotated with metadata. Thus, the semantic dimension of urban transport services modeling is important due to the fact that in addition to algorithmic structures, data representation models are used in the implementation as a form of knowledge.

In the semantic modeling of urban transport user profile concepts of customers knowledge are used as a cognitive continuum stored in long-term and working memory, and the entities are: data, information, possessing knowledge, applied knowledge, intelligence, wisdom and when receptors memoery is included, the capacity to share knowledge in network contexts is copleted. Their attributes are: type of learning, performance focuses, time perspective of learning and awareness.

The extension of the mechanism for access and delivery of urban transport services in the chain of technologies involved, also includes the Semantic Web technology that allow data linking and use of commom formats to integrate and combine data from different sources. In addition metadata enables software agents to interpret, i.e. to understand the linked data by using a common language to describe them, which is a prerequisite for effective and efficient multidimenzional urban transport service.

Key words: *urban transport services, customer profile, continuum of human knowledge forms and their parameters, data representation models, models of knowledge representation, semantic modeling, multiagent communication, technologies of the Semantic Web*

PAPERS

IMPORTANCE AND POSSIBILITIES OF MONITORING SAFETY PERFORMANCE INDICATORS AT THE LOCAL LEVEL, THE CASE STUDY CITY OF BELGRADE

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Abstract: *Safety Performance Indicators of the traffic safety system are numerical values that describe and "measure" the performance of the traffic safety system. The values of the traffic safety indicators well describe (measures) the performance of the traffic safety systems and have a strong correlation with the number of injured and killed in traffic. The paper presents the most important results of recording safety performance indicators in Belgrade and recommendations for improving the situation in Belgrade and establishing the practice of recording indicators in other local communities.*

After establishing a national methodology for monitoring safety performance indicators in Serbia, Belgrade is the first city in the region to carry out research on safety performance indicators at the local level. Establishing a regular recording and analysis of the basic safety performance indicators in Belgrade will have great importance both for understanding the problems of traffic safety in Belgrade, as well as for understanding the significance and possibilities of tracking indicators at the local level.

The paper presents the results of measuring the value of the safety performance indicators in the city of Belgrade in 2018, for 17 city municipalities, and according to the methodology that has been improved and harmonized with the national methodology and the best world practice. Measurements of the indicators related to the use of daylight, the use of safety belts by drivers and passengers, use of child seats, use of protective helmets by power-two wheelers, pedestrian and driver behavior at pedestrian crossings with traffic lights, exceeded the vehicle speed by at least 10 km/h. Recordings were made in the settlement and outside the settlement. Finally, a discussion of the results of the research with the proposed measure was given.

Key words: *Safety Performance Indicators, City of Belgrade, Case Study, Traffic Safety*

IMPORTANCE OF MEASURING POPULATION EXPOSURE IN ROAD TRAFFIC

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Abstract: *Using traffic accidents data provides an opportunity for a large number of complex analysis in the field of road safety. The reasons for using these data, as well as the objectives of the conducted research and analysis, are numerous. Comparison of the state of road safety, whether it be on different areas or different time periods in one field, can not be achieved through the use of absolute safety in traffic indicators that indicate the number of traffic accidents and their effects. Traffic accidents and consequences data are largely depend on the number of inhabitants in the observed area, the number of registered vehicles, the length of the road network, the number of realized movements and other factors. Bearing this in mind, analyzes that aim at a comparison require the use of relative indicators of road safety, or risk. It is precisely in this segment of road safety that the significance of measurements of population exposure in traffic is most evident. Exposure indicators are extremely important for precisely and clearly defining the state of road safety in an area, as well as the comparison of the state of road safety of different entities. The need for measuring and quantifying the exposure of the population was recognized as early as the sixties of the last century. However, in recent years, activities have been intensively pursued to develop this area. The aim of this paper is to point out the importance of measuring traffic exposure for the needs of road safety management, as well as the need to establish a single methodology for assessing exposure.*

Key words: *exposure, risk, comparability, measurement, road safety*

CLASSIFICATION OF 'SCHOOL ZONES' AND RISK MAPPING IN FUNCTION OF SPATIAL NETWORK CRITERIA - CASE STUDY OF THE CITY OF BELGRADE

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Abstract: *The school's location on the traffic network is one of the first and basic criteria in the traffic analysis of 'School Zones'. In the current approach to this problem, the mentioned parameter is often superficially considered or even omitted, which can certainly have different negative consequences. The variations in positioning of these zones in the road network, as well as in the urban area, are the basic subjects of this paper. In general, inadequate positioning of the school can significantly decrease the level of service and pose the threat to traffic safety, especially if the school is located near the city arteries or high-speed urban roads. The most obvious unwanted consequences, in that sense, are traffic accidents, whose number in these locations must be reduced to a minimum. The focus of this paper is the spatial analysis of primary schools in the city of Belgrade, that is, their classification in relation to the categorization of the surrounding traffic network and their position in the city. One of the aims of the work is to examine the dependence of traffic accidents and the location of these zones according to the proposed classification. The results of this analysis can help with the selection of adequate design measures, as one, and often the only way to improve the existing situation. Bearing in mind the fact that the choice of measures depends primarily on the road category, the authors believe that, with this analysis, there will be a chance to facilitate the selection in the process of a comprehensive examination of 'School Zones'.*

Key words: *'School Zones', classification, street category, traffic safety*

IMPLEMENTING THE IRAP SRS METHODOLOGICAL APPROACH FOR DETERMINATION OF INFLUENCE OF CRITICAL HUMAN, VEHICLE AND ROAD FACTORS ON THE PROBABILITY OF FATAL ROAD TRAFFIC ACCIDENT OCCURRENCE IN THE REPUBLIC OF CROATIA

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Abstract: This paper shows the implementation of iRAP SRS methodological approach for the purpose of identifying the locations of high fatal traffic accidents occurrence risk on the state, regional and local road network in the Republic of Croatia, as well as for performing the detailed statistical analysis of selected dangerous spots in order to determine the influence of road, vehicle and human factors on the probability of road traffic accidents occurrence. Based on the technical revision of 307 locations of fatal traffic accidents, the representative statistical sample of 10% critical locations was selected. The iRAP SRS procedure was then used for detailed analysis of relevant traffic safety, design and technical characteristics of existing road infrastructure and road environment, analysis of available data on road traffic volumes and traffic flow structure, as well as for the analysis of types and causes of occurred road traffic accidents in order to define the appropriate countermeasures. The results of the performed analysis indicate that the implementation of proposed countermeasures is necessary to achieve sufficient road traffic safety level on the observed locations in future periods, i.e. to ensure the maximal reductions in the number of fatal road traffic accidents, considering the available funds.

Key words: Road traffic safety, iRAP risk analysis, countermeasures implementation, influential factors of road traffic accidents occurrence

SAFE AND COMFORTABLE RIDE OF PASSANGERS IN PUBLIC TRANSPORT

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Abstract: *Public transport is an important part of the daily life of people living in large cities. Ensuring that passengers are transported comfortably and safely is one of the main tasks of transport companies. Transportation in cities is provided by various means of transport. Critical situations may occur in transport and knowledge of the effect of vehicle's longitudinal and lateral acceleration on passengers is necessary for subsequent assessment. In the city of Brno (Czech Republic), where the research was conducted, passenger transport is provided by city buses, trolleybuses and trams. The first set of measurements deals with the analysis of trolleybus and tram deceleration and its effect on standing passengers during normal operation and test runs. The second set of measurements focused on determining the limit of comfortable and safe driving for a seated and standing passenger during normal operation on tram, trolleybus and bus lines in Brno.*

Key words: *Public transport, passengers, safety, ride comfort*

SPECIFICITY OF DETERMINING THE CURRENT SITUATION OF THE DANGEROUS SITUATION IN ANALYSIS OF TRAFFIC ACCIDENTS IN WHICH PEDESTRIANS ARE INVOLVING

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Abstract: *A dangerous traffic situation is any traffic situation, activity or activity of the participants in the traffic that can lead to the occurrence of a traffic accident. In the time-spatial analysis of traffic accidents, the baseline of analysis is the determination of the moment of occurrence of a dangerous situation. The moment of occurrence of a dangerous situation is the moment in which traffic participant is required to react and take security actions in order to avoid the occurrence of a traffic accident. The aim of the research of this paper is to show the specifics of the characteristic behaviors, dynamics and ways of pedestrian movement and influence on determining the moment of occurrence of a dangerous situation in the analysis of traffic accidents in which pedestrians involving. The paper uses the approach of identifying and analyzing previous research as well as analyzing existing trends in practical application. Research, comparative analysis and simulation methods were used. Research on the basis of a specific traffic accident through this paper contributes to the creation of a critical basis for a more detailed treatment of available data and information, as well as the specificity of each individual traffic accident in which pedestrians involving, with a special aspect to the importance of treating the moment of occurrence of a dangerous situation. The importance of the work is reflected in the development of practical approaches to traffic accident analysis. Through the example of a specific traffic accident, the importance of specifying the moment of occurrence of a dangerous situation in traffic accidents involving pedestrians is emphasized.*

Key words: *time-spatial analysis; speed and ways of pedestrian movement; point of contact; simulation; traffic accident reconstruction.*

TRANSPORT DEMAND EVOLUTION IN CROATIA - FACTORS OF CHANGE, SCENARIOS AND CHALLENGES

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Abstract: *The aim of this paper is to investigate and analyze the evolution of traffic demand in the Republic of Croatia from 1996 to 2017. Special attention is given to the research and evaluation of the factors of traffic demand changes. The purpose of the paper is to create scenarios for the development of traffic demand and forecast the development of total traffic demand as well as the demand for individual branches of traffic by 2030. The research results are based on the method of linear trend and statistical methods of correlation and regression analysis. The main findings of this paper can be helpfull to traffic managers of all levels.*

Key words: *transport, transport demand, trends in passenger transport, trends in freight transport, scenarios*

REACTION BEHAVIOUR OF DRIVERS TO MARKED AND UNMARKED ROAD: GHANA PERSPECTIVE

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***Abstract**: Africa is the leading continent globally in the rate of road traffic fatalities, yet it is the least motorized compared to the other five continents. This predicament is said to be one of the leading cause of death among youth and generally, rated as one of the ten causes of death in the world. Exclusively, Ghana's rate of traffic fatalities is growing despite the efforts invested in reducing it. Nevertheless, more focus needs to be invested in the traffic control systems such as traffic signals, signs or road markings. As this system tends to considerably reduce the number of conflicts and minimize road user's errors. Furthermore, this system creates drivers' expectations of the conditions which they will meet ahead and the driving tasks required. If misleading information is provided, or none is available, hazardous situations can result. Overall, this traffic system is inadequate or lacking in most developing countries as there are no proper maintenance strategies in place. Thus, this study investigates and evaluates the reaction of drivers to the marked and unmarked roads. Using random quantitative sampling methods, Ghanaian drivers were interviewed on their experiences when driving on the marked and unmarked road. Overall, this study will highlight the necessity of road markings in reducing traffic fatality rate and the psychological effect of the unavailability of road marking on drivers' expectation and consequently, the effect on their behaviour in most developing countries.*

***Key words:** Traffic fatalities; Road user's; behaviour; traffic safety; road markings*

MODEL FOR THE ASSESSMENT OF LINE OPERATION IN INTERMEDIATE PASSENGER TRANSPORT

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Abstract: *Transport companies dealing with the transport of passengers on long-distance lines have a problem with the profitability of the lines operation, which reduce their efficiency. The aim of this paper is to present a methodology for estimating income using a sample method of a transport company that will show that with the existing capacity, the company can better perform the chosen jobs. The research was performed by tracking the operation of the long-distance line over two years and calculating the relevant parameters and measuring coefficients of the reference transport company. The results show that the following parameters have the greatest influence on the income and profit of the transport company: the coefficient of static utilization of bus capacity (γ), the coefficient of dynamic utilization of bus capacity (ε) and the capacity of bus (q). This indicates the possibility of introducing vehicles with lower capacity, if it is shown to be necessary, and thus reducing operating costs. The proposed methodology can be applied in the process of transport production in order to establish cost and revenue norms on long-distance lines, since the cost-effectiveness of line operation is not performed on the lines of these classes.*

Keywords: *transport company, line profitability, long-distance passenger transportation, fleet exploitation parameters*

REVIEW OF THE APPLICABLE METHODS IN ROUTING VEHICLES OF DANGEROUS GOODS

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Abstract: *This paper presents a review of applied methods in solving the problem of vehicle routing (VRP - Vehicle Routing Problem) with dangerous goods based on works published in renowned international journals and conferences during 2008 - 2018. Using a several of methods for vehicle routing of dangerous goods in order to solve problems in the real world was significantly improved during this period. Based on a detailed review of the published works, the criteria that influence the routing of vehicles in the transport of dangerous goods have been identified. In this paper, innovations in the methodologies used by researchers to solve various problems in routing vehicles with dangerous goods are presented.*

Key words: *Dangerous goods, routing vehicles, review of methods*

THE PROBLEM WITH VEHICLES MOVEMENT THROUGH A ROUNDABOUT

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***Abstract**: The main goal of implementing and introducing roundabouts is increasing efficiency and safety of traffic, as well as reducing the number of conflict points compared to „classic" intersections. However, the construction of roundabouts, in addition to all its advantages, must be done in accordance with regulations and standards, with some experience from countries that have identified problem of movement through roundabouts. Therefore, in this article, based on video footage taken at roundabout located in Rebrovac in Banja Luka, are identificated most frequent conflict points. Despite the smaller number of conflict points compared to „classic" intersections roundabouts continue to be a problem in these areas. The problem of irregularly movement through roundabouts shouldn't be ignored as there are an increasing number of traffic accidents in ones.*

***Key words:** roundabout, conflict points, traffic safety*

IMPACT OF MODERN SYSTEMS ON IMPROVING SAFETY FEATURES OF COMMERCIAL VEHICLES

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***Abstract:** Commercial vehicles have a major impact on the development of every society. With the increasing number of vehicles on the roads, improving traffic safety becomes more important. Commercial vehicles are involved in many fatal traffic accidents. The most traffic accidents occur due to driver error. Advanced active safety systems of commercial vehicles can significantly influence on improving traffic safety, by eliminating weaknesses and wrong driver decisions. Influence assessment of active safety systems of commercial vehicles on improving road safety is very important. In this paper will be present the basic working principle of some active safety systems of commercial vehicles and their influence on improving traffic safety. Based on previous research, in this paper will be presented the possibility of reducing the number of fatalities in traffic accidents involving commercial vehicles in the Republic of Serbia, using some of the vehicles active safety systems. The results of this paper are reflected in the importance of applying some active safety systems of commercial vehicles.*

***Key words:** traffic safety, commercial vehicles, active safety systems*

EFFECT OF ACCESS POINTS ON CONDITIONS OF VEHICULAR MOVEMENTS IN TRAFFIC FLOW

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Abstract: *Access or access point usually presents approaching roadway constructed directly along the driveway of the main road through whom vehicles are entering on or exiting from private property, but also it implies commercial approaching and access roads. Increased access-point density connected on the main road affects the disorder of functional dependence of fundamental parameters of traffic flow. An increase of access-point density on main road has the effect of decrease of capacity and speed of traffic flow, but also increase of travel time. This paper is the outcome of research on several roadway segments in Bosnia and Herzegovina, and results are presenting the distribution of access points in a function of section lenght. Key results are related to access-point density, i.e. number of access points on both sides of two-lane highways divided by the length of the roadway segment. Depending on access-point density, decrease of free flow speed appears on mentioned sections which value goes from 2,35 km/h to 21,53 km/h and that is significant dispersion determined free flow speeds on given sections. In this paper is analyzed unplanned and uncontrolled construction of a large number of access points along the driveway of two-lane highway, which does not attract significant attention in our country and neighborhood. The main goal of this paper is to determine decrease of speed on segment of representative road network depending on access-point density and highlight the importance and necessity of increased control of access points.*

Key words: *access point, access-point density, time delay*

RESEARCH OF THE EXPECTED QUALITY OF SERVICE IN TAXI TRANSPORT SYSTEM IN CITY OF KIKINDA

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Abstract: *The taxi system in the city transport system is an important factor in the development of the concept of combined mobility with a very significant impact on the quality and efficiency of citizens' lives in urban areas.*

In the process of planning and designing a taxi system, it is necessary to conduct continuous research of all forms of quality, in particular, the required levels of quality of services by direct users. Research results are a useful tool to ensure the system meets the actual needs of users and compliance with the real capabilities of the operator and adjust the system to the real transport market. These activities are directly designed in the feedback loop to improve the structure and functioning of such a system and increase its production and economic efficiency.This paper defines and analyzes the features and indicators of the quality of service in a real taxi system in Kikinda, taking into account the aims of the system as a whole and the convenience for practical application. In the process of research and analysis of the expected quality of service, specific methods, techniques and tools in the field of transport engineering were used. On the basis of the obtained research results, an analysis and ranking of the selected features of the quality of service were performed.

Key words: *system approach, taxi, transport, quality of service*

LEGAL FRAMEWORK IN BOSNIA AND HERZEGOVINA IN THE FUNCTION OF SUCSESFULL REALIZATION OF INLAND AND INTERNATIONAL OVERSIZED TRANSPORT OF GOODS

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Abstract: *Oversized transport on a public road represents transport by a vehicle that empty or together with the load has a mass or axle load or dimensions that exceed allowed limits. Having in mind complexity of performance of oversized transport on a public road, as well as its impact on other traffic participants, it is of great important to create conditions for successful performance of this type of transport task. For a successful performance of oversized transport, it is necessary that all authorized and responsible subjects take synchronized necessary activities regarding preparation, realization and control of performance of the transport task. Having in mind above stated, it is necessary to secure fulfillment of defined conditions in accordance with the legal framework that defines performance of oversized transport as well as supervision during the performance of this type of transport task. Besides the activities regarding the performance of inland oversized transport, special peculiarity represents planning, execution and supervision of international oversized transport. In this study you can find review of legal framework in Bosnia and Herzegovina and neighboring states that regulates preparation, execution and supervision of oversized transport and a review of specific activities during the preparation and realization of this type of transport task. Also, this study provides proposal of harmonization of national legislation with the legal framework of EU that should contribute to successful realization of international oversized transport of goods.*

Key words: *transport, oversized, harmonization*

INFLUENCE OF WEATHER CONDITIONS ON REAL OPERATION VEHICLE ON THE HIGHWAY SECTION '9. JANUARY'

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Abstract: *The paper analyzes the effects of weather (in) conditions on the actual operating speeds of vehicles in progress and formulates mathematical models of linear, square and cubic shapes thar describe the 85th percentile of real operating speeds at the observed section of the highway. The survey was conducted on the section of the '9. January' near the Mahovljana loop. The influence of the following weather factors on the speed of vehicle movement is observed in the paper: influence of wind speed, rainfall intensity, thickness of water film on the pavement, pavement temperature and air temperature.*

The aim of the paper is to determine and present correlative relationships between individual weather factors and vehicle speed based on the analysis of the influence of different weather factors on the real vehicle operating speed.

Key words: *85th percentil speed vehicle; mathematical models; individual weather factors*

STRATEGIES IN FUNCTION OF ROAD SAFETY MANAGEMENT-ANALYSIS OF EXISTING ROAD SAFETY STRATEGY IN THE REGION

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Abstract: *In order to manage road safety, or projected future desired state, it is necessary to understand the current situation od road safety. Therefore, the purpose of Strategies in road safety is to introduce the present situation of traffic safety, design state of road safety that we want to achieve, and control measures and guidelines by which we will on fastest and easiest way get to the desired state.*

This paper aims to show the existing Road safety strategy in the region (Serbia, Croatia, Montenegro), in the current situation analysis, design of the desired condition and management measures in order to approach the current situation to the desired state, with emphasis on the strategic documents in the field of Road safety in Bosnia and Herzegovina. The results of this paper will provide the scientific and expert public with insights into the strategic documents in the road safety, with special reference to its objectives.

Key words: *Strategy, management, road safety*

GLOBAL TRENDS IN TRANSPORTATION OF GOODS AND LOAD UNITS

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Abstract: *Encouraged by the globalization of industries and sciences, they are trying to identify solutions for the sustainable development of freight transport. Particular attention has been given to standardizing load units so that goods can be transported without restrictions in multimodal transport. The paper is based on a review of published documents, studies and papers on global flows and transport units in the present and future. To this end, the paper gives an overview of the major global flows in the world their development, and the expected transport units on these flows. The focus is primarily on goods flows in Europe - China - USA triangle.*

Key words: *globalization, global flows, transport units, transport policy*

ANALYSIS OF TRAFFIC SIGNALIZATION AT LOCATION OF TRIVE AMELICE AND DR MLADEN STOJANOVIC IN BANJA LUKA

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Abstract: *Roads as base on which takes place traffic, must be designed, built, equipped and maintain so they fit mine purpose and requirements security traffic. Participants in traffic are obliged to act in accordance with traffic regulations, traffic signaling and commands which if it is authorized person, where it is arranged to be participants in traffic they are obliged to act in accordance with traffic signalization and when this deviates from the traffic rule. Analyzing unfolding traffic on considered crossroad there was a change procedure way regulation traffic on crossroad and improvements functionality crossroad and increasing the safety of traffic on the same.*

Change ways regulation traffic on intersection is necessary, and will be performed using vertical i horizontal traffic signs, and PVC prefabricated elements, with a view to traffic on crossroad regulates on principle "roundabout ". Also, the intersection must be design to get out with elements, traffic signs and the equipment, in accordance with legal regulation and traffic-safety requirements.

Key words: *roundabout, design, positioning, traffic signalization and equipment, traffic-safety*

TRANSPORTATION OF DANGEROUS GOODS CLASS 1 - PROBLEMS AND SOLUTIONS

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Abstract: *Class 1 dangerous goods (explosives and subject with explosives) are transported, stored and manipulated in a manner prescribed by international and national regulations. Transport of explosives is one of the most risky transports today. The reason for the high risk is that this type of hazardous substance can cause great harm to people and property as well as to the environment. The characteristic of all Class 1 hazardous materials is that they may cause an explosion, which may in addition be toxic. Not every carrier can carry Class 1 hazardous materials, but only one that is licensed by the competent authority and meets the requirements of ADR. In carrying out this work, carriers encounter many problems that can be solved in the ways outlined in the paper, all with the aim of preserving human health and protecting the environment.*

Key words: *explosives, environmental protection, safety of participants in the transport of dangerous goods*

MODEL OF PEDESTRIAN SPEED ON SIGNALIZED CROSSWALKS

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Abstract: *The time required for crossing the crosswalk is in the basic function on the length of the crosswalk and walking speed of the pedestrian. However, when pedestrians demands is required, the crossing time is increased, becouse the speed of the pedestrians walking decreases due to the interaction between the opposite pedestrian flows. In this case, another dimension of the marked pedestrian crossing became significant - its width. The paper analyzes the pedestrians speed depending on the width of the crosswalk. Using the methods of scientific observation and video surveying techniques, results are obtained about the pedestrians speed at crossings of different widths, on the basis of which the velocity model and the progressive improvement of the rate of change in the marking speed have been presented.*

Key words: *pedestrian speed, crosswalk, signalized intersections, intersection geometry*

EVALUATION OF CONDITIONS IN THE TRAFFIC FLOW ON THE CROSSROAD OF THE MAIN ROAD M4 AND MILUTIN MILANKOVIC BOULEVARD IN BANJA LUKA

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Abstract: *The design and construction of roundabouts, as a solution that will replace the classic intersection, has great application in our area, because it has proven to be the best traffic solution. The aim of this paper is to determine whether the roundabout will provide better traffic conditions than a traffic light. Baseline data were collected by counting traffic at the intersection in question and then processed in the SIDRA INTERSECTION software program. The program analysis covers the following criteria: service level, time losses, costs and emissions. Reducing speed has increased the safety of all road users, which in addition to the environmental aspect is the most important positive effect. With traffic congestion, traffic intensity and service levels have been raised. The construction of the roundabout would continue the trend of construction of roundabouts in Banja Luka, which, in addition to traffic amenities, gives this city an aesthetically pleasing new dimension.*

Key words: *Roundabout, designing, traffic flow distribution, traffic counting, traffic safety*

STRESS AS A CAUSE OF TRAFFIC ACCIDENTS

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Abstract: *The purpose of this paper is to define and describe one of the most important causes of today's illness - stress, and to explain the causes and consequences of stress in traffic and in everyday life. Stress is defined as a state of long-term tension resulting from physiological, psychosomatic reactions that result in a deterioration of health, frustration, mental and physical exhaustion. Stress is any change in the environment or in the human body that affects an individual, positive or negative. The importance of this topic is reflected in the fact that we are all exposed to stressful situations every day and may not even be aware of it. The fact is that stress is part of our daily lives and that it has a negative impact on the overall health of the individual. The experience of stress is different for each individual, and stressful situations are considered, for example, exams, visits to the doctor, marital and financial problems, traffic, etc. For this reason, the harmful effects of stress, the most common causes, the way possible, will be explained in this paper. to combat stress, differences about the causes and effects of stress across Europe and the United States. By comparative analysis between the two areas, the aim is to define the differences between stressors, mentalities, the development of traffic safety awareness and the adverse effects of traffic resulting from stress. During the preparation of this paper, a survey was conducted with professional truck drivers in Europe and the United States.*

The survey was conducted by telephone and the respondents answered 15 questions asked. The survey questions are the same for both groups of drivers

Key words: *traffic safety, stress, traffic*

IMPLEMENTATION OF THE ZIGBEE PLATFORM AS AN ASSISTANT TO DRIVERS FROM THE SAFETY ASPECTS OF TRAFFIC PARTICIPANTS

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Abstract: *According to the research smart driving assistants can prevent 20-30% of road accidents. The biggest drawback of these systems is the high price. Because of that, we can find smart driving assistance, just as enhancement of expensive cars. One way of reducing the number of accidents is the implementation of security systems in all cars. To make this possible, we need to create a simple, inexpensive and efficient system that have small price, ease of installation and long life. Than we would be able to reduce the number of accidents. One potential solution is to use a system based on ZigBee platform.*

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

INFLUENCE OF THE STRUCTURE OF THE TRAFFIC FLOW ON THE PERMEABILITY OF TWO-WAY ROADS ON FALL

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Abstract: *In a real traffic flow with a heterogeneous structure, several classes of vehicles are present, with a significant impact on their movements in progress. The translation of a non-homogeneous flow into a conditionally homogeneous is carried out using the equivalents of commercial vehicles (PCE) which multiply individual classes of vehicles from the structure of the traffic flow. The subject of this paper is the determination of equivalents of freight vehicles at cross sections of two-way roads. Equivalents of freight vehicles were obtained by determining the time interval of follow-up based on the Greenshilds basic model. Analyzing the obtained results of the survey, it has been proved that the value of equivalents of freight vehicles on the fall of two-way roads does not significantly increase with the increase of the longitudinal fall.*

Key words: *Heterogeneous traffic flow, time headway, longitudinal fall*

ANALYSIS OF THE CONTROL OF LIGHTING DEVICES ON CARS AT TARGETED GROUPS OF VEHICLES ON TECHNICAL INSPECTION

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Abstract: *The need for mobility, as well as the need for greater safety in low visibility conditions at night, has led to permanent improvement of light systems to high quality level, comfortable driving and comfort. Nowadays, car manufacturers are paying attention to safety, therefore they improve lighting and signal light devices, and so they come to the most perfect solutions. The functioning of lighting and signal lights on the vehicle is an important factor of safety and therefore the control of these devices is a complex procedure, which has recently been conditioned by advanced systems on vehicles. The aim of this paper is to present faulty lighting devices on vehicles through age structure and their contribution to the malfunctioning for all devices on vehicles controlled at the vehicle inspection station. Applying the data analysis method, the literary research method, and the visual adjustment rating and light intensity of vehicles on a vehicle inspection station using a regloscope device, we introduced some of the research results presented in this paper.*

Key words: *safety, malfunction, LED lighting, laser lights*

ANALYSIS OF STATIONARY TRAFFIC AT PARKING 'PALAS' IN BANJA LUKA

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Abstract: *Parking is one of the key traffic problems in the city of Banja Luka. This paper analyzes the parking on one microllocation, in this case the parking lot 'Palas'. This type of analysis, individual microlocations, can in the future serve as a more detailed analysis of parking on the territory of the city, and serve as an input for the formation of a tariff system for parking payment, as well as the formation of parking zones on the territory of the city of Banja Luka.*

Key words: *problem of parking system, tariff models, parking zones*

RAILWAY INFRASTRUCTURE LIFECYCLE MANAGEMENT – A CASE STUDY

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Abstract: *Rail transport is the most climate-friendly as compared to other modes of transport. It can create multiple economic and social development benefits, in addition to reducing emissions. Within the railway system, infrastructure being a long- lived asset has a pronounced share in the economic, social and environmental impacts. In the effort of retaining the sustainability of the railway sector, infrastructure management plays major role. Railway infrastructure is a complex system with various subsystems. In this regard, infrastructure managers in railway companies are constantly looking for the financial implication of their decisions and choose the most economical and effective way of managing their projects. They at the same time endeavour to provide a safe and reliable service. The balance of the sustainability factors and their impacts on the management of infrastructure assets can be done quantified by using Lifecycle costing (LCC), lifecycle performance (LCP) and lifecycle Assessment (LCA) methods. LCC is a subject area that has evolved from project appraisal tool to a more compressive method as organisations look for a long-term economic sustainability. LCP shows the lifecycle reliability, availability, maintainability and safety of infrastructures. LCA is a technique to assess the environmental impact associated with activities at all stages of the infrastructure lifetime. This contribution illustrates an integrated application of LCP, LCC, LCA tools in Railway infrastructure asset management. The paper moreover presents a case study that identifies the technical challenges, other barriers and opportunities related to the application of the methods in an integrated way.*

Key words: *lifecycle perspective, asset management, sustainability, maintenance, decision support*

COMPARATIVE ANALYSIS OF RAILWAY FREIGHT OPERATOR'S EFFICIENCY

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Apstract: *In this paper we measured the efficiency of railway freight transport companies from the region. The collected data describe the business and functioning of these companies in the period just before, during and immediately after restructuring process. This period was selected in order to compare the efficiency of selected transport companies during the reform phase, through which they had to pass. The efficiency of each company is separately determined, according to the environment in which it operates, as well as according to the basic indicators and resources in the previous period. For the efficiency comparison, we have used Data Envelopment Analysis (DEA), the input-oriented CRR models. Finally, the analysis of the relative influence of individual input parameters on DEA results was carrie out.*

Key words: *Railway freight operator, Efficiency, Data Envelopment Analysis (DEA)*

TRAIN PATH ALLOCATION PROBLEM: BETWEEN DEVOTION FOR OPEN MARKET AND PRACTICE ON RAILWAYS

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Apstract: *With adopting an open access policy to infrastructure, the railway sector has taken a major step towards attracting competition between railway operators. However, in recent years it has become clear that the market has not achieved the effects foreseen by the EU strategic documents. An example of (non) market functioning in practice is the procedure for allocating train paths using a priority criterion that is not based on the market value of the service but on its type. Through the method of allocation of train paths and the analysis of the used priority criteria in the conditions of competition in the market, the paper illustrates the big gap between the strategic commitment to the market opening and the current practice on the railway, which is one of the reasons for the slow railway market growth.*

Key words: *priority criteria, competition, infrastructure congestion, train timetable design*

LABOR DEVELOPMENT AND COMPETENCE CHANGES IN SERBIAN RAILWAYS DURING THE TRANSFORMATION PROCESS

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Apstract: *The objectives of studies was development of labor development plan identifying the specific competences required for each line of business and defining the structured program of staff training and development.. The methodology we use is based on the following understanding of the differences between Training, Education & Development of labor. We conducted the study in the following order:*

First: Gathering input to determine where to focus.

Second: Defining goals for Job Duties, and Job Specific Competencies that will build skills for today, or will prepare for future roles.

Third: Identifying development activities that support achievement of goals.

Fourth: Define the next steps.

The main results are following: Labor development needs have been assessed based on information from three sources: existing surveys, questionnaires and interviews with specific representatives of the target groups; A detailed list of possible competencies and areas for development has been prepared; the list of competencies is allocated in line with the core business lines.

Areas where staff training is required, namely: development of digital skills; development of managerial skills; budget planning and technical-economic planning; specific trainings for ERP systems; highly specialized trainings and re-trainings in areas related to train traffic safety and additional trainings mainly related to procurement of new equipment.

Key words: *labor development; competencies; core business lines; digital skills; managerial skills*

DEVELOPMENT OF COTIF´S UNIFORM RULES FOR THE INTERNATIONAL OPERATION OF RAILWAY VEHICLES

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Apstract: *Before their introduction into COTIF´s Uniform Rules, the conditions for accepting railway vehicles in international traffic were organised among rail companies in the form of the RIV and RIC agreements, which were coordinated by the non-governmental International Union of Railways (UIC). COTIF 1999 and its Appendices APTU and ATMF, which entered into force in 2006, moved responsibility for the admission of railway vehicles in international traffic from railway companies to government authorities. In 2015, OTIF started drafting a new Appendix H to COTIF with the aim of harmonising the principles for the cross-border operation of both vehicles and complete trains in order to help make international railway operations more efficient. This paper reviews the development and substance of the existing Appendices F (APTU UR) and G (ATMF UR) and the rationale underpinning the development of the new Appendix H (EST UR) to COTIF.*

Key words: *COTIF, admission of railway vehicles, railway system, interoperability, safe operation of trains*

MARSHALLING YARDS: NOISE REDUCTION BY VARIABLE ROLLING RESISTANCE

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Apstract: *Marshalling yards are necessary for the single wagon load traffic. Unfortunately, conventional braking systems produce noise emission. Therefore, different research projects have taken place to find out how and in what form emissions can be reduced. One possibility is to use a braking system with variable rolling resistance which can be individually steered for each freight wagon. In order to verify the present idea, an experimental investigation was carried out on a model. For this purpose, a ramp with a brake section was realised on a reduced scale. It was found, that the coefficient of friction can be increased by a factor of nine. Although the acoustic emissions could be reduced and theoretically a sufficient braking force can be generated, further in-depth research is necessary to be able to make statements about the exact braking force, its control and wear.*

Key words: *Marshalling yard, shunting yard, rail freight, single wagon transport, braking systems*

TRANSPORT POLICY INSTRUMENTS ON RAILWAY CORRIDORS

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Abstract: *In the context of the development of trans-European networks (TEN-T) and the establishment of rail freight corridors for competitive transport (RFC) EU had increasingly actualized the issue of unified management of the functioning and development of railway corridors in recent years. The analysis of recently established Alpine-Western Balkans RFC corridor, one more time showed the urge to explore ways in which states use transport policy instruments and their goals on railway corridors. In addition, the need for better implementation of the transport policy evaluation process was noted. The aim of the paper is to, after evaluating how countries use transport policy instruments, suggest key performance indicators to evaluate the state's performance in implementing transport policy instruments in the case of the competitiveness of the Alpine-Western Balkan RFC Corridor.*

Key words: *transport policy, TEN-T, RFC, key performance indicators for corridors*

APPLICATION OF OPENTRACK AT ZELEZNICE REPUBLIKE SRPSKE

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Abstract: *OpenTrack is a planning and simulation tool for railway operations. It was developed at the Swiss Federal Institute of Technology in Zurich, Switzerland and is currently supplied by OpenTrack Railway Technology Ltd. to over 230 organisations in 50 countries. Predefined trains run according to the constraints of the timetable data on a defined track topography. The simulation has both continuous and discrete parts. The continuous part calculates differential equations for train speeds and distances. The discrete part simulates processes such as states of the signalling system and the propagation of delays. During a simulation, the user can watch the track topography in an animation mode that shows running trains, prepared routes and current signal aspects. The user can interrupt the simulation at any time, and if required go into OpenTrack and modify certain constraints. This paper describes the application of OpenTrack at Železnice Republike Srpske for the railway line from Doboj to Tuzla and furthermore to Zvornik Novi and State border to Republic of Serbia.*

Key words: *Simulation, Railway Operation, Timetabl*

MEASURING THE EFFICIENCY OF THE RAILWAY UNDERTAKING BY APPLICATION OF FUZZY LOGIC

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Abstract: *Measuring company performance inevitably becomes a prerequisite for the survival of companies in the market in today's dynamic and highly turbulent environment. Modern systems of measuring efficiency include not only business results in the form of financial indicators, but also the causes of the achieved results, which can only be known through certain indicators. The application of the new European transport policy at the end of the last century caused major changes in Europe's transport system. Traffic is being developed in accordance with the goals of sustainable development. With the market liberalization, railway operators are forced to act like all other modern companies in other markets and other industries, which means they must constantly develop and maintain competitive advantages, or be better than others. For railway companies undergoing a transformation process, it is very important to form a performance/efficiency measurement system that is appropriate to modern business conditions. Operations in today's dynamic and competitive intensive environment by railway operators require precisely constant measurement of non-financial indicators, which are identified as causes of the financial result, so that eventual negative trends can be corrected before their effect negatively affects the final result of operations, which is, as a rule, evaluated from a financial perspective. This paper develops an innovative model for assessing the volume of work of railway undertakings for the transport of goods, which can greatly help to increase the competitiveness of railway undertakings in the single railway market.*

Key words: *Railway undertaking, efficiency, method, fuzzy logic, model*

BIR AND TEN-T, COMPETITION OR COOPERATION?

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Abstract: *In 1992, the European Union formally established the "Trans-European Network", also known as "TEN-T", with the aim to achieve the integration of its countries' territories and facilitate the functioning of the common transport market. About two decades later, Chinese officials launched the One Belt One Road initiative, which also refers to the establishment of a network of transport corridors. The official objectives of this initiative are: coordination of the development policies of the corridor-sharing countries, network connectivity, trade without restriction, financial integration and strengthening people-to-people links. This paper analyses basic features of both concepts through different prisms. Main question that paper seeks to answer is whether the EU and China, in the context of globalization and different approaches to the transport corridors, can cooperate achieving benefit for both sides.*

Key words: *One belt one road, TEN-T, globalization*

EU-CHINA RAIL ECONOMIC CORRIDORS AND THEIR ROLE IN TRADE IN GOODS

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Abstract: *Exchange of goods between the EU Member States and China is increasing year by year and in 2018 has reached about 2.2 billion tones. Considering dependence of exchange of goods and efficiency of transport system, the launch of the Belt and Road initiative by the Government of the People's Republic of China can only influence the increase of this trend. Namely, under the umbrella of this initiative, a revitalization of the historic Silk Road is planned. This revitalization involves the establishment of a modern Silk Road with quality transport infrastructure on which efficient transport services will be organized along recognized land and sea routes. The very realization of the initiative should provide support for further economic growth and increase in trade on the Eurasian continent. The aim of this paper is to identify the role of railway transport and railway corridors in the trade between the EU and China along established economic corridors and Serbia's position in this context. The authors analyzed the possibility of establishing a railway link between China and the Republic of Serbia as part of the initiative.*

Key words: *Belt and Road, rail corridors, freight transport, Middle corridor*

CHARGES FOR TRAIN TOWING – PLACE OF CONFRONTATION OF REGULATION OF RAILWAY AND ENERGY SECTOR

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Abstract: *Similar to Railway sector, where it came to separation of management activity from activity of transport of goods and passengers, energy sector went trough the process of restructuring where it came to separation of production, transfer, distribution and electricity supply activities. Restructuring of energy sector is based on free choice principle of electricity supplier which leads the railway sector in problematic situation regarding the organization of the system and calculation of electricity consumption in according with reguirements of railway and energy regulations. Namely, according to energy regulation final users of electricity are considered to be railway carriers, and not infrastructure managers who buy it today and „cede“ to carriers. In this work we are exploring te answers into the following questions: whether is railway sector regulation in coalition with energy sector regulation? Does Energy law recognize railway system for supplying with electricity for towing trains? Whether the valid law on railways complies with relevant regulation of European Union and to what extend?*

Key words: *charges, towing trains, restructuring, transport market*

HOW DOES THE PROBLEM APPROACH IMPROVE THE SOLUTION OF THE MODELING PROBLEM IN TRANSPORT

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Abstracts: *In this paper, we identify and discuss several possible causes that indicate a relationship between problem solving and goal attainment, such as e.g. problem setting and choice of alternative, knowledge level, procedures, influence of bias, public influence, uncertainty and environment. The above mentioned causes explained in the paper in different ways influence the modeling and finding of solutions in the decision making process. Also, a few examples will give an overview of where and how in the modeling process the chosen ways of solving the problem influenced the further application, the solution. Although the focus of this paper is mainly on how to solve transportation problems (transport modeling), the ideas and phenomena described in this paper can be used in other areas and problems e.g. in policy analysis, system analysis, and generally in all model-supported approaches to problem solving.*

Key words: *model, systems approach, causation, alternatives, decision making*

IMPROVEMENTS IN CONTROL AND TRANSFER OF DATA OF RAILWAY ELECTRIC TRACTION SUBSTATIONS USING ABB RTU560 DEVICE

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Abstract: *Aim is to show the advantages of using the ABB RTU 560 for receiving and transmitting data for remote control in the electric substations in relation to the existing system in the Railways of RS. Approach Table view of multi-year monitoring of the work system with statistical data of working hours consumption and error data statistics on the existing system; the projected value of using a new device. Results The advantages of using ABB RTU 560 devices in the remote control system, new way of data collection, a more appropriate system operation communication protocols, and adjustments to already existing solutions are presented. The data are given in tabelar comparative values, the number of operating hours on maintenance, and the advantages and disadvantages of both devices. Contribution Development of technology has expanded end-user requirements, and upgrade of control devices and a new approach to device exploitation have to be viewed through the prism of economic cost-effectiveness and maximum utilization of devices and the enhanced safety of railway transport.*

Key words: *remote control, electric sub-stations, CLP 500, RTU 560, railways*

INTERACTIVE MOTION TRACKING DIAGRAMS TO HELP ENGINEERS IN DECISION-MAKING WHILE DRIVING

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Abstracts: *During the train driving engineer may encounter numerous situations that adversely affect the driving process (slow order speeds, faulty ss devices or its parts, etc). The way of thinking and the decisions that engineers make while driving the train, in such difficult conditions, have a direct impact on the train's driving time. Bad knowledge of the situation on the track leads to a more careful behavior of the engineer. This is mainly expressed by moving at a slower speed than the maximum allowed at the observed moment and results in an unplanned extension of the train driving time. Interactive train movement diagrams could have an important role and great help in decision making while driving. A constant insight into such diagrams could influence the way of engineers thinking and to realize such movement of the train that will contribute to the minimal extension of driving times. At the monitor in locomotive cab a constraint train movement diagram according to the current situation on the track and real-time train movement diagram, created by gps tracking, are presence. On the basis of the installed movement diagrams at new locomotives series 463, at the TENT railway system, suggestions of the movement diagrams are proposed at this paper, which could contribute to a better way of making driving decisions and reducing the driving time.*

Key words: *railway, train engineer, train movement, driving time, motion diagram*

MODERNIZATION OF THE SIGNALING AND SAFETY SYSTEM ON DOBOJ - BANJA LUKA RAILWAY SECTION

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Apstract: *Aim The project "Modernization of the signaling system on the Doboj - Banja Luka railway section" with its installed electronic signalling and safety devices of stations and level crossings will be presented in this paper. Approach Presentation of new signalling systems of the type ESA 44-BH and the level crossing protection type RLC23. Results The advantage of using electronic devices on the railways, which includes inter-station dependency and remote traffic management systems, provides the possibility of centralised remote traffic management. Contribution The use of new generation signaling devices for railway traffic menagement enhance safety of railway transport and the permeability of railway tracks.*

Key words: *remote traffic management, inter-station dependency*

PLANNING AND DESIGN OF NARROW GAUGE RAILWAY FROM STAPARI TO BIOSKA USING ADVANCED SOFTWARE SOLUTIONS

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Abstract: *Sargan Eight is the most attractiveheritage narrow gauge railway in the Europe. It was constructed in the period from 1921 to 1925, as a unique technical concept in the world. The line was closured in 1974 then renewed and eligible for operate in 2003. The construction of dam on the river Djetinja and the formation of an artificial lake in 1984, a part of the old tourist narrow gauge line Mokra Gora - Uzice was sunk. In this way, it is impossible to continue the reconstruction of narrow gauge track towards Uzice, along the former line. Therefore, in this paper an attempt was made to find a solution in aim to revitalize that part of railway line from Stapari to Bioska in the valley of the lake Vrutci. This would connect a broken line and enabled further and better development of tourism. By revitalizing this part of the railroad, the new attraction would be gained around Lake Vrutci and the railway line Beograd - Bar would be connected with a tourist line. This line would be of great tourist and cultural significance for the development of the Zlatibor district and tourism in Serbia. In addition, it would also have an international significance because it would allow connection between Uzice and Visegrad (Bosnia and Herzegovina). With the implementation of software tools for planning and design of railway alignments based on modern concepts of design and using advanced information technologies, the new line is presented in layout, longitudinal profile and cross sections.*

Key words: *railway line planning, computer aided design of railway alignments, heritage railway*

APPLICATION OF RAILWAY TRAFFIC COMMUNICATIONS VIA PUBLIC GSM NETWORK

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Abstract: *Objectives To show the solution for railway traffic communications through the public telecom operators GSM network on the example of the installed system on the ŽRS. Approach Comparison of basic characteristics of the RDV system and GSM communication system. Comparison of the applied GSM solution and GSM-R systems. Results Benefits of the GSM system as a voice and data communication system in relation to RDV. Contribution To show one of the solutions for improving traffic functioning, for companies that do not have GSM-R infrastructure, and want to use more modern ways of communication than an analog RDV system.*

Key words: *GSM, GSM-R, RDV, railways, communication*

MULTI-CRITERIA FUCOM-MABAC MODEL FOR THE SELECTION OF TANK WAGON FOR TRANSPORT OF THE WHITE OIL DERIVATIVES

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Abstract: *The volume of transported goods by rail is directly related to the number of railway wagons that the company has in its own park. By expanding the railway park by purchasing new tank wagons, it is possible to increase the volume of transport of oil derivatives by rail. The aim of this paper is the selection of the most suitable tank wagon, which meets all technical and exploitation standards and regulations for traffic on Serbian Railways. This problem is an important multi-criteria task since the selection of the wagon tank directly affects the productivity of work and technological processes, which directly affects the time of manipulation and keeping the wagon on loading or unloading. For this reason, a model has been created consisting of six alternatives and a number of criteria, such as: tank volume, maintenance costs and availability of spare parts. The first part of the model refers to the determination of the weight coefficients of the criteria using the FUCOM method. The second part of the model is based on MABAC method which is used in the evaluation of alternatives. In the final phase of this model, stability of the obtained results was checked through the sensitivity analysis. In addition, a sensitivity analysis involving the application of the ARAS, EDAS and WASPAS methods, which confirm the previously obtained variant ranking.*

Key words: *railway tank wagon, FUCOM, MABAC*

PARAMETER ESTIMATION OF PAIRS IN LINESIDE RAILWAY CABLE FOR SHDSL APPLICATIONS

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Apstract: *Aim of this paper is to define certain parameters of nonstandard copper cables used for SHDSL link. As much as the railway environment is burdened by overhead contact line it is also aided by the quality of cables and their protection. By testing the pairs and their parameters for given rates on SHDSL links, the aim is to derive parameters of transmission over these pairs of nonstandard length, diameters, and isolation. In the era of optical cables, existing railway cables would survive and gain in significance for future connection of end elements in the field to its belonging subnetworks, especially in cases where remote power supply of elements should be provided.*

Key words: *lineside railway cables, SHDSL*

MODEL OF E-EDUCATION AND INFORMATION ON THE CASE OF RAILWAY TARIFFS

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Abstract: *All railway trensport organizations and higher education institutions can be considered as a service to users of services, real and potential students, which applies the latest information and communication technology (ICT) to provide efficient and quality services, information and data needed new knowledge via the Internet. The client expects to find on the Internet services to meet their needs and on the other rail operators have their own reasons for the increase in all segments of the quality of service. Institutions of higher education to students provide new models for understanding the everyday communication needs of users and better mastering the curriculum over the Internet. The paper specifically describes the use of railway and examines tariff, as a basis for transport in railway transport organizations which is of special interest for the customer as well as for students. The ultimate goal is to model the ICT architecture model railway tariff, which is based on the analysis of the dynamic complexity of the interaction of five components representing contemporary paradigm of business processes (technology, organizational processes, environment, human resources, and service / product).*

Key words: *Rail transport organization, modeling of architecture, service quality, railway*

IMPROVEMENT OF WORKING TECHNOLOGY IN SODA FACTORY LUKAVAC FOR INCREASING THE PARTICIPATION OF RAILWAY TRANSPORT

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Abstract: *The soda factory in Lukavac, with a production of about 500.000 tonnes of soda a year, today makes minimal use of rail transport in shipping, although most of the production is exported. In order to exploit the great potential for rail transport, it is necessary to investigate today's deficiencies in the operation of the private siding and the Lukavac station. The paper examines the flows of raw materials and soda as well as the characteristics of existing technology of work in the delivery of raw materials and the shipment of finished products. Based on the results of the analysis, a proposal was made for measures to increase the efficiency of the technological process of work in order to increase the shipment of soda and other products by rail to the markets.*

Key words: *private siding, technology, railway freight transport, last mile*

MAAS IN EU RESEARCH PROJECTS OF IMPORTANCE FOR THE DEVELOPMENT OF RAILWAY

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Abstract: *Although mobility is when people or goods change place in an area, mobility as a service represents transport service according to the requirements of the users regarding the quality of the transport service wanted by them. The final goal of this concept is to reduce the use of individual vechiles and equaly share participation in the transport process between all modes of transport. That is the chance for railway to increase its share in the transport market. This paper will describe the concept of MaaS through the presentation of research projects supported by EU funds, as well as the potential chances for participation of the railway in it.*

Key words: *MaaS, mobility, railway*

BIG DATA IN EU FUNDS RESEARCH PROJECTS WHICH SUPPORTING RAILWAY DEVELOPMENT

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Apstract: *The Big Data concept emerged as part of the fourth industrial revolution as a result of the development of modern computers, highly affordable data storage devices and increased data collection potential. The main goal of deploying Big Data technologies is the ability to collect and manage large amounts of data in real time. Within this paper, the concept of Big Data technologies was presented through a presentation of 8 research projects supported by European Union funds. Particular emphasis was placed on the application of Big Data technologies in the transportation of goods by rail. The analysis of the selected projects gives a clearer picture of the current and future application of Big Data technologies on the rail, and especially in the segment of freight transport by rail.*

Key words: *Big Data, Industry 4.0, railway*

STUDENT'S AND YOUNG PEOPLE'S INTEREST IN BEING A TRAIN DRIVER

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Apstract: *Bearing in mind that in the next 5-10 years a great natural outflow of train drivers is expected, as well as the expected increase in rail work and the need for train drivers, the question arises as to whether the existing education system will be able to respond to the expected market demands. If this can not be achieved then one of the solutions could be the establishment of training centers for train drivers, which represent a modern way of training for this type of occupation. The subject of this paper is the assessment of the interest of students of secondary railway technical schools of the educational profile train driver for a job in that field immediately after the completion of high school. The results of this research should show the numerical status of high school students who have chosen this kind of occupation, the reasons why students enrolled in the secondary rail school and the percentage of students who are interested in dealing with the job of a train driver in the future. For this purpose, the survey used pupils of all grades of the education profile of train drivers at the secondary railway school in Belgrade. In the end, a discussion was held about the expectations in the future about meeting the market demands for train drivers based on the survey results.*

Key words: *training center, survey, train driver*

IMPLEMENTATION OF THE DRY PORT CONCEPT IN THE WEST BALKANS REGION

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Apstract: *The development of intermodal transport (IT) systems is of great importance for the achievment of sustainable development of a region. The necessity for IT systems capacity and service expansion faces a great challenge caused by the presence of space restrictions and ecological regulatives. The implementation of the Dry Port (DP) concept allows the expansion of capacities and services of a port terminal in conditions of space restrictions. The focus of this paper is on the importance of IT systems development for the west Balkans region. The effects of the DP concept implementation for the observed region are analyzed. The results show that the implementation of the DP concept would lead to the costs reduction for the observed logistics network.*

Keywords: *intermodal transport, intermodal terminal, seaport container terminal, dry port concept, West Balkan*

TRANSPORT QUALITY MANAGEMENT

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Apstract: *The interest in the quality management systems in the organisations in Bulgaria has been increasing in recent years. The main reason for this is related to the recognized need for organisations to improve their management processes, including logistics, and therefore allow the formation of competitive advantages. (Chankova, 2005). The only and unconditional measure of quality is customer satisfaction with the products offered, including both the characteristics of physical products and the service they provide. In order for organizations to survive in today's conditions of intense competition, it is necessary to ensure high quality of production and customer service, which implies the need for quality management.*

The report will look at the methods and tools for quality management in transport companies. An analysis of the quality control methods applied in the transport organizations in Bulgaria will be carried out and on this basis recommendations for quality improvement will be presented.

Key words: *transport industry, quality management, customer satisfaction*

DIGITAL TRANSFORMATION AS A FACTOR OF EFFICIENT DEVELOPMENT OF LOGISTICS SYSTEMS

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Apstract: *The paper deals with the problems and possibilities of digital transformation of the logistics system as a factor of more efficient development of logistics. The aim of the research is to identify the problems, benefits, essential performance and barriers to the application of digital transformation of the logistics system that have the potential to create a completely new work environment that increases the speed and quality of processes and procedures, since speed and time are crucial. Improving supply chain connectivity, better forecasting capabilities, newer technology, changes in logistics patterns and scenarios, challenges in resources, people, management, but also energy, value chain integration, and other reasons for the need for accelerated digital logistics transformation. The research results present a new approach to digital transformation through the analysis of hyperconnections and hybrid chains based on available literature and empirical data. The following scientific methods were used to achieve the set goals of the paper as well as the most efficient research results: descriptive method, comparative method, synthesis method, method of analysis. The importance of the work is reflected in identifying key parameters for successful digital transformation and closing the existing shortcomings facing the logistics industry.*

Key words: *Digital transformation, logistics, efficiency*

FEASIBILITY OF LOGISTICAL MODEL OF COMMUNAL WASTE MANAGEMENT

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Apstract: *The logistic is recognizable because the decisions are always brought at different levels. When it is a word for communal waste management (hereinafter CWM) the decisions are brought at different places. In this paper that will be at three levels. First level it is considered at management economical level. Second level when a word is for CWM is the technical in other words logistic level. And the third level is considered at strategic level or level where the strict laws and regulations should be observed, for protection of the living environment in function of the previous two levels. With such logistical approach the certain state should be partially considered and all with one sole purpose in order to have a possibility for the solutions to be changed only in defined segments and again to be put in functionality of the complete system. With this the decisions that are brought at different levels are practiced at all logistical concepts of CWM (spatially, timely and functionally). With that the feasibility of the logistic model (hereinafter LM) will be a reality not only as a project but also as an operational finished desired state. With this from this paper it comes clear that every approach and especially the logistical one, it could and it must be put in phases and in levels and at the same time to be feasible as a desired product. With analysis and synthesis in application of the logistics the contours of the desired and future scientific project in this field will be formed.*

Key words: *feasibility, logistic model, communal waste management, management level, logistic level, strategic level*

LOGISTICS PARAMETERS OF THE NON-PEDESTRIAN PART OF THE CENTRAL CITY ZONE

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Abstract: *The city is the place of the largest concentration of economic and social activities, and the delivery of goods is a prerequisite for the maintenance of urban life and business activities through which the development of the city is achieved. City logistics deals with the problems of delivery of goods in the city and it seeks to increase the efficiency and mitigate the negative effects of logistics processes and activities while supporting the sustainable development of the urban areas. In the studies dealing with city logistics, special attention is paid to the central city zones, which initiate one third of all freight flows. Accordingly, the subject of this paper is to analyze the parameters of city logistics of the central city zone in order to investigate the characteristics of goods and transport flows. This creates the preconditions for identifying existing and potential problems, as well as defining the possible solutions. The aforementioned analysis is carried out in this paper on a realistic example of the parameters investigation for the non-pedestrian part of the Belgrade's central city zone.*

Key words: *city logistics, parameter, central city zone*

DETERMINATION OF KEY FACTORS AFFECTING TRANSIENT SEAPORT SELECTION FOR LANDLOCKED COUNTRIES IN AFRICAN CONTINENT

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Abstract: *Many countries around the world suffer from the lack of a sea port directly linked to the rest of the world. Such countries are called "landlocked countries". This leads to Weak competitiveness of their products in the global market, as well as to the high cost of the imports. Africa has the largest share of these countries, with 16 of the 43 landlocked countries around the world. The aim of this paper is to propose a general framework for criteria that can be used to choose between ports in transit countries that can be used for import or export. These criteria are related to the assessment of the sea ports in terms of infrastructure and tariffs. It is also related to transport infrastructure from the transit country to the landlocked country and the level of safety. The study identified nine criteria that could be used to compare between ports in transit countries. Using Full Consistency Method (FUCOM) to evaluate those criteria showed that the number of navigation lines is the most important criteria followed by the port service level.*

Key words: *Land locked Countries, Africa, Supply chain management, Sea ports*

SWOT ANALYSIS OF THE BUSINESS OPERATIONS OF THE COMPANY EURO LIMUN D.O.O. DOBOJ

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Abstract: *The work is based on the collection of data on the business of the company "EURO LIMUN" d.o.o. in the period from 2006 to 2015.*

For each business year of this company, a SWOT analysis of business performance was performed. The analysis itself shows that the company's potentials, infrastructure and staffing have changed, but also the most important segment of this analysis, which ultimately is presented is a profit for the company in each business year; The impact of capital investments as well as changes in the personnel structure subsequently produce profits every fiscal year. The aim is to show the organizational and structural changes from year to year, which led to the strengthening of the strategic position of the enterprise in the market of transport services.

Key words: *transport company, SWOT analysis, capital investments, personnel structure*

MACHINE LEARNING - APPLICATION IN LOGISTICS

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Abstract: *The implementation and monitoring of logistics flows are today accompanied by the continuous generation of large amounts of data. Datasets that have Big Data features provide the ability to apply modern data mining techniques. A significant class of these techniques is predictive analytics based on the application of supervised machine learning. The main objective of this research was to define and verify the methodology of predicting the volume and structure of logistics flows in a country's foreign trade, based on the construction and application of a supervised machine learning model. The paper describes all stages of the machine learning process: data preparation, construction, evaluation, testing and application of machine learning models, ie. prediction of dependent variables. The proposed methodology was applied in the case study of the prediction of foreign trade logistics flows in the food industry of the Republic of Serbia. One of the contributions of the research is to identify machine learning algorithms that produce good results on the available data set. Models based on decision tree type algorithms showed the best performance: Random Forest, Random Tree and REPTree.*

Key words: *Big Data Analytics, Prediction, Foreign Trade, Decision Tree*

EVALUATING EFFICIENCY OF LOGISTICS PERFORMANCE BY USING RADIAL AND NON-RADIAL DEA MODELS

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Abstract: *The main aim of this paper is to present radial and non-radial efficiency measurements on the selected data set involving more Decision Making Units (DMUs) operating in the field of transport by using Data Envelopment Analysis (DEA). Herein, we demonstrate that a DMU can be efficient or inefficient in its use of inputs to achieve outputs. The results indicate that the non-radial measurement is stricter in evaluating the efficiency than the radial measurement for each of the inefficient DMUs.*

Key words: *Efficiency measurement, Radial and non-radial DEA models, Optimization*

TECHNICAL TECHNOLOGICAL CHARACTERISTICS OF DELHAIZE STARA PAZOVA DISTRIBUTION CENTER

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Abstract: *Taking into account that the delivery of goods is carried out in the same way in the same way, where as a result we have a greater number of goods flows in the supply chain, this paper will show how the easier distribution of goods and capital in the presence of logistics elements in the distribution downtown Delhaize Stara Pazova. An overview description of the main characteristics of the distributive center has been provided as the significance of general consuption goods supply on the territory of the city of Belgrade. The distribution center is characterized and stands in comparison to other standard heart of the quality of logistics services. The construction of the distribution center and by connecting it to the global distribution network conditions have been created for the considerable increase in the productivity of logistic elements in all the total logistic system, Serbia. These distribution center is fully enabled the creation of an efficient distribution network solutions, increasing the efficiency of the implementation of commodity flows, opened the possibility of presence of local manufacturers and distributors of goods and capital at the regional and partly on the international level, which gives the terms and conditions for the total acceleration of the flow of goods capital and thus increases the efficiency of logistic elements.*

Key words: *commodity flows, goods supply, distribution center*

TRADE TRANS RAILPORT INTERMODAL TERMINAL – LOCATION DETERMINATION MODEL

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Apstract: *Intermodal transport represents an imminent segment in optimizing the flow of goods flows. The places of transformation of commodity streams, or changes in the mode of transport, and the terminals play a key edge in enabling the functioning of intermodal transport. The paper presents the TRADE TRANS RALIPORT intermodal terminal in Arad as a kind of "dry port" according to location characteristics. The segments of the terminal location as well as the ways of attracting the goods flow into the defined gravitational area were examined. The functionality of the terminal was analyzed in a multi year scenerio and provides a good example of practice, which is located according to location selection criteria that do not agree with the theoretical models for determining the optimal location of such systems. The aim is to demonstrate, through a practical example, the lack of theoretical models for determining the macro and micro locations of logistics systems.*

Key words: *intermodal terminals, TRADE TRANS RAILPORT ARAD, optimal location of terminal*

MATHEMATICS IN THE SHIP'S ROLLING MECHANISM OBSERVED AS A SET OF ELECTONIC FILTERS

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Abstract: *Maritime bussiness can be defined in the strict sense and in the broader sense of the world; in the strict sense of the word maritime bussiness is an art of sailing or a skill to manage and manouvre the ship. In broader sense of the word it includes all operations which are in any way (direct or undirect) connected with exploaration of the sea and through two approaches - sea as a media of communication and sea as a resource of natural goods. Matemathics, as one of the oldest science, helps us in many calculations in close relation to maritime business. Ships stability, swinging on the waves and navigation are just some of the problems that can be solved by using mathemathics. Theme of this work is explaining, disassembleing and simplifying physical models of ships swinging.*

Key words: *waves, wave spectrum, triangle course, frequency*

INTERNET OF VEHICLES: CHALLENGES AND DEVELOPMENT TRENDS

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Abstract: *IoV(Internet of Vehicles) as an extension and application of the state-of-the art IoT (Internet of Things) concept in the vehicular environment represents highly interestingresearch topic that is triggered during the last few years by leading automotive manufacturers, telecom operators and service providers, research institutions, regulatory bodies and other stakeholders. Rapid development of information and communication technologies together with their intensive integration withthe automotive industry provides an opportunity for the IoV concept to be realized in the near future. It is expected that the IoV concept will gain huge commercial interest by developing a broad range of applications for various participants in the vehicular environment. The most important task of IoV architecture is to connect vehicles and other participants with heterogeneous wireless networks, as well as with each other, in such a way that the transport and traffic system functions safely, productively and economically, as well as energy efficiently and environmentally friendly. This paper presents the basic concepts of the future intelligent IoV architectures, with an emphasis on reviewing the various research challenges and problems that have to be addressed, with particular reference to security attacks and detection mechanisms.*

Key words*: Internet of Vehicles (IoV), V2X communications, security attacks*

ANALYSIS OF DEVELOPMENT OF THE E-COMMERCE MARKET IN THE REPUBLIC OF SERBIA IN ACCORDANCE WITH THE UNIVERSAL POSTAL UNION PROGRAM

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Abstract: *The e-commerce market is in the stage of intensive growth throughout the world, primarily in highly developed countries. The growth rate of e-commerce is due to the general penetration of the Internet, as well as higher rate of economic growth. In the past few years this trend is evident in the Republic of Serbia, which greatly affects the operations of postal operators providing services in this segment. The Universal Postal Union has developed a program aimed at improving e-commerce through the creation of a multifunctional, integrated and reliable infrastructure, in order to create a single e-commerce market and accelerate delivery of international parcels. The paper will present the basic principles of the program, will be tested level of development and market potential of the Republic of Serbia in the field of e-commerce. Also, in the paper will be assessed the state and perspectives of further development of e-commerce in accordance with the Universal Postal Union Program in the Republic of Serbia.The economic justification for the introduction of this program in the Republic of Serbia will be examined. This would assess the importance of introducing program for e-commerce development, as well as for better positioning and greater participation of the Republic of Serbia at the global international market.*

Keywords: *parcels, ECOMPRO, e-commerce*

INTERNET OF THINGS AND SMART CITIES

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Abstract: *The application of the internet of things has become especially popular in many different areas: intelligent production, transport, logistics, ecology, health care, smart energy networks, smart homes, smart cities, etc. Internet of things includes sensors, actuators, electronic processing, microcontrollers, software, communication services and information services related to the intelligent devices. According to various estimates, until the year 2050, two-thirds of the population will live in urban areas. This development of the situation will require enormous efforts by all services involved in city management. One of the solutions could be technologies of the smart city, where different aspects have to be taken into account. The paper presents some of standards, architectures, protocols and applications related to the internet of things. The methods used in this paper are: research of case studies, analysis of reports about the application and examples of use of the internet of things in city management. Solving of traffic congestion and parking problems are strong enough reasons for using the internet of things in the smart cities. The paper points to the contribution of the internet of things, both at the individual and community level. At the city level, professional services achieve better productivity because of better use of data in the decision-making process.*

Key words: *information technology, intelligent transport systems, urban development*

KNOWLEDGE INNOVATION TRENDS IN THE STANDARDIZATION FIELDS 'ROAD VEHICLES ENGINEERING' AND 'RAILWAY ENGINEERING'

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Abstract: *Objectives: This paper presents multi-criteria research and statistical analysis of selected segments per fields Road Vehicles Engineering (ICS1 = 43) and Railway Engineering (ICS1 = 45). The aim is to monitor the intensity of innovating knowledge, trends, knowledge sources, individual knowledge of each expert, and updating the knowledge base for improving the quality of the standardization platform. Approach: The study relates to standardized fields of the International Classification of Standards (ICS). The focus is on the trends of knowledge innovation at the beginning of the second decade of the 21st century. The analysis of global (ISO / IEC) and local (SRPS) knowledge sources in the PDCA (Plan-Do-Check-Act) quality loops is presented. For research, analysis, systematization and presentation of results, Java software is used – to search ISO and SRPS standards.Results: The paper focuses on the latest trends in knowledge sources and trends in individual standardized field/subfields of higher (daily) intensity of innovation. The results of the access to knowledge sources in ICS1 = 43 and ICS1 = 45 and comparisons with standardization at local (national) and international level in all other areas of creativity (ICS1 = 01 to 99) are presented.Significance: The model for improving the basic knowledge system is based on the defined intensity of innovation and elements in the PDCA. The time dimension of the quality improvement loop determines the intensity of the innovation of the target fields/subfields and the application of the information system in traffic and communications.*

Key words: *Innovation of Knowledge; Trend; Road Vehicles Engineering; Railway Engineering; Standardization*

SPATIAL ACCESSIBILITY ANALYSIS OF HEALTH CARE FACILITIES IN SERBIA

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Abstract: *One of the dimensions describing accessibility to health services is its spatial component. This paper presents the methodology of using GIS technologies for the analysis of existing locations of health institutions in Serbia. The methodology includes determining the coordinates of hospitals using the geotagging, on the basis of which isochrons are created with 10 minutes time interval. For that purpose, the road network and functionalities provided by HERE Maps and its APIs are used. This service is selected since it offers high quality and complete data related to the network of roads in the territory of interest. Taking demographic data into account, the goal is to examine the impact that the distribution of institutions has on the population, first of all as the percentage of the population living at a certain distance from the nearest institution. The obtained results can be significant for future development, as critical spots with poor accessibility can be identified. These locations are suitable for the construction of new health care facilities.*

Key words: *Geographic information systems, geotagging, isochrones, HERE Maps*

GRAPHS IN MODELING LOCAL ROAD NETWORKS: A PRELIMINARY LITERATURE REVIEW

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Abstract: *Graphs have been proved as efficient tool for modeling and analyzing issues in different types of networks in socio-technical systems. Different issues and properties related to locations and distances in road networks can be presented and analyzed by using graphs. Since it is evident that local roads have a significant impact on everyday life, it is necessary to identify issues that affect their more efficient use. This paper presents preliminary literature review on using graphs for modeling and inquiring issues related to local road networks. The literature review protocol is outlined, followed with the discussion of research findings, constraints and benefits. Implications of the research are also presented, which is the main contribution of this study.*

Key words: *graph, mathematical model, local road network, literature review*

LOWCOST CONVERSION OF A CLASSIC CAR IN A ELECTRIC VEHICLE

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Abtract: *The accelerated development of new technologies has enabled the introduction of new ecologically pure transport vehicles based on the electric drive. In our region, very little or almost no mention is made of this type of transportation means. The market for used electric cars in our country does not exist, while new electric vehicles are extremely expensive for the average citizen of Bosnia and Herzegovina. One of the transient steps that could be taken in this direction, taking into account the circumstances and the poor economic situation, is the conversion of existing vehicles with a standard gasoline or diesel engine into electric-powered vehicles. Starting from this idea, a proposal of such a model was given here. The paper analyzes the possibilities of conversion of standard vehicles with gasoline aggregate into electrically driven vehicles. The conversion was analyzed from the point of view of the components used with the proposal of a mathematical model that was used to simulate the characteristics of a processed vehicle.*

Key words: *conversion, electric vehicles, model*

UNMANNED AEIRAL VEHICLE APPLICATIONS IN URBAN ENVIRONMENTS

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Apstract: *The paper explores the possibilities of detecting and identifying objects using drones in urban areas. The urban environment often abounds in areas that include special traffic regimes. In particular, the paper deals with the simulation of parking regulation by drones, outside dedicated areas such as grass or gravel surfaces adjacent to the fairgrounds, motodroms, concert stages and halls, etc. The main objective of research is to investigate the benefits of limited simulation of parking regulation and to determine the optimal parking strategies. Simulation involves the use of Unmanned Aerial Vehicles (UAVs), which communicate with drivers through a web application.*

Key words: *drones, simulation, parking*

NETWORKING MODEL OF MECHATRONIC VEHICLE SYSTEMS

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Apstract: *Today's modern vehicles contain a complex symbiosis of intelligent electronic systems and integrated mechanical structures. In-vehicle networks provide an efficient method of communication between the various electronic components in an automobile. In vehicle communication contains a very complex structure because safety is a high priority. The communication protocols discussed in this paper are Controller Area Network (CAN), Local Interconnect Network (LIN), Media Oriented Systems Transport (MOST) and FlexRay. In addition to the above described protocols, their components are defined, and also their comparisons are presented. The essence of this paper is the networking model of these protocols.*

Key words: *controller, network, mechatronics, diagnostics*

IMPLEMENTATION OF CONTEMPORARY IOT TECHNOLOGY IN CONTROL AND MANAGEMENT OF ROBOT HANDS DIRECTED ON 3D PRINTER

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Abstract: *The application of 3D printers has undergone a revolution in the last few years. Different aseptics are applied from the printing of pendants, fashion elements, prosthetic parts to complicated assemblies and elements. As one of the application segments, this paper also analyzed the use of 3D printers in the creation of a robotic hand that would be managed through the Arduino microcontroller assembly. A part of the project of printing and assembly of a robotic arm was done at the Faculty of Traffic Engineering within the laboratory for Electronics and Communication Technologies. The paper proposes a robotic hand intelligent robot management system using a mobile phone application and speech management applications. Both of these systems would be integrated into one whole. The basis of the project is a robotic arm with the implementation of the modern method of networking devices, ie IoT (Internet of Things). The development of such systems provides the opportunity for the development of advanced intelligent industrial robots that would be managed from a remote location which could control the work from one center through a web application aggregate into electrically driven vehicles. The conversion was analyzed from the point of view of the components used with the proposal of a mathematical model that was used to simulate the characteristics of a processed vehicle.*

Key words: *3D printers, web applications, arduino microcontroller, speech management*

ADAPTIVE NEURO-FUZZY MODEL FOR INDOOR WI-FI SIGNAL STRENGTH PREDICTION

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Abstract: *Modeling and prediction of signal attenuation is of great importance in the planning and optimization of wireless radio networks, especially indoors where, due to a large number of physical obstacles, the negative effects of signal propagation occur. The aim of this paper is to develop an adaptive neuro-fuzzy inference system (ANFIS) model for predicting indoor Wi-Fi signal strength, as well as to compare the results with a mathematical model obtained by nonlinear regression. ANFIS integrates the principles of fuzzy logic and artificial neural networks and thus unifies their advantages and those are the ability to learn and draw logical conclusions. The test results show a much better performance of the ANFIS model compared to the regression model.*

Key words: *ANFIS, propagation, regression, RMSE*

IMPROVING THE PASSIVE SECURITY

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Abstract: *For public transport passengers, subjective safety is a major selection criterion when choosing their means of transport. Objectives: Despite an objectively good safety level, it appears that certain groups of people feel uncomfortable in some areas outside of rush hours. In this respect, various approaches to increasing the subjective feeling of safety were investigated in the project SafeMobil. Approach: The research showed that the main aspects contributing to a feeling of safety are good lighting and free visibility of places in the evening and at night. In addition, not being alone is reassuring to those affected. Furthermore, different possibilities were discussed regarding the question how a security network can be set up with an application and a control centre, which has a low hurdle for use. Results: Four typical scenarios were illustrated in storyboards and evaluated by both potential users and experts. By means of the created system different variants could be shown, how it is possible to increase the passive safety over an app by including different interfaces. Contribution The study shows that the corresponding financing achieves an increase in passive safety. An outlook shows that further steps are necessary to ensure the required basis for such an application.*

Key words: *Mobility, subjective security, public transport, safety, public*

FREIGHT SIGNAL PRIORITY OPERATIONS IN CONNECTED VEHICLE ENVIRONMENT

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Abstract: *Connected vehicle (CV) technologies offer significant possibilities for traffic safety and operational improvements. The large and accurate data which can be shared among vehicles, or vehicles and the infrastructure, enact possibilities to ameliorate existing traffic operations or create new ones. The limited number of field tests have proven that CV can be used for different adaptive traffic control programs. However, there are still many applications which require more research. This study develops and tests CV-based Freight Signal Priority (FSP) algorithm for commercial vehicles. The algorithms are using the latitude/longitude (lat/lon) coordinates of CV-equipped vehicles and intersections to establish communication, share information and request priority. The tests were performed in VISSIM microsimulation with ASC/3 Software-in-the-Loop (SIL) controller emulator. The test-case for this study is a signalized intersection adjacent to an I-80 interchange in Laramie, Wyoming. A total of six scenarios with the same traffic volume but with different percentage of CV-equipped freight vehicles were developed and compared. The study shows that CV-based FSP can reduce delays by up to 48% for specified vehicles. This algorithm is the first step in further research and development of adaptive signal priority programs.*

Key words: *Connected Vehicles, Freight Signal Priority, VISSIM, ASC/3*

PHASES OF IMPLEMENTATION RFID TECHNOLOGY IN LOGISTIC SYSTEMS

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Abstract: *The implementation of Radio Frequency Identification (RFID) is a big step forward in the functioning of logistics systems and allows much better control of the flow of goods and information through the complete product lifecycle from manufacturer to end user. The implementation of information systems supported by RFID systems is carried out through several interconnected phases that cover all aspects of integration, from the development of initial ideas, design, implementation, up to the maintenance and further development of the implemented solution in accordance with customer needs.*

Through the research and analysis of these phases, we try to define all the challenges that designers and potential users face when implementing this type of information systems in logistics systems.

This paper provides a methodological overview of all critical factors for implementing RFID in logistics systems that, as a result, enable future users to understand the benefits of such information systems and how much information systems will improve the business processes compared to existing traditional business processes systems.

Key words: *RFID, logistics, information systems, development levels, risks*

APPLICATION OF SMART SIGNALIZATION IN ORDER TO INCREASE THE SAFETY OF TRAFFIC PARTICIPANTS

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Apstract: *In recent times, great efforts have been made to apply information technology in traffic. All of this has been done in order to improve and increase the safety of all traffic participants. The greatest attention is focused on pedestrian crossings that are considered as one of the most dangerous places in the traffic field. It is considered that information technology can be great support in the development of certain infrastructure for traffic regulation. This paper presents smart road systems that warn drivers about road safety, as well as smart semaphores that help pedestrians known as "the weakest" traffic participants.*

Key words: *Smart signalization, information technology, smart semaphores*

IMPROVING THE QUALITY OF TRAFFIC BY USING THE IOT CONCEPT

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Abstract: *Today, half of the world's population lives in cities, leading to problems such as traffic jams, poor air quality, traffic noise, etc. Using a technical solution such as Internet of Things (IoT) and the use of different kinds of smart devices can significantly increase the quality of traffic. The Internet of Things allows smart traffic regulation, smart parking or other innovative solutions in the field of traffic and that are related to IT. The paper presents the concept of the IoT network infrastructure as well as some of the world's solutions that can contribute to the quality of traffic and traffic safety.*

Key words: *IoT, smart devices, traffic regulation, smart parking*

DEVELOPING THE SECOND GENERATION OF SAFETY MANAGEMENT IN THE AVIATION

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Apstract: *Safety management belongs to the newest and one of the fastest developing domains in the aviation. Since its invention from around the year 2000, there has been growing interest worldwide in getting more control over the negative aspects of risk in flight operations. Today, the achievement is remarkable given the safety records of modern aviation. However, past success cannot be guarantee of future safety due to fast pace of development and ever-increasing complexity of the aviation industry. Past methods and approaches do not indicate as great performance today and so has the approach to safety management deal with the new emerging challenges. This paper deals with potential implementation of the modern safety theory into the established framework of safety management system. It utilizes all current safety models and methods and proposes how the framework could be updated in the aviation to achieve new generation of safety management. The results show how the theory can be integrated in the aviation with some remarks about the new concept. The paper shows the way forward to the future safety management and ground the future research in the domain.*

Key words: *FRAM, RAG, resilience engineering, safety engineering, STAMP*

GEODETIC REFERENCE SYSTEMS IN AVIATION

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Abstract: *Starting with active use of the World Geodetic System 1984 (WGS-84) as a common geodetic reference framework for international civil aviation, there is provided a faster and easier access to data, as well as better and more quality services to airports. Qality improvement of services to airports in some kind illustrates development level of the country, and its integration to the rest of the world. Observing of obstacles in the both of air and ports, increases security of National airspace systems, delivering accurate spatial coordinates of objects that could pose a risk to aircraft during take-off and landing. An obstacle is any natural or artificial object, such as a towers, trees, antennas or buildinges located in an area intended for the movement of aircraft across the ground or extending beyond the surfaces defined for the protection of aircraft in flight. Conventional methods of exploring airports obstacles include a combination of photogrammetric and field techniques that provide high level of accurate and reliable obstacles.*

Key words: *WGS-84, obstacles, geodetic reference systems*

ANALYSIS OF THE AIRPORT COMPLEX ACCESSIBILITY

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Abstract: *This paper analyzes the problems of airports accessibility (flights) by individual centers that build the airport service area. Therefore, the main goal of this paper is to carry out research in order to find (and develop) new suitable methods for analyzing the problem of availability of airports (flights) in order to efficiently perform air traffic, ie shorten travel time, using certain methods. In the process of finding the best possible solution to the problem, the paper used the method of interviewing passengers on the line Belgrade -Istanbul as a weekly sample of 568 respondents. The presented methodology is current, especially for small airports, with smaller flows of passengers on the service area network, while in large airports this problem is practically non-existent since the collection center is the airport itself and connections within the service area have been developed. Thus, outputs can be combined to derive other indicators, as well as be used as inputs for other models, especially in planning.*

Keywords: *airport complex, landside, time table, catchment area, collection center*

SAFETY OF USING GAS DEVICES IN VEHICLES

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Abstract: *Installation of a gas appliances in vehicles today is not something unusual. More and more vehicle owners are considering installing a gas appliance in their vehicle, mostly for economic reasons. However, many do not decide to switch to more economical fuel besause of the existence of many myths and legends of gaseous fuels such as: "Gaseous fuels have a disastrous impact on the vehicle, drivers and passengers" or "What if suddenly explodes"? One can often hear a comparison of the reservoir as a "bomb on wheels". Also, the word "gas" is associated with fire, explosion and something that poses a threat.*

In order to bust a myth about the danger of gas appliances, the authors tried to understand and represent the real situation and whether the exploitation of additionaly built-in gas appliances in the cars is really safe.

An analysis of the physical and chemical properties of gas and conventional fuel (gasoline and diesel) has proven that the use of gas is less dangerous than the use of conventional fuels, and structural analysis of modern gas appliances showes that their use is much safer than using traditional gasoline and diesel power systems. Based on statistics, test results and their own experience they confirmed that professional installation of modern gas appliances on vehicles, with proper maintenance and exploitationdoes not in any case present an additional threat to safety. The authors conclude with certainty that the issue of the safety of the use of gas appliances in vehicles is not an argument for the negative decision of the vehicle owner when deciding on their installation.

Key words: *vehicle, gas, liquefied petroleum gas, natural gas, economy, safety*

ANALYSIS OF FACTORS AFFECTING DAMPING PROPERTIES AND ECONOMICITY OF HYDRODYNAMIC TRANSMISSIONS OF MOTOR VEHICLES

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Abstract: *In this paper, attention is devoted to the analysis of the factors that influence the economy and attenuating effect of the gearbox with the hydrodynamic component on the overall economy of vehicles and comfort from the aspect of the continuity of the gear, without rapid acceleration and deceleration.*

In order to reduce fuel consumption to an optimal level, for the given construction of the drive unit and the whole vehicle, it is necessary to harmonize the engine operating modes with hydrodynamic gearing, ie with the resistance caused by the movement of the motor vehicle. The goal is to rationalize the fuel consumption of the drive engine. This is, for now, largely achieved by the use of a gearbox with a continuous change in gear.

The installation of the transmission with continuous change of gear in the vehicle enables: continuous adjustment of the output torque and speed with variable resistance of the motor vehicle, rational use of the engine power, greater passage, increases the life of the vehicle and enables easier control. The possibility of programming the change of gear allows for achieving minimal fuel consumption. Determination of the effect of the dampening effect of hydrodynamic power transmission on the torsional oscillations of the vehicle's gearboxes, as well as the effect of the disturbance on its dynamic behavior, is done primarily on the basis of dissipation energy. When optimizing the parameters of the blade system, it is necessary to take into account, first of all, the dampening effect and the economy of the hydrodynamic power transmission.

Keywords: *motor vehicles, hydrodynamic power transfer, economy, dampening effect*

OPTIMIZING THE PREVENTIVE MAINTENANCE OF THE ENGINE COOLING SYSTEM

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Abstract: *This work presents a possibility to find the optimal solution in the maintenance of the engine cooling system when the criteria functions are maximal availability and minimal maintenance costs. These two criteria lead to several solutions of the engine cooling system assembly maintenance; therefore, it was necessary to apply the multicriteria optimization.*

Results of voluminous investigations of the engine cooling system reliability parameters, which were obtained by monitoring the behavior of the analyzed motor vehicle in the real exploitation conditions, from the aspect of failure occurrence of its engine cooling system, and with application of the corresponding scientific knowledge from the area of probability, mathematical statistics, systems theory and reliability theory, have served as a basis for finding the optimal periodicity of the engine cooling system maintenance, taking into account the criteria of maximal availability and minimal costs of its maintenance. Since the optimal periodicities of conducting the engine cooling system preventive maintenance, determined by criteria of maximal availability and minimal maintenance costs differ from each other, it was necessary to apply one of the multicriteria analysis methods. The presented methodology of the multicriteria decision-making can be applied for obtaining the reliable value of optimal periodicity of conducting the preventive maintenance procedures also of other parts of the analyzed engine cooling system.

Key words: *Engine cooling system, Maintenance, Optimization, Reliability, Availability, Costs*

EXPLORING THE POSSIBILITY OF REDUCING HARMFUL EXHAUST GASES FROM MOTOR VEHICLES

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Apstract: *Air is important for the lives of people, but not only for humans, but for all living beings, and one of the basic pollutants is the emission of exhaust gases from motor vehicles. Therefore, the aim of this paper is to explore the possibilities of reducing the harmful effects of exhaust gases. Some of the possible ways to reduce these emissions are primarily by applying appropriate so-called. Alternative fuels (liquid petroleum gas, biodiesel, ethanol and methanol, hydrogen, natural gas, electricity ...), followed by engineered intervention on the engine (favorable construction of the combustion area, quality of the blend) and further exhaust gas treatment (catalytic converter, gas return). Alternative fuels that are environmentally friendly in terms of diesel and gasoline have a growing application in the automotive industry, and based on data obtained by measuring the vehicle's technical examination, a comparison of emissions of harmful gases in vehicles with conventional and alternative drives has been analyzed. More accurate and precise measurements of this kind and similar measurements in the near future will be able to be carried out at the Technical-Laboratory Center of the Traffic Faculty in Doboj.*

Key words: *fuel, emission of harmful gases, exhaust system, vehicle inspection*

TESTING TRACTION CHARACTERISTICS OF VEHICLES DRIVED BY LIQUID PETROLEUM GAS

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Abstract: *Traction characteristics represent one of the most important parameters of motor vehicles. The traction test may be performed on a polygon or on dynamometers intended for the traction test of motor vehicles (chassis dynamometers).*

Certain changes to the powertrain, such as the installation of a LPG engine supply system, may change the towing characteristics of the motor vehicle. For this reason, we performed a test of the power and torque of a passenger motor vehicle, which has a factory-installed system for supplying the propulsion unit with gasoline, and to which a system for propulsion of the engine by LPG was subsequently installed. Tests were performed when the vehicle was powered only by gasoline and then only by LPG. The paper presents comparative data of measured traction characteristics for both propellants.

Key words: *power, torque, chassis dynamometer, LPG system*

INTERACTION BETWEEN SUSTAINABLE MOBILITY AND ECONOMIC DEVELOPMENT IN BOSNIA AND HERZEGOVINA

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Abstrakt: *The paper explores the development possibilities of the concept of sustainable mobility in Bosnia and Herzegovina, as well as the process impacts on the national economy. Therefore, the paper presents the main features of a sustainable mobility system and development conditions in Bosnia and Herzegovina. From this perspective, an important part of the research will analyze the opportunities and requirements for the development and modernization of multimodal transport. Using analytical, comparative and descriptive methods, the paper is based on exploring the elements of efficiency related to promoting the use of multimodal transport in relation to road, rail or maritime transport. Based on these studies, it is obvious that to support sustainable mobility in BiH it is necessary to develop multimodal transport. In this context, the paper also presents the current situation and perspective of multimodal transport in BiH. As a main conclusion, Bosnia and Herzegovina's economic policy, which aims to reduce energy consumption, increase the efficiency of transport of goods and persons within better transport quality and reduce the negative environmental effects of transport, will be positively and significantly influenced by the achievement of a sustainable mobility system.*

Key words: *Multimodal transport; Mobility; Economic development; Sustainability*

TESTING REVITALIZATION OF WASTE TRANSFORMER OIL IN BOSNIA AND HERZEGOVINA

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Abstract: *The study presents revitalization test (reduction of the mass fraction of water and increase of dielectric strength) of waste transformer oil (WTO). Revitalization was carried out in the field in the power facilities (substations) such as: Bijeljina, Priboj, Zvornik, Vlasenica and Milici. The mentioned facilities belong to Republika Srpska, i.e. Bosnia and Herzegovina (BiH). The technical and elemental analyses of WTO mixture from the substations indicate a high mass fraction of carbon (C = 86.86%), hydrogen (H = 12.51%) and high inferior calorific value (Hd = 44.124 MJ kg-1). The mass fraction of water in oil in the substations is within the threshold limit values (≤ 20 ppm), while the dielectric strength of oil in the substations Priboj (166 kV cm-1) and Zvornik (146 kV cm-1) are not in compliance with the limit value (≥170 kV cm-1). The results of the WTO revitalization test show that the reduction in the mass fraction of H2O in WTO in the power facilities of Republika Srpska (BiH) ranged from 64.89% in the Milici substation to 76.46% in the Zvornik substation. This resulted in an increase in the dielectric strength of the WTO from 6.67% in the Milici substation to 64.38% in the Zvornik substation. Increase in the value of WTO dielectric strength and the reduction of the value of water content in oil after the treatment in the power facilities (substations) of Republika Srpska (BiH) will improve transformer oil features, insulation properties and substations' operation safety, and thus the environmental impact.*

Key words: *waste, oil, dielectric strength, moisture, environmental protection*

DIVERSIFICATION OF GAS TRANSPORTATION ROUTES AND SOURCES FOR GAS HUB BALKAN

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Apstract: *Objectives The report reviews different gas supply routes for Republic of Bulgaria and conversion the Republic of Bulgaria into an energy center by building gas pipelines Russia-Black sea-Turkey-Bulgaria, Azerbaijan-Georgia-Black Sea-Bulgaria, Turkmenistan-Azerbaijan-Georgia-Black Sea-Bulgaria, Iran-Armenia-Georgia-Black Sea-Bulgaria, Israel-Mediterranean sea-Greece-Bulgaria and gas interconnectors with neighbor countries. Approach Case study of gas transportation routes and sources for gas hub Balkan. Results The research made by the author shows that gas pipeline between Georgia-Black sea-Bulgaria with diameter of 1220mm and length of 1400km will provide almost 3 times more gas in comparison with a same pipeline with diameter of 810mm and length of 1200km. Contribution Building of a gas distribution center on the territory of Bulgaria will improve energy security and geopolitical influence of the region.*

Key words: *gas pipeline, building pipelines, energy center*

REFLEXION OF FIXED COSTS ON BUSINESS RESULT AND RISK OF ACHIEVEMENT OF THE BUSINESS PROFIT OF THE COMPANY

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Abstract: *The development of the market economy has led to a significant shift in the approach to the financial management of transport companies and the change in the basic economic settings in the management of financial flows. Starting from this fact, and using rationalistic methods of analysis and comparisons, in this paper was done practical processing and analysis of the structure of total revenues and total costs of the selected company in the field of transport. The focus of the analysis is focused on the level of business, financial and other revenues and costs in the observed five-year period. The aim of the research is to point out the importance of the impact of fixed costs on the business result of a transport company and identify the causes that led to fixed costs which reaching significantly higher values than normal ones. In this regard, there is analysis of the risk of achieving the financial result and the it was established factors of business risk, financial risk and overall risk in conditions when the margin of coverage is insufficient to cover the costs of the period, or when the company receives a loss from regular business activity.*

Key words: *fixed costs, business result, business risk*

RESEARCH OF THE REGIONAL CONCENTRATION OF THE TRANSPORT ACTIVITY IN THE REPUBLIC OF SRPSKA

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Apstract: *The problem of unequal economic and regional development of the Republic of Srpska is one of the key issues that seek to overcome but also to some extent equalize. Concentration of activity indicates the extent to which a region has a stake in the overall economic activities of the country. The main objective of this research is to mark the position and concentration of activity Transportation and storage in the set of all activities in the Republic of Srpska.Calculation of the index of concentration in the present study was done on the basis of Hefindahl-Hirschman Index of concentration and normalized Hefindahl-Hirschman index. In the final part of this paper made a comparative analysis of all activities by region of the Republic of Srpska. The Transport and storage sector in representation occupies seventh place in the framework of the Republic of Srpska. The high concentration of this sector was recorded in the region of Doboj. Studies have shown that the region of Banja Luka, Doboj and Bijeljina have a moderate concentration of activity, while the region of East Sarajevo and Trebinje non-concentrated activity.*

Keywords: *regional development, Hefindahl-Hirschman Index, a regional disparity, transportation and storage.*

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ВЛАДА
РЕПУБЛИКЕ СРПСКЕ

ЖЕЉЕЗНИЦЕ РЕПУБЛИКЕ СРПСКЕ А.Д. ДОБОЈ