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SIMULATION OF TRAFFIC WITH THE HELP OF PTV VISSIM SOFTWARE

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Transport is one of the key systems of the urban body, which is appropriate to compare in importance with the blood supply [1-3].

To control traffic on the transport network of cities, control systems are widely used, the algorithms of which are based on models of traffic flows. The requirements for the accuracy and complexity of the models are extremely high. One of the most significant applications of transport models for at least 10-15 years will be the design of intelligent transport systems (ITS), the need for which is due to radical changes in traffic conditions and traffic management tasks, caused, in turn, intense, explosive growth motorization.

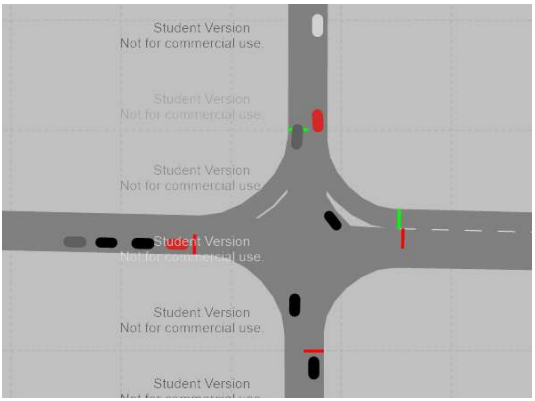

Fig.1. Visualization of vehicle movement

In modern conditions, the task of passing as many vehicles as possible is replaced by the task of maintaining the transport balance between the capacity of the existing road network and its actual load through redistribution (and if necessary through the introduction of traffic restrictions) of traffic flows.

With the help of the software product the average delay time of vehicles of different directions of movement is calculated.

In addition to analytical calculations, it is possible to visually observe the simulation based on the visualization of vehicle movement, as shown in Fig. 1. This allows you to qualitatively analyze the organization of traffic and identify elements that need improvement.

In addition, the use of software for calculating traffic flows allows you to determine emissions of harmful substances on different streets of the city. The use of data on emissions of harmful substances based on CFD methods of aerodynamic modeling [4-8] makes it possible to assess the environmental risks of urban development. Modeling the air temperature distribution when flowing around multi-storey buildings is given in [9-11].

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IMPLEMENTATION TRAFFIC SAFETY MANAGEMENT SYSTEM FOR RAILWAY TRANSPORT IN INTERNATIONAL TRAFFIC

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The formation effective methods for managing safety of railway transport in international traffic should be based on deep and comprehensive analysis state safety, including an assessment existing system for ensuring traffic safety in international traffic and available statistical data on safety, as well analysis domestic and foreign experience in managing risks violations traffic safety.

The work sets task on basis domestic and foreign practice ensuring safety of traffic in international traffic to develop draft unified traffic safety management system (UTSMS) on railway transport in international traffic and implementation "control system" approach: formulate purpose and principles constructing an UTSMS, its structure and functions, composition and description UTSMS components and requirements for them.

By beginning 2015, development unified European railway network was associated with solution of following significant problems in field interoperability and safety organization international transport [1]:

- more than 20 different and incompatible train control systems were in operation;
- each country had its own rules operation of railways, which contradicted each other;
- each country has its own national requirements for safety certification;
- each country used its own training and licensing systems for drivers;
- five different traction power supply systems were used;
- eight different and incompatible communication and radio communication systems were used;
- its own language in almost every country.

These problems and consequences (delays at borders, significant costs and, as result, high tariffs) sharply reduced competitiveness and attractiveness of rail transport in comparison with road transport for transport passengers and goods in international traffic. One ways out situation was creation unified European system for ensuring interoperability and traffic safety on railway transport in international traffic.

On basis, it was possible form main components new system [2]:

- security design authorities;

- regulatory and advisory bodies;
- safety regulatory framework;
- system and technical solutions.

Regulatory and advisory bodies for traffic safety on European railways are European Commission and European Railway Agency (ERA) [3]. At same time, each state of European Union (EU) has its own national railway safety regulatory bodies.

An analysis domestic and foreign experience in ensuring traffic safety on railway transport in international traffic shows domestic safety management system was built on administrative principles using a "rigid" (strictly mandatory) regulatory framework, and European Union, safety on railways is ensured through coordination of Missions. Objectives and Policies National Railways through “flexible” (voluntary-binding) regulatory framework [4,5].

The purpose Unified Traffic Safety Management System for railway transport in international traffic is implement following activities:

- development unified strategy and permanent mechanisms for achieving and maintaining positive trends in ensuring traffic safety;
- coordination activities of national railway administrations in implementation strategy and mechanisms;
- organization exchange of experience and implementation best practices [6].

Traffic safety objectives should aim improve level safety in international traffic. By acquiring best practices in international traffic, it is expected increase level traffic safety in general and level national transport systems. The advantages of UTSMS include creation single integration space in matters traffic safety, use modern management mechanisms and standards, possibility unifying regulatory framework, possibility of harmonization with European traffic safety management system, exchange experience, as well obtaining economic benefits from damage reduction and optimization investment plans and operating costs.

In accordance with international practice and standards in field railway safety, UTSMS is based on six basic principles:

1. Focus on results − increasing level traffic safety through use advantages UTSMS.
2. Voluntary participation national railway administrations in UTSMS.
3. Binding nature decisions UTSMS for national railway administrations in area competence of UTSMS, subject participation in project.
4. Using scientific approach formation UTSMS.

5. Taking into account best practices national and world transport systems.

6. Evaluation performance in achieving goals and continuous development UTSMS.

One most important tasks UTSMS is development nomenclature key indicators and monitoring effectiveness activities achieve goals [6]. The application process approach and constant attention improvement of processes should ensure positive trends in development UTSMS.

At national level, it is necessary consider certain hazardous events associated with activities of railway transport, and all stages its life cycle, provide protection against events.

To assess effectiveness control, taking into account presence two levels, following system differential equations can be proposed:

$$\begin{cases} \dfrac{dx}{dt} = ay - b(x - X), \\ \dfrac{dy}{dt} = -k(x - X) \end{cases} ; x, X, y, a, b, k > 0$$

where x, X − respectively, actual and target values number traffic safety violations in international traffic;

y −coefficient characterizing control actions upper level − UTSMS, at lower level − traffic safety system (TSS);

a − coefficient characterizing response TSS control action UTSMS;

b − coefficient characterizing ability TSS achieve target value number traffic safety violations in international traffic, defined for him within UTSMS;

k − coefficient characterizing reaction UTSMS actual value number traffic safety violations in international traffic.

Differentiating first equation system in time and substituting second into it, we obtain following second-order differential equation:

$$\frac{d^2x}{dt^2} + b\frac{dx}{dt} + ak(x - X) = 0$$

to solve which, in turn, we compose and solve following quadratic equation:

$$\lambda^2 + b\lambda + ak = 0$$

$$\lambda_{1,2} = -\frac{b}{2} \pm \sqrt{\left(\frac{b}{2}\right)^2 - ak}$$

If discriminant $D = \left(\frac{b}{2}\right)^2 - ak > 0$, then roots equation are real numbers, and solution equation will have following form:

$$x(t) = c_1 e^{\lambda_1 t} + c_2 e^{\lambda_2 t}$$

c_1, c_2 − any real numbers.

If discriminant D<0, then roots equation are complex numbers

$$\lambda_{1,2} = -\frac{b}{2} \pm \sqrt{\left(\frac{b}{2}\right)^2 - ak} = \alpha \pm \beta_i$$

then solution equation will have form:

$$x(t) = e(c_1 \cos \beta t + c_2 \sin \beta t)$$

The obtained mathematical expressions, which establish relationship between control actions UTSMS on TSS and reaction these influences, make it possible determine degree change in state of traffic safety in international traffic when changing control actions from UTSMS.

The basis formation organizational structure UTSMS should be process-oriented model corresponding fundamental model UTSMS. Strategic documents, regulatory framework for traffic safety (both national and supranational), as well organizational structure UTSMS represent management basis for planning and implementing life cycle processes of railway systems, monitoring indicators (effectiveness, efficiency, benchmarks) and adopting necessary corrective and preventive measures.

As organizing systemic measure overcome negative trends in state safety, it is advisable form unified traffic safety management system for railway transport in international traffic, which has two levels management (UTSMS − national traffic safety systems, including railway infrastructure and rolling stock) and implemented on process basis. (management processes, life cycle of transport systems, resource provision and output control). The process organization traffic safety management in international traffic will make it possible set achievable economically

feasible safety goals and decompose them into life cycle processes of railway systems.

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USING ARTIFICIAL INTELLIGENCE IN TRANSPORTATION AND LOGISTICS

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The artificial intelligence is gradually developing, new solutions appear, it is being integrated into various areas. If, until recently, artificial intelligence allowed solving a number of medical problems and helped in science, now the scope of application has increased significantly, it includes transportation and logistics.

Public transport is something that residents of both megalopolises and small localities. Passengers who travel frequently by buses, metro, trolleybuses or trams want such trips to be as comfortable and safe as possible. To achieve this goal, artificial intelligence technologies are being introduced into the urban transportation industry. With their help, it is possible to

regulate the flow of cars, monitor bus routes, and ensure the comfortable movement of people to their destinations.

Today, artificial intelligence technologies help automate and optimize various processes in the transport system. For example, artificial intelligence is being used to control traffic lights and reduce traffic congestion. Analyzing data on the congestion of highways, artificial intelligence recommends re-routing. Artificial intelligence is being introduced to study passenger traffic and monitor the health of transport - smart buses with artificial intelligence systems are being developed by various companies. Modern cars with artificial intelligence are equipped with modern equipment and software that provide increased comfort and safety of passengers, which contributes to:

• improving the quality of passenger service due to the accuracy of the route within the time frame;

• transportation becomes safer;

• route optimization;

• cars break down less often;

• facilitation of control passenger flows and simplify control of fleet.

Artificial intelligence machines are most often made electric and, as a result, less harmful gases are emitted into the air.

An unmanned vehicle equipped with artificial intelligence differs from the traditional one in that it is controlled by a computer. Such a machine is capable of moving independently. It chooses a route taking into account the traffic situation, weather, time of day. An unmanned vehicle never gets tired and vigilant.

Artificial intelligence technology can make travel more comfortable and safer, making commuting a real pleasure, not an endurance test.

Artificial intelligence in the field of logistics is evolving, but it should not be confused with computerization. For example, it will become possible to forecast demand, improve logistics itself, automate internal processes, form individual offers based on customer analysis, etc., which will allow:

1. Increase the efficiency of marketing campaigns;
2. Reducing staff costs;
3. Reduced communication costs;
4. Reduced time spent analyzing clients and creating suitable offers;
5. The last, as a result of implementation - profit growth.

One of the elements of artificial intelligence is expert systems that allow sharing the knowledge of one person with others in a single network. These systems allow you to solve a number of serious tasks and automate the process:

1. Selection and definition of carriers;
2. International marketing;
3. Solving global logistics problems;
4. Accounting for stocks in warehouses;
5. Design of information systems.

Modern trends in the field of information technology are carefully monitored by the largest transport corporations and organizations, including domestic ones, who are trying to find the best option for themselves to integrate innovations in their business.

Recently, information from the company appeared that, together with Maersk (a leading company in the field of container transportation of goods), they will create a unique trading blockchain technology for the logistics sector as a whole. Analysis of information allows not only to adequately optimize the work of logistics companies, providers, but also gives a very serious competitive advantage.

Despite the seeming benefits of artificial intelligence, some concerns remain. This is about security - few people want their project and countless amount of confidential information to fall into the hands of attackers. Another issue, also related to security, is that artificial intelligence, as a whole technology, is not yet fully developed - it can bring not only profit, but also loss.

Summing up, it should be noted that transport logistics over the past time has become one of the brightest and most rapidly developing sectors of the economy. Customer requirements are constantly increasing, in particular with regard to automation. The solution to the problem is simple - they will introduce artificial intelligence and similar solutions gradually, analyzing the results.

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DETERMINATION OF VERTICAL LOADS OF THE BEARING STRUCTURE OF A FLAT CAR WITH VISCOUS RESTRAINT IN THE LONGITUDINAL BEAMS

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The competitiveness of the rail industry in the transportation market can be maintained by putting into operation innovative rail vehicles. It must be noted that designers should pay special attention to the bearing structure of a rail vehicle [1 – 3], especially, to their multi-functionality, i.e. capability to perform several functions.

Moreover, one of the widespread problems is provision of the fatigue strength of the bearing structure of a car; particularly it refers to long-base cars, such as flat cars due to the periodic cyclic loads in the vertical and longitudinal planes. It causes damage of the bearing structure of a car. Therefore, the designing of these cars requires the measures aimed at higher fatigue strength of the bearing structure by implementing innovative solutions.

Thus, a decrease of the dynamic loading on the bearing structure of a flat car and an increase of the fatigue strength during operational modes can be reached through application of viscous elements in the bearing structure. These viscous elements were placed in the longitudinal beams of the frame. It requires replacement of the main longitudinal beams of the frame with the U-profile beams covered with a horizontal sheet. The inside part of the profile was filled with viscous material. The dynamic loads to the bearing structure of a car were extinguished by the viscous resistance forces emerging in the main longitudinal beams of the frame.

The dynamic loads of a flat car with viscous restrain in the longitudinal beams were determined by the mathematic modelling. All the im-

provements were implemented for a 13-7024 flat car which was taken as the prototype. The research was made in the plane coordinates.

A flat car was taken as a system of three solid bodies: the frame and two 18-100 bogies with suspension groups with specific rigidity and the relative friction coefficient. The study included motion of an empty car over a joint irregularity.

It was assumed that the viscous restraint in the longitudinal beams of the frame of a flat car was activated at the forced oscillations of a car, thus it did not impact the natural oscillations of the bearing structure.

The mathematical model was solved in the MathCad software. The accelerations on the bearing structure of a flat car were about 2.1 m/s^2 (≈ 0.2g), and they did not exceed the allowable values [4, 5]. The allowable accelerations on the bearing structure were taken equal to 0.75g ("allowable" motion).

The accelerations in the areas of support of the bearing structure on the bogies were about 0.45g, and the accelerations of the bogies were about 0.8g.

The research conducted will help engineers to design innovative rail vehicle structures, decrease their dynamic loads in operation, and, thus, improve the fatigue strength and increase the rail transport efficiency.

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RESEARCH OF DYNAMIC LOADING AND STRENGTH OF A LONG-BASE FLAT CAR WITH RESILIENT ELEMENTS IN THE LONGITUDINAL BEAMS

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Efficient transportation is the key factor of economic development of European countries; its main component is railway transport. The railway network in Europe maintains effective cooperation and development of all countries in Europe. It is important to mention that the leading position of railway transport can be maintained by introducing modern efficient rail vehicles.

The most required type of rail vehicles for international transportation is the flat car. Flat cars are used for transportation of the freight which does not requiring protection from atmospheric fallout. Particularly in the international transportation these cars are used for all types of containers. The main bearing element of a flat car is the welded frame.

Long-base flat cars can provide more efficient service as each can transport four 20-ft containers. However, due to their elastic-yield structures they suffer from large vertical loads. It causes accumulation of fatigues stresses in the bearing structure and damage. Therefore, there is a need to implement new alternative solutions aimed at lower dynamic loads of the bearing structure in operation [1 – 3].

Thus, the dynamic loads on the bearing structure of a flat car can be decreased, and the fatigue strength can be increased during operational modes with application of resilient elements. They are placed in the main bearing structures, the longitudinal beams. It requires replacement of the main longitudinal beams of the frame with ones of the U-like profile.

The dynamic loading on the bearing structure of the improved flat car was determined by means of the mathematic modelling. The research was made in the XZ plane coordinates.

The maximum vertical acceleration of the bearing structure of an empty flat car was about 2 m/s^2 (0.2g), and that of the bogies – about 8.29 m/s^2 (0.8g). This solution can decrease the vertical accelerations on the bearing structure of a flat car by about 15% in comparison to that of the prototype car. The motion of the car was estimated as excellent [4, 5].

The study deals with the research into the fatigue strength of the bearing structure of a flat car. The calculation was made with the finite element method in the SolidWorks (CosmosWorks) software. The

maximum equivalent stresses were in the contact area between the bolster beam and the diagonal braces; they amounted to 254.0 MPa. The maximum displacements were in the middle part of the longitudinal beams and amounted to 12.6 mm. Thus, the strength of the bearing structure of a flat car was provided [4, 5].

The study presents the numerical values of the accelerations in the bearing structure of a flat car and their dislocation fields. The difference between the results of the mathematical and computer modelling of the dynamic loading of the bearing structure of a flat car was about 12%.

The research deals with the fatigue strength and natural oscillation frequencies of the bearing structure of a flat car. It was found that the fatigue strength of the bearing structure at a test base of 10^7 was provided.

The research may be useful for those who are concerned about designing innovative flat cars and improved operational efficiency of combined transportation.

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USING MESSENGERS AND CHATBOTS IN LOGISTICS

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The effectiveness of an enterprise depends on managers' ability to work with people as well as on their work with information, especially given the new trend of remote work. Communication with customers is the key to business success in many fields. At some point, companies realize that they need an effective tool to facilitate communication between employees [1].

A fairly new and very popular means of communication is instant messengers. The spread of instant messengers and chatbots is associated with digitalization and the advantages they can provide. Even drivers who have not previously used mobile apps or instant messengers can deal with bots. In other words, companies win twice. First, they do not need to pay as much as they would have to spend on developing their own mobile app. [2]. Secondly, they save on employees' training. Increasing availability of smartphones, the spread and cheapening of fast mobile Internet also contribute to the growth of their popularity [3].

We propose a model of a chatbot created for implementation at retail enterprises to facilitate communication along the entire route of the transport. Drivers will no longer have to carry their documents risking to lose them or get them damaged. The electronic consignment document is signed at various stages by the consigner, the consignee, the transport and logistics company, and the driver. Since the latter is mostly on the drive, the only document management tool that is convenient for them is a mobile device. Thanks to the fact that they and other participants can sign documents online, all other processes are accelerated. Payment due date for cargo transportation services is reduced from 6-7 to 1-2 weeks. The complexity of processing incoming documents is reduced by 70% [1]. Finally, it is possible to dispose of dusty archives at the office due to digitalization as documents are stored in an electronic form. At the moment, our bot has the ability to search for consignment documents in the database, report about new consignments, sign them directly in the chatbot, track where the cargo is located in real-time mode, and calculate the approximate delivery time.

Cargo tracking is also an important feature. One often has to call the driver, who cannot always pick up the phone, to find out how long they have to wait. Using the driver's phone, the tracking system can see the driver's location if he gives his permission at the beginning of the trip.

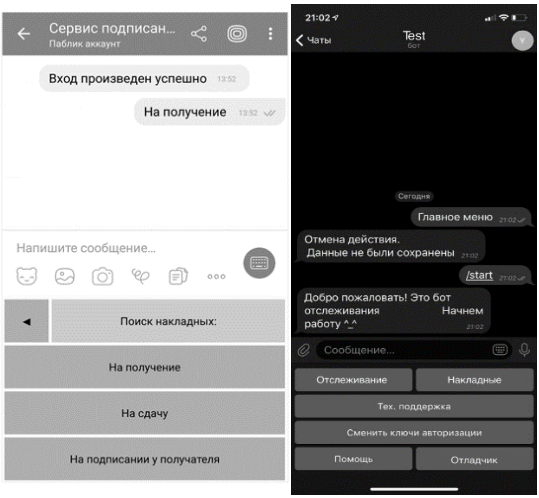

Fig. 1. Appearance and features of the bot

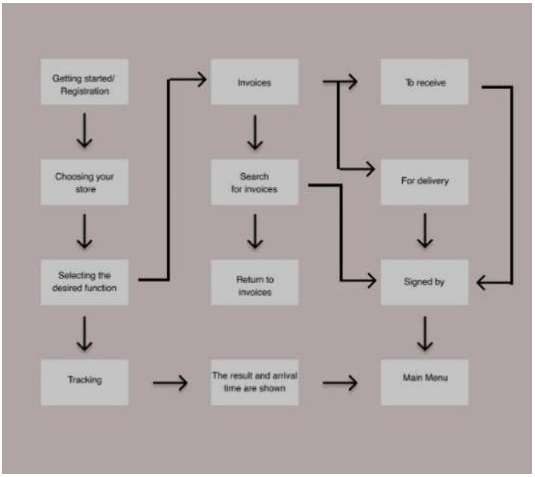

Fig. 2. Bot's algorithm

In the future, we are going to expand features of the bot with such things as chat or call directly to the driver, and cargo reception by scanning barcodes through the smartphone camera. Then we are going to use it at the enterprise and test it in a retail store.

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REGARDING THE QUALITY MANAGEMENT OF ENTERPRISES TRANSPORT AND LOGISTICS PROCESSES

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The world experience analysis of the quality management systems implementation shows that under modern conditions of scientific and technological progress acceleration, globalization of the economy, intensification of competition between manufacturers, the importance of quality problems is constantly growing [1, 2].

However, improvement of competitiveness and the ability to respond dynamically to market demands, efficient use of transport and logistics companies' internal resources is impossible without the development and implementation of a process approach in the organization and application of methods for statistical quality management. Determining of a logistics enterprise efficient operation patterns is based on the study of a large number of factors and requires the use of methods for quality processes managing on the quantitative basis. The use of statistical modeling and optimization of quality features helps to identify patterns and assess the level of processes stability based on the original statistical information, and directly manage the quality of transport and logistics processes of the enterprise.

To improve the quality of transport and logistics processes, a two-phase model has been developed to substantiate effective measures of the enterprise transport and logistics processes quality management.

The first phase involves the implementation and development of a process approach in the organization. To increase the level of enterprises maturity, which characterizes the manageability and predictability of processes, managers implement systems to automate the company's activities (business processes, document management, etc.). The process maturity scale defines five gradations. To reach the fifth level, the processes must be fully defined, their goals and objectives are synchronized with the overall strategic goals of the business, i.e., they become an integral part of the daily activities of each participant in the process. Independent continuous improvement becomes part of the processes [3, 4].

An effective way of business processes automation is the BPMS system. It allows you to go from the instructions to automatic execution and control of processes helping to manage the efficiency of the company. The mechanism of continuous process improvement makes it possible to develop the management model in the company. BPMS-system allows you to support the business at all stages of formation and improvement of the process approach in the company management. Development and improvement of the business, increase of competitiveness are possible only if the company uses the full Deming cycle "Plan-Do-Check-Act" (PDCA). Use of the BPMS-system capabilities allows not only to collect and organize statistical information on existing business processes, but also to monitor their strict execution [4].

The second phase includes transport and logistics processes statistical quality management and has two stages: evaluation of parameters and their monitoring [5]. The purpose of the first stage is to obtain information about the process variation, to achieve a state of statistical stability and to obtain estimates of process parameters in this state. The purpose of the second stage is to maintain the process in a stable state.

Proposed an algorithm for detection of the enterprise unstable processes and determination of ways to stabilize them based on quality indicators statistical management and transport and logistics processes improvement with the help of control charts. The algorithm is based on the use of the process improvement mechanism, which affects the development of the enterprise management model based on the full Deming cycle (PDCA). The control function is a necessary attribute of management, which makes it possible to identify problems and adjust the activities of the organization before these problems escalate into a crisis. The control is carried out by means of the preliminary analysis of the executed processes. The algorithm contains the following steps:

Step 1. Definition of key business processes to ensure the successful development of the company.

Step 2. Identification and systematization of the factors influencing the quality of transport and logistics processes.

Step 3. Identification of the main problems, the existence of which slows the development of the company.

Step 4. Analysis and justification of quality indicators management methods of transport and logistic enterprise processes based on quantitative estimations.

Step 5. Introduction of the process improvement mechanism, which influences the development of the enterprise management model based on the full Deming cycle (PDCA).

Step 6. Choosing a tool for statistical modeling and calculations. The technologies of statistical analysis and data processing of the Statistica software package were chosen for modeling, particularly the module of industrial statistics (Statistica Quality Control) and the Six Sigma tools [6].

Step 7. Analysis of simulation results. Detection of unstable processes at the logistics company.

Step 8. Development of the proposals for quality indicators improvement based on the enterprise transport and logistics processes stabilization.

Step 9. Checking the effectiveness of measures to stabilize the processes of the transport and logistics company through modeling of advanced processes. If the goal is not achieved, proceed to step 8 until the processes are stabilized.

For the purpose of logistics company supply processes statistical management, modeling was performed using one of the main modules of the Statistica software package - industrial statistics and Six Sigma. Based on the calculations, Schuhart maps of average values and variation magnitudes, maps of multidimensional flow of Hotelling T^2 are constructed. Modeling with the use of control charts helped to identify violations of process stability. Based on the analysis, ways to stabilize supply processes to improve the logistics company activities are proposed.

Such approach will help to make key management decisions that drive the enterprise success. The results can be used for further research in the direction of enterprises logistics processes quality improvement.

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QUALITY OF TRANSPORTATION SERVICES ON DIFFERENT TYPES OF TRANSPORT

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The search for optimal solutions, allowing to efficiently master the required volumes of traffic at the lowest possible cost of resources, currently belong to the main tasks of stabilization and further recovery of the national economy.

The main technical and economic features of railway transport are:

1. Inseparable connection with industrial and agricultural enterprises, construction sites, trading bases, warehouses, etc. Today, all large enterprises and bases of trade organizations have railway sidings connecting them with mainline railways.

2. Possibility of building a railway network practically on any land territory of the country and ensuring stable connections between regions.

3. High capacity of railways. A double-track railway line equipped with automatic blocking can transport more than 100 million tons in each direction per year, and a single-track railway line - 20 million tons or more in each direction per year. These values can change with a change in the total mass of trains, travel speeds. The ability to carry out mass transportation of goods in combination with low cost of transportation.

4. Possibility of uninterrupted and uniform transportation around the clock in all seasons.

5. Relatively high speed of movement and terms of delivery of goods and passengers. The timing of the delivery of goods is one of the important quality indicators that determine the efficiency of using a particular type of transport for a particular transportation. In general, the acceleration of cargo delivery has a great economic effect.

6. Delivery of goods and passengers along the shortest route. It is worth remembering that the shortest route is not always the most efficient. In a number of cases, it is advisable to use low-cost modes of transport on powerful freight traffic compared to short routes.

7. Relatively high economic indicators and a fairly advanced transportation technology. If the average fuel consumption for rail transport is taken as a unit, then for road transport it will be 4-5 units.

On various types of transport, the prime cost is influenced by such indicators as the capacity of freight and passenger traffic, the average distance of transportation, the ratio of loaded and empty runs, the area where the line is located, its technical equipment, etc. Therefore, for the objectivity of assessing the effectiveness of the use of a particular type of transport, it is advisable to proceed from the specific conditions of transportation that develop in different regions or directions.

The features of sea transport include:

1. Dependence on natural-geographical and navigational conditions. This determines the duration of the navigation period and the complexity of the ice regime. Partial or complete freezing of routes in a number of areas causes the seasonality of sea communications.

2. The need to build a complex port facility on the sea coast. It is more economical to use sea transport over long distances, since one of the important advantages of sea transport is not realized over short distances - the possibility of using ships of large cargo capacity.

3. Limited use of sea transport in direct sea communications.

In the work of maritime transport, seaports are of great importance. They are used for loading and unloading cargo, processing shipping documents, auxiliary operations for the maintenance and supply of the fleet and other work related to the departure, processing and arrival of cargo, as well as the embarkation and disembarkation of passengers.

River transport is an important link in the overall transport system of the country, especially when transporting bulk cargo of oil and oil products, timber, grain, building materials in areas where there are rivers and where it is the cheapest.

The main technical and economic features of river transport are:

1. Large carrying capacity on deep-water rivers.

2. Relatively low cost of transportation. The cost of transportation on

rivers is about 30% less than on railways and several times less than in road transport. Relatively small capital costs. The costs of organizing navigation on natural main waterways with a throughput of 80-100 million tons per year are several times less than for the construction of a railway (with rolling stock) and 3-4 times less than for the construction of a paved road ...

The features of using river transport include:

1. Restrictions on the use of rolling stock associated with the seasonality of work.

2. Extension of routes for the passage of goods.

3. Small, in comparison with other modes of transport, the speed of transportation of goods and passengers.

4. The need for the formation of large consignments.

Automobile transport is widely used both for intra-production (technological) transportation and for the direct delivery of goods from points of production to points of consumption (in the sphere of circulation).

In the sphere of circulation, about 35-40% of the total traffic volume is transported by cars.

Automobile transport has a number of technical and economic features that determine its widespread use in all sectors of the economy.

1. Great maneuverability and mobility. Cargoes by cars can be transported directly from the point of production to the point of consumption without reloading and intermediate storage, that is, "from door to door".

2. High speed of delivery of goods and passengers. In terms of speed, road transport is second only to air transport.

3. In some cases - the shortest route for the movement of goods and passengers. It is advisable to deliver goods and transport passengers by road in cases where the distance of transportation by road is shorter than by rail.

The features of road transport include:

1. Relatively high prime cost, much higher than that of water and rail transport. The high level of prime cost is the result of the low carrying capacity of the rolling stock unit and the sufficient complexity of the automobile rolling stock.

2. The relatively high cost of the material and technical base of car maintenance, despite the fact that in some cases this base is not yet sufficiently developed.

3. Insufficient length and poor technical condition of the existing highways.

In the transport system, air transport is the main type of passenger transport for a distance of more than 1000 km. An important role of air transport is to strengthen international relations. Air transport is more appropriate when transporting passengers over long distances. The technical

and commercial speeds of air transport are significantly higher than those of other modes of transport.

The main advantages of air transport in passenger transportation are:

1. High speed of delivery of passengers, comfort of travel in rolling stock.

2. Maneuverability in the organization of passenger transportation. New overhead lines can be built in a short time and with little investment. Air transport has the ability to maneuver rolling stock (airplanes, helicopters) depending on the volume of passenger traffic.

4. Shortest distances of air routes in comparison with routes on other modes of transport. Thus, the route of passage by air transport is shorter than by rail, by 25%, by sea and river lines - by almost 50%. Transportation distance between some points is reduced by 2-3 times.

5. Saving passengers' time.

6. Sufficiently high culture of passenger service during flights.

The peculiarities of air transport include the high cost of transportation.

Air transport is mainly passenger transport. Freight transportations carried out by him, in the total volume of cargo turnover, occupy an insignificant share, however, the special nature and value of such transportations for some specific cargoes make them economically efficient. In civil aviation, helicopters are also used, which are used in many sectors of the economy, construction, agriculture, geology, etc. Helicopters also deliver and install supports for high-voltage electrical lines, contact networks and electric railways, communication lines, radio relay masts.

The specific features of various types of transport determine the areas of their appropriate use.

The economic indicators of cargo transportation by one or another mode of transport depend on many factors.

Taking into account the production conditions, it is possible to determine the areas of the expedient use of various types of transport in terms of ensuring the quality of services.

So, the main factors that determine the scope of use of a particular type of transport are:

- connection of communication routes of various types of transport with settlements;
- throughput, passenger and freight traffic;
- the speed of delivery of passengers (cargo).

The expedient use of transport will improve the quality of transport services.

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ANALYSIS OF MODERN TRANSPORT LOGISTICS PROBLEMS

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Today, logistics must take into account all the nuances that can happen during the transportation of goods, both ordinary and dangerous, in which all International agreements, rules and conventions issued in New York and Geneva must be observed. The main problems during transportation in logistics is the delivery of goods to the destination, on time without violating the transportation rules.

The need to take into account the provided logistics services is due to the increase in the number of links in the chain on the way of the goods from the manufacturer to the consumer. Each link, represented by the carrier or intermediary company, increases the final price of the product, so finding the best path is very important to reduce the time and cost of delivery of the goods.

Production volumes are growing, and competition between companies is intensifying, especially in the international market. Any advantage can be decisive for the survival of the company, so the role of logistics is increasing from year to year. The processes, the effectiveness of which is assessed by logistics, include: transportation, warehousing, delivery methods to the consumer.

In 2019-2021, there is a fight in the world with the covid-19 virus, which has greatly affected the entire logistics market. It all started as a common flu, but now it has grown into an epidemic. Which greatly influenced the logistics.

Now, when transporting goods, logisticians have to calculate how long this cargo will stand during quarantine at the border, how long it will take to check it.

Losses during the covid period in 2020 alone amounted to 6.5 percent of world GDP.

After all, the main suppliers of products were those countries that were part of the red zone, where there were the largest factories for the production of those products that needed to be delivered to the country that needed these products.

After all, many cargoes are stuck in ports or at the border until the drivers and cargo are checked for the presence of the virus. This greatly influenced the cost of cargo and the provision of services because not all suppliers or consumers were willing to pay an overpriced product or risk their staff by sending it on a flight to a neighboring country or an area where the virus was rampant.

And then the main drawback of logistics came out, it was the imperfection of the color of the transport infrastructure, not ready for the volumes of goods that were supposed to be delivered. This is especially pronounced when different types of transport are involved in the delivery of goods.

So you can refer to one article, for example, on April 7, large international organizations: the International Road Transport Union (IRU) and the International Transport Workers' Federation - published an open letter to the governments of all countries requesting support for the transport industry in the context of the spread of COVID-19. The crisis caused an imbalance in freight traffic associated with changes in demand, production suspension and imposed restrictions. Because of this factor, national governments and international organizations must give the highest priority to maintaining the continuity and strength of supply chains.

Thus, in connection with the global crisis triggered by the COVID-19 pandemic, the logistics industry is in dire need of support. The quarantine measures taken to suppress the coronavirus epidemic have led to the congestion of most airports and sea terminals and, as a result, the violation of the terms and conditions of cargo delivery.

Among those who have been given new opportunities by the pandemic are rail carriers. Railway transport operators do not respond to changes in demand by increasing rates, and therefore this mode of transport seems to be the most reliable and efficient in the transportation of goods between Ukraine and the EU in the current conditions. In the next few years, the railway will become one of the main logistics channels to ensure uninterrupted trade between Ukraine and Europe and the delivery of anti-epidemic drugs.

To get out of the crisis state of the logistics industry, state support measures are being actively implemented. As a rule, support is provided to the public transport sector (railways, aviation). The commercial sector can be provided with government support through the introduction of tax holidays, the abolition or reduction of the road toll, as well as financial assistance to companies that will suffer large losses due to the pandemic. If we talk about trucking, then assistance in reducing the cost of spare parts for vehicles, for example, by reducing import duties or the VAT rate for this group of goods, will be significant. Very effective measures could also be: a moratorium on fines (except for fines regulating road safety), tax exemptions for the most vulnerable carriers, and suspension of lease payments without fines.

Overcoming the current crisis is an unprecedented challenge for the management team of all logistics players. It is necessary to promptly take stock of all available state support measures and develop a further action plan. This will require the resources of a whole team, including lawyers, financiers, economists. In parallel with this, now is the time to revise partnerships with contractors, terms and obligations under contracts, carefully work with working capital and liquidity.

After the pandemic, the logistics world will not be the same. But companies that follow trends and quickly adapt to changing circumstances will be able to manage the situation, create demanded services and strengthen their position in business.

Most importantly, a common misfortune has united and rallied the logistics industry. In the context of the emergence of the global economy from the "pandemic peak", it is the collaboration of logistics companies that can become one of the most important and effective drivers of further development and growth.

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COMPARATIVE CHARACTERISTICS OF DIFFERENT TYPES OF TRANSPORT FROM THE LOGISTICS POSITION

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In modern society, not all human needs can be met without the help of transport, which is used either to transport goods to their places of use, or people to places of consumption of goods and services.

In Ukraine, as in other developed countries, transport is one of the largest basic sectors of the economy, the most important component of production and social infrastructure.

Transport communications unite all regions of the country, which is a necessary condition for its territorial integrity, the unity of its economic space.

Ukraine's transport industry is one of the leading in many areas.

Transport is of major importance in the country's economy. It is one of the industries that form the infrastructure of any production, serves as a material basis for work in society, specialization and cooperation of enterprises, as well as for the delivery of all types of raw materials, fuel and products from production points to consumption points.

The development of transport provides the expansion of the industrial use of natural resources and the growing scale of social production. Transport provides a variety of links between mining and manufacturing, industry and agriculture, production and consumption.

The main modes of transport in Ukraine are rail, road, air, pipeline, sea and river. Each of these modes of transport performs a certain function within the transport system of Ukraine in accordance with its technical and economic features, carrying capacity, geographical and historical features of development.

Transport as a type of economic activity is divided into public and non-public transport.

The largest volume of freight and passenger traffic is performed by road. However, of the total volume of freight transport, rail transport carries 80 ÷ 90%, road transport 10 ÷ 12%, sea 0.4 ÷ 0.7% and inland waterway 0.2 ÷ 0.3%. Passenger traffic, respectively, is: 38 ÷ 40%, 50 ÷ 60%, sea 1 ÷ 2%, inland water 1 ÷ 2% and air 1 ÷ 1.5% (Fig. 1). Also in terms of growth of freight and passenger traffic since 1970, road transport occupies a leading position.

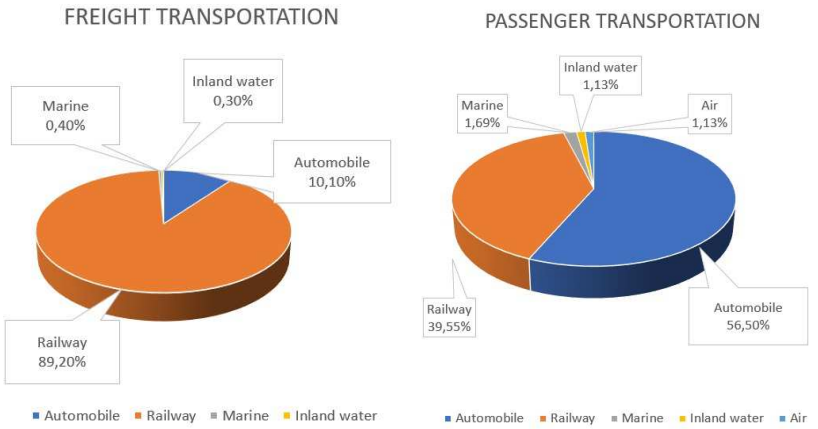

Fig.1. Volume of freight and passenger traffic

If we analyze the role of each universal mode of transport by freight and passenger turnover in the activities of the transport complex, it can be noted that rail transport by freight turnover of the total turnover of the transport complex ranks first, over 90%, sea – 12.0%, river – 4.4%, automobile – 6.5% and air – 0.05%. For the same modes of transport, passenger turnover is 37.1%, 0.08%, 0.6%, 34.00% and 20.0%, respectively.

Thus, in terms of freight turnover, railway transport occupies a leading position in the transport complex of the country. Road transport on this indicator is 8 times inferior to rail transport, 2 times – sea and 2 times supe-

rior to river transport. However, the volume of freight traffic by road is greater than the volume of traffic by rail. The priorities of transport in relation to the proposed indicators of evaluation of their activities do not match, and the fluctuations of these indicators reach from 2 to 100 times or more.

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INCREASING THE LEVEL OF INTEGRATED SAFETY AND REDUCING ACCIDENTS ON TRANSPORT

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Since the last century, as measures to improve transport infrastructure and including the safety of transport flows, many countries have begun to put into use certain elements of intelligent transport systems (ITS). ITS is a universal term to denote the integrated application of communication, control and information technologies in transport systems, the implementation of which should result in the preservation of lives, time, money, energy and the environment. ITS includes all modes of transport and considers in

their interaction with each other all elements of the transport system: vehicle, driver, infrastructure

Fig. 1 shows that the lowest mortality rates per 100,000 people really are in the countries that are working on the creation of intelligent transport systems, in particular, the best indicator is in the countries of the European Union. However, despite the introduction of ITS elements in countries such as Russia and China, the mortality rate remains unacceptably high and is approaching the level of countries in the African region. These figures may indicate that the introduction of elements of intelligent transport systems into the transport infrastructure is not a decisive factor in improving road safety in general and reducing the death rate in particular. However, the indicator of the number of vehicles differs very significantly for the countries under consideration. It is quite natural that countries with higher road congestion will be more at risk of road accidents. In this regard, we calculate the mortality rate per 100,000 registered vehicles in the countries proposed for consideration. The calculation results are shown in Fig. 2.

Fig. 2 demonstrates how much lower this indicator is in countries forming an intelligent transport system, while the lowest indicator is in countries that earlier began to implement and introduce such elements into everyday life, which indicates the effectiveness of activities carried out within the framework of ITS.

One of the main priorities for the development and implementation of ITS is to improve road safety, this is what many activities and programs are aimed at, in particular, the eCall program developed by the European Community. eCall, or emergency call, is an initiative to provide immediate assistance to road users who have been involved in an accident anywhere in the European Union. A vehicle equipped with an emergency call system automatically sends an emergency signal to the nearest emergency center. Even if none of the participants in the accident is able to speak, the system will send a minimum of information, notifying the rescue service of the specific location of the accident, thereby increasing the chances of accident participants to save lives and health.

The presence of the eCall device in cars, according to scientists and experts, will reduce the arrival time of rescue services by 40-50%. This means that across the EU, it could save the lives of more than 2,000 people a year.

The need to use an automated eCall system has long been recognized by Europeans. A similar technical infrastructure has long been in place in countries such as the United States, where it is called OnStar, and in Brazil, Simrav.

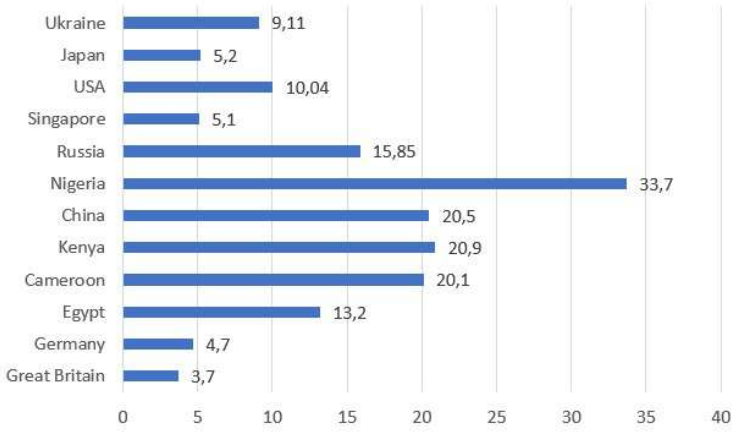

Fig.1. Number of road traffic deaths per 100,000 people

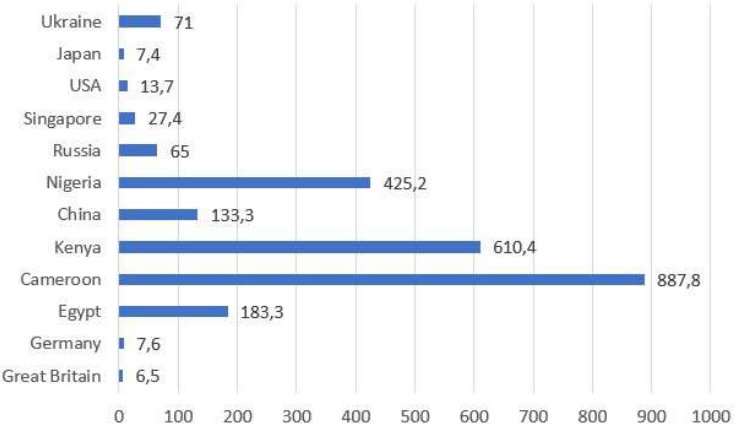

Fig.2. Deaths per 100,000 registered vehicles

According to the "Transport Strategy of Ukraine until 2030", the following areas of ITS implementation in transport have been selected:

- introduction of the classification of road accidents recognized at the world level;

- improvement of the system of collecting information about emergency transport events, their analysis and development on the basis of the obtained results of management decisions;

- introduction of an effective mechanism for transport safety management, state supervision and control over transport;

- extensive use of innovative technologies to ensure road safety;

- creation of the Register of Road Carriers, which includes a database on violations of legal requirements.

Thus, it can be assumed that the development and improvement of ITS really helps to reduce mortality on the roads, primarily influencing not the human factor, but the safety of the vehicle and the conditions for its movement.

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MODERNIZATION OF THE FIRST STAGE OF SPRING SUSPENSION FOR HIGH-SPEED LOCOMOTIVE MOVEMENT

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An urgent problem facing the railway transport of Ukraine is the renewal of rolling stock and increasing its speed. The creation of high-speed rolling stock is a complex scientific and technical task, which is associated with reduced stabilization in the interaction of locomotive wheels with rails, increased impact on the track, reduced smoothness, increased noise and vibration transmitted from the track to the train. These adverse effects can be eliminated by upgrading the spring suspension, the design and parameters of which depend on the dynamic performance of the locomotive in straight and curved sections of track. Therefore, the creation of spring suspension with the necessary parameters for high-speed rolling stock is an important and urgent problem. The running qualities of the locomotive in the vertical plane are determined mainly by the magnitude of the static deflection and the degree of damping of the spring suspension. Spring suspension damping should be selected based on the amount of static deflection, design speed and possible critical zones of oscillation.

On modern locomotives the spring suspension with rather low size of a static deflection prevails. As a result, the resonant velocities at random confluence of the natural frequency of vertical oscillations and the frequency of alternation of joints on the rails are high, so there is a very great need to create an optimal damper in systems [1, 2].

The spring suspension's sensitivity to damping changes increases with decreasing static deflection. Based on the results of the theoretical analysis and research of spring suspension of locomotives, technical solutions have been proposed for the creation of spring suspension of high-speed rolling stock [3, 4, 5, 6]. On high-speed rolling stock, it is advisable to use a 2-stage spring suspension, which allows at the first stage to increase the static deflection, minimize the impact on the track, on the second stage of spring suspension - to provide elastic lateral and angular communication. Due to a number of advantages over other types of springs (compactness, low weight, stability of characteristics, lack of a dead zone, low maintenance requirements), it is more rational to use coil springs in the first stage of spring suspension.

For a coil spring of the first stage of spring suspension, the deflection is calculated by the formula [7]:

$$\Delta_{cm(1)} = \frac{8D^3Nn}{Gd^3} \quad (1)$$

where N – is the working load, N;

G – shear modulus, MPa;

D, d – diameters of springs and bar, m;

n – the number of working coils of the springs (excluding parts of the coils that are supporting).

From formula (1) it follows that an increase in static deflection is achieved by increasing the number of working turns. Below is an improved design of the first stage of the spring suspension of the locomotive. The weight load of the body with the equipment and the bogie is transferred to the housing 5 of the axle boxes through the elongated springs 1, which are installed in the holes of the lower 2 and upper 3 surfaces of the bogie frame and abut against the glasses 4 (Fig. 1).

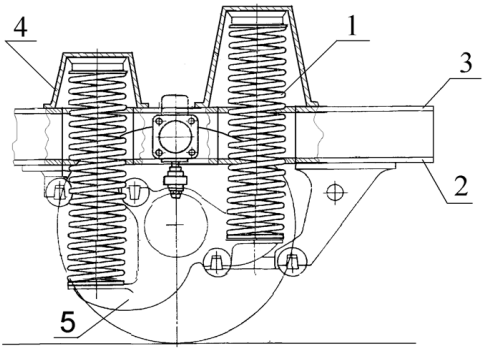

Fig. 1. Locomotive spring suspension
1 – extended spring, 2 – lower surface of the bogie frame, 3 – upper surface of the bogie frame, 4 – glass, 5 – axle box body

In the first stage of spring suspension of the diesel locomotive 2TE116, the helical springs have 4 working turns, and the helical springs of the proposed spring suspension – 18. Based on mathematical calculations according to formula (1), it follows that in the improved first stage of spring suspension (Fig. 1) static deflection is possible increase by 4,5 times, which will create conditions for the development of high-speed rolling stock [7].

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USING A COMMUNICATIVE APPROACH IN ENGLISH CLASSES TO STUDY THE TOPIC «MODES OF TRANSPORT»

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Communicative methods (Communicative Language Teaching (CLT) is one of the popular methods of teaching foreign languages in higher

school. The essence of communicative learning is to prepare the students to participate in the process of foreign language communication and gain practical knowledge that they will need in the future. «The CLT approach allows both teachers and students to transfer their traditional teaching and learning beliefs into an innovative teaching and learning approach» (Dos Santos, 2020).

The described approach includes modelling of real communication situations based on the use of authentic materials. The essence of this technique is to transfer to students not knowledge of language as a system, but to provide them with speech skills and abilities for the practical application of language in any foreign language communicative situation. The purpose of communicative methods is to bring students closer to the real foreign language conditions of communication.

But according to Luis Miguel Dos Santos (2020) there are some disadvantages of Communicative Language Teaching approach. The author identifies such weaknesses as lack of language proficiency, unwillingness to fully accept the CLT approach due to students` traditional views of language learning techniques, the requirement of most examinations for grammar and wtiting skills, but not for oral skills, learner behaviour would be highly influenced by the practice of the CLT approach in a classroom environment, classroom size and student enrolment numbers for each individual classroom significantly influence the outcomes and performances of the CLT approach, psycho-linguists and social-linguists advocate that regardless of the age, gender, nationality or background of language learners, awareness of grammar acquisition and understanding of the language grammar, both systematic and progressive, is that it would be carried out in a certain order.

There is also the problem of studying grammatical material, because grammar is studied sporadically and thus a certain consistency of language is lost. «It is important that the communicative approach harmoniously combines different ways of learning without compromising grammar, as knowledge and the ability to use grammatical resources of a language are one of the components of a foreign language communicative competence» (Korol, 2012).

Learning topic «Modes of transport» it is important to teach students to model language units by themselves, analyse texts productively, make conversations about different situations, use language correctly. Such kind of topic is well presented in the textbook «English for logistics» by Marion Grussendorf (2009). It has eight units which consider topics of logistics and covers all necessary points. In the unit «Modes of transport» we can see such topics as «Transport and handling equipment», «Container types», «

Types of goods». Considering the recourses of the textbook it is possible to see the special language units at the beginning of unit, such as «swap-body, container ship, grappler lift, road-railer trailer, river barge, LGV (large goods vehicle)», then such terms as «multimodal, piggyback, intermodal, unaccompanied, block train, single-wagon» are introduced to the learners. In further exercises these lexical units are consolidated and activated through listening exercises. The grammatical material about the degrees of comparison of adjectives is represented by a separate rule and two exercises. The textbook has many illustrations that facilitate the perception of information and study of materials. Useful phrases are given to create own dialogic situations about proposed topic. Such task as «Describe the container features to a partner using words from this unit» is accompanied by additional material, which is presented in the section «Partner files», which contains the main characteristics of the container to be described. This provides the additional opportunities for the development of communication skills.

Exercise 13 in the form of a crossword puzzle, which has the following task: «Complete this crossword puzzle on transport modes with words from this unit» is considered to be enough interesting for students. It provides a useful example of the memorizing of the target vocabulary of this unit. At the end of the unit there is a text that contains new lexical items and aims to enhance the independent work of the student. The answers to the proposed questions help to find out the main content of the presented text.

Thus, all fourteen exercises of the proposed unit are subject to the purpose of learning English, what means the development of communication and speaking skills of students. These exercises involve the development of reading, speaking and listening skills. During the study period, students should systematically work on improving their own speech, get acquainted with various means of influencing the communication partner, improve practical speaking skills.

In order to improve the process, it is also useful to develop writing skills using an active vocabulary of the topic, the use of communicatively oriented tasks, namely communicative training, when the teacher sets a task or situational task that students must perform or simulate a situation close to real conditions. For example, to convince the client to use the services of their company or to simulate a telephone conversation. The use of such activities helps to improve communication skills and promotes psychological adaptation to the conditions of future work.

So as we can see the Communicative Language Teaching (CLT) approach is really useful in higher education environment in the terms of facilitations of learning foreign languages process.

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PEDAGOGICAL TECHNOLOGIES FOR FORMING MORAL CONSCIOUSNESS OF TRANSPORT SPECIALTY STUDENTS

Krokhmaleva O.

The problem of forming the moral consciousness of a student of a classical university is an important social and pedagogical problem. Its solution raises the pressing issues of education, since in modern conditions a specialist is needed who can quickly adapt to a social reality woven of contradictions.

The process of the formation of moral consciousness in a classical university is an organized integral organizational and pedagogical system aimed at the organic interaction of the intellectual and cognitive activity of transport students and the upbringing of their spiritual and moral image as a value personality. The main conceptual idea on which the organizational and pedagogical system is based is to comprehend the modern educational and educational process of the university, which performs the function of converting information - knowledge into information - value attitude to the surrounding reality and to scientific facts. In the process of a value attitude, the objective moral meaning turns into the subjective moral meaning of the individual, which significantly affects the activation of moral information contained in scientific knowledge. Not only a rational understanding of the scientific content is realized, but also experiences, emotional assessments of moral information, concentrated in scientific facts, arise. Thanks to this, knowledge becomes value-significant for the individual, and therefore, the

relationship between the cognitive and value attitude of a person to scientific information is carried out [1]. V. Sokolov identifies more acute problems in the moral sphere:

- in the spiritual and moral world, the sphere of socially important positive guidelines has significantly decreased, while a part of personal ones has almost doubled, compared with the Soviet period, the importance of such qualities as the social significance of work, a sense of social duty, honesty, adherence to principles has decreased;
- a change in value orientations is taking place at a rapid pace - the values of consumption come first, consumer psychology is being reborn into a consumer ideology;
- the cult of money has spread in the mass consciousness, it has become the main force that contributes to the spread of immoralism;
- in the minds of modern people there is a "erosion" of "simple" moral norms, such as kindness, honesty, decency, politeness, responsibility, etc. [2].

O. Drobnitsky in his work "Problems of Morality" notes that in the conditions of scientific and technological progress, a person found himself in a position of so-called moral bankruptcy. The scientist had in mind the West (70s), but the same situation has developed in our country. The progress of science and technology is not accompanied by the same progress in the moral sphere. Man, as if creating comfortable conditions for his existence, conquering nature, increasingly neglects moral laws, thereby placing himself in dangerous conditions of existence. "The conditions of the scientific and technological revolution create a specific dimension of the problem - technology against morality, science against values, powerful means against humane goals, knowledge of facts and all pervading necessity that occurs against the meaning and higher purpose of life, material wealth against the background of spiritual poverty" [3 , from. 318].

Consciousness is a complex phenomenon, a broader concept than thinking. This is not only a person's knowledge of something, attitude to it, but also emotional experiences. The following structural components of consciousness can be distinguished: sensory matter, meaning and personal meaning. It should be emphasized that thanks to sensory images, consciousness is provided with the reality of the picture of the world, which is revealed to the subject. Thanks to meaning, sensory images acquire a new quality, meanings are the most important "formations" of human consciousness. Personal meaning lies in the subjectivity of consciousness, which manifests itself in the selective attention of a person to a particular object, depending on drives and needs [4].

On the basis of certain theoretical provisions, we have developed a program of experimental work, which provides for preparatory, ascertain-

ing, formative and control stages and is based on the use of a complex of anthropological, axiological, culturological, personality-activity approaches.

The main conceptual idea of this program is to search for new cultural dominants and new approaches to the upbringing of a morally developed personality, which correspond to the modern understanding of morality.

The program is aimed at:

- creation of conditions for a person to realize his natural potential and spiritual and moral attitude to life;
- development of creativity;
- return and affirmation of the ideal of a moral person;
- preservation and active promotion of historical and cultural heritage, strengthening its prestige;
- coordination of the activities of executive authorities at all levels, public and religious organizations, educational and cultural and educational institutions associated with the development of a person's moral consciousness.

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

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

As a result of the research, the conceptual foundations of the modern system for the formation of moral consciousness have been developed; the specificity of the formation of the moral consciousness of student youth is revealed; a multilevel technological model of the system of forming the moral consciousness of students of a classical university has been created; the technology of the formation of moral consciousness has been introduced into the real practice of the educational process of the university.

The result of research work on the implementation of the multi-level technology developed by us for the formation of moral consciousness of students of a classical university was:

- increasing the level of professional readiness of scientific and pedagogical workers in solving problems of forming the moral consciousness of students;

- transfer of the methodological level of the pedagogical process in accordance with the goal of forming the moral consciousness of students into the zone of self-education, self-development, self-education, which, as a result, made it possible to increase the level of moral self-education of students of a classical university;

- change in quantitative and qualitative indicators relative to the levels of formation of the basic moral qualities of students in experimental groups.

Thus, the effectiveness of our experimental work was ensured and confirmed.

It should be emphasized that our youth are increasingly worried about the state of spirituality that prevails in our society. Their reasoning about cruelty, monetary substitution of human feelings and ideals testifies to a sufficiently high level of moral consciousness.

Student youth are worried about the problem of communication culture, which today really requires extremely serious attention. A kind of "cry from the heart" is the appeal of young people, who are at the highest level of spiritual and moral development, to be "mutually beautiful" and mutually spiritual and moral in dialogue with their peers, with close people. After all, the word is a powerful tool with which you can do both good and evil to a person.

Our research at the current stage of the problem of the formation of moral consciousness of students of a classical university is a definite contribution to the solution of a major scientific problem of great socio-cultural significance - the problem of practical adaptation of students of transport specialties to social reality in the process of spiritual and practical development of the world, which is carried out with the participation of moral consciousness. We realize that not all of the tasks set by us have been resolved deeply and thoroughly. At the same time, the study reveals a number of problems, the study of which can and should be continued. In particular, this is the study of how to form the ethical outlook of student youth, how to develop the moral consciousness of students in unity with their moral behavior.

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CONTACT OF A WHEEL COMB WITH A LATERAL SURFACE OF A RAIL AND RESISTANCE OF MOVEMENT AT REALIZATION OF A TRACTION MOMENT BY A LOCOMOTIVE WHEEL

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The level of economic condition of society depends on the quality and safety of railway transport. The problem of interaction between rolling stock and railway is one of the most important in the transport industry. Despite some progress in the study of physical processes in the contact of the wheel with the rail, this problem has not been fully studied [2, 3].

Long-term operation of rolling stock shows that the service life of wheelsets is determined by the wear of the rolling surfaces and, to a greater extent, wear of the ridges. This is evidenced by numerous publications on excessive wear of the ridges of the wheelsets and the lateral surface of the rail head. In particular, problematic aspects are considered in the works of OL Golubenko, Barteneva LI etc.

The process of interaction of the wheel ridges with the side surface of the rail is an important point both in terms of the occurrence of lateral dynamic forces, and the processes of wear and resistance. As when moving in the straight sections of track, and in curved, the ridges of the wheel for a long time interacts with the side surface of the rail. The longitudinal forces arising from this interaction when the wheel ridge is in contact with the side surface of the rail are considered as resistance to movement. Consider the movement of the locomotive, in particular, when he implements the traction force.

Suppose that the wheel makes a "pure" rolling (Fig. 1), i.e. there is no realization of traction.

Point A is the point of contact of the rolling surface of the bandage with the track on the rail, point C is the center of the wheel, point B is the point of contact of the wheel ridge with the side surface of the rail.

In this case, point A is the instantaneous center of rotation and the speed at point A - $V_A = 0$ m / s.

The distance l_1 is equal to the rolling radius of the locomotive wheel. Let $l_1 = 1.05$ m, the distance l_2 is 0.01 m [1], the wheel moves with a speed $V_C = 10$ m / s. Then the instantaneous velocity at point B will be equal to $V_B = -V_C l_2 / l_1 = -0.1$ m / s. The magnitude of the relative slip at point B.

$$\varepsilon = \frac{V_B}{V_C} = -0.01$$

or -1%. However, this suggests that at point B there must be a force of friction acting from the rail on the ridge of the wheel and directed towards the movement of the wheel, i.e. opposite to the direction of the sliding speed.

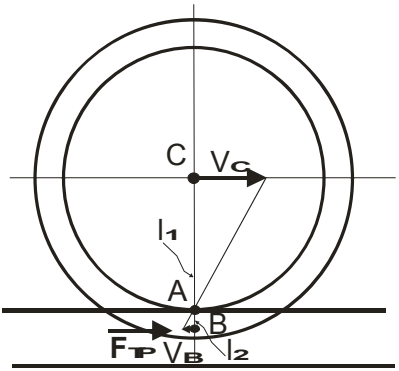

Fig. 1. Scheme of "pure" rolling of a wheel on a rail (the center of turn in t. A)

When modeling the movement of the locomotive wheel relatively to the rail, it is necessary to consider in more detail the contact of the wheel ridge with the lateral surface of the rail. When realizing the traction moment on the ridge of the wheel, a friction force may appear, which contributes to the realization of the traction moment and is not resistance to movement.

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PROFESSIONAL TRAINING OF FUTURE RAILWAY ENGINEERES AT THE UNIVERSITIES OF GREAT BRITAIN

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The national system of higher engineering education has undergone significant changes in recent years. Changes in railway transport need highly qualified professionals and in accordance and it put new demands on their training in higher educational institutions of Ukraine.

Modern railway transport needs a specialist who must have deep theoretical knowledge, professional skills and abilities, be ready to work in difficult conditions of competition, capable of self-learning, self-improvement.

"Modern society does not want to have specialist-guintica, specialist who can quickly make management decisions and calculate their consequences. It should be not just a specialist, but a creative, spiritually rich and intellectual person "[1, c. 101].

Higher engineering education, which is currently being reformed, should train such specialists.

In the training of engineers, there are many unresolved issues that occur in higher engineering education, in particular: insufficient knowledge of the latest technologies and the timeliness of their inclusion in the content of education; discrepancy between the existing system of engineering education and the requirements of the European Community to join a single system of continuing education; outdated forms, methods, means of training and needs of higher technical educational institutions in the application of innovative technologies.

The study of the problems of professional and social competence, personal qualities of the engineering staff intensively carried out by scientists. E. Alexandrov, M. Zgurovsky, O. Ignatiuk, V. Klepikov, O. Kovalenko, V. Kremen, B. Lomov, S. Pazynych, O. Ponomarev, O. Romanovsky, L. Tovazhnyansky, T. Shargun and many others work fruitfully in this field.

In the context of modernization of higher education in Ukraine in accordance with European and world standards, an effective way to improve the quality of training of future railway engineers is to focus on the experience of developed countries to find fundamentally new approaches.

Among the leading countries with a high level of training are the United States, Canada, Australia, Great Britain, France, Germany and Japan.

The achievements of the United Kingdom are of scientific and practical interest, as the world rankings show the high performance of the United Kingdom in terms of human capital development index, technical, economic, political and cultural-educational relationships.

The analysis of theoretical sources gives basis to assert that in the scientific literature certain aspects of the theory and practice of professional training of railway transport engineers are insufficiently covered.

The range of topical issues related to the content and a procedural component of professional training of specialists in this field in the universities of the United Kingdom remains understood poorly and requires research.

Understanding the theoretical basis of the problem and studying the practical experience of professional training of railway engineers in Ukrainian universities in comparison with the United Kingdom made it possible to identify contradictions that slow down the solution of the above problems, in particular: challenges of globalization, rapid technology development, railway transport and the current level of their professional training and, as a consequence, insufficient readiness to perform professional functions in society; modern world trends in the development of higher engineering education and the need to improve the legislative, content, organizational and scientific and methodological support of professional training of engineers in accordance with world educational standards; the need for a thorough scientific analysis of rational ideas of foreign experience of professional training of railway engineers and the actual lack of its systematic study and generalization in the national pedagogical theory and practice.

Professional training of future railway transport engineers in Ukraine is carried out taking into account the provisions of the Laws of Ukraine "On Scientific and Scientific-Technical Activity" (1992), "Higher Education" (2014), the National Strategy for Education Development in Ukraine for 2012-2020), Sustainable Development Strategy "Ukraine - 2020" (2015). The normative and legal documents emphasize the need to transform the content and forms of education, the development of new methods of training.

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PROBLEMS OF LOGISTICS OF IMMUNOBIOLOGICAL DRUGS IN THE ERA OF A PANDEMIC

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In a global pandemic, humanity is looking forward to vaccines against the COVID-19 coronavirus. Scientists have created and tested them, pharmaceutical companies in all countries are increasing their production, governments of different countries have begun mass vaccination of the population. To do this, the vaccines will need to be delivered as quickly as possible to different parts of the world.

It should be understood that all vaccines are sensitive biological substances that eventually lose their activity (i.e., their ability to protect against diseases). Loss of activity occurs much faster when the vaccine is exposed to temperatures above, or sometimes below the recommended range. The once lost activity of the vaccine is not restored when the vaccine is returned to the correct temperature regime. Any loss of vaccine potency is irreversible. Therefore, storing vaccines at the correct temperature is vital to maintain the full potency of the vaccines until they are injected into the human body. During the manufacture, transport and administration of vaccines, strict adherence to a continuous cold chain must be followed.

With the COVID-19 pandemic and the global need to vaccinate the world's population, the global logistics industry faces an unprecedented challenge. In the coming years, she will have to ensure the delivery of several tens of billions of vaccine doses. The problem, however, is not only and even not so much in the volumes of forthcoming transportation, but in the fact that at least part of the vaccines must be transported under special conditions - at low and even ultra-low temperatures. We are talking, first of all, about the vaccine of the American company Pfizer and its German partner BioNTech, which must be stored at minus 70… 80 degrees Celsius.

The Pfizer / BioNTech vaccine is considered one of the most effective among others. However, even in the conditions of technically and technologically advanced countries of the European Union, its logistics is a difficult problem. Vaccines are usually transported and stored at + 4 ... 8 ° C, so the transportation of drugs requiring special conditions is a responsible task that falls on logistics companies and warehouses.

The International Air Transport Association (IATA) has already called the upcoming vaccine distribution worldwide "the largest and most complex logistics operation of all time" [1]. She urged governments to open borders and restore air links, recalling that quarantine measures have sharp-

ly reduced the number of flights. And this greatly limits the volume of air cargo transportation, since there are very few opportunities to send cargo by passenger aircraft.

It should be noted that a number of large logistics companies (for example, DHL) already have considerable experience working with deep-frozen pharmaceutical products, although this has not been the main business so far. Previously, they had to transport quite significant amounts of anti-Ebola drugs at ultra-low temperatures, and even a special warehouse was equipped on the border with the Netherlands, where 58 especially powerful refrigerators were installed.

Representatives of the DHL company at one time stated the need for 15 thousand flights and 200 thousand pallet spaces, which will need to be moved with the strictest temperature control only to meet the basic needs of the world's population for vaccination. If you repack the products in a thermal container, then you will need three times more transport containers.

During the spread of coronavirus vaccines around the planet, DHL and its regional partners (for example, in Germany - the Deutsche Post DHL concern) will become one of the key carriers, but, of course, not the only ones. For example, the fleet of the Swiss company Kühne + Nagel in Europe has 200 refrigerated cargo trailers for the delivery of medical products, and its logistics centers have refrigeration chambers designed for temperatures up to minus 20 degrees, which can be converted to temperatures of minus 80.

An important role not only in the United States, but also in Europe, is also to be played by the American logistics companies Fedex and UPS.

The existing logistics market of Ukraine is most adapted to work with a temperature regime of plus 2…8 ° C, since the largest number of currently used immunobiological drugs require maintaining this temperature. In such cases, dry ice containers are used. The volume of the substance is calculated depending on the amount of vaccine.

Difficulties associated with a lack of knowledge and experience may arise if it is necessary to deliver that version of the vaccine that requires storage at a temperature of minus 70 ° C. The process of storing and transporting vaccines with temperatures below minus 18 ° C on a national scale is a new process. This requires more attention, tuning, debugging, if necessary, correction.

The main problem is unloading and storage, as the temperature must be kept low at all times. This problem can be solved with the help of thermoboxes, the technology of using which has been quite well developed by the participants in the circulation of medicines.

Logistics companies now have enough transportation capacity to de-

liver the required amount of vaccine: large thermoboxes (so-called pallet boxes) hold about 10 thousand doses of vaccine. The truck can hold 30 such boxes, that is, one car is capable of delivering 300 thousand doses of vaccine, which is comparable to the population of an average city.

The problem with the delivery of the vaccine may appear at a time when it will be necessary to deliver large volumes of goods by road over long distances. Transportation in thermoboxes has a significant drawback - the weight and volume of cargo increased due to packaging, which inevitably leads to an increase in the cost of delivery.

At the same time, for all its shortcomings, thermal packaging is the only complete way to maintain a stable cold chain. Without thermoboxes, it will simply be impossible to avoid temperature escapes during the delivery of unstable frozen forms of vaccines during loading and unloading, it will simply be impossible to deliver products to remote parts of our country.

It should be noted that refrigerators without thermoboxes are not suitable for the delivery of vaccines that must be stored at temperatures below minus 20 ° C, since the temperature inside the vans can be in the range of + 5 ° C, which is unacceptable. Therefore, the best way to transport the vaccine is to transport it in thermal containers that are able to maintain a given temperature for three to four days; for greater reliability, they need to be loaded into refrigerators.

However, the level of these problems with the logistics of immunobiological drugs can be significantly reduced. Thus, there was encouraging information that the temperature regime for transportation and storage of the BioNTech / Pfizer vaccine was allowed to be weakened [2]. Pfizer approached the US Food and Drug Administration (FDA) in February 2021 with a request to adjust the shipping and storage guidelines for its vaccine. The manufacturer claims that BioNTech / Pfizer can be transported and stored for two weeks in conventional freezers. Previously, one of the most important conditions was maintaining at the stages of transportation and storage the temperature regime from minus 60 to minus 80 degrees Celsius. Only five days before direct application was it allowed that the drug was in conventional refrigerating chambers at temperatures from 2C to 8C. According to representatives of the company, these changes are associated with the analysis of data that were obtained in nine months from the beginning of the development and use of the drug.

Having considered the arguments given by the manufacturer, on February 25, 2021, the FDA officially announced permission to transport and store the BioNTech / Pfizer coronavirus vaccine for two weeks at temperatures from minus 15 to minus 25 degrees Celsius - that is, in conventional freezers. This solution will significantly reduce the pressure on transport or-

ganizations, whose tasks included the mandatory use of super-powerful freezers, as well as special containers with dry ice.

Many hospitals already have refrigerators for minus 20 ° C. They were intended for immunobiological preparations: sera to be stored frozen, biomaterials. For the stability of the cold chain, special equipment is needed, for example, additional generators that should automatically turn on in the event of a power outage.

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TECHNICAL AND TECHNOLOGICAL ASPECTS OF INTEROPERABLE INTERACTION OF DIFFERENT TYPES OF TRANSPORT

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Interoperable interaction of different modes of transport consists in coherence of operations on different types of transport participating in multimodal transport process. In this case, this interaction should provide in the process of multimodal transportation process minimal time, financial, material and labor resources for the implementation of this process. Analysis of practice and research of the transportation process show that the interaction of different modes of transport depends on many aspects of technical, technological, organizational and informational, economic and legal nature. Consider the features of the most important aspects of interoperable interaction - technical and technological. In the technical aspect, the problem of interoperable interaction is reduced to the structural and power unification of all elements and units of different modes of transport involved in the implementation of transportation in multimodal connections. This requires:

- linking the parameters of rolling stock and transport equipment of interacting modes of transport;

- coordination of the capacity and processing capacity of the connecting lines, which are followed by the flow of goods and passengers in a multimodal connection;

- coordination of parameters of separate devices in transport nodes;

- rational planning of transport nodes, transshipment bases and terminals, the flow of placement in them of individual elements and subsystems, ensuring parametric and geometric compliance of roads, rolling stock and reloading equipment;

- creation of reliable and convenient means of communication between the operational personnel providing multimodal transportations, and the management of transport knots;

- design of compatible automated control systems and information systems.

With regard to the technological aspect, the feasibility of handling cargo in transport hubs in a single order, without which the rapid and efficient transition of goods from one mode of transport to another is impossible, does not require explanation. This requires careful coordination of individual technological processes with each other. This applies to railway stations, car companies, ports, access roads to the clientele and other links concentrated in the nodes. To date, the practice has developed quite perfect forms of interconnection of work - the only technological processes that are developed as a separate document and approved by officials - representatives of interacting modes of transport.

So, the positive experience of technological interaction between sea, rail, river and road transport in a number of transport hubs on the basis of a "continuous plan-schedule of the transport hub" is quite well known. This document allows you to predict future work for several days ahead, which facilitates the operational shift-daily planning and maneuvering of available means and manpower in all interacting units of transport.

Work on this method helps to reduce the storage time of cargo in the port, reduce the time of berthing, reduce downtime of cars under freight operations, increase the static load of cars and increase the overall efficiency of the site.

However, the improvement of technological interoperability of the interaction of different modes of transport should not be associated only with the introduction of a single technology of work in transshipment points. Undoubtedly, transshipment points play a significant role in the interaction of different modes of transport, but this approach does not fully solve the problem of interoperable interaction. Interoperable technological

interaction of different types of transport should be extended to the entire transportation process from the point of departure to the point of destination. It must be carried out when:

- organization of centralized delivery of goods at stations, piers and ports and centralized export of goods by public vehicles;
- concentration of cargo work on a smaller number of points of cargo operations;
- improvement of freight forwarding services for consignees and consignors with their release from a number of ancillary operations related to the transportation process;- introduction of a direct variant of transshipment of goods (bypassing the warehouse);
- organization of end-to-end routing of cargo transportation with the participation of several types of transport, use of non-reloading connections, introduction of agreed schedules for bringing rolling stock to transshipment points;
- development of uniform (complex) technological processes and operative planning of work of transport enterprises in knots.

It is also technologically expedient to introduce a common nomenclature of goods, which unifies the documentation base and ensures the formation of a single information space of transport enterprises, cargo owners, state control and regulation bodies.

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IMPLEMENTATION OF EU REGULATORY ACTS ON MULTIMODAL TRANSPORT IN UKRAINE

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Modern processes of globalization transform the market of transport and logistics services and encourage its players to develop new forms and types of transportation. The formation of "seamless multimodal mobility" has already been identified as one of the tasks of the EU's Sustainable and Smart Mobility Strategy, which was presented at the end of 2020. In order to fully realize its transit potential, Ukraine must also join these processes and use all the opportunities provided by multimodal transportation and modern digital technologies.

According to the results of 2020, were transported of large containers in quantity 425,066 TEUs by rail through Ukraine. This is 11% more than the volume of container traffic in 2019. 50 container trains ran on a permanent basis in Ukraine, 11 of them were international. And this area continues to grow rapidly.

An efficient system of multimodal / combined transport, on the one hand, allows to perform transport quickly, cheaply and efficiently, and on the other hand, provides an appropriate level of transport service and related services. With the support of European experts, the Ministry of Infrastructure has already started preparing a Roadmap for the development of multimodal transport in Ukraine, which provides practical steps to build a sustainable network of multimodal terminals.

One of the commitments made by Ukraine after the signing of the Association Agreement with the European Union was the implementation of a number of EU regulations into the legal framework of Ukraine. The main task for the implementation of the implementation plan of Directive 92/106 / EEC on European combined transport was the development and adoption of a new Law of Ukraine "On Multimodal Transport". After a long elaboration, consultations and public discussion, on March 5, 2021, the Verkhovna Rada of Ukraine adopted in the first reading the bill № 4258 "On Multimodal Transportation". It is improving the existing legal framework and introducing legal mechanisms for the wider use of multimodal freight in Ukraine's transport system. This, in turn, will help protect the environment through the reorientation of a significant part of road transport to the river and other environmentally friendly modes of delivery, as well as significantly optimize time and costs by implementing a single multimodal transport contract.

In the bill "On multimodal transportation":

- the concept of multimodal and combined cargo transportation, multimodal terminal, multimodal transportation document, operator and customer of multimodal transportation was introduced;

- the right of participants of multimodal transportations to carry out cargo transportation on the basis of the uniform contract - the contract of multimodal transportation irrespective of change of modes of transport, and also to carry out cargo transportation on one transport document - the document of multimodal transportation is fixed;

- the essential conditions of the contract, the rights and obligations of the parties, the basic principles of state regulation and assistance in this type of transportation are determined;

- the responsibility of the multimodal transport operator (and the maximum amount of this responsibility) for the cargo to the customer of the service from the moment of acceptance of the cargo for multimodal transportation and to the moment of its delivery is introduced.

The adoption of this law as a whole is also extremely important for Ukraine in the field of integration, as it implements the provisions of the EU Council Directive of 7 December 1992 establishing common rules for certain types of combined transport of goods between Member States. At the same time, it is aimed at Ukraine's accession to the Agreement on the Development of Multimodal Transport TRACECA - an international transport program with the participation of the European Union and 14 member states of the Eastern European, Caucasian and Central Asian regions.

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PSYCHOLOGICAL AND PEDAGOGICAL REQUIREMENTS TO TEACHERS OF PROFESSIONAL PRELIMINARY EDUCATION

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The object of pedagogical activity of college teachers are young people, boys and girls with certain inclinations, interests, features of cognitive needs. In the process of training, the future specialist grows as a person, a creative person and acquires professional knowledge and skills to solve professional problems related to the organization and management of transportation processes by rail.

This poses an extremely important task for teachers - to help them become highly qualified competitive professionals in the labor market. In this regard, the modern teacher has diverse requirements for both his professional and personal qualities.

The professionalism of a high school teacher is to effectively implement a system of professional knowledge and skills:

- special (knowledge of the theory of science he teaches and practical skills to apply them in teaching practice);
- psychological and pedagogical (knowledge of psychological and didactic bases of teaching the chosen discipline, knowledge and taking into account the psychological characteristics of students and their own personality traits, patterns of students' perception of the content of education);
- methodical (possession of methods, techniques and means of conveying scientific information to students);
- organizational (possession of skills to optimally organize their own activities and manage the activities of students). [1]

Successful pedagogical activity is promoted by individual psychological qualities of the teacher. What should a teacher be like? To answer this question, the college conducted a survey among students of transport specialties. Students were asked to answer the question - "What psychological and pedagogical qualities of the individual should have a modern teacher?"

The students' answers were as follows:

- perfect mastery of their discipline;
- creative approach to teaching material;
- possession of IT - technologies;
- ability to communicate with students on various topics;

- pedagogical tact, the ability in each case to find the right course of action;

- in the moral aspect, the teacher must be what he wants to make students.

The combination of personal and professional qualities of the teacher forms his authority. An authoritative teacher is one who deeply knows his discipline and skillfully and creatively approaches its teaching, loves and knows how to communicate with young people, feels their intentions and aspirations, responds kindly to them.

Modern professional activity of a higher school teacher requires a new pedagogical thinking. The teacher must constantly work to improve the level of their own psychological and pedagogical training and readiness for professional activity in terms of innovative learning.

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RESEARCH ON THE RISKS OF INTRODUCING THE LATEST SOLUTIONS IN THE TRANSPORT INDUSTRY

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Investments are the main method of extended reproduction of capital stock. Innovative investment is one of the promising investment methods in the advanced countries of the world. A study of the state of innovation in the railway industry of Ukraine indicates that its level remains low. Namely, the share of enterprises that implemented innovations is about 11-12% [1]. The main reason, which hinders innovation in industry was and remains the risk of introducing new technical solutions, according to the State Committee on Statistics of Ukraine [2].

Decision-making support suite of tools is essential for increasing the efficiency of decision-making on the implementation of innovative projects at a machine-building enterprise. It shall include an assessment of the level of risks and economic security, which shall be carried out using expert assessments and allows increasing the likelihood of making the right managerial decision.

Traffic safety during the transportation of freight and passenger trains is the main criterion for assessing the risk in railway transport. It is customary to characterize the level of safety with the probability of the implementation of certain dangers and threats, occurring phenomena and processes that are accompanied by the formation of factors that negatively affect the person and the environment. This is the mathematical expectation of the most important types of damage [3].

Possible scenarios for the implementation of innovative technical solutions can lead to significant material losses. This has led to the creation and practical application of system approaches, methods and tools for assessing the risk of their introduction.

Monte Carlo method is one of the methods that allows quantifying the risks of implementation, namely, simulating random variables in order to calculate the characteristics of their distributions. Simulation according to Monte Carlo method allows building a mathematical model for a process with uncertain parameter values. And, while knowing the probability distributions of process parameters, as well as the relationship between parameter changes (correlation), get the distribution of project profitability.

Different types of projects have different vulnerability to risks. It is revealed during simulation. Simulation modeling according to Monte Carlo method has several stages.

Creation of a forecast model is the first stage of the risk analysis process. Such a model determines the mathematical relationships between numerical variables that relate to the forecast of the selected financial indicator. The source data of the current forecast of economic benefits and expenses shall be indicated in the tables below (Table 1). Their maximum and minimum values, in which each of the technical solutions that were suggested for implementation was investigated, shall be taken from literary sources [4, 5].

Simulating of a forecast model is the second stage. A sufficiently large volume of random scenarios is generated. Each of these scenarios corresponds to certain values of cash flows. The generated scenarios shall be gathered together and processed statistically in order to determine the share of scenarios that correspond to a negative NPV value. The ratio of such sce-

narios to the total number of scenarios gives an assessment of the risk of investment.

Table1

Initial data for forecasting the resulting economic benefits and expenses while introducing innovative solutions

Economic effect factors			Cost factors during introduction		
Desig-nation	Name	Meas. unit	Desig-nation	Name	Meas. unit
ES	Energy saving	UAH	IC	Intellectual expenses	man/hour
RS	Resource saving	UAH	MC	Material expenses	UAH
LS	Labor saving	UAH	LC	Labor costs	man/hour
EC	Environmental saving	UAH	SC	Maintenance service	man/hour

During the simulation, the values of the variables shall be randomly selected within the boundaries of the given ranges, according to the distributions of probabilities and correlation conditions. The value of the project efficiency indicator shall be calculated for each set of such variables. An example of calculating project efficiency is shown in Fig. 1. All obtained values shall be stored for subsequent statistical processing.

Use of the suggested decision-making procedure will increase the level of economic security during the introduction of innovative technical solutions in railway transport that are aimed at reducing real hazards and risks of economic security of the enterprise, the optimal distribution of resources for the innovative development of railway production.

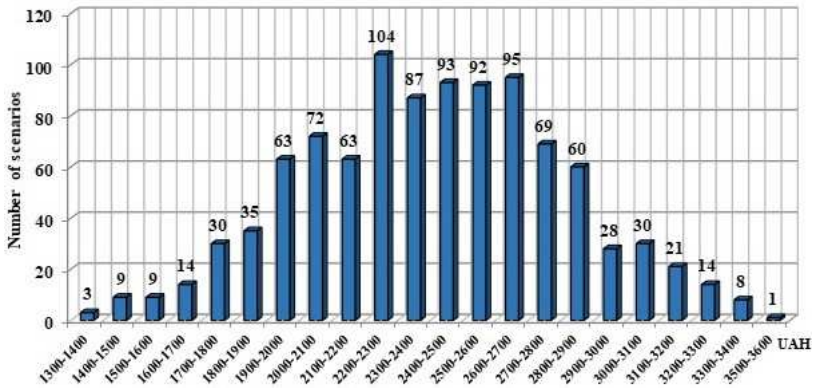

Fig. 1 Example of calculating project efficiency

A risk assessment method was used in this study when introducing innovative technical solutions for improving friction interaction in a two-point «wheel-rail» contact, which is based on the Monte Carlo method. In this case the results of the simulation coincide with the decision for choosing the most promising ways in order to improve the contact conditions in the «wheel-rail» tribocoupling using expert assessment. The least risky technical solutions for the introduction of railways that are aimed at reducing them were identified as a result of the simulation.

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IMPROVEMENT OF RAILWAY LOGISTICS OF GRAIN CARGO ON THE BASIS PRINCIPLES OF RIDESHARING

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In the conditions of crisis phenomena in the market of freight transportation of Ukraine, in particular in the market of grain transportation freight, there is a tendency to increase the cost of movement of wagon

shipments by rail network. It is possible to reduce costs and speed up the advancement of grain wagons application of the principles of ride-sharing service for the organization of step routes. This approach will allow JSC "Ukrzaliznytsia" to stay on the market of group and car shipments, and improve the rate turnover of grain trucks, which in turn will lead to increased traffic. Under such research conditions aimed at analyzing the use of ride-sharing transportation on various modes of transport and detection advantages of services for the possibility of improving the technology of grain transportation by rail transport are relevant.

One of the most dynamic emerging markets in the transportation industry is the services market transportation based on the principles of ride sharing. Ridesharing (English ride - a trip, share - to share), or carpooling (English car - car, pool - association) - sharing a vehicle with the help of services with search for companions based on the concept of sharing economy [1].

The first private startup projects of carpooling services began to appear in the early 2000s [1]. In 2001, a company called Mitfahrgelegenheit.de appeared on the German-speaking European market and on the international market was promoted as Carpooling.com brand [2]. This company was the first to have recognizable brand and had a large number of users, but later the company was bought by others BlaBlaCar project. In 2004, France launched the world's largest online search platform car companions called BlaBlaCar [1]. The idea of creating a service for joint trips for the first time appeared with the Frenchman Fred Mazella in 2004. The economic model of the startup is designed for long distances and targeted at car owners who find companions to fill vacancies during trips that would have occurred in any case. In essence, the idea of the service was to use the potential of the P2P system, which uniting people will give efficient use of resources with a positive effect on the economy and the environment [3].

In ridesharing distinguish the following stages of service:

- *Mediation:* drivers adjust their travel offer with all relevant driving details (start, destination, date, price, etc.) on the Internet portal. Online service shared the use of cars corresponds to these details with the search queries of passengers and establishes contact between users if they are compatible.

- *Organization:* If the indirect partners agree on a meeting place (landing), further details of the tour will be discussed at the stage of organization. The driver acts as an organizer among all passengers which he accepts.

- *Implementation:* The participants of the trip gather in an agreed place and start the journey.

- *Payment:* After a successful boarding, passengers pay the fare to the driver and, if it is required to pay an agency fee levied online.

One example of a slightly modified approach to the principle of ride sharing is the sharing service cars, which are not owned by any of the users, and which belongs to the manufacturers - Daimler AG and BMW Group [4]. This pilot project focuses on the implementation of the BMW Group service platform car sharing called "DriveNow". The DriveNow project allows you to attract new ones customers who need a car only occasionally.

It is important to highlight a slightly different view of ride-sharing services in the services of taxi companies - Uber and Lyft. Private drivers offer taxi services here. In these cases, however, it is the "passenger" who plans and organizes travel, while in the previously discussed sense of ride sharing, the driver of his own private car plans and organizes the route. The most famous company is Uber (German: über, meaning "above") - an American company was founded in 2009, which created a mobile application of the same name for finding, calling and paying for a taxi or private drivers [5]. In terms of the broader economic and social context, the company works within the concept economics of joint participation. The Uber mobile application allows the user to order a car with a driver and track its movement to the specified place, payment for driver services is made by bank cards or cash. The mobile application is available for download on mobile gadgets running on based on iOS and Android.

The direction of business model development is interesting for the improvement of railway grain logistics ridesharing, which allow a common economy of use and can be used in logistics. At the moment For some time now, about 41% of US consumers have used programs [6] that offer delivery services in that day itself, expedited services or services on request. Delivery company on request Postmates that based in the United States, is currently a leader in this field.

One of the areas of ride sharing is digital brokerage platforms that provide data flow in real-time and communication between shippers and carriers, and therefore provide a smooth coordination of cargoes with the available carrying capacity of different types of transport. The advantage of this approach is real-time communication, tracking shipments via mobile GPS, secure payment and critical collection of documents - all this is convenient to do in the mobile application. Brokerage platforms can effectively distribute excess capacity in all modes of transport with a larger audience shippers [7].

The analysis of ride-sharing services showed the effectiveness of their use in logistics markets services. The studied practical examples of application of ride-sharing services in various branches allowed to reveal im-

portant features of technology for the possibility of their application for railway logistics. Suggested to review the current operating model Hub & amp; Spoke for transportation on the railway transport of Ukraine grain cargo by wagon shipments. You can significantly reduce costs and attract more senders cargo due to the use of a service product for the transportation of grain cargo based on principles of ride sharing. Within the digital platform-aggregator to combine car shipments in step route at the expense of consolidation of loading of parties of grain to 15-25 cars of various senders wishing send in matching calendar periods for the possibility of booking a place in the step route.

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INFLUENCE OF THE MEASURING TOOL INSTALLED IN THE UPPER END COVER OF THE VORTEX CHAMBER PUMP ON ITS CHARACTERISTICS

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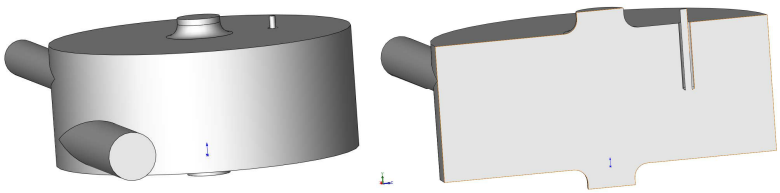
Research of hydraulic systems and devices is carried out mathematically or experimentally. The complexity of the analytical calculation of flows led to the fact that the main confirmation of the efficiency of ideas in the design of hydraulic machines could only be an experimental study. However, in order to determine the main parameters of the flows, expensive instrumentation is required to measure the flow velocity at a point. The requirements for the measuring equipment that the researchers impose are based on one basic principle - the measuring equipment should not distort the integral parameters of the flow in the hydraulic machine. However, practically no one has carried out studies on how exactly the measuring instruments affect the flows in the flow path. There is an unspoken rule that the size of the measuring device should be as small as possible and the size of the research object as large as possible. This rule leads to significant financial costs for the production of enlarged copies of the measurement objects and the purchase of measuring equipment of a reduced size.

On the other hand, over the past 50 years, numerical methods for studying flows in hydraulic and pneumatic machines have been actively developing [1]. Numerical modeling is based on the solution of the Reynolds-averaged Navier-Stokes equations [2-4]. In many respects, numerical modeling made it possible to reduce the number of experimental studies and increase the quality of studies due to flow visualization [5-6]. However, the peculiarities of averaging the equations according to Reynolds required the use of turbulence hypotheses, which led to significant errors in mathematical modeling based on the numerical solution of the equations. Thus, when carrying out numerical modeling, there still remains a need for experimental verification of the obtained solutions at a qualitative and quantitative level - the so-called verification and validation of the results obtained [6-8]. When carrying out verification, the question of the correspondence of the flow patterns obtained experimentally and numerical simulations remains important, especially if the influence of the measuring equipment on the flow was significant. Therefore, the problem of defining the influence of a measuring tool on the flow parameters in a hydraulic machine becomes actual. The authors of this paper have been researching new jet pumps for a considerable time, called vortex chamber pumps [2, 7, 9]. These pumps take advantage of the advantages of jet technology and vane pumps based on the rotation of

the flow inside the vortex chamber. Flows in vortex chambers are one of the most difficult flows in hydrodynamics; therefore, the effect of measuring instruments on the flow can be very significant [5, 10].

In this paper, based on the numerical solution of the Reynolds equations, a comparison of the flow patterns in a vortex chamber pump with and without a measuring tool of different diameters is carried out. Fig. 1 shows the design scheme of the vortex chamber pump (VCP) [9] in the form of a solid model for calculations.

The VCP operation parameters shown in Fig. 2: $\overline{V}$ is the relative velocity at the point of measurement; $\overline{p}$ is the relative pressure at the point of measurement; $\overline{\eta}$ is the relative efficiency of the pump; $\left(\overline{Q_{in} / Q_s}\right)$ is the relative coefficient of flow (ejection) of the pump. All parameters are referred to the parameters of the pump without a measuring tool.



a b

Fig. 1. Calculated solid (a, b) models

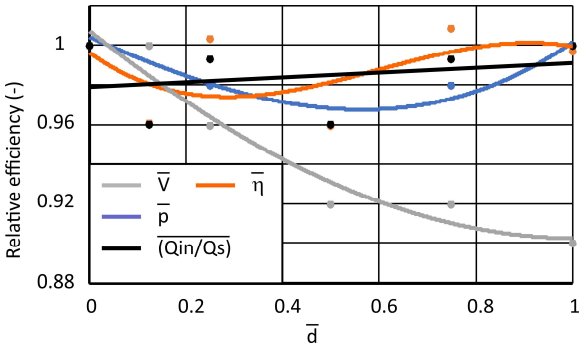


Fig. 2. Dependence of VCP performance indicators on the relative size of the measuring tool

On the basis of numerical simulation of the flow in a vortex chamber pump, the measuring tool influence on the flow characteristics was investi-

gated, and the results were compared with the results of the undisturbed flow parameters measurements.

The distribution of velocities in the vortex chamber is typical for the flow around a circular cylinder.

The installation of the measuring tool in the end cover of the vortex chamber leads to a decrease in the flow rate sucked by the pump through the lower axial channel.

The size of the instrument has practically no effect on the energy characteristics of the VCP. To ensure the measurement accuracy, the ratio of the vortex chamber dimensions and the tool should be ensured so that the relative diameter of the tool does not exceed 0.25 of the vortex chamber throat diameter.

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INCREASING THE EFFICIENCY OF CONTAINER TRANSPORTATION ORGANIZATION

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The geographical position of Ukraine dictates the dependence on the level of development the transport infrastructure, which affects not only the industrial, but also the social development of the state. In the context of integration and the aspiration of our country to the international economic community, the use of container transport is particular importance. Taking into account the large territory and ramification of mainline railways, the development of rail container traffic is becoming urgent.

Container transportation is one of the most technologically advanced, multimodal transportation, which allows to reduce the cost and time of loading and unloading operations, to ensure the safety of goods and logistics of delivery "from door to door" and "just in time" [1].

It should be noted that the share of transportation costs makes up a significant part the cost of production products, and with the development of transport, it can have a beneficial effect on the price of domestic goods. In modern conditions, one the types of transport business, which is the most in demand and dynamically developing, is the organization of container transportation. At the same time, the issue of developing infrastructure of transport and forwarding complexes for organizing container transportation is one of the main ones. Organization of door-to-door delivery is increasingly accompanied by just-in-time. Using this method allows you to reduce the lead time of cargo owner, reduces the level of stock in warehouse and ensures that order is completed before the required deadline. If the total delivery time does not meet the client's requirements, then measures are developed to reduce the duration of individual elements due to technical and technological changes. In this case, delivery regulation can be carried out at the stage of transportation planning and during the transport process. To ensure the delivery of goods on a "just in time" basis, it is necessary to track the movement of goods and, in some cases, to apply control actions on technical and technological parameters.

The main reason for the lack of growth in container traffic is considered to be an insufficient container fleet in Ukraine, since this market is controlled by global foreign carriers. They are reluctant to give their equipment inland due to the underdeveloped infrastructure; there is no production of containers, wagons and platforms for transporting containers. One of the main problems hindering the development of container cargo servicing

market in Ukraine is the underdeveloped infrastructure. The number of container terminals is insignificant.

It is also necessary to legislatively approve conditions that stimulate private investment in container terminals and related infrastructure. A new level efficiency in the provision of transport services will be ensured with the attraction a significant amount of investment for the emergence freight traffic along the created corridor in a volume that justifies its construction. To do this, it is necessary to analyze the current state of affairs related to the functioning the corridor, identify existing restrictions and problems, draw up a list of measures necessary to eliminate them, find potential investors and forms of cooperation between the state and private business.

Also of interest are constructive solutions in terms ensuring optimal conditions for the transportation of goods in containers. One of these specialized types containers is tank containers that provide transportation of liquid cargo. This technology has a number of distinct advantages. First of all, this is an excellent opportunity to ensure diversification the methods of supplying goods to foreign and domestic markets. On the other hand, this is the most efficient and profitable way of delivering goods in small consignments to individual recipients.

Improving the organization of container shipping is one the most promising areas for the development of transport system. In the long term, it is possible to predict high growth rates of container flow compared to the average annual growth rate in Ukraine, as a result of which the export structure will change, the capacity of container terminals will increase, and the degree containerization of Ukrainian foreign trade cargo will increase. This is possible in case support at the state level and attraction of large investors who are ready to invest in the development of this direction, container transportation can reach a qualitatively new level.

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ORGANIZATION OF INTERACTION BY RAILWAY AND SEA TRANSPORT

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In modern conditions, when the economies of countries are linked together in a network of world production, the development of effective transport and communication systems is a prerequisite for developing countries to penetrate this global network.

Since the first years of Ukraine's independence, the country's image has been created as an image of a transit state, which, with its international transport corridors, connects the countries of East with the countries of West. This is due to the importance of transit traffic for economic life. These circumstances also define a new approach to the transit system as a single multimodal process. In this case, the services provided to customers should include a full range of logistics, including the transportation of goods, storage, customs operations, services, etc. A very important role in the transit chain is played by sea and rail transport. The interaction of sea and rail transport can be characterized by common interests to attract transit cargo and use (maximum) existing infrastructure capacities and, in connection with this, new investments and marketing to guarantee the functioning of a single multimodal system in the future by attracting new cargo [1-3].

Organization of interaction between railways and seaports is the most important component the transport strategy of Ukraine. Analyzing the features interaction of sea and rail transport, we note that at the moment, as a rule, two schemes for organizing port services by rail are used:

A) trains arrive at the front yard marshalling yard, located on the approaches to the port, where a selection of groups cars is performed for delivery to the port in directions of loading and unloading, and after their unloading or loading in the port, the wagons are taken to the station, trains are formed and sent to the external net.

B) trains arrive at the front yard marshalling yard, located at the approaches to the port, where demountable trains are formed to the port address, then they go to the port station or to regional parks located directly in front of the loading and unloading fronts (with a sufficient front length, there is a possibility of direct supply, bypassing district parks). On the sorting tracks the port station, groups of cars are formed for delivery to the loading and unloading fronts.

Of course, railways and ports are complex, capital intensive industries. An important problem is the lack investment in the development of

railway infrastructure on the approaches to the ports, as well as investments related to the development of port complex. At the moment, the depreciation of rail and sea transport is significant. This measure will give the desired effect, while ensuring a reciprocal fashion between port workers and railway workers, optimizing technological processes the work of ports and adjoining stations, adapted to the new economic conditions, as well as providing guaranteed volumes of traffic along the agreed routes [3, 4].

Taking into account the systemic nature the problem of organizing the interaction of railway and sea transport, on the coordinated supply of wagons and ships, as well as optimization of the norms for unloading wagons in ports on the basis of contracts for supply and unloading, it is obvious that its solution lies in the development and implementation a single set of agreed measures.

A further increase in the level organization of interaction between rail and sea transport is possible through the creation of joint ventures. Attraction of third-party capital is also possible through corporatisation the joint venture being created and placement of shares on stock markets. Such an approach is quite attractive, since it allows attracting potentially significant additional funds from private investors in the construction of infrastructure facilities, and increasing the level of consistency in the operation modes of transport in a transport hub.

At present, the problems of interaction between rail and sea transport in seaports and on the approaches to them are especially acute. The use of "dry port" technology will not only improve the quality of freight forwarding services, the organization of interaction between rail and sea transport, but also increase the attractiveness of our country for international transit.

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WAYS TO IMPROVE THE EFFICIENCY OF INTERMODAL TRANSPORT

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Refusal the centralized planning of transportation, dispersion freight traffic, their instability and other factors negatively affect the rhythm of the transportation process. Also, an increase in the delay of rolling stock in anticipation of transshipment and an increase in the cost of transshipment goods in seaports and river ports has a negative impact.

The intermodal method of transporting goods solves a significant number of problems, such as: building the most optimal logistics, shortening the delivery time, increasing the safety of quality the goods, reducing the transport costs of consumer, which is accompanied by a clear interaction in the work between transports [1, 2]. An integrated cargo delivery process gives a synergistic effect only if an optimal balance is achieved between the quality of transportation and speed of services.

In addition, with the help of intermodal transportation, it is possible to achieve a reduction in the cost of transportation by combining several modes of transport, saving time and money, both for shippers and consignees, as well as increasing the reliability international delivery of goods.

The possibility and degree of implementation of intermodal transportation in Ukraine is an important task, the intensive development of foreign economic relations determines the special role of transport. It must provide continuity, reliability, high speed and delivery guarantees within strictly defined terms. An important and urgent task of transport industry today is the development of close coordination and interaction of all types land, water and air transport based on the widespread introduction of logistics approaches, automated control systems for transportation process, the development of new technologies. Improvement of these components will make it possible to fully realize the transit potential of country.

Regardless the change in modes of transport and complex logistics, the implementation carriage of goods is carried out according to one shipping document of intermodal transportation Reducing the delivery time of cargo is carried out by minimizing warehouse operations, increasing the productivity of work during loading and unloading of rolling stock, the ability to install automated control the movement of cargo packages, as well as accelerating financial calculations.

Container transport is an integral part of intermodal transportation, it is the most technological segment of modern transport industry, which is

especially sensitive in the economic environment. The low level development of science-intensive industries determines dominant role the export of raw materials, which for the most part do not need container service and, conversely, the development of high-tech industries, the growth of science-intensive products change the structure exports in favor of those goods that form the demand for container transportation.

With the help of such technologies, it is possible to achieve an increase in the level of interoperability cargo transportation by using advanced technologies in comparison with existing delivery technologies.

Increasing the level of interoperability cargo transportation can be carried out using progressive systems by finding the best delivery method. One of transportation options using intermodal transportation is the use of block-train technology [3]. This makes it possible to reduce the delivery time due to movement of train with the cargo along "tight schedule lines".

On the basis of this experience, it is proposed to increase the level of interoperability cargo transportation by using advanced technologies. This can be done in comparison with existing delivery technologies. For example, in the field of transportation goods to some countries in the direction of "Ukraine-EU".

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APPLICATION OF A SYSTEM APPROACH IN THE ORGANIZATION OF THE PROCESS OF CARGO TRANSPORTATION BY ROAD TRANSPORT TAKING INTO ACCOUNT HOUR WINDOWS

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Under the influence of the phenomena of economic globalization, there is an increase in freight turnover in international and intercity traffic. These trends, against the background of increased competition among transport enterprises, stimulate the development of cooperation in their production activities, which contributes to an increase in the efficiency of the use of vehicles implementing the transportation of goods. Therefore, the issues of increasing the efficiency of organizing and implementation the processes of freight road transport on the basis of a systematic approach are relevant for transport enterprises.

Due to the fact that the processes of the emergence and servicing of requests for the carriage of goods, in particular in intercity traffic, are stochastic in nature, simulation tools are the most suitable for their study and analysis [1-2]. If we do not take into account the characteristics of constant and random requests, then delays occur during the implementation of the transportation process. The ability to identify hidden dependencies between making managerial decisions and fulfilling requests for cargo transportation received for service in a certain automated way is fundamental [3-4].

The aim of the study is to improve planning, selection and distribution of requests for the transportation of goods, and, as a result, to maximize profit. In this case, the costs associated with time delays in the process of servicing such requests should be taken into account.

The calculation of the criteria that form the basis for planning the process of implementation the freight road transportation, with greater accuracy, can be obtained if we take into account the hourly connections between the implementation of requests, which are based on hourly windows and make it possible not only to fulfill the customer's requirements, but also to ensure the implementation of the transportation process with a minimum number of vehicles.

To solve this problem, it is proposed to use a systematic approach, the initial principles of which are to strive with maximum completeness to take into account all the input and output characteristics of the object when conducting its research. At the same time, it is proposed to distribute the flows of requests according to the priorities of their implementation. The

ordering of the implementation of requests is carried out according to priorities, which are determined in alternately.

To determine the priority of requests implementation, it is advisable to use the indicator of their compatibility in a single flow of requests.

The highest priority is determined by the compatibility factor to establish the desired sequence of implementation of requests, which is calculated based on the hourly connections between requests for the carriage of goods, according to the formula:

$$K_{c.ij} = \frac{a_{0i}}{a_{ij}}, \quad (1)$$

where a_{0i} – the duration of the implementation of the j request with the assumption that there are no preparatory operations, waiting and downtime of the of vehicle; a_{ij} – hourly connections matrix element.

The priority of execution of the j request can be set using the concentration factor of requests on the transport network and its modifications, which indicate the type of route being implementation and, which will be most effective for fulfilling a given list of requests:

$$K_k = \frac{N_t}{Q_g}, \quad (2)$$

where N_t – the number of requests ready for implementation in a given period *T*; Q_q − the number of points of departure and reception of cargo, which relate to requests planned for implementation during the period *T*.

It is proposed to determine the coefficient of unevenness of the set of known requests, which characterizes the level of unevenness of the duration of the implementation of the corresponding processes, and to choose the order of implementation of the j request [5]:

$$\eta_t = \frac{a_0^s . j . \max}{\overline{a_0^s \cdot j}}, \quad (3)$$

where $a_0^s . j . \max$ − the maximum time spent on the implementation of the of the j request, excluding previously completed orders, associated

with the movement of the vehicle; $\overline{a_{0.j}^{s}}$ − the average time spent for the implementation of the j request, which are associated with the movement of the vehicle.

Unlike the coefficients (1) and (2), the coefficient η_t refers directly to the duration of the request implementation, does not take into account the preparatory and transitional operations.

The proposed method and algorithm for the distribution of the implementation of request s for the transportation of goods allow not only to solve the problem of planning the transportation process with a large volume of incoming data arrays, but also to obtain higher numerical values of the optimization criterion - the total profit from the implementation of transportation.

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SPECIFICS OF TRANSPORT PLANNING AT INTERACTION OF RAILWAY AND MARITIME TRANSPORT

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To ensure a modern level of transportation management and continuous interaction of railways and seaports, it is necessary to qualitatively plan not only the operational train, but also link it with local work in the node in the short, medium and long term. In this case, planning is one of the most important controls, which includes the following steps:

1. Setting the goal of planning;
2. Clear formulation of specific tasks that will achieve the goal;
3. Definition for each task of ways and means of achievement of the purpose;
4. Consideration of alternative solutions;
5. Setting deadlines for achieving the goal.

Planning of railway and port interaction is based on the following principles:

1. Continuity - planning the interaction of two transport facilities (port and railway station) should be carried out both in the short and long term;
2. Scientific - planning of technological and technical development of transport systems and their individual elements should be carried out on a scientific basis, ie based on reliable information and performed by scientifically sound methods;
3. Flexibility - developed plans should be adjusted in accordance with possible changes in the transportation process;
4. Accuracy - compliance of planning of technological processes with the established volumes and terms of their performance;
5. Priority - the focus of programs and plans to achieve strategic goals of development of enterprises of interacting modes of transport.

Currently, there are the following logical and economic-mathematical methods [1, 2], which are most often used for planning transport processes:

1. Program-target method - planning, which is based on
development of complex programs focused on achieving the set goals;
2. Balance sheet method - planning is carried out on the basis of various documents on the principle of balance sheets;

3. Normative method - planning is carried out taking into account the system of norms and standards;

4. Economic-mathematical method - during planning use various economic-mathematical models, which are a formalized description of the studied economic process (object) in the form of mathematical dependencies and relations;

5. Forecasting method - is a set of techniques and methods that allow based on the study of internal patterns of development of the object and its external relations to make judgments (forecast) of a certain reliability about the future state of the forecasting object;

6. Intuitive methods are based on intuitive-logical thinking. They are used when it is impossible to take into account the influence of a number of factors when planning due to the significant complexity of the object and the result is assumed without justification or if the object is too simple and does not require time-consuming calculations.

As practice shows, in operational planning on railways are used mainly normative and intuitive methods. It should be noted that both in the field of local work and in the operational regulation of train traffic for the timeliness, accuracy and quality of planning is responsible for operational and control personnel.

The success of the process of interaction between the railway and the seaport depends on: the timely supply of rolling stock to the junctions in a mode that ensures the smooth operation of both modes of transport, and the organization of local management at the junction. In the system of JSC "Ukrzaliznytsia" implemented a hierarchical system of management of relevant processes, which provides for the separation of the technological process of planning the organization of train traffic and management of local traffic management. Planning of all freight traffic is carried out by the department of planning and operative rationing of the Branch "Center of transport logistics" of JSC "Ukrzaliznytsia" [3, 4].

Each of the levels of traffic planning management is responsible for the result of work within the established and assigned competencies. It performs certain functions, both in terms of planning and forecasting the delivery of certain goods, and the implementation of the promotion of trains with them, followed by the supply of cars to their destinations:

• the level of dispatch change of the management area - planning and management of the promotion of local cars within the area during the shift;

• the level of management of the management area - planning of freight work of railway stations of the management area for days and change;

• the level of the dispatcher shift manager - coordination of the work of the control districts on the transfer of loaded and empty local cars between the control districts during the shift.

Operational management of the transportation process of local work at the regional level is carried out by a single dispatch change. The control shift includes:

• senior traffic management dispatcher (shift manager);

• engineer (shift) to control the delivery time of goods;

• dispatching apparatus of management districts.

The logistics center (LC) is engaged in forecasting the interaction between the railway and the port.

Delivery of trains to the address of port stations is planned by the leading engineer (variable on ports) of department of the organization of transportations of freights of the logistics center on the basis of the analysis of information from roads of departure, transit roads, port stations of destination of cargo, recipients - ports and terminals taking into account delivery time. taking into account the application of the chief of the port station, drawn up in agreement with the representative of the port (warehouse number, cargo and the recommended time of delivery of the train to the station in accordance with the train schedule set by the threads).

The supply plan must be drawn up in such a way that at six o'clock in the evening the station has a balance of wagons for unloading at a level not lower than the daily norm and does not lead to the accumulation of unclaimed cargo.

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PROJECT-ORIENTED MANAGEMENT IN LOGISTICS

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The desire of transport companies to improve the efficiency of providing services by reducing costs, responding in a timely manner to competition and taking into account the changing priorities of consumers has led to the need to search and introduce new, more flexible approaches to business organization. One of these approaches is the development and use of logistics tools to control the functioning of flow processes.

In addition to logistics tools, managing the process of transforming material flows requires the use of other methods. Now the transport and logistics systems of Ukraine are at the stage of development and require the development and implementation of innovative design solutions. Therefore, the use of project-oriented management methods in logistics is relevant.

Project management is a specific branch of logistics management. The essence of project management in logistics is to manage the goals of the organization, which will allow the company to be successful in the competition, quickly respond to external and internal changes, save time and money. Three points are under constant attention of the project manager: time, budget and quality of work. Project management is the process of managing the team and resources of a project using specific methods, thanks to which the project ends successfully and achieves its goal.

The above-mentioned features of modern project management have led to the emergence of the concept of "project-based management" in management, which differs from the concept of "project management". In particular, project management is the solution of problems of a high degree of novelty for the creation of certain systems, and project-oriented management is the activity of fulfilling customer requirements, which is also associated with the solution of new, unique tasks. The content of this approach is shown in Table 1.

However, project-oriented management can be interpreted as an approach aimed at solving the sequence of all tasks, where the task is understood as the goal of the activity, given in certain conditions, which must be achieved. The solution to the problem is manifested in the achievement of a given result under conditions of certain restrictions.

The application of the approaches discussed above, as well as the functional approach in logistics, presupposes a certain specificity, features, as well as differences associated with the different nature of the problems to be solved, the goals and results achieved, which is demonstrated in Table 2.

Table 1

Comparison of project management and project-oriented management

Goal setting object	Activity content	The degree of novelty of actions	
		Recurring	New
Customer	Meeting customer requirements with a focus on experience	Process Management	Project oriented management
System	Creation of certain systems based on the accumulated experience	Production Management	Project management

Table 2

Correlation of approaches to management in solving problems of logistics management

Compared characteristic	Management approach		
	Project management	Project oriented management	Functional
Control object	Project	Functional activity	Functional activity
Goal setting object	Logistic system	Logistic flow	Logistic operation
Result	Creation of a logistics system	Solving the problem of flow control	Maintaining a certain functional state of the logistics system
Regularity	Upon the emergence of a need	The regular nature of the tasks being solved	Regular nature of operations
Degree of novelty	High	Average	Low
Organizational structure	Design and target	Matrix	Functional

The key distinctive feature of the logistics approach is the consideration of management objects in the form of flows, and the key distinguishing

feature of project management is the consideration of a management object in the form of a project - a unique complex activity limited to a certain time interval and performed independently of the activities of the enterprise. At the same time, there are a number of common properties characteristic of both approaches.

The main idea of the logistic approach is that all stages of the logistic process are considered as a single and continuous process of transformation and movement of the material flow and related information. Project management is also cross-functional in nature, when to achieve the planned result requires the participation and interaction of all functional services of the enterprise.

Thus, the creation of logistics systems becomes an object of project management, and the tasks of managing flows in the process of operating logistics systems are solved on the basis of the organization of project-oriented management. Functional management, in turn, is limited to the management of logistics operations and solving problems of a low degree of novelty. This approach makes it possible to expand the scope of project management and the range of tasks solved with the help of its tools in logistics. This allows us to consider project management as a factor in increasing the competitiveness of a transport company.

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THE POSSIBILITY OF USING A LOGISTIC APPROACH IN THE WORK OF ROAD TRANSPORT

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For the survival of trucking companies in modern conditions (the COVID-19 pandemic, which provoked the crisis, both in Ukraine and in other countries), taking into account the competitiveness, it is necessary to adapt the dynamic state of market, to explore the prospects for implementation of their services.

Therefore, at this stage of market development, it becomes necessary to study the possibility of using a logistic approach in the work of road transport. For example, in a trucking company, a feature of the logistic approach is that the companies, as well as its partners, are considered as a single economic system with the goal of meeting the needs of consumers in the best possible way.

The management of this system can be carried out by a single logistic management, which directs the activities of system to achieve general system goals. The difference between the logistic approaches to enterprise management from the traditional one is as follows.

One of the difficulties in introducing a logistic approach to a trucking company is that the company is a complex system that operates under conditions of uncertainty and risk.

Considering this problem, it is necessary to study foreign experience in this area. So, in the United States, a system was taken into development where vehicles work without stopping, tractors with semi-trailers that are twice as large are used. They act as temporary storage warehouses. Firms that specialize in the logistics market in North America follow a couple of basic tricks. This implementation of the logistics process is based on the needs of client and the direct provision transport and storage services. To do this, they need terminals, warehouses, rolling stock.

Experience in European countries and the USA shows significant role of transit logistics organizations in budgeting. For example, in Norway, the development of intermodal transport is one the most important public policy objectives. The main direction of transport logistics is strengthening the role of rail transport. Therefore, the second tracks are actively being built, new terminals are being built and old ones are being reconstructed, which are later used for storing large consignments of cargo. The restructuring of warehouse complexes was done taking into account the large volume

of cargo transported in containers. The interaction of automobile with other modes transport has been established.

The main task of transport logistics in Finland is to provide inexpensive and reliable international routes, to ensure the attractiveness of Finnish logistics complex against the background of continuous strengthening the positions of Estonia, Latvia, Lithuania and Poland.

In the countries of Central Asian region, there is an increase in the volume of international trade with foreign countries. This makes it possible to build up the transport and logistics potential of these countries. In this regard, there are special requirements for the modernization of existing infrastructure transport and warehouse complexes.

In this perspective, the experience of Toyota (Japan) is noteworthy [1], the logistics enterprises is based on the concept of production management "Just in Time", aimed at reducing stocks the enterprise. The efficiency of logistics technology "Just in Time" was confirmed during the crisis periods. This technology, as indicated in [1-3], was part of production system the enterprise. The implementation of this task was based on minimizing costs, finding the most effective methods of work and constant, continuous changes in the production process.

Analysis of logistics management technologies at motor transport enterprises of Ukraine showed the following features. There are a sufficient number of producers, as well as end and intermediate consumers, who form the market for transport services. These companies offer both in transportation and in other operations of physical distribution (consolidation, sorting, loading, unloading, storage, etc.) throughout the entire supply chain.

For a quick and economically sound solution of complex problems logistics management, it is necessary to use a complex of modern information programs and technologies that will provide an effective information system. According to various estimates of foreign experts, the use of such tools has significant reserves for optimizing logistics processes and reducing logistics costs. Modern information systems used in trucking enterprises must reflect all business processes, contain elements of logistics management and provide all the necessary information about their change in time and space.

It is the automation of all logistics processes and their full reflection in the information system that will make it possible to quickly make optimal decisions in the management of logistics activities, as well as implement complex projects that contribute to the growth of profitability, efficiency and competitiveness.

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ANALYSIS THE PROBLEMS OF CREATING MULTIMODAL LOGISTICS CENTERS

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It is known, that the development of transport and warehouse logistics is a prerequisite for increasing the efficiency of commodity circulation within Ukraine and international traffic, for realizing the transit potential of our country. Despite the status of Ukraine as a transit state, at present, there are still problems insufficient development of logistics for multimodal transportation, low quality of transport services for customers, which leads to a decrease in the efficiency of both transport industry and the economy as a whole. Also a problem is the slowdown in industrial growth, insufficient implementation of the transit potential of our country. Insufficiently coordinated work modes of transport, primarily in transport hubs. It is also necessary to note the insufficient development on territory of Ukraine high-quality transport and forwarding services along the entire logistics chain of cargo transportation, the underdevelopment services for the provision of intermodal transportation using various types of transport.

In Western Europe, there are number examples of multimodal logistics center projects, which are successfully operating and developing. This definition is understood as a multifunctional terminal complex, which is located at the nodes of transport network, performs the functions of a logistics transport and distribution center, ensuring the coordination and interaction various types of transport, loading and unloading operations and transshipment of goods, short-term and long-term storage, cargo handling, perform-

ing the necessary customs procedures, integrated transport and forwarding services, ensuring the delivery of goods to customers on the "door to door" and "just in time" technology, providing a full range of service and commercial and business services, including production and technical, banking, information, consulting and analytical services, and other types of logistics services. At the same time, due to the integration of commodity, information, financial and service flows, the maximum synergistic effect is achieved.

Several European organizations and government agencies are actively involved in the development of modern multimodal transport corridors, including rail, road, air and sea transport, to facilitate the smooth movement of goods within the region. Local governments and regional organizations are interested in creating safe and sustainable multimodal transport systems that not only serve as a catalyst for socio-economic development, but also increase international competitiveness. An efficient way of transporting goods with low cost and greater efficiency is a strong reason for multinational firms to invest in a particular region, leading to an increase in foreign direct investment. The presence of strong multimodal production and transport networks increases trade in goods, services and capital flows in the region and, therefore, intra-regional trade.

Analysis the literature of European countries on multimodal transport has shown that there is a need to develop multimodal transport networks, a comparative analysis of multimodal freight transport, temporary benefits from the use of multimodal transport, as well as research on specific projects in the EU and APEC regions. Several studies focus on behavioral aspects, that is, the perception of consignee and the shipper, taking into account the choice of the mode of transport [1-3].

For example, the cost and time case study conducted in [2, 3] shows the cost and efficiency benefits of using different combinations routes and modes of transportation within ASEAN boundaries. Several methods have been adopted to study issues related to the integration of multimodal transport networks. The model used in the study is based on freight forwarders' freight rates and is used to calculate the cost of one twenty foot equivalent unit (TEU) of all freight modes (FAK) on four different routes through different countries and ports using combination different modes of transport.

Despite the unsatisfactory state of our country in this process, there are still certain steps in this direction. It is planned to actively cooperate between Ukraine and Slovakia in the development of multimodal transport between Asia and the EU. The corresponding memorandum of cooperation within the framework of the "Silk Road Economic Belt" was signed by the

ministers of infrastructure and transport of the respective countries [4]. The idea of creating multimodal logistics centers between Ukraine and Slovakia was also discussed.

Although there are a number of obstacles in the creation a multimodal transport network, efforts to create integrated transport corridors require harmonization of tariffs customs and cabotage rules. In addition, there is a need to reduce the problems associated with the lack of infrastructure and obstacles to proper coordination at border and checkpoints. Therefore, it is necessary to deeply understand the general problems associated with the integration of multimodal transportation into the country's transport system with the development a network of multimodal logistics centers.

The benefits obtained from cost savings and time savings in a number of studies point to the need for the establishment and operation a network of multimodal logistics centers, which leads to efficient and economical logistics services.

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ON SAFETY AND RISK ASSESSMENT IN RAILWAY TRANSPORT

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Ensuring the safety the rolling stock of railway transport directly depends on the organizational and technical solutions in this area. Train traffic safety is one of the main tasks of JSC "Ukrzaliznytsia" in the operation

railways, transportation of passengers and cargo. Therefore, all organizational and technical measures in railway transport must meet the requirements of safe and uninterrupted train traffic.

When organizing the transportation process by rail, much attention is paid to its safety and the calculation of various risks. There are many reasons for the violation safety of transportation process, but one the significant ones is that this process is carried out under conditions of uncertainty. When uncertainty is taken into account, many factors are considered as random variables with known or unknown distribution functions.

The presence a number of intelligent systems in the modern world dictate the relevance of their use in railway transport, including in the field of security. With the increasing complexity of technical systems and technological processes, the cost of human error is growing. The probability of making a mistake, which leads to an emergency, is influenced by the correct choice of a solution when controlling a technological process. This makes it necessary to increase the requirements for quality and reliability of traffic safety equipment, as well as for the professional training and experience of railway personnel, is directly involved in the implementation of train traffic.

There are studies [1-3], which show that the majority of human errors are caused by the unsatisfactory design of system with which he works. This makes increased demands on ensuring the reliability of equipment, as well as to the depth analysis of causes of accidents that have already occurred. In turn, it was noted [3] that the presence of an integral assessment the safety level allows, on one hand, to reveal the response of railway transport safety system to certain management decisions in the field of safety. On the other hand, to carry out its forecast for the near future. Using the risk assessment as a quantitative safety measure for rolling stock, when moving trains allows us to develop a set of organizational and technical measures to reduce it.

The review of features the assessment safety and risks, taking into account the results of studies [2, 3]. It was noted that there are a number of peculiarities in foreign railway systems. Thus, in the United States, traffic safety on railways is assessed by the following indicators: an accident rate equal to the number of accidents per 1 million trips-kilometers, an accident rate at level crossings, equal to the number of accidents per 1 million vehicles, an accident rate when transporting dangerous goods, equal to the number of accidents during the transportation of dangerous goods per 1 million trips, the number of injured railroad workers per 200 thousand people worked, the number of people injured with fatal accidents as a result of accidents, as well as victims with fatal outcomes at level crossings. On the railways of Great Britain, traffic safety is assessed by the total number of

accidents, including collisions of trains with each other and with other vehicles at level crossings, the number of deaths, the number of injured, the number of accidents associated with the stay of people in area the railways.

Thus, in assessing the safety features and risks in railway transport, various intelligent technologies are used. Unfortunately, despite the variety of approaches to the study factors affecting the state safety of railway enterprises and transport in general, the conceptual and theoretical foundations of this category in the security system are currently at the stage of formation. In turn, the effective development of regional economy directly depends on an integrated approach to the system of safety assessment and risk management in railway transport. The role of the state in this process is also important.

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LOAD DISTRIBUTION IN RAILWAY WHEEL CONTACTS

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The tribological system "wheel-rail" performs the following main functions: the function of the engine, the function of the direction of movement and the function of support. The requirements for the interaction of wheels and rails for the implementation of these functions are quite contradictory [1, 2].

Consider the peculiarities of the interaction of the wheel pair and the track when one of the wheels is on the rail (fig. 1).

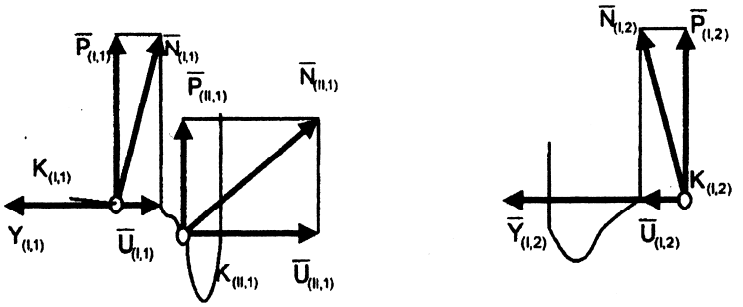

Fig. 1. The scheme of loadings distribution in contacts

The equation of a wheel pair equilibrium in the transverse direction has the form:

$$\overline{Y}_{(I,1)} + \overline{Y}_{(I,2)} + \overline{U}_{(I,1)} + \overline{U}_{(I,2)} + \overline{U}_{(II,1)} = 0\,, \qquad (1)$$

where $\overline{U}_{(i,j)}$ - rolling (gravitational) component of normal loads in the corresponding contacts

$$U_{(i,j)} = P_{(i,j)} \cdot tg\gamma_{(i,j)}\,, \qquad (2)$$

where $P_{(i,j)}$ - vertical loads in the corresponding contacts;

$\gamma_{(i,j)}$ - the angles of the wheel profile inclination at the points of contact.

Taking in this case the load of the wheel on the rail constant and equal to static - P_0, can be written as

$$P_{(I,j)} + P_{(II,j)} = P_0\,, \quad (j=1,2)\,. \qquad (3)$$

From the vector equation (1) we obtain the formula for the guiding force - the horizontal reaction of the wheel on the rail, for the first wheel

$$U_{(II,1)} = Y_{(I,1)} + Y_{(I,2)} - U_{(I,1)} + U_{(I,2)}\,. \qquad (4)$$

The normal load in the contact of the oncoming wheel crest on the

rail is determined

$$N_{(II,1)} = \frac{P_0}{\cos\gamma_{(II,1)}} \cdot \frac{f_0\left(\frac{k_{(I,1)}}{\cos\gamma_{(I,1)}} + \frac{k_{(I,2)}}{\cos\gamma_{(I,2)}}\right) - tg\gamma_{(I,1)} + tg\gamma_{(I,2)}}{f_0\frac{k_{(I,1)}}{\cos\gamma_{(I,1)}} - tg\gamma_{(I,1)} + tg\gamma_{(II,1)}}. \quad (5)$$

Equation (5) is the dependence of the normal load in the crest contact on the angle of the wheel on the rail.

Figure 2 shows the calculated dependences of normal loads in the crest contact on the angle of the wheel pair incidence (ψ) for crest cone $\gamma_{II,j} = 50^0$ i $\gamma_{II,j} = 70^0$ in the modes of run-out and traction, where N1(ψ), N3 (ψ) – for crest cone $\gamma_{II,j} = 50^0$, N2(ψ), N4(ψ) for crest cone $\gamma_{II,j} = 70^0$, N1(ψ), N2(ψ) – in the modes of run-out, N3(ψ), N4(ψ) – in traction mode.

One of the main reasons for the undercutting of crests can be considered parasitic sliding within a closed power circuit between the crest contact and the contact on the rolling surfaces of the wheel and rail [3].

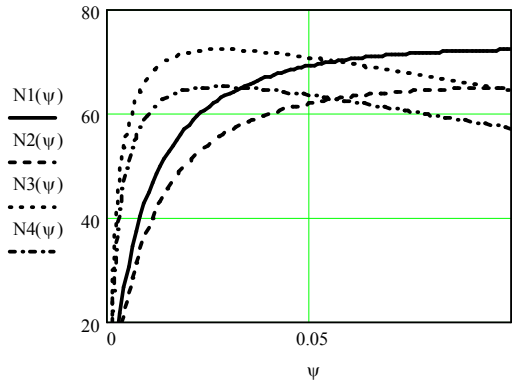

Fig. 2. Dependences of normal loads in crest contact:
(N1(ψ), N2(ψ), N3(ψ), N4(ψ), кN)
from the angles of incidence of the wheel pair (ψ, rad)

The values of normal loads in the crest contact, in this case, can reach values equal to the maximum horizontal dynamic loads on the rail track, and larger values correspond to smaller angles of the crest cone. In the thrust mode, the crest loads on the rail are more sensitive to increasing the angle of incidence than in the run-out mode.

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