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INNOVATIONS OF TRANSPORT.

PROBLEMS, EXPERIENCE, PROSPECTS

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IMPROVEMENT OF MICRO-LOGISTIC CONTROL SYSTEMS OF TRANSPORTATION PROCESS AT INDUSTRIAL PLANTS

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Nowadays based on scientific research the several functional areas of logistics distinguished: supply, industrial, distribution, sale, commercial, and transportation [1–7]. The plant transportations control systems may be considered as a part of transportation logistic. Supplying of the main manufacture needed materials and accessories “just in time” with a necessary amount and range, maximum state to be ready for usage, on the definite workshop sites under conditions of minimal consumption of workers, materials, and energy resources is the main purpose of the plant transportation control systems.

To improve the micro-logistic systems of industrial plant transportations it recommends considering and exploring the following aspects:

1. **Technical facilities.** Trends in technical facilities framework and amount are studying. Packing materials and vehicles are choosing (logistic system technical supply).

2. **Transportation process:** volume of transportations forecasting; the prospect of various transport modes applying; transport vehicle fleet in time and by power usage; the vehicle cargoes delivery between origin and destination points on pendulum routes; preliminary gathered small-part cargoes delivery on distribution routes; inter-workshop cargo delivery with vehicle routes optimization.

3. **Mathematical models** developing for the cargo delivery processes optimization.

4. **Distribution chains:** from manufacturer to the consumer directly; distribution from plant warehouses to production workshops through specialized supply department.

5. **Impact of transportation process and distribution chains on micro-logistic system framework.**

6. **Warehousing, preparing, gathering, and loading of cargoes.**

7. **New approaches to the transport-technology processes.** Analysis of technologies in control systems of industrial transportation implies to consider following questions: comparison proposed changes to traditional technologies; functionality distribution among departments and performers; demands for transportation, storage, preparing, handling, information flows, stuff qualification, ecology; factors which may be obstacle or promotion;
effects of logistic changes in certain departments and for the industrial plant at the whole.

8. **Stuff and its readiness** to work in changed conditions of the improved logistic system.

As result of the analysis, the key points reveals in existing micrologistic system. There are six categories of micro-logistic system improvement process: transport service, distribution, delivery planning and transportations control, information systems, management framework, stuff. Improvement impacts for each category involve various procedures and noted below.

**Transport service**: enhancement list of services, transport facilities standardization, preparing cargoes for transportation.

**Distribution**: automatic cargo stocktaking at the warehouses; automatic demands handling; automatic materials distribution with considering its presence.

**Delivery process planning and transportations control**: warehouse inventory management, vehicle types optimization; delivery cycle reduction (daily or weekly planning instead month planning); optimal routing, timetabling and dispatching of the transport process.

**Information systems**: computer support of delivery planning and cargo handling operations; information workflow automatization and paperless technology usage.

**Management framework**: Specialized department of industrial plant needs to be obliged on operations of material flow control (for instance, marketing or logistics department).

**Stuff**: awareness by the stuff of objectives importance for the industrial plant; proper stuff education; high-level of stuff transferability.

Improving procedure of integrated micro-logistic control systems which deal with transportation processes at the industrial plants should be divided into eight stages:

1. Awareness of micro-logistic system necessities.

2. Objectives definition (system features) which are aimed at the satisfaction of revealed necessities. This definition focuses on the finite consumer, i.e. production workshop.

3. Scientific research: analysis and forecasting of freight flow dynamic, novel solve methods of logistic tasks with the aim of micro-logistic system improvement; information gathering needed to actual tasks solving.

4. Scheduling of the tasks that required for purpose achieves and programs realization.

5. Costs calculation and resources distribution by tasks that need for purpose achieves.
6. Organization policy of micro-logistic system development: principal decisions design, common rules of behavior initiation, guidance and directives preparing.

7. Technological preparation of warehouse handling and transportation operations; guiding materials design; issuing of orders to decision support systems (DSS) provide.

8. DSS setup: arrangement and computer software for logistic tasks solution, technical maintenance of PC and computer networks.

Improvements of micro-logistic control systems that deal with transportation processes at the industrial plants allow getting a significant economic benefit. For instance, implementation of the workshop delivery micro-logistic system at metallurgical plant “Zaporizhzhal” with warehouse stock management has allowed:

1. Significantly reduce freight mass, which keeps at the warehouse stocks, through coordination of delivery and consumption processes.

2. Output production volume increased due to release free space at the plant territory which before used for cargo storage.

3. Manufacturing interruptions because of materials deficit emerges were eliminated.

As a result, the annual economic benefit is 1.282,000 UAH.

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THE DECISION-MAKING MODEL ON CARGO FLOWS MANAGEMENT IN PULL TYPE LOGISTICS SYSTEM

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Under current economic conditions Ukrainian manufacturing enterprises are under the influence of large number of macro and business risks, which can’t be taken into account on the production planning stage especially in pull type production logistics systems. That is why cargo flow management in pull type logistics system in real-time is relevant.

For the successful functioning of pull type logistic system in the conditions of uncertainty, it is necessary to provide quick scientific based decision-making on:

1. The optimal quantity of orders in system in daily production schedule working out. In this case the alternatives are quantity of orders cards. Evaluation of alternatives is carried out on logistics costs criterion. The model was fully described in [1].

2. The decision on the optimal parameters of cargo flow in case of accidents such us: production facilities breakage, urgent orders receiving, industrial transport failures.

The task of second type of decisions described on example of one type flow moving between two stages or workshops. The alternatives for decision making are pairs of cargo flow parameters – demand rate (μ) and production rate (λ). It is necessary to define which pair of cargo flow parameters will ensure a minimum level of logistics costs and fulfillment of a given production plan.

The production rate is number of cargo units produced and transported per unit time. Production rate is in frame of real and design workshops...
productivity. To prevent production overloading, it is necessary to maximize production rate to real workshop productivity.

The demand rate is number of requests for cargo units from receiving workshop to production workshop. It is more suitable to apply the inverse demand rate index, which is time between demand request. This index should not exceed the tact time of production workshop taking into account time for transportation and loading and uploading operations.

The main stages of decision-making model on optimal parameters of cargo-flow in pull-type production system are:

1. Setting the initial data, which are: demand rate, production rate, number of orders, inventory storage buffer capacity.
3. Calculation of insurance stock [3].
4 Setting of membership functions of terms of internal and external linguistic variables. The internal linguistic variables are criterions of alternatives evaluation: work-in-process, waiting time, percentage of served demand, percentage of immediately served demand. And the external linguistic variable is logistic costs.

Membership functions of linguistic variables are based on five terms: very good, good, satisfactory, bad, very bad, and are set by two parameters: membership function center and width. The type of functions is Gaussian. The approach to Membership functions building was developed and described in [1].

4. Setting fuzzy inference rules base based on logical operator AND.
5. Calculation of external membership functions values for all alternatives – pares (λ, μ).
6. Choosing alternatives (pares of demand rate and production rate) on the criterion of maximum value of external linguistic variable “logistics costs”.
7. The final choosing of alternative on the criterion of optimal production capacity.

Intelligent decision support systems for cargo flow parameters management based on described model will allow to instantly adjust the production schedule in cases of: production failures, when the production has been suspended for some time, and comply with the production schedule with minimal logistical costs in the system; necessity to increase number of production units in case of urgent orders appearance.
FORMING OF MODEL OF RISK MANAGEMENT AT THE SWITCHYARD STATION AT OPERATING RAILCARS WITH DANGEROUS GOODS ON THE BASIS OF RISK EXPOSURE

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Switchyard stations (SS) are one of major elements of the railway freight transportation system, that is why actual is a question of development of modern technology of management of operative work of SS, in particular in the conditions of risk that is related to transporting of dangerous goods (DG).

Development of modern technology of management of marshalling yards is possible only on condition of realization of quality transition from information systems to automated control systems that is able to solve complex mathematical problems real-time for the timely forming of decisions. However it should be noted that a SS is the extraordinarily complex system, that is not only functioning in the conditions of permanent change of operative situation but also operates objects, that can be the source of different sort of dangers, a level of that, besides, can be very high. These objects include, first of all, wagons with DG.

For the technology of control of SS, the necessary conditions are not only the implementation of the principles of automation and logistics to save resources, but also the implementation of the concept of security.

Thus, at the first stage of the formation of automated control technology for SS, the task of creating a security concept and formalizing it in the form of a proper mathematical model is relevant.
To obtain a model of operative planning of the station’s operation, provided that the risks are reduced, it is necessary to carry out a procedure for quantifying its parameters. In order to assess the degree of danger, it is expedient to use the notion of technical risk, which in the context of solving this problem can be presented as a product of the probability of an accident with railcars with DG and valuation of its consequences.

The next step is to construct a mathematical model that uses a modern mathematical apparatus, such as Bayesian nets, and allows to comprehensively and accurately calculate risks at any given time, taking into account all available current information. By applying this model to a certain time interval, for example, the planned period of SS operation, and using forecast information, it is possible to obtain a time-dependent risk function.

The purpose of using such a function is the operational planning of SS work in order to reduce the risk associated with the presence of railcars with DG to the SS during the planning period.

For a case where there is only one railcar with DG in the SS, such planning is reduced to minimize the total railcar’s downtime at station, and especially the period when the probability of an accident is maximal.

If there are several such railcars, then the model should be complicated, because there is an additional probability of an accident with one railcar due to the occurrence of an accident with another. However, the mathematical apparatus of Bayesian nets, which is expedient to use in constructing the model, allows an adequate assessment of the probability of an accident for each railcar separately, and if, besides the railcar with DG, there is another railcar with DG that could cause the accident of this car, then the probability of an accident for the participation of the first railcar is increasing by the magnitude of the probability of an accident caused by an accident with an adjacent carriage. If there are several such railcars, then this contribution to probability is even greater.

The main task of risk management at the sorting stations during operation with the railcars with DG is the priority and acceleration of the processing of the trains in which they arrived, the acceleration of the formation of trains and the departing of these railcars from the station. The more dangerous a load is, the more time it is necessary to reduce the time spent by such railcars at the station. It is also necessary to avoid the simultaneous presence of a large number of such railcars at the station, or to reduce as much as possible the duration of this time, as well as to make it impossible for them to stay at the station in close proximity, if possible, to reduce the probability of a chain reaction occurring in the event of an accident with one of wagons. In order to describe and formalize these states, it is proposed to use the term "risk exposure" [1, 2]. This term only begins to enter the sci-

Scientific lexicon. Some risk researchers in the technical fields use it in scientific articles, referring to its similarity to the notion of that exists in the field of finance and business.

But these two terms have significant differences, because the term "risk exposure" implies the presence of the subject at risk only through deliberate choice and the display of activity, for example, to generate additional income. The danger to industrial sites is directly related to technological processes and is always present, usually it can not be completely avoided, but it is necessary to reduce its influence. Common in these terms is that they, besides the probabilities and magnitudes of possible losses, also take into account the time interval of the risk. Thus, in our case, the exposure of danger is the presence of an object under the influence of factors that may cause accidents. According to this logic, for two time intervals of the same duration of exposure, but of different magnitude of risk, the exposure of the danger will be greater where there was a greater risk. This process is analogous to the mechanism for obtaining a dose of radiation.

Accordingly, risk exposure is the main criterion for managing the risks associated with the transport of DG, while implementing the operational control of the technological process of SS. That is, risk exposure is an integral over time of a generalized risk function:

$$\mathcal{E} = \int_{t_0}^{T} R_\Sigma(t) \, dt,$$

where $T$ is a planning horizon (in minutes from the beginning of the planning period);

$t_0$ – start time of the planning period;

$R_\Sigma(t)$ – generalized risk function from time.

Thus, the task of managing risks when working with railcars with DG is expedient to solve at the stage of operational planning by optimizing the order of performing operations with trains and railcars at the SS, minimizing risk exposure.

References:
RECOMMENDATIONS ABOUT ACCEPTING OF MANAGEMENT SOLUTIONS FOR FUNCTIONING OF THE LOGISTICS SYSTEM OF SUGAR BEET DELIVERY

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The process of functioning of the logistics system (LS) on delivery of sugar beet during harvesting belongs to the difficult category. Therefore, it is necessary to use an integrated approach for receiving full-fledged assessment of current state and level of the organization. It must be based on analysis parameters which connected with questions connected with economic (efficiency) and technological (reliability) parameters of this kind of systems.

This category LS includes five large subsystems such as: the agricultural enterprise, a temporary warehouse, the motor transport, the sugar plant and the logistic center. That's why the management of the system of similar size must be coordinated by time parameter. It is necessary to develop and to accept the correct management decision in due time. This fact gives a chance to achieve optimum results for ensuring delivery process of sugar beet during the peak period by using quality transportation and logistics.

Therefore, from the point of view of system approach, the influence of management in this LS must increase in reliability and must decrease in component of expenses during a functioning of each element of the system. That's why a new type of an algorithm must be used to decide such problem. It consists of four blocks:
- the probabilistic block for defining of cargo's volume on each part of a supply chain;
- the block for definition of time to an exit on the planned transportation volume of cargo;
- algorithm of assessment of functioning reliability of LS;
- the block for assessment of specific expenses of a logistics system.

For start the calculations of the first block will be used the parameters from entering such as: productivity of $W_i$ of each of participants, $t_{3M_i}$, the period of working time and the quantitative parameter $N_i$ – number of units of the harvesters, mechanisms and equipment for loading and unloading of cargoes or the transport necessary for ensuring normal work of each of elements in the considered system.
When the second block will be used, the technical and operational parameters of work of the automobile transport and planned volumes of sugar beet which will pass across each part of LS must be considered.

The coefficients characterizing "a firmness stock" and "sensitivity" of a logistics system are result of calculation of the second block. The second result received following the application of this algorithm is expressed as the constants of time which characterized inertia and delays in work of elements of LS.

The third block provides definition of parameter of reliability of a logistics system on delivery of sugar beet. The assessment of result is using the volumes relation of processing for each participant of supply chain to necessary at the plant. The value of this parameter has to aspires to unit in ideal option. That's why all potential volume of transportation and possibilities of the processing of each part of a logistics system must be equal among themselves. Therefore, if the value of coefficient equal 1, that's will demonstrate absolute reliability of LS.

This indicator is one of the entering parameters when fourth algorithm is calculating in total. Based on the received results the management decision on numerical structure of the park of vehicles and nominal capacity of loading for the automobile is made.

Similar approach will allow to minimize specific cost from functioning of LS on delivery of sugar beet and will increase a value of reliability parameter for each element of the system also.

**References:**


When modeling traffic flows through the intersection of the street-road network (MAC), the most difficult task is to simulate the behavior of the driver, because it does not give in to any precise mathematical description, depends on virtually unlimited number of factors and even on the same the driver can significantly change over a relatively short period of time, for example, one trip.

A number of approaches to solving this problem are known:
- All drivers behave identically and in a disciplined manner; the "average" driver is modeled [1];
- Drivers behave differently within any constraints (for example, the method of boundary intervals) [2];
- the method of boundary intervals, in which for some predetermined part of the drivers the values of the boundary intervals change [3].

Known approaches allow only a very approximate simulation of the behavior of drivers, which is acceptable in solving a number of problems, for example, when modeling in the process of designing the road traffic organization (ODD) at separate intersections or relatively small areas of the MAC.

Earlier, the authors proposed a method for simulating driver behavior using the "resoluteness" coefficient of the form

\[ K_p = \frac{\tau_T}{\tau_\phi}, \]  

where \( \tau_T \) – theoretically the necessary time interval for performing the desired maneuver, \( \tau_\phi \) – actually selected and evaluated by the driver as sufficient.

In this case, each driver of the car standing first in the queue before the intersection, the value of \( K_p \) is assigned as a random variable, taking into account the experimentally obtained probability distribution of the \( K_p \) values for this type of intersection and the type of maneuver. In fact, this method is a "method of sliding boundary intervals", since for each driver, its own boundary interval is determined based on the decisive factor assigned to it as
It is obvious that in the construction of traffic flow patterns taking into account the behavior of drivers according to the proposed method, the most laborious is obtaining experimental distributions of the probabilities of the values of Kp. The value of $\tau_T$ for (1) can be easily obtained from the geometry of the intersection and the trajectory of the movement of cars when the desired maneuver is performed from the relation

$$l_{Tp} = \frac{j\tau_T^2}{2}.$$  \hspace{1cm} (3)

where $l_{Tp}$ - trajectory length during maneuvering. $j$ - acceleration of the vehicle during maneuvering.

The value of $\tau_\phi$ for (1) can be determined by processing the video of the motion of the streams at intersections. To illustrate the procedure for video recording in Figures 1, 2, 3, video snapshots are recorded at the moment when the car's mobile starts moving a (Fig. 1), with the exit to the main road and the left turn (T-shaped intersection at UDS of the city of Kharkov "ul.") At the moment of completion of maneuver by car a (figure 2) and at the moment of arrival at the point of completion of maneuver by car a of car b driving along the main road (Fig. 3).

![Fig.1. Freeze frame of video shooting at the moment of the beginning of movement by the car a and with you on the main road](image-url)

Displacement of the images is carried out in accordance with the personnel. If from the position of Fig. 1 to the position of Fig. 3 the image is shifted by n cadres, and the shooting frequency is 24 frames / second, then

$$\tau_{\phi} = \frac{n}{24} \text{ (sec)} \quad (4)$$

The values of Kp obtained from (1) with allowance for (4) are plotted over intervals and histograms of the probability distribution of the values of Kp for a left-handed flow are plotted (Fig. 4).
At the request of developers of models for the motion of transopt flows, the Kp interval can be reduced, for example, to 0.05, 0.025, etc. Along with the above method, the histogram of the kind shown in Fig. 4 can be obtained for other types of maneuver: right turn, intersection of the main road, overtaking, etc. With the help of such histograms, the values of Kp for each car in the flow can be specified using any known random number generator.

The proposed method of simulating the driver in traffic models makes it possible to approximate the accuracy of simulation to the real variety of behavior of drivers, and, consequently, to increase the adequacy of models.

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KEY EFFICIENCY INDICATORS IN THE LOGISTICS SYSTEM AS A FACTOR OF INCREASING COMPETITIVENESS FOR AN ORGANISATION

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Due to the emergence of market relations in recent years, a new scientific and practical direction - logistics - has been established and actively developed. This can be explained by the significant results that have been gained due to the application of a logistic approach in the economy of developed capitalist countries. Logistics has become a business tool for such well-known corporations as IBM, Proctor & Gamble, General Motors, Ford Motors, Johnson & Johnson [1].

Today, in a century of fierce competition, the problem of satisfying the needs of the client comes first when determining the effectiveness of the company. For this reason, it is necessary to measure the performance of logistics operations in order to know precisely what benefits it brings to customers.

So, if a company does not provide timely delivery of supplies and is not interested in the reaction of customers, then the increase of the number of orders is unlikely. If the accuracy and speed of deliveries are more important than prices for customers, they will contact another supplier [2]. The firm must contend for each client, otherwise, in the future, there may be problems with determining the choice of the development path, therefore, logistics in an enterprise should pay attention not only to the internal environment of the enterprise, but also to the external one.

In order to build a working KPI system, the organization must establish measurement standards. KPI (Key Performance Indicator) is an indicator of success in a particular activity or in achieving specific goals. It can be said that KPI is a quantifiable indicator of the actual results achieved.

In the ELA terminology, the term «KPI» is a key indicator of the effectiveness and efficiency of logistics as an activity, which refers to relatively easy-to-use indicators that allow the logistics plan to be implemented along with the basic functions of product flow management (marketing-sales, production-logistics plans).

During the development of logistics in industrialized countries, a system of indicators has been formed that generally assess its efficiency and effectiveness, which generally include: general logistics costs, logistics service quality, logistics cycle duration, productivity, return on investment into logistics infrastructure.
These indicators are called key or complex indicators of the effectiveness of the LS (Logistics system). They are the basis of reporting forms of companies and systems of indicators of logistics plans on different levels.

There are common procedures of comparative evaluation of businesses (benchmarking) in the field of logistics based on analytical and expert methods that use these integrated indicators. Key complex indicators of the effectiveness in LS are called the main measurement of the effectiveness of the use of resources in the company for the formed LS, which in the complex assess the effectiveness of logistics management. They are the basis of logistics planning, accounting and control [1].

The problem of developing methods for defining and applying key performance indicators in the area of competitiveness has recently been very relevant.

Thus, for the successful application of logistics potential in the organization's competitiveness, the task of developing a methodology for determining and applying key performance indicators in the field of quality is still relevant.

References:
THE CONCEPT OF CREATING A NEW GENERATION CONTROL SYSTEM

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The aim of the Ukrainian railways to ensure high-speed traffic and increased traction of locomotives requires the modernization of the existing rolling stock and the development of promising systems for improving the economy, energy saving and traction and braking qualities of locomotives.

One of such systems is the sand system, designed to improve the coefficient of traction of wheels with rails and reduce the likelihood of skidding and slipping. The study of sand system designs and their work allowed identifying the main disadvantages that adversely affect the locomotive and track economy, and also negatively affect the ecology [1]. Given these disadvantages, the authors developed, tested and brought to prototypes two promising directions for controlling the traction of wheels with rails [2, 3]:

1 – modernization of the existing sand system, which allows to perform a jet-abrasive action on the rolling surface, while in a pulse form, regulate productivity and, thus, reduce the consumption of abrasive material by 3-7 times, depending on operating conditions;

2 – control of the thermomechanical loading of the local tribological contact, which consists in cleaning and cooling the contacting surfaces with the latest systems - a two-phase flow of dry ice granules and forced cooling with compressed air using a Ranque-Hilsch tube to achieve a stable contact temperature.

Obvious advantages of the second direction, contribute to its increasing distribution, both in the industrial sphere and in the service sector.

Efficiency and intensity of purification by dry ice granules are provided by three effects: mechanical – in a compressed air flow, dry ice pellets act on the surface at a speed of about 100 m/s, performing removal of contamination; thermal – the heat exchange between the surface and the ice granules causes sharp local cooling and brittleness of the contaminants, causing thermal shock; sublimational – through the formed cracks the granules of dry ice penetrate into the layers of contaminants and sublimate in them with more than 400-times expansion, due to a sharp change in the phase state, as a result of which a rarefaction wave forms and a complete separation of the contaminants occurs.

Dry ice cleaning of the surfaces of the wheel and rail from the «third body» has the following advantages: dry ice is an environmentally friendly solid phase of carbon dioxide (CO₂) with a temperature of -79 °C, due to
these unique properties, after heating, it sublimes (evaporates) into the atmosphere, does not require the recycling of secondary waste, dry ice granules are not capable of damaging surfaces that, after sublimation of the granules, remain dry, does not reduce the adhesion coefficient due to water and does not affect the chute electrical equipment and void it. The expediency of using dry ice granules is confirmed by laboratory tests, analysis of fundamental and applied works, which indicates that this method is the most effective for cleaning surfaces covered with oil contamination [4, 5, 6].

Patents for useful models and inventions of Ukraine were obtained by the authors on the developed directions. Scientific and industrial organizations are being searched for joint research, prototyping and participation in grants.

References:
1. Kovtanets M.V. Improvement of the adhesion characteristics of the locomotive jet abrasive effect on the contact zone of the driving wheel and the rail Cand. Diss., Severodonetsk, 2015. 206 p.
EVALUATION OF ECONOMIC SAFETY OF IMPROVING THE RAILWAY VEHICLE BRAKE SYSTEM EFFICIENCY INNOVATIVE METHODS IMPLEMENTATION

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To increase the efficiency of decision-making on the implementation of innovative projects at a machine-building enterprise, a decision support tool is needed, which includes an assessment of the level of risks and economic security, which is carried out with the help of expert assessments, which increases the probability of a correct management decision.

The study of foreign experience has shown that investment in innovation activity of enterprises is on average a high-cost (profitable, justified), despite the significant risk of such investments and a long period of their payback. And investments in scientific ro-production bring the effect not only to a separate enterprise that produces them, but also to society as a whole [1].

Assessing the efficiency of investments in the innovation activities of enterprises, there is a risk that, when choosing individual innovations for such studies, it is necessary to consider those that ensured a high return on investments.

The main criterion for risk assessment in railway transport is the safety of movement during the carriage of cargo and freight depots. The level of security is taken to characterize the probability of the implementation of certain hazards and threats, phenomena and processes that arise and are accompanied by the formation of negative effects on man and the environment, that is, mathematical expectations of the most important types of damage [2, 3].

One of the methods that allows quantifying the risks of implementation, namely, to simulate random variables in order to compute the characteristics of their distributions, is the Monte Carlo method [4, 5, 6]. Monte-Monte-Monte-Carlo method allows us to construct a mathematical model for a process with uncertain parameter values, know if the probabilistic distributions of process parameters, as well as the relationship between the values of the parameters (correlation), and the distribution of the profitability of the project.

In the general case, the Monte Carlo method is a numerical method for solving mathematical problems by simulating random variables.

The scheme of using the Monte Carlo method in quantitative risk analysis is as follows: the mathematical model of the resulting index is con-
structured as a function of variables and parameters. Variables are random components of the project, the parameters are those components of the project whose values are predicted to be deterministic. The mathematical model is recalculated at each new simulation experiment, during which the value of the main uncertain variables is chosen randomly on the basis of the generation of random numbers. The results of all simulation experiments are combined into a sample and analyzed using statistical methods to obtain the distribution of the probabilities of the resulting indicator and the calculation of the main project risk meters.

The Monte Carlo simulation model is the development of a risk-based approach to risk analysis and can simultaneously be assigned to a group of theoretical-probabilistic risk analysis methods. On the basis of statistical data and expert estimates, analysts select the distribution laws of some of the components of the project, and, based on repeated imitation experiments with a given level of accuracy, one can determine the law of distribution of the resulting parameter and calculate its main characteristics: mathematical expectation, variance, mean square deviation.

Імітаційне моделювання складається з трьох етапів: побудова математичної моделі, здійснення імітації, аналіз результатів.

At the stage of construction of the mathematical model, the risk variables (random components of the project cash flows) are selected based on the re-typing of the elasticity and the estimation of the predictability of the variable, according to the available statistical data and expert information for each risk variable, the distribution law is selected, the conditions of the probabilistic dependence of variables.

The simulation is carried out using a specially designed computer program [9], which also contains calculations of the performance indicators of the investigated project.

The comprehensive approach to risk assessment implemented in applying the Monte Carlo method consists in the fact that the analyst gets different indicators: the distribution of probabilities of the resulting design variable; estimation of the average value, the mean square deviation and the coefficient of variation of the resulting indicator; any other specially designed risk meters (expected loss ratio, probability of implementing an inefficient project).

Important indicators of integral riskiness of the project are the index of expected losses and the probability of implementing an ineffective project. The results of the assessment of the risk of introducing innovative methods for improving the efficiency of the brake system of the railway vehicle are as follows: 74.3% - for cooling of the brake frictional contact supplying the
compressed air, 64.4% - for using the vortex effect, 62% - for using the heat-transfer inserts, 56.8% - for adaptive cooling system.

References:
POSSIBLE WAYS TO SOLVE ENVIRONMENTAL PROBLEMS OF URBAN TRANSPORT

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Transport is one of the most important components of social and economic development, absorbing a significant amount of resources and having a serious impact on the environment. Despite the importance of the transport complex as an integral element of the economy, it is necessary to take into account its very significant negative impact on natural ecological systems. It is known that these impacts are felt particularly sharply in large cities, increasing as population density increases. This pattern is also true for urban passenger transport [1, 2].

Today, ecology is becoming an instrument of integration in Europe and the world. By means of structural and regional planning it became possible to organize the transportation of goods, people and the delivery of energy using more environmentally friendly, cleaner means of transport and intermodal systems.

Transport flows are growing because of the spontaneous, disregarded rational planning, housing residential and industrial areas. Streams of cars filling the street network (by no means calculated on them) make traveling around the city during peak hours painfully slow.

The impact of various modes of transport on the urban environment is not the same. If the averaged ratings are constructed from the averaged data, then according to the increasing values of the negative influences it will look like this: the metro, trolleybus, tram, bus [3].

Measures to reduce the harmful impact of road transport (the main ways of development of vehicles in the interest of protecting the environment):

– improving the design of cars in terms of toxicity (design of filters, special neutralizers);
– Increase the level of maintenance (correct adjustment of the fuel system of the car) and improve systems and methods for monitoring the technical condition of machines;
– refusal to use leaded gasoline, transfer of petrol cars to other types of fuel (gas, biofuel, etc.);
– the creation of new, "clean" from the ecological point of view of cars (electric car, hybrid car, solar electric car, inertial engine car, ie not a battery, but a flywheel as an energy storage device) [4].
To contribute to solving the environmental problems of large cities can be through the displacement of passenger traffic from personal transport to public. For this, there are two global paths:

- Administrative measures that include the transition to public transport, the design of infrastructure and the development of standards, taking into account environmental aspects, training of trainers who train transport specialists;
- Increase of the environmental consciousness of the population.

Conclusion

The most significant factors of the negative impact of the transport system on human beings and the environment are pollution of the environment: noise, vibration, heat release, hazardous substances.

The main cause of environmental problems is the use of obsolete internal combustion engines, non-environmental clean fuel, abuse of life, mistakes in town planning.

To solve these problems, a technical upgrade of the transport system is necessary:

strict adherence to the rules of urban development;
- transfer of the transport system to environmentally friendly (gas turbine, electric vehicles), use of bio-based fuel;
- expansion of the landscaping zone of the massifs throughout the city;
- removal of cargo transit lines beyond the city limits.
- completely eliminate the through passage of transport through the residential quarter.

Recognizing the priority of electric transport based on environmental assessments, it is necessary to develop and implement a system of measures that significantly increase its competitiveness.

References:
The level of informatization of modern society is determined by the introduction and use of the latest information technologies, information and telecommunication systems, automated management systems, transport and logistics and information and analytical systems. These are the systems that have a direct impact on the defense of the country, the traffic junction, the safety of human life, the economy, education, science and the like.

The issues of ensuring information security of transport infrastructure facilities in the last few years are in the first place in all processes of the vital activity of the transport industry. A special role was played by transport safety in connection with the mutual integration of the Ukrainian and European markets and in a competitive environment.

When these systems function, information processing (its collection, introduction, fixation, transformation, reading, transmission, storage, destruction) is performed with the help of hardware and software and information and telecommunication systems that are part of the domestic and global network infrastructure.

Information security is the state of protection of vital interests of a person, society and the state, in which harm is prevented through: incompleteness, untimeliness and unreliability of the information used; negative information impact; negative consequences of the application of information technology; unauthorized distribution, use, violation of integrity, confidentiality and accessibility of information.

The complexity, multidimensionality and specificity of the information security problem, including in the information systems of transport logistics, makes it necessary to solve it only in a dynamic development - from the traditional protection of information in its processing systems to the integrated security of information protection objects which processed in institutions and organizations that constitute the service, commercial, professional, personal secret and other types of restricted access information.

The level of information security today is largely determined by the process of informatization of the modern world, and, as a consequence, the need for diverse protection of information, regardless of the location of its carriers; wide use of specialized transport and logistics systems and global information systems in the management bodies, accumulating and transfer-
ring huge amounts of valuable information and, at the same time, vulnerable to uncontrolled access to protected information, increasing the risk and danger of unauthorized impacts on information in these systems; the relatively large amount of danger of internal information threats, the widespread use by criminal structures of devices for secretly obtaining information, the inability to predict and identify these threats in a timely manner, correctly assess the danger and take adequate measures to eliminate them.

Security, as a state of security of the system, is determined by the presence of possible vulnerabilities of the system and threats aimed at its destabilization. The algorithm for assessing vulnerability data includes the following main steps (Fig. 1).

![Algorithm for assessing the vulnerabilities of transport infrastructure facilities](image)

Fig. 1. Algorithm for assessing the vulnerabilities of transport infrastructure facilities

The safety of the functioning of transport infrastructure objects depends very much on the nature of the objects and their interaction with the external environment. If you exclude cargo and vehicles from the concept of transport infrastructure, you can identify the following objects of information and transport security: transport routes (roads, railways, seas and rivers, air corridors, pipes) and transport and logistics nodes.

In conclusion, it should be noted that the security of transport infrastructure should be approached in a comprehensive manner. Only with the coordinated participation of several agencies it is possible to develop a system of measures, means and mechanisms for interaction of all participants in the transport process in the information security system based on the
principles of regulatory, software and cryptographic protection. When organizing such an information security system, it should be borne in mind that the concept of the security of the transport infrastructure is complex and combines the measures of both transport and information security, while the object to which the security action is directed should be considered as a structural object with various composite parts of different levels of organization and with different principles of functioning and management.

References:

METHOD OF AUTOMATED DETERMINATION OF THE LIMIT VALUES OF NAVIGATION PARAMETERS DURING VESSEL MOTION

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The most important problem on inland waterways (IWW) of Ukraine is the use of the instrumental navigation method (IMN). In order to achieve this goal, it is necessary to consistently solve a number of tasks related to the implementation of a divided information and telecommunication system. The most important step in solving the problems is the automated determination of the limit values of navigational parameters when navigating a vessel along a fairway channel.

The paper presents navigation parameters for solving the problems of safe navigation of a vessel and the functional stability of IMN with the
use of artificial intelligence, elements of fuzzy logic when using Inland ECDIS. Formalized safe navigation areas. The value of the permissible distance to the hazard is the variable and depends on a number of factors. Safe areas are represented graphically in the form of a circle, an ellipse, and a quadrilateral. To determine the boundaries of safe distances, map objects \((obj)\) on SENC (coastline, hazards, etc.) are considered as danger domains \((Dd)\) in the form of dangerous isobaths (Fig. 1). That is, the creating of Dd during vessel motion is set with loxodromic lines (geometric primitives).

\[
\{H_{SENc}(t) = H_0 + h(t)\} \in \{S_{Dd}(t)\} : H_{SENc}(t) \leq H_d + \delta, \quad (1)
\]

where \(H_{SENc}\) – actual depth on SENC; \(H_0\) – design level of water according to RIS data; \(S_{Dd}\) – danger domain area; \(H_d\) – draft of the vessel; \(\delta\) – safe margin under the keel of the vessel.

The basic mode of operation of Inland ECDIS is the relative motion mode. The relative course of the vessel \(K_0\) is the relative motion line (RML). To find the safe distances boundaries of the closest point of approach \(D_{CR}\), it is taken into account that an emergency occurs when RML crosses the centre of the screen or \(D_{min} < D_{CR}\). The limit value \(D_{min}\) is obtained when RML touches the Dd boundary. The Dd boundary changes only when the water level increases / decreases, in other cases it is const. Thus, the set of points of Dd can be considered as a special case of differences in targets.

\[
\forall \ obj \ \exists ! \ V_{Dd} = 0. \quad (2)
\]

Possible options for RML positions are defined, which cover three initial navigational situations
1) $\text{Cod} (B, D)_i = \text{const}, i = 1, 2, 3...n, K_S \parallel LRM, D_{\text{min}} > D_{\text{CR}}, f(x-x_0, y-y_0)_i \neq \text{const};$

2) $\text{Cod} (B, D)_i \neq \text{const}, i = 1, 2, 3...n, K_S \# LRM;$

3) $\text{Cod} (B, D)_i = \text{const}, i = 1, 2, 3...n, D_{\text{min}} > D_{\text{CR}}, f(x-x_0, y-y_0)_i = \text{const}.$

Hence the conclusion is made:

1) when changing the direction or velocity of radar signal at $K_S \& V_S = \text{const}$, it is impossible to make a definite conclusion about the type of target maneuver. The type of maneuver can be defined only with the mathematical processing of the primary radar image;

2) the turn-away of the vessel from the radar signal does not allow to estimate the effectiveness of this manoeuvre, as the relative speed of approach decreases, the $t_{cr}$ increases and as a result, a drastic change in the direction of RML is possible. This is defined only with the mathematical processing of the primary radar image.

The main type of orientation in the Inland navigation mode ECDIS is the vessel’s course orientation $K_S$. The mathematical models of the formalization of the location of the point's motion along the trajectories in various orthogonal coordinate systems [1] are defined in the paper.

1) Shifted Cartesian coordinate systems $X_10Y_1$ and $X0Y$;

2) Cartesian plane with a polar coordinate system.

Algebraic dependences are established on the limitation of variations for each coordinate system.

Possible situations are presented in this work. So, the coordinate system $X_10Y_1$ is rigidly connected with the vessel. Axis $0Y_1$ lies in the diameter plane and is directed towards the head of the ship, and axis $0X_1$ is in midship section and directed towards the starboard.

![Fig. 2. Definition of $D_{CR}$](image)
tion with the roll and pitch axes of the vessel. To calculate boundary bearings, an analytical expression for the safety area of obj and movable targets in the reference coordinate system XOY is defined. To do this, two more coordinate systems are introduced $X_1O_1Y_1$ i $X_2O_2Y_2$ (Fig. 3).

![Fig. 3. Relations between coordinate systems](image)

$$
\alpha = \arctg \frac{x}{y} = \arctg \frac{X_0 + b\sqrt{1 - \frac{x_1^2}{a^2}} \cdot \sin K + x_1 \cdot \cos K}{Y_0 + b\sqrt{1 - \frac{x_1^2}{a^2}} \cdot \cos K - x_1 \cdot \sin K}.
$$

For defining the bearings $\alpha_{\min}$ i $\alpha_{\max}$, we differentiate the expression (6) and then set the derivative to zero.

$$
\alpha_n = \arctg \frac{X_0 \pm b\sqrt{1 - \left(\frac{x_1(1)\sqrt{2}}{a^2}\right)^2} \cdot \sin K + x_1(1)\cdot \cos K}{Y_0 \pm b\sqrt{1 - \left(\frac{x_1(1)\sqrt{2}}{a^2}\right)^2} \cdot \cos K - x_1(1)\cdot \sin K} = \arctg \frac{\eta}{\mu},
$$

$n = 1, 2, 3, 4.$

$$
\text{det} = \left\{ x_1^{(1)\sqrt{2}} = -\frac{a^2cb}{a^2 + c^2r^2} \pm \sqrt{\left( \frac{a^2cb}{a^2 + c^2r^2} \right)^2 - \frac{a^2c^2(b^2 - r^2)}{(a^2 + c^2r^2)}} \right\}.
$$

The value of the signs of bearings’ components \( a_n \) from the obtained roots at \( x_1 > 0, y_1 > 0 \)

<table>
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<td>1</td>
<td>( X_0 + b \sqrt{1 - \left( \frac{x_1^{(1)}}{a^2} \right)^2} \sin K + x_1^{(1)} \cos K )</td>
<td>( Y_0 + b \sqrt{1 - \left( \frac{x_1^{(1)}}{a^2} \right)^2} \cos K + x_1^{(1)} \sin K )</td>
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<tr>
<td>2</td>
<td>( X_0 - b \sqrt{1 - \left( \frac{x_1^{(1)}}{a^2} \right)^2} \sin K + x_1^{(1)} \cos K )</td>
<td>( Y_0 - b \sqrt{1 - \left( \frac{x_1^{(1)}}{a^2} \right)^2} \cos K + x_1^{(1)} \sin K )</td>
<td>( x_1^{(1)} )</td>
</tr>
<tr>
<td>3</td>
<td>( X_0 + b \sqrt{1 - \left( \frac{x_1^{(2)}}{a^2} \right)^2} \sin K + x_1^{(2)} \cos K )</td>
<td>( Y_0 + b \sqrt{1 - \left( \frac{x_1^{(2)}}{a^2} \right)^2} \cos K + x_1^{(2)} \sin K )</td>
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<tr>
<td>4</td>
<td>( X_0 - b \sqrt{1 - \left( \frac{x_1^{(2)}}{a^2} \right)^2} \sin K + x_1^{(2)} \cos K )</td>
<td>( Y_0 - b \sqrt{1 - \left( \frac{x_1^{(2)}}{a^2} \right)^2} \cos K + x_1^{(2)} \sin K )</td>
<td>( x_1^{(2)} )</td>
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\( x_1 > 0, y_1 = 0 \Rightarrow \alpha = 90^0; \ x_1 < 0, y_1 > 0 \Rightarrow \alpha = 360^0 - \arctg x_1/y_1, \)
\( x_1 < 0, y_1 = 0 \Rightarrow \alpha = 270^0, \ x_1 \neq 0, y_1 < 0 \Rightarrow \alpha = 180^0 + \arctg x_1/y_1. \)

The proposed method of automated determination of boundary values of navigational parameters will increase reliability in solving navigational problems for improving the safety of vessels. The peculiarity of the proposed algorithm is to overcome the multicriteria of optimization tasks, determine their volume and quality, overcome a number of uncertainties that are inevitable when using the principles of data flow processing, etc.

**References:**

RESEARCH INTO CONDITIONS TO DECREASE THE DISTRIBUTED INFORMATION SYSTEM DECOMPOSITION

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The current trend in the information system development is the distributed information systems. And it is due to the development of cyber-physical systems, cloud data storage systems, information processing systems, automatic control systems in production, etc. We consider the distributed system as a set of hardware or software components linked together which coordinates their actions by sending messages. But the usage of distributed systems presents a lot of challenges. One of basic problems is decomposition of the systems into subsystems. Decomposition is the situation when the system is divided into two or more fully-autonomous functional subsystems. The problem is synchronization of the working data obtained from these subsystems after each system recovery, which is costly and complicated, especially, in distributed information processing and data storage systems. Therefore, the research into conditions for minimization of the decomposition number in a distributed information system is urgent [1].

As it is known, there exist two alternative methods to improve the stability of a distributed information system and to minimize the decomposition number, namely, to improve the stability of the system elements and to increase the number of alternative ways how to share information within the system elements. Here, by stability is meant the failure-free operation time for a subsystem, and the number of data transfer paths can be increased due to a higher value of the average clustering coefficient for the system elements. The problem resides in finding an optimal solution to the task how to minimize the decomposition number in a distributed information system [2].

It is reasonable to solve the task with the simulation modelling methods. In modelling the distributed information system was presented as an undirected graph in which nodes are the system elements and edges are their links. The elements have two statuses: function and maintenance, and a status transition timer. The edges fail when at least one of the neighbouring elements fails. It should be mentioned that the model simplicity can be explained by our interest to the status of the whole system rather than its each element. The software implementation of the mathematical model was presented in the programming language Python with NetworkX library. This choice is due to availability of specialized libraries and a high speed of code writing in Python. The input data format is defined as follows: the
program inputs simulation time, subsystem maintenance time, subsystem failure-free operation time, number of subsystems and average graph correlation coefficient (system topology). Here, the time is the number of iterations. The output parameter is only the average system decomposition number obtained in the experiment. The optimal relation of the failure-free operation time to the maintenance time for an element was experimentally found. The results of the experiment demonstrated that the recovery time should not exceed the operation time. Otherwise, the portion of functional elements in the system is fewer than half.

![Flowchart](image)

**Fig. 1** The operation algorithm for the simulation model of a distributed information system

The model developed made it possible to experimentally research the efficiency of methods for decomposition minimization in a distributed information system. The operation algorithm for the simulation model of a distributed information system described on fig.1. The experiments with...
variables were conducted: the failure-free operation time for the system elements and the average clustering coefficient for the graph elements. Results of the experiments described on fig. 2, fig. 3, fig. 4.

Fig. 2 The relationship between the failure-free operation time of an element and the average number of divisions

Fig. 3 The relationship between the average clustering coefficient and the average number of divisions

The correlation regression analysis of the experiment outcome demonstrated existence of some dependence between the average number of system decomposition and the failure-free operation time of the system elements (the correlation coefficient between the values is -0.646), and a strong dependence between the average system decomposition number and the average clustering coefficient of the system elements (the correlation coefficient between the values is -0.982). In order to compare these methods the experiment with two variable characteristics (a = the average correlation coefficient of the graph elements and b = the failure-free operation time of the graph elements) and one resultant (y = the average decomposition number in a distributed system) was conducted. The linear regression model designed is as follows: $y = 10.8187 - 0.00147b - 13.8206a$. In order to find the degree of dependence between the values the coefficients of paired correlations were defined; they demonstrated that the average decomposition number for an information system mostly depended on the average clustering coefficient of the graph elements (the paired correlation coefficient - 0.962). The research into the standard regression form confirmed the previous results. It should be mentioned that the empirically determined coefficients are the theoretical estimate and describe the whole process trend.

Thus, the statistical analysis of the results obtained in the simulation experiments on the described model of a distributed information system demonstrated that the approach towards minimization of the decomposition
number in a distributed information system on the basis of an increased average clustering coefficient of the system elements is more efficient than the increased reliability of the system elements. The presented solution is also cost-effective since the price for improved hardware reliability is much higher than additional data flow creation.

References:

THE INFLUENCE OF THE CHOICE OF METHODS OF EMERGENCY SITUATIONS ANALYSIS ON THE CATEGORICAL CONCLUSIONS OF AUTO-TECHNICIAN EXPERT

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Ensuring safe operation of automotive equipment is an urgent problem for many countries around the world. Its successful solution depends on the excellence of knowledge about the operational properties of cars, the ability to assess the road situation and on this basis identify the most effective areas of emergency management.

The task of analyzing and reconstructing the circumstances of road accidents (road traffic accidents) can be represented as follows. Let the given set of possible variants of conducting of a concrete auto expertise is \( X: X = \{x_1, x_2, \ldots, x_p, \ldots, x_n\} \).

Each variant is characterized by a set of parameters of the quality estimation \( Y: Y = \{y_1, y_2, \ldots, y_j, \ldots, y_m\} \).

Between each element of the set \( X \) and every element of the set \( Y \) there is a fuzzy relation denoted by \( xy \) or \( \mu_{ij} \). In other words, \( \mu_{ij} \) represents the level of correspondence of the \( i \)-th version of the expertise to the requirements for the \( j \)-th parameter (\( \mu_{ij} \in [0, 1]; i = 1, \ldots, n; j = 1, \ldots, m \)). If we take together all the fuzzy relations \( x_i \) and \( y_j \), then we obtain a matrix of fuzzy relations \( R \) in size \( nm: R = \{\mu_{ij} | i = 1, \ldots, n; j = 1, \ldots, m\} \).

You need to choose a better version of \( x^* \) from the set of \( X \) i.e.

\[
x^* = \text{opt}(X, Y, R, M),
\]
where $M$ is the model of the decision of the problem, chosen by the person making the decision.

Depending on the model $M$ used, the results of the task solution can be different for the same output data. Consequently, the quality of the decision-making process depends on the completeness of taking into account all the factors that influence the consequences of the decisions taken. Uncertainty can be eliminated entirely or partially in two ways: an in-depth study of available information or acquisition of information that is lacking.

The analysis of literary sources from the road accident expertise [1, 2, 3] suggests that six groups of models can be used to find a solution to a problem (1): mathematical, simulation, informational, situational, linguistic and physical. If we rank these groups of models according to the properties of stability, complexity, completeness, abstractness, and accuracy (Fig. 1), then we can see that as the description language of the object is changed from mathematical to linguistic, there is an increase in stability, complexity and completeness, and decrease of accuracy and abstractness. It should be remembered that the boundaries between the various methods of constructing models are dynamic and conditional.

![Fig. 1. Changing of the properties of the model depending on the description language](image)

The reliability and accuracy of the results of the road accident expertise is an important factor that determines the categorical conclusions of the auto-technical expert and influences the decision concerning the degree of guilt of the participants of the accident. Modern automotive expertise
requires the use of techniques and technologies that provide not only the required accuracy of the calculations performed, but also allow a thorough investigation of the mechanism of the road accident.

In the EU countries and the USA, automotive research using specialized computer software is a standard procedure for modeling the mechanism of an accident and its visualization. Computer programs are perceived as computerized versions of the known laws of mechanics, as well as fundamental research in the field of mechanics of impact and dynamics of cars. Such programs, as a rule, do not require certification or testing - an autotechnical expert himself chooses the methodology and is responsible for the objectivity and scientific character of the research.

The introduction of information technology into expert practice began through the simulation of road accidents, the creation of software complexes, individual programs for the implementation of auxiliary calculations, programs for the preparation of expert conclusions. Advantages of computerization are: quantitatively - a much larger amount of payments is performed; qualitatively - the probability of arithmetic errors decreases; it is possible to visualize the results of research.

The generally accepted analysis technique and reconstruction of the circumstances of road accidents, which are used in world practice, are based on mathematical models describing two main processes that occur in traffic accidents with cars - the process of motion and the process of impact. Both processes are described by the models constructed on a scientific basis using known laws of mechanics and based on certain experimental data. To ensure a certain level of accuracy of calculations and categorical conclusions of the expert, it is necessary that the mathematical models thus obtained should also be scientific. The scientific character of the models used can be estimated by applying the concept of an interpolation and extrapolation model.

It is proved that the problem of interpolation always has a single solution, since it is solved within the definition area [4]. The mathematical model by which the value of the reaction of an object outside the definition area is determined is extrapolation. It is intended to predict the magnitude of the reaction on the basis of some hypothesis, the accuracy of which can be statistically determined for a large number of tests, and the accuracy of the result in a certain test is unknown. Such models can be successfully applied as a source of accident reports. And for submitting a categorical conclusion on a specific accident using extrapolation models, an expert must prove the impossibility of other circumstances without reference to the hypotheses underlying these models.
References:

CATALYTIC CONVERTER WITH A CATALYST ON A CARRIER FROM METALLIC FIBER

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Motor vehicles are the most significant sources of air pollution by harmful substances, especially in large cities. The composition of exhaust gases varies on the type of engine operating modes, and especially on the type of fuel. Toxic substances that enter the atmosphere, have no color and odor, are involved in the emergence of smog. and therefore extremely hazardous to human health. Significant reduction of emissions of toxic substances into the atmosphere to date remains an urgent task. [1].

Reducing the content of harmful substances in the exhaust gases by optimizing the combustion process is the most promising measure, because products of incomplete combustion of CO and C_mH_n are easier to get rid of at the stage of their formation. However, it is impossible to avoid the content of harmful substances in the exhaust gases [2]. Catalytic converter allow a significant reduction in the content of harmful substances in the exhaust gases without changing the design of the existing fuel system.

The catalytic converters, in which the rare earth elements (Pt, Pd, Ro, Ru) are used as a catalyst, are most widely used, which allow to significantly reduce the energy threshold at which the oxidation-reduction reactions begin. The efficiency of cleaning the exhaust gases by the catalytic converters for all components is about 90% at a temperature of 750ºC [3].

The most common in automobile neutralizers are ceramic catalytic blocks having thermal engineering, strength and gas dynamic characteristics
that do not meet the working conditions. There are no drawbacks in metal carriers. The specific heat of the metal carrier is lower, and the thermal conductivity is higher than that of the ceramic. This contributes to accelerating the heating and reduces the probability of local overheating of the catalyst on a metal carrier.

Volodymyr Dahl East Ukrainian National University and the Research and Production Center "Chymavtokat" developed metal-fiber carriers for catalysts for the treatment of exhaust gases, a combined method for preparing low-percentage (0.05-0.08%) platinum-palladium metal-fiber cellular block catalysts [4, 5]. Preparation of the catalyst was carried out in two stages. In the first stage, as a technology for the application of active components, the method of ion implantation was used. The next stage of preparation of the catalyst was the application of active palladium and platinum to the surface of carrier [5].

The catalyst placed in the block cassette is a cellular structure with holes the straight-through configuration of 1,8×1,8 mm. Two cylindrical catalyst cartridges with a diameter of 100 mm, a length of 100 mm, a weight of 0,8 kg each are loaded into the neutralizer.

The catalytic converter was installed on a serial ware-house auto-loader, equipped with a gasoline internal combustion engine from a car GAZ-2410. Results of measuring of concentrations CO, NO\textsubscript{x}, efficiency of the catalytic cleaning depending on the coefficient of surplus of air on idling at the fully warmed up engine are given in table 1.

### Table 1

Degree of cleaning of exhaust gases of petrol engine of brand of "GAZ-2410" in a catalytic converter with a metal-fiber catalyst with the different coefficients of surplus of air

<table>
<thead>
<tr>
<th>Coefficient of surplus of air</th>
<th>CO content after neutralizer, % vol.</th>
<th>Degree of cleaning (CO), %</th>
<th>NO\textsubscript{x} content after neutralizer, mg/m\textsuperscript{3}</th>
<th>Degree of cleaning (NO\textsubscript{x}), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.87</td>
<td>1.00</td>
<td>54.50</td>
<td>147.20</td>
<td>93.71</td>
</tr>
<tr>
<td>0.89</td>
<td>0.70</td>
<td>63.20</td>
<td>223.00</td>
<td>91.30</td>
</tr>
<tr>
<td>0.93</td>
<td>0.29</td>
<td>83.40</td>
<td>307.60</td>
<td>90.80</td>
</tr>
<tr>
<td>0.95</td>
<td>0.12</td>
<td>92.50</td>
<td>375.60</td>
<td>89.90</td>
</tr>
<tr>
<td>0.98</td>
<td>0.06</td>
<td>96.80</td>
<td>320.80</td>
<td>89.90</td>
</tr>
<tr>
<td>0.99</td>
<td>0.04</td>
<td>97.50</td>
<td>377.40</td>
<td>87.40</td>
</tr>
<tr>
<td>1.01</td>
<td>0.03</td>
<td>98.00</td>
<td>446.60</td>
<td>88.30</td>
</tr>
<tr>
<td>1.03</td>
<td>0.03</td>
<td>98.06</td>
<td>548.00</td>
<td>86.80</td>
</tr>
<tr>
<td>1.05</td>
<td>0.03</td>
<td>98.01</td>
<td>724.30</td>
<td>83.10</td>
</tr>
<tr>
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<td>0.02</td>
<td>98.70</td>
<td>1083.00</td>
<td>75.50</td>
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</tbody>
</table>

References:


THE CHOICE OF THE METHOD FOR DETERMINING THE DIRECTION OF CURVATURE OF THE PATH SECTION TRAVERSED BY THE LOCOMOTIVE

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The growing volume of freight transport and increase of speed of trains increase the role of operational control of parameters of rolling stock nodes in terms of ensuring traffic safety. The element that most influences the safety of motion is the wheel pair of the locomotive and its interaction with the rail tracks [1, 2].

To reduce the force impact of the ridge of the wheel with the head of the rail when driving the locomotive on the curvilinear sections of the track, it is advisable to change the angle of rotation of the locomotive wheel on the track by turning the wheel pairs. Monitoring of the condition of a locomotive wheeled pair is possible by operational measurement of the actual angle of the wheel on the rail.

To implement such a system, reliable information is needed about the magnitude of the angle of the wheel run on the rail. Existing methods for determining the angle of a wheel run on a rail without the installation of a stationary sensor on a railroad web are used by indirect measurements to calculate the values of the angle of the run and do not reflect the processes of force interaction between the wheel and the rail. Existing methods for determining the angle of the wheel run on the rail provide for data in post-processing. The development of a method for controlling the angle of the wheel on the rail
will allow the development of a system for automatic control of the position of the wheelset on the rail track, which will improve the quality of control, traffic safety in the curvilinear sections of the path and reduce the wear of the wheels and rails. The development of a method for controlling the angle of the wheel on the rail will allow the development of a system for automatic control of the position of the wheelbase in the rail track.

Existing monitoring systems for locomotive wheel angles on the track are imperfect and contain a large number of unrestricted devices and different control methods. In Europe, a common standard is created based on the developed TSI guidelines to stimulate work aimed at improving the existing systems of monitoring the wheel's position with respect to the rail.

Formulation of the problem. At the moment, the rolling stock is not monitored on the Ukrainian rolling stock. In western countries, the sensors of capacitive and inductive types are used to monitor the state of the wheels on the rail. Control is carried out more often in metro and places with increased safety requirements (bridges, tunnels). In the existing systems of rotation of wheel pairs in the horizontal plane, the wheel angle on the rail is not controlled, which leads to the intense wear of the wheel and rail, reducing safety and stability of motion.

The method of acoustic emission of the determination of the angle of the wheel on the rail is not sensitive to the direction of the run-up or the alignment of the wheel on the rails [3, 4]. Therefore, one of the tasks is to determine the direction of curvature of the curvilinear section of the path that passes the locomotive.

One of the ways to determine the direction of curvature of the curvilinear section of the path that passes the locomotive is to find the change of coordinates of the location. There is a problem in precisely determining the location of the locomotive while driving, since this information is used when steering the wheel pairs of the locomotive and errors are unacceptable.

The use of satellite navigation systems on locomotives is one of the tools for identifying vehicles on the road section, but for steerable wheel track in the track, they do not provide the required accuracy of measurements. Contact methods for obtaining data on the movement of a locomotive do not allow determining the position of the locomotive on the section of the road at each time and require the stationary installation of the sensor along the railroad bed [5].

For unambiguous identification of a locomotive on an iron-nail cloth, it is necessary to have a digital map of the road and the availability of the following information [6]:
- number of the section of the passageway of a moving unit, limited by street transfers and / or isolated joints with known coordinates;
coordinates obtained from navigation equipment;
- matrix of transition between the ground system of coordinates and the local station system of coordinates;
- number of the function that describes the path area.

With the information on the speed of the movement, the control of the navigation equipment equipment locomotive is carried out, by substituting these values as output data in the functions describing the path of the path, determining the coordinates of the locomotive in the station coordinate system.

After construction of the coordinate model of the INS, they proceed to the Kalman filtration procedure. The input of the Kalman filter is a model of the INS and corrected GPS coordinates. At the same time, the refinement of the model of the INS and the correction of GPS data takes place. At the output of the Kalman filter, a high-coordinate coordinate of the location of the locomotive wheelset on the first iteration is obtained.

References:
DOMESTIC AND FOREIGN EXPERIENCE DEVELOPMENT OF REGIMES INFORMING DRIVERS AND STUDYING PROCESSES OF PERCEPTION OF INFORMATION IN THE MANAGEMENT PROCESS

Kliuiev S., Lopata O.
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Systems for informing drivers using on-board units or TFISs, located along roads, are increasingly important for managing traffic flows on road networks. Information about possible problems significantly reduces congestion due to the fact that the driver can choose other options for the path or appropriate parking or parking. European projects are now increasingly focused on TFIS systems, given that on-board units in vehicles are not yet very widespread and thus can not have a significant impact on traffic flows. Projects in this area (AUSIAS, CAPITALS, CONCERT, CLEOPATRA, COSMOS, EUROSCOPE ;, TABASCO) were aimed at studying the behavior of the transport network and determining the optimal management strategies.

The use of information and navigation systems in the framework of European projects can be shown on the example of the following cities:

- Bristol (CONCERT): TFIS for better use of the Park and Ride system;
- Brussels (CAPITALS): TFIS as part of a superior system of traffic flow management in tunnels at the inner ring of the city;
- London (CLEOPATRA): determining the impact of TFIS when locating traffic accidents on the choice of drivers for railways and traffic efficiency on the network;
- Lyon (CLEOPATRA): Information strategy for TFIS in automatic mode using data obtained from measurements conducted on network roads;
- Munich (TABASCO): TFIS for Park and Ride;
- Piraeus (COSMOS): A strategy to change the direction of traffic flow in the seaport area;
- Southampton (EUROSCOPE ): Integrated detection of traffic accidents and parking management;
- Toulouse (CLEOPATRA): general strategy for changing the direction of traffic flow;
- Turin (CLEOPATRA): TFIS strategy together with the traffic management strategy in the city.

Information before the trip and information at the stops of the city passenger public transport (GPOT) have shown that they have a significant
impact on the behavior of most passengers. It turned out that they, ultimately, caused a small but noticeable increase in the number of passengers. The integration of traffic management in the city, GPOT services and information systems in Turin led to a 14% reduction in travel time on public urban passenger transport and 17% in passenger cars. This led to a 3% increase in GPOT and a general improvement in traffic in the city. The investment in the subsystem of detecting accidents in the traffic management system in the city of Southampton has proven to pay for one year. Nevertheless, the payback essentially depends on the method and on the speed of detection of an accident [1].

The driver while driving is constantly experiencing a dynamically changing information field around him. Its ability to adequately perceive information and react in a timely manner to changing road conditions is crucial to ensuring road safety (BDR).

The perceived driver of the lower information code includes, in addition to the data transmitted by the external information system, such data from the internal human information system, which are transmitted directly from the internal environment of the organism.

The perception of information is the formation of a "sensory image" in the central nervous system of the driver, which in the future is converted to a representation that is adequate to a particular object. Emerging with this mental image reproduces the properties and structure of the object. In the course of comprehension by the driver of perceived information that occurs at the level of realization of labor processes, an important role is played by the hypothesis, the essence of which is that, in separate, disparate portions of information transmitted by lower codes (the variety of objects, phenomena), probable higher codes are determined.

A driver driving a car perceives the environment in a discrete manner, although the information itself enters the perception bodies continuously. The perception of information occurs discretely at moments of "reading" of nerve impulses at the output of the perception bodies (receptors), and the frequency of "reading" is the function of the rate of receipt of information. At the moment of "reading" the driver evaluates not only the increase of the signal on any output of the information channel, but also estimates the rate of change of this increase.

The process of perception and processing of received information ends with a motor act, which is a universal reaction of the driver in the impact on the bodies of cars.

The driver's performance is influenced by his individual characteristics, the conditions of activity and the characteristics of the flow of information.
When receiving, processing information and its implementation in the activity of the driver distinguish five stages:

1. receiving information;
2. processing information;
3. decision-making;
4. implementation of decisions;
5. control of the performed action carried out by means of feedback, which is information about the results of driver's actions.

In the conditions of intensive urban traffic and when driving a car at high speed there are information overloads. There is a shortage of time, as a result of which the driver does not have time to perceive and process all the information that comes in and timely perform the necessary control actions. The lack of information ("sensory famine") also affects the driver's performance, as well as the absence of other participants on the road, a monotonous monotonous landscape, with a constant movement at a constant speed on the straight sections of the road. The acute shortage of information takes place also when driving a car in conditions of poor visibility (at night, in a fog, during snowfall, etc.), which causes a strong nervous-psychic tension, which complicates the perception and processing of information [2].

References:

IMPLEMENTATION OF ELECTRONIC DOCUMENT CIRCULATION IN AUTOTRANSPORT

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The advantage of electronic document circulation over the traditional one is undeniable, because the main problem of traditional document management technology is the practical inability to centralize the organization's
document flow in real time. In addition, the real positive features of electronic document management are:

1) the possibility of placing in a document, in addition to text, multimedia data;
2) the possibility of using pre-prepared forms;
3) high speed of information transfer for a large number of addresses;
4) saving paper;
5) high compactness of the archive;
6) high speed of search and reception of information;
7) the possibility of protecting documents from unauthorized access and delimiting the access rights of employees to information.

Currently, there is one international standard for an electronic document format - ODF, which was adopted in 2006 under ISO 26300.

ODF is a document storage format created as an open and free alternative to closed formats and with all procedures and formalities. The complete format description takes 738 pages.

Today, this format does not depend on either a particular company or a specific application. The format is available for reading and writing to anyone without any restrictions associated with licenses or patents. 31

This approach gives ODF a number of significant benefits. Developing a format for a nonprofit organization guarantees backward compatibility. The format is already supported in more than 30 packages, working not only under Windows, but also under Linux.

However, radical, revolutionary approaches to document management automation are dangerous because they can lead to serious problems in management and even disorganization of activities. In particular, the introduction of electronic workflow allows you to reduce the number of services involved in working with documents, which will definitely affect the reduction of staffing in the organization. Moreover, according to experts, the introduction of the concept of "electronic document" requires disclosure of his nature and understanding of complex concepts such as electronic documentation, electronic archive, archive electronic documents and others. It is not legislatively or methodically described as such a complex of automation system of document circulation in the organization. Therefore, it is too early to talk about a quick and qualitative transition from traditional document circulation to electronic in Ukrainian organizations without a clear, well thought-out normative-methodical base.

One of the problems associated with the introduction of electronic document management systems is the need to ensure the legal validity of
electronic documents. In addition, the procedure for the selection of electronic documents for archival storage remains incompletely clarified.

In accordance with part one of Article 8 of the Law "On electronic digital signature", the key certification center is a legal entity, regardless of the form of ownership, or the individual who is the subject of entrepreneurial activity that provides the electronic digital signature service and has certified his public key in the central certifying body or certification center in accordance with the requirements of Article 6 of this Law ("Requirements for certification of a key). Experts believe that the number of people willing to engage in such activities may be rather insignificant. In particular, because the financial barrier to entering such structures in the current conditions will be quite high due to the specifics of their functions (provision of digital signatures, formation, distribution, cancellation, blocking and renewal of key certification, generation of public and private keys, etc.) And given that everything should start from almost zero, since almost so at this stage is the user's market, the "return" of the investments made will be quite long.

Consequently, electronic document circulation is a set of technologies that not only significantly optimize, but also significantly change the work of any organization. And it is quite obvious that a system of such a scale can not be implemented from scratch, since implementation can cause long-term paralysis in the organization's activities. Failures in the work arise not only in the internal environment of the organization, which is automated, but, as a consequence, in the organization under its control. Thus, before deploying the system of electronic document management and record keeping, we must carefully evaluate the readiness of all decision-makers (organizations) for quality new technologies.

References:
ABOUT THE SYSTEM OF MODERN LABOR LAW PRINCIPLES

Kotova L., Liamzienko V.
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Labour law principles belong to the category that denotes key ideas and approaches that underlie labour relations and determine nature and ideological orientation of legal regulation. We can state that labour law principles are a dynamic phenomenon that is developing in accordance with specific historical conditions.

The tendency of recent years is a significant extension of the system of labour law principles, first of all, due to implementation of international, in particular European standards in the field of labour regulation. Some of them have already been reflected in the labour legislation, while others still need to be consolidated. In order to find out the ways of improving the legislative regulation of the labour law principles, there is a need for their systematization.

Some aspects of the labour law principles were studied by such scientists as: O.A. Ahakov, V.V. Honcharov, L.P. Hruzinova, V.I. Kurilov, O.V. Lavrinenko, P.D. Proskuriakov, O.V. Starchuk, V.I. Shkatulla etc.

The purpose of the thesis is to systematize labour law principles considering modern tendencies in its development.

Labour law is a complex branch of law, consisting of several sub-branches and individual institutions. Diversity of labour relations stipulates the existence of the system of relevant principles, which other types of labour relations are based on. For legal science a traditional approach is to classify principles according to their scope: 1) general legal principles inherent in all branches of law (humanism, democracy, the principle of social justice, recognition and guarantee of human and civil rights and freedoms, equality etc.); 2) interdisciplinary principles that reflect the unified features of several branches of law (the minimum conditions of work and production safety); 3) branch principles that characterize a particular branch of law (generality, social security etc.); 4) intra-branch principles concerning certain institutes of the branches of law (principles of minimum wage level, social services etc.) [1, p. 23-24].

A similar classification is appropriate to use when differentiating the labour law principles. In particular, the general principles can be applied to all types of labour and other related legal relations; interbranch ones cover several institutes of labour law, and branch principles cover only one of them. In this context, the opinion of scientists is that application of the branch principle of unity and differentiation in the legal regulation of labour
presupposes (as a means of its implementation) the division of the norms of labour law into two groups: 1) general rules that are applied to all employees; 2) special rules that are applied to certain categories of employees, including certain categories of civil servants [2, p. 520].

In the same way the basis for the classification of labour law principles may be the following criterion, for example the scope of the relevant group of principles to the subjects of labour relations. Those which can be applied to all subjects of labour relations belong to general principles, and the rest can be applied to the special ones.

According to O.V. Starchuk, a system of labour law principles, as a branch diversity of law principles, comprise branch (basic) and institutional (secondary) basic principles (law principles) that determine the content and orientation of labour law, which implement legal regulations of labour and closely related to labour relations. Basic principles of labour law are those that underlie the content of the norms that regulate labour and closely related to labour relations. Secondary principles of labour law determine the norms existence within labour law institutes [3, p. 165]. In our opinion, the differentiation of labour law principles as main and secondary ones does not meet the requirements of expediency, and would mean an artificial reduction of the axiological sense of one or another principle, which is incorrect.

Thus, we can state that the whole system of labour law principles in their scope is appropriate to classify into three groups: 1) general; 2) branch; 3) interbranch.

The first group traditionally include: 1) the principle of labour freedom; 2) the equality principle in the field of labour; 3) the principle of contractual nature of labour; 4) the principle of definiteness of the labour function; 5) the stability principle of labour relations; 6) the principle of financial interest in the labour results; 7) the principle of labour safety; 8) the principle of the participation of labour collectives and trade unions in the issues concerning the establishment of working conditions and control over the exercising of labor legislation; 9) the principle of freedom of association for exercising and protection of your rights and freedoms; 10) the principle of material security in case of sickness absence or because of maternity [4, p. 103-104].

The fundamental principle of labor law (as well as other branches of law) is the principle of the rule of law. Its compliance is in fact a condition for effective implementation not only all other principles, but also the rights determined by the law.

According to N. R. Nizhnyk and V.V. Tsvietkov, the principle of the rule of law should be understood as a legal principle formed under the influence of globalization, international and European integration processes.
which in its content is a combination of a number of criteria (requirements),
which, although differ in their form of regulatory mediation in the national
legislation, but are intended to ensure the priority of rights and freedoms,
the legitimate interests of a man and a citizen in the society, including in rela-
tions with public authorities at all levels, and also the equality of all sub-
jects before the law [5, p. 34]. This principle equally extends its effect on all
labour, as well as other legal relations existing in our state.

If we consider labour law principles of the EU, we should note that
these are the guiding ideas and principles that have emerged in the process
of European social policy evolution, national labour law of the EU member
states, EU rights, which are reflected in international and regional social la-
bour acts and are used to regulate individual and collective labour relations
at the supranational level. O.M. Darmoris highlights four groups of labour
law principles of the EU [6, p.16-17]:

1) principles reflected in international and regional labour acts (la-
bour freedom and prohibition of forced labour; prohibition of child labour;
freedom of association; the right of social partners to negotiate and con-
clude collective agreements; equality and prohibition of discrimination; the
right to just and secure working conditions, the right to fair remuneration
that provides an adequate standard of living for a worker and his family
members, the right to decent attitude to work, the protection of workers' rights, the principle of assistance).

2) principles that have got real reflection in the EU's labour law. They are: the principle of freedom of movement, the principle of men and
women equality in the field of labour, the right of social partners to negoti-
ate and conclude collective agreements.

3) principles inherent in the EU labour law as part of the European
social policy: the principles of subsidiarity, proportionality, the basic mini-
mum of social rights.

4) principles (qualifications) inherent in EU law and labour law in particu-
lar as part of this legal system. This is rule of the national systems of the
Member States; direct action; integration into the national systems of the
Member States; jurisdictional security.

In the context of this study, we are most interested in systematization
of branch and inter-branch labour law principles. Each of these groups of
principles requires development of the self-reliant approach to classifica-
tion. So, based on the analysis of international and regional acts, in particu-
lar European [6; 7; 8; 9] and national legislation [10] in the field of regu-
ling labour relations, as well as the draft of the Labour Code of Ukraine [11],
we believe that branch labour law principles can be classified according to
the criterion of their regulatory influence on:
1) principles defining the nature and orientation of labour relations: equality, social justice, social partnership, stability, continuousness etc.

2) principles-conditions of exercising the labour function by employees: implementation of employment solely on the basis of the individual labour contract; additional compensation for work in harmful and dangerous working conditions; safety guarantee of production and labor protection etc.;

3) principles-standards of labor activity: legislative consolidation of the minimum standards in the field of remuneration, labor protection, labor safety etc.; ensuring full and productive employment of workers and protection against unemployment; creating equal opportunities for employees in terms of their professional growth, training, retraining and advanced training etc.;

4) principles-prohibition in the field of labour law: prohibition of all forms and types of forced labour; prohibition of labour exploitation; prohibition of child labour and labour of people aged 14 to 18 without the consent of parents;

5) principles defining the rights and obligations of the employer: combination of economic power of the employer and state regulation of labour relations; the employer's responsibility for creating safe and healthy working conditions; providing right of employees to compulsory state social insurance by the employer etc.

We think that the principles of labour law form a multi-faceted system. Some principles defined in international and regional acts, have not found their proper reflection in the acts of national legislation. Considering this, as well as the absence of a certain system of principles in the current Labour Code of Ukraine, there is a need for their legislative consolidation. This should be the subject of further research in this field.

References:


FEATURES OF DETERMINING FACTORS AFFECTING THE TRANSFER OF METALLURGICAL GOODS IN EXPORT CONNECTIVITY

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Of course, solving scientific and technical problems related to the transport of metallurgical goods in export connections is difficult in the transportation process. This is due to the complexity of taking into account the influence of several dozen factors. For a rational choice of directions for solving scientific and technical problems related to the transfer of metallurgical goods in export, it is expedient to use the opinions of highly skilled specialists. Their competence will avoid possible errors in the future, partly compensate for the lack of information, as well as correctly assess the prospects for further development of research.

Determination of the most influential factors for the transportation of metallurgical goods in export carried out with the help of the expert evaluation method [1-3].
The application of the expert evaluation method has allowed identify most significant factors among those that affect transportation of metallurgical goods in export mix. These factors scored the highest weight (Table 1)

<table>
<thead>
<tr>
<th></th>
<th>The most significant factors</th>
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<tbody>
<tr>
<td>1</td>
<td>The loading level of vehicle</td>
</tr>
<tr>
<td>2</td>
<td>Delivery time of the cargo</td>
</tr>
<tr>
<td>3</td>
<td>Technical condition of rolling stock</td>
</tr>
<tr>
<td>4</td>
<td>Types of transport (road, rail, sea, etc.), which are necessary for transport</td>
</tr>
<tr>
<td>5</td>
<td>Preservation of cargo during transportation</td>
</tr>
<tr>
<td>6</td>
<td>Coherence action of carriers in the interaction different modes of transport</td>
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<td>Technical condition of the road</td>
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The use of the expert assessment method in the study of factors affecting the transport of metallurgical goods in the export combination is an important step for further study of this complex problem. The concentration of information from literary sources, the experience of highly skilled specialists in this field, allows us to identify the appropriate solutions. As analysis results of the expert survey, it was found that the problem considered in the work can be effectively influenced by the time factor. This seems promising in terms of reducing the idle time of vehicles with the interaction modes of transport and when choosing the optimal route of transportation.

References:
PEDAGOGICAL TECHNOLOGIES FOR FORMATION OF MORAL CONSCIOUSNESS OF STUDENTS OF CLASSICAL UNIVERSITY

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The substantive essence of the organizational and pedagogical system of methods for the formation of the moral consciousness of students of the classical university is represented by the development of the program. The main conceptual idea of this program is to search for new cultural dominants and new approaches to the education of a morally developed person, corresponding to the modern understanding of morality.

The program itself is aimed at:
- creation of conditions for the person to realize his natural potential and spiritual and moral attitude to life;
- development of creativity;
- affirmation of the ideal of a moral person;
- preservation and active propaganda of historical and cultural heritage, strengthening of its prestige in the World;
- coordination of the activities of the executive authorities of all levels, public and religious organizations, educational and cultural institutions associated with the development of the moral consciousness of man.

The program focuses on the following areas: the development of a creatively gifted person, the education of legal culture, the education of ecological culture, artistic and aesthetic education, patriotic education, spiritual and moral education. These areas, in fact, correspond to the structures of intellectual, moral, artistic-aesthetic, ecological, family-household culture and communication culture.

The system of methods for the formation of the moral consciousness of the students of the classical university developed by us is aimed at developing in the student youth historically inherent in the Slavic people high moral values that promote the assimilation of the best examples of both domestic and world spiritual and moral wealth; development of an optimistic worldview, education of high patriotism, political, ecological, moral culture, healthy lifestyle, in which the basis of interaction between the spiritual and physical prevails; the development of youth social organizations, where the foundations of morality, social-moral consciousness and human qualities, moral and aesthetic ideals are formed.
Features of the system of methods for the formation of moral consciousness of students of a classical university in modern society are as follows:

1. The system is based on the concept of spiritual development of students of the National University named after Vladimir Dhal. It is based on:
   - theoretical provisions on the phenomenon of man as the unity of body, soul and spirit, having a co-planetary essence;
   - the concept of spirituality, spiritual development, which is carried out in the process of mastering and obtaining its various forms (intellectual, moral, aesthetic, artistic, environmental, legal, communicational, etc.);
   - technologies of creating of multi-purpose, cultural and educational programs taking into account the natural, socio-cultural and economic features of the city.

2. Contextually and functionally, this system is aimed at the formation of moral consciousness as an integrated quality of the individual, which is achieved in the process of spiritual development due to the mastery of the values of spiritual culture, the satisfaction of spiritual needs, creative activity. The result of the integrity of the formation of moral consciousness of students is the culture of their actions, their moral, aesthetic and spiritual behavior.

3. Moral consciousness is a unified holistic cultural and educational system that operates in a culture-creating and human-creating environment and is aimed at forming the qualities of a spiritually developed personality of each student.

4. The formation of moral consciousness facilitates the interaction of the activities of various cultural and educational institutions for the realization of this goal.

5. The process of the formation of moral consciousness does not include individual activities, but the daily painstaking work on the education of value orientations, the acquisition of a value-semantic life experience, cultivation, humanizing of each personality and creating a situation of spiritual self-giving.

6. Structurally, the system is a mega program containing several educational projects (programs), each of which contains essential characteristics of the moral consciousness of the individual.

The conducted research makes it possible to form theoretical and practical conclusions, recommendations on the problem of formation of the moral consciousness of students of the classical university, a problem the solution of which largely depends not only on the social and spiritual for-
formation of an integral personality, but also on professional-civic formation and development.

As a result of the research, the conceptual foundations of a modern system of the formation of moral consciousness have been developed; the specifics of the formation of the moral consciousness of student youth are revealed; a multilevel technological model of the system of formation of the moral consciousness of students of the classical university was created; The technology of formation of moral consciousness of educational process of high school was introduced in practice.

References:
DEVELOPMENT OF TRANSPORT INFRASTRUCTURE OF THE CITY TAKING INTO ACCOUNT THE SOCIAL ASPECT

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To date, logistics is the science of movement, the creation of the necessary comfort, processing and distribution of material, financial, human and information flows. The main function of logistics is the organization of information, optimization of human and material flows to meet the needs of consumers. In logistics a systematic approach is used which represents its conceptual basis and includes the theory of systematization, structuring and designing of the system for further use in the aggregate of temporal and spatial resources, ensuring the organization of human and material flows of finance and information.

The transport industry is key to the majority of countries in the life of the state, since, without producing any material value by itself, it delivers goods from producers to consumers and provides the passenger turnover of the country.

The future of public transportation, in the first place, depends on the decision of the following priority tasks:
- provision in the region of production and quality of life;
- priority transportation services of socially vulnerable groups of the population;
- Environmental Protection.

It is necessary to create a system of transport infrastructure that guarantees and effectively satisfies social, economic, environmental and other requirements [1].

The current dynamics of socio-economic development of regions of different countries of the world has largely been conditioned by the state of socio-cultural systems and the ecological environment of population living.

Especially acute socio-cultural factors influence the formation of the mechanism of development of transport infrastructure of different regions.

With an increase in the welfare of the population, transport infrastructure begins to play a dominant role in everyday human life, due to the large number of natural and manpower resources. Therefore, economists believe that the level of development of transport infrastructure determines and determines the overall level of socio-economic development of both the region and the national economy as a whole.

In this regard, when forming elements of the transport infrastructure and the functioning of its facilities, the following factors should be taken in-
to account:
- concentration (density) of the population on the territory;
- residence on the territory of the population of different nationalities, confessions, various traditional and moral forms;
- the territory may have either a unique natural-climatic or cultural-historical character;
- comfort of the geographical position;
- the possibility of constructing a complex industrial or tourist-recreational structure;
- the need to use this territory by people living in neighboring or other regions, countries;
- natural-resource, economic or political significance of the territory.

In the case of passenger transport, logistics is a combination of methods and controls used for a specific type of passenger transport, technical and design solutions that help ensure the optimum level of passenger service, their safety, reliability and continuity of delivery in a fixed time with minimal expenses. The application of logistics in passenger transport allows you to improve the transportation process through logistics connections involved in the provision of transport services, while this process is a logistics system of operators and infrastructure objects [2].

In the management of passenger transport systems, the social aspect of passenger transport logistics always plays a special role. It is necessary to take into account the needs of modern society and on their basis to plan the work of the system of transport infrastructure.

To date, in all countries with social policies, the transport strategy is aimed at reducing the number of individual means and increasing the use of public transport. Every year there are attempts to take urban passenger transport under the patronage of state power by adopting appropriate programs and regulating tariffs. However, the methods of "intervention" of the authorities do not fully correspond to the directions of their daily activities - ensuring the well-being and comfort of society in the present and future. Thus, there is a correlation between the process of spreading the use of public transport and the development of society. The future of public transportation depends on the solution of three priority tasks [3]:
- guaranteed transport services to socially vulnerable groups of the population;
- ensuring the welfare of life and production in the region;
- protection of the environment.

The main direction of the transport industry is the preservation and development of a unified infrastructure of urban passenger transport, the creation of an integrated system of public transport, while reducing the de-
gree of participation of budget funds, attracting and consolidating the market of carriers of various forms of ownership, the use of the principle of competition. This will maintain the proper level of transportation by public transport, despite the high rates of motorization in recent years.

The accounting of socio-cultural and environmental factors in the development of the mechanism of sustainable development of transport infrastructure of the region derives the socio-economic development of this region at a new institutional level, both theoretically and practically.

Efficient functioning of the system of urban passenger transport is the proper level of transport services of the population by high quality services in achieving maximum economic efficiency in the industrial, social and environmental spheres.

References:

ANALYSIS OF CRITERIA OF VEHICLES OF TRANSPORTATION AND EXPEDITION WORK WITH AN EXAMPLE OF LOGISTIC APPROACH TO PLANNING LOAN AND COMMERCIAL OPERATIONS IN RAILWAY TRANSPORT

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In today’s market conditions of the development of the economy, competition in the market of transport services is intensifying, and therefore the problem of improving the quality and complexity of transport services of enterprises, reducing the transport costs of the economy becomes very urgent. In these conditions, the role of specialized transport and logistics
and forwarding companies and companies that assume the functions of the operator (coordinator) of the logistics process of commodity rowing is growing.

The paper shows the relevance of transport and forwarding work and its advantages on the railway as a whole, the analysis of the main criteria of influence on the example of the logistic approach to the planning of freight and commercial operations on the railways is made. The main attention is paid to the relevance and implementation of logistics in freight forwarding, in developing efficient transport routes in order to increase the level of commercial services provided to potential customers. The main principles of the logistic approach used in forwarding services are also considered, and an algorithm is proposed which should improve and simplify the choice of the actual choice of transport and transport carrier.

Based on the analysis of the proposed new logistic approach, the schedule of cargo turnover for all types of transport from 2005 to 2015 inclusive is made.

![Fig. 1. Total freight turnover for all types of transport](image)

It is noted that the first and one of the most important criteria of influence is the choice of the mode of transport. In the future, four stages of the study and evaluation of the choice of the mode of transport are proposed:

Stage 1 - Analysis of the market of transport services and selection of factors-criteria affecting the choice of the mode of transport.

Stage 2 - Pre-selection of several types of transport.

Stage 3 - Calculation of integral indicators for the selected mode of transport.
Stage 4 - Determination of the total indicator for each type of transport survey, equalization of the total indicators (the higher the value of the surplus indicator, the better the type of transport for the client).

At the stage of the analysis of the market of transport services and the selection of factors-criteria for choosing a mode of transport, the client himself or with the help of the involved experts-analysts (experts) determines the list of factors-criteria for choosing a mode of transport. Having defined the list of factor-criteria, the client conducts their ranking (hierarchy), thus determining the degree of importance. At this stage, another option is possible to determine the list of factor-criteria.

But the next most widespread task in the logistics system is the choice of logistics intermediaries. Among the transport forwarding intermediaries are: specialized transport, forwarding, forwarding (logistic) companies, companies of physical distribution, cargo terminals and terminal complexes, cargo distribution centers, companies for sorting, packing of finished goods, cargo processing and other enterprises.

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1. Selection of indicators (criteria) for evaluation of LA
2. Grouping indicators (quantitative, qualitative, relay)
3. The choice of applicants among the LA
4. Generation of a common table of indicators for all LA
5. Checking the compliance of the indicators of the LA with the main limitation
6. Exclusion of LA
7. Rating results for LA
8. Determination of weight coefficients
9. Calculation of quantitative estimates
10. Requirement of qualitative estimates
11. Calculation of integral assessments (ratings) for LA
12. Choosing the best option of LA

Fig. 2. Algorithm of choice of logistic agents

References:
8. Transport and communications of Ukraine - 2012 (Statistical collection), Kiev – 2013

RESEARCH OF LOADS ON CARRYING STRUCTURES OF CONTAINERS IN COMBINED TRAINS IN RAIL FERRY TRANSPORTATION

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Development of foreign economic relations of Ukraine with other countries requires introduction of combined transport systems. International links of Ukraine through the sea gates of the Black Sea and the Azov Sea contributed to introduction of rail ferry transportation, that have been in operation since 1954 by example of the first rail-ferry route between Taman and Kerch.

Today rail-ferry routes connect Ukraine with Bulgaria, Georgia and Turkey. One of the recent such routes linked European and Asian countries, when the first combined train crossed the waters of the Black Sea by a train ferry and headed to China.

So that to ensure safety of combined rail-ferry transportation by sea
it is necessary to research the dynamic loads on and stability of the containers relative to the flat wagon frames.

The dynamic loads on the carrying structure of a container within the combined train in the train ferry transportation were defined by mathematic modelling by applying the Lagrangian method of the 2\textsuperscript{nd} type.

The angular displacements of a train ferry relative to the longitudinal axis (lurch), as the heaviest loading on the carrying structure (the equivalent of vibrations is rolling in train dynamics), and the influence on container stability relative to the flat wagon frame were taken into account. Three interaction patterns between a container and a flat wagon located on the train ferry deck were considered in building equations of motion:

1) without displacements of the flat wagon and containers relative to the initial position under the train ferry vibrations;
2) with displacements of the flat wagon with train ferry vibrations considering the container immobility relative to the flat wagon frame; and
3) with displacements of the flat wagon relative to the deck and the containers relative to the flat wagon frame.

The differential equations were solved with a program created in Mathcad where they were reduced to a regular Cauchy problem and then integrated by the Runge–Kutta method.

It was established that without displacements of the flat wagon and containers relative to the initial position the general value of the acceleration impacting the flat wagon with containers (last in the row from the bulwark) was about 0.25g.

And when the flat wagon was displaced in train ferry vibrations and the containers were immobile relative to the frame, it was established that the general value of the acceleration impacting the flat wagon (last in the row from the bulwark) was about 0.3g.

With displacements of the flat wagon relative to the deck and containers relative to the flat wagon frame the general value of the acceleration on the flat wagon (last in the row from the bulwark) was about 0.4g, and that on the containers located on it was about 0.47g.

The acceleration values obtained were considered in defining values of the carrying structure capacity of the container in train ferry transportation within a combined train. For this reason a spatial model of a standard 1CC container was designed. The graphics works were conducted in Solid Works. The capacity analysis was conducted by the finite element method in CosmosWorks.

The capacity model considered the dynamic loads on the container due to train ferry vibrations, the vertical reaction in the area where the fittings rested on the fitting stop, and also the horizontal reaction from the dy-
dynamic loading. The container was fixed in the areas where it rested on the flat wagon. The 09Г2С steel was used as a construction material.

The results of the calculation showed that the maximum equivalent loads in the container carrying structure for all loading patterns did not exceed the accessible loads.

In order to assess the container stability relative to the flat wagon frame the research into the equilibrium stability coefficient under angular displacements of the train ferry relative to the longitudinal axis was conducted. The stability threshold was defined when the values of restoring and overturning moments were equal.

Besides, it was established that the stability coefficient of the container relative to the flat wagon frame was less than 1 with displacements of the container fittings relative to the fitting stops of the flat wagon. And the container stability was ensured at rolling angles of the train ferry up to 25°.

The research conducted enhances the higher efficiency of combined transportation along international transport corridors.

References:
ENVIRONMENTAL EVALUATION OF THE ORGANIZATION OF THE TRANSPORTATION OF THE VEHICLE

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The introduction in Ukraine of the methodology of environmental impact assessment according to European requirements was conditioned by the international obligations of the country, which are derived from: Association Agreements between Ukraine and the EU; from the sections of the international Convention on Access to Information in the Field of Public Information in Decision-making and Access to Justice in Environmental Matters; and the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) [1]

Since the existing system for assessing the environmental impact of the flotation through the use of a modern environmental assessment system does not provide adequate scope for studying the consequences of the implementation of activities potentially hazardous to the environment and taking into account such conclusions in the decision-making process and does not ensure the effective participation of the public in this process, the need for scientific study of this issue.

Summarizing scientific works of the above-mentioned scientists it is possible to establish such: modern resource and ecological crisis attained the limits of the global system, putting under a threat safety of biological life on a planet; humanity forces to search an exit from socio-economic crises, uniting in an only global concord; for the economic systems possibilities of increase of materially-power streams appeared outspent, to satisfy the necessities of growing population, and humanity forces to bind the hopes to the production and consumption of informative resources, passing to fundamentally new technologies, economic relations, social.
The basic feature of modern period of development of humanity consists in absence of limit between natural resources and natural terms: the scales of the traditional use of natural factors grew as resources, as a result a factor that before belonged to the natural terms grows into a natural resource; the amount of functions that the same natural factor can execute person natural resource grows, for example, atmosphere earlier her an economic role was determined by such functions: resource of biological recreation of lab our force, environment of existence, source of oxygen for incineration of organic fuel, wind energy source. Presently the economic functions of atmosphere are considerably wider: used here lectromagnetic, optical, acoustic and other physical and chemical properties; an atmosphere, carrying information about bodies and forces town, is also an informative resource. [2, p. 15]

A car is the source of a number of extrass that negatively influence on a natural environment. Exhaust gases the amount of that and in a mass, and by in volume relation is extraordinarily large prevail among them. Harmful substances, during exploitation of motor transport, get in air with exhaust-gass, by fumes from the fuel systems, and also during priming of car by a fuel. On the extrass of oxides of carbon(carbon dioxide and carbon monoxide) relief of road and mode and rate of movement of car influence also

Taking into account the large volume of initial information and complication of tasks for scientifically technical validity made decision necessary is creation and the use of ecological estimation with specialization on industries of economy that shows a soba CAS of acceptance of expert decisions. State and his governmental officials, collecting tax, force to think not only of external safety of territory but also about economic power that largely reposes on naturally-resource potential of country. Wherein it is understood, it is succeeded on ten, hundreds, and sometimes and to attain thousand years prosperity of productive, political, military, cultural and ecological constituents of life of society, due to that they are in harmony with economic laws. [2, p. 49]

References:
ON ANALYSIS OF THE SIZE-AND-WEIGHT CONTROL IMPLEMENTATION IN UKRAINE

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Unsatisfactory condition of the highways in Ukraine and discrepancy with the regulatory framework international standards in the field of the road complex operation activity became a significant factor in delaying the entry of the state into the EU. Since European integration is Ukraine's main and unchanged foreign policy priority, special attention was paid to the issues of the further strategy for the restoration and development of the road industry.

During 2017 within the framework of the size-and-weight control, 458,796 vehicles were inspected, which is 98% more compared with 2016. According to the results of inspections, 11345 violations of the size-and-weight parameters were identified, which is 67.6% more than in 2016. There were 5583 decisions on the penalties for the size-and-weight parameters violation. Fees in amount of €2,249,353 EUR have been charged for traveling by road with the excess of size and weight, 17,635,993 UAH were transferred to the National Budget of Ukraine, which is 154% more than the same indicator in 2016.

According to the Ukrtransbezpeka territorial authorities size-and-weight control results in 2017, the largest number of vehicles weightings (more than nine thousand weightings) were conducted by the following units: Mykolayiv, Rivne, Kyiv, Kirovograd, Ternopil, Chernomorsk, Chernkasy, Odessa.

According to the indicators analysis of the transfers in 2017 to the National budget of funds charged as the weighting fees for the overweight and (or) oversized vehicles traveling by the general use roads and imposed penalties the following territorial bodies of Ukrtransbezpeka can be highlighted: Chernomorsk, Kharkiv, Kirovograd, Donetsk, Odessa.

As an important event of 2017 one may mark the successful conduct through the public procurement system ProZorro purchase of 78 mobile weight control stations by Ukrtransbezpeka on the National Budget costs which was funded by the financial resources of the European Union, provided to Ukraine in the frame of the Agreement on funding the program “Assist to Ukraine Transport Strategy Implementation”. By the beginning
of 2018, all the territorial bodies of Ukrtransbezpeka received three such complexes each, Luhansk - two, Dnipropetrovsk and Mykolaiv - four, Odesa - five.

The purchased mobile weight control systems comply with European quality standards, equipped with certified high-tech devices, control measurements of which are beyond doubt. In the Ukrtransbezpeka territorial bodies there was an opportunity to implement measures of the weight control in Ukraine at a qualitatively new level.

But the number of problems should be highlighted, the presence of which creates obstacles for the effective use of mobile weight control systems, namely:

– lack of required number of special certificated sites for carrying out weight control. In Ukraine there are officially only 135 sites suitable for carrying out weight control, of course, in the presence of such a small number, it is not possible to ensure the efficient use of new mobile weight control systems. Therefore, solving the problem of building a network of sites is extremely topical;

– limiting number of official staff in the Ukrtransbezpeka territorial bodies, namely the inspectorate, which directly carries out measures of the state control, in particular size-and-weight control, does not provide an opportunity to provide round-the-clock operation of the particular mobile size-and-weight control system, to exclude cases of transportation with violations of size-and-weight parameters at night;

– necessity to ensure proper financing of Ukrtransbezpeka territorial bodies from the National budget. To ensure reliable and uninterrupted operation of mobile size-and-weight control system a large number of fuels and lubricants are needed, organization of storage, maintenance and meteorological certification is compulsory;

– amendments to regulatory acts on vehicles size-and-weight control implementation in Ukraine, in particular, to increase the scale of fines up to the European level for the national weight standards violations (such as Poland – from €1500 EUR). Implementation of the responsibility of the company that loads the vehicle in case that no control weighing was performed in the presence of the carrier.

Implementation of the vehicles size-and-weight control in Ukraine can be stated as a fact that joint efforts of the state with the EU overcame the most difficult and simultaneously important period – the establishment of the size-and-weight control. As a result, tens of millions hryvnia of fines came to the budget. Of course, to get a well-established control system, there are still a lot of clear and consistent steps to be taken, this is the only way to complete the task – to restore and preserve Ukrainian roads, to en-
sure an adequate level of traffic safety in Ukraine, in the context of the European integration policy implementation.

References:

WAYS OF REALIZATION OF TRANSIT POTENTIAL UKRAINIAN RAILWAYS

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Ukraine has a very geographical stand-in, qualificatory her considerable transit potential basis of which is made by a railway. It allows to be organically included in the international Eurasian transport infrastructure. Presently this potential will be realized far not in full, although a present transport infrastructure of country is able to transport to 100 million t of transit loads annually.

The Ukrainian transport system traditionally served the traffics of goods, which was formed yet in the days of the USSR, till recently, when 80% loads acted from Russia, 7-8% - from Kazakhstan, 4-5% - from Belarus and Moldova.

Thus potential of height of transit turnover of goods of Ukraine was limited to possibilities of development of economies of countries the CIS, first of all - Russia and Kazakhstan, that oriented a transport system of Ukraine on transportation of unprofitable loads of raw material orientation, which do not require application of new transport technologies.

Taking into account the political situation and blocking Russia of transit folded presently through the territory, the traffics of goods from Russian Federation and Kazakhstan went down considerably.

Therefore a search of new transit traffics of goods, optimization of logistic chains of deliveries and transport cost cutting, is for the Ukrainian
transport system a very actual task.

The real integration of Ukraine in a world transport system and further prospect of development of transit railway transportations of loads are directly related to introduction of effective transport technologies, first of all - with containerisation of loads. This world tendency compels to search and find the new ways of decision of questions, related to интермодальными transportations, develop and inculcate new technologies of vehicular process.

Ukraine actively works on perfection of technologies of container-traffics. One of important steps was creation of national operator of the combined transportations - the Ukrainian state center of a transport service (CTS "Liski") [2]. This structure is structural subdivision of PJSC "Ukrzaliznytsia" and gives the complete spectrum of services in organization of transportations a railway transport. CTS "Liski" is the manager of all park of containers of railways of Ukraine and fitting platforms for their transportation.

In those directions which are characterized by the considerable stable traffic of goods, CTS "Liski" jointly with PJSC "Ukrzaliznytsia" organizes transportation of loads in composition container trains, that allows substantially to accelerate delivery of loads, facilitates procedure of passing of custom registration and provides safety of transportation.

Now successfully rout container trains work: «Viking» (Chernomorsk-Klaipeda), «Yaroslav» (Kiev-Slavkuv), «Khreshchatyk» (Chernomorsk/Odesa - Kiev-Liski), «Dniprovetz» (Chernomorsk/Odesa - Dnepr-Liski), «Podillya» (Chernomorsk/Odesa - Khmelnytskyi), Mariupol - Kiev-Liski and etc.

In May, 2016 to the project of train of the combined transport «Viking» joined a new participant is JSC «Azerbaijanian railways». Joining of railways of Azerbaijan will allow to improve the concurrent conditions of transit transportations of loads in directions East is the West, North is South, and also will create alternative transport communications for торговых connections between the countries of Europe and Asia.

Expansion of geography of plying of train will allow to save the existent volumes of containertraffics and will assist the increase of volumes of multimodal transportations within the framework of international corridor Baltic - Black - Caspian seas.

The train of the combined transport "Viking" in January-October, 2017 transported containers in an amount 6658 TEU. It on 97% more than in an analogical period the last year [1].

In the direction of Ukraine a train mainly transports raw material, clothes, fish, motor-car repair parts, polymers, tobacco, paper of and other
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In the direction of Belarus and Lithuania - cleansers, tile, tree, products from black metals, wares from a stone, swizzles of and other.

The increase of the imported transportations of oil products and fertilizers is forecast in 2018, increase of export of grain-growing, mineral and building loads to 10%.

Russian Federation from 1.01.16 stopped for Ukraine the action of agreement the CIS about a free trade zone. Hereupon transit of the Ukrainian commodities which are transported by a motor and railway transport to Kazakhstan must come true only through territory of Republic of Belarus. Thus a transport shoulder for commodities which are supplied to Asia through Russia increases on a 500 km, in this connection transport charges increase approximately on 23-50% depending on the type of commodity. In July, 2016 in Russia additional limits are entered on Ukrainian transit to Kirghizia.

To level consequences from entered by the Russian side of transit limitations it is possible due to working of alternative routes of transporting. There can one of such routes be the so-called «New silk way» which links the countries of Asia, first of all actively developing China, with the European states.

A project «The New silk way» has three variants:
1) along the route Kazakhstan-Azerbaijan-Georgia and farther by ferries on the Black sea - to Istambul, Varna, Constanse and Odesa;
2) south of caspian Sea through Kirghizia, Uzbekistan, Turkmenistan, Iran and Turkey;
3) through Kazakhstan, on territory of Russia to Moscow and Saint Petersburg.

In behalf on that the first variant for China is priority, a report testifies about the plans of China to build a bridge through the Caspian sea from Kazakhstan to Azerbaijan [3].

Connected to this project, Ministry of infrastructure of Ukraine together with PJSC "Ukrzaliznytsia" in January, 2016 started the demonstration trip of container train along the route Ukraine-Georgia-Azerbaijan-Kazakhstan-China.

Experts from the Ministry of Infrastructure are also discussing the launch of a test cargo train along the Ukraine-Iran route in the summer of 2018.

Thus, the organization of rail transportation of containerized cargo as part of accelerated container trains is one of the important ways to realize the transit potential of the Ukrainian railways in modern conditions.
OPTIMIZING PARAMETERS OF SOFT CONTAINERS

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The Rules for the placement and fastening of goods in wagons and containers [1] are the recommended schemes for loading soft containers (SC) into gondola cars for only a few of their sizes, which are in the form of a cylinder. Modern manufacturing technologies of SC allow their production of almost any shape with a wide range of parameters. At the same time, it seems promising to use SC, the shape of the bottom of which is a square, which makes it possible to make full use of the floor area of the cargo space of the vehicle.

When choosing the parameters of the desired SC, it is also necessary to take into account the transport characteristics of the bulk cargo carried, since the full load capacity and capacity of the vehicles depend significantly on the bulk density of the cargo at various parameters of the soft containers used.

In general, to select the rational parameters of the SC from the perspective of their most effective placement in the cargo space of the vehicle, it is necessary to solve the optimization problem with the objective function of the following kind

\[ G_{ijk} = f(N_i, M_i, Z_{ij}, b_i^2, h_j, \gamma_k) \rightarrow G_B^{max}, \]

(1)

where \( N_i \) and \( M_i \) is the quantity of SC \( ij \)-th type, which can be loaded along the width and length of the cargo space; \( Z_{ij} \) - quantity of tiers of SC.

References:

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Problems, experience, prospects.
loading, $b_i$ and $h_j$ - width and height of SC; $\gamma_k$ - cargo density.

The solution of the problem must be carried out taking into account the limitations

$$K_{ij} \rightarrow K_{\min}, \quad b_i^{\min} \leq b_i \leq b_i^{\max}, \quad h_j^{\min} \leq h_j \leq h_j^{\max}, \quad b_i^2 \cdot h_j \cdot \gamma_k < G_M.$$  \hspace{1cm} (2)

Here $K_{ij}$ - the quantity of used SC $ij$ -th standard size, $G_M$ - the payload capacity of the hoisting-and-transport machines, used when overloading the SC.

For example, Fig. 1 shows some results of calculations for optimization of the objective function with the above limitations. The solution of this discrete optimization problem was carried out by means of MS Excel [2]. In the calculations it is accepted: the vehicle is an all-metal gondola car model 12-295 with a carrying capacity of 71 tons with internal dimensions of the body: $B = 2.89$ m, $L = 12.69$ m, $H = 2.05$ m; density of cargo $\gamma_k = 0.7 ... 1.8 \, \text{t/m}^3$; $G_\text{max}^B = 70$ t; $G_\text{max}^* = 1.5$ t.

![Dependence graphs](image)

a) dependence graph $b_i^{opt} = f(\gamma_k)$  

b) dependence graph $h_j^{opt} = f(\gamma_k)$

Fig. 1. Some results of solving the optimization problem

Analyzing the obtained graphs, it is possible to select a rational ratio of the SC parameters, at which the maximum utilization of the vehicle's carrying capacity for the specified characteristics of the bulk cargo is achieved with the minimum number of soft containers with the adopted parameters, which are used for transportation.
Thus, the rational choice of the parameters of soft containers in accordance with the transport characteristics of the cargo being transported, will reduce the cost of containerization of bulk cargo transportations in obtaining all the known advantages of container transport.

References:

PERSPECTIVE TRANSPORTATION TECHNOLOGY
VISCOUS AND CONGEALING SUBSTANCES

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The transportation of viscous and congealing substances on the railroad has its own characteristics. For this purpose, special wagons and tanks are used. It is well known, with what difficulties have to face when transporting such products by different types of transport. The main one is the difficulty of the total unloading of products from the tanks of vehicles when the cargo is frozen at low ambient temperatures [1].

For example, bitumen, as well as a number of petroleum products, has a high viscosity, which suggests the difficult nature of its transportation in winter. The frozen bitumen in front of the drain from the tank must be heated, which increases the technological time needed for transportation, as well as the costs associated with transportation.

This fact must be taken into account while still pouring bitumen. It hardens even at 60 degrees, so the process of heating the destination arrival almost inevitable.

In addition, when transporting viscous substances by rail, other properties should also be considered: flammability, explosiveness, volatility, toxicity, adverse effects on the metal shell of the cargo tank and the environment. There is another important nuance associated with the cooling of
bitumen in the process of its transportation by rail. As the temperature decreases, the volume of bitumen decreases as well. As a result, when arriving at the final point, the tank part is not completely filled.

To avoid this, when the bitumen is poured, the temperature is lowered. The normal temperature of the substance loading in the tank varies from 75 to 85 degrees. In practice, reducing the temperature of the filling of bitumen by only one degree gives up to forty kilograms of the product. Therefore, the cooling of bitumen at the stage of its loading has its economic advantages.

All of the above factors once again underline the fact that when transporting bitumen by rail, particular attention should be paid to means of transport.

For transportation of bitumen, special containers with high strength and tightness can also be used. Each of them is equipped with a drain device at the bottom, or a special pumping unit in the upper part.

In addition, such containers are convenient for transportation not only by rail, but also by road transport, as well as for the next transshipment on board the ship. The bitumen container can be easily installed on an appropriately equipped tractor. They have a universal volume that allows you to work with different batches of goods.

However, such technology is characterized by significant disadvantages of the use of specialized containers, namely - the need for returning empty transport equipment.

An effective alternative to traditional technologies for the transportation of this type of cargo can be the use in the technological process of transportation and temporary storage of bitumen soft specialist containers (hereinafter SC) with special inserts [2]. Such containers in the filled form acquire the shape of a cube or a parallelepiped.

After analyzing the available information, one can formulate the following advantages of the technology of using SC during transportation and temporary storage of viscous and congealing substances in comparison with traditional technologies:

• Possibility of safe and economical packaging of products directly at the factory;
• Ability to temporarily store products in soft containers up to 6 months;
• Any kind of transport can be used for transportation;
• High energy efficiency of the technology (there is no need to heat up the products during its transportation and drainage);
• Flexibility in the choice of transport (no need to use specialized types of cars, cars and tankers with heating);
• There is no need to return empty vehicles and transport equipment;
• Technological efficiency of loading, unloading, and transshipment when changing the mode of transport;
• Possibility of transporting small commodity batches of products;
• Absence of the need to maintain and use special infrastructure (heated containers and special equipment for drainage and pouring);
• Less packaging costs (for example, one SC contains about one ton of bitumen, instead of, for example, 5 metal barrels for the same quantity of products);
• Lack of product loss during unloading.

References:

SOCIO-ECONOMIC SUPPORT FOR PASSENGER TRANSPORT OF GENERAL USE

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Passenger transport is one of the most important factors that ensure the livelihoods of society, combining different parts of the territory into a single complex organism, as well as an integral part of industrial infrastructure. Its steady and effective functioning is a necessary condition for stabilization and recovery of the region's economy, its structural adjustment, ensuring integrity, as well as improving the living conditions and standard of living of the population. Efficient functioning of the system of urban passenger transport is the proper level of transport services of the population by high quality services in achieving maximum economic efficiency in the industrial, social and environmental spheres.

A characteristic feature of the passenger transportation market is that the existing structure of the rolling stock does not meet the requirements, primarily the class of urban buses, which greatly impairs the quality of service of the population and the ecological situation in the region.
The enterprises of passenger transport have such problems as the lack of investment resources for upgrading and upgrading the rolling stock; the presence of unequal conditions for the operation of motor transport enterprises of different forms of ownership; the lack of an adapted to the modern conditions of the socio-economic mechanism of financing.

World experience shows that in most countries the organization of passenger transport operation is a matter of constant attention and care of the authorities, finding funds for its financing, including investments. With limited budget resources, many tasks can be effectively solved by attracting private capital in the form of mixed and municipal and private enterprises, and the relationship between them and the administration is built on a contractual basis with a different share of the state from 10 to 100% [1].

Today in Ukraine the conditions of functioning in the market of passenger motor transport are favorable for private carriers - individuals - and very unfavorable for large enterprises, which leads to the gradual disappearance of the latter from the market. As a result, there is a loss of control by the state on the number and quality of services, the technical condition of the rolling stock of carriers, as well as the refusal of private carriers to provide free services to privileged categories of the population. Therefore, the implementation of administrative methods of influencing road transport today by government agencies is very complicated. Public authorities should create certain conditions for business for entrepreneurs to ensure that these conditions are effective, while developing them, account should be taken of the interests of all, without exception, participants in the process of road transport - both carriers and passengers [2, 3].

The system of passenger transport organization does not allow to solve a strategic task of increasing the quality and safety of passenger transportation. In connection with this, there is a need to improve the organizational system for the provision of transport services, which would ensure the accumulation of funds for the development of the problem of rolling stock renewal, more efficient use of it [4, 5].

The basis of the implementation of the selected model of the organization of urban passenger motor transport is the proposed socio-economic model for ensuring the financing of passenger transport. The basis of this model is the interaction of the customer and the carrier of transport services on the basis of the creation of a joint venture for the purpose of quality passenger services by transport services. Under present conditions, neither private carriers nor local self-government bodies can afford large-scale financing. Therefore, this model proposes replacing the old fleet of buses in stages.

In accordance with the functions entrusted to both parties, the private
party provides basic financing and management of the company, on the other hand, local authorities provide conditions for the organization of passenger transportation and the work of carriers. Private carriers carry out fees for carriage and maintenance of vehicles. The executive authorities ensure control over the fulfillment by the carrier of the terms of the contract, and in the event of violation of these conditions, the contract may be terminated. Thus, high control over the intended use of depreciation deductions is achieved.

Application of such an organization forms an opportunity for enterprises to receive a tax allowance, the funds released, in turn, are aimed at updating the material and technical base [6].

The condition for the updating of the material and technical base is provided by the norms of the Tax Code for enterprises registered by single tax payers [7, 8].

Organization of transport process on the basis of the model of financing of city passenger transport of the enterprise allows enterprises to more effectively perform their activities in the conditions of change of tax legislation; obtaining a tax allowance makes it possible to release funds for the renewal of rolling stock, while allocating funds does not significantly affect the cost and, accordingly, the tariff, as well as accumulate and redistribute depreciation deductions for the purchase of buses of middle and large classes.

The proposed model of the organization of urban passenger motor transport allows to provide financing of the necessary structure of the fleet of vehicles in terms of the number of urban buses. The replacement of the old rolling stock must be completed gradually over four years. The new fleet of rolling stock will satisfy the demand for passenger transportation in Kremenchug, will ensure a high level of transport services for the population, economic efficiency.

References:
TRAFFIC CAPACITY MANAGEMENT ON RAIL INFRASTRUCTURE FROM THE PERSPECTIVE OF THE ORGANIZED COMPLEXITY PARADIGM

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Formation of new management methods for traffic capacity distribution on the rail infrastructure of Ukraine requires investigation into the behaviour of the system under consideration. The system of organization and forwarding of loaded and empty wagon flows to destination points is based on the normative document, i.e. the Train Formation Plan (TFP). This document defines the efficient rail operation and directly influences financial results of its application. Thus, the TFP on Ukrainian railways is a network structure which forms a certain framework of a complex organization of rail transportation, and research into the structure properties gives information content about the properties of the whole system. The study proposes research of the property of the system of spatial organization of wagon flows into trains within the Ukrainian rail network based on the complex network analysis.

The TFP was presented as a directed graph of 482 links and 181 nodes-destination stations. The analysis conducted made it possible to de-
fine the graph structure metrics. The hypothesis on subordination of the empirical distribution of the degree of a vertex to the power law was statistically proved. The research demonstrated that distribution of in-degrees is subjected to the power law with a constant of \(~2.34\), out-degrees – with a constant of \(~2.07\), and all-degrees – with a constant of \(~1.9\). The power factor values were calculated on the basis of the maximal likelihood method and tested for adequacy with the Kolmogorov–Smirnov test (KS test). The bar charts of probability distribution for the degrees of graph vertices in two logarithmical coordinates are given in Fig. 1. It allowed putting forward the hypothesis that the assignment network of TFP is a type of free-scale networks [1]. The destination network graph of the TFP is not random, and its development is based on self-organization processes in complicated non-linear systems.

[Fig. 1. The histogram of probability distribution of graph’s node degrees in two logarithmic coordinates: a) in-degree distribution; b) out-degree distribution; c) all-degree distribution]

It is of importance to find the appropriate management method on the base of the above-mentioned conclusions asserting that the rail transportation system is complex and non-linear, and its expansion stimulates self-organization processes. Under these conditions it seems impossible to use traditional approaches towards designing new management methods for rail traffic capacity distribution applying reductionism methods thus simplifying all complicated phenomena to their most simple components, with subsequent description of these components taking into account that their properties are logical for the whole system.

Taking into account the above-mentioned the authors proposed application of a new paradigm based on the research in the field of the organized complexity to solve the problem [2-4]. The philosophy of complexity considers complex systems (one of them is the system of train flow organization on Ukrainian railways) as systems whose properties cannot be reduced to the properties of their components, thus reduction is inappropriate.
A conceptual approach towards the distribution management of traffic capacity on Ukrainian rail infrastructure from the position of the organized complexity paradigm was developed. Based on the complexity of transportation system, it was proposed to develop the management method for rail traffic capacity distribution on Ukrainian rail infrastructure on the base of indirect impact upon the train creation process at the expense of natural processes of complex structure formation without a forced external order. The basis of this method is the principle of management system decentralization through the function distribution between “operation” and “infrastructure”, which allows, thanks to self-organization of the competitive transportation market, taking the rail network as the foundation of interaction between producers and transport service consumers. It will allow setting in motion the self-organization mechanism within the transportation system.

Tactically, it leads to rejecting detailed planning and directing wagon flows along the shortest train routes (according to the TFP). Thus, forwarding companies will be able to select the destination routes for wagon flows in the network in conformity with their internal operational criteria. The rejection of the detailed planning requires regulations which can serve as the framework of the system where forwarding companies will take independent decisions in planning their work. In order to reach an attractor, a set of the states where the system the most efficiently uses the traffic capacity of a rail network, it is important to create incentives and stimuli in the transportation system based on the division and route classification for setting tariffs in accordance with the access conditions. These incentives will enforce the rules according to which for heavy rail sections the fare will be higher while the freight delivery time will be shorter, and for rail sections of less intensive traffic the fare will be lower and the delivery time will be longer. Such an approach makes it possible to actualize the most essential components of self-organization, i.e. positive and negative feedback within the system.

The system equilibrium can be maintained by establishing an actual exhaustion limit of traffic capacity for the rail network, thus avoiding a phase transition of the system, and, as a result, operational losses due to congested sections within the rail network. It allows adaptation of the rail infrastructure operational modes to the customers’ needs taking into account interests of all parties of the rail transportation market, assessed by the cost minimization criterion, and achieving the rational traffic capacity distribution through the network.
IMPROVEMENT OF THE METHOD OF STUDYING THE PARAMETERS OF TRAFFIC

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In the present situation, in most cases, the collection of information on the parameters of transport and pedestrian flows is carried out by the method of field observations, which involves the involvement of a number of accountants. However, with the development of the latest technologies, the possibility of their application in various areas of human activity raises the question of the feasibility of attracting a large number of people to conduct transport research. Therefore, the issue of maximizing the automation of such activities with the involvement of a minimum number of researchers looks urgent. The information thus obtained may be useful for solving various problems, one of which is to reduce the time of movement of special vehicles to the place of call [1-3].

Studies were initiated in the foreground [4, 5], however, they mainly concerned the analysis of the current state of the problem and the coverage of promising directions for studying the parameters of traffic. In work [6] the existing methods of studying the parameters of traffic and their main disadvantages are analyzed. Therefore, it is necessary to develop a method for studying the parameters of traffic, which would ensure the efficiency of research of parameters of transport and pedestrian streams to solve problems in the field of road traffic organization and other related areas of activity.

The task is solved by the fact that the proposed method of studying the parameters of traffic involves the use of an unmanned aerial vehicle with a video camera. An unmanned aerial vehicle rises, flies and hangs over the necessary sections of the street-road network to receive video recording of traffic and then there is a study of the parameters of traffic.

In order to implement the proposed method of studying the parameters of the traffic with the use of an unmanned aerial vehicle, an algorithm for carrying out research on transport and pedestrian flow parameters presented in [6] is proposed.

As we see, the use of unmanned aerial vehicles for transport research will make it possible to substantially facilitate the work of researchers and increase the efficiency of their work, and the resulting video material will also be useful during the educational process to improve the quality of student perception of material.
References:

MODERNIZATION OF WAREHOUSE PREMISES OF THE COMPANY ON THE BASIC OF WMS

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The automation of the warehouse and implementation of the management system has economic meaning where storage, transfer and accounting of any goods, postal items, archival data, etc. are carried out [1]. There are several separate problems regarding the efficiency of the warehouse operations, the solution of which guarantees the efficient functioning of the

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warehouse, its location, the number of storage systems and the size of the warehouse network, the choice between the public warehouse or an own one.

The use of the WMS system makes sense not only in large logistics centers, but also in relatively small warehouses, distribution centers, archives and in production facilities.

In the warehouse, with a large number of operations and insufficient automation, such processes as accounting for goods, their storage and movement, collection of orders and preparation for shipment, inventory tracking result in the loss of manageability.

A large-scale warehousing management today can not be effective without a warehouse management system (WMS).

Today, the modern market offers many solutions for improving warehouse economy: from simple ones, as based on 1C, to expensive Western European systems.

To maximize business needs, it is necessary to automate a warehouse and logistics. The efficiency of the company as a whole depends largely on whether logistics and warehouse work efficiently.

A hardware and software complex designed to fully reflect and optimize logistics processes, which includes a large set of features and capabilities that can effectively manage the placement and movement of goods in a warehouse, is a warehouse management system [2].

The WMS system includes: software (the main part responsible for the logic and algorithm of the WMS-system), equipment (data acquisition terminals, barcode printers and label applicators, bar code scanners, work stations, logistics labels etc.), the conceptual decision on the organization of a management system, developed for a specific enterprise [3].

According to western experts, the correct use of software products in warehouse management is the most urgent point in the organization of warehousing, which brings significant benefits.

The effectiveness of the implementation of the WMS system depends on the experience and qualifications of the specialists who carry out the project at the enterprise. The correct choice of a system depends not only on the software capabilities, the important role is played by how well the processes will be tailored to a particular enterprise, taking into account the specifics of all procedures and operations. Software and equipment can be used in a variety of ways, depending on the organization of the warehouse, the specifics of the product and the management of the warehouse of the enterprise.

System Group Ukraine offers a number of solutions of various sizes for the modernization of a warehouse [4].
Primarily, it is necessary to identify the problems for which it is planned to introduce a system of warehouse automation. When choosing and implementing this system, it is necessary to understand and describe all the problems that it is difficult for workers to solve in all existing ways and means.

Implementation goals and functional requirements for the system should be clearly outlined; an analysis of the functionality should be conducted; cost and timing of implementation, the costs of further exploitation should be calculated; the amount of possible achievements and the number of successful projects in enterprises of similar orientation should also be taken into consideration. Automation of the warehouse will allow the increase in the discharge capabilities of warehouses; expedite warehouse processes, and prevent the loss of goods.

As practice shows, nowadays, enterprises are in dire need of using modern information solutions in warehouse management systems. Due to this it is possible to establish effective relations with clients, significantly increase the speed of the tasks, monitor transactions in real time.

The key to success and competitiveness of a company primarily depends on the correct choice of logistics. Speed and quality of work, profitability of an enterprise depend on proper organization of warehouse accounting at each stage. Unspecified or poorly controlled work of the warehouse entails cash expenses. Introduction of a warehouse automation system today is one of the main solutions to these problems.

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RESEARCH INTO EXCESSIVE BRAKE PAD WEAR IN FREIGHT WAGONS

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Railway transport of Ukraine suffers greatly from excessive wear, poor performance and considerably short service life of brake pads in freight wagons. Figure 1 illustrates a random selection of brake pads removed on demand during the maintenance service of wagons due to their unserviceability for further use on trains because of their poor braking efficiency, high temperature damages on the wheels’ rolling surfaces and other loss development reasons. Annually hundreds of half-worn brake pads are thrown from railway car repair facilities to industrial waste by multiplying it with unrecyclable asbestos and rubber substances, detrimental for people and environment [1]. Besides the most unprofitable factor for rail infrastructure is uneven wear of brake pads, which increases tractive resistance in trains, thus leading to higher energy consumption by locomotives.

Fig. 1. The brake pads prematurely removed during the freight wagon maintenance service due to their unserviceability and accident threat but with rather substantial remains of working substance

The research conducted by the authors demonstrated that the general losses from an excessively long service of brake pads in freight wagons on Ukrainian rail infrastructure is about €130,000 annually.

The analysis of all statistical material gathered made it possible to establish that such negative tendencies is the result of low reliability of the
brake pad retraction device designed by Russian specialists as early as in 1974. [2]. In 1980 this device was approved for compulsory usage for the brake system of fright wagon bogies on the former Soviet Union railways in accordance with the technical requirements ТУ 32ЦВ 1351-80 (Fig. 2, Position 1 and 2).

Such devices fail to operate after a run of 10-15 thousand kilometers on the wagon they were installed with the warranty run up to 200,000 km. Thus, their reliability is about 5-7%.

The research conducted on the brake system structure of a bogie [3] uncovered that the reason of a low reliability of the brake pad retraction device was structural imperfections in triangle 3 (Fig. 2). Here, by the construction, joint 4 between vertical lever 5 and brake beam king post 6 is off-center relative to two joints of pendulum suspension 7 of a pair of brake pads 8. That is, axis $A$ of joint 4 relative to the axes of two joints 7 (false line $BB$), is located at distance $L$. This distance is the arm of force $Q$, which creates the moment of force:

$$M_q = Q \cdot L,$$

(1)
where $Q$ is the force created by the weight of vertical lever 5 and elements linked to it; $L$ is the distance forming the eccentricity (arm) relative to the joints between the pendulum suspension of the brake beam and the brake pads.

Such a moment of force intensified by strong dynamic vibrations in the unsprung parts of the bogie in train movement creates heavy working loads on loop 2 and lock 1 and harmful impact on such a construction.

The results of the research conducted formed the basis for development of an innovative brake pad retraction device and modernization of the brake beam in order to eliminate the damaging effect from the torque moment on this device. According to the diagrams and techniques developed by the authors, Kryukovsky Railway Car Building Works produced research prototypes which were later approved by PAT Ukrzaliznytsia for installation on 10 wagons. The results of observations proved that operational tests confirmed the theoretical background and highly reliable behavior in operation. It allowed eliminating negative consequences on the excising structure.

Conclusions.

1. The set of research made it possible to reveal the moment of force leading to poor reliability of a typical brake pad retraction device that could be the reason of considerable losses suffered by the Ukrainian rail infrastructure on essential transportation routes.

2. As Ukrzaliznytsia has replaced the technical requirement ТУ 32ЦВ 1351-80 and GOST 4686-74 with the innovative technical requirements developed and tested, it will be possible to eliminate losses of freight transportation through widespread excessive wear of brake pads in freight wagons.

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EFFECTIVENESS INCREASE OF THE VORTEX EJECTOR

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Classic direct-flow pumps and ejectors have sufficiently large longitudinal overall dimensions, which does not allow them to be assembled in some compact systems [1]. It is possible to solve this problem by using vortex devices such as vortex ejectors.

The vortex ejector, with small dimensions and simplicity of construction, becomes widespread in a lot of industries, however, despite the accumulated theoretical and experimental data on its work [1, 2], at the moment the questions of energy efficiency use of such superchargers, requiring additional testing. In addition, the ejectors of the vortex type have a low efficiency of not more than 10% [3]. In the publications is not practically information on the dependencies of the efficiency of the vortex ejector on its geometric dimensions.

Thus, the improvement of the energy characteristics of the jet superchargers is an urgent task, the solution of which may be to improve the hydrodynamics of the vortex chamber and the output spiral diffuser, which should lead to an increase in the efficiency of such vortex devices.

On the basis of the numerical solution of the mathematical model, the dependencies of the efficiency, the coefficient of ejection and the vacuum on the vortex chamber of the vortex ejector are obtained. The calculation of the design of a spiral-shaped vortex ejector has shown that use of a spiral drain reduces efficiency by half, due to the loss of energy of the outflow in the spiral drain, due to the swirling of the flow, and its separation from the walls. The research is done by performing a numerical experiment on the basis of the Navier-Stokes equations solution averaged over Reynolds for a incompressible fluid obtained using the generalized Boussinesq hypothesis, which relates Reynolds stress with averaged parameters of the flow [4]. To calculate the fluid flow accepted modified two-layer SST-model. As the fluid flow in the chamber is characterized by fairly large angular velocities, the rotation-curvature correction the streamlines is used [5].

The adequacy of the mathematical modeling of the theory in the vortex ejector was verified by various means, in particular by comparing the estimated patterns of the fluid flow patterns obtained experimentally, according to the integral parameters and the calculated distribution of pressure along the radius of the vortex chamber from experimental.

Thus, a vortex ejector, due to the formation of a sufficiently large vacuum on the vortex chamber axis, creates high dilutions in vacuumed cir-
cuits, which allows it to be used, primarily as an ejection vacuum pump. Its use in pneumatic transport systems is inappropriate due to low efficiency [6]. In these cases, it will be better to use the vortex chamber superchargers, in which the solid particle moves to the periphery of the vortex chamber, it enters the tangential exit channel with the help of centrifugal force.

References:

And it was in the experience of a number of post-socialist states that at one time successfully overcame the path of integration with the EU, and Ukraine was able to identify the main priorities in the rehabilitation of the road sector, which was in critical condition by 2014. According to the Ministry of Infrastructure of Ukraine [2], out of 169.6 thousand km of public roads, about 2.5 thousand km can be recognized as complying with national standards. According to the report of the World Economic Forum on Global Competitiveness on the level of development of roads in 2017, Ukraine occupies only 137th place out of 144 countries [3].

It should be noted that the entry of Ukraine into the EU is possible only if international standards are achieved in the field of activity of the motorway complex, therefore the issue of the further strategy of rehabilitation and development of the road sector needs to be given special attention. After all, socio-economic development of the country, its integration into the world community depends to a large extent on the development of transport infrastructure, in particular on the level of availability of motor roads. The existence of an extensive network of highways and their technical condition are important indicators of civilization of the society, since they have a significant impact on all areas of its functioning.

From 2015, Ukraine has been actively embarking on the realization of all the possibilities of the EU-Ukraine Association Agreement. Guarantees of the approved Association Agreements between Ukraine and the EU [4] on the possibility of using EU assistance resources, including through the exchange of experience and advice, dissemination of best practices and know-how, dissemination of information, including providing advice and structural process of approximation to EU law, capacity-building and institutional strengthening support enabled the Strategy for the Reform and Development of the Ukrainian Roads (hereinafter - the Strategy). The overall objective of the Strategy is to determine the conceptual framework for the formation and implementation of state policy in the field of transport, aimed at creating an integrated transport network of Ukraine's efficient transport system, increasing the investment attractiveness of the transport sector, meeting the needs of the population in transportation, and improving the business environment for sustainable economic and social development of the country. Its main priority is the protection of roads from violators of weight standards. The protection of roads from violators of weight stand-

ards is chosen as the first step not by chance. Patterns of destruction of the design of road clothing show that the excessive increase in axial load from vehicles significantly reduces their durability. It will not be an exit and installation on all roads of a covering, which can withstand a lot of weight, their cost considerably more expensive, than existing today. And in Ukrainian conditions, when the intensity of traffic is three times lower than in Europe, it will never pay off (even in European countries there are only 3-4 countries where such expensive roads exist: Spain, France, Greece, the Netherlands). In the US, UK, Germany, etc. build roads that can withstand no more than 11 tons per truck axle) [5]. In general, any construction of new roads, in the absence of effective weight control of vehicles, inefficient spending of financial resources.

As shown by the practice of developed countries, the introduction of effective road restoration measures has a positive economic effect. Organizing effective control of compliance with the weight standards by the participants in the movement, with the financial and technical support of the EU, is a more effective measure than every year to rebuild the destroyed roads.

When the introduction of dimensional and weight control in Ukraine was identified as a priority and was carefully considered by both the authorities of the country and authorized representatives of the EU, it became clear that there is not only a material and technical base, but also a proper control service, which can be put into operation.

The solution to the problem was the creation of a European Police Transportation Police - the State Service for Transport Safety (Ukrtransbezpeka), one of the priorities of which is the preservation of Ukrainian roads through the implementation of vehicle dimensional and weight control.

The process of the formation and development of Ukrtransbezpeka is carried out in close cooperation with European colleagues, because Ukrtransbezpeka is created by the prototype of the EU transport inspectorates. An example is the involvement of UkrTransSec security from 2016 to active cooperation with the Euro Controle Route (ECR) - the union of transport inspections of the countries of the European Union, and within the framework of the institutional development tool TAIEX, Ukrtransbezpeka specialists on a permanent basis take on the work experience of the controlling bodies in Poland [6].

These actions of the Government allowed the launch of state control and supervision of transport safety in accordance with the EU standards. This became possible as a result of the implementation of strict personnel policy, during the formation of the inspectorate, the introduction of changes in obsolete control methods. Also, the creation of an anti-corruption unit in
the Ukrtransbezpeka structure and the implementation of all stages of video-registration control have become effective measures to combat corruption at all levels. The formation of the most transparent mechanism for the provision of administrative services, the implementation of state control and supervision of transport safety has greatly increased public confidence. Ukrtransbase exercises its powers directly, through territorial bodies established in the established manner in each oblast of Ukraine.

The first stage in the reform of the road sector as part of the creation of the state body for the control of the new specimen, prepared the basis for the implementation of the following steps, which resulted in the stabilization of existing GVKs and the modernization of measuring and weighing equipment.

In order to improve the technical equipment of Ukrtransbezpeka units at the expense of funds allocated in 2015 from the European Commission grant within the framework of the technical assistance project "Support for the implementation of the Transport Strategy of Ukraine", in November 2017, 78 mobile laboratories were purchased, the equipment of which includes modern devices for implementation dimensional and weight measurements, which greatly increased the efficiency of the service [6]. The application of weight limits and effective monitoring of their compliance at the beginning of the implementation met violent resistance of carriers, especially the agrarian sector, which over the long term ignored the legislation of Ukraine and completely ignored the traffic regulations, significantly overwhelmed large-sized trucks, moved not intended for freight traffic by roads. In protest of the implementation of measures of dimensional and weight control, there were actions of blocking roads by trucks, and not stopping at the request of Ukrtransbezpeka officials, but the public did not support such actions. In the public consciousness there was a clear understanding that all road users would suffer damage to the roads destroyed by trucks, while the overloaded vehicle was severely controlled and posing a danger.

But we can state the fact that the joint efforts of the state with the EU overcome the most difficult and simultaneously important period - the establishment of dimensional and weight control. As a result, tens of millions of hryvnias of fines came to the budget. But this is not the main thing. There have been qualitative changes in the minds of people, now there are cases when representatives of indifferent public block the traffic trucks with significant excess of the dimensions and weight standards.

Also, an important step for the development of dimensional and weight control is the adaptation of the Ukrainian legislation to the EU standards. The main thing is the implementation of the EU legislation on the
implementation of road transport, the list of which was approved by the order of the Cabinet of Ministers of Ukraine of November 26, 2014 No. 1160-p [7]. Particularly important is the implementation of Council Directive 96/53/EC of 25 July 1996 on the fixing of maximum allowable tonnage values for national and international traffic and maximum permissible weights in international transport for certain land transport vehicles moving within the Community) and Directive 99/62/EC of the European Parliament and of the Council of 17 June 1999 on the charging of transport vehicles for the use of certain infrastructures.

Successful implementation of measures to save road traffic on the example of the developed EU countries for Ukraine is a very important proof that we are ready for change at all levels. Thanks to the fruitful cooperation, active financial and technical support of the EU in the implementation of vehicle dimensional and weight control, in Ukraine, the implementation of the system of overall and weight control on roads, a new European Police Transportation Police was created, material and technical base was updated. It is important that all these actions, not just the implementation of the "next action plan", are part of a system policy aimed at restoring Ukrainian roads.

Particular importance is that for the Government of Ukraine and the Ministry of Infrastructure these changes are not the ultimate solution; the program for the further development of dimensional and weight control is already being developed by developing a network of automatic GVK equipped with sensors mounted on the road and allowing to measure the weight of vehicles in motion (Weight in Motion, WIM), with simultaneous automatic photo and video fixation of violations with the definition of appropriate parameters of the vehicle (date, time of violation, registration number, weight, dimensions of the vehicle, etc.). One of the most important advantages of such automatic weighing systems is: weighing without the need to stop the vehicle, round-the-clock control of vehicle movement, minimizing the human factor and reducing corruption risks, automatic fixing of violations.

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ADAPTATION OF UKRAINIAN LEGISLATION ABOUT HIGHER EDUCATION TO EUROPEAN STANDARDS IN CONTEXT OF IMPLEMENTATION OF THE ASSOCIATION AGREEMENT BETWEEN UKRAINE AND THE EU

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On 2014 was signed the Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Ukraine, of the other part (hereinafter the Association Agreement). Almost simultaneously in Ukraine started great educational reform — new law “On higher education” adopted by Verkhovna Rada (national parliament of Ukraine).

Now, after more than three years after beginning of these processes we can analyse integration of Ukraine to the European Higher Education Area (hereinafter the EHEA) in context of implementation of the Association Agreement.

It should be noted that Ukraine joined the EHEA from its launch in March 2010 as signatory part of the Bologna declaration, but eurointegrational processes started after signing of the Association Agreement deserve special attention and appropriate analysis.
So the Association Agreement provides for such activities in the field of higher education:
- reforming and modernising the higher education systems;
- promoting convergence in the field of higher education deriving from the Bologna process;
- enhancing the quality and relevance of higher education;
- stepping up cooperation between higher education institutions;
- building up the capacity of higher education institutions;
- increasing student and teacher mobility: attention will be paid to cooperation in the field of education with a view to facilitating access to higher education [1].

Law of Ukraine “On higher education” of 2014 also declares that state policy in the higher education is based on principles of international integration and integration of the higher education system of Ukraine into the European Higher Education Area, subject to the preservation and development of the achievements and progressive traditions of the national high school [2] and harmonization of Ukrainian higher education quality assessment systems and the European Higher Education Area [3].

To implement these activities in Ukraine changed system of educational levels: Junior Bachelor instead of Junior Specialist and Doctor of Philosophy (Ph. D.) instead of Candidate of Sciences. Also, qualification level Specialist, which existed in Ukraine as an inheritance of the Soviet system of education, was excluded from Ukrainian higher education system.

For the proper quality assurance, the National Agency for Higher Education Quality Assurance (hereinafter NAZYAVO) is scheduled to be established. Cabinet of Ministers of Ukraine approved statute of NAZYAVO in 2015 [4], but it did not work for one day and in 2017, due to provisions of the new Law of Ukraine “On education”, all members of NAZYAVO was dismissed and new selection of members was started [5].

We hope that NAZYAVO will start working soon. After all, the very proper quality assurance of education is an important component of deepening integration to the EHEA.

As already noted, in 2017 new Law of Ukraine “On education” adopted by Verkhovna Rada. This law regulates not only higher education, but education at all. Moreover, it also declare European aspirations of Ukrainian education — ensuring sustainable development of Ukraine and its European choice determined as the purpose of education [6].

Summarizing, we note that Ukraine has done a lot of work in the field of adaptation of legislation about higher education to European standards for these three and a half years. Was adopted new laws “On higher ed-

ucation”, “On education”, “On scientific activity” etc. In addition, many acts of Cabinet of Ministers of Ukraine and Ministry of Education and Science of Ukraine approved. Higher education institutions (universities, academies, colleges) have received significant autonomy in their activities.

Nevertheless, the issue of activity of the National Agency for Higher Education Quality Assurance remains unresolved as many other issues in the field of higher education in Ukraine.

We hope that processes of Ukrainian integration to EHEA would not stop and implementation of the Association Agreement will only contribute to this.

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FINANCIAL ASPECTS OF OPTIMIZATION OF LOGISTIC ACTIVITY OF THE TRANSPORT ENTERPRISE

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Logistics management has a significant impact on the state of financial and economic as well as legislative provision in the context of modern market economics. This circumstance is necessary, first of all, in relation to the market of motor transport services, the establishment of the economy of the warehouse, the formation of motor transport services in the intermediary organizations.

According to some estimates, in Ukrainian practice, logistics costs account for about 35-45% of the total cost of the organization [1].

The question of the need to automate various business processes for today is of particular relevance. In modern reality, only companies that use advanced information technologies can compete fairly. Not to a lesser extent, this applies to enterprises of the transport complex.

Changes in the economy dictate the need to rethink the approaches to organizing logistics activities.

Requirements for automation of business processes of a transport company are based on a number of tasks, the solution of which is impossible without a systematic approach. In the first place, it is necessary to note the high resource-complexity of similar enterprises, in which most employees often employ a significant number of employees, the need to strictly observe the schedule of transfer and dependence on these financial indicators, as well as the overall complexity of management and control of the process.

In a number of studies of the international transport market there is a trend towards increasing competition, which, of course, leads to increased pressure on prices, so international players, entering the domestic market, are forced to play with the price, and also use additional resources to increase efficiency, in including the introduction of modern automated control systems. It allows to significantly reduce production costs, save time for logistic operations, improve productivity and efficiency [2].

The analysis of the experience of such companies as Toyota, IBM, Jonson & Jonson, Coca-Cola, Philip Morris, Motors, General Ford Motors, etc., allows us to conclude that the application of the logistic concept allows for a high degree of the competitiveness of goods and services produced by the enterprise. In this case, the efficiency of the enterprise, which applies the principles of logistics in the production cycle, can be achieved by reducing the cost of production, increase its reliability and quality of supply.
The scientific literature gives enough attention to the prospects for the development of logistics and factors contributing to this development. A lot of research shows that at the stage of formation of a new economy, the processes of globalization and informatization of society, as well as increasing the influence of consumers on logistics activities, will have a serious impact on the prospects of logistics development and logistical priorities [3].

One of the urgent and specific problems for transport companies operating in various spheres of urban and suburban passenger transport is the introduction of automated systems of travel options (ASAP).

In any city there are many businesses that work in the field of passenger transportation. However, the passenger, who is only interested in comfort and speed of travel, is not at all interested in understanding the subtleties of their interrelations.

Increasing the efficiency of the passenger's transport system as a whole is to create a common system that synchronizes and unifies the ticket menu, which includes all operators, including commercial ones. Such a system must also take into account all categories of privileged passengers who must be able to benefit from privileged travel in any form of municipal and commercial transport, in accordance with the law.

In general, the complex automation of the ticket sales process provides for an increase in the collection of income from fares for travel not less than 15%; the possibility of partial, and at individual transport schools, complete replacement of cashiers on automatic machines; decreasing queues at peak hours without increasing the number of cashiers; dysfunctionality of the ticket sales service at round-the-clock mode seven days a week without the involvement of additional staff.

In order to optimize logistics, as well as to improve the financial position of the company should:
- use a lease instead of a bank loan;
- to expand the use of loan per-sonal;
- reduce transport costs by reducing the average delivery need and concluding long-term contracts with third-party motor transport companies.

References:
PSYCHOLOGICAL FEATURES OF ROAD SAFETY

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The problem of road traffic is not only a driver, it is also a pedestrian. An experienced driver is, first of all, the ability to master one's emotions, the work of consciousness, the ability to get out of a predicament. But still the main participants are drivers, which can be attributed to different categories, drivers are inclined to road accidents, neutral and reliable drivers, these are those who are able to think psychological, collected, own emotions.

The state of road safety is largely due to the psychological characteristics of drivers who are distinguished by a sufficiently high level of activity on the road and who act as part of the "man-technology-environment" system at the time the vehicle is driven. Therefore, an important task is to study the psychology of drivers as one of the categories of road users and the nature of its impact on road safety.

In recent years, scientists and practitioners have been actively discussing road safety issues, suggesting a systematic and step-by-step approach to their solution, but an analysis of conference materials and international forums shows that psychological and pedagogical issues are not adequately reflected in these discussions and in concrete reality.

Studies by some scientists have shown that drivers who are prone to accident 20%, neutral 30%, and reliable drivers 50% [1, 2].

Experts in the field of motor psychology, found that people fairly objectively assess the threat of their intoxication, but the impact of the level of intoxication on their functionality, they determine much worse. M.A. Kotik draws attention that a significant part of road accidents is associated with a slight intoxication of drivers. In this state, the real functional potential of the driver is somewhat reduced, while the driver, on the contrary, believes that due to the tonic effect of a small dose of alcohol, he has an additional activation of the nervous system and an assessment of his capabilities is significantly increased [3].

Specialists noted that risky behavior depends on the situation of activity and personal qualities of a person. Risk is characterized by a choice between less or more dangerous behaviors; while taking into account the degree of validity (justification) or the unjustified (unjustified) decision-making by a person about risky behavior [4].

Psychological features of road users is inattention, which leads to driver error, for example, when the driver approaches the intersection, he
believes that the yellow traffic light signal turns green, but turns red. [5].

Inattentiveness also includes incorrect decision-making, for example, instead of maneuver, the only one necessary in a given traffic situation, the driver applies emergency braking. Further, the driver can not cope with his emotions and again makes a mistake, starts applying emergency braking, mistakes the accelerator pedal, thereby increasing the speed, there is an accident.

Mental properties of people are not the same. Human mental properties are influenced by environmental factors, which, affecting the nervous system, change the depth and speed of the course of mental processes.

The participants of the road traffic should work at night to visual reaction, as a factor of psychological features. For example, in conditions of poor visibility, there is a constant lack of information about the traffic situation. At night, the driver's activity is hampered by a lack of visual information. This factor and the resulting negative emotions tire the driver. Some features of the psychology of vision are necessary for the driver when choosing the mode of motion under conditions of artificial illumination of the road.

Important enough awareness of road users, including drivers, about the psychological patterns manifested in traffic conditions, in particular, the patterns of the functioning of mental cognitive processes. For example, it is useful to know that in order to reduce the likely negative consequences of dazzling drivers at the oncoming crossroads at night, it is recommended that a strong-willed effort not to shift their eyes to the light source [6].

Types of drivers are systematically violated the rules of the road, which are found in both pure and mixed form:

- a cynical driver, who has had an experience of impunity for committed offenses, there is no (or decreased) fear of being punished;
- provoking driver - the one who by his actions intentionally creates conditions for committing offenses to other road users;
- aggressively-risky driver due to the ease of the emergence of negative emotions and hostility, aggressiveness as a character trait creates conflicts with other road users and police officers;
- inexperienced driver, i.e. Having inadequate driving experience, incl. reduced level of automation of actions, can not comply with the SDA due to limited self-regulation of behavior and poor level of preparedness.
- emotionally unstable (anxious) driver in traffic conditions easily gives in to fear and thus shows a tendency to emotional reaction to the road situation.

Conclusions

Inability to manage psychological data by road users has serious

consequences, these are road accidents that could be avoided.

Characteristics that affect the safety of road traffic are negative psychophysiological conditions, individual psychological qualities - a tendency to unreasonable risk, victim behavior, frivolity, the desire to exceed the established speed limits. The modern driver training system in Ukraine needs to improve its practical focus, optimize the training methodology in driving schools; it is necessary to strengthen the psychological component of training drivers and educate the culture of behavior on the road.

The provision of road safety is possible when implementing an integrated and cross-sectoral approach, consisting in:
- the development of workgrams of professional drivers, their typologies and classifications;
- a thorough study of the regularity of the formation of individual driving styles;
- scientific justification and implementation of modern techniques and technologies for driving instruction, advanced training of experienced drivers;
- the formation of communicative and legal literacy of all road users, as well as neutralizing the impact of negative physical road-situational factors.

References:
APPLICATION OF THE SYSTEM OF DETERMINATION OF DEFECTS OF RAILWAY CONCRETE CONSTRUCTIONS OF RAILWAY BRIDGES

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More than 80,000 man-made structures, including 7732 bridges, are being operated on the Ukrainian railways, including 24 off-class and 288 large ones. Most of them were built 50 years ago. In this period, more than 50% of the total number of bridges is defective and weak, which is difficult to process the standard railroad load of class C14. In recent years, the lack of funds for the construction of new railway bridges makes responsible for operational work, the quality of its contents and the timely elimination of damage, therefore significantly increases the quality of accounting defects, processing of the information to determine the causes of their occurrence. This may allow scheduled timely repairs of railroad reinforced concrete bridges, predict the probability of their defective work, significantly reduce the cost of carrying out preventive maintenance, and will make it possible to prolong longevity.

The behavior of bridge structures in real conditions of operation is due to the influence of random factors. The appearance of defects - a process of random nature, and the reliability of the design depends on its proper technical state, therefore, based on the provisions of the theory of probability, the appearance of a certain type of defects in a certain time can be predicted.

Based on the experience of surveys and tests of bridges, it can be argued that the predominant number of defects and damage that accrue before the bridge's termination can be attributed to the influence of the factors acting on this or that stage of the bridge existence, but there are extremely rare cases when the reason for the failure of bridge structures can not be established.

In order to obtain statistically reliable defect characteristics of beam reinforced concrete runways of railway bridges, it is necessary to conduct a thorough job of collecting information. The data is to be taken from the reports of continuous surveys performed by railways service departments. This approach simultaneously provides an opportunity to assess the quality of the system of tracking and supervision of bridge structures. On the basis of the received information it is necessary to create a base of defects of reinforced concrete runways of railway bridges.
The existing system of tracking and monitoring rail bridges does not provide accumulation of data on defects in bridges for the full period of existence of this system. Restrictions were carried out with one more amount of data. Based on considerations of obtaining qualitative theoretical and practical useful results, it is necessary creating a statistical picture of defect on all Ukrainian railways with the study of the process of accumulation of defects in bridge structures in time.

Summarizing the data of the technical reports on the survey of bridges performed by the railways services services, one can present the following main factors of the designation of defects when the parameters of durability are exhausted at the constant operating load:

- exhaustion of endurance of the valve as a result of fatigue processes, which are manifested in the appearance of cracks and tears of the rods;
- cracking adjacent to the working armature of concrete zones;
- exhaustion of the endurance of the compressed area of concrete with the appearance of cracks and shrinkage;
- leakage of concrete with the appearance of stains, drains and stalactites;
- the appearance of cracks defrosting the outer layers of concrete, as well as the detachment of concrete, the exposure of the working armature, the corrosion of the reinforcing bars or beams;
- destruction of the weakened concrete of the compressed zone, breaking of the rods of the working armature, wires in beams;
- carbonization of the protective layer of concrete with its subsequent exfoliation and corrosion of the naked fittings.

The first two factors can be attributed to the natural loss of durability. They depend on the level of operational load and time of the runway construction. Other factors affect the durability of bridge structures when overloading elements compared to the design values of loads. An example of a defect identification system is presented in Table 1.

According to the results of the analysis of the technical documentation on the survey of bridges and the fixation of defects in reinforced concrete runways, it can be said that the errors of the inspections are random and distributed according to the normal law. The proposed division of defects by nature and place of appearance will allow for better planning of maintenance and durability. The hypothesis about the existence of a relationship between the term of service, the type of runway structures and the frequency of defects is confirmed. We consider it expedient to introduce the system of designation of defects of reinforced concrete runways for unification of data on all railways of Ukraine.
Globalization of scientific and educational space. Innovations of transport.
Problems, experience, prospects.

Table 1

<table>
<thead>
<tr>
<th>The name of the defect</th>
<th>Defective code</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
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<tr>
<td></td>
<td>2</td>
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<tr>
<td>A. The bridge on the bridge</td>
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<tr>
<td>Insufficient thickness of the ballast layer under the sleepers</td>
<td>1</td>
</tr>
<tr>
<td>Displacement of the axis of the track with the axis of the</td>
<td>02</td>
</tr>
<tr>
<td>runway</td>
<td></td>
</tr>
<tr>
<td>Disturbance in the overlap of deformation seams</td>
<td>03</td>
</tr>
<tr>
<td>Excessive ballast layer thickness under the sleepers</td>
<td>04</td>
</tr>
<tr>
<td>Insufficient amount of strain seams ...</td>
<td>05….54</td>
</tr>
</tbody>
</table>

References:

ANALYSIS OF CAUSES AFFECTING ON ROAD TRAFFIC SAFETY

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As is known, there is a complex dynamic system on the automobile roads, which contains a set of elements: person, car, and road operating in a specific environment. These elements of the unified road transport system are in definite relations, connected with each other, and form the integrity [1].

Road safety for citizens is an important part of government protecting program ones from negative factors resulting in people dying or injuries. Therefore, identification of factors that significantly affect on the road safety level is an important nowadays task. In addition, the development and implementation of measures aimed at reducing or eliminating the effects of the identified factors are especially important.

Statistical analysis of road accidents in Ukraine gives an opportunity to make a simple conclusion – we can observe their sufficient rising last years (see Fig. 1).

![Fig. 1. Road accidents dynamic in Ukraine by years](image)

It is interesting that reduced to gasoline (liquefied gas consumption is more than gasoline consumption on 25 % in average, diesel fuel consumption is less than gasoline consumption on 30 %) total fuel sales decreased through the gas stations in that time gap (Fig. 2).

Thus, we can observe that related to one road accident volume of fuel consumption in Ukraine decreases. Comparative analysis shows that in...
2014 there were 34.8 thousand liters of fuel by one road accident whereas in 2017 there were 29.1 thousand liters of fuel by one road accident only.

Fig 2. Reduced to gasoline annual fuel sales in Ukraine by years

It is known that several factors affect road safety state [2]. In addition to the poor condition of the road surface last decades, in our opinion, the fact of road police absence has a significant impact. Therefore, it should be noted that one of the causes of road accident level increasing is lack of specialized supervisor authority and photo&video registration systems of road accidents. In other words, the system is highly desirable that could reveal and punish of drivers.

Fig 3. Fuel consumption related to one road accident by years

Delays in the large-scale introduction of road police on the Ukrainian roads, as well as low self-discipline of Ukrainian drivers while driving – this is the main reason for the increase in the number of road accidents in Ukraine.

As a result, the prevailing cause of road accidents has changed. In 2012 among the overall account of accidents the maneuvering rules violation ranked first (37.3 %), the safe distance rules violation ranked second (19.4%) and the excess of safe speed ranked third only (15.4%). Whereas in 2017 after two years the road police was eliminated the prevailing cause of road accidents with injured people was the excess of safe speed (27.8%). The safe distance rules violation ranked second (19.1%) and the crossroad traffic rules violation ranked third (10.9%).

Hence, if poor condition of the road surface had affection on increasing of traffic accidents, the excess of safe speed would not be so significant factor. At the same time, an absence of the road supervisor authority that would provide control the driver’s with low self-discipline level is, in our opinion, the primary cause of road accident rate increasing and personal safety reduction for road traffic participants.

We believe that main urgent actions for sufficient raising the personal safety level of road traffic participants are: 1) retrieving the thorough road control for abidance the traffic rules by drivers and pedestrians; 2) increasing of penalty amount as punishment for traffic rules violators.

References:
QUALITY IMPROVEMENT METHODS FOR RESTORED PARTS OF THE ROLLING STOCK

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Build up welding is the most common method of restoring parts of the rolling stock. Build up welding of the parts being restored enables to produce the surface layer of different chemical composition and properties [1,2]. The most promising method is formation of the layered structure with various properties.

Today, the following layer quality improvement methods where each technological procedure has the relevant area of application can be used for restoration of the worn-out surfaces of parts of the rolling stock:

- using an electrode wire;
- using a welding filler;
- coating before building up [3,4];

A few dozens of different grades of solid electrode wires are manufactured providing the hardness of the built up layer in the wide range (up to MKS 50) are manufactured now. However, alloy wires are quite expensive due to the complexity and labour intensity of the manufacturing technology. For this reason, twisted electrodes from the small-diameter wires of different grades are not used.

Flux cored wires have higher cost. Most of them are produced with a diameter of 2.4 to 3.2 mm, which limits their range of application for build up welding, since the more the electrode diameter is the more the welding current, and hence the heating of the part itself is. The difficulty of the use of such materials is due to different electrode filling coefficients. This is associated with different currents on the electrode caps and the density of the cap inside the electrode. Therefore, an individual selection of the electrode for a particular surface being restored is required, which is inappropriate for the technological line processes [5].

Welding becomes more difficult when the cast iron structure changes as a result of prolonged exposure to high temperatures, as well as the penetration of oils and fuel combustion products. The formation of such defects is less likely if hot building up (with pre-heating of the part) and low-temperature techniques (soldering, soldering-welding) are used.

Cast iron parts have high bond resistance. They are also distinguished by reliable operation under the reversal loads and can quench vibration distortions.

There are a lot of restoration techniques for cast iron parts, including...
coating using a cast iron electrode [6]. However, in this method there are no preparatory operations with the removal of defects and traces of wear, as a result, the deposited metal layer will be depleted during the operation. The restoration of iron parts can be carried out by electrochemical treatment with electrolyte feed through a tubular electrode – a tool undergoes induction building up, grinding of the built up surface and oxidation in nitrogen atmosphere.

The main disadvantages of this method include high technological requirements and inability to provide necessary adhesion of the main and built up metal. Therefore, the high-quality restoration of the geometric dimensions of worn-out parts is impossible.

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STRUCTURAL CHANGES IN IRON-CARBON ALLOYS UNDER CONDITIONS OF FRICTION

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One of the most important trends in the development of machine building is the reduction of the material consumption of machines and mechanisms. Reducing the size and weight of products leads to the need to
transfer higher contact pressure and capacities, which leads to a rapid change in the properties and structure of the material, especially under conditions of friction. A wide variety of complex physicochemical concurrent processes occurring on friction surfaces makes it difficult to create a unified description of the process of rubbing surfaces wear.

Friction and wear of the material under the conditions of adhesion is a complex multifactorial type of loading, as a result of which changes occur in the metal-environment interface, directly related to the formation of a highly deformed fragmented metal-environment interface and transfer from a normal wear mechanism to a catastrophic. Catastrophic metal wear can be characterized as a sharp and irreversible increase in fracture of the metal-environment interface of the sample, comparable to the dimensions of the sample itself. The study of the specific features of the structure formation of metallic materials, their physicomechanical and tribological properties under various friction and wear conditions is the problem number one at present.

Structural changes in the metal-environment interface of solids under friction conditions consist in the formation of a special surface layer, the structure of which is strongly crushed under deformation, mixing, and heat generated by friction. Typically, the formation of such interface is mainly associated with the transfer and mixing of fragments and wear particles on the surface. Thus, popularly believed the formation of the layer proceeds gradually and is not associated with a change in the scale factor. It was found that this process can occur in a very short time in the form of displacement of one part of the material relative to the other, due to loss of shear stability of the metal-environment interface under conditions of strengthening of the adhesive friction component. Based on the available preliminary results, it was assumed that during the adhesion wear process; deformation localization can lead to a local loss of material resistance to shear and the rapid formation and transfer of a highly deformed material with elevated adhesion activity. Since the mechanism of deformation of the material in the nanostructured state differs from the deformation mechanism of the polycrystal, the wear mechanisms must also be different. On change of the friction conditions, a transition occurs from the defect accumulation regime to the adhesive wear regime at a higher scale level. By doping technique the friction zone it is possible to bring the system back to a low scale level, creating a protective membrane with low adhesion activity [1].

Various classes of materials were taken for research and tribotechnical tests were carried run a test on them. Then the structural degradation of the metal-environment interface of the samples was studied. Stainless materials do not form oxidized layers on the friction surface, therefore the
entire friction work is spent on heating and deformation of the metal-environment interface. As a result, the material begins to deform at low pressure, and all the features of the wear process are caused by increase of the plastically deformed layer by the opposite element. The resulting nanocrystalline membranes relieve mass transfer processes on the surface, by displacing fragments relative to each other.

Tribotechnical tests of stainless steel of the austenitic alloy 304 AISI in combination with tool steel have made it possible to reveal certain features of the friction coefficient and temperature near the friction surface, depending on the load and sliding speed increase. As a result, the friction coefficient decreases and then increases with the load and speed increasing [2].

With increasing pressure plastic deformation intensifies, leading to the formation of a fragmented layer (Fig. 1) and a zone of plastic flow characterized by a change in the shape of the grains (the arrow shows the direction of sliding)

![Fig. 1. Microstructure of the subsurface layers of the alloy 304 AISI under various pressure conditions](image)

The diffraction pattern obtained from the surface of the austenitic alloy indicates that this layer is not a transfer layer, since there are no traces of the material of the opposite element. The linear dimensions of the fragments are 0.01-0.1 μm (Fig. 2, a). As the external parameters (pressure and speed) increase, the number of these sections increases, due to the temperature increase. As a result, almost the entire surface of the sample is involved in the deformation process. The structure of the underlying zone of plastic deformation externally differs from the original structure only by an increased number of observed dislocations (Fig. 2, b). There takes place texturing in the alloy during the process of deformation under conditions of friction [3].
Fig. 2. Microstructure of the subsurface layers of the alloy 304 AISI
a) a layer with a fragmented structure, b) a zone of plastic flow

Thus, under conditions of intense plastic deformation, the material actually decomposes into two essentially different parts: a layer with a fragmented structure and a zone of plastic flow. The studies of stainless steel showed that the deformation of the metal-environment interface in friction process under heavy pressure displaces along the friction surface as a whole.

References:
CALCULATION OF TRAFFIC LIGHT REGULATION REGIMES, TAKING INTO ACCOUNT EMPIRICAL CHARACTERISTICS OF TRANSPORT MOTION

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Crossroad is one of the most complex objects of transport infrastructure in the traffic system. Organization of traffic control on crossroads, which is safe for drivers and pedestrians, is an important scientific task. Theoretical methods for calculating elements of the traffic light cycle were created during the times of relatively low traffic intensity; therefore, they require constant improvement in view of the existing actual changes in the parameters of the traffic flow.

Of current interest is the study of the actual parameters of the movement of vehicles during braking in order to stop before the prohibiting signal of the traffic light at the intersections. This will improve the method of determining the elements of the traffic light cycle, depending on the parameters set.

When determining the parameters of traffic signaling, account should be taken of the actual reaction of drivers to the change of signal, so that the controlling influence of the traffic signal corresponds to the real characteristics of the traffic.

The purpose of the research is an experimental verification of the conformity of existing theoretical methods of calculating the parameters of the traffic-light control for the requirements of road safety at the intersections and improvement in the part of calculating the minimum time interval and the duration of the basic tact of the regulation phase.

The research was conducted on 15 traffic lights of the city of Zaporizhzhya, characterized by high accident rate. One of the main causes of the accidents at these intersections is the driver's violation of the control signals. As an example, 3 objects are considered: Naberezhna Street–Fortechna Street, Naberezhna Street – Nemyrovycha-Danchenka Street, Kosmichna Street – Stoliarna Street, Zaporizhzhia city. They are typical representatives of the entire study group. The first object is a controlled pedestrian crossing. Others are crossroads with a correspondingly high and low intensity of cross-sectional movement.

At these intersections, starting from the stop line, beacons were installed at intervals of 5 meters from each other. These beacons were used as reference points in determining the location of vehicles at the beginning
of braking. The braking start moment was recorded visually by the switching on of rear stop signals while watching a video.

The instantaneous speed of vehicles at the moment of the start of braking was recorded by the Iskra-1 radar meter (Ukraine).

The time of the start of requirement for braking of vehicles was traced by the signals of the traffic light [1], in this, the first second of the green flashing signal was set as the first second. The results of 48 measurements were taken as input data for further analysis. The moment of deceleration, the actual instantaneous speed of the car at this moment and the distance from the point of the start of braking to the stop line were determined. Only those cars that did not cross the road without stopping were selected as objects of observation.

After analyzing the results of the research, it can be argued that most drivers start braking at a distance from the traffic light, which gives them the opportunity to brake with a comfortable deceleration, without having traveled the stop-line. However, in the traffic flows researched, there are drivers who have a more dangerous driving style.

It is also possible to determine that more than 30% of drivers start braking in the fourth second (that is, at the first second of the yellow signal), and less than 5% of drivers start braking in the fifth second. Drivers who began braking at the last second of the yellow signal were not detected.

The amount of deceleration of 85% of the support is 3,43 m/s², which, however, does not exceed the maximum acceleration value recommended for practical calculations (4 m/s²). In this regard, it is proposed to make some clarifications to the formulas for calculating the duration of the additional tact.

The formula for calculating the minimum duration of an additional tact has the form [2]:

$$ t_n = \delta_1 + \frac{V}{2a} + \frac{B + l_a}{V}, \tag{1} $$

where \( \delta_1 \) is the reaction time of the driver, s; \( V \) is the speed of movement of 85% of security, m/s; \( a \) is the deceleration of the car, m/s²; \( B \) is the width of the crossroads, m; \( l_a \) is the length of the car, m.

Instead of the value \( \delta_1 \), it is proposed to substitute the value \( t_n \), which is the time of 85% of the provision of the start of braking, which according to the calculation results is 3,5 s. The value \( a \) is proposed to take 3,43 m/s².

If you use this formula, then the value of the additional tact will increase significantly, however the fraction of the effective time (before the
start of braking) will move from the main tact to the additional one. In order to compensate for this difference, it is necessary to change the formula for calculating the duration of the basic tact [2], describing it as follows:

\[ t_{oi} = \frac{y_i}{\bar{Y}} (T_o - L) - t_e, \]

where \( y_i \) is the phase coefficient of the \( i \)-th phase of regulation; \( \bar{Y} \) is a total phase factor of crossroad; \( T_o \) is the duration of the regulation cycle, s; \( L \) is the time lost in a cycle, s.

Thus, as a result of the research conducted, the dependence of the elements of the traffic light cycle on the actual parameters of the vehicle movement during braking in order to stop before the prohibiting signal is determined. On the basis of them, the formulas for the calculation of basic and additional cycles are specified.

In the known formula for calculating the duration of an additional tact, the presence of traffic light green flashing signal was not taken into account. With its introduction in accordance with [1], the appearance of a yellow signal is not unexpected for drivers, therefore, the moment when they start braking changes. It is possible to redistribute the effective and lost time of the traffic light cycle between the main and the additional cycles, taking into account the actual behavior of drivers.

References:
The most promising direction development coal technologies in Ukraine of water-coal fuel (WCF) as alternative fuel for needs heat and power complex of Ukraine. The low effectiveness previous implemented measures practical orientation is due not only lack organizational and managerial component, but also need for more in-depth studies of WCF as theoretical and empirical nature [1, 2].

The performed theoretical and experimental studies transport WCF showed that a lot factors influence transport parameters, one which is granulometric composition fuel. The study effect granulometric composition on energy efficiency transportation requires a significant amount of experimental research and permanent change composition, which influences rheological indicators.

For solution this problem, methods computational hydrodynamics - finite volume method (FVM) method are used. The essence method consists following: a certain closed region fluid flow is selected, for which search for fields macroscopic quantities (for example, velocity, pressure) describing state medium in time and satisfying certain laws, formulated mathematically [3,4]. The most used are conservation laws in Euler variables: for any value $\phi$, at every point $O(x, y, z, t)$ space, surrounded by some closed end volume, at instant time is following dependence: total number values $\phi$ in volume may vary due to factors.

In addition sampling of calculated area, one must also consider general sampling methodology basic equations. Because when constructing differential equation of any value, a uniform form is used, we consider process discretization by method control volumes on example some value $\phi$ in integral form [5].

In the paper mathematical model three-dimensional spatial flow of water-coal fuel (WCF) was developed, which, unlike existing models SST turbulence, can determine hydraulic parameters transportation WCF in industrial hydrotransport systems, taking into account rheological properties, flow regimes and granulometric composition. To solve this problem, we used methods computational hydrodynamics - the finite volume method FVM. A three-dimensional model experimental setup was constructed to perform calculations hydraulic transport parameters WCF. A comparison is made between accuracy determination pressure losses by different models.
It has been established that greatest error in calculating flow without taking into account rheological law, that is flow Newtonian fluid with same viscosity. It is established that slightest error is laminar model and SST-model, taking into account rheological law [6,7].

The results numerical calculations qualitatively coincide with analytical description of Bingham current and results experimental studies. The use above mathematical model and numerical means calculation is possible only specialized software due complexity computational procedures exclusively by computer means. To date quite number software products that allow to calculate flow fluids and gases: OpenFoam, Ansys Fluent, Cosmos FlowWorks, Ansys CFX, FlowVision and many more.

References:
ASPECTS OF PROJECT MANAGEMENT IN LOGISTICS SYSTEMS

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Logistics management of the company solves complex designing and creation of logistic systems. Therefore, logistics is another area of application of project management methods. Project management in logistics is aimed at creating new or transforming existing logistics systems. Project management in this case is used as an instrument for implementing strategic logistics solutions of the enterprise, and the management of logistics projects is carried out from the standpoint of system and logistic approaches simultaneously [1].

Any project and the process of its implementation, implementation is a complex system, where the project itself acts as a managed subsystem, and the management sub-system is project management.

Project management in logistics is based on the use of project and program management methods in the process of creating or transforming logistic integrated systems that ensure the quality of production and delivery of finished products to the end user.

The combination of methods and methods of logistic management with methods of project management ensure achievement of enterprise maximum profit, expansion of market segment, obtaining competitive advantages in the conditions of optimal use of the resources at the company's own resources and adaptation to environmental changes. [1, 4]

The managed project parameters include: scope and types of works; cost and costs of the project; terms, duration of work, stage, phase of the project, as well as the interconnection of works; resources required for the implementation of the project, in particular: labor, financial, material and technical, as well as their lack; quality of project decisions, used resources, components of the project [2, 4].

Experience has shown that logistics has a high potential for economic efficiency. The relatively short history of the development of practical logistics confirms this view. The economic effect of logistics manifests itself in the high level of organization of production and, as a consequence, in the economy of material and monetary resources. The size of the effect, in its turn, depends on the scale of the distribution of logistics.

The analysis of research in this field made it possible to conclude that under present conditions one of the most effective methods of controlling logistic systems is the use of outsourcing.
Outsourcing is the transfer to the management of specialized firms of the entire business process or its individual functions.

By transferring the functions of managing the logistics project to external structures, enterprises can focus on the main tasks, eliminate the problems of selection of specialists in project management and logistics, reduce costs [3].

Functions that are most commonly transmitted to outsourcing: drawing up and monitoring the implementation of a project calendar plan; monitoring and control of project implementation; general administration of the project (minutes of meetings, control over fulfillment of orders, control over the implementation of plans, keeping an archive of documents regarding the project).

Depending on the nature of the activities of the customers, their intensity, the flow of documents, the need for consulting support, outsourcing services may be provided on a full or partial outsourcing basis.

The main advantages for the organization-customer of outsourcing services in the field of project management are: more efficient use of own resources; improving the quality of management, budget compliance and the timing of work, reducing costs; achievement of strategic goals; ensures an increase in the competitiveness of the organization; the work of the involved employees is remunerated from the calculation of the actual time spent; For projects you can plan and modify the quality management options.

Consequently, outsourcing of project management significantly increases the effectiveness of project implementation within the time and financial budgets, which allows companies to take advantage of new competitive advantages and more effectively achieve their business goal.

References
Global environmental disaster can be one of the reasons of destruction of a modern human civilization. In dust content of air the leading role belongs to motor transport. Environmental problems, the environment in general, by universal recognition, became the most terrible after a problem of nuclear war. The main pollutant of an atmospheric air is the transport working at a basis of heat engines. Each car for 1 year throws out on average 1 kg of lead in the form of an aerosol. Rubber dust is a product of wear of automobile tires. Exhaust gases of cars give bulk: lead, nitrogen oxide, carbon oxide. Asbestos dust is a consequence of wear of friction facings, disks, couplings of brake shoes. Asbestos is badly brought from an organism therefore process of its impact on internals, lungs, a mucous membrane is very long, can reach 10-15 years, and up to the end isn't studied. Heavy metals belong to strong toxins. Each car throws out more than 3 kg of harmful substances daily. Content of lead in an organism is higher at those people who live near busy roads.

The purpose of work consists in the analysis of a problem of air pollution by exhaust gases of cars and assessment influence of transport infrastructure of the cities on their ecological safety.

Motor transport is continuously moving source of pollution. Exhaust gases first of all affect respiratory organs. Owing to constant effect of harmful substances there are diseases both sharp, and chronic. Some chemical elements have property to settle in an organism, especially heavy metals. Collecting gradually in an organism, they lead to serious diseases over time. From warmly vascular system: otodyshka, dizzinesses, stenocardia, development of a myocardial infarction. From airways: allergy, bronchitis, asthma, tumors. From nervous system: indispositions, irritability, sleep disorder.

In rather small territory of the cities the set of the enterprises which emissions significantly influence a condition of ecology is located. Transport infrastructure of the cities is provided by network of categories of public highways of regional and territorial value and the public roads relating in the parameters to local roads. Uneven distribution of pollutants across the territory of the city is noted. At the beginning of the 90th years of the XX century the index of air pollution of the cities exceeded admissible norms. For this reason nature protection actions were developed and ap-
plied. In the last five years air pollution and waters increases again. The cities with the biological and landscape diversity have ability to recovery of an ecosystem. Zones in which squares are located parks and green plantings carry out a role of natural filters. The central regions of the cities which are characterized by the increased level of pollution is in a zone of influence of the railway and motor transport. Therefore concentration of dioxide of nitrogen, soot and benzpyrene constantly exceed norm by 1.5-2 times. The districts of the cities located in close proximity to large enterprises exceed average monthly concentration on formaldehyde. It is considered that aerosols of haloid compounds of lead can be exposed to catalytic and photochemical transformations, participating in formation of a smog. The polycyclic aromatic hydrocarbons found in gases — strong carcinogens. Among them benzpyrene is most studied, except it anthracene derivatives are found: 1,2 — benzanthracene; 1,2,6,7 — dibenzanthracene; 5,10 — dimethyl — 1,2 — benzanthracene.

The toxicity of different hydrocarbons strongly differs, in the presence of nitrogen dioxide photochemically are oxidized forming poisonous oxygen-containing connections — making a smog.

Table 1

<table>
<thead>
<tr>
<th>Chemical element, %</th>
<th>Petrol</th>
<th>Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂, об.%</td>
<td>74-77</td>
<td>76-78</td>
</tr>
<tr>
<td>O₂, об.%</td>
<td>0,3-0,8</td>
<td>2,0-18</td>
</tr>
<tr>
<td>NO₃(steam), об.%</td>
<td>3,0-5,5</td>
<td>0,5-4,0</td>
</tr>
<tr>
<td>CO₂, об.%</td>
<td>0,0-16</td>
<td>1,0-10</td>
</tr>
<tr>
<td>CO, об.%</td>
<td>0,1-5,0</td>
<td>0,01-0,5</td>
</tr>
<tr>
<td>NO₂, об.%</td>
<td>0,0-0,8</td>
<td>0,0002-0,5000</td>
</tr>
<tr>
<td>CₖH₂ₙ₊₂, об.%</td>
<td>0,2-3,0</td>
<td>0,09-0,500</td>
</tr>
<tr>
<td>CₖH₃₅O, об.%</td>
<td>0,0-0,2</td>
<td>0,001-0,009</td>
</tr>
<tr>
<td>Soot</td>
<td>0,0-0,04</td>
<td>0,01-1,10</td>
</tr>
<tr>
<td>C20H12</td>
<td>10-20x10-6</td>
<td>10x10-6</td>
</tr>
</tbody>
</table>

For reduction of influence of exhaust gases specialists recommend by-ways in settlements for transit and cargo transport. Cardinally gardening since the carbon dioxide gas is absorbed by plants resolves an issue and oxygen is emitted. To provide control of adjustment of traffic in big cities in order to avoid traffic jams since during traffic jams more exhaust gases with toxic substances, especially in rush hour are emitted. It is necessary to look for ways of decrease in toxic exhaust gases. For this purpose it is necessary to apply less toxic fuel, instead of internal combustion engines to use envi-
ronmentally friendly installations on engines of converters. To recommend the rational choice of power setting. For decrease in pollutants in the atmosphere it is desirable to pass to gas-balloon engines, the low-used hydrogen engines. To lower to a trip car minimum, to go on foot or to use the bicycle as the vehicle. There are new means for air pollution reduction by exhaust gases, for example such as: the special biocatalyst which allows to save fuel. An important factor of decrease in risk of a disease is fuel quality. Development of euro standards and application them allows to regulate quality of human life.

In this regard development of a road network of the cities taking into account development of transport infrastructure of all regions is relevant that in turn will allow to unload the main highways of the cities. The solution of such task in this way will allow to improve an ecological condition of the atmosphere. The most important direction of protection of the atmosphere of the cities is the state control of sources of pollution of an atmospheric air for the purpose of obtaining the objective information about emissions of pollutants in the atmosphere by the industrial enterprises and transport and assessment of compliance of the actual values of emissions to the established standards. This direction provides development of system of monitoring of a condition of an atmospheric air in the cities in which stationary and route posts of observation have to carry out the main role.

References:


ANALYSIS OF THE PROBLEMS OF ORGANIZATING PIGGYBACK TRANSPORTATIONS IN INTERNATIONAL TRAFFIC

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Throughout the world, piggyback transportations are considered as a natural process of overcoming competitive relations between the road and rail transport and transition to cooperation relations [1, 2].

The organization of piggyback transportations is possible on the basis of a developed network of terminal complexes, the technology of functioning of which must be formed on the basis of a logistics approach [3-5]. In turn, with the coordinated work of all participants of complex production and transportation systems, a synergetic effect is achieved [6].

The prerequisites for the development of piggyback traffic are the following: seasonal restrictions on the movement of large-capacity vehicles; limitation of the driver’s continuous driving time; requirements as for the safety of goods transportation. As a result of the analysis of practical experience of using piggyback transportation in the international traffic, existing problems of technical, technological and economic nature are highlighted, among which are the following:

- presence of disproportions in the foreign trade of goods, when the predominantly finished goods are imported, and the commodities are exported, so that the goods with different transport characteristics are presented for transportation;

- not a coincidence of the volumes of freight flows in the export and import traffic, which does not allow to ensure a full backload of the rolling stock, and therefore characterizes the inefficient use of the rolling stock.

- low degree of utilization of the load-carrying capacity of railway platform-forms, as they do not transport only cargo, but also road-trains or semi-trailers. This leads to an increase in the cost of transportation;

- lack of a representative network of national transport, logistics and forwarding companies outside Ukraine to ensure a high degree of coherence of actions of all the participants of the delivery process and their interests protection;

- lack of the legislative basis and the system of environmental protection from the harmful effects of various modes of transport, which casts doubt on the commercial feasibility of piggyback transportation;

- the need for a large fleet of specialized railroad platforms to transport laden lorry trains and semi-trailers;
- a significant complexity of developing cross-cutting tariff schemes and the formation of tariff rates for transportation of transit and export-import goods by trailers, connected primarily with different legislative and regulatory frameworks of different states, as well as with different approaches to the formation of tariffs for road and rail transport;
- lack of a developed network of transport and logistics centers in Ukraine within the framework of international transport corridors;
- a limited number of trailing piggy trains, while the need for these transport services exists in many regional centers of the country, not only in the international traffic, but also in the domestic one.

Thus, it is advisable to create new routes for piggyback trains after commercializing their effectiveness [7], provided that there is complete information on the structure of the freight flow on a particular route and market segment of the service. At the same time, a logistical approach to the organization of piggyback transportation, using the results of scientific research, is necessary.

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ENERGY EFFICIENCY OF THE USE OF ELECTRICAL ENERGY STORAGE DURING SHUNTING OPERATIONS

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Currently, the issue of increasing the energy efficiency of the transport process in the railway transport is given a lot of attention both in Ukraine and abroad. First of all, this is due to the fact that the cost of fuel and energy resources constitute a significant share in the structure of the cost of rail transport, and reducing this value can improve the economic efficiency of its activities and competitiveness with other modes of transport. Secondly, due to the fact that the bulk of energy resources are currently imported to Ukraine, reducing their level of demand by traction rolling stock, it allows to reduce the level of dependence of rail transport on external factors.

Analysis of the structure of expenditures of fuel and energy resources by all technical means and technologies of carrying out the transport process on the railway transport allows to determine the main directions of increase of energy efficiency and energy saving. The main measure aimed at reducing the consumption of fuel and energy resources by traction rolling stock is its modernization with a decrease in the specific fuel consumption per unit of performed work and increase of efficiency, as well as its replacement on a more modern and energy efficient rolling stock.

One of the innovative energy-saving directions is the use of energy-intensive energy storage devices on maneuver locomotives. Modes of work with constantly changing load and periodic combination of traction and braking are largely inclined to highly efficient use of drives. Their application improves the passage of transient processes simultaneously in the transducers and drive locomotives. They will also allow the fullest use of recuperative inhibition energy.

As a result of calculations the variant of the structure of the drive is determined, which allows to provide carrying out maneuvers with minimal fuel consumption.

From the above analysis it can be seen that the difference in the specific fuel consumption of a train with and without a drive is from 0.5% to 8.5%, such a large difference is that the maneuvering work performed by diesel locomotives is of a multi-faceted nature and varies, and also depends on the track profile.

It should be noted that the parameters of the combined drive also depend on the type of maneuvering work.
The scheme of use of electrodynamic braking energy for power condenser power supply is proposed. As a result, the energy received during braking can be reused with further acceleration.

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