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The aim and scope of the Traffic and Transport Theory and Practice (TTTP) Journal is:

- Provide international dissemination of knowledge and contributions to the science and practice in the field of traffic and transportation
- Promote and exchange information and knowledge in the transportation research arena and its application
- Explore the new trends in development and invention related to the efficiency, reliability, safety and economically and ecologically sustainable transportation.

TTTP provides conditions and positive environment for the new idea promotion, exchange research results and achievements accomplished by the scientific community from academia and transportation industry.

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EDITOR'S WORD

Dear reader, respected colleague,

Striving to continue affirming ourselves as a magazine that manifests new ideas and ways of thinking by scientists and experts in the area of traffic and transport technology, I would like to take this opportunity to present to you the sixth issued of the TTTP - **TRAFFIC AND TRANSPORT THEORY AND PRACTICE** magazine with seven new titles, carefully selected, with established double review, based on mandatory discretion of both authors and reviewers.

This issue of the magazine is also available in both printed and electronic version.

The magazine features authors and reviewers from Bosnia and Herzegovina and neighbouring countries, as well as from the United States of America. In the same vein is the magazine's open access scenario, with invitation to the wide population of interested researchers and individuals, aiming to publish and protect the authors of published articles.

For the last four years, the Faculty of Traffic of the Apeiron Pan-European University has been organizing expert training for specialists in education of professionals in road traffic and transport. From next year, the plan is to organize a scientific and expert conference on traffic safety, which will significantly increase magazine's capacity, in terms of selection of more quality and scientifically declared articles.

I would like to stress that the magazine has provided open access to its previous issues (from 2016 to 2020) on its own webpage (http://tttp-au.com).

At this moment the TTTP magazine can be found in the international database - Index Copernicus.

Editor-in Chief
Danislav Drašković

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ORIGINAL SCIENTIFIC PAPER

Improvement of the Safety System in the Railway Infrastructure of Montenegro

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Abstract: Safety is an extremely important feature of railway traffic, and, at the same time, it is one of the most important criteria for the organization and functioning of the railways as a complex, technical-technological and dynamic system. [9]

Traffic safety is a basic requirement for the operation of the railway system and is based on coordinated activities at the technical and administrative level.

The administrative level includes the determination of the obligations and responsibilities of all stakeholders (Infrastructure Managers, Railway Undertakings, Suppliers, Railway Administration, Authorities), and is based on Railway Safety Directive 2004/49 / EC .

The technical level includes the definition of standards for each component of the railway system.

Continuous development of the safety system is a precondition for the future development of the Railway Infrastructure of Montenegro as a modern and reliable partner in the railway system.

The safety system is expected to recognize risks in every work area, that may affect its efficiency in operation, and to eliminate or control them. Hence the need for constant monitoring of the functioning and improvement of the Safety Management System.

This Paper presents a classification of the railway system, with all the specifics and infrastructural features. Then, the current state of the safety system in the Railway Infrastructure of Montenegro (RIoM) is analyzed. Finally, based on a comprehensive analysis, in order to improve the existing situation, the Paper presents the concept of Risk Management Models that can adversely affect the safety system.

Keywords: Safety, System, Management, Model, Infrastructure, Improvement.

INTRODUCTION

Complete traffic safety, at the end of second decade of 21st century, is not yet possible. On the other hand, traffic must be used, so the aim is to establish optimal safety with sustainable further development of traffic.

Railway traffic safety is a constant concern of the entire railway organization, including users of railway services. It is an extremely important feature of railway traffic, and, at the same time, it is one of the most important criteria for the organization management, control and functioning of the railways as a complex, technical-technological and dynamic system. [9]

The railway safety system is based on coordinated activities of two levels, as follows:

- Technical level - defining standards for each component (railway infrastructure, rolling stock, operational procedures of workers) and
- Administrative level - determining the obligations and responsibilities of all stakeholders (Infrastructure Managers, Railway Undertakings, Suppliers, Railway Administration, Authorities).

The administrative level of safety is based on Railway Safety Directive 2004/49 / EC. This Directive stipulates that all railway companies (Railway Undertakings and Infrastructure Managers) are responsible for the safe operation of the railway system, and in order to fulfill this obligation, this Directive requires them to establish their own Safety Management System.

The introduction of the Safety Management System in the railway system companies in Montenegro was preceded by several laws and by-laws: the Law on Rail-

ways, the Law on Safety, Organization and Efficiency of Railway Transport, the Rulebook on the detailed contents of the Safety Management System of Infrastructure Managers and Railway Undertakings.

The Safety Management System describes the proceedings, procedures and other elements that are implemented in the Railway Infrastructure of Montenegro, in order to ensure that the company achieves its planned business goals in a safe way. These goals must be met in today's ever-changing and complex railway environment, providing evidences that the organization meets all safety requirements that apply to it.

THE CLASSIFICATION OF RAILWAY SYSTEM

The general importance of infrastructure for the functioning of the economic and social life of the country is at the same time a framework for the international integration of economies, such as the European Union. On that basis, large projects are being formed, such as the European High-Speed Rail Project as well as the Pan-European Transport Corridors, in which the transport infrastructure of the Western Balkans also participates.

In order to organize the transport of passengers and goods, the railway system must have appropriate technical means, devices and facilities, as well as proceedings and procedures. However, commercial train traffic on the entire railway network requires, inter alia, harmonization of infrastructure and vehicle characteristics, as well as efficient interconnection of information and communication systems of infrastructure and railway undertakings, as infratsructure capacity users. Efficiency, safety, quality of services and costs accompanied by business activities depend on this harmonization and interconnection. Due to its size and complexity, the railway system is divided into subsystems. According to the European concept of interoperability and safety, there are the following subsystems: [2]

1. Infrastructure;
2. Control, management and signaling of infrastructure;
3. Energy;
4. Rail vehicles;
5. Traffic regulation and management;
6. Maintenance;
7. Telematic applications for services in the transport of goods and passengers.

All technical resources in the above subsystems can be classified into two basic groups, as follows:

a. immovable (stable) and
b. movable (mobile) resources.

The group of immovable resources includes railway lines and stations with all their facilities, electric traction substations, stable signaling technology, depots and workshops. In a word, immovable resources form a railway network. The group of movable resources includes vehicles, i.e motive power unit and hauled vehicles .

Between several divisions of the railway system, it proved to be very practical to divide the railway as a technical system into a structural and a functional part, which also represent its subsystems. The structural rail subsystem includes railway infrastructure, electric power plants, signaling - safety and telecommunication devices and railway vehicles. The functional rail subsystem includes the regulation and management of traffic, maintenance of all subsystems, as well as all telematic applications related to the transport of passengers and goods.

ANALYSIS OF THE CURRENT SITUATION OF THE SAFETY SYSTEM IN THE RAILWAY INFRASTRUCTURE OF MONTENEGRO

The Railway Infrastructure of Montenegro JSC. Podgorica (RIoM)/Željeznička infrastruktura Crne Gore AD-Podgorica(ŽICG)/ is the manager of public railway infrastructure on the territory of Montenegro.

The RioM function is determined by the Law on Railways, defining that infrastructure management is an activity of public interest and includes: organization and regulation of railway traffic, protection, maintenance of infrastructure or its part.

In accordance with the Law on Safety, Organization and Efficiency of Rail Transport, RIoM has established a Safety Management System, by adopting the SMS Manual (official title of the document for Safety Management System in RIoM).

The SMS Manual has been prepared on the basis of the Rulebook on the detailed contents of the Safety Management System of the Infrastructure Manager and the Railway Undertaking. This Rulebook defines 19 points that should be included in the Safety Management System of an Infrastructure Manager. Accordingly, RIoM has prepared the SMS Manual, 19 chapters thereof refer to the points from the said Rulebook.

The previous retroactive railroad approach, which was based on the principle that something must happen first to cause a reaction, is being changed to a proactive approach, the principle that predicts what is likely to be happened and seek to prevent it. This safety approach seeks to identify in advance the risks and factors that can lead to failings in order to take measures to eliminate or minimize these hazards.

RIoM opted for a system approach based on the process-based principle according to which the SMS is a set of processes and proceedings or procedures that enable the definition, planning, execution and control of all RIoM activities related to traffic management and regulation and infrastructure maintenance.

The systems approach is based on a preventive safety approach that seeks to identify in advance the risks and factors that can lead to failings, in order to take measures to eliminate or minimize these hazards. The system approach also enables the management and control of interactions between different processes and procedures and between different functional and hierarchical parts of RIoM as well as the continuous improvement of SMS.

Analyzing the current state of the safety system in the Railway Infrastructure of Montenegro, it can be concluded that the entire scope of work is divided into three areas, namely:

- Safety Management System - system established by the Infrastructure Manager or the Railway Undertaking for the purpose of enabling safe management of work processes,
- Control over safe traffic flow - supervision over safe, orderly, regular and undisturbed traffic in the field of traffic, construction and electrical activities and the activities of mechanization of railway infrastructure, and
- Emergency investigation - determining the causes, consequences, circumstances and responsibilities of emergencies and the preparation of analysis and statistics with purpose to prevent future incidents and accidents.

The analysis by scope of work was conducted through the time and organizational framework of action.

The time frame of action of every area is focused on the analysis of preventive and consequential action as shown in Table 1.

The organizational framework of each area is focused on the analysis of areas of application and actions within the company and outside the company as shown in Table 2.

Safety Management System Analysis

As an organizational unit, the Safety Management System was established in August 2016, and in compliance with that, the basis for safety policy was made, being based on the analysis of the work of the Control over safe traffic flow and the investigation of emergencies, and thus the issue of safety at level crossings is raised. The basic features of the current state of the Safety Management System are:

- Newly created jobs related to SMS in RIoM,
- The scope of work is in line with the Railway Safety Directive 49/2004 / EC and the further development of this field of work is based on the Law on Safety, Organization and Efficiency of Railway Transport and the Rulebook on the detailed contents of the safety management system of infrastructure managers and railway undertakings,
- Other railway companies do not have a well-developed Safety Management System,
- the existing safety policy is too extensive and has not improved since its adoption,
- in the countries of Western Europe, the SELCAT project has been completed, and in Montenegro it has not even yet adopted and started with its implementation.

Control over safe traffic flow

The control over the safe traffic flow is performed by the Sector for Traffic Management and Regulation, the Coordinator of the Safety Management System with associates, as well as the Internal Control Service.

Characteristics of the current state of control over safe traffic flow are:

- Partial level of control over the application of regulations in the field of traffic activity, i.e organization and regulation of traffic,

Table 1. Time frame of action

Type of analysis	Safety Management System	Control over safe traffic flow	Emergency Investigation
Preventive	Development of a new safety policy	Advisory and educational regular teaching	Improving safety through emergency analysis, statistics and causes
Consequential	Analysis of conducted controls according to the Minutes (regular and extraordinary)	Safety control in the field of traffic, construction, SS and TC devices, ETA, machinery and vehicles	Analysis and control of the Commission's investigation reports and control of the work of the Commission for the Investigation of Emergency Events

Table 2. The organizational framework of action

Type of analysis	Safety Management System	Control over safe traffic flow	Emergency Investigation
Outside the Company	Cooperation with other railway companies; Cooperation with competent Ministries and bodies; Cooperation with other railway administrations;	Cooperation with controllers of other railway companies; Cooperation with competent Ministries and bodies; Cooperation with other railway administrations;	Cooperation with the Ministry; Cooperation with other railway companies; Cooperation with the National Commission; Cooperation with other railway administrations;
Within the Company	Development of safety within railway infrastructure;	Control in basic organizational units; Operational control; Control in sectors	Advisory management of emergency investigation; Failure analysis;
Scope of work	Traffic organization; Infrastructure subsystems;	Control of application of traffic regulations, construction, SS and TC devices, ETA, mechanization and vehicles	Emergency Investigation; Communication in crisis situations;

- Partial level of control over the application of regulations and standards in the field of technical infrastructure subsystems (construction and electrical activities),
- The conclusions of the Minutes on the control of the application of regulations are not used sufficiently in preventive measures, in order to improve safety,
- Vacancy of all jobs involved in the control over safe traffic flow,
- Administrative control of regular teaching (without real knowledge of the professional qualifications of executive workers),
- Weak connection of controllers from RIoM with controllers from other railway companies, reducing business efficiency.

Emergency Investigation

The Law on Safety, Organization and Efficiency of Railway Transport, as well as the Instruction in the Event of an Emergency, stipulate that every rail emergency event must be investigated. Quality investigation and investigation of emergencies is the basis for maintaining the existing level, but also a condition for raising the level of safety.

Features of the existing emergency investigation are:

- There is no application of emergency events that would be connected between the stations and the service that investigates them (it exists in the countries of the region, in Western Europe it is an even more developed technological solution),
- The Commission for the investigation of extraordinary events conducts a consequential investigation, without a greater possibility for preventive action,
- Members of Emergency Investigation Commissions are often inexperienced in this work
- Members of the Emergency Investigation Commission often work under pressure of their superiors and are primarily in the function of their companies, rather than Emergency interrogation and investigation,
- Very frequent discrepancy of the opinion of the Emergency Investigation Commission, even when the cause is obvious.

IMPROVEMENT OF THE SAFETY SYSTEM IN THE RAILWAY INFRASTRUCTURE OF MONTENEGRO

Followed by the analysis of the current situation, in order to improve the safety system in RIoM, SWOT analysis was made showing the internal strengths and weaknesses and external opportunities and threats by work areas. Then, an analysis was made related to the identification and definition of risks that could jeopardize the further development of the safety system in RIoM.

SWOT analysis

Table 3 (SWOT analysis) shows internal strengths and weaknesses, as well as external opportunities and threats by work areas. Based on the input elements, strategic guidelines were also identified:

- **Safety Management System -** maximizing activities towards other railway companies and other railway administrations.

Table 3. SWOT analysis for safety system

SWOT analysis	Safety Management System	Control over safe traffic flow	Emergency investigation
Internal strength	Professional staff; Good business cooperation with the environment; Computer literacy; Willingness to improve; Work experience;	Work experience; Knowledge of different professions; Establishment of a Safety Management System; Professional attitude towards safety;	Work experience; Expertise and competence; IT skills; Analysis and statistics;
Internal weaknesses	A few people; Insufficient teamwork; Non-involvement in the work of professional bodies; Non-involvement in the work of state bodies:	Insufficient teamwork; Long period of business stagnation; Outdated work processes; Absence of IT applications; Small number of controllers;	Insufficient connection with the field work; Dislocation from the scene; Lack of technical and IT support; Insufficient authority power;
External opportunities	Safety Law; Directive 49/2004 / EC; Rulebook on the detailed contents of the safety management system of the infrastructure manager and the railway undertaking; Work experience;	Cooperation with other companies; Safety control in order to make rationalisation; Application of safety regulations; Development of new regulations; Greater railway safety compared to other modes of transport;	New Emergency Instruction; Safety Law; Safety Directive; Public sensitivity to railway safety; Existence of investigation experts in the field ;
External threats	Absence of established rules; Closedness of other companies; Weakness of the information system; Lack of funds;	Organization of control in other affairs; Insufficient funds for safety; Non-compliant regulations; Resisting technological changes; Poor organizational positioning;	Ignorance of new technologies; Reducing the number of workers; Insufficient quality of work of the Commission and investigation bodies; Increased number of disturbances and failures; Negative public attitude towards level crossings;

- **Control over safe traffic flow -** maximizing activities within RIoM.
- **Emergency investigation -** synergy of all stakeholders in railway companies.

In addition to implementing the provisions of Directive 49/2004 / EC concerning railway safety, in order to establish good relations with other railway companies, the Safety Management System should be developed based on positive experiences of internal control, establishing good relations with other organizational units and participating in drafting missing by-laws related to traffic safety.

Development of control over safe traffic flow in the future is possible with harmonization and definition of control of application of regulations in all professions (within jobs), harmonization and definition of control of application of regulations with other organizational units, harmonization and definition of control of application of regulations with other railway companies, then strengthening activities related to active monitoring of the implementation of conclusions and solutions and active participation in the development of new regulations.

The development of a joint Emergency Instruction by all railway companies was the basis for significant activities related to the development of emergency investigation. Also, an important part for the quality of reporting, notification and investigation of emergencies is the development of an IT application for emergencies.

Risk analysis

The existing safety system of RIoM includes the management of risks that may affect the safety of traffic and the entire system, however, the analysis of the current situation and emergencies indicates that risk management must be improved.

For this reason, an analysis has been performed related to the identification and definition of risks (Table 4) that could jeopardize the further development of the safety system in RIoM. Risk analysis consists of:

1. Risk identification - identification and description of at least ten possible risks,
2. Risk exposure assessments - the result of risk opportunities and risk impacts,
3. Risk management planning - research, acceptance, avoidance, mitigation, risk randomness and
4. Preparation of a review of measures - adoption of measures to eliminate or mitigate the identified risks.

Measures to eliminate or mitigate the identified risks consist of defining a clear way of cooperation with other organizational units, getting acquainted with the characteristics of workers, defining the way of working in all areas, quantifying railway safety, clearly separating the scope of work of services and defining relations between them, defining the scope of work of management of the safety management system (tactical level) and scope of work of employees (operational level), optimization of the scope of work in accordance with the capabilities of the company, defining ways of cooperation with other railway companies, developing a plan for technical means and organizing educational training.

It can be said that the key word in the railway safety system today is a proactive approach to risk management.

Pursuant to the ISO 31000 standard, in order to manage risk in the safety system, it is necessary for RIoM to develop, implement and constantly improve the Framework which purpose is to integrate the risk management process in the entire organization, i.e at the company level (in management processes, defining strategy and planning, reporting processes, policies, company values and corporate culture).

By proper implementation of the risk management process, according to ISO 31000, RIoM would have multiple benefits:

- Increasing the probability of achieving the set safety goals,
- Encouraging proactive action of management,
- Raising awareness and understanding of the need to identify and treat risks impacting safety,
- Improving the ability to identify opportunities and threats,

Table 4. Risk review according to exposure assessment

Risk analysis		
Safety Management System	**Control over safe traffic flow**	**Emergency Investigation**
Insufficient cooperation within company	Non-acceptance of changes	Insufficient cooperation within company
Absence of teamwork	Insufficient control within company	Absence of teamwork during the interrogation and investigation
Non-acceptance of suggestions from other services	Absence of teamwork	Non-acceptance of suggestions within the service
Poor communication at all levels	Poor communication at all levels	Poor communication at all levels
Insufficient administration support for changes in the safety system	Insufficient administration support for changes in the safety system	Insufficient administration support for changes in the safety system
Insufficient cooperation with other railway companies	Insufficient cooperation with other railway companies	Insufficient cooperation with other railway companies
		Changes in the manner of interrogation and investigation
		Poor organizational positioning of the investigation area

- Increased harmonization with relevant legal norms and international standards,
- Improving safety management and reporting,
- Establishing a reliable basis for decision-making and planning related to safety,
- More efficient use of resources,
- Improving the health and safety of employees, improving business, environmental protection,
- Improving the organization's capability to resist the problems, etc.

Also, in order to manage the risks related to the safety system in qualitative way, which means their complete elimination or mitigation, according to the ISO 31000 standard, it is necessary for RIoM to adhere to the following:

a. Continuous improvement,
b. full ultimate responsibility for risks,
c. Application of risk management in every decision-making,
d. Constant communication,
e. Full integration into the management structure of the organization.

Based on the results of the performed analysis, it is possible to define - set the following model of management of risk which in any way can jeopardize the efficient functioning of the safety system of RIoM, Figure 1.

CONCLUSION

Railway Infrastructure of Montenegro (RIoM)/ Željeznička infrastruktura Crne Gore (ŽICG)/ is a complex technical-technological system, consisting of a large number of complex organizational units as structural elements (subsystems), where appropriate planning decisions are made. In order for the safety system to function effectively, which means eliminating or bringing under control all risks that may negatively affect it, it is necessary that each organizational part of the system is interactively connected and function efficiently with each other.

Based on the analysis made, it can be concluded that it is necessary to increase both the time and organizational framework of work, in order to improve the administrative level of interoperability of railway lines, especially railway lines of international importance. The adoption of a new safety policy based on explicit analysis is the first step in the implementation of the set guidelines and the adoption of quantitative and qualitative safety goals.The continuous development of the Safety Management System is a precondition for the future development of the Railway Infrastructure of Montenegro as a modern and reliable partner in the railway system. The main task of the future work of the Safety Management System is to document, to allocate responsibilities and to determine the manner of ensuring control by the management in the traffic and infrastructure subsystems in order to ensure continuous improvement of the Safety Management System.

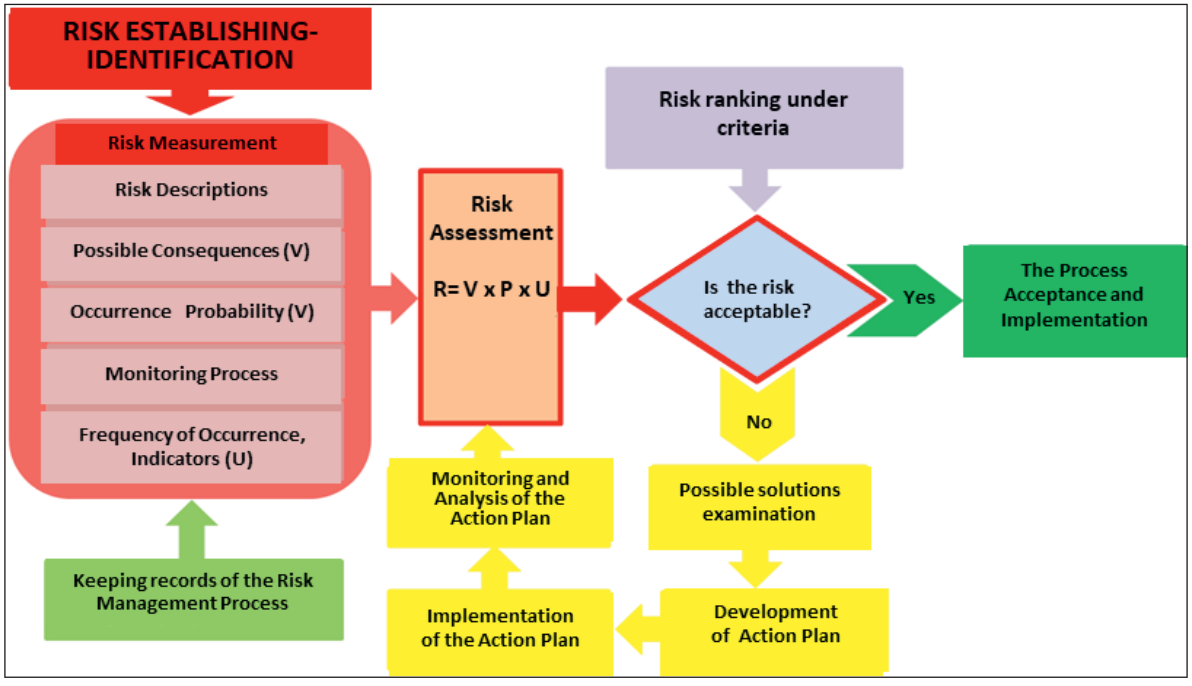

Figure 1. Risk Management Model in the Safety System
(Source: Authors)

Supervision over safe traffic flow, as a safety corrector, in the future, should have the following tasks: organization and permanent implementation of supervision over safe traffic flow in the field of traffic, construction and electrical activities, and activities related to railway vehicles, with an aim of safe, order, regular and undisturbed railway traffic operations. Employees, with their experience, will continue to participate, in quality way, in drafting of regulations and in providing expert advices, comments and suggestions on all regulations that are being drafted.

The main tasks in the future work of emergency investigations should be the organization, permanent control and development of interrogation and investigation of emergencies, establishing their causes and circumstances, consequences and responsibilities in order to determine measures to eliminate the consequences, and development of analytical and statistical indicators to reduce the number of emergencies and the number of the consequences and thus increase the level of railway traffic safety. Raising the level of work quality in the field of emergency investigation, will contribute to a greater extent to increasing the level of traffic safety.

Future tasks will also relate to cooperation between all areas:

- Safety Management System and control over safe traffic flow: preparation of analyzes based on performed regular and extraordinary controls, preparation of analyzes in order to prepare for regular and extraordinary controls, and the main goal is risk identification and preventive action to railway traffic safety.
- Safety Management System and emergency investigation: analysis of the causes of emergencies, failures of technical subsystems and emergencies analysis by place and by time. The main objective is to develop and harmonize the emergencies investigation with the provisions of Directive 49/2004 / EC concerning railway safety.
- Supervision over safe traffic flow and investigation of emergency events: mutual coordination in performing regular and extraordinary controls of investigation of emergency events. The main goal is to reduce the number of emergencies based on the recognition of the relationship between the safety situation in the basic technological and business processes and the number of emergencies.

The development of the safety system will also depend on the development of the safety system in other companies of the railway system. Accordingly, the part of the task of improving the safety system relates to the development of cooperation with Montenegrin railway undertakings.

The safety system is expected to recognize risks in each scope of work, that may affect its efficiency in operation, and to eliminate or control them. Hence the need for constant monitoring of the functioning and improvement of the safety Management System. To this end, Risk Management Model has been set up, identifying the elements and factors that affect an efficiency of the safety system and identifying areas where processes and procedures can be improved, and thus contributes to the efficient functioning of the safety system.

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PRELIMINARY COMMUNICATIONS

Traffic Demand Management Tools in Small and Medium-Sized Cities

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Abstract: The function of the public urban and suburban passenger transport (PUPT) system as a transport activity is to provide transportation services in a certain urban area. By using new solutions in traffic demand management in small and medium-sized cities, which do not have an efficient PUPT system, in combination with paratransit systems, we can significantly increase the combined mobility of the population, reduce the use of passenger cars, reduce the need to build new roads, and take full advantage of the PUPT system. This paper presents the traffic demand management tools by which these effects can be achieved.

Keywords: Public urban passenger transport system, tools, management, transportation demands.

INTRODUCTION

Traffic demand management (DTM) tools are tools that focus on enabling local governments to use transportation demand management strategies and techniques in order to encourage individuals to change their behavior in small and medium-sized urban environments. The term 'traffic demand management' (TDM) describes a wide range of policies, programs, and services designed to reduce the demand for the use of passenger cars (vehicles) by influencing the behavior of individual passengers. Innovative TDM programs strive for reduced transportation and improved mobility at the same time. TDM examines the demand for transportation in order to determine how car use can be reduced, especially during peak hours. It seeks to improve options, such as walking, cycling, carpooling, and telecommunications.

TDM is developing strategies to fill empty car seats to increase capacity on roads (streets) without increasing the number of cars. It is also looking for ways to reduce the total number of drivers by redirecting travelling to other modes of transportation (e.g. cycling, etc.) so that traffic can flow more smoothly (1). An additional TDM strategy is to move travel times beyond peak periods (e.g. by allowing flexible working hours to employees) to make better use of existing road capacity. Local governments understand that TDM can avoid future road congestion, save money on road construction, increase social welfare, and reduce greenhouse gas emissions.

ADVANTAGES OF TRAFFIC DEMAND MANAGEMENT

Traffic demand management was originally designed to address the problem of congestion on city roads during peak hours. Many local governments want TDM to help them manage their transportation systems, ensure a balance between travel modes, and achieve the most cost-effective and strategic infrastructure improvements. Local governments can use TDM to support businesses in urban areas by developing optimal travel patterns and concentrating development around the city center. TDM can also offer residents more comfortable travelling by bike, walking, or hitchhiking. Perhaps the biggest impact of TDM is through the promotion of greater personal health and fitness. Residents may want to participate in active transportation programs as a way to integrate physical activity into their daily journeys. For many local governments, TDM is a way to resolve environmental issues by increasing sustainable transportation opportunities (2).

Reports on energy and emissions in the community include an estimate of energy consumption and greenhouse gas emissions that have a high level of greenhouse effect in transport, buildings, solid waste, and land use change. By dealing with problems before they become insurmountable, TDM also serves as a prevention. In the long run, it promotes the development of denser, more compact, and sustainable communities with less land space intended for car travel and parking.

TDM OPPORTUNITIES

TDM provides a range of options applicable to small and medium-sized cities, such as: active transportation, public health and smart growth, more walking, support of multimodal transportation, more cycling, carpooling, public transport services, and parking management. The term 'active transportation' refers to any human-powered form physical activity, such as walking, cycling, running, rollerblading, and skateboarding. The health and well-being aspects of active transportation are clear and can be used to attract new walkers and cyclists. Walking and cycling are the most common modes of active transportation, and skateboarding is the choice of an increasing number of people, especially young people (5). Basically, these modes include sharing the right to travel with other users, whether on the sidewalk, road, bike lanes, or pedestrian lanes. Municipalities can design communities, especially roads, in order to increase the safety of those using active transportation. For example, marked bike lanes can be added to roads. Increased walking means addressing the following issues:

- Is there a network of sidewalks, paths, and lanes in the community?
- Are there sidewalk ramps, especially in the city center, for people using wheelchairs or other mobility aids?
- Are there signposts showing walking time to different community destinations?
- Are paths and lanes mixed for cyclists, walkers, joggers, etc.?
- Are there sidewalks along the main roads to the city?
- Are financial resources for pedestrian facilities identified and secured?

Multimodal transportation describes several modes of transportation used in a single journey. For example, walking is usually part of travelling by public urban passenger transport (PUPT), as public transport users have to walk to the bus station (in small and medium-sized cities, there is mostly only bus transport) and then again from the bus station to their final destination. Residents can take a bus to work and walk home, or if the buses are equipped with bicycle stands, they can cycle home.

Increasing bicycle traffic includes addressing the following issues (3):

- Are there specific bike paths or bike lanes in the community?
- Are bike paths or trails clearly marked?
- Do bike paths have street lighting? Are there benches where cyclists can rest?
- Are there mixed-use off-road trails that allow bicycles?
- Is there a map that clearly indicates bike paths, routes, and facilities?
- Are there bicycle stands in the city center or elsewhere?
- Are there other facilities to complete the cyclist's journey, such as showers or safe areas to lock the bike?
- Are buses equipped with bicycle racks?
- Is the community seeking funding for bicycle facilities?
- Is there a bicycle master plan that promotes cycling?
- Is there a local cycling advocacy group?
- Is cycling supported and promoted in district schools? Are cycling safety classes available in the community?

Car sharing and van sharing are two forms of sharing a journey. When sharing a car, a private vehicle is used, while when sharing a van, a vehicle rented specifically for that purpose is usually used. Ridesharing programs may be of particular interest to scattered rural communities where population density is too low for public transportation and the distance is too great for active modes of transportation.

The conventional public urban passenger transport (PUPT) system serves the general population and uses fixed-line buses. Most buses are wheelchair accessible and door ramps are lowered, and PUPT offers in rural and suburban areas flexible lines and schedules for passengers in minibuses, taxis, and vans. Many paratransit services as subsystems of PUPT (which are quite common in small and medium-sized cities) offer excursions outside their immediate community one or more days a week. The customized PUPT serves those who cannot use conventional PUPT due to disability and involves the arrival of vans and minibuses by phone call, a practical door-to-door service. The service is also offered through contracted programs for additional payment of taxis and taxi savers (discount coupons). If the community does not have a PUPT, it may explore carpooling or vanpooling and consider accessing paratransit services of a nearby community for inter-community travel (7).

Parking management is a TDM strategy that local governments can use to increase the demand for different modes of transportation and reduce the use of land intended for parking. Parking management refers to policies and programs that result in more efficient use of parking resources. Local governments are now able to raise money from parking because parking is prohibited on the street, even if there is no available parking space nearby. The money can instead be channeled into a sustainable transport infrastructure fund and used to fund future projects. Marking street parking spaces for smart cars, bicycles, and outdoor vehicles is one way to visibly support different modes of transportation. Determining the best parking spaces at a field station for bicycles and parking has a similar effect. People walking or driving

by will notice these marked areas. Another parking management technique is to determine the price of a parking space in the city center higher than the price of a monthly bus ticket (4).

TDM TOOLS

TDM tools include:

A. Plans and rules

They include official community plans, regional growth strategies, transportation plans, local plans, and bylaws affecting land use and transportation. Such plans and policies can support TDM policies to improve infrastructure and social marketing programs, as well as set goals for changing behavior in transportation (6).

B. Smart growth planning

Smart growth planning aims to promote lush, more compact development with a combination of land use, enabling residents to access services within the walking space. It seeks to reduce the number of vehicle journeys needed for community residents to meet their daily lives and access the goods and services they need. Having more people living closer to these goods and services is essential for the sustainable development of transport. As such, smart growth planning is an important tool for developing an effective TDM strategy.

C. Transportation plans

They set future targets for modes of transportation and seek to increase the market share of other modes of transportation. The plans differ only in the way of how aggressively they promote change and prioritize different modes of transportation.

D. Local plans

Local plans can address specific transport-related locations, barriers, desired infrastructure change, priorities, and weather. Such plans usually advocate connecting and extending of sidewalks, paths and bicycle paths, improving of other pedestrian facilities (wider sidewalks, benches, sidewalk ramps), and dealing with specific parking problems (parking only for residents, stop zones, bus stations, signaling).

NEW TDM OPPORTUNITIES

The TDM tool contains significant successful TDM initiatives and encourages local governments to follow concrete initiatives that can increase the sustainability of their community. The following areas in which local governments could be leaders in new TDM initiatives - especially for their adaptation to small and medium-sized cities are:

A. Program Areas

There are direct benefits if people try alternative modes of transportation during big events. For example, local governments may partner with ticket providers for special events (exhibitions, fairs, etc.) in order to charge a ticket fee, thus allowing people to use their ticket as a PUPT ticket (for an event located in an area for which there is already a PUPT line). Through an additional fee, local governments reimburse revenues in the PUPT system on these special tickets.

B. Community Buses

Community bus transportation allows a large, defined group of people to purchase highly discounted annual season tickets. The next target "community" for special access to the PUPT system could be all high school students in a given municipality. Students would benefit from a community bus ticket by gaining access to the PUPT both after school and at weekends.

C. Specialized Pupt Programs

Many specialized PUPT programs exist in larger communities; they are often underused or do not even exist in small or medium-sized communities.

- **Time tickets:** Many systems accept this "open transfer" policy, which allows users of the PUPT system to use the ticket within 90 minutes of the original boarding time.
- **Bicycle and bus:** Buses equipped with a bicycle carrier can transport twice as many bicycles. This program has proven to be very popular in a number of cities around the world and supports bimodal transportation.

A. Services for Youth and Families

- **Family travel:** Local governments can introduce a family ticket in the PUPT, which allows parents to use buses at the same time with their children (even at weekends).
- **Summer tickets in PUPT:** Local governments can introduce bus season tickets intended for young people for the summer period at attractive prices, even two months for the price of one.

A. Services for the Elderly and Persons With Disabilities

- **Travel training assistance especially for the elderly:** who may need door-to-door service (a small bus that can be ordered ahead of time to pick up and drop off passengers at certain locations).
- **Taxi service program:** a program that allows users to purchase an affordable subsidized taxi ticket in order to compensate for their travel options. This program is especially useful for the elderly and in those hours or days when there is no PUPT service (night hours).

A. Parking Subsidization Programs

Residents who shop in the city's business centers can get reduced parking prices with the purchase of goods or services. This subsidy does not support sustainable use of PUPT.

B. Personalized Transportation Planning

Personalized transportation planning can provide individualized advice in person, over the phone, or online to help residents develop travel plans that reduce car use.

C. Ride Home Programs

Guaranteed ride home programs offer a cheap solution for individuals who want to leave their vehicles at home. These programs offer a free ride home, usually by taxi, in emergencies for employees who regularly use sustainable means of transportation to work.

D. Telecommunications

Telecommunications includes programs that allow employees to reduce the number of their weekly trips by working from home one day a week or more. Providing high-speed Internet service to communities is perhaps the most practical way to allow some people to work from home. This allows them to reduce the number of trips to work.

CONCLUSION

TDM aims to solve the problem of city congestion. Achieving these goals requires individuals to change the way they travel, meaning that people should drive less frequently. This is where traffic demand management comes into play. It is important to fill the free car seats in order to increase the capacity on the road without increasing the number of cars. TDM is exploring ways to reduce the total number of drivers by redirecting travelling to other modes of transportation, such as walking, cycling, public urban transportation, or carpooling, so that traffic can flow better. Efficient public transportation can be achieved only if the main requirements of passengers in transport are met. This means that the passenger needs to be offered reliable transportation, with a satisfactory frequency, and with comfort at an enviable level of quality.

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PRELIMINARY COMMUNICATIONS

Training of Drivers for Safe Transport of Dangerous Goods

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Abstract: The safety of transporting dangerous goods is conditioned by a number of factors, many of which are significantly influenced by drivers. Drivers, as the central component of human resources, are expected to react appropriately at all times during the performance of their professional activity, in order to prevent the occurrence of a traffic accident or reduce its consequences, thus contributing to the safe transport of dangerous goods. He is expected to assess the situation and make a valid decision in accordance with the set tasks. Due to irregularities and omissions in the work when making an independent decision on how to act in certain moments, the driver directly influenced the occurrence of a large number of accidents. In order to minimize the driver's failures in the transport process, appropriate attention must be paid to their training.

Keywords: dangerous cargo, safe transport, training of drivers.

INTRODUCTION

Modern technological development has led to an increased of dangerous goods in the transport system. For the safe conduct of the transport process, it is necessary that all participants are professionally trained in accordance with their obligations and tasks. Training must be understood and realized as a unique process of acquiring knowledge, skills, habits and developing psychophysical and intellectual abilities necessary for efficient and safe performance of functional duties of individuals in the entire transport process.

In order to provide the appropriate level of knowledge of drivers for safe transport of dangerous goods, the scope and content of the training program is defined, starting from the initial basic training course to specialist training courses defined depending on the mode of transport or type of dangerous goods. The constant need to increase the level of safety during the transport of dangerous goods and to adapt to changes in transport require that these drivers complete periodic refresher courses. In order to achieve the minimum level of knowledge of drivers required for the safe transport of dangerous goods, unique common rules have been defined for several countries that have made agreements on this. Many countries have additionally regulated by national regulations the conditions for the transport or handling of dangerous goods, which is accompanied by additional training programs depending on the needs and policies of each country.

SAFETY OF DANGEROUS GOODS TRANSPORT

Transport and handling of dangerous goods differs significantly from procedures with other types of cargo. The terms "dangerous substance" or "dangerous goods" are often found in the literature. A distinction needs to be made so as not to create the confusion and misunderstandings that have already taken place. In particular, the term "dangerous substance" may be confusing if it is not known whether it is a dangerous substance in use as a "chemical" or a dangerous substance in transport, when it is a dangerous cargo or dangerous goods. The identification of the terms "cargo" and "goods" is wrong.

"Dangerous goods" is a product of industry, agriculture, crafts or other activities when it is intended for sale or is already on the market. The basic characteristic of a product that makes it a commodity is the intention of the manufacturer to sell it on the market, and not to satisfy his own needs with it [1].

Cargo is a thing that is manipulated in the traffic-transport sense [2].

Non-goods cargo can also appear in transport, and according to the established criteria for classification by modes of transport, made on the basis of UN transport recommendations, it is a danger, so for these reasons the term "cargo" is more appropriate, in this case "dangerous cargo".

Transport of dangerous goods is a process with increased risk that carries with it a number of potential dangers to people, property and the environment. The dangers are especially in the case of a traffic accident or an extraordinary event during transport. Transport relies on a number of complex and interdependent technical, technological and organizational components that can affect the safety of the process.

The existence of a high risk, ie consequences that may occur in the event of an accident with dangerous goods requires from all participants in the transport process maximum responsibility, knowledge and implementation of established rules for all participants, as well as compliance with all rules for specific transport, which are listed in ADR..

Accidents with hazardous substances during transport, handling or during the production process or storage are always possible. Accidents in India, Bhopal, 1984, are often cited as an example of the scale of the effects of a chemical on the environment. where more than 2,800 were killed and more than 50,000 were injured[3]. In the transport of dangerous goods, the consequences are usually not of that magnitude, but they are by no means negligible. An example is the accident in Spain in 1978 in Los Alfaques, where a tanker with 43 m3 of liquid propylene exploded [4]. 217 people were killed and an area of nearly 400 m in diameter was completely destroyed, indicating that the consequences could be incalculable. The latest example is the explosion in the port of Beirut of more than 2,700 tons of stored ammonium nitrate, on 04.08.2020, which has a wide used in agriculture, confirms the seriousness of the consequences that can occur depending on the characteristics of the cargo. The blast killed more than 200 people, injured more than 6,000 and left more than 300,000 homeless, according to newspaper reports.

According to the Organization for Economic Cooperation and Development (OECD), depending on the severity of the consequences, accidents are divided into technological disasters, major accidents, significant accidents [3].

This classification is based on the number of dead, the number of injured, the number of evacuees, the amount of material damage (outside of the plant).

An example for estimating the severity of the consequences of an accident based on the number of dead is:

- technological disasters - accidents with 25 or more dead;
- major accidents - accidents with 5 or more dead;
- significant accidents - accidents with 3 or more dead.

Cases of explosions of tanks on loading or unloading, spills of liquid on loading or unloading, overturning of vehicles and spills of liquids occur. Recurrence of accidents with the same consequences indicates that, among other things, no detailed analysis of these accidents is performed, omissions and responsibilities are not determined and appropriate preventive and punitive measures are not taken. Every accident during the transport of dangerous goods requires a detailed analysis of the causes, occurrence and possible consequences. Each case can serve as an example in reviewing omissions and defining the procedure for such cases. Only in this way can a long-term reduction in the number of accidents as well as the consequences of such an event during the transport of dangerous goods (cargo) be ensured.

ROLE AND TASKS OF DRIVER IN THE DANGEROUS GOODS TRANSPORTATION PROCESS

Based on the obligations he has in the process of transporting dangerous goods, from the sender to the recipient, the role of the driver is especially important. He is often required to make important decisions quickly and independently, which are related to taking appropriate actions according to traffic conditions as well as in cases of endangering transport safety. In that way, it directly affects the possibility of an accident and the magnitude of the consequences, ie the safety of transporting dangerous goods.

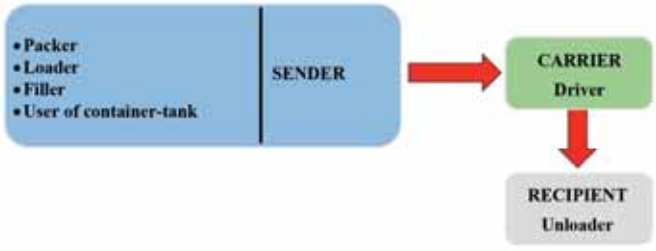
The potential danger posed by the transport of dangerous goods and the possible impact on the territory of several countries have contributed to the creation of unique, common rules according to which this process will be performed. In 1957, the European Agreement concerning the International Carriage of Dangerous Goods by Road - ADR [6] was concluded, which entered into force in 1968 when the agreement was ratified by five states. According to ADR 2019, the contracting parties to the agreement are 51 states.

Numerous subjects or persons participate in the process of transporting dangerous goods. They can be divided into main and other participants, Chapter 1.4 ADR. Their roles and obligations are conditioned and connected. The beginning of the transport is with the sender and therefore the biggest responsibility. When the driver picks up the load, he must check that the conditions are met and only then can he perform the transport. In order to make the right decision, it is necessary for him to be qualified for that. The transport ends at the consignee of the cargo, where the unloader appears as a participant in the transport, who sees the fulfillment of the conditions for transport that were the obligation of all previous participants. In that case, the knowledge gained could be used to establish a safer transport system.

According to the tasks they perform in the transport process, the main participants are:

- - sender;
- - carrier (driver) and
- - recipient.
- Other participants in the transport process are:
- - packer;
- - loader;
- - filler;
- - unloader and
- - user of container-tank / portable tank.

Transport takes place in three phases: preparation of dangerous goods for transport at the sender, transport of dangerous goods and unloading of dangerous goods at the recipient or reception. The packer, loader, ie filler and user of the tank / portable tank participate in the preparation of the dangerous cargo for transport at the sender, at the carrier it is the driver, and at the consignee it is the unloader, Figure 1).



Picture 1. Participants in the transport process

By acting within the framework of its obligations and responsibilities, the sender can have the greatest impact on creating an environment for safe transport. Several persons participate in the shipment of cargo at the sender, who influence the course of the process, picture no. 1. In addition, the sender shall be responsible for the delivery of dangerous goods and shall verify that the conditions of the carrier are met.

The role of other participants in the transport process is also important, but with less complexity and conditioning by the environment.

Safe transport of dangerous goods, in order to reduce the risk of an emergency, imposes a large number of restrictions on all participants in the transport process, ie established rules and conditional procedures. The carrier must adapt to the conditions imposed by such transport, in order to protect and preserve human lives and the environment.

Drivers who drive vehicles during the transport of dangerous goods are a central component of human resources. They are independent, often without the possibility of assistance at a given time and as such represent the most important resource for the success of the transport process. Drivers, as well as other persons who may be in the zone of potential impact of dangerous cargo during its transport, are exposed to possible occurrences of undesirable consequences, which are mainly directly affected by the driver. The importance of the role of the driver can be seen from his obligations, subsection 1.4.2.2 ADR.

Based on the transport and accompanying documentation, visual inspection of the vehicle or container, and where appropriate the cargo, the driver must ensure that:

a) Cargo classified in accordance with ADR and that its transport is permitted;

b) Has the appropriate documentation and information made available to him by the sender;

c) Vehicle and cargo without visible defects, no leaks or cracks, no missing parts of vehicle equipment, etc .;

d) The date of the next test of tank-vehicles, battery-vehicles, demountable tanks, portable tanks, tank-containers, and MEGC has not expired;

e) That the vehicles are not overloaded;

f) That the markings and markings on the packaging and the vehicle comply with the requirements of Chapter 5.3 of the ADR;

g) To ensure that the equipment prescribed in the written instructions, section 5.4.3 ADR, for the transport unit, vehicle crew and certain classes, is in the vehicle

Based on the stated obligations of the driver, the complexity and responsibility of the work he performs is considered. If the driver finds that the ADR requirement has not been met, he will not start transport until the defect has been rectified. Facilitation is the ability for the driver to rely on information and data available to him from other participants, such as the sender in relation to the allegations under (a), (b) and (e).

A carrier is a company, other legal entity, entrepreneur or natural person, who, in accordance with the national legislation of the state in which its registered office or residence is located, is authorized to perform cargo transportation [2].

In accordance with the established requirements for driver jobs, the carrier as an organization must provide drivers who are competent for their work on the basis of education, training and qualifications. Checking and selecting a driver for the jobs he performs also requires checking his qualifications. In order for this to be done successfully, it is necessary to perform:

- competence checks before employment and during working life;
- training for acquiring and maintaining the necessary competencies;
- assessment of competencies;
- monitoring and periodic evaluation of the system for evaluation of driver competencies.

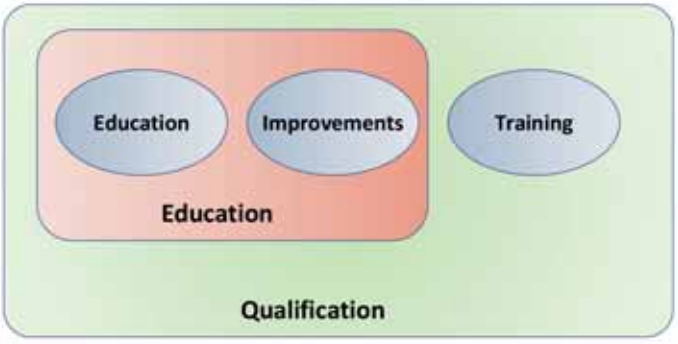
Records of measures taken and activities must be kept and the results obtained during the verification compared.

TRAINING AS A FACTOR OF DRIVER TRAINING FOR DANGEROUS GOODS TRANSPORTATION

The SRPS ISO 9001 standard pays significant attention to human resources, focusing on employees whose work affects the fulfillment of some of the requirements of the quality management system. As far as drivers are concerned, they are required to have education, training, knowledge and experience in the transport of dangerous goods, ie. to be trained for the work they perform.

The interrelationship of theory and practice in each individual case determines the content and character of the personification.

Training drivers for the *transport of dangerous goods* is a complex process composed of training, education and training, Picture 2, where education and training as educational processes are realized in educational institutions [7].



Picture 2. Training structure

The essence of the problem is in the optimal, not equal participation of education and training in training. When this relationship is broken, then improvements is equated only with training, or only with education. The conditionality of training with education, that is, that broader education enables training to be achieved through more intensive and shorter training, does not justify minimizing any component of training. The formal result of the training is a qualification, ie a "certificate" as an institute of social recognition of the right to perform certain tasks. The certificate is obtained in the process of verification and recognition of qualifications for a certain activity.

Training can be defined as the establishment of a system of behavior that consists of attitudes, knowledge and skills, which are required of participants in order to act adequately in order to achieve a particular task. The training has specific goals and strives to minimize individual differences.

Education of drivers for the transport of dangerous goods is an organized activity by which individuals are trained to perform dedicated tasks in the handling of dangerous goods. It is a unique process of acquiring knowledge, skills and habits and developing psychophysical and intellectual abilities and other qualities that are necessary for efficient performance of functional duties of dangerous cargo drivers.

Successfully completed training for the result should have persons trained for the activity - jobs for which they were trained.

The quality of training can be said to be conditioned by a number of factors, such as:

- expected goal of the training (level of achieved abilities),
- qualitative preconditions of training (ability of persons in training to adopt habits and gather information, motivation of persons and training providers and training methods),
- environment-ambience of training (place and time of implementation, scope of content, price of training, etc.),
- the content of the training (durability of the acquired knowledge and the way of checking the achieved level of training),
- adequacy of the applied method of work in the training system,
- material support of training (literature, aids and other teaching aids) i
- evaluation of the achieved results by the contractor

In the training process, different training methods are applied, which depend on the ability of the training provider to solve its tasks. Using the training methods, the persons in training acquire the necessary knowledge in mastering the skills and habits necessary for performing the tasks of transporting dangerous goods.

The need for continuous training arose as a consequence of the amount of new knowledge that is increasing every day, while existing knowledge is becoming obsolete faster.

The development of a dangerous goods transport system largely depends on the ability of all participants to achieve the projected training objectives, which are determined by the needs in the transport of dangerous goods. At the same time, it is very important to connect general education with the essential study of new contents and forms that arise from newly introduced technologies.

Becoming an essential feature of the profession, training drivers to transport dangerous goods has become a task of modern education and upbringing of adults. The importance of this task grows proportionally with the speed of changes that occur in the transport process of dangerous goods.

The need for continuous training of employees in jobs in the transport of dangerous goods, and especially drivers, has become a development area of work of many institutions specializing in the training of adults through various types of training.

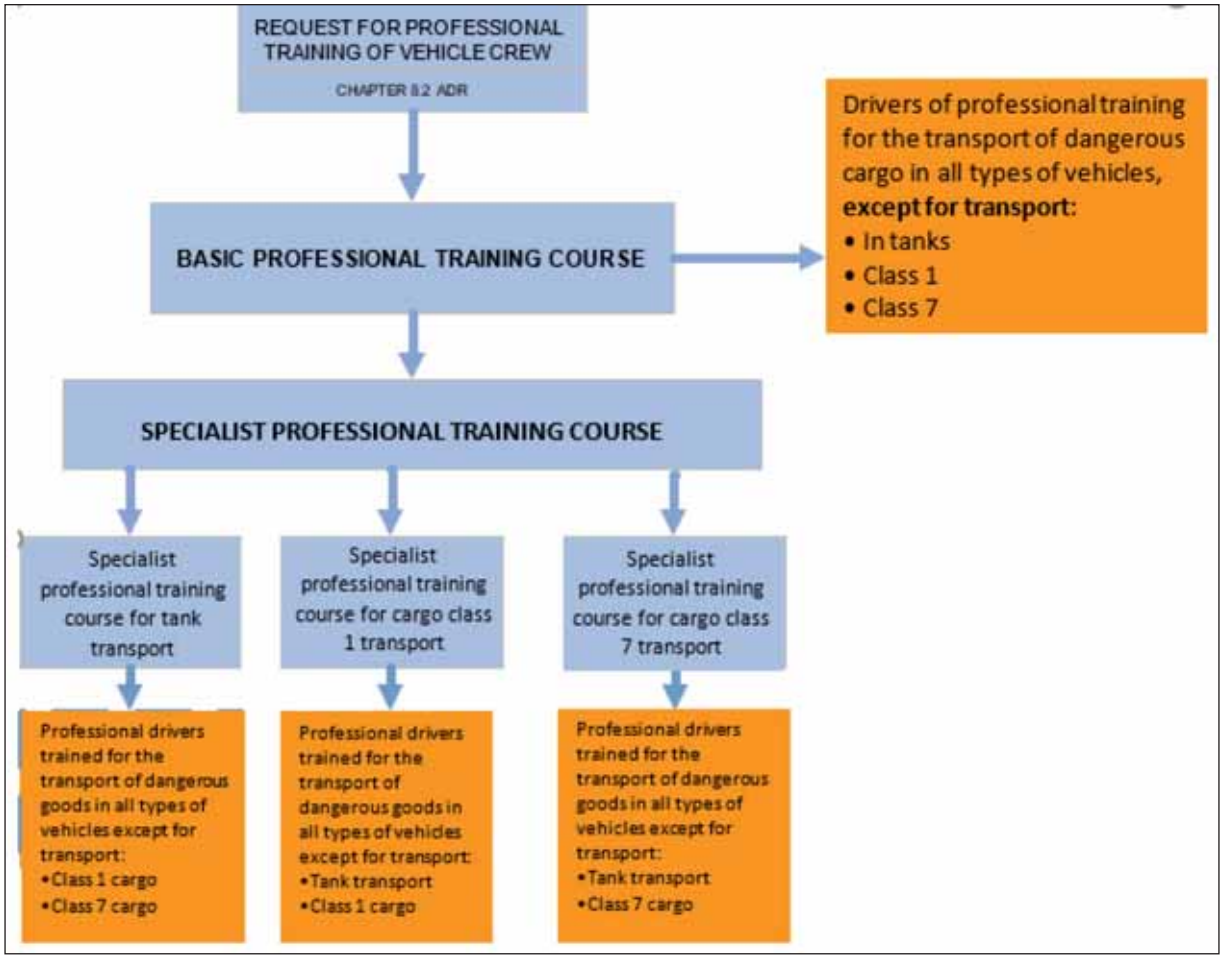
TRAINING OF DRIVERS FOR TRANSPORT OF DANGEROUS GOODS IN ACCORDANCE WITH ADR/

It is possible to provide an appropriate level of knowledge to all drivers who transport dangerous goods on the territory of countries that have accepted the provisions of the ADR, by adopting a unique program and content that is implemented in a certain period of time. Depending on the mode of transport and the type of cargo, different courses for drivers are defined, Chapter 8.2 of the ADR, Figure 3. All drivers must complete an initial basic vocational training course. After passing the exam and obtaining the certificate, they are able to transport dangerous goods in appropriate packaging, except for the transport of explosives and objects with explosive substances (class 1 ADR) and the transport of radioactive materials (class 7 ADR) for the transport of which it is necessary to have a certificate exam belonging to the specialist. For transport in tanks, it is also necessary to attend and pass a specialist course for tanks. Taking the exam according to the program of the specialist course is possible after passing the exam according to the program of the basic course.

The validity of the certificate is five years. Due to the need to know the changes in ADR or national regulations as well as the need to update the acquired knowledge, the same courses can be attended as courses for knowledge renewal and take the exam in the last year of validity of the certificate. The new certificate is valid from the date of expiration of the previous certificate.

In addition to the unique type of courses that drivers for the transport of dangerous goods attend, a training program and a fund of classes for each of the courses have been determined, Picture 4. Drivers who attend the initial basic training course attend classes for 18 teaching section. The specialist course for transport in tanks lasts 12 teaching section and the specialist courses for the transport of dangerous goods of class 1 and class 7 are eight lessons each. A maximum of eight teaching section per day is allowed.

Individual practical exercises covering the topics of first aid, extinguishing a fire and measures to be taken in



Picture 3: Types of training courses for drivers transporting dangerous goods in accordance with ADR

the event of an emergency or accident must be held as part of theoretical professional training.

Drivers who attend refresher courses have the opportunity to attend a reduced number of teaching section in classes.

The training program according to the type of course includes defined teaching topics for the basic course, subsection 8.2.2.3.2 ADR, for tank transport, specialist course subsection 8.2.2.3.3, for transport of explosives and objects, class 1 ADR specialist course, subsection 8.2.2.3.4 and for the transport of radioactive materials, class 7 ADR, specialist course, subsection 8.2.2.3.5 ADR, Picture 4.

The program of the initial basic course must contain, in the narrowest scope, the following teaching topics:

- General requirements governing the transport of dangerous goods;
- Main types of hazards;
- Information on environmental protection, control of waste transport;
- Appropriate preventive and safety measures for various types of hazards;
- Post-accident procedures (first aid, road safety, basic knowledge of the use of protective equipment, etc.);
- Marking and marking of packaging and vehicles;
- Driver's actions during transport, permitted and impermissible actions;
- Purpose and manner of operation of technical equipment on vehicles;
- Prohibition of joint loading in the same vehicle or container;
- Precautions to be taken during loading or unloading of dangerous goods;
- General information on civil obligations;
- Information on multimodal transport operations;
- Handling and stacking pieces i
- Traffic restrictions in tunnels and instructions on behavior in the tunnel (prevention and safety, procedure in case of fire or other hazards, etc.).
- Awareness of the importance of security

For a simpler visual presentation of teaching topics from the training program, the graph shows six teaching areas, Picture 4:

1. General rules regarding the transport of dangerous goods;
2. Documents;
3. Vehicles, devices, equipment, marking;
4. Obligation of the driver;
5. Cargo and classification and
6. Packaging and labeling.

The training program for tank transport includes the following teaching topics, Figure 4:

1. Behavior of vehicles on the road, including movement of cargo;
2. Special requirements relating to vehicles;
3. General theoretical knowledge of different charging and discharging systems;
4. Special additional provisions applicable when using these vehicles (documents, markings, markings, etc.).

Training program for the transport of Explosives substances and substances with explosive substances, class 1 ADR, includes the following teaching topics, Figure 4:

1. 1. Special types of hazards related to explosive and pyrotechnic substances and objects;
2. 2. Special requirements for mixed cargo composed of substances and articles of Class 1.

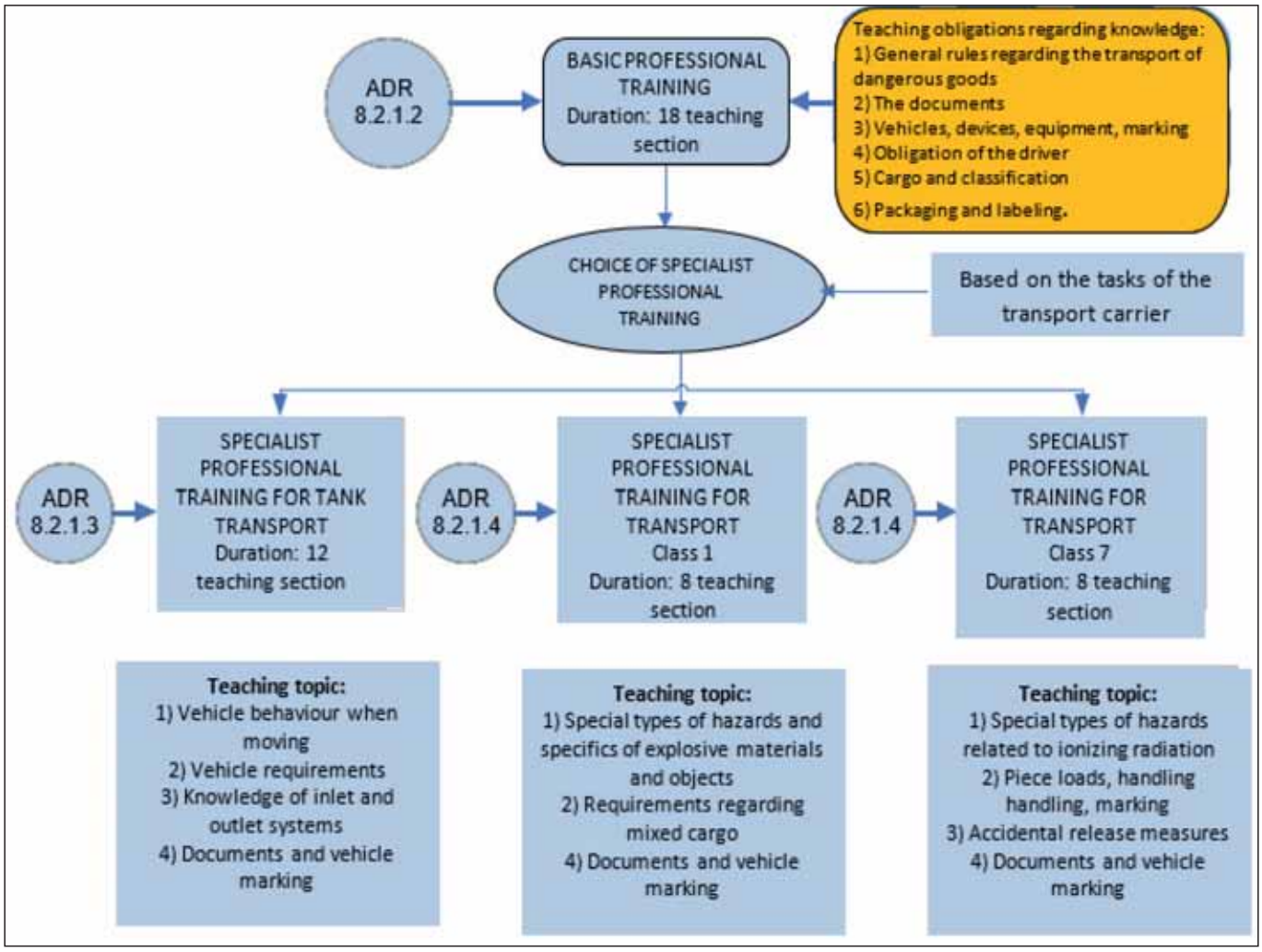
The training program for the transport of Radioactive Materials, class 7 ADR, includes the following teaching topics, Picture 4:

1. Special types of hazards related to ionizing radiation;
2. Special requirements for the commands, handling, joint loading and stacking of radioactive materials;
3. Special measures to be taken in case of accidents during transport of radioactive materials.

By defining teaching topics and classes for each of the courses, they provide conditions for the uniqueness of training in all ADR signatory countries. All certificates of professional competence which comply with the requirements of ADR and which are issued in the form defined in ADR, by the competent authority of a contracting party or another organization recognized by those authorities, must be accepted (recognized) by the competent authorities of other contracting parties, during the entire period of validity of the certificate, subsection 8.1.2.6 ADR.

Considering the above-mentioned facts about the importance of training, defined teaching topics and the duration of training, it is an extremely dangerous phenomenon that, in accordance with that, pre-established rules are not respected in all ADR signatory states. The collapse of the training system cannot pass without consequences. In the first place, there is a threat to transport safety, as well as various administrative measures that will be taken by the institutions of countries that seek to preserve the required training system or level of training of participants in the transport of dangerous goods to protect their territory and population.

In addition to the driver, there may be a co-driver and a companion in the vehicle for transporting dangerous goods. The co-driver, as a member of the vehicle



Picture 4: Vocational training program and number of teaching section for drivers transporting dangerous cargo in accordance with ADR

crew, has the same obligations and conditions as the driver. An escort is a person who for certain reasons (safety, professional competencies, loading, unloading, etc.) accompanies the cargo and is listed as a crew member. He has the appropriate training in accordance with the jobs he performs in transport. All members of the vehicle crew must have personal protective equipment, must be trained in the use of fire extinguishers and must have completed appropriate training.

CONCLUSION

The safe transport of dangerous cargos, among other influencing factors, depends to a large extent on the driver, who is a central component of the overall human resource. Drivers are expected to act correctly at all times during the transport process and thus make a full contribution to preventing the accident or reducing its consequences. All this implies their ability to act correctly, starting from the assessment of the situation to the appropriate situational response.

It is rightly expected that the carrier, ie the organization, will establish the practice of providing competent drivers for safe transport of dangerous goods who acquire their competencies in the system of education and training. In the formation of driving resources, a special place must be given to checking their qualifications, both starting with checking competence before employment, and during the working life, when trying to raise the level of qualification for the jobs they perform through various types of training. This is especially important because the tasks of drivers become more complex and demanding from year to year.

The unique driver training program and content, through various courses appropriate to the modes of transport and types of cargo, provided by the ADR is a reliable and proven framework for providing an appropriate level of knowledge to all drivers transporting dangerous goods in countries that have accepted the provisions of this international agreement. The pursuit of profit by carriers or institutions engaged in various types of training must not call into question the justifica-

tion of the established system of driver training as one of the most important participants in the transport of dangerous goods.

In addition to training drivers, very important preconditions for safe transport of dangerous goods are the adoption of appropriate regulations and their implementation, professional training of all other participants in the transport process for jobs within their tasks and mandatory training of institutions and services tasked with supervision and control of transport this type of cargos.

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PROFESSIONAL PAPER

Models of Management of Railway Infrastructure of Montenegro

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Abstract: In time of rapid economic and technological change and turmoil, no one can manage business successfully, just because they think they are 'smart'. In order to successfully manage organizations in the era of dramatic change, in this case ŽICG (Railway infrastructure of Montenegro), it is no longer sufficient to master the classical management process, but also to master the overall quality of management process.

In order to achieve the best possible business results in the Railway Infrastructure of Montenegro, the theoretical and practical knowledge on which the management process is based, starting from planning (goal setting, determining ways to achieve goals, allocating required resources), organizing (a division of labor, delegation of authority, coordination), leadership (supervision, motivation, remuneration and punishment, training), conflict resolution) and lastely control (choice of control parameters, monitoring of results, comparison of planned and realized, taking corrective actions).

In order to improve the current situation, the models of management of railway infrastructure are considered, for which as a manager builds and invests in railway infrastructure, takes care of its modernization, current maintenance, provides access and allocates infrastructure capacities and organizes and regulates railway traffic. In the processing of the management model, the work relies on the Strategy for the Development of Transport of Montenegro in the period 2019-2035, which establishes the situation in the areas of transport, defines the infrastructure, organizational and operational goals of the development of the transport system, which are realized through time and long-term implementation plans.

Key words: organisation, management, models, railway, infrastructure, control, effects, results.

INTRODUCTION

``Work hard,
because who does not progress every day,
it goes back every day".
Konfucius

As a system, the railway has its own entrance, internal traffic-transport process, traffic-transport activities, exit, external influences, and return, or regulatory links. The central input component to the rail system is, among other things, diverse resources.

Resources, as input components, are transformed into output elements of the rail system, that is, to the transport service, which is essentially a product of the rail process. In order to use rail resources efficiently and effectively, it is necessary to manage them, that is, to establish processes by which resources are provided, used, monitored, evaluated, maintained and protected.

Railway infrastructure is one of the key material resources of the railway. In order to use material resources in a way that achieves the efficient and effective realization of the transport service, it is necessary to establish appropriate procedures, rules, instructions, etc. for this purpose.

In order to improve the railway business, it is necessary to work on the development of such models of railway infrastructure management that will best ensure that the railway successfully builds and invests in the railway infrastructure, thus contributing to its modernization, reliable current maintenance. In addition, the railways must effectively ensure access to and allocate infrastructure capacity, organize and regulate rail traffic.

CHARACTERISTICS AND CONDITIONS OF RAILWAY INFRASTRUCTURE OF MONTENEGRO

There are different conceptions of resources that adapt to specific situations. In the most general sense, a resource

is defined as an aid, a source of help; the source (economy) from which the raw materials are supplied; a place for leisure; narrower society.

Railway infrastructure as material resource includes: railways and railroad facilities; electricity and stable electric traction plants with associated facilities; signalling/interlocking installations with associated facilities; telecommunications and IT facilities with associated facilities; land in the railroad and protective zone, buildings, depots and other objects that are in the function of traffic.

The overriding task of railway infrastructure is its use to achieve the objective of the railway system, which can be defined as the achievement of an efficient and effective realization of the transport service.

Railway Infrastructure of Montenegro JSC.-Podgorica (RIoM)/ Željeznička infrastruktura Crne Gore AD-Podgorica (ŽICG)/ is a joint stock company founded on July 7th, 2008 in accordance with the strategy of restructuring of the Montenegrin Railways.

As infrastructure managers, as well as public goods in the general use and ownership of the state of Montenegro, the Railway Infrastructure of Montenegro has built and researched the railway infrastructure, saline solution for its modernization as well as for the current maintenance. Also, secured access and additional infrastructure capacity of all interested railway undertakings that meet the legal requirements, determine the quantities for the use of infrastructure capacity, create and publish red traffic, organize and regulate railway traffic.

The total length of the railway lines (Figure 1) in Montenegro under the jurisdiction of RIoM is 250 kilometers, that is, 327.6 km with station tracks, 224 km of which are electrified, 168 km of the open line Vrbnica - Bar, Podgorica - Bajze, border with Albania 26 km and Podgorica - Niksic 56 km. There are 106 tunnels, 107 bridges, 13 galleries and 371 culverts, or 37% of the railway, which are complicated infrastructure projects. It comprises the highest railway viaduct in Europe (the bridge over Mala Rijeka) and the Sozina Tunnel, 6.2 km long. The permitted axle load is 22.5 tonnes. The rail network density in Montenegro is 18.4 m of rail / km2, or 0.40 / 1000 inhabitants. This railway line, previously referred to as maintenance, makes it the most complicated and expensive railway in Europe. [10]

The total reconstruction of the Vrbnica - Bar railway line is 50% of the total length. Of the total of 16 sections, to date (March 10, 2020), eight have been reconstructed, that is, the repair of the railway has been completed. These are seven sections, from the border with the Republic of Serbia to Trebjesica - Kolasin municipality and one section to the south, Sutomore - Virpazar. The map shown in green shows the overhauled sections.

Montenegrin railway stations do not have an adequate length of bypasses to provide conditions for freight trains of 740 m length (as required by Regulation 1315/2013 for valid ERTMS operations). Compatibility of standards for the fulfillment of obligations on the network of lines on the TEN-T network has been implemented continuously since 2018, as started with the publication of the TSIs, which are determined by the Law on the safety, organization and efficiency of railway transport ("Official Gazette" MNE, No.01 / 14). TSIs for Infrastructure and CCS for Control Command Systems in 2019 have been published. In the meantime, TSIs related to energy and tunnels will be published, and in the next 5-7 years all other TSIs, which implementation will be feasible on the railway lines of Montenegro, will be published.

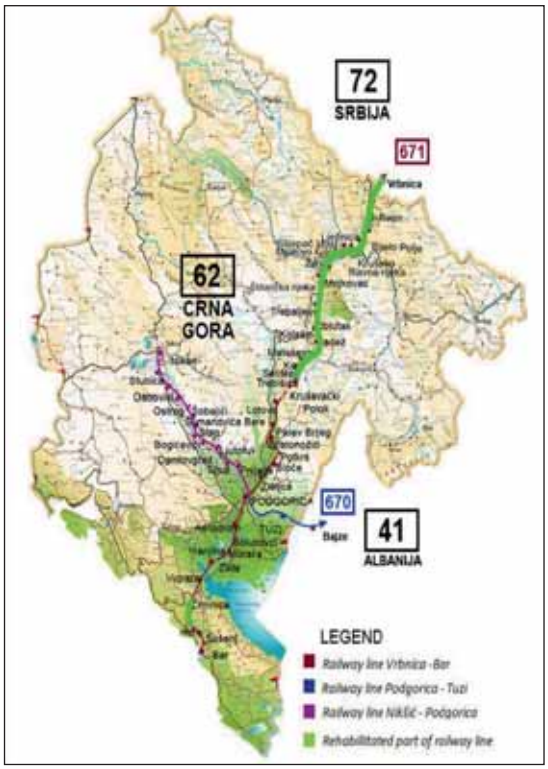

Figure 1. MNE Railway network [10]

Railway infrastructure of Montenegro is one of the first companies in Montenegro that adopted Corporate Governance Code of Montenegro Stock Exchange and its implementation. RIoM is a member of CER (Union of European Railway Companies and Infrastructure Managers) and a member of UIC (Union of Railway Companies). [9]

Given that the railway is a rigid system, which is slowly adapting and certainly does not suffer sudden changes, it was to be expected that the restructuring process under the Companies Act would not take place easily or quickly. This is confirmed by the fact that the process has been going on for 15 years, with the end still not clear. In addition, very often the deadlines set for the achievement of particular goals are shifted because soon in practice they are shown to be unrealistic due to the in-

fluence of many factors that were not taken into account when planning.

This undoubtedly indicates that the one setting the objectives (European Commission) does not have a clear idea of how the restructuring process should take place, especially when it comes to its time dimension. Despite the many lessons learned, it is evident that they are not sufficient to answer the question of when the expected goals should be reached, i.e. the completion of the restructuring process.[8]

The speed of movement, the gross weight of the train and the length of the space sections also determine the capacity of the infrastructure. This way of organizing transport ensures that by increasing the speed and weight of the train, the capacity of the infrastructure increases. The traffic of all trains is regulated according to the prescribed maximum speeds and weights of the trains, which enables optimal use of both infrastructure and other capacities.

The transition period of the company from 1990 to 2003 had a negative impact on the overall economy of Montenegro and countries in the environment whose recovery is slow and inflexible in the measure of adaptation to the latest technical and technological developments that accelerates the production process, shortens the time of cargo / goods transfer, and providing passenger transport services, increasing speed, reducing operating costs, improving the position of railways in the market relative to competitors (road, air, sea and river transport), in the domestic and international markets.

In addition, we should not neglect the fact that due to the poor financial condition and maintenance of the infrastructure of Montenegro, it was increasingly neglected, which had a negative impact on competitiveness, and the railway became increasingly unreliable carrier and over time lost traditional users of transport, such as is the energy sector, construction sector, timber industry, agriculture, etc.In the broader context, RIoM should be seen as part of a large system of interconnected actors, whose external environment is characterized by risk and uncertainty, and internally high investments in reconstruction, rehabilitation, repair, rehabilitation, ongoing maintenance of the railway line, which burden current operations. Especially since we often cannot improve the overall condition (we keep the existing track 2 to last until the main overhaul, because only individual parts are replaced (for example: sleepers) and when they are completely worn out and as such they cannot be in the track or they can be in a small percentage (that's why we introduce light rides and abolish after replacement).

Internal high investment in RIoM, the results of which depend on several factors and whose results are visible in relation to the percentage of utilization of the routes in relation to the projected and planned, as can be seen from the graphical representations given in Figures 2 and 3 in a certain time period. Strategic approach to the management of the WGI is a comprehensive, multidimensional and balanced construction in combination of the various elements that make up the management system in this type (type) of traffic. Bearing in mind the importance of the RIoM for the overall economic development of Montenegro, and beyond, efforts are being made to improve a new way of organizing, managing and improving the functioning of the RioM.

The RIoM Maintenance Studies have projected a trend in maintenance costs flow by the following dynamics: from 1-5 years growth of 2%, from 6-10 years growth of 4%, from 11-15 years growth of 8% from 16-20 years growth at a rate of 6%. From the available documentation and expert reports, funds allocated for ongoing maintenance are not adequate to adequate i.e. qualitative track maintenance. Table 1 provides an overview of the funds allocated from the state budget for the period 2008 to 2018.[10]

Table 1. Funds allocated from the state budget of Montenegro for the maintenance of railway infrastructure [10]

ALLOCATION OF FUNDS FOR MAINTENANCE OF RAILWAY INFRASTRUCTURE			
Year	BUDGET		Total (mil E)
	Ongoing maintenance RIoM	Investment maintenance (Railway Administration)	
2008	7,2	1,7	8,9
2009	9,7	/	9,7
2010	9,6	/	9,6
2011	8,3	/	8,3
2012	7,2	/	7,25
2013	6,8	/	6,8
2014	6,7	/	6,7
2015	6,7	/	6,7
2016	6,8	/	6,8
2017	6,8	0,05	6,85
2018	6,8	0,12	6,92

The projections for the development of RIoM require significantly greater appropriations for the maintenance of the overhauled part of the railway line of 50% and the second part of the railway line from Kolašin to Bar, the part of the railway which is planned for reconstruction / overhaul in the coming period, since it would by no means be rational from the economic point of view that the time of reconstruction of the part of the railway line completed at the end of 2019 and the time of the beginning of reconstruction of the remaining part of the railway line coincide, since the reconstruction time should be done every 20 up to 25 years. Part of the funds in the table are not maintenance investments but to finance part of the current liquidity of the RIoM. [10]

There is a significant difference between the design and actual-instantaneous train speeds, and this condition is mainly conditioned by the existing infrastructure.

Tables 2 and 3 provide basic information on railways and networks of railway infrastructure of Montenegro.

Table 2. Main data about railroad of RIoM [10]

RAILROAD	VRBNICA - BAR	NIKŠIĆ-PODGORICA	PODGORICA-BAJZE	TOTAL
PUTTING INTO OPERATION YEAR	1976	1948/1965/2012	1984	
Length of open track with station passing tracks (km)	169.21	56.60	24.70	250.51
	electrified	electrified	not electrified	
Length of station tracks (km)	65.71	8.73	2.77	77.21
Category of railroad (valid)	D4 (22,5 t per axle; 8 t/m)	D4 (22,5 t per axle; 8 t/m)	D4 (22,5 t per axle; 8 t/m)	
Official points (number)	9 stations, 8 passing points, 19 stops	2 stations, 2 passing points, 7 stops	1 stations	12 stations, 10 passing points, 26 stops
Area of station and business buildings	35.138,00 m²	5.688,00 m²	1.499,00 m²	42.325,00 m²
		OBJECTS AND ROAD BED		
Bridges (number, type)	108 bridges (92 concrete, 16 steel)	9 bridges (8 concrete, 1 steel)	5 concrete bridges	122 bridges
Total length of bridges in m':	8,404.49	374.75	190.00	8,969.24
Tunnels (number)	106 tunnels	12 tunnels	3 tunnels	121 tunnels
Total length of tunnels in m':	51,597.00	3,439.00	2,676.00	57,712.00
Galleries (number)	14 galleries			14 galleries
Total length of galleries in m':	391.57			391.57
Number of culverts under railroad (pcs.)	372 culverts	45 culverts	24 culverts	441 culverts
Road bed (embankment, cutting and insection) in km	107 km	52 km	22 km	181 km
Length of retaining walls in km	45,30 km	2,70 km	2,30 km	50,30 km
Registered landslides (total length in m')	2.890,00 m			2.890,00 m
Level crossings	10	22		32 Level crossings
Underpasses	10	6		16 Underpasses

Table 3. Main data about RioM network (length of the network, ancillary tracks, number of objects on the railway line) [10]

RAILROAD	VRBNICA - BAR	NIKŠIĆ-PODGORICA	PODGORICA-BAJZE	
Length of contact network in km	**223,80 km**			**223,80 km**
EVP (electric traction substation)	Mojkovac, Trebešica, Podgorica and Bar			4 substation
PSN (substation for sectioning from neutral line)	Bijelo Polje,Kolašin, Bratonožiće and Virpazar	Danilovgrad		5 substation
PS (sectioning substation)	Mijatovo Kolo, Trebaljevo, Lutovo, Kos, Bioče, Golubovci and Sutomore			7 substation
Contact network building – OCL	Mojkovac i Podgorica			2

The following figure shows data on the utilization of the ŽICG routes for the period 2017-2019, which shows that the utilization percentage is below the planned which indicates that the revenue generated is below the planned, which impedes the business of the Company "Montecargo", i.e that the utilization percentage route in 2018 lower by 25.80% compared to 2017 or higher in 2019 compared to 2018 by 8.69%.[10]

Figure 2. Usage of the path – Montecargo (%) [10]

In order to contribute to achieving balance of financial strength, the fixed assets - routes of the RIoM,it is needed:

- that capacity is used in a direction that leads to a distance beyond the point of cost-effectiveness;
- to mobilize invested funds more quickly
- to preserve the substance of the funds invested.

The lower margin of profitability is defined as the ratio of costs (fixed and variable) and revenue from transportation.The volume of production of services and the point (limit) of profitability are mutually conditioned.

The higher the fixed costs, the greater the volume of transportation required to achieve a lower cost-effectiveness point. Fixed costs are the product of engaging a factor in the production of services. Hence, investments must be 'covered' by an increase in the volume of transport at least in the amount of additional fixed costs.

Removing capacity utilization from the lower point (margin) of profitability is also achieved by reducing the time (cycle) of investment, that is by the favor of investing in fixed assets with lower fixed costs - this is equipment.

From the information available to the RIoM (Balance Sheet, Income Statement and Financial Statements as well as Operators, and the Bureau of Statistics –Monstat these three Companies should plan to reorganize / restructure as soon as possible in order to create conditions for business on the principles of market economy and their sustainability.

The other operator also noted that the routes are used in high percentage and that the usage in 2018 is higher by 0.33% compared to 2017, that is, the utilization rate in 2019 is decreased by 4.72% compared to 2018. What is burdensome to the RIoM is that in this case the methodology for determining the cost of using RIoM tracks is lower than the price to cover variable operating costs and, from an economic point of view, the redistribution of costs within the GISG and the operators as users of the tracks is not well done.

RAILWAY INFRSTRUCTURE MANAGEMENT

One of the key issues in the economy of the transport business, and of transport policy in general, is the issue of infrastructure. Content, method and method of reproduction, as well as infrastructure management, are key issues for the conditions of economy and harmonization of competitive conditions of carriers in the transport services market. Various local and foreign authors have taken up the definition of infrastructure issues and have taken various positions. This problem has been addressed by the International Railway Union. It is generally agreed that the infrastructure of the transport sys-

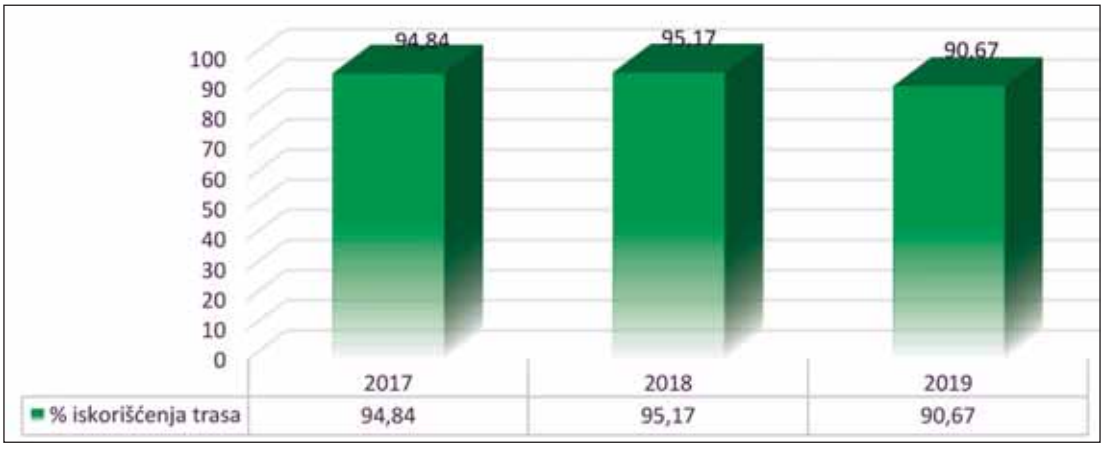

Figure 3. Usage of the path – Railway transportation of Montenegro (%) [10]

tem, the harmonization of economic conditions and the competition of transport carriers in the market of transport services. The general importance of infrastructure for the functioning of the country's economic and social life is at the same time a framework for international economic integration, such as the European Union. On this basis, major projects are being formed, such as the European High Speed Lines Project as well as the Pan-European Corridors, which also includes the transport infrastructure of the Balkan countries.

Because of the above, from time to time, doubts are raised about the whole process, which again has a retroactive effect. At the beginning of the establishment of the Railway Infrastructure of Montenegro, as a separate company, there was no clear timetable and expectations in this regard by the EC and the EU as a whole. Here, the authors ask justifiable two questions, themselves and others, which are the experiences of others in conducting such or similar processes. [8]

1. How long did the restructuring process take place in other railway companies in Europe and

2. How long did this process take place in other non-European rail systems?

Economic principles in a liberal and open market economy are unaware of the so-called "agreed economy", therefore, the process of reorganization of the Montenegrin Railway and all economic entities where the state is the majority owner of the capital, needs to be reorganized in depth and breadth as soon as possible, in order to increase the efficiency and effectiveness of business operations and to include Montenegro and the countries of Southeast Europe or the Western Balkans and EU accession.This is necessary for the integration of WGI in international economic flows, which includes: market expansion, better use of installed production / service capacities, job creation, reduction of unemployment rate, reduction of migration movements, increase of land use rate, increase of production volume, achievement of greater business results , reducing business costs, increasing productivity, rapid and efficient reconstruction, all with the aim of improving the living standards of citizens, improving transport infrastructure, increasing the mobility of all segments for accelerated economic development of Montenegro. [6]

Railway infrastructure resource management means a set of processes that includes resource planning, provisioning, maintenance and use of resources, with constant review.

Resource planning for railway infrastructure means identifying resource requirements and planning for their provision. The provision of resources is the process of timely obtaining the required quantities of resources of a

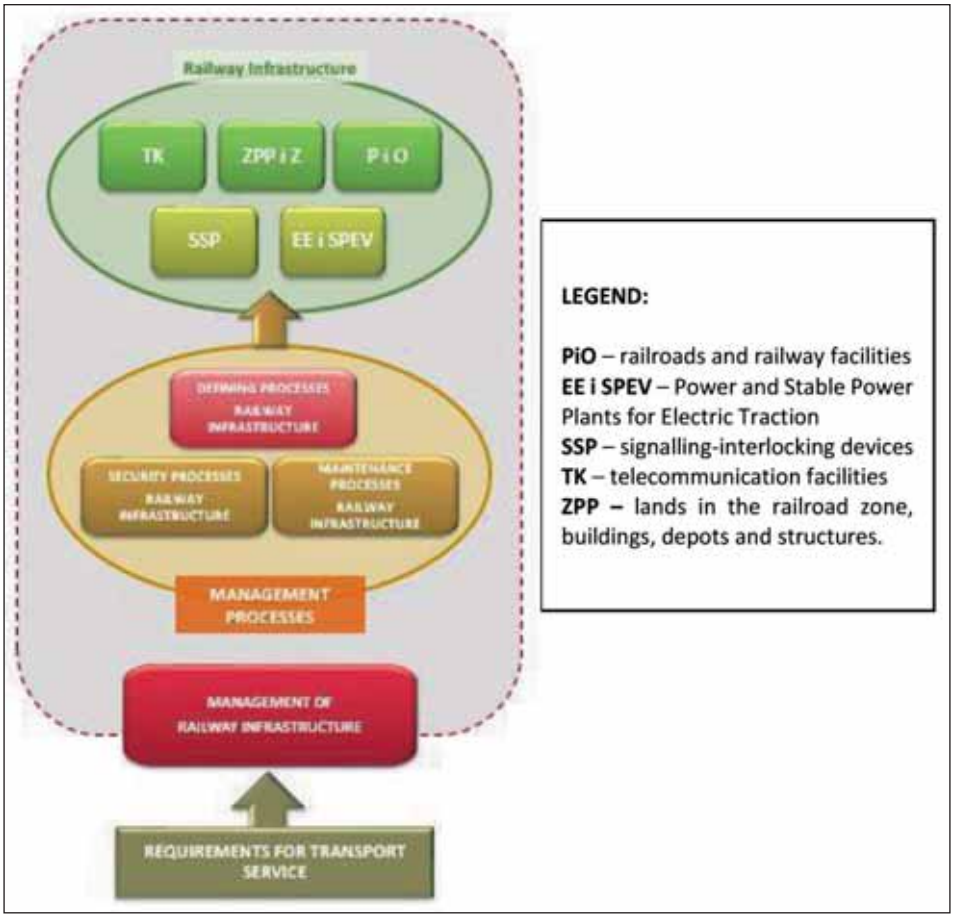

Figure 4. Railway infrastructure management (source: authors)

certain quality and their allocation. Maintenance ensures availability of resources in a state that ensures their efficient and effective use. Resource review involves evaluating, optimizing and developing resources to use them effectively and efficiently.

The international standard ISO 9001: 2008 provides requirements for infrastructure management. Starting from the fact that the transport or transport service is the basic product of the railway as a railway organization, it must define, provide and maintain the necessary infrastructure necessary to achieve compliance with the requirements of such service as its product.. [5]

Railway infrastructure enables the design, development, implementation and provision of delivery services for transport services, and within these processes these processes are implemented and their results depend on it. Without adequate railway infrastructure and its proper maintenance, the desired results in the provision of transport services will not be achieved.

The requirements for railway infrastructure management may be illustrated in Figure 4.

The overall process of managing an organization involves choosing a process that requires improvement. In order to be able to do this, it is necessary to define the processes and their users beforehand and it is always defined from the perspective of users of the RIoM routes. In the first phase, the following questions are asked:

- What products or services are the result of the process? In railway infrastructure, everyone should ask themselves what is actually the result of their work or the process in which it participates. This may be relatively obvious in manufacturing, but it is not quite so clear in administration.
- Who are the users of these products and services (they can be internal or external)? Everyone in the railway infrastructure should be aware that they are working for a user and that their mission is to meet their needs.In order to build this awareness, it is necessary for everyone on the railway to ask themselves: who are my customers?
- What do users really need? Railways should ask themselves whether their "products" and services satisfy what the user of those products and services needs.
- How can this be measured? Adaptation to customer needs is not practicable if those needs cannot be expressed through some quantified characteristics of the product or service in terms of quality, time of use, price levels, operating and maintenance costs, utilization of available capacities, number of executors, qualification structure, age structure of employees, their effectiveness and efficiency in the workplace and the like. Management will give more importance to everything that is quantified. *Peter Draker rightly argued that if you can't measure something, you can't even manage it.* [4]
- What are the critical processes whose improvement can meet the needs of the users of the RIoM routes? Once the processes and their users have been identified, a selection of processes will be selected that will be enhanced. It is common to select the processes that have the most problems and whose enhancement creates added value for the consumer, service user or customer.

Process evaluation is most often measured in terms of quality, time cycle process, productivity, added value. Some researchers believe that performance measurement is often also a motivation to achieve something - what was measured in the Montenegrin Railway Infrastructure is what it had been done.

There are different interpretations of why such changes have taken place in the international environment, and one of them is the view that the world is going through certain cycles and stages of development, the so-called *long waves*, characterized by changes within various activities, including transformations of economic systems and policies. Technological and knowledge development are important factors and drivers of such processes.

Philip Kotler warns that the world market is entering the zone of the "vicious circle". In his book Ten Deadly Sins in Marketing, this famous professor states: [6]

"No matter how cheap a company can produce its product or provide a service in the domestic market, it cannot be the cheapest as long as China has something to say and offer." An example is the arrival of a ``*China Railway Express*" ` freight train with equipment for the construction of high-speed rail in Serbia.

It arrived from China to Belgrade with 510 tons of high-speed line construction equipment on the Belgrade Center-Stara Pazova route, 34.5 kilometers long, as part of a project to build high-speed lines up to 200km per hour between Belgrade and Budapest. The train consists of 28 wagons with containers. The train departed on September 24th, 2019 from the Chinese city of Jinan, in the Shangdong province, and traveled about 10,500 kilometers, with the train route: China-Mongolia-Russia-Belarus-Poland-Hungary and Serbia-Belgrade, arriving on October 24th 2019.

Rail is one of the central traffic modes of China's Global Belt and Road Initiative, and high-speed rail from Belgrade to Budapest is an integral part of the project. Is this the announcement of fierce competition to the operators using the railway infrastructure of Montenegro, are we ready for such an organization with the existing organization, equipment, functionality of all employees. It is natural that all manufacturers will look for an operator that has better quality services at lower prices in the pro-

vision of goods and passenger transport services, which inevitably can lead to a fall in employment in Montenegro and countries in the region. A decline in employment means less purchasing power and less sales. This creates a vicious circle. [11]

What is considered to be a limiting factor in the slow reorganization and restructuring is the capital structure of the Railway Infrastructure of Montenegro AD in which the state is majority owner with 72.44% as shown in Figure 5. In the countries of Western Europe and the USA the capital structure, the organization, operation and performance of the railways are regulated differently, privately owned and defined subsidies on an annual basis, investments, maintenance and regular revenues and their monitoring of operations and achievement of the basic goal defined in their strategic documents, mission and vision of the Railway Infrastructure of Montenegro.

turing or certain reforms towards better organization, planning, implementation, control, use of routes, pricing for the operators / users of the freight or passenger transportation services, more employees than actually needed in relation to the installed capacities, the costs of which further burden the current business and reduce the possibility of allocating more funds for the current maintenance. It is important to note that the annual ongoing maintenance of the railway is approximately EUR 72,000 thousand per kilometer, excluding the additional costs incurred by natural factors (natural disasters), human factors and treated as extraordinary events, which are certainly remedied / repaired at the burden of the current operating income of the RIoM. [10]

The development of an integrated model of strategic management in the RIoM is a complex issue that needs to be monitored / improved on a daily basis due to accelerated technical and technological development

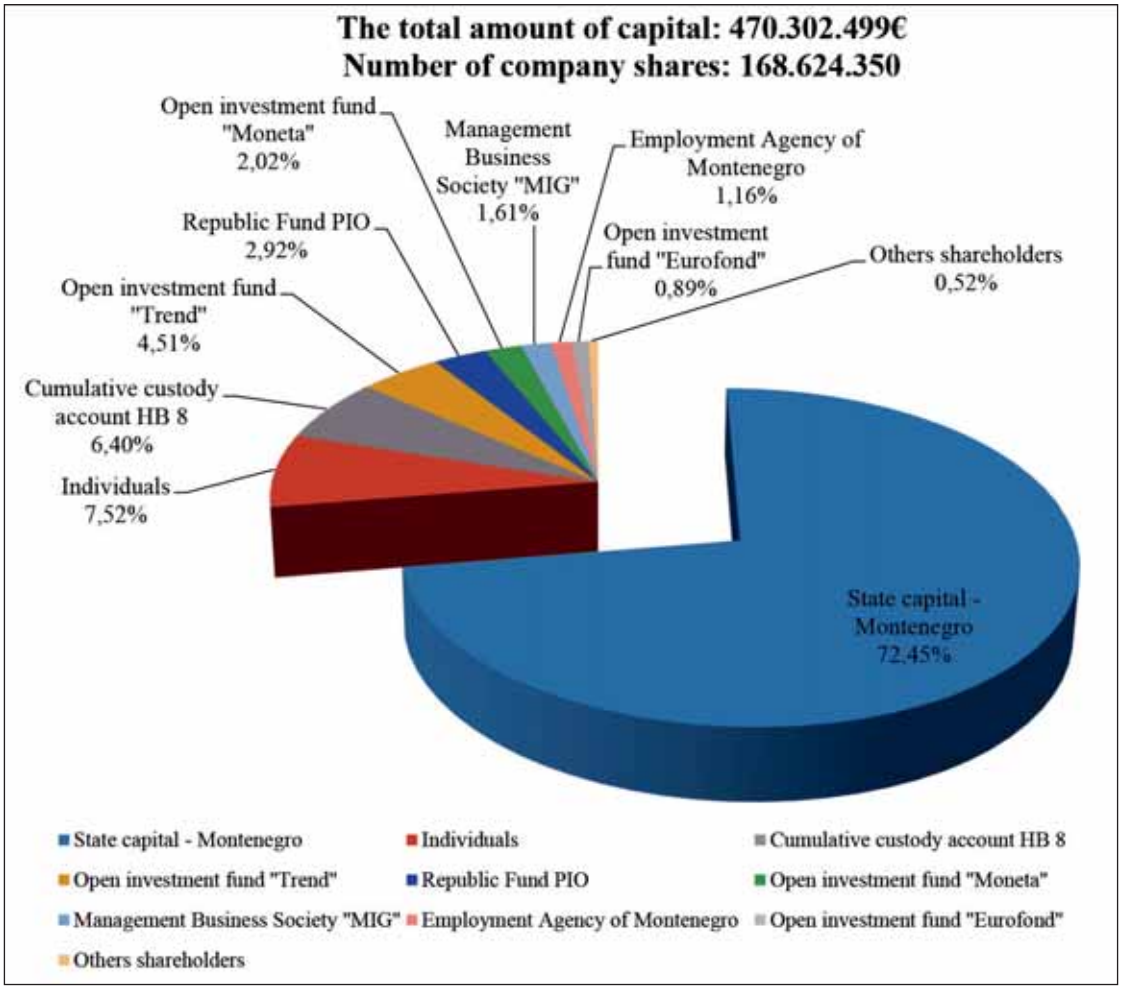

Figure 5. Ownership structure of RIoM JSC. Podgorica [10]

The difference in ownership structure certainly has a significant impact on the time dimension of the reform process, since state-owned railways operating in market conditions have more time and space to delay restruc-

and alignment with other railways in the surrounding area, as well as other modes of transport / goods transportation and passenger transportation services at different destinations, as well as the degree and quality

of maintenance and the degree of use of the tracks. The Integrated Strategic Management Model of the RIoM through analysis of the existing Knowledge Fund confirms that the comprehensiveness and integrity of the RIoM strategic management model can be achieved by linking interdependent strategic management components, which are individually and thoroughly analyzed, systematized and observed through four basic phases of the general model for strategic management of organizations. namely: planning, organizing, leading and controlling.

In terms of market conditions, there is a difference, which, with the passage of time, is getting smaller, but is still significant at the moment. Namely, the railway infrastructure in Montenegro was built in 1976, when self-government is a social system and a system that organizes and manages state property in a completely different way.

This is also the time when the state controls pricing through its administrative measures and the way of doing business in relation to the transition period from 1990 to 2003, and doing business in times and conditions of a liberal and open market, a model that tends towards Europe but which development is extremely slow and perhaps the most difficult to achieve goal of all existing goals, because of the slow transition in large economic systems / enterprises, the volume of production of various goods in the economy of Montenegro and the surrounding countries has been reduced, as well as the transportation of different cargoes and the provision of passenger transport services.The percentage of use of the Port Bar in Montenegro has decreased and the decline in the physical volume of production in the surrounding countries has strong negative economic reflections on its own available capacities due to the reduced capacity utilization and the large number of employees not adequately allocated to the production needs, negative effects also affected the Montenegrin economy and the economy of the countries in the region, which had the conditions to use the railway for transport to different destinations, which is also limited by the volume of production, the quality of the product, the quantity of goods that can be realized on the international market, high cost per unit of product, packaging method, competition ratio, distribution channels from production-wholesale to retail to consumer as well as securing goods, warehousing, market position, product prices in the domestic market, regional and international markets.[3]

CONCLUSION

The Railway Infrastructure of Montenegro (ŽICG), is a complex techno-economic system, consisting of a large number of complex organizational units as structural elements (subsystems), in which appropriate planning decisions are also made. There is a great deal of interactive connections between these parts, which indicates that the decisions made at the level of the lower organizational parts are multifaceted.

Planning on the Railway Infrastructure of Montenegro - JSC reflects the highest degree of complexity of decision-making of economic entities, since it is where decisive decisions are crucial for the functioning and development of railway traffic. Strategic (key) planning decisions define the basic directions, frameworks and constraints of railway development. These questions basically relate to: volume and structure of transport, modernization of transport capacities, volume and structure of investment, number and structure of employees.

Effective development management and decision making is only possible with the planned coordination of all relevant factors. All this indicates that in making these strategic planning decisions, a very high level of expertise, a high degree of constructiveness and coordination within ever-changing external factors from the environment is required, in order to ensure that rational and expedient actions are taken in the whole process of transport and business in order to achieve what better business results of the Railway Infrastructure of Montenegro (RIoM).

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PROFESSIONAL PAPER

Sustainability of outbound logistics in small businesses in Serbia

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Abstract: A significant percentage of entrepreneurs, micro and small companies in Serbia do not have adequate outbound logistics capacities in order to register significant growth in business. The needs of everyday business and the demand for certain products and services is a reflection of the quality of products, and very often it is not realized in full potential, due to poorly dimensioned aspects of logistics function, or due to insufficient operational capacity of the company itself. The key problems of small companies from Serbia, which are trying to internationalize their products or services, lies in the fact that Serbia (as a country) generally has very poor outbound logistics and transport efficient solutions and capacities. In addition, transport costs and supply chain length have critical impact on the ability of a small company to meet demand outside the local market. The complexity of the problem is affected equally by internal capacities of micro and small companies, but also by weak external support for specialized outbound logistics services (transport, transshipment, etc.). These problems will be analyzed on a sample of small Serbian companies that deal with different fruit cultures processing, and are trying to conquer new markets. The result of the conducted research serves in an attempt of narrowing the problem to specific sectors of the industry, which are affected by inadequate logistics capacities. Future research could contain concrete measures to improve the delivery process and internationalization of goods for companies outside large systems (corporations), by defining concrete proposals to improve outbound logistics management capacities in Serbia.

Keywords: logistics, small business, sustainability

INTRODUCTION

Logistics management is an essential component of supply chain management, used to meet customer demands through integral design, planning, control and realization of the effective movement and warehousing of related information, products and/or services from creation to destination (final market). Logistics management helps businesses and managers in their effort to reduce costs, as well as to establish full customer service. In most cases, logistics management processes begin with gathering of raw materials (supplied from local or imported capacities), all the way to the final stage of delivering finished goods to its buyer. By answering to customer needs and industry standards, logistics management procs a sustainable approach to strategy, planning and implementation. It is very closely connected to marketing and product management, and interlaces within all investments oriented towards market growth.

Previous studies on outbound logistics management in large companies (with specific business operating unit devoted to logistics management) involved numerous topics, including:

- Selecting appropriate vendors with the ability to provide transportation facilities [1],
- Choosing the most effective routes for transportation [2],
- Using software and IT resources to proficiently handle related processes [3].

Not many existing studies seem to focus on factors limitating successful exporting businesses to develop, in the case of small businesses. The results of a worldwide research on family businesses, conducted by consultant company PwC [4], refer to unpredictable market conditions as one of the major external challenges for the future of family businesses.

Studies dealing with existing literature and observing existing and potential trends regarding operations of family businesses have been narrowed, referring mainly to the EU, and then to Serbia specifically. Currently, Serbia is ranked as 48th in Doing Business's world list, having declined from 2017 (all other countries in the region face steady positions). Meanwhile, PwC reports that majority of surveyed European family businesses predict

moderate or rapid growth in the midterm, but it is not known whether this is the case in Serbia.

On the other side, this paper presents an attempt to broaden current trends in literature, and to empirically deal with an important topic in the form of a survey, which was defined with support of family business owners. The results and discussion part of the paper attempts to identify similar conclusions, but with clearly analyzed findings, related to the current state of the Serbian economy [5]. The final part of this research paper sums up and announces the future research efforts of the authors, defining a clear potential for international publishing.

When observing current knowledge about transport resources allocation and management in small business, authors concluded that majority of existing research focused key factors of logistics in large corporations (majority of those are non-family businesses), while failing to deeply analyze the share of transport costs in overall costs of production, and the fact whether small businesses employ their own logistics resources, or rely on partner relationships. Related to previous knowledge about logistics in family business management (micro and small businesses particularly), the authors needed to address these topics, by defining the following two main research questions:

Main RQ:

1. How large is the share of transport in overall operating costs of key products and services in small businesses in Serbia?
2. Are small businesses in Serbia using their own transport resources, or through employing a specialized logistics company?

Firstly, it is needed to theoretically define key differences between family and non-family businesses in terms of logistics operations, and then to define a framework for sustainable logistics management in small businesses. Through an empirical research, those differences shall be observed by correlating operating costs of outbound logistics of manufacturing companies, with high potential and need for exporting. Based on the need to position small (most often family) businesses from a rural setting to the big stage (large market), it is necessary to review existing literature about previous conclusions and similar attempts.

The following chapter presents previous findings on two main topics: key findings regarding transport and logistics in Europe and Serbia, as well as factors of sustainability of logistics in small businesses overall.

MATERIAL RESULTS FROM LITERATURE REVIEW

Majority of fruit processing companies in Serbia (which produce at least 1.000 tonnes annually), base their exports mainly to Russia (31%) and EU countries (58% of exports), while exports of fruits to surrounding countries is really insignificant. Following a trend for the last few years, fruit production companies from Serbia are trying to win new markets, such as Middle East or Africa [6,7].

Besides that, companies are trying to present themselves as certified for production of only a few fruit cultures:

- Apples, pears and quinces,
- Raspberries, strawberries and currants,
- Plums and cherries [6].

Transport of produced fruit (in the form of raw or semi products) in Serbia is conducted mainly by truck (with cold storage), and by airplane (when transporting to long distance markets). Predominant usage of roads for transport, results in: high transport costs [8], high risks of accidents due to incomplete network of motorways in Serbia [9], and also long hours of waiting at national borders [10].

Very important factor when organizing outbound logistics activities, is the possibility/capacity for cold storage, and availability of machines for automatic selection of best fruit products. Also, factors of influence to the outcome of logistics is quality management, particularly when dealing with highly sensitive products (such as fruit cultures). It consists mainly of:

- Standardized processes of picking crops, sorting, creating additional value of raw product,
- Packaging (crates, bags, boxes),
- Level of automatization of inbound logistics [11].

Finally, marketing activities (CRM) take place, while trying to preserve existing markets, and position the product in new markets. All of this was examined in the empirical part of this research, and main findings shall be presented in the following chapter.

A study by Credit reform [12] reveals that transport and logistics expenses hold a very high position when analyzing different industry sectors. Table 1. presents the share of companies in most developed countries of EU (Germany, Austria, France, UK), by displaying a two-year trend of companies:

- With share of logistics/transport costs up to 1% of all production costs;
- With share of logistics/transport costs exceed 1% of all production costs.

It can be seen from the table that transport and logistics activities recorded fourth place, with a declining trend of companies with logistics costs over 1% of all costs, which is positively caused mostly because of the common markets across the EU. Risks connected to transport report a rising trend, while bankruptcy and collection of receivables from foreign partners, are the main risks of internationalization efforts.

Table 1: Losses as direct effect of export business, displayed across different industry sectors [12]

Industry sector/type	Up to 1,0%	over 1,0%
Construction industry	73,7 (69,8)	6,5 (9,5)
Manufacturing industry	72,8 (67,5)	5,4 (10,2)
Commerce	67,6 (65,7)	9,5 (13,0)
Transport/Logistics	65,9 (65,7)	7,3 (8,6)

% of companies, () = % of companies from previous year

It appears that there is considerable potential for the growth of all European based companies, for export operations in Eastern Europe. After all, one fifth of export companies already plans to start business relations in the region of Russia or Ukraine in the next period. Countries such as Romania, Bulgaria, Croatia, Serbia and Bosnia are very popular, as export destinations (which is not the case in Serbia). Small share of european companies would like to open new sales opportunities in the countries of Benelux and Scandinavia (mostly large corporations and offshore companies).

Even countries traditionally served by German companies in the past - such as Austria, Switzerland and France - are likely to further increase their share of imports, by looking for products and services from Eastern-European based companies. Finally, a new market interest, such as Turkey, will be added to existing momentum of expansion to the East, in foreign trade.

Also, it would be interesting to analyze whether company size enables different results when considering internationalization of business activities (on regional and european level). Below is a table containing share of companies in most developed EU markets, differentiated by company size.

Table 2: Percentage of Exporting companies based on size [12]

	% of exporting companies (EU based)
up to 50 employees	19,6
51- 100 employees	17,7
101-250 employees	23,0
251-500 employees	18,2
501-1000 employees	8,1
More than 1000 employees	12,0

Having all in mind, it can be concluded that the majority of existing research focuses on outbound logistics of stable, large businesses with diversified network of exports, while micro and small businesses are not represented equally in existing literature.

RESULTS OF EMPIRICAL RESEARCH AND DISCUSSION

The research questionnaire has been sent to 500 addresses, inquiring small business owners who are doing business for at least 3 years, across most dominant fruit cultures in agriculture industry of Serbia. The questionnaire was formed carefully, to avoid direct questions about costs and effects of business activities. The response rate was relatively fair, as a total of 30 owners have answered all questions. The authors made an attempt to ensure representativeness of the sample, in terms of regional inclusion and different industry subsectors (fruit cultures). The overall population of family businesses in Serbia is not defined in domestic literature, and there is very little known data about family companies.

All sources, references from literature review and empirical data used in this paper have been read and analyzed several times; the data was cross-referenced and tested. The authors based internal validity of the data gathered from the sample on the authenticity of questions. The questionnaire was developed with the help of experts in the field of agricultural manufacturing oriented towards exporting activities. It reflects actual real-life processes in a family business, to extract maximum information about the topic, from the respondents.

Distribution of the sampled companies is the following:

- 3 companies from Belgrade region;
- 4 companies from Vojvodina region;
- 15 companies from Sumadija and West Serbia region, and
- 8 companies from South and East Serbia region.

All of the sampled companies are micro and small (up to 50 employees), doing business as manufacturing companies, and mainly exporting their products (80%). Basic information about the sampled enterprises is given below with Table 3.

TABLE 3: Basic information about sampled companies

Question	Response	Pct. of answers (%)
Number of employees	1-9	30
	10-50	70
	51-249	0
Company type	Manufacturing	90
	Combined	10
Presence on different markets?	Only on the domestic market	20
	Yes, on Serbian and foreign markets	35
	Yes, on foreign markets only	45

When asked about the model they use to position their product in a foreign market (see table below), the owners responded mostly that their products fall under "geographical" or "national" cover brand. It can be concluded that Serbian companies and their products are not yet strong enough to be recognized as such on an international scale.

Table 4: Representation of products from sampled companies in foreign markets

	Response	%
What is the cover brand for Your product internationally	Region of product origin	20
	Serbia as a country	50
	Premium product/Name of company	10
	We don't export	20

This fact can contribute largely to efficiency of logistics, when it comes to packaging, because it enables all products of the same kind to be packed and sold through cover brands (from Serbia). Also, costs of branding (promotion and positioning of products) in a foreign market is more efficient that way, but it has to be supported by a specialized organization, such as USAid, within a dedicated programme [13].

Also, the owners noticed that a proper answer to competitors' offer on the (domestic and foreign) market presents the main challenge when planning all business activities (95% of all answers). Companies which report a faster growth rate in exports, are at the same time more tightly connected with outbound logistics organizations (correlation coef. equalls 0.87 out of 1), reducing the risk level of operations to a minimum.

There is no discovered correlation in the sample, between company size and type of business relationship with foreign partners (private consumer or business consumer- reseller on foreign market), and this confirms the results of a previous study by Hall and Astrachan [14].

The owners regard transportation/shipping as a synonim for logistics operations in their company (85% of answers), as holding (inventory), warehousing and security of their products is less important. They were asked to rank (1 being the highest rank, 5 being the lowest rank) all parts of the transportation process, in terms of complexity and their level of involvement. Below are presented results:

Table 5: Ranking of transportation process activities, in terms of complexity

Transportation process activity	Mean value of Rank
Signing of the shipping contract between the loading company (may be the exporter or the importer, depending on the terms agreed upon in the sales contract) and the international logistics operator.	1.8
Collection of the goods in the exporting company's warehouse, generally using lorries. The goods are then sent to the shipping terminal (full container) or to the warehouse of the logistics operator (fractionated cargo)	2.4
Handling and storage at the logistics platform of the transport operator or terminal.	3.9
Loading and packing onto the means of transport (ship, train, lorry, or airplane) after customs processing at the departure terminal.	4.3
Shipping of the goods by the main means of transport.	4.5
Unpacking and unloading at the destination terminal and import customs processing.	4.5
Handling and storage at the shipping terminal or logistical platform of the international transport operator.	4.5
Transfer of the goods (full container) to the importing company's warehouse, or after de-consolidation of the container if fractionated cargo is involved.	4.5

It can be seen from the table, that level of involvement from sampled small businesses across the supply chain is decreasing throughout the process, and in most cases it ends with the gathering of goods to be taken over by the specialized logistics operator (with cold storage, etc). There were no reported companies which fully control (are heavily involved in) all activities of transport, which is also a confirmation of discovered correlation between small businesses and delegated transport function to a specialized outbound logistics operator.

CONCLUSION

The theoretical review of this research paper concerning sustainability of logistics in small (family) business studies, integrally examined operations of manufacturing companies and the role of logistics and transport, with taking into consideration specific industries and the parent (regional markets) where a family company operates. The key contribution of this paper is the recognition of main factors which contribute to solving the posed main research questions. The second most important result of this paper can be found after conducting empirical research of small (family) businesses, located mainly in Western Serbia (50% of surveyed enterprises), by examining their business portfolio across operating problems of logistics and transport. The owner of the small business plays the integral part in providing support for

these processes, and he/she is directly influencing the model and outcome of logistics in small businesses, unlike diversified logistics and transport organizational sectors in large corporations. It was discovered that majority of small businesses employ external organizations for specialized outbound logistics operations, reducing their operating costs primarily and enabling themselves to become a part of a larger supply chain network. Also, the surveyed owners which do not cooperate with specialized operators, report significantly higher share of transport in overall costs, making it harder to grow and expand their operations outside of local market.

When considering limitations for proper research on this topic, there is a clear fact that the business environment in terms of family-owned and small companies hasn't been explored fully in Serbia and overall. Still, the main limitation of this research is a failure to explore surrounding markets (CEFTA region), in terms of sustainability of logistics in a small business surrounding. The owners largely agree that actual trends evident change of market share and internationalization (import/export activities) of their business, as it was previously analyzed in a larger sample of small business owners in Serbia [15].

But further analysis is needed, to be able to fully understand the perspective for the region, as it was conducted in [16,17]. There is a clear gap left for further research since there is a clear preference of the EU for further expansion and integration, at least in terms of business relationships with West Balkans countries.

Another potentially important contribution of future research is to provide and present more knowledge about "below the radar" small, family businesses in Serbia, their management structure and logistics management, as well as to describe best business practice examples from Serbia as one of developing countries with moderate and sustainable growth.

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PROFESSIONAL PAPER

Application of New Materials Technology With the Aim of Satisfying the Regulations

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Abstract: The reconstruction of the passenger car body is approached for several reasons: development of a new model, installation of a new unit, compliance with new regulations, weight reduction, introduction of new materials and technologies, etc. It can be realized through: constructive changes, introduction of new materials or combined. The paper analyses the effects of implemented changes in order to meet regulations as well as the need to change existing technologies on the example of a car body. The introduction of new materials can significantly improve the existing structure with minimal changes.

Keywords: car body, materials, modifications.

INTRODUCTION

Reconstruction of the car body is approached for several reasons: development of a new or restyling of the existing model, installation of new units, compliance with regulations, weight reduction, introduction of new materials / 1/2 / and technologies, etc. It can be realized through: constructive changes, introduction of new materials or combined / 3 /. The development and introduction of new materials for the production of car body parts is in line with general social requirements, available resources and the need to preserve them, preserve the environment, increase traffic safety, etc. With all this in mind, the following materials are increasingly used for the production of car body parts: high-strength steel sheets (HSS), Al-alloy sheets, titanium and its alloys, plastics materials, composites, etc. Figure 1.

Figure 1. Example of application of different materials in the construction of a car structure [4]

However, the introduction of new materials also requires a series of technological harmonizations in existing production processes or the introduction of completely new technologies. In addition to technologies by deformation, casting and sintering, there are more and more frequent requirements for new technologies by joining, especially materials with different characteristics / 4 /. In / 5 /, presents the introduction of new generation plastics in order to improve the rigidity of the bodywork. Having all the above in mind, as well as the need to install a new power units and meet the Regulations of ECE 12, 94 and 95, the reconstruction of the bodywork of the vehicle Koral was started.

REINFORCEMENT OF THE FIRST BODYWORK

When defining the reconstruction of the FIRST reinforced car body, the results of all realized tests were taken into account. The following changes have been made to the car body:

- constructive
- application of new materials.

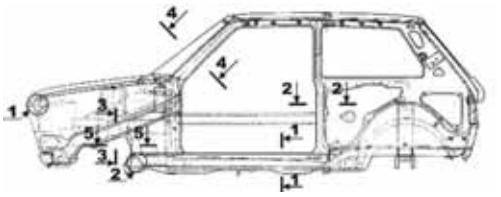

Figure 2. Supporting construction

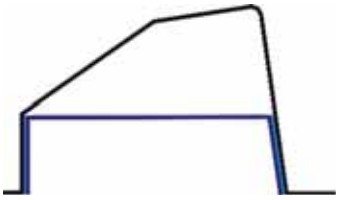

Figure 3. Detail

a. Constructive changes

At the beginning of the project, the goal was set to change the existing solutions of the existing body parts, as little as possible with the proposed reconstructions. This was a very significant limitation, especially considering the years of designing the car body of the base model as well as the regulations, which were in force at the time. The idea was as follows:

- **All open cross-sections** on the load-bearing structure, especially in critical zones, needs to be closed which significantly improves the structure. In fig. 2 shows the supporting structure of the bodywork of the Koral vehicle. The front upper cross member is defined by detail 1, see fig. 2 and 3. The introduction of a new girder resulted in a girder of a closed construction of a closed cross-section, which connects longitudinal girders much better in this zone, which is very important from the point of view of ECE 94. The introduction of this girder was aimed at reducing asymmetry of deformation the existing body parts have not been changed. A similar reconstruction was realized on several girders on the supporting structure.
- **Reconstruct critical places** on the supporting structure. For the type of supporting structure, as with the considered body, the front longitudinal supports are important elements of the supporting structure of the front skeleton. When designing them, it is necessary to take into account: their position, that is the direction of transmission of longitudinal deformations to other elements of the supporting structure, cross section, method of connection with other body elements, number and arrangement of weld points, etc. Based on the results of static tests and the developed quasi-static test / 6 /, two sensitive zones can be distinguished on the supporting structure of the frontal skeleton: A (joint zone of the front longitudinal girder, front inner lining and partition wall) and B (front inner lining joint zone, partition wall and car floor), as shown in Fig. 4. A new carrier was introduced by the constructive reconstruction of this joint, see fig. 5, in order to strengthen this zone as well as the place of support of the drive unit. Similar reconstructions were realized on other supporting zones in other sensitive zones.

Figure 4 Sensitive zones on the frontal skeleton

Figure 5. Section 6-6

- **Introduction of new supports**, taking care to change the existing supports as little as possible, as well as the car body assembly procedure. A new reinforcement was designed at the junction of the front inner lining and the partition wall, on the passenger side, with the aim of connecting this reinforcement to the front longitudinal girder with the floor skeleton (section 5-5, see Fig. 6) as well as the reinforced joint itself. In fig. 7 shows some of the newly introduced reinforcements on the supporting structure.

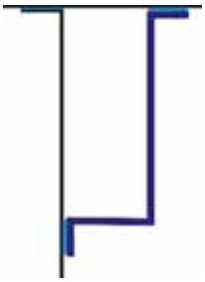

Figure 6. Section 5-5

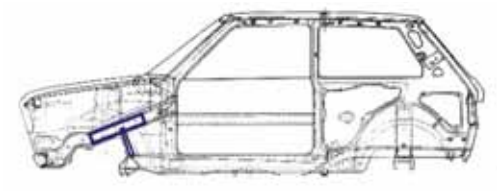

Figure 7. Display of newly introduced reinforcements

- **Reinforcement of side doors.** The side doors are important for the body's behavior according to ECE 94 and especially according to ECE 95. There were several standard side door reinforcement solutions on the vehicle, depending on the model. One reinforcement solution in the door belt was selected, see fig. 8, to which a new reinforcement has been added. In addition, two new pipe reinforcements were introduced. The skeleton of the door is reinforced laterally as well as the connections of the skeleton with the reinforcement in the belt.

Figure 8. Section 7-7

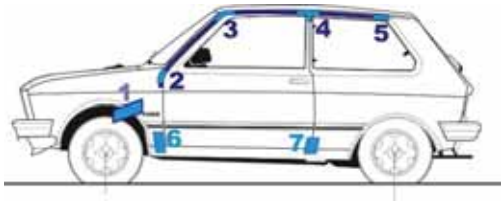

Figure 9. Schematic representation of reinforced body joints

b. Application of new materials

- **Application of materials for strengthening body joints.** From the point of view of ECE Regulations 94 and 95, the side frame, in conjunction with the side door frame, is an essential part of the supporting structure, especially on a vehicle without airbags. Analysis of the reinforcement effects of one body joint showed that the desired body joint reinforcement effects were achieved. The overall effects of strengthening the body of the Florida vehicle as a whole gave good results / 6 /. Since the same body reinforcement procedure is applied, similar overall body reinforcement effects can be expected. In such a complex reconstruction, it is very important to determine or select the body joints, which need to be strengthened, in order to obtain a significantly strengthened body as a whole. In fig. 9 is a schematic representation of reinforced body joints on the body of a Koral vehicle using new generation plastics.
- To strengthen the body joints, Dow Automotive form materials called Betafoam 88100 and 88124 used.
- The materials are mixed in a special pump at room temperature, and then the resulting mixture is injected into the desired joint, after the surface protection and body painting process is completed. The material is formed and gets its final shape at room temperature, after 20-30 minutes, depending on the size of the reinforced joint or the available space in the elements of the supporting structure. The new material, in addition to reinforcing the body joints into which they were injected, was used as a connection and support for the pipe reinforcement of the side frame. Without this material, the desired effect of strengthening the supporting structure would not be achieved, especially in the area of the windshield.
- **Application of structural adhesives.** One of the ways to strengthen body joints or body parts is the use of structural adhesives, which can significantly reduce the number of weld points. For additional bonding of body joints, especially in critical areas where access for spot welding is difficult, Betamate 1493 adhesive from Dow Automotive was used, as schematically shown in Fig. 10. Having in mind the goal of applying these adhesives for joining the elements of the supporting structure, the structural adhesive was first used in the front longitudinal girder, in order to strengthen its connection with other parts of the body as well as the connection with transverse supports. The next place of greater application is the skeleton of the side, at the

joints of the longitudinal girders as well as the places of connection with other parts or elements of the supporting structure. In general, this improves the joints of the longitudinal girders, with each other, as well as their connections with the transverse girders.

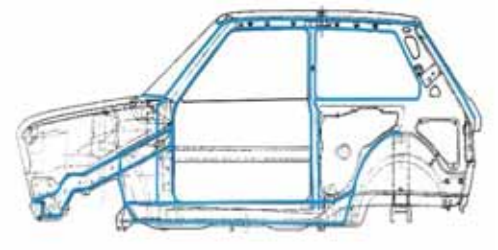

Figure 10. Places of application of structural adhesives on the body of a Koral vehicle

Figure 11. Car body testing device

ANALYSIS OF THE EFFECTS OF CORAL VEHICLE BODY REINFORCEMENT

Testing of the reinforcement effects of the FIRST reinforced body of the Koral vehicle was performed in the conditions of the ECE 94 test simulation, according to the methodology defined in / 5 /. In fig. 11 shows a device for quasi-static tests. During the test, the following measurements are performed:

- Total deformation displacement at all measuring points
- Deformation displacement at selected measuring points
- Recording car body behavior.

Figure 12. car body after test

Figure 13. Vehicle after ECE test 94

In fig. 14 and 15 show the results of a quasi-static test of the first reinforced body of a Coral vehicle. The behavior of vehicles with a reinforced body after the ECE 94 test is shown in Fig. 13. One of the basic parameters of body behavior is the analysis of deformed body, see Fig. 12. Significantly greater deformation on the driver's side. The zones of large deformations are the same as on the vehicle, after the impact test. The developed test gave the expected results. The application of new materials and technological procedures has significantly increased the longitudinal stiffness of the body, see fig. 15, in relation to the base model / 5 /.

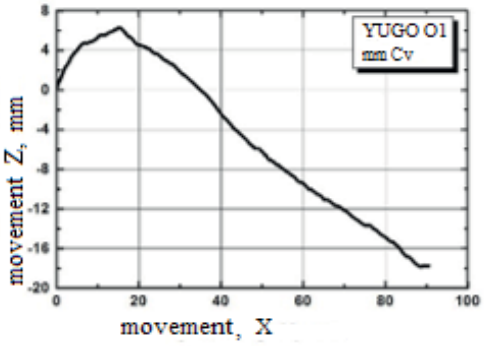

Figure 14. Moving the steering wheel connection

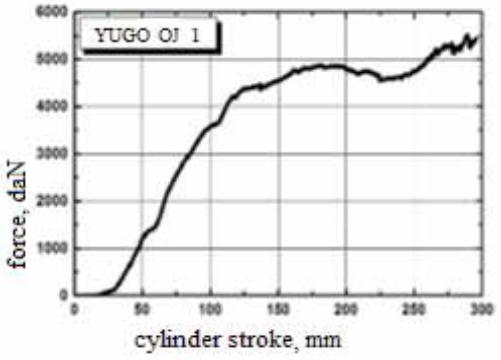

Figure 15. Realized force-stroke dependence

CONCLUSION

The development and introduction of new materials in the automotive industry is inevitable, especially given the increasingly stringent requirements. The requirements for reducing harmful gases and fuel consumption are directly related to reducing the weight of the car. Reducing car weight can be achieved in several ways: using high-strength steels, aluminium alloys, polymeric or composite materials. The application of these materials often limits the application of classical technologies, ie. requires new procedures and often completely new technologies. One of the reasons for the possible delay is the cost of such a process. The presented results indicate the justification of the introduction of new materials, especially for models that were previously designed, ie. in models where reconstruction is justified. In this way, the reconstruction of previous models creates new models with new shape and characteristics.

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PROFESSIONAL PAPER

Advanced Airspace Management Process

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Abstract: In order to increase efficiency and reduce delays, an improved airspace management process must be implemented leading to optimal route planning, better utilization of available airspace and increased performance targets in service delivery- through the establishment functional blocks of airspace (FABs). The Single European Sky (SES) project supports the establishment of the FAB through greater optimization and better performance, strengthening the ATM network through the introduction of the main objectives of the regulatory package, redesigning the European airspace in order to establish new air traffic flows; creating an increase in additional capacity, all with the aim of increasing the efficiency of the ATM system.

Keywords: air traffic, air traffic control, ATM, FAB.

INTRODUCTION - COMPLEXITY OF AIR TRAFFIC

The development of air transport in Europe is recording constant growth, and the forecasts show the expected growth of up to 6 percent on an annual level. Growth depends on the unstable phases that are the causes of terrorist attacks, as well as the development of the global economic crisis, which is still ongoing. Aircraft manufacturers Boeing and Airbus, according to the ordered aircraft, give a forecast of an increase in air traffic of up to 5% by 2023. [1] According to EUROCONTROL's forecast, the expected traffic growth rate is from 3.5 to 4.5% per year. The rapid development of low cost airlines in 2015 had approximately 45% coverage of the European market. According to statistical analyses, today over 4.5% of the world's gross product is brought by the aviation industry, 45% of passengers belong to the category of tourists. As a result, there is an increasing increase in air traffic at airports, which has increased five times in the last 30 years. [2] There are over 450 registered airports in European airspace; 130 companies and 60 air traffic control service providers. The operational implementation of "Enroute" air traffic, as well as in the terminal and airport zones, serves around 16,700 air traffic controllers in the European area. The daily number of flights in the complex structure of the ATM under the jurisdiction of EUROCONTROL airspace is conducted from 26,000 to 38,000 flights per day.

Complexity can be defined as a situation that is difficult to analyze and resolve, as the state of difficulty of an operation or task. The current European airspace is divided according to national borders into the provision of air transport services that can represent a limited space for the development of the European space through the design and implementation of optimal and satisfying user needs. The current airspace is divided into areas:

- In-flight information areas Flight Information Regions (FIRs),
- Upper Flight Information Regions (UIRs). [3]

Each airspace has its own specifics in the provision of air transport services as well as limitations for the design and implementation of European airspace in order to improve cooperation between service providers regardless of national borders.

The goal of the introduction of the Functional Airspace Block (FAB) is to increase the efficiency of air traffic through the improvement of the air traffic integration process as well as the goal of streamlining the airspace organization which will result in increased performance goals in service provision.

Factors of airspace complexity have a significant impact on the elements of air traffic control services. EUROCONTROL's model of complexity considers internal and external factors that affect the workload of air traffic controllers, and thus the efficiency of air traffic in the area of competence.

By internal factors we mean:
1. organization of airspace,
2. route structure,
3. airspace sectorization. [4]

In the factors of complexity as internal factors we take into consideration: Operational and technological concepts, which are used. Under external factors we consider:

- characteristics of traffic in the area of jurisdiction
- external constraints that affect operation

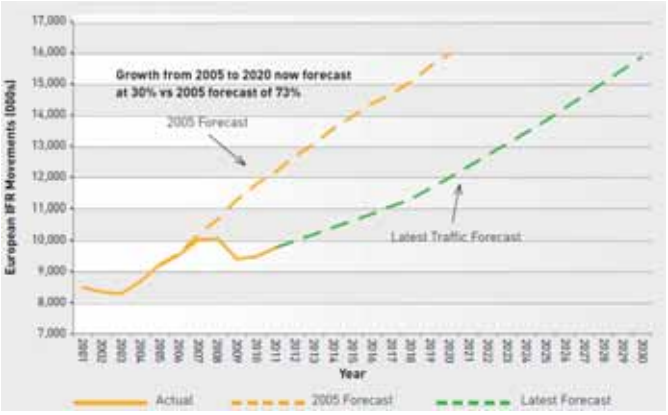

Figure 1. Overview of the increase in air traffic in the period from 2005 to 2020 [11]

Considering internal and external factors, we can conclude that the workload can be flexible, more or less depending on the applied above characteristics and limitations that affect the work as well as the layout of airways, their complexity, traffic schedule in time and space - sectoral configurations of operational procedures and concepts in order to separate aircraft.

The characteristics or factors may be affected by various restrictions on the use of airspace of jurisdiction, such as: military zones or restrictions on the use of certain parts of the day, month or year. All this affects the workload of the area of competence, work sectors, as well as air traffic controllers. A larger number of aircraft contributes to the reduction of unit labor costs. [7]

Considerations of indicators for assessing the complexity of traffic - complexity we can consider the requirements for altitude change during the summer, the number of airports nearby, as well as the number of conflicts. Factors for estimating the level of traffic flow are influenced by: unplanned aircraft, planned aircraft at certain time intervals, spatial and temporal number of aircraft, time required to fly through the sector and as a recorded number of conflicts. [5]

Unplanned aircraft are all those aircraft that have not completed the flight plan to fly through certain FIRs (sectors). These include aircraft that must be on their route due to weather conditions, cumolonimbus, meteorological fronts, strong altitude wind, turbulence zones, emergency restricted zones on the route; to use unplanned neighboring FIRs to fly to the destination.

Planned aircraft are all those aircraft that have completed and received approval for the planned-requested flight plan. [4]

STRATEGY FOR REFORMING AIR TRAFFIC CONTROL IN EUROPE

Reforming traffic control is absolutely crucial. The Association of Airlines of the European Region (ERA) agrees with this, but they point out that the changes are taking place at a very slow pace. The problem is reflected in the fact that the authorities of the EU member states are slowing down the improvement of the unified air traffic management system. In 2004, the European Commission presented a plan for more efficient flight management in Europe through the Single European Sky initiative. [9] This implies that air traffic control is not divided by countries, but by regions, the so-called functional air traffic blocks. In addition, the exchange of research and technology through the European program SESAR for research and development of European airspace is planned. A new generation of air traffic control technology has also been developed, which began to be applied in 2014. The EU initiative also envisions coordination with the US next-generation air traffic management system, in order to better manage overseas routes.

CREATING A SINGLE EUROPEAN SKY (SES)

In order to rationalize the organization of airspace to achieve and increase performance goals in the provision of services to airspace users and their expectations, the idea of creating a single European sky - Single European Sky (SES), through the establishment of FABs, all in order to improve safety , efficiency of capacity increase, lower costs of services, as well as reduction of environmental pollution in the area of competence. The fragmentation of airspace (a large number of national air traffic control providers) also affects the safety of air traffic in the area of jurisdiction, reduces airspace capacity, increases costs (employed licensed personnel in the provider, technical equipment in air traffic control, equipment maintenance), affects the whole process of work. In accordance with the above, appears the idea of uniting certain countries-providers in air traffic control in blocks from several countries in the European Union. [8]

The SES program includes national air traffic control service providers in Europe and plans to establish a common and unified airspace. In order for the program to be acceptable, consent at the level of national requirements of the provider is required, as well as the implementation of national, regional and global operations. Europe's airspace is seen as a common good that should

be jointly managed in order to have a single airspace with maximum optimization of systems and processes in order to satisfy all users.

Regardless of the fact that in the European Union airspace is considered as a common resource, in most cases it coincides with state borders and as such it is managed through the function of airspace management (Airspace Management - ASM). This way of airspace management reduces capacities, and thus increases the costs of airspace users.

With the establishment of FABs, there has been an improvement and increase in safety, an increase in the capacity and efficiency of the system as well as lower costs of service providers - improving the overall efficiency of air traffic management and air navigation services in Europe. Due to the reduction of capacity, security and increase in the costs of airspace users, the integration of upper airspace within Europe has started. With the main goal: reconstruction of the airspace in the function of air traffic flows, creation of additional capacities, as well as increasing the efficiency of the ATM system - creation of FAB. FAB is defined as an air traffic block based on operational requirements that are established regardless of national borders, in which the provision of air navigation services and related functions are optimized or integrated. The introduction of FABs enables optimal use of airspace, as well as air traffic flows. This is conditioned by the ECAA agreement. This is a multilateral agreement on the establishment of a common European airspace, which provides for the harmonization of domestic regulations with European Union regulations in the fields of aviation security, safety, air traffic management, airport management, protection of passengers and other users of air traffic services, air markets liberalization, the prohibition of state aid and environmental protection. [10]

Given that the aim of the FABs is to enlarge the airspace to operational requirements that is established regardless of national borders, in which the provision of air navigation services and related functions are performance-driven and optimized in order to, in each functional block introduced improved cooperation between air navigation service providers or, where appropriate, an integrated (joint) service provider. FABs are, among other things:

- supported by a security study,
- enable optimal use of airspace, taking into account the flow of air traffic,
- ensure compliance with the European route network established in accordance with Article 6 of the Airspace Regulation,
- justified by total added value, including optimal use of technical and human resources, based on cost-benefit analyzes;
- ensure the smooth and flexible transfer of responsibilities in the field of air traffic control between air traffic service units,
- ensure coherence between different airspace configurations by optimizing, inter alia, current flight information regions,
- compliant with the conditions arising from regional agreements concluded within ICAO;
- in accordance with the regional agreements in force on the date of entry into force of this Regulation, in particular those signed by a third European country,
- aligned with performance targets at Community level. [12]

Formation of functional airspace blocks

The SES regulation requires the formation of FABs at least in the upper airspace of Europe and the ICAO AFI region above FL 285. There are currently nine FABs:

- AB FAB Baltic - Poland, Lithuania,
- FAB Blue Med - Italy, Greece, Cyprus, Malta (Tunisia, Egypt and Albania as associates and Jordan as an observer),
- AB FAB Danube - Bulgaria, Romania,
- FAB Central Europe - Austria, Czech Republic, Croatia, Hungary, Slovakia, Slovenia, BiH,
- FAB Europe Central - France, Germany, Switzerland, Belgium, the Netherlands, Luxembourg and the UK as associates,
- FAB NUAC - Denmark, Sweden,
- AB FAB NEFAB - Norway, Finland, Estonia, Iceland, Denmark, Sweden,
- AB FAB SW Spain, Portugal
- FAB UK-Ireland - UK, Ireland. [6]

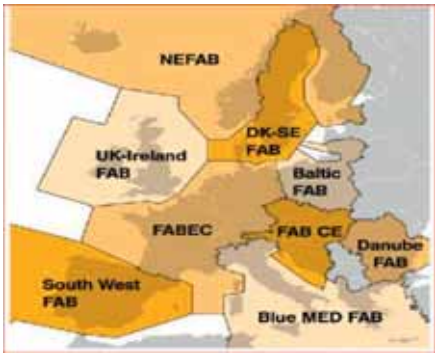

Figure 2. Schedule of FABs according to SES regulations [5]

Several countries are not members of any FAB initiative, Serbia, Montenegro and Macedonia. Serbia, Montenegro and Macedonia are signatories to the ISIS project, which aims to implement the SES program in Southeast Europe.

4. CONCLUSION

The expected airspace, as well as the pressure of airlines for shorter routes and reduction of delays in air traffic, has developed the need for a new organization of airspace, and thus the provider. It was concluded that the establishment of SES regulations in European airspace is needed in order to improve ANS performance. FAB is defined as an airspace block based on operational requirements for the provision of air navigation services and performance management and optimization functions, through improved cooperation in a functional airspace block among air navigation service providers and integrated service delivery regardless of national borders. The above requires the interoperability of functional, technical and operational characteristics of the constituent elements of the technical systems used in the provision of air navigation as well as their operational procedures for the purpose of safe, continuous and operational work within the FAB. IT integration of all systems used during operation is a prerequisite for achieving all set goals of increasing the efficiency of ATM systems.

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The length of each paper, including the abstract and references may not exceed **7,500 words**; that is, a paper that is only text should contain no more than 7,500 words. Each figure, photograph, or table accompanying the text counts as 250 words. For example, if two figures and three tables are submitted, the text may be no more than 6,250 words.

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Each paper must have an abstract. The abstract must be no longer than 250 words, it must be self-contained, and it must not require reference to the paper to be understood. In some cases, only the abstract of a paper is read; in other cases an abstract prompts further reading of the entire paper. The abstract should present the primary objectives and scope of the study or the reasons for writing the paper; the techniques or approaches should be described only to the extent necessary for comprehension; and findings and conclusions should be presented concisely and informatively. The abstract should not contain unfamiliar terms that are not defined, undefined acronyms, reference citations, or displayed equations or lists.

Following the abstract, about 3 to 5 **key words** that will provide indexing references to should be listed.

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Margins: 25.0 mm (1 in.) top, 30.0 mm (1.25 in.) left, 25.0 mm (1 in.) botton and 25.0 mm (1 in.) right. Paper format is A4.

Font (typeface): Times New Roman, no smaller than 10 points.

Numbering: Insert page numbers at upper right of each page; insert author's name(s) at upper left of each page.

Text: Single space

Paragraphs: Indent first line 1.27 mm (0.5 in.); do not use an extra line space between paragraphs; do not indent first line after a subhead.

Subheads: All subheads should be flush with the left margin, with one line space above.

FIRST-LEVEL SUBHEAD
(all capitals, boldface, on separate line)

Second-Level Subhead
(initial capitals, boldface, on separate line)
Third-Level Subhead
(initial capitals, italic, on separate line) **Fourth-Level Subhead** (initial capitals, boldface, on same line as text, with extra letter space between the subhead and text) *Fifth-Level Subhead* (initial capitals, italic, on same line as text, with extra letter space between the subhead and text)

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Indent first line 12.7 mm (0.5 in.); do not indent for text runovers.

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TABLE 5 Effects of All Factors
(Insert title above the table; "Table" is all capitals; title is initial capitals; all type is boldface; extra space but no punctuation after number; no punctuation at end of title.)

FIGURE 3 Example of results.
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Body of paper

The **Introduction** should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of disciplines.

The **Materials and methods** should be complete enough to allow possible replication of the research. However, only truly new research methods should be described in detail; previously published methods should be cited, and important modifications of published methods should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail.

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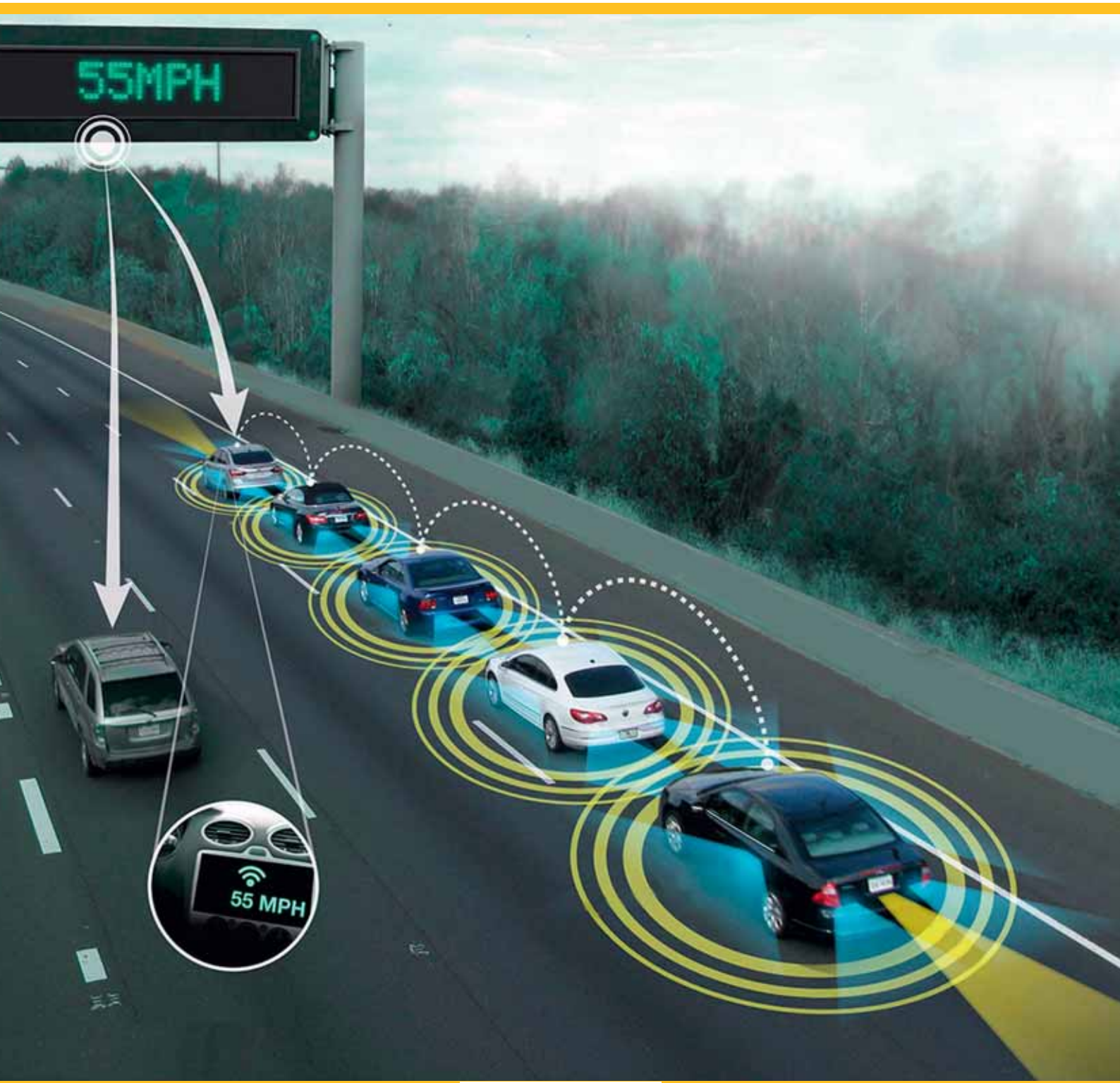

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