

# **The organization of car transportation**

**Case: Ekspo Auto Center LLC car dealership**

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Abstract  <p>The theme of Thesis: "The organization of car transportation in intercity traffic using the example of the "Ekspo Auto Center LLC car dealership". The volume of work is 50 pages, it contains 4 figures, 10 tables, list of sources and 1 appendix. The object of this study is the process of organizing the transportation of Renault cars to St. Petersburg from a factory in the city of Tolyatti. The subject of the study is the most profitable option for the transportation of Renault cars based on the analysis of modes of transport and rolling stock. The aim of the final work is to organize the events of the most economical and fastest way to deliver Renault cars from the Tolyatti factory to the "Ekspo Auto center LLC car dealership" in St. Petersburg. Research methods are presented by the study and analysis of specialized literature, as well as the mathematical apparatus recommended for processing statistical and calculation material of the same type of questions. In the process, an analysis of the estimated indicators for organizing the transportation of Renault cars to the Auto Center in St. Petersburg by road and rail was made. As a result, measures have been developed to organize the transportation by the most optimal way. The effectiveness of the proposed measures is determined by the cost and time indicators of the delivery of cars.</p>		
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## **1 Introduction**

For a very long period of time, there are cases when goods that people need are not produced in the location, they live in. Thanks to logistics, these goods are quickly and cheaply distributed all over the world, which leads to turnover and demand improvement. Hopefully, we live in the 21<sup>st</sup> century, when you just need to write in the internet what you are looking for, pay and wait for the arrival of the goods. We live in the modern world, and modern world means modern solutions.

Logistics is understood as the effective management of material, informational and financial flows. The role of logistics is to organize a rational process of goods transportation from manufacturers to consumers, as well as functioning of the sphere of products, goods, services circulation. This is the science about planning, managing and controlling the movement of material. The main task of logistics is to optimize internal and external material flows, as well as informational and financial flows, to optimize business processes in order to minimize total costs. The consumer should receive the goods he ordered in time, in the right place, from a good supplier with good service level.

The relevance of studies is based on the search for ways to resolve the contradiction between increased production and utilization of passenger cars in time of limited possibilities for their transportation from car assembly points and foreign manufacturers to regional dealers. The degree of development of this topic requires serious consideration. Especially regarding connections in the existing political and economic relations between Russia and countries-producers, changes in the tariff policy on the international and domestic transport markets by various modes of transport.

## **2 Problem definition and thesis objective**

The object of studies is the process of organizing the transportation of Renault cars to St. Petersburg from a factory in the city of Tolyatti. The subject studies are the

most profitable option for the transportation of Renault cars based on the analysis of modes of transport and rolling stock. Research is limited only to the transportation of Renault cars by road and rail. The aim of Thesis is to organize the events of the most economical and fastest way to deliver Renault cars from the Tolyatti factory to the “Ekspo Auto center LLC car dealership” in St. Petersburg with help of the following questions: “What is the cheapest and most adequate way of car transportation from Tolyatti to St. Petersburg?”, “What is the process of car transportation from Tolyatti to St. Petersburg?”, “What happens if the car got damaged during the transportation?”

Research methods are presented by the study and analysis of specialized literature, as well as mathematical apparatus recommended for processing statistical and calculation material of the same type of questions. The basis of studies is the existing tariffs for the carriage of cars by various modes of transport on the territory of Russian Federation. The theoretical significance of studies lies in the version of solution to the problem presented in the work to determine the most economical and fastest way to transport the given type of cargo. Thesis consists of introduction, sections with an output for each, conclusion, list of sources.

The determination of methods of car transportation is carried out by choosing an alternative rolling stock: in road transport - car transporters of various modifications; in railway transport - platform comparison; gondola car; railway carriage - “net”; transportation in a railway container; delivery in covered all-metal wagons. The technologies of Renault car transportation, cargo capacity, placement, securing and marking of cargo on rolling stock are determined. Based on a comparative analysis of the time and cost indicators of transportation options, measures are developed to organize the optimal transportation method, depending on the proposed conditions.

## Limitations

The research covers the matter of transportation, and transportation cost is something that may be changed daily due to following factors: political situation in Russia;

the rate of Russian ruble to dollar, euro; corona virus; the price of gasoline/l. There is also a place for contingencies that may occur due to special cases as car accidents or roadworks. In the research, interviews were avoided due to corona virus situation all around the globe. The research is limited only to road and railway transportation.

### **3 Research methods**

In this section, the research methods of qualitative and quantitative analyses will be emphasized, this is due to the fact that a correct way of transportation from St. Petersburg to Tolyatti embraces the qualitative research that has nuances of quantitative analyses. Later on, the explanation of the selection will be given.

The first research method that was chosen called quantitative research method, and it is an analysis of phenomena and processes that are based on a system of quantitative indicators (Kovalchenko, 2003). Quantitative research method refers to a method of collecting data that is subsequently used in the research. This method is not considered to be difficult, since the research is based on numbers that provide accurate information about the object of research. Usually, this method is used for gaining an information from a large number of people (responders), using the help of online surveys. The method plays a supporting role in the research, numerical indicators are used to illustrate the conclusions obtained. They allow to establish quantitative characteristics and measures, the intensity of the studied phenomena and processes (Zarubina & Fateeva, 2016).

The second research method that was chosen called qualitative research method, this is a method through which you can get thorough and detailed information about the subject of studies. The main difference with quantitative method is that data is collected from a relatively small group of respondents and not analyzed using statistical methods (Semenova, 1998). From logistics point of view the quantitative method is vital, since the entire way of transportation should be understood, and the processes happening during the transportation itself should be reasonable. After the

information is gathered and analyzed, the correct transportation method can be implemented.

## Case study method

The case study method seems to be the most appropriate, since the method involves the usage of different sources in order to get a good understanding of the process itself. Or, like Yin (as cited in Ellram, 1996) stated, the case study method basically gives an idea of what case study research is, when it should be applied, and its application in qualitative and quantitative research methods.

The case study method usually concentrates on observations, interviews, documentation research, information analysis, the list is vast. With help of such method, there is a possibility of getting into the base of studied phenomena that subsequently gives you a desired and detailed result (Scholz, 2002). Regarding the transportation from St. Petersburg to Tolyatti, the case study method observed documentation research for understanding of legislations and rules of transportation, observations for understanding of modes of transport, and information analyses for correct calculations. The most difficult aspect- is the right source of information, you need to go through all pages of certain documents and make a distinction between subtopics of legislation, traffic rules, or tariff guides for example. It takes time to understand whether the rule you are applying is correct, but this is the way how people learn. Just always remember that every transportation is unique and must be treated differently with help of knowledge you have already gained from the previous transportations. Interviews were avoided due to corona virus situations and are not implemented.

Fulfillment of obligations regarding the transfer of the goods ,the application for its transportation by the sender, and the approval of the application by the railway carrier, leads to the emergence of obligations for the consignor to transfer the goods and consignment notes for transportation, as well as the obligation of the railway carrier to issue it in the appropriate order for sending to a certain point and transferring it to the final recipient, the procedure is usually regulated by documents, but do



not forget that the documents must be reviewed , analyzed and understood beforehand, this is why the current method in “Tolyatti- St. Petersburg transportation” case is concentrated only on observations, documentation research and information analysis.

## **4 Theoretical basis**

The dynamics of car production in Russia is one of the biggest in the world. Twenty years ago, for example, Russians had ~40-50 cars/1000 inhabitants. Currently, about ~300 cars per 1000 people. In comparison, the average for Europe is around 500 cars/1000 inhabitants (The number of cars per person, 2015). Car delivery belongs to the market of transport services. The relationship between the market for transportation services and the market for goods is not direct; their relationship is expressed in attracting subjects of the market for transportation services on contractual terms. In terms of composition, this market includes carriers, freight forwarders of various profiles, as well as owners of rolling stock. Nowadays, the main options for transportation in Russia are rail transport - transportation in specialized covered wagons of car carriers; road transport - car transporters. When transporting cars by road, car transporters are used - specialized vehicles designed to transport cars. They consist of a tractor and special trailer (semi-trailer). There are open and covered car transporters. During railway transportation, various types of wagons are used, they are discussed in more details below. Both delivery technologies are associated with the accumulation of a certain batch of cars at one destination. It is assumed that each delivery technology has its own characteristics and segment of activity. Transportation of cars over long distances is mainly carried out by rail. Road transport is used for transportation over medium (up to 3,500 km) and short distances (Galyatdinov, 2014).

## 4.1 General Concept and Terms

Transport is an important element in the sphere of logistics, it performs crucial function in production- movement of goods to the right point. Everything seems simple and easy, but it is not, since moving an item to the right place involves several processes. The goods, for example, need to be transported by the most optimal route in order to minimize total cost, in addition, you need to choose the right vehicle, plus the delivery must be in time. Based on this, it is clear that logistics is a combination of steps that transformed into single well-coordinated process.

Transport is a vital point in logistics world since the transportation itself involves a participation of certain kind of vehicles, and here (Table 1) the general concept and terms will be reviewed:

Table 1. General concept and terms in transportation (Concept and Terms, 2003).

Motor vehicle	commonly 4-wheeled vehicle driven by engine and designed to transport people, goods or equipment (having a curb weight of more than 400 kg);
Car transporter	specialized vehicle designed to transport cars
Consignee	person who is responsible for the receipt of cargo financially
Consignor	individual or legal entity indicated in the transportation document, speaking on his own behalf or as a representative and fulfilling the obligations prescribed by the contract of carriage
Dealer	legally independent enterprise whose activities are based on the sale and maintenance of goods of one/ more manufacturers
Carrier	individual or legal entity that performs the functions of transporting goods or passengers
Railway/ automobile rolling stocks	vehicles of any categories, adapted for movement on railways or highways

## 4.2 Determination of routes

Routing traffic is the compilation of routes for the movement of a vehicle or its sequence between the start and end points. Routes depending on the main classification can be divided by length, the first one called urban and means within the city. Second and third differ by mark of 50 km- suburban means within 50 km, while inter-city means over 50 km. Everything what is beyond the boarder of Russian Federation called international. Routes are also separated by the period of the year, there are two classifications: permanent and seasonal/ temporary. You may have guessed that by using permanent, it is meant year-round, while seasonal/ temporary means during a specific time or season, basically it means action that happen occasionally. Routes may differ by the type of movement; it could be repeating movement between points (like pendulum) , movement of vicious circle type with the service of several consumers or with a gradual loading and last unloading at several points (Transportation routing, 2020).

Rail payment for the carriage of goods is charged for the shortest distance over which transportation is carried out, including the case of distance increasing over which transportation of goods is carried out, for reasons depending on the owner of the infrastructure and the carrier. This ensures the rational execution of the contract of carriage. According to Tariff Guide No. 1 (part 1, paragraph 2.1), the freight payment on Russian railways is charged for the shortest direction distance, if the goods are transported at high speed; for the real traveled distance when transporting oversized cargo or cargo on transporters; for the total distance of transportation on the Russian Railways when transporting goods with the Kaliningrad Railway; for the transportation distance (taking into account the bypass of railway junctions for a number of dangerous goods), and other goods (taking into account the bypass of inactive sections of high-speed lines) (Tariff Guides on railways, 2008).

### 4.3 General information about the subject

Nowadays, cars are supplied to the customers by regional dealers. Enterprises are divided into dealer enterprises of domestic manufacturers, foreign manufacturers, car assembly. Automakers conclude target agreements with dealers (dealer agreements), which consist of quantitative and qualitative parts. Such activity in most cases is limited to a certain region, in accordance with the concluded dealer agreement (Afanasjev, 2016).

The work will be around car brand Renault; Renault cars first appeared in Russia at the beginning of the twentieth century- the imperial family moved around the city on cars of this brand. In 1916, the Russian Renault stock company was established, it included factories in Petrograd and Rybinsk. The organization's board was located in Petrograd, at English embankment, 34. The main products of the enterprise are automobiles, tractors, engines, and also airplanes. After the revolution, the plants were nationalized. The policy of the USSR meant to develop domestic automobile industry, but in the 1960s, Renault resumed cooperation with Moscow: an official representative office was opened, and in 1970 an agreement between the USSR government and the French automakers about the development of the automotive industry was signed (Shugurov, 2001).

Renault made a great contribution to the modernization of the "Moskvich" factory and the creation of the "Kam Automobile Plant" (KAMAZ) in the 60s - 70s. About a quarter of Soviet cars were produced using Renault technology by 1980. In 1992-1993, the first Russian office of Renault was opened in Moscow, and in July 1998 an agreement with Moscow government about the creation of united venture "Autoframos" was signed. This name was made up of 3 words: "auto", "France" and "Moscow". A year later, on the basis of the AZLK factory (AZ - Moskvich), an incomplete assembly workshop was opened, which produced Renault Megane and Renault 19, then Clio and Symbol (Shugurov, 2001).

In 2003, the construction of a full-cycle factory for the production of Renault Logan began, all the work was finished in April 2005. In 2006, Logan became the best-selling foreign car in Russia. Renault's share in the capital of "Autoframos" gradually increased, and in November 2012 Renault were 100% of total stock (Midler, 2013). In July 2014, the Russian company changed its name to "Renault Russia", directly linking its name with the glorious history of the company (Automated Info-Controlled Systems in the Oil and Gas Complex, 2014).

On March 1, 2010, the production capacity of "Autoframos" was doubled (up to 160 thousand cars per year), while the production of Renault Sandero B-class hatchback, created on the modernized platform of the already mastered Renault Logan sedan, started. The so-called test assembly of hatchbacks in Moscow started in December 2009, the first commercial vehicles appeared at Russian dealers in the spring of 2010. Since 2011, "Autoframos" has launched the assembly of a compact Renault Duster crossover. In February 2008, Renault acquired a blocking (25%) share, and in June 2014, a controlling (50%) block of shares in "AutoVAZ" (Nikitina & Lebedeva, 2014). The "Renault Group" sells its cars in more than 200 countries. Renault headquarters is located in Boulogne Billancourt (near Paris). The "Renault Group" controls several branches at once – "Nissan Motors" and "Renault Samsung Motors", also owns shares of "Dacia" (Romania), "Volvo", "AutoVAZ" and other companies. Speaking generally of Renault manufacturing countries, several main factories can be distinguished. First one is Romania, where cars are mostly produced for Europe, although sometimes cars reach Russia. Second one is located in Brazil, in this country the factory is considered to be one of the largest Renault factory. Third one is located in India, where the production is mainly focused on the domestic market (Africa and Asia). On the territory of Russian Federation, Renault cars are produced near Moscow and at "AutoVAZ" Renault is expecting to reform Russian's automakers (History of Renault brand, n.d.). According to Christian Estev, Renault General Director in Russia, "AutoVAZ" plans to organize the production of Renault, Nissan and Lada cars on the basis of a single B0 platform (Logan platform), as well as the production of its ultra-low-cost cars (Renault Master, n.d.). The general information about the Renault Logan model (Figure 1), delivered to dealerships in St. Petersburg presented below.



Figure 1. Renault Logan (Renault Logan, 2019)

Renault Logan is a subcompact four-door sedan of class B. Its overall characteristics are length 4346 mm, width 1733 mm, height 1517 mm, wheelbase 2634 mm, ground clearance 155 millimeters and weight up to 1165kg. Such clearance is a characteristic of cars designed to move along paved city streets and highways. They hold the road well and can even storm small curbs during parking. The trunk has an enviable value for this class of cars. Its volume is as much as 510 liters of free space (Renault Logan, 2019).

#### 4.4 Definition of modes of transport and vehicles

For correct logistics services, it is always necessary to understand the methods of transportation and remember that transport is a combination of vehicles, routes, structures and devices on these routes. Transport is always distinguished by its purpose. It could be public transport, which main purpose is transportation of passengers; special use vehicles that are usually military vehicles; private use vehicles such as personal cars (Galyatdinov, 2014).

Now let's have a look at the ground transportation that is divided into a number of subspecies: the first one called rail transport and it carries out the transportation of passengers and goods by wheeled vehicles on railways (trains, trams, subway, mono-rail). The railway characteristics (Table 2) are following:

Table 2. The railway characteristics (Galyatdinov, 2014)

Vehicles	Locomotives and wagons
Railways	Railways, bridges and tunnels
Alarm and control	Semaphores, switches
Transport hubs	Railway stations and hubs
Energy supply	Contact network, equipment points and refueling locomotives

The advantages/disadvantages of railway transport (Table 3) mentioned below:



Table 3. Advantages/Disadvantages of railway transport (Transport logistics: concept, modes of transport, types of transportation, 2014)

Advantages of railway transport	Disadvantages of railway transport
- high carrying and throughput ability;	- a limited number of carriers (natural monopoly);
- does not depend on climatic conditions, time of year or day;	- large capital investments in the production and technical base;
- high regularity of transportation;	- high energy and material traffic;
- transportation safety;	- unavailability at the end points of sales;
- high speed delivery of goods over long distances (over 1500 km);	- not very high cargo safety;

The second one is called automobile transport, and it carries out the transportation of goods and passengers on trackless road, it could be buses, trucks, cars, armored personnel carriers (Galyatdinov, 2014). Characteristics of road transport (Table 4) are following:

Table 4. Characteristics of road transport (Galyatdinov, 2014)

Vehicles	Various types of cars (trucks, cars, trolleybuses, buses)
Ways of communication	Roads, tunnels, bridges and overpasses
Alarm and control	Traffic lights, traffic signs, traffic police, traffic rules
Transport hubs	Bus stations, bus stops, parking lots
Energy supply	Contact network, gas stations
Technical support	Road services, service stations, bus depots

The advantages/disadvantages of road transport (Table 5) mentioned below:

Table 5. Advantages/Disadvantages of road transport (Transport logistics: concept, modes of transport, types of transportation, 2014)

Advantages of road transport	Disadvantages of road transport
- high availability;	- low efficiency;
- the ability to deliver cargo "door to door";	- Dependence on weather and road conditions;
- high flexibility and maneuverability;	- high cost of transportation over long distances;
- high speed delivery;	- the impossibility of a long wait period for unloading;
- the ability to use various routes;	- the danger of pilferage of cargo and theft of the vehicle.
- the ability to send cargo in small batches;	
- wide possibilities of choosing a suitable carrier.	

#### 4.4.1 Specialized vehicles in road transportation

Here will be reviewed a special case of the transportation of goods, namely cars, which is carried out with the help of a car transporter and trailers. A car transporter consists of a tractor and a special trailer (semi-trailer). There are open and covered car transporters (tilt, with sides). The standard car transporter is designed to carry 7-

8 cars of group B (Renault Logan), European trailers can carry up to 9-10 cars, depending on their size. Currently, car sales are growing at an unprecedented pace, and the increasing demand for their transportation stimulates the production of a separate type of specialized rolling stock - auto transporters (Illarionov, 2010). The attention was paid to this topic, since the expansion of the standard sizes of transported cars, of course, was reflected in the complexity of modern designs of cargo superstructures.

The legislation of the Russian Federation permits a maximum height of a car carrier of 4 m and a length of 20 m, and most of the products offered by Russian manufacturers are characterized by a relatively simple design - these are company-type bunk semitrailers designed for transportation of cars (Rules of car transportation, n.d.).

Among the Western European manufacturers in Russian market, three main players should be noted: the French company Lohr Industrie, the Austrian Kassbohrer Transport Technik GmbH and the Italian Rolfo. The latter stands out with the widest range of models. Rolfo Classic car transporters, capable of transporting from 7 SUVs to 10 ordinary cars, are designed according to the design scheme: a tractor with a stationary superstructure and a trailer with a folding upper tier, with the front struts of the superstructure on the tractor being screwed and the rest, including the trailer, are double-levered. Car transportation by auto transporters is the most used option for transporting cars from manufacturing plants (distribution sites) to regional dealers (to recipients) (Foreign car carriers, 2020).

In our case, the Renault cars will be delivered by SCANIA road train (Figure 2).



Figure 2. Car Transporter “Scania” (Scania, 2019)

#### 4.4.2 Specialized rolling stock on the railway

When transporting goods by rail, various types of rolling stock (Figure 3) are used, the choice of type is determined by the question of what type of cargo needs to be transported.

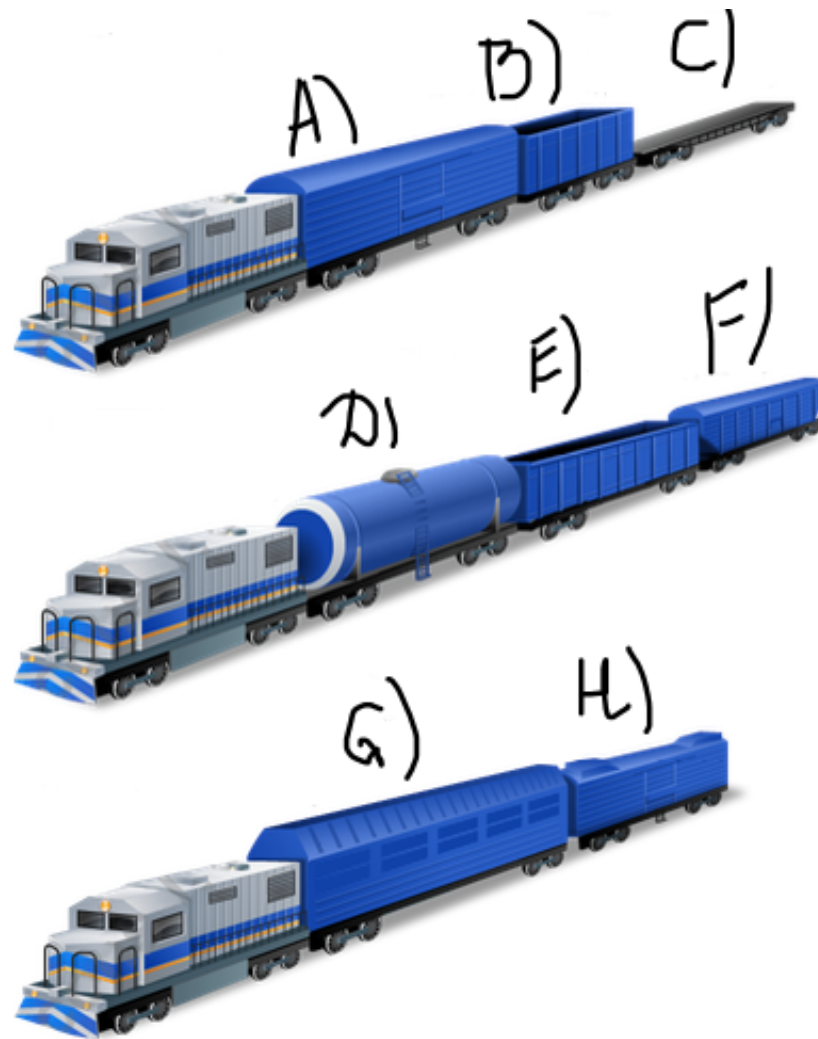


Figure 3. Types of rolling stock (Types of railway wagons, n.d.)

Types of rolling stock are usually distinguished by the type of transportation depending on cargo, it could be covered goods wagon that is designed for the moisture-susceptible goods transportation on picture A, or open wagon which is designed for bulk goods transportation on picture B. Schnabel car or simply saying transporter is designed for huge heavy oversized cargo transportation, picture C. On picture D, the cistern is illustrated, cistern usually serves as liquid cargo transporter. On picture D, the bulk and lump cargo transporter is illustrated, its name is dump car. The hopper is illustrated on the next picture, hopper is designed for quick unloading of bulk cargo. As you may have guessed by finding windows on G picture, the car carrier is illustrated, the wagon is designed for car or car parts transportation). The final picture illustrates refrigerated wagon that is designed for perishable goods.

The transportation of cars by rails is the competence of Russian Railways under a carriage contract that has the status of a public contract (Types of railway wagons, n.d.).

During the railway transportation, there are several transportation options such as platforms; gondola car; car carriers; transportation in a railway container; delivery in covered all-metal wagons.

Each of the transportation options has its advantages and disadvantages. So, the safest in all perspectives is the transportation in car carrier wagon (Figure 4), but you must keep in mind that delivery will be carried out only after the wagon is completely full, and this is 8-10 cars (Types of railway wagons, n.d.).

In addition, it is worth considering that the car is completely open to all winds and precipitation.



Figure 4. Car carrier (Car carrier wagon, 2016)

## 4.5 Features of car loading and fastening

Before sending the car, it is necessary to wash it and record any damages (if there are), take a final photo to protect your rights in case of damage to the paintwork when loading or unloading the car. This is a common practice in transport companies that transport a car by rail. The certificate of acceptance is signed by the owner. If there is an adjustable suspension, it must be put into transport position, all additional devices must be removed from the roof of the car - trunk, ski racks. Side windows are recommended to be lowered. Cover the seats with protective covers in the passenger compartment. From the passenger compartment and trunk of the car you need to pick up all your personal belongings. The car battery must be fully charged, the fuel tanks are almost empty, although this point should be checked with the carrier, some shippers require a completely dry tank, while most carriers require 5-10 liters of gasoline in the tank. Fuel is necessary for loading and unloading a car. It is necessary to check, and if necessary, eliminate all leaks in the underbody of the car (Requirements for car transportation, 2020).

In such condition, the car is provided to the trucker. Before you load a car, you should firstly check the requirements for picking a car. When sending a car, you need to have an identity document, a certificate of registration (if the car is registered). The car is loaded by employees of the consignor company, usually the staff has sufficient skills and experience, so that nothing threatens the car during loading and unloading. After loading, the car is put on the hand brake and first gear (manual transmission) or “parking” position (automatic transmission). Then it is fixed by at least two stops under the wheels, and two or more belts, or cables. Under the bottom of the car is a polymer film. The battery is disconnected from the car network. The car remains in such condition during the entire transportation (until unloading) (Requirements for car transportation, 2020).

### 4.5.1 Technology of car transportation and receiving

When transporting Renault cars by transporters, the general rules of transportation apply. Car transporters must be technically sound, clean and equipped with security



barriers; Racks should be equipped with protective materials to protect the doors of cars during their opening on a car transporter; The floors of platforms and gangways should not have sharp structures that could damage the lower part of the car and tires; Lubricants are not allowed on loaded cars; Car transporters must be equipped with the necessary number of thrust blocks and mounting belts; The fastening belts must be adjustable, having anti-skid blocks, the ends are securely stitched. These are considered to be crucial in car transporters preparation (Rules of transportation, n.d.).

All transportation of cars is carried out in accordance with applicable law, including the observance of the Rules of the road. A car on a platform of a car transporter is secured before transportation according to a special scheme. First of all, the loading platform of the car transporter must be covered with special perforation for better traction of the wheels of the transported car (with the loading platform of the car). After that, under the wheels of the car, especially designed rollbacks are installed with a lateral stop, which keep the car from longitudinal and transverse movement. And finally, the wheels of the car are attracted to the cargo platform of the transporter by a special flat, synthetic belt with a large margin of safety (up to 3-5 tons, depending on the design of the belt). Whatever the car (high SUV / low car), it will be fixed on a car carrier for safe movement. Standard cars are not fixed by body parts to the platform of the transporter (Rules of transportation, n.d.).

General requirements for the organization of receiving of vehicles make us working according to rules. If possible, it is advisable to unload the cars in a closed territory for better cargo safety, but if it is not, then it is necessary to ensure safety in the place of unloading by enclosing with signal cones and providing traffic control for the matter of security. If safety measures are not observed during unloading, there is a high risk of an accident. In this case, all responsibility for car damage rests with the receiving party (Rules of transportation, n.d.).

Appearance of the employee performing the acceptance place vital role as well- a special form of clothing that does not have elements capable of damaging the car (belt buckles, zippers, metal elements in the form of buttons or rivets, watches) must

be worn as well as reflective vest and gloves (not mandatory) (Rules of transportation, n.d.).

The representative of the host must necessarily submit a power of attorney for the right to accept material assets. The initial inspection of the cars is carried out by the representative of the receiving party when the cars are not unloaded from the vehicle in order to identify possible damage, as well as after removing the cars from the vehicle, but before moving them to the car wash. Make sure that pictures of unloaded car transporter are taken, so that the photographs can determine the location of cars on the platform (front and back). Dirty vehicles require a wash. Instructions for receiving cars from a car transporter in winter are following: go around the car carrier with arriving cars several times and carefully inspect the cars for damage; make sure to set guards at the unloading transporter from the unloading side; give a chance to the loaded cars to heat up a little (2-3 minutes); when transporting cars from the car transporter to the car wash, do not turn on the wiper blades. (scratches of a windshield are possible); If necessary, clean the windshield from dirt and snow, use a sweeping brush and liquid to defrost the windows. Never use scraper to clean the windshield; If it is impossible to clean the windshield, lower the driver's glass all the way and carefully drive the car through the driver's door (Velmozhin, Gudkov, Mirotin, & Kulikov, 2006).

When unloading, it is forbidden to move by inertia, to drive over fastening belts, thrust blocks and other objects. After the delivery of cars and checking of condition, the certificate of receiving is signed. The brand, configuration of the car, its technical condition, mileage, digits, flaws, and the fact that it was generally transferred is proved by using an acceptance-transfer protocol. It must be completed and signed by both parties, photographs of vehicles and an inventory of all things in the car, if any, must be attached to the act. You must also indicate the number of keys given to the carrier. Correctly drawn up acceptance-transfer protocol may be used for making claims to the carrier if the car is delivered in a condition that does not correspond (Rules of transportation, n.d.).

#### 4.5.2 Technology of transportation by road

The safety of cargo during transportation primarily depends on the quality of fastening, as well as on how carefully technological requirements are observed during loading/ unloading. Preparations for car loading must emphasize certain aspects such as distance between cars should allow you freely open the door and lead the car to a car transporter, in other words there should be enough space. Car seats must be equipped with protective materials and clean, so nothing prevents from proper inspection. The batteries must be serviceable and fully charged, tank must contain at least 5 liters of fuel, do not forget to turn off all car security systems in the car. For vehicles equipped with an adjustable suspension, the suspension should be in the "transportation" position. Shipping documents for the carriage of vehicles must be prepared and contain all the necessary information (Requirements for car transportation, 2020).

The next phases embrace the matter of proper examination before departure. The forwarding driver conducts an external inspection, checks for completeness, checks the VIN and controls the preparation of the vehicles for loading. It is necessary to make sure that the platform floor is cleaned of sharp objects, thrust blocks and fixing belts are correctly fixed on the sides of the transporter. After that, the driver turns on the ignition, checks the operation of the main and auxiliary brake systems and suspension adjustment (if the car is equipped with an adjustable suspension). If necessary, it is recommended to fold the side mirrors. While driving onto the platform, it is necessary to do that at a low speed. The distance between the car and any surface of the car transporter should be at least 8 cm, and not exceed 20 cm between cars. The gearshift lever should be in the first gear position; the parking brake is applied. For automatic gearboxes - position P. The car on the platform must be secured with at least 2 mounting straps and have 2 thrust blocks, the belt tension handle must not touch the vehicle. After loading, the cars must be closed and keys are put in a special case (Requirements for car transportation, 2020).

### 4.5.3 Technology of transportation by rail

The cargo must be prepared for transportation in such way that the safety and security of its transportation, the rational use of rolling stock, and the acceleration of cargo operations are ensured. The charter of the railways obliges to submit for loading wagons and containers that are serviceable, suitable for the transportation of certain cargo, cleaned of cargo and garbage residues. Each wagon supplied for loading at the stations is inspected technically and commercially. A commercial inspection of the wagon should guarantee the safety of cargo during transportation. A car's serviceability is commercially characterized by the quality of cleaning from previously transported cargo, the absence of nails or bolts protruding inside the carriage on the walls or on the floor, tight closure and reliable fastening of side and ceiling loading hatches, as well as unloading hatches, self-sealing doors, serviceability of the lining door bolt, rack-mount brackets of platforms and the absence of seals from the outside in the body of a covered wagon and so on (Technical conditions for cargo securing in wagons and containers, 2003).

When loading, it is necessary to comply with the conditions ensuring the safety of train traffic and the safety of goods during transportation, as well as the rational use of the carrying capacity and capacity of cars. The seal is a security sign confirming that there was no access to the cargo during the transportation process. Serviceable seals (if the car is in good condition) indicate that no one entered the car and that the cargo in it is in the form and quantity in which it was at the station where the seals were applied. Therefore, the imposition of seals on wagons is one of the main means of struggle for the safety of cargo during transportation. The procedure for sealing is established by the rules of transportation. If the wagons are loaded by means of the road, then the sealing of the wagons is carried out by the road, when loading the goods by means of the shipper- then shipper (Semenov, Kustov, Teterov & Romanova, 1995).

The containers are sealed with the seals of the sender, with the exception of containers presented by citizens with agricultural products and household items that are sealed with seals of the railway in the presence of the sender. When providing

freight forwarding services by a freight forwarding organization, containers are sealed with its seals. The seals hung on a wagon or container must have the following signs: when related to road- the full or abbreviated name of the station, vice number, abbreviated name of the road, control signs of the seal; when related to consignor - full or abbreviated name of the consignor, full or abbreviated name of the station, abbreviated name of the road, number of vices. Control signs consist of three digits corresponding to the last three digits of the number of the sealed wagon or container. To seal cars and containers, lead seals are used with a chamber or two parallel openings, polyethylene seals with a chamber that are hung on a car (container) using heat-treated wire with a diameter of 0.6 - 0.7 mm (Semenov et al, 1995).

Recently, label-seals and lock-seals began to be used. Compared to other fillings, they are more reliable. At the end of loading, the transceiver draws up a wagon sheet, informs the shunting dispatcher (station duty officer) that the wagon is ready for cleaning. Wagon sheets arrive at the goods office, where waybills and road sheets are selected for each of them. All documents from the goods office are transferred to the technical. The shunting dispatcher instructs the train compiler to remove the cars from loading points on the station's path to include them in the train. The cleaning time of the wagons is noted in the memo of the transceiver (statements of supply and cleaning of wagons). The waybill - the main transportation document accompanying the cargo to the destination station. The safety of the goods and the fulfillment of the delivery time depends on the correct filling of the consignment note. In addition, accurate drawing up of the consignment note helps to ensure the safety of train traffic, accelerate the turnover of cars and the correctness of settlements for transportation. The road sheet - a document of settlement and financial significance - contains data about the delivery time of the cargo, the progress of the points of transition from road to road. The road sheet, along with the waybill, accompanies the cargo to the destination station. At the destination station, the recipient signs it in the receipt of the goods. Receipt of goods - a legal document confirming the acceptance of expensive goods for transportation from the sender to whom it is issued (Semenov et al, 1995).

## 4.6 General info about transportation documents

When carrying out transportation, there must be certain documents that have a series and account number. In general, these documents include waybill and commodity invoice (when transporting goods of a commercial nature (having value)).

The waybill is the main document that defines the indicators for accounting for the operation of the vehicle and the driver, as well as payments for transportation.

On the waybills in the upper left is an ordinary stamp or stamp of carrying organization. Before leaving the line, information about driver, accompanying persons, vehicle, time of the beginning and end of work, customer of transportation, planned mileage and fuel are filled in. If the transportation is subject to licensing, the license number and series must be indicated on the waybill. The date of issue indicated in the waybill must correspond to the date of registration of the issued waybill in the journal. When carrying out transportation of goods in conjunction with the waybill, commodity invoice is used. The consignor draws up a commodity invoice for each consignee and each transportation trip with the mandatory completion of all details in at least four copies. For goods of a non-commercial nature, the volume of transport of which is taken into account, a commodity invoice is issued in triplicate (Gorev & Oleshenko, 2009).

## 4.7 Transportation damages and insured events

When transporting cars by auto transporter, the cargo can reach the recipient with damages, this is due to the fact that the cars are transported in open auto transporters, without protective covers in different weather conditions, and emergency situations can occur on the road. In this section, the problems with cargo safety will be reviewed. When the goods are delivered to the recipient, the procedure for acceptance of vehicles and the preparation of appropriate documentation take an action. There

are certain procedures for the acceptance and execution of appropriate documents. First of all, the receiver provides a power of attorney for the right to accept material assets. The representative of the receiving party must submit a power of attorney for the right to accept material assets. Next, an initial inspection of the cars takes place, it is carried out by the representative of the receiving party when the cars are not unloaded from the vehicle in order to identify possible damages, and also after removing the cars from the vehicle, but before moving them to the car wash. If the receiver finds damages, he draws up a report. For the initial inspection of vehicles, a quality map is created for each unit of cargo received. As part of the initial inspection, it is necessary to inspect cars after they are unloaded from the transporter. In this case, the cars are inspected next to the vehicle on which they were delivered (before moving to the car wash). Inspection of cars is carried out together with a representative of the transport company (driver) in order to identify possible differences in quality. Secondary inspection is carried out after the initial inspection and, if necessary, with a car wash. If damage or shortage is detected, you must take a photo of the general view of the car, take a picture of VIN, inform the driver about damages as soon as possible, and after all of that evaluate the defect (manufacturing defect or transport damage) (Gorev & Oleshenko, 2009).

In this section, the concept of "Transport damage" is highlighted, as damage (external, internal) that occurred with the cargo during transportation, or delivery of the goods to the recipient with factory defects. For the latter case, Renault has the following acceptance regulations. If a paintwork defect is detected, or any other defect that does not fit the definition of "Transport damage", that is, the origin of the defect is not related to transportation by unloading, loading, storage of the vehicle in the manufacturer's warehouse or the transport company, the receiver contacts the warranty engineer or competent service specialist to assess the defect. If the defect is a "factory defect", you must draw up a formal report and print four copies, take the driver's signature and sign, stamping the receiving side. Then you give the first copy to the driver, the second goes to the commercial administrator. Transfer the third and fourth to the guarantee engineer for submission to the Guarantee department and notify the sales office, indicating VIN. Mark this vehicle in the warehouse, indicating the location of the defect (for example, a defect in the front bumper, on the

left), arrange a referral to the service and hand over the car for repair, specifying the terms of readiness and simply monitor the availability of the car (Road transport charter, 2007).

To reduce the number of cars at acceptance point, it is better to transport vehicles in closed containers and use protective covers and films during transportation. These measures will help reduce damages during transport. If the parts of the car were damaged during transportation, and the damaged part cannot be repaired, a disposal certificate shall be issued. In case of any delays or incorrectly executed documentation, also if the documents indicate the cargo of one model, but in fact the receiver sees another, not declared model, claims are made to the transport company. Also, if a car transporter gets into accident during the carriage of goods, with corresponding cargo damage, and the components of the body or its fixed parts are damaged on a unit of cargo, the car returns to the factory with the relevant documentation and execution of the penalty, indicated in the contract) (Gorev & Oleshenko, 2009).

The Procedure for the consideration of claims for damage/loss of cargo.

In this part the excerpts from regulatory documents governing the procedure for the consideration of claims and claims for damage/loss of goods during transportation by road and rail will be reviewed. In road transport, claims arising from the carriage of goods are presented to the carrier that issued the goods, and in case of complete loss of cargo- to the transport organization that accepted the goods for transportation. The claim must be presented to the transport organization, which, in accordance with the law, is authorized to consider it. The claim must contain all the necessary information and the number of claims, allowing to consider it on the merits, documents must also be attached to the claim, which, in accordance with the transport legislation, can serve as evidence of the presented claims. In case of partial satisfaction or rejection of the claim, the notification of the carrier must indicate the basis of the decision taken with reference to the relevant regulatory legal acts. The carrier is obliged to consider the claim and notify the applicant about its satisfaction or rejection within 3 months - claims arising from carriage by road, within 6 months -



claims arising from transportation in direct mixed traffic, within 45 days - claims for the payment of fines (Road transport charter, 2007).

When considering claims itself and claims for damage/loss of goods during transportation by rail, a document called "Rules for the presentation and consideration of claims related to the carriage of goods by rail" can be used. In accordance with the Transport Charter, the consignee or consignor has the right to submit a claim, providing relevant documents. The consignor/consignee can transfer their rights to bring claims and claims to other legal entities and individuals through proper execution of the so-called agreement of order or power of attorney. Claims regarding the loss, shortage, damage (spoilage) of goods shall be presented to the freight and commercial work department of the railway. Claims on the delay in the delivery of goods are presented to the freight and commercial work department of the railway. Claims on payment of fines for the delivery into dirty wagons, containers are presented to the freight and commercial work department of the railway. Claims are signed by the consignor, consignee or persons authorized by them. In case of loss of cargo - a receipt of cargo with a mark of the final railway station about the non-arrival of the goods, or a document confirming payment of the goods and a certificate of the railway about the shipment with the mark of the final railway station of the non-arrival of the cargo confirmed by the bank or other credit institution must be presented. In case of shortage, damage (spoilage) of the cargo - a waybill or a properly certified copy and a formal report, in case of delay in the delivery of goods - original documents (waybill) must be presented. In the event of delay in the delivery of the goods – waybill and general form act. The railway is obliged to consider the claim received and notify the applicant within 30 days from the date of receipt of the claim (Road transport charter, 2007).

## 5 Analysis

### 5.1 The 1<sup>st</sup> route : Tolyatti – St.Petersburg by road

In this part of the chapter, the length of the route will be reviewed; information about the starting point, final point, average travel time will be given.

“Ekspo Auto Center” located at Blagodatnaya st,63, gets Renault cars from “AutoVAZ” factory, located in Samara region, Tolyatti, Juzhnoe Highway, 36. The length of the route is equal to 1719 km (Table 6), the length may vary due to traffic, car accidents, new routes and road works. Average journey time is 23 hours. The route that is chosen for transporting Renault cars from the “AutoVAZ” passes through the E105, A114, M8, R152, E22, M7, R162, P231, P178, A151, E30 highways due to a smaller number of paid sections and better road conditions.

Table 6. The route “Tolyatti – St.Petersburg” (Google maps, n.d.)

<b>Point A</b>	<b>"Ekspo Auto Center", Blagodatnaya,63</b>
<b>Point B</b>	<b>"AutoVAZ" , Juzhnoe Highway, 36</b>
<b>Distance</b>	<b>1719 km</b>
<b>Time</b>	<b>23h</b>

### 5.2 The 2<sup>nd</sup> route : Tolyatti - St. Petersburg - by rail

Mixed (intermodal) transportation is the transportation of goods by several or more than one mode of transport under a single transportation document with the transfer of goods at transshipment points by one mode of transport to another without the participation of the cargo owner. The difference between multimodal transport from unimodal is that it is carried out by one mode of transport. Mixed separate transportation is usually carried out by two modes of transport: sea - road, rail - road, etc., in the absence of a single freight tariff rate and the presence of several

transport documents. In our case, the route uses vehicles (auto transporters) and railway transport. Approximately 90% of Russian transportation of goods is carried out using several types of transport. The use of intermodal transportation methods includes the following features: it saves time, reduces the impact of the disadvantages of various modes of transport, using the advantages of another, improves the quality of customer service and reduces transportation costs (Savenkova, 2010).

**The route consists of 4 points, that will be mentioned below:**

At the first point, located in Samara region, Tolyatti, Juzhnoe Highway, 36 ("AutoVAZ" factory), cars are loaded into a car transporter (maximum number 8 pcs.), Then the loaded car transporter is sent to the sorting station - Samara, "Tolyatti sorting", average time - 9 minutes, the distance is 3.7 km (Table 7). At the "Tolyatti sorting", auto transporters are getting unloaded, and cars move into closed wagons (maximum 10 cars /wagon) and accompanying documents are drawn up.

Table 7. Route "AutoVAZ"- Tolyatti railway station (Google maps, n.d.)

<b>Point A</b>	<b>"AutoVAZ" , Juzhnoe Highway, 36</b>
<b>Point B</b>	<b>Samara, "Tolyatti sorting" station</b>
<b>Distance</b>	<b>3.7 km</b>
<b>Time</b>	<b>9 min</b>

The second point is the Samara railway station, "Tolyatti sorting" station, from which cars (using the railroad track) leaving to "St. Petersburg Sorting" station. The total length of the route that is equal to 1965 km, and stations that the train passes during the journey are shown in Appendix 1, the travel time is about four days. After arriving at the third point of the route to "St. Petersburg Sorting" station, having inspected and issued all the necessary documentation, the cars are getting unloaded and loaded into the car transporters, because of the number of cars received, it is not economical to use tow trucks in this case. Then the car transporters arrive at the

end point of “Ekspo Auto Center” car dealership. The distance on this site is 7 km and average travel time is 12-15 minutes (Table 8). Later on, as in the first route, cars are received, and proper documentation is issued.

Table 8. ” St. Petersburg Sorting”- “Ekspo Auto Center” (Google maps, n.d.)

<b>Point A</b>	<b>"St. Petersburg Sorting" station</b>
<b>Point B</b>	<b>"Ekspo Auto center" , Blagodatnaya, 63</b>
<b>Distance</b>	<b>7 km</b>
<b>Time</b>	<b>12-15 min</b>

### 5.3 The comparison of transportation routes

#### 5.3.1 Cost, Route number 1

The average speed is 60 km / h. As noted earlier, the length of the route is 1719 km. The average travel time in one direction is 34 hours, because it is necessary to take into account the driver’s rest time, namely: for every 24 hours, the driver must have a continuous daily rest of at least 11 hours. The daily rest period can be used on a vehicle if it has a berth and the vehicle is parked (Rules of work/rest of drivers, 2013). Road transport tariffs are the most flexible and mobile. At the moment, there is no single directory of tariffs for the carriage of goods by road. Currently, there is no exact tariff plan for the transportation of this cargo by car carrier with a trailer, various logistics companies offer their price packages for transportation, it is worthwhile saying that the transport tariff is set for each customer differently. The transport tariff is the payment charged for the service provided by the transport company. The general conditions for determination are characterized by legislative documents, while the main tariffing takes place in accordance with other regulatory acts or without them, depending on the situation. But the fuel consumption on this route could be calculated.

The fuel consumption on the route can be determined by the following formula:

$$Q_H = 0,01 * (H_{sa} * S + H_w * W) * (1 + 0,01 * D) \text{ (Hisamutdinov, 2015, 154).}$$

where  $H_s$ - the basic fuel consumption rate for a towing vehicle (18.5 l / 100km);

$H_w$ - fuel consumption rate for the transportation of payload (1.3 l / 100km);

$D$ - bonuses for wintertime working (6%);

$G$  - the mass of the equipped semi-trailer (6.6 t);

$S$  - mileage (1719 km);

$W$  - transport work (19,140.8tkm) -  $S * \text{mass of cargo}$ ;

$H_{sa}$ - the rate of fuel consumption per mileage of a road train as part of a tractor with a semi-trailer.

To calculate the fuel consumption, we first need to determine the unknown  $H_{sa}$  value, for this we use the formula 2:

$$H_{sa} = H_s + H_w * G$$

$$H_{sa} = 18,5 + 1,3 * 6,6 = 27,08 \text{ (l / 100km)}$$

Having determined that  $H_{sa}$  equals 27.08 (l / 100km), we can proceed to the calculation of  $Q_H$ :

$$Q_H = 0.01 * (27.08 * 1719 + 1.3 * 19140.08) * (1 + 0.06) = 757.185 \text{ (l)}$$

the cost of a liter of fuel is 46 rubles (57,5 c), 34 830.51 rubles (435,375 e) will be spent on this route. This does not include company services, cargo insurance.

Modern logistics companies offer the price online. For such calculation, it is necessary to enter the starting point, the address of the ending point, type and number of vehicles, and the weight of the consignment. Next, fill out a request, an offer with an approximate cost and deadlines comes to the declared mailbox during the day.

Let's review the service of the logistics company "Vezet vsem". The cost of transporting of 8 Renault cars along the route of the "Ekspo Auto center" LLC car dealership from "AutoVAZ" is 302,300 rubles (3778,75 e) (Road transportation calculator, 2020).

### 5.3.2 Cost, route number 2.

The first point is "AutoVAZ", cars are loaded into a car transporter (maximum number 8 pcs.), Then the loaded car transporter is sent to the sorting station "Tolyatti sorting", the path takes around 9 minutes, the distance is 3.7 km. Loading and unloading time is established by Renault standards, it is 15 minutes/car, in our case 2 hours will be spent for 8 cars. By using the online calculator of the service of the logistics company "Vezet vsem", the cost of transportation for this segment was calculated. Total price is 20,600 rubles (257,5 e). The average time including loading is 3 hours (Road transportation calculator on Vezet Vsem website, 2020).

At the sorting station auto transporters are getting unloaded and cars move into closed wagons (maximum 10 cars/wagon), accompanying documents are drawn up. For the sake of clarity, we will set 8 vehicles in the calculation, such number can be transported by a car carrier with a trailer.

The second point is Samara, "Tolyatti sorting" station, from which cars (using the railroad track) leaving to "St. Petersburg Sorting" station. The total length of the route is 1965 km, the travel time is about 3.5 days. Considering the tariffing of transportation by rail it is necessary to dwell upon the following points- when transporting goods by rail, an agreement must be concluded between the "Shipper" and the "Carrier". Each party has its own duties and rights. The concluded contract must comply with the Charter of the railway mode of transport of the Russian Federation. In Russia the owner of all railways is the organization "Russian Railways". On the balance sheet of this organization are also trains and wagons. There are many ways to calculate the cost of transportation by rail. Manually performing such calculations is impractical, since there are programs that allow you to perform this online. Currently, the calculation of the price of the railway tariff for the carriage of goods can be done online on

the carrier's website. In this way, the cost of transportation of 8 Renault cars on route number two is calculated.

For correct calculations of the cost of transportation by rail, you need to enter the following information (Table 9):

Table 9. Information for correct calculations (Vezet vsem, 2020)

-type of wagons used;	-dimensions of the transported cargo;
-specific route;	-type of cargo;
-the amount of cargo carried;	-type of containers used;
-the number of railways used;	-carrying capacity of wagons;
-the number of forced outages;	-size of wagons;
-the cost of processing the necessary documents;	-speed of movement.
-whether there will be a crossing of the borders of the Russian Federation;	

Carriage may be insured, eventually it will affect the price. Insurance of the cargo itself from the point of view of legislation is not mandatory. Another thing is the responsibility of the carrier. The law considers this to be necessary. The calculation of carriage of cars by rail (Table 10) will be done by using the online calculator on Vezet Vsem website.

In order to calculate the cost of railway transportation correctly, you must specify the unified freight nomenclature, namely the classes of transport rates, it includes the names and code designations of goods used by railways in the preparation of transportation documents. The code is used to determine the required tariff and for the purposes of accounting and automation of freight charge taxation. It is used to calculate the freight charge on the roads of Russian Railways for domestic transportation, export / import. The Harmonized Nomenclature of Goods (HNG) is created on the basis of the Harmonized System of Description and Coding of Goods of the World Customs Organization and corresponds to the Harmonized Nomenclature of Goods of the International Union of Railways. It serves to describe and encode goods in international freight traffic of member countries participating in the Agreement on international freight traffic. The classes of transport rates code have a number of 381087, which means "Cars"; The Harmonized Nomenclature of Goods code is 87032311, "Cars with a piston internal combustion engine (with spark ignition; with a cylinder capacity of more than 1,500 cm<sup>3</sup> but not more than 3000 cm<sup>3</sup>" (Nomenclature, n.d.). The Station of departure is Tolyatti and station of arrival is St.Petersburg, total weight is equal to 11,200 kg, wagon that is chosen called covered wagon for cars (car carrier).



Table 10. Calculation of car transportation by rail (Vezet vsem, 2020)

Station 1	Station 2	Km
Russia		1965
63740 Tolyatti	24700 Krasny uzel	496
24700 Krasny uzel	26290 Novky 2	436
26290 Novky 2	30260 Koshta	577
30260 Koshta	03000 St.Petersburg	456
Calculation		
Country	Sum	Currency
Russia (1965 km)		
Sum	205595.00	RUB
Tax	41119.00	RUB
Total	246714.00	RUB
Per Ton	22028.04	RUB
<b>Total</b>	<b>246714.00</b>	<b>RUB</b>
<b>Tax</b>	<b>41119.00</b>	<b>RUB</b>
<b>Per Ton</b>	<b>22028.04</b>	<b>RUB</b>

With all the given parameters, the transportation of 8 cars with a total weight of 11,200 kg will be 246714 rubles (3083,925 e) (Road transportation calculator on Vezet Vsem website, 2020). After arriving to St. Petersburg, having inspected and filled out the necessary documentation, the cars are unloaded and loaded into the car transporters, because of the number of cars received, it is not economical to use tow trucks in this case. Then the car transporters arrive at the end point of the “Ekspo Auto Center”. The distance on this section is 7 km, the average travel time is 12 minutes. Loading and unloading time is established by Renault standards, it is 15 minutes/car, in our case 2 hours will be spent for 8 cars. Later on, as in the first route, cars are received, and proper documentation is issued. Using the online calculator of the service of the logistics company “Vezet vsem”, the cost of transportation for this segment by a car carrier is calculated. Total price is 14370 rubles (179,625e), the average time with loading is 3 hours (Road transportation calculator on Vezet Vsem website, 2020).

Let's summarize the cost of the segments, and find the total cost spent on the entire route of this part:  $20600 + 246714 + 14370 = 281684$  rubles (3521,05 e). The total time spent on the route is 4 days.

#### 5.4 Determination of the optimal route of transportation

By comparing routes 1 and 2, it is worth mentioning that according to the money spent on transportation, routes do not differ much. The first route is 302300 rubles, second - 281684 rubles. Regarding the time, route 1 is more optimal, since the time spent on its passage on average is 1.5 d, when the average time is 4 d on route 2 using the railway transport. It is also worthwhile to include less labor costs in favor of the first route, with a mixed second route, you have to spend money on loading and unloading, paperwork, this can also be called low maneuverability and mobility - transportation of small consignments requires delivery by road. It is advisable to use the second route in a situation of weather worsening (for example, snowfalls), this can ensure the rhythm of traffic and the regularity of shipments.

## 6 Discussion

Research objectives were to define the most optimal way from Tolyatti to St. Petersburg and determine the methods and technology of transportation of cars. The main methods of transportation were considered in the work and brief characteristics of the main types of transportation of vehicles were given. Specialized vehicle for the carriage of cars by road was reviewed: "SCANIA" truck. Specialized vehicles for the carriage of cars by rail were considered (all-metal wagons).

Calculations of tariff payments for transportation on various modes of transport and transportation time were made, the cost of transportation on route 1 by road was identified, the cost of the first route will be 302 300 rubles, the total time spent on the route is 1.5 d. And the mixed route 2 (road plus rail) is 281 684 rubles, the total time spent on the route is 4 d.

This research gives a clear picture of transportation and how it can be implemented, all mentioned regulations and rules provide an understanding of logistics itself, where everything should be according to established rules. Routes that were presented are trustworthy and can be used in real transportation cases. The significance of theoretical basis lies in the core of logistics concept and provide the understanding of transportation processes from very beginning till the final phase. Accidents that could potentially happen such as car damage/ loss were identified with help of special literature and solutions for such cases were found as well. Phases of loading/ unloading were reviewed with step-by-step instructions. Every number that was mentioned is very close to reliable, it is said "close to reliable" due to certain factors such as politics, Russian ruble rate to dollar/ euro, price of gasoline. It is worth mentioning that the information absorbed throughout the thesis may be used in some transportation company in Russia due to simplicity and accessibility. Despite the fact that routes are different, it is fair-enough saying that two options are worth being considered, and factors such as climate, distance, volume of cargo may define the better choice.

The research methods used in this work are represented by the study and analysis of specialized literature, as well as the mathematical apparatus recommended for processing statistical and calculation material, the services of online calculation of the cost of transportation by logistics companies were also used. Unfortunately, interviews were avoided due to corona virus situations and were not implemented in the research.

Future development for such transportation is to find and analyze new possibilities of car transportation and avoid any unpredicted circumstances that may occur on the way to receiver.

The scientific novelty of the work lies in the analysis of indicators of the organization of transportation of cars by various modes of transport. The theoretical significance of the study lies in the version of the solution to the problem presented in the work to determine the most economical and fastest way to transport a given type of cargo

and volume of traffic. The results obtained in the course of this study are of practical importance and can be recommended for use.

## 7 Conclusion

The various modes of transport and their characteristics were examined. In the course of characterizing these modes of transport, advantages and disadvantages were highlighted. Specialized vehicles for the transportation of cars by road were taken (auto transporters). Specialized vehicles for the carriage of cars by rail were overviewed (platforms; gondola car; car carrier; railway container; covered all-metal wagons). The Renault Logan car that is usually delivered to dealerships in St. Petersburg was highlighted. The main documents during transportation such as waybill and commodity invoice (when transporting goods of a commercial nature (having value)) were reviewed.

The concept of "tariff distance" was reviewed - this is the distance for which freightage is charged for the carriage of goods. Characteristics are given for the main models of tractors and semi-trailers on which Renault brand cars are delivered (SCANIA). The technology of transportation and receiving of Renault cars is mentioned. The routes considered by Renault cars from the "AutoVAZ" located at Samara Region, Tolyatti, Juzhnoe Highway,36 to the "Ekspo Auto Center LLC car dealership" located at Blagodatnaya st,63. The first route is a route where auto transporters are involved, the length of the route is 1719 km. Average journey time is 23 hours. The route chosen for transporting Renault cars from the "AutoVAZ" passes through the E105, A114, M8, R152, E22, M7, R162, P231, P178, A151, E30 highways due to a smaller number of paid sections and better road conditions. The second route consists of 4 points: at the first point, located in Samara region, Tolyatti, Juzhnoe Highway, 36("AutoVAZ" factory), cars are loaded into a car transporter (maximum number 8 pcs.), Then the loaded car transporter is sent to the sorting station - Samara, "Tolyatti sorting", average time - 9 minutes, the distance is 3.7 km. At the "Tolyatti sorting", auto transporters are getting unloaded, and cars move into closed wagons

(maximum 10 cars /wagon) and accompanying documents are drawn up. The second point is the Samara railway station, "Tolyatti sorting" station, from which cars (using the railroad track) leaving to "St. Petersburg Sorting" station. After arriving at the third point of the route to "St. Petersburg Sorting" station, having inspected and issued all the necessary documentation, the cars are getting unloaded and loaded into the car transporters. Then the car transporters arrive at the end point of the "Ekspo Auto Center". The distance on this site is 3 km, the average travel time is 9 minutes. Later on, as in the first route, cars are received, and proper documentation is issued. Transportation comparison of routes 1 and 2 was given.

The first route is a route where only auto transporters were involved. The average speed is 60 km / h, length of the route -1719 km. Travel time is on average 34 hours (one way). And the second multimodal route- by rail. The total length is 1977 km. Routes 1 and 2 do not differ much. The costs for the first route are 302300 rubles., For the second- 281684 rubles. According to the time, route 1 considered to be optimal, since the time spent on its passage on average is 1.5 d, when the average time is 4 d on route 2 using the railway transport; It is also worthwhile to include less labor costs in favor of the first route, with a mixed second route, you have to spend money on loading and unloading, paperwork, this can also be called low maneuverability and mobility - transportation of small consignments requires delivery by road. Also, problems with cargo safety were identified, the cargo can reach the recipient with damage, this is due to the fact that the cars are transported in open auto transporters, without protective covers in different weather conditions, and emergency situations can occur on the road. Important options such as transportation in closed containers and usage of protective covers and films during transportation were identified. These measures will help reduce the amount of damage during transportation, increasing the safety of the cargo.

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## 9 Appendices

### Appendix 1. Railway stations Tolyatti-St. Petersburg

Departure	Arrival	Distance = 1965 km				Code	Stations	Track	Country	Distance
63730 Tolyatti	03000 St.Petersburg									
63730	Tolyatti	Kuybisevskaya	RUS	0	31860	Ivanovo	Severnaja	RUS	1019	
63711	Otvalny	Kuybisevskaya	RUS	19	31630	Jermolino	Severnaja	RUS	1039	
63680	Zhigulevskoe morje	Kuybisevskaya	RUS	25	31600	Furmanov	Severnaja	RUS	1058	
63660	Otvaga	Kuybisevskaya	RUS	48	31550	Nerechta	Severnaja	RUS	1106	
63560	Sizran 1	Kuybisevskaya	RUS	133	31010	Jaroslavl	Severnaja	RUS	1156	
63544	Novoobrasovoje	Kuybisevskaya	RUS	142	31000	Jaroslavl-main	Severnaja	RUS	1161	
64210	Inza	Kuybisevskaya	RUS	329	31070	Filino	Severnaja	RUS	1172	
64000	Ruzajevka	Kuybisevskaya	RUS	440	31110	Danilov	Severnaja	RUS	1236	
24700	Krasny uzel	Gorkovskaya	RUS	496	30000	Losta	Severnaja	RUS	1368	
24631	Veseley	Gorkovskaya	RUS	600	30010	Vologda 1	Severnaja	RUS	1375	
24580	Shatky	Gorkovskaya	RUS	638	30230	Cherepovec 1	Severnaja	RUS	1499	
24560	Arzamas 1	Gorkovskaya	RUS	671	30260	Koshta	Severnaja	RUS	1509	
24420	Arzamas 2	Gorkovskaya	RUS	678	04680	Podbrovje	Oktabrskaja	RUS	1679	
24000	Murom 1	Gorkovskaya	RUS	801	04750	Tihvin	Oktabrskaja	RUS	1775	
24015	Bezlesnaja	Gorkovskaya	RUS	829	04800	Volhovstroy 2	Oktabrskaja	RUS	1850	
24040	Volosataja	Gorkovskaya	RUS	861	04000	Volhovstroy 1	Oktabrskaja	RUS	1853	
26310	Kovrov 1	Gorkovskaya	RUS	912	03020	Mga	Oktabrskaja	RUS	1925	
26303	Sergeycevo	Gorkovskaya	RUS	920	03022	Gory	Oktabrskaja	RUS	1931	
26300	Novky 1	Gorkovskaya	RUS	927	03100	Obuchovo	Oktabrskaja	RUS	1963	
26290	Novky 2	Gorkovskaya	RUS	932	03000	St.Petersburg	Oktabrskaja	RUS	1965	