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REVIEW OF CURRENT STATE OF EUROPEAN 3PL MARKET AND ITS MAIN CHALLENGES

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This article examines basic reasons behind the use of 3 PL, i.e. the main drivers of outsourcing (Chapter 2) as well as explains the essence of 3PL service (Chapter 3). In Chapter 4 the analysis of current state of 3 PL market in Europe has been analysed. Finally, Chapter 5 gives an overview of the main challenges that European 3 PL service providers currently are facing.

Keywords: 3PL service, outsourcing, logistics service providers

1. Introduction

The practice of outsourcing logistics operations has grown significantly over the past few years.

Outsourcing is a strong trend and has been for decades now in most industries. Companies try to simplify the structure of their organizations and focus on "core business", leaving everything out that does not belong to that central part of their operations. By doing so, the number of companies participating in production and distribution set-ups increases and thus the number of external relationships between the companies grows.

Outsourcing opens the door to resources not necessarily available in one's own organisation – world-class services, products, processes and technology – without the need to invest in infrastructure.

2. Concept of 3PL

The term 'third party logistics services' has been used in a number of ways, from describing one single service, e.g. the outsourcing of transport to describing the outsourcing of a set of complex processes. For those firms that provide the third party logistics services, however, there are a number of established definitions [1, 2]. From the point of view of the buyer of these services, the third party logistics can be seen as a combination of the following elements:

- an external agency provides all or a considerable number of the logistics services;
- the shipper uses a limited number of service providers;
- long-term and close business relations between service provider and customer in place of single business transactions;
- integrated logistics functions;
- both parties try to exploit the synergic benefits the partnership offers.

Originally, 3PL means outsourcing logistics activities including transportation and warehousing to outside firms, which are not a consignor or a consignee. However, it is not common 3PL practice to outsource a single activity of logistics independently, but to outsource multiple activities from the firm's strategic point of view.

3PL (or 3PL provider) has the following features at present:

1. integrated (or multi-modal) logistics service provider;
2. contract-based service provider;
3. consulting service provider.

Firstly, a 3PL provider is regarded as an integrated logistics service provider. IT-related activities for controlling goods flow such as order processing, and inventory management, among others are also included in the function of the 3PL provider. However, the 3PL provider need not provide all the services solely. The 3PL provider can outsource some activities to sub-contractors.

A 3PL provider can be classified into the asset-based and the non-asset-based. The asset-based 3PL provider owns some assets, particularly transport-related assets such as trucks, warehouses, etc.,

while the non-asset-based 3PL provider does not own such assets, and usually relies on sub-contractors' assets. Examples of non-asset 3PL providers include forwarders, brokers, marketing companies, and information system management companies.

Secondly, the service of 3PL is a contract-based one. Recently, a contract was written about the way to share responsibilities assuming various situations in detail. Such strict contract makes reliable relationship between the parties, and strengthens the alliance.

Thirdly, offering consulting-services to the firms is an important feature of the 3PL. The 3PL provider can make various advises to answer customers' requirements concerned with marketing strategy, information system configuration, cooperative transportation, etc.

Currently Logistics Service Providers offer a number of services in addition to transportation. These are cross-docking services in terminals, and storage or integrated logistics value-added services in warehouses and distribution centres. Table 1 shows common physical and administrative services provided by LSPs.

Table 1. The type of physical and administrative services provided by Logistics Service Providers

	Basic	**Intermediate**	**Advanced**
Physical services	storage good reception picking according to order and packing (pick & pack) re-packing and labelling return of goods delivery from storage	consolidation & deconsolidation preparation for freezing, thawing, sawing prepare for delivery and pack set building, sequencing, product resorting and labelling cross-docking	assembly of components operate vendor management inventories in stores or stock-keeping facilities recycling with waste handling and reconditioning unpacking and quality control
Adm. services	tendering and contracting other LSP tendering and contracting carriers insurance services stocktaking	payment services order administration and customer service claims handling export clearance and import clearance Track & Trace information forwarding services financial services provide one-stop logistics service purchase	forecasting and inventory management administration of minimum and protective inventories purchase and call-offs delivery planning and management and follow up exception management design of individual logistics set-ups implementation of logistics set-ups operation of customers' logistics set-up responsible for the customers' logistics operations

3. Reasons behind the Origin of 3PL

Continually pressured to improve the efficiency and reliability of their transportation and logistics operations without sending their overheads through the roof, shippers are realising the potential economic advantage of outsourcing their logistics activities.

In the early stages of logistics outsourcing, transport and warehousing activities came into focus. The effects of passing over the transport operation to a third party are obvious for those with moderate

volumes of goods and widespread distribution areas, regions or countries. The outsourcing tendency has accelerated in recent years and more companies are now contracting their activities to external parties.

The principle reasons why companies use third party services are a need to focus on core activities, to cut costs, and at the same time provide their customers with better standards of service. Outsourcing gives companies the opportunity to concentrate their resources, spread their risks and focus on matters which are vitally important for their survival and future growth [3].

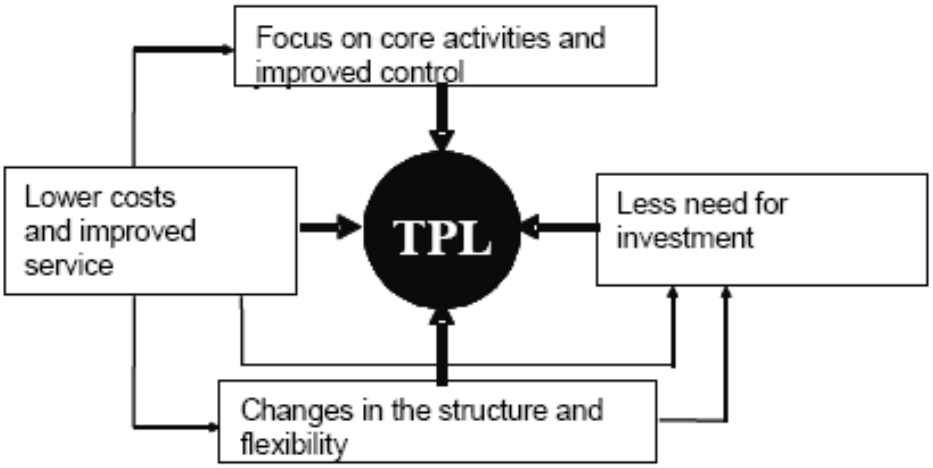

Figure 1. Third party logistics drivers

Lower logistics costs and improved services are the commonest reasons for using third party logistics services. When successful, outsourcing logistics activities and operations has meant savings of 10%-30% on costs. Furthermore, going by indicators that measure standards of service, outsourcing has been responsible for improvements in this area. Most savings on costs are normally achieved in those relating to capital tied up in stock and storage/warehousing costs [4].

The basic assumption is that the provider of logistics services can exploit the economies of scale involved in providing the same service to more than one customer. One has grown accustomed to the notion that improved efficiency is a precondition of long-term financial benefit and better standards of service. Better efficiency can, for example, be achieved by improving the expertise of existing staff or by recruiting new skilled personnel.

4. Current State of European 3PL Market[1]

In total, 42% of the enterprises in Europe currently outsource their logistics operations to 3PLs.

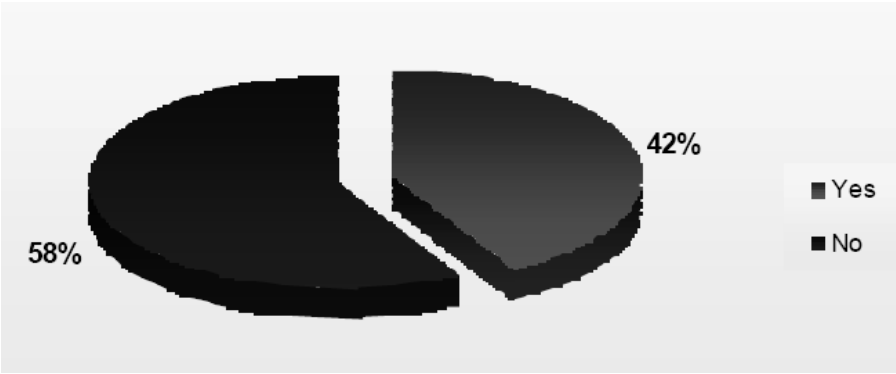

Figure 2. Share of outsourcing logistics operations

[1] Based on the findings of the eyefortransport report „Outsourcing Logistics Europe 2006“

Taking into account that an increasing number of shippers are shifting to a non-asset based business model, one would expect that transport would top the list of logistics functions that are outsourced. Almost two thirds of the companies say that they are outsourcing their transportation activities. Less than 10% of the respondents outsource their inventory management, while more than a third happily hands over their warehousing operations to 3PLs.

A quarter of the companies outsource their information systems. However, fleet management is only outsourced by 13% of the European enterprises.

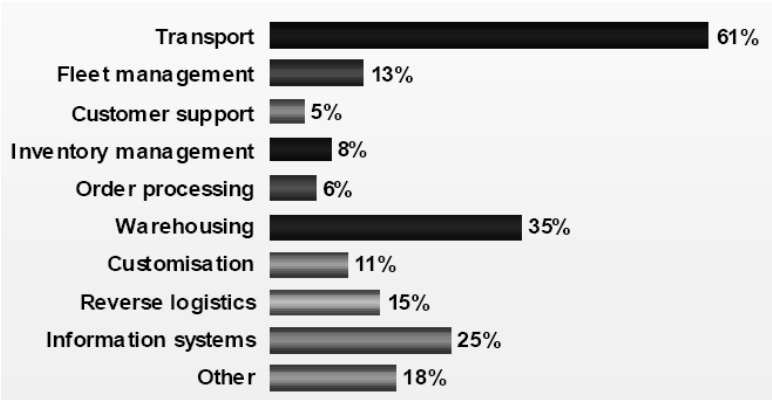

Figure 3. Outsourcing logistics operations

Some interesting findings are in respect with the level of satisfaction expressed by the users of 3PL services.

Once the decision has been taken to outsource to a 3PL, satisfaction levels are generally good. A total of 79% of the companies selected 'good' (62%), 'higher than expected' (13%) or 'outstanding' (4%). In comparison, only 21% are somewhat less enthusiastic about the performance of their 3PLs.

74% of the companies say that outsourcing inventory management and coordination of warehousing and manufacturing answers their logistics issues, which ties in with the 73% that face frequent and dramatic shifts in customer demand.

Just over three quarters of the companies believe that outsourcing logistics activities is the answer when it comes to expanding distribution systems without major capital expenses in labour, assets and technology.

On average, three quarters of the companies say that outsourcing logistics to a 3PL solves the problems caused by suppliers and carriers who fail to coordinate shipments and deliveries, and late shipments that result in the loss of money and customers.

Since the majority of the companies currently using 3PLs are getting 'good' to 'outstanding' service (79%), it is not surprising that they will 'possibly' (52%) or 'very likely' (32%) increase their reliance on 3PLs.

5. Main Challenges to European 3PL Service Providers[2]

Maintaining profits under price pressures from customers is still considered as the biggest challenge to European 3PLs. A total of 79% of 3PL service providers said it was a 'big challenge' or a 'very big challenge'.

Relationship with customers is perceived as a big or very big challenge by 78% of 3PLs. This factor, in combination with the price pressures from customers, points to the considerable sensitivity of 3PLs to the markets they serve.

Globalisation of the 3PL market and delivering services in new geographic regions has been rated a big or very big challenge by 68% of 3PL companies.

Consistently delivering the latest cutting edge technology to customers has been considered a big or very big challenge by 59%. Completing the 'top five' challenges as perceived in 2006 was competing with giant global 3PLs, considered a serious challenge by 52%.

[2] Based on the findings of the eyefortransport report „The European 3PL Market"

Figure 4. Main challenges for European 3PLs

Conclusions

1. The practice of outsourcing logistics operations has grown significantly over the past few years. Continually pressured to improve the efficiency and reliability of their transportation and logistics operations without sending their overheads through the roof, shippers are realising the potential economic advantage of outsourcing their logistics activities.
2. European industry is currently experiencing a degree of transition, and the increasing numbers of shippers considers the merits of outsourcing one or more of their logistics operations. According to the results of survey intended to investigate European 3PL market, in total, 42 % of the companies currently outsource their logistics operations to 3PLs.
3. The survey confirms that almost two-thirds of the enterprises outsource their transportation activities. Less than 10 % of the companies outsource their inventory management, while more than a third happily hands over their warehousing operations to 3PLs. A quarter of the companies outsource their information systems. However, fleet management is only outsourced by 13 % of the companies.
4. Competition among 3PLs has become intense. Therefore the main challenges for current 3PL services providers seem to be as follows: maintaining profits under price pressures from customers; relationship with customers (this factor, in combination with the price pressures from customers, points to the considerable sensitivity of 3PLs to the markets they serve); globalisation of the 3PL market and delivering services in new geographical regions; consistently delivering the latest cutting edge technology to customers; competing with giant global 3PLs; emergence of 4PLs / LLPs.
5. A total of 79 % of the companies selected "good" (62 %), "higher than expected" (13 %) or "outstanding" (4 %). In comparison, only 21 % are somewhat less enthusiastic about the performance of their 3PLs.

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VIDEO REGISTER PICTURE EVALUATION TO SUPPORT DRIVERS TRAINING AND EXAMINATION

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This paper refers to some problems on digital video recording of picture during driver's training and examination process for obtaining driving license. Since 10 April 2006, all examining institutions have to use video and audio recording devices in Poland. The legal regulations in force do not clearly determine the functional requirements and technical parameters for video recorders; hence the actual devices used do not meet user requirements. This paper describes a deterioration of recording quality parameters of the video recorder as well as construction of camera, its main elements and their influence on the recording quality parameters. The paper refers to attention to geometrical deformation of image that is made in optical camera system. The authors have made an attempt to determine camera parameters, their location and quality of the picture. In the mentioned case the objective and subjective picture validation methods will be presented.

Keywords: video register, quality picture evaluation

1. Introduction

According to the Ministry of Infrastructure's Act from the 27-th of October 2005 referring to training, examining and obtaining certificates by the driving instructors and examiners [4], as of the 10-th of April 2006, all centres conducting exams for the B category driving licence, should ensure that the cars used for examining, were equipped with video and audio recording devices. The recorder should at least record forward view through the front windscreen of the examining vehicle, while the viewing angle should not be smaller than 45 degrees. Picture registered must contain the date and time of the exam as well as registration number of the examination vehicle. The sound from the inside of the vehicle should also be stored. However there are no clearly determined functional requirements and technical parameters for the video recorder. The experiences of the users show, that from the types of recorders on offer, very few actually meet user requirements. Lack of requirements for the video recorders definitely hampers an effort to create a tender documentation for the purchase of the new cars. At present there are used monitoring devices, consisting of the elements from the CCTV (Closed Circuit Television).

Thus it is necessary, to determine the location and number of cameras, the video recorder should be equipped with, as well as other requirements (amongst them: colour or monochrome, sensitivity, resolution, focusing distance, location, camera direction, admissible picture distortions), minimal picture and sound quality. An important thing is ensuring appropriate quality of the picture being recorded, however the first stage of the tests, in opinion of the authors, should rely on the assessment of the static picture obtained from the cameras and selecting the right ones.

2. Cameras and the Recorders Used in the Mobile Video Registering Systems

Electrical equipment installed in the vehicles should meet technical and functional requirements, which will ensure their correct functioning in the car operating conditions. Thus they will not result in any endangering of the road traffic safety. According to the PN-EN 55022 [5] Polish Standard, they cannot adversely affect the operation of the onboard vehicle devices. Additionally these devices should be adapted to the operating conditions of the vehicle. Apart from shaking caused by the uneven roads, they have to be resistant to low and high temperatures as well as its changes, occurring during the use of the vehicle. This problem has a particular significance in the case of recorders which especially have to be adapted to the operations in such operating conditions. They form a group of so called mobile devices that differ from the devices used in the stationary monitoring system in design and the use of electronic

subcomponents. One of the digital recorders adapted for use in the vehicle is MRX-1004 A from the APER firm. According to the manufacturer it is shock and vibration resistant. It can be supplied with 12 V current, directly from the car electrical system. It can have 4 cameras plugged in, while picture data is registered on its hard disc or on the Compact Flash (CF) card. Recorder allows also copying data from the hard disc to the Secure Digital (SD) memory card. Particularly useful is the use of CF cards, due to an easy data transfer and making copies outside the recorder. This is especially important in case of examining drivers for the B category driving licence, because that data must be stored for administrative purposes, according to the Act, for the period of at least 14 days from the date of the exam. Technical data of the recorder is presented in the Table 1.

Table 1. Technical data of the APER MRX-1004A recorder

No	Name	Description
1.	Maximum resolution	720 x 288 pixels
2.	Maximum recording speed	25 picture frames / s
3.	Range of admissible operating temperatures	from + 5 °C to + 40 °C, humidity 90 % (without condensation
4.	Supply voltage	12 V (allowable.: 8 ÷ 28 V)
5.	Dimensions	210 x 43 x 145 mm
6.	Number of video inputs	4
7.	Number of audio inputs	1
8.	Number of video outputs	1
9.	Additional plug-ins	LAN, USB, RS-232

Vehicles monitoring systems usually utilize colour cameras, of vertical resolution not acceding 520 picture lines. Depending on the type of the camera optical and electronic system used, the quality of the picture from various models can differ significantly, even in case of the devices of the same resolution.

3. Assessing Quality of the Static Picture

To assess the quality of cameras, one uses reference pictures. During the work conducted at the Motor Transport Institute the *Delta CCTV Test* testing picture was used, developed by „DELTA" firm from Poznań (www.delta.poznan.pl), with the overall dimensional proportions 4:3 (Fig. 1).

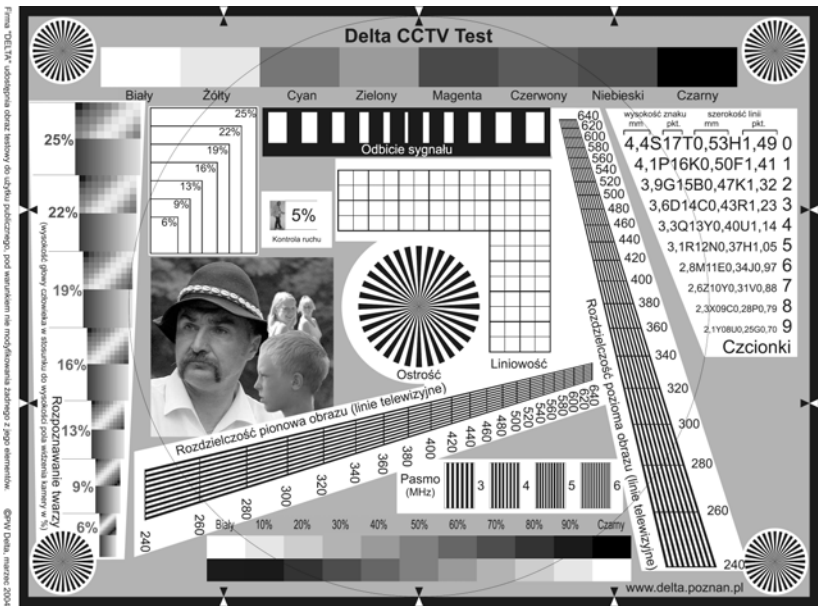

Figure 1. Test picture for the CCTV

The quality of the picture recorded, apart from the camera, is affected also by a type and parameters of the compression algorithms used in the recorder, as well as quality of the transmission track between the camera and the recorder. The device described uses MJPEG compression, relying on the recording picture sequence, subjected to encoding to JPEG format. In order to assess the picture quality, the above mentioned test picture was used. Pictures obtained from four cameras, used with this video recorder, are shown on the Fig. 2.

Three colour cameras were used of vertical resolution, 520 lines (camera 2), 520 lines (camera 3), 480 lines (camera 1) and one monochrome camera of 700 lines (camera 4) resolution.

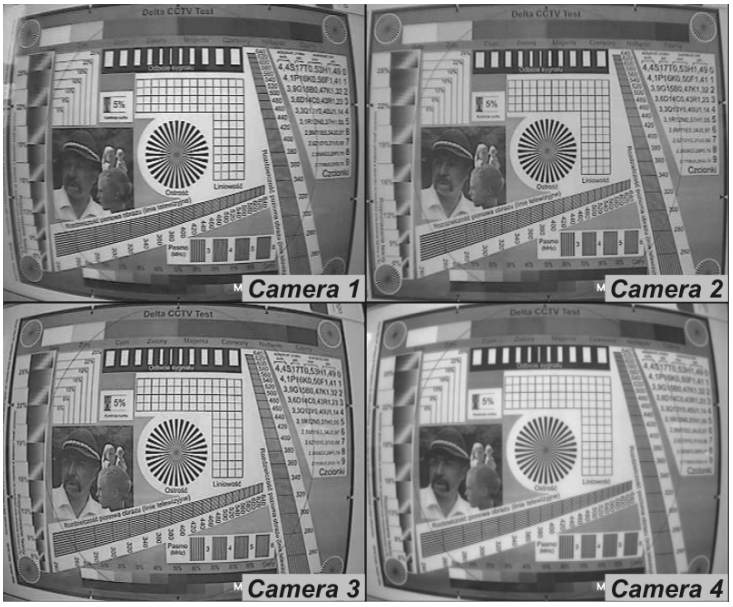

Figure 2. Pictures from four cameras, showing CCTV test picture

Locating Test Picture on the control monitor screen has been chosen in such away, so that it takes the whole height of the screen and the black framing of the picture is not seen. Identical principle should also have been used for the remaining edges of the picture, but significant geometrical distortions of the picture made such adjustment impossible. According to the requirements of the PN-EN 50132-2-1 Polish Standard [6] geometrical distortions of any part of the picture should not be more than 2 %. This requirement has not been met for any of these cameras.

Maximum resolution has been determined from the section, for which it was still possible to distinguish black lines and white spaces between them.

Based on the pictures registered by the cameras, the assessment was made of the picture - connecting cables – picture recorder set. Section of the registered picture, showing lines used for determining vertical resolution, has been shown in the Fig. 3.

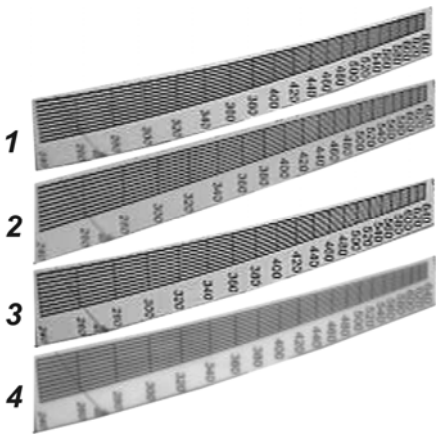

Figure 3. Fragments of the picture used for the purpose of estimating the vertical from the cameras

Following resolutions of the TVL (picture lines) were obtained:
- 460 TVL – camera 1 (480 lines acc. to the producer),
- 460 TVL – camera 2 (520 lines acc. to the producer),
- 480 TVL – camera 3 (520 lines acc. to the producer),
- 440 TVL – camera 4 (700 lines acc. to the producer.

4. Assessment of the Pictures Sequence Quality

Due to the limited data transmission speed and required capacity of the data carrier, where the date is filed, the algorithms used are of so called lost data compression [3]. This causes significant deterioration of the picture and sound quality. Reconstructed data file differs from the original and it becomes necessary to evaluate its quality from the aspect of the degree of date compression. Before being used the compressed data is decompressed. The criterion of decompressed data quality is dependent on the compression techniques used, but it is impossible to formulate unified, commonly useful quality criteria and the extent of admissible degrees of compression [7]. The necessary condition is to maintain clarity of the reconstructed picture as far as the elements, essential for assessment of the person taking the exam for the driving license, are concerned. An important aspect, which must be taken into consideration while assessing the quality of the picture registered by the video recorder, is quality of the original picture, by which here is meant the uncompressed picture from the camera, or cameras co-operating with compression and filing module of the video recorder. Therefore, first stage aiming at determining minimum quality picture has to take into consideration defining the quality of the picture obtained from the camera. Second stage should consider the quality of the picture, subject to compression by the recorder. The picture obtained as a result of processing the original picture is of a „good" quality usually when visually it looks pleasantly natural (without heavy distortions), or it is useful for some purposes. However there is no universal measure allowing determining quality of the reproduced picture in each case. There are three methods used to determine quality:
- Objective measurements of distortions (otherwise known as automatic measures) – measurable quantities or vector ones defined automatically according to a set dependence;
- Subjective quality measures (otherwise known as observation measures) – psycho-visual quality assessment, curried out by a group of specialists (users),
- Statistical simulation measures – more complex, referring to a particular application, and evaluations based on as faithful as possible simulation of the real conditions of the picture analysis as well as statistical analysis of the classification tests results.

In order to evaluate the pictures, a sequence from four cameras has been recorded installed in the Opel Astra I estate. The sample picture from the recorder equipped with 4 cameras is shown in the Fig. 4. The picture sequence obtained allows a further study.

Figure 4. Sample picture registered using recorder equipped with 4 cameras

Many research shows that a single compression technology cannot be effectively used in most of the applications, and points to a need for non-uniform compression. It therefore becomes necessary to develop a quality measure which is to able of determining the amount of degradation level, the kind of degradation and the impact of compression on different frequency ranges in a reconstructed image.

A lot of publications concerning the image quality measurement show the measures are numerical, combining the pixel differences in the original and degraded images into a single number. Although there are some efforts to establish a stronger relationship with subjective evaluation, the scalar measures are not able to describe either the degradation type or the local error. Only general purpose graphical measure that can be used with some success to describe both the amount and the type of degradation is Hosaka plots. However, its application to images with different deterioration of quality has indicated a number of difficulties:

- the selection of the two main parameters for the block size and the variance threshold is not easy and depends on the compression ratio, compression algorithm, and the frequency contents of the worsened image,
- the plots transparently display the artifact of blackness but are not equally successful in showing blurriness.

Professor A. M. Eskicioglu [1, 2] proposes graphical measure based on three criteria. To be able to make a local error analysis, the first step depends on division a given image into areas with certain activity levels using, as in this case of Hosaka plots, a quad tree decomposition. The block sizes in the decomposition scheme may be from 2 to 16 pixels. This gives four classes of blocks having the same size. Class *k* represents the collection of *k* x *k* blocks. A higher value of *k* denotes a lower frequency area of the image. After obtaining the quad tree decomposition for a specified value of the variance threshold, it is necessary to compute three values for each class (i = 2, 4, 8, 16), and normalization.

The calculations have to be made as follows:

- the number of pixels / the number of pixels in the entire image,
- the number of different pixel values / the number of possible pixel values in the image area,
- the average of the standard deviations in the calculated blocks / a preset maximum standard deviation (the preset value have for example 100).

The sample obtained characteristic values of the image are shown in a normalized bar chart (Fig. 5).

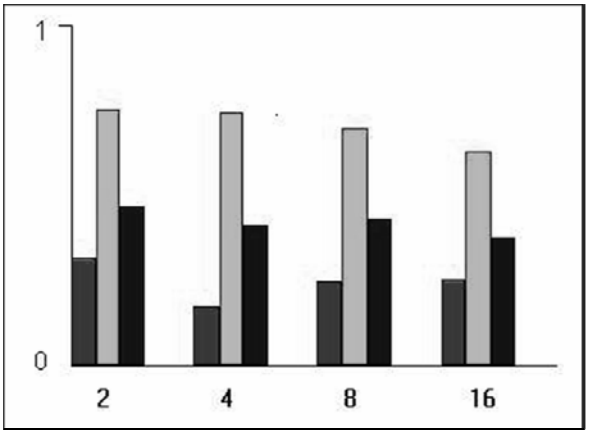

Figure 5. Sample characteristic values of the image obtained by the Eskicioglu computing method

Conclusions

Motor Transport Institute is conducting work on developing minimal requirements for the video recorders used during the exams for the exams for the B category driving license. These devices can be utilized also during the training process. For this purpose, apart from the tests aimed at establishing the optimal number and locations for the cameras, there will also be a method developed to assess the picture quality and minimal requirements for that. In the authors' opinion, in order to do that, it is essential to combine objective and subjective picture quality assessment methods. Such approach will ensure taking into account the experts opinions (from the subjective-observational assessment) and will enable obtaining numerical values, using which minimal picture quality will be defined. The first stage of tests

should however rely on defining static requirements, such as the amount and location of the cameras as well as their technical parameters. The article presents evaluation of the vertical resolution of the cameras and a sample picture registered during tests. The tests being conducted are only an introduction to defining requirements for the video registers. The next stage of the tests is conducting, by a group of experts, an evaluation of the pictures' quality, according to the procedures recommended by ITU (International Telecommunication Union). Pictures obtained will be used for defining a minimal quality, using automatic assessment method („objective").

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THE ANALYSIS OF THE CONSTRUCTION COSTS OF TRANSPORT INFRASTRUCTURE PROJECTS

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The significant rise of the construction costs of transport investment projects at present days is considered in the paper. The analysis of reasons of cost rise is accomplished on the purpose to use the EU financial support and other financing resources for transport sector more effectively and to plan the further usage of investments for transport infrastructure. Costs, acting factors, financing resources influence on the priority projects of transport infrastructure are analysed and changes of construction costs are defined and the problems of the implementation of infrastructure project are clarified. The recommendations are offered concerning preventive measures for up the costs of transport infrastructure works and their application possibilities, and to substantiate the development of infrastructure projects.

Keywords: transport infrastructure projects, financing resources, the evaluation of investment projects, construction costs, influence of external factors

1. Introduction

People and companies of the State are users of transport infrastructure; operating influence of this infrastructure correlates directly or indirectly with all branches of the state economy. The government is responsible for the maintenance and the development of transport infrastructure; governmental programmes are prepared for its development. The substantiation of the state investment depends on the resources necessary for economic and social development and investments of the state [1].

The importance of infrastructure, including transport infrastructure, is real big on the level/scale of the macroeconomics. The development of transport infrastructure raises the prestige/status of the state and has direct influence on the implementation of the transport policy [2]. Furthermore, the construction of infrastructure objects requires scientific and industrial capabilities of the State, increases the employment and the productive level of different sectors of the Economy.

The process of the evaluation of infrastructure projects is very difficult and has separate methodologies and complexities for different sectors of the economy. There are many valuation methods of investment, but not all of them can be applied to the infrastructure [3].

The investment projects of transport infrastructure are characterized by as follows:

- duration of subject operating and also duration of whole project is quite enough;
- all projects are opened for capital and require large financial recourses; it is rarely possible to dispose the borrowing of means;
- usually project benefit overbalances cumulative costs after long period, therefore the payback period of investment mostly is very long [4].

The aim of this research is to analyse increased construction costs of transport infrastructure projects and to investigate the reasons of growth of construction costs as well as possible influence on the provided plans of the implementation of the EU support for transport sector and on perspective plans of investment usage for modernization of transport infrastructure in Lithuania [5, 6].

2. The Dynamic and the Tendency of Changes of Construction Expenditures of Transport Infrastructure Projects

The research is performed according to the formal annual adequate priced catalogues:

1. Comparable economic indexes of construction calculating prices [7].

2. Approximate calculation of construction work costs [8].

Comparable economic indexes of construction calculating prices evaluated on the basis of analogical building structures according to the calculated costs of adequate annual construction resources. All expenditures experienced during construction process of building: direct, supplementary, social insurance and other expenditures, including value-added, are determined and reckoned in these estimates. Extra share of constructor expenditures for the formation of contractor benefit is also included in these price indexes.

Comparable economic indexes of construction calculating prices are used in the process of investment needs planning on the pre-project stage or preparing construction substantiation and other cases. The costs of separate constructional units, including direct and supplementary expenditures of contractor, are determined in the approximate calculation of construction work costs.

Table 1. The changes of construction costs and expenditures of resources of transport infrastructure

Types of construction	Dimen-sion	Price	2003	2004	2005	2006	2007	2008
1. According to the comparable indexes of calculating prices [7]								
1. State highways I category	1 km	Thous. LTL	6450	6689 (103,7)	7331 (109,6)	8444 ((115,1)	10057 (119,1)	10560 (105,0)
2.Local roads (asphalt)	1 km	Thous. LTL	520	539 (103,7)	591 (109,6)	680 (115,1)	822 (120,9)	863 (105,0)
3.Urban roads (main streets)	1 km	Thous. LTL	4780	4957 (103,7)	5439 (109,7)	6258 (115,2)	7852 (125,5)	8269 (105,3)
II. According to the approximate calculation of construction work costs [8]								
1.Cover of urban main streets	100 m²	LTL	14651	14940/100 (102,0)	15909/100 (106,5)	19535/100 (122,8)	21801/100 (111,6)	23262/100 (106,7)
a) labour payment		LTL	189	221 / 1,5 (116,9)	262 / 1,6 (118,6)	323 /1,7 (123,0)	408 /1,9 (126,3)	434 /1,9 (106,4)
b) materials		LTL	12117	12279/82,2 (101,3)	12740/80,1 (103,8)	14569/74,6 (114,4)	16155/74,1 (110,9)	17257/74,2 (106,8)
c) mechanicals		LTL	699	739 / 4,9 (105,7)	1072/6,7 (145,1)	1317/ 6,7 (122,9)	1496/ 6,9 (113,6)	1578 / 6,8 (105,5)
d) total price of resources (direct expenditures)		LTL	13005	13239/88,6 (101,8)	14074/88,5 (106,3)	16209/83,0 (115,2)	18059,/82,8 (111,4)	19269/82,8 (106,7)
2.Concrete borders (total price, without VAT)	100 m	LTL	4833	5119/100 (105,9)	5713/ 100 (111,6)	6807 /100 (119,1)	8168/100 (120,0)	8452/ 100 (103,5)
a) labour payment		LTL					1719/21,0	1822/21,6
b) materials		LTL					3873/48,4	3932/46,4
c) mechanicals		LTL					48 /0,6	52 /0,6
d) total price of resources (direct expenditures)		LTL					5639/69,0	5806/68,7

Note. Increase of prices, comparing with last year is shown in brackets; in denominator – percentage share of expenditure and recourse input according to their types.

The data of Table 1 defines these trends and consistent patterns of changes of transport infrastructure costs:

1. In the period of 2003-2007 construction costs have been increasing constantly. Their change have expanded annually [5]. The reducing of these changes has been noticed only in 2008. Early future will show if this is the long-term tendency, which is circumstanced by the reducing of the demand in construction market and by other reasons.

2. According to separate expenditure types and separate resources costs there are considered the following consistent patterns:

- the share of labour expenditures in the total construction cost increases constantly. This is determined by unsatisfactory situation in the labour market;
- the expenditure of mechanical exploitation increases more rapidly. Probably it is stipulated by both the increase of labour payment and the increase of costs of energy resources, especially fuel.

- the share of building materials input reduces comparing with the increase of labour payment and mechanical exploitation share. However the tendencies of these changes can be determined by more detailed analysis.

3. The share of direct expenditures in the total construction contractor costs part is decreasing. Consequently, indirect expenditures, consisting of the extra chargers and estimated profit, are increasing respectively. Presumption can be done: the calculation of the supplementary expenditures of the increasing labour payment can stipulate the increase of these expenditures.

3. Projects with Extra Subsidies

During the period of analysis problems influenced by the procedures of preparation, evaluation, coordination and financing of projects and changes in construction market were formed in the evaluation and planning sphere of transport infrastructure projects in Lithuania. Positive and negative experience has been already collected in 2006.

The financing of road sector construction was supreme in 2006 – 1278 millions LTL. Performing the development of the international transport corridors (roads), the projects financed by the EU funds and the means of Road Maintenance and Development Programme were successfully implemented. More than 219 millions LTL were realized from the EU funds.

Both the construction and the modernization, also periodical repair and the maintenance of roads give benefit for community. About 107 km gravelled roads were asphalted in 2006. Annual road transport operating costs reduced about 6.2 millions LTL per year due to asphalting work. Due to the reduced dusty were saved about 2.4 million LTL per year. In total during the 20 years of project existence road users operating costs decreased about 155 millions LTL due to the asphalt works of the gravelled roads.

Summarized received benefit shows, that the State capital increased about 326 millions LTL, as this sum consisted of the investments of Road Maintenance and Development Programme used for the state importance roads. Moreover, the State capital enlarged by 219 millions LTL of the EU support funds used for the state importance roads. The capital of local authorities was enlarged by 172.8 millions LTL due to the investments of this programme used for local importance roads and streets in 2006.

The level of necessary resources for the development of road transport sector is changing together with the changes in the construction market. The net present value for the 20 year period (project existence duration) of transport infrastructure projects accomplished in 2006 consists of 1408.1 millions LTL or 40.4 millions LTL per year. The economical calculations of the most projects accomplished in 2006 were performed in 2004-2005. During this short period the prices of fuel and material were changing. The net present value could be larger, if the economical calculation were done in 2006. The internal rate of return of implemented projects was more than 24 percent.

During 2006 the Lithuanian Road Administration has announced 268 competitions and signed 1266 contracts. Though the financing was increased till 2006, but the prices for fuel, materials and labour increased largely. Only the prices of bitumen jumped to 40 percent per year. The estimate of the Road Maintenance and Development Programme was upgraded up to 874.1 millions LTL by the Government of Lithuania: in July 2006 to 1039.8 millions LTL (extra 165.4 mill LTL) and in October to 1068.5 mill LTL (extra 28.7 mill LTL). Seeking to implement projects of 219 millions LTL of the EU support, Ministry of Transport and Communications additionally had budgeted 2.073 millions LTL of the total financing means for sector.

In 2006 performing the Programme of the development of gravelled roads the procedure of the evaluation of applications and other administrative procedures were protracted, the financing contract of the 6th package (only 19-12-2006) was signed up behind time. These are the main reasons for the lost time of seasonal works to begin. Considering a great part of the Programme, financial means are not spent. Moreover, many contractors – competitors didn't perform their work plans for 2006, as the preparation, the coordination and the signing of the financing contract were protracted.

The contractors proposed distinctly larger prices in several competitions as it was calculated. This was the main reason repeatedly to declare new competitions for same subjects. Since the duration of these procedures was long, consequently the unused means were kept.

Since 2007 projects planned for 2007-2013 programming period and financed together with the EU are being started to perform. In 2007 projects of financial support of the Cohesion fund for 2004-2006 programming period were accomplished. During present period of the implementation of infrastructure

projects is very important to keep the rate of planned works, to perform administrative procedures on time and to preserve the level of initiate construction prices.

Concerning above mentioned reasons performed new evaluation of projects shows, that many projects have already demanded the additional support (see Table 2 and Table 3). The extra support for local projects is 19.4 percent of total support of 94061.2 thousand LTL. The demand of extra support for state importance transport projects is 27.5 percent of total suitable sum of support contract: 99424.3 thousand LTL. The extra support dedicated only for two projects (see Table 3).

Table 2. Results of the evaluation of the applications for the extra support for the transport infrastructure projects

No.	Project subordination	Suitable expenditures for project financing determined in the support contract, LTL	Allocated sum for project support, LTL	Extra support sum requested by project contractor, LTL	Allocated extra support, LTL
1	Local projects	94061198.19	77836415.19	15120207.61	15120207.61
2	State projects	99424260.28	99424260.28	27304931.48	1060868.39

4. The Comparison of the Prices of Vilnius Southern Bypass Project

The research analysis is based by transport infrastructure construction project „Vilnius Southern Bypass Project“. In this aim construction costs of new automobile road are estimated and compared with indexes of 2003 (Table 3).

Table 3. Comparison of road construction costs

State importance roads	Price of 1 km road construction, thousand LTL					
	2003	2004	2005	2006	2007	Average
AH category	7230	7498	8218	10034	10656	8727
I category (4 traffic lanes)	6450	6689	7331	8951	9508	7785

Notes:
1. When AH category road has 6 traffic lanes, the price of 1 km road is being increased by 1.25 coefficient;
2. When street for speed traffic has 6 traffic lanes, the price of 1 km road is being increased by 1.45 coefficient.

Obviously during the period of 2004-2006 the construction costs have been increasing up to 34 percent, evaluating both types of state importance roads from the level of the Project Feasibility study to the contract sighing with contractors (see Table 3).

Table 4. Comparison of the construction costs of 2 layered asphalt cover

Asphalt cover (2 layers)	Price of 1000 m^2 asphalt cover (2 layers) , thousand LTL					
	2003	2004	2005	2006	2007	Average
Driveways	140	145	159	191	203	168
Parking places	170	176	193	230	244	203

During the period of 2003–2007 the construction costs of 2 layered asphalt cover had increased up to 45 percent (Table 4). Meanwhile during the period of 2004-2006 the price had increased about 32 percent evaluating from the level of Feasibility study to the contract signing. Thus since 2004 up to 2006 calculated prices of new road construction and asphalt cover construction have been increasing 10 percent per year.

With reference to these conclusions the price of analysed bypass project can increase from 51.2 millions € to approximately 68.6 millions €. Furthermore, since one section (total of 1.1 km length) of fast traffic street is projected of 6 lanes, the costs of this section have to be increased in 1.45 times.

In conclusion larger prices can be logic reasoned by the changes of work amounts and the increase of work costs. Prices indexes estimated by the Statistic Department are presented in the Table 5 [5].

Table 5. The price indexes of construction expenditures, 2000 year - 100 percent

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
2000	97.5	97.4	97.5	99.4	99.9	101.0	101.4	101.1	101.4	101.6	100.9	100.8	100.0
2001	98.8	99.0	98.8	100,2	98.9	99.6	100.2	100.3	101.1	99.2	98.7	98.6	99.5
2002	97.3	97.7	98.4	98.9	99.4	100.1	99.8	100.6	100.6	100.2	100.6	99.8	99.5
2003	98.1	98.6	98.7	99.6	100.7	101.1	101.1	102.0	101.4	100.5	102.1	102.0	100.5
2004	101.3	101,8	102.0	104.2	106,4	106.7	108.4	108,8	109.2	110.4	110.3	110.2	106.7
2005	110.5	110.7	110.5	112.0	112.8	114.3	115.8	116.0	117.4	118.6	119.1	119.8	114.8
2006	120.5	120.8	121.3	123.4	124.1	125.5	127.1	127.7	129.4	129.8	130.5	132.4	126.1
2007	132.3	133.9	135.3	140.1	141.2	143.5	145.0	146.4	148.9	149.5	151.5	152.9	142.5
2008	153.0	153.9	156.3	156.8	158.5	160.0							

Obviously, not all the costs evaluated in the Feasibility Study are increased (Table 6). Some costs of contractor decreased – railway reconstruction, some costs were not foreseen at all (ransom of land and buildings) or these costs were included into other type of works. The costs of majority works increased signally.

The costs necessary for the implementation of construction project are presented in the Feasibility Study (according the price level of 2004). It is unclear what approximate calculated construction costs indexes were used as only final prices of construction and works are presented.

Only when the Feasibility Study was prepared new details which could not be predicted were clarified in the Technical Project. Since the new fast traffic street is being projected and the reconstruction of other crossing and joining streets are being planned in Vilnius City, the reconstruction of engineering communications (electricity lines, external electricity communications, cabling lines, gas and heating support lines, sewerage lines, and water-supply) are planned. These extra works of reconstruction requires expenses – about 53.7 millions LIT (25 percents of total price) of unsuitable for financing expenses. The works planned in the technical Project are compared with works determined in the Feasibility Study and the purchase document. All the works foreseen in the Technical Project are included into the purchase documents.

Table 6. Comparison of works and costs foreseen in the Feasibility Study and in the Contract

Works	Costs, millions LTL in Feasibility study	Costs, millions LTL in Contract
Preparation of the site	----	0.42
Ransom of land and building	6.17	----
Road construction and street reconstruction	22.95	38.40
Buildings	69.5	101.31
Engineering works	34.6	53.70
Railway reconstruction	18,4	12.08
Total	145.45	196.70
Projecting and construction supervision	7.58	----
Other expenses	1.8	----
Incidental expenses	15,8	17.82
Total	176.77 millions LTL (51.2 millions €)	224.47 (65.01 millions €)

The duration from the beginning of Feasibility Study to the Contract signing takes 4 years. The most part of time is spent for – the preparation of Feasibility Study requires about 18 months. Purchasing documents are being prepared during 12 months. The period from the preparation of the tender application (being prepared during 8 months) to the decision of the EC extended about 9 months. Total period of all procedures extended up to 1.5 years (17 months).

Table 7. The main reasons of the changes of investment demand and approximate sums

The financing sum of project in the application	176.8 millions LTL
Works foreseen in the Feasibility Study but not included in the tender price: ransom of land and building	- 6.2 millions LTL
Works foreseen in the Technical Project, which amounts are increased comparing with the data of the Feasibility study	+ 24.4 millions LTL
Decreased works amounts comparing with the data of the Feasibility study: railway reconstruction	- 6.3 millions LTL
Influence of the changes of construction costs according common construction price indexes of October 2006	+ 43.2 millions LTL
Projecting and construction supervision costs and other expenses not included into the Contract	- 9.4 millions LTL
Increased incidental expenses	+ 2.0 millions LTL
The value of implementation Project at the time of analysis	224.5 millions LTL

In the period from the preparation of Feasibility Study to the Contract signing the biggest share of increased expenditures consisting of the increment of construction prices of skyways and other structures makes about 31.81 millions LTL; engineering works – 19.1 millions LTL; street construction – 15.45 millions LTL; and incidental expenses – 2.02 millions LTL.

Conclusions

1. During several later years the increase of construction prices of transport infrastructure has become a heavy interruption in the process of new investment planning and also required the additional financial means for the finishing the early started constructions.
2. In the period of 2003-2007 the prices of construction prices has been increasing constantly and their change has been expanding annually. The reducing of these changes is noticed only in 2008. Early future will show if this is the long-term tendency, which is circumstanced by the reducing of the demand in construction market and by other reasons.
3. According to separate expenditure types and separate resources costs there are considered the following consistent patterns:
   - the share of labour expenditures in the total construction cost increases constantly. This is determined by unsatisfactory situation in the labour market;
   - the expenditure of mechanical exploitation increases more rapidly. Probably it is stipulated by both the increase of labour payment and the increase of costs of energy resources, especially fuel.
   - the share of building materials input reduces comparing with the increase of labour payment and mechanical exploitation share. However the tendencies of these changes can be determined by more detailed analysis.
4. Feasibility studies of transport infrastructure don't present the specific works and their precise volumes. The prices of works determined in feasibility study can only be used for the approximately planning of means, preparing the application for the financing support of the EU; any more latterly covering of increased costs is going to LR financed share. Indicators of works and subject prices calculated according approximated indexes are presented in feasibility studies. The works indicators obligated in the purchase documents and contracts are different by their specification: each major indicator is elaborated in the technical project.
5. The share of direct expenditures is decreasing signally in the total price of construction contractor (without VAT). Consequently, indirect expenditures are increasing respectively, including the extra charges and estimate profit. It confirms the precondition, that calculation of extra expenditures of the increase labour payment determined the increase of these expenditures;
6. The amount of the EU financing share of Vilnius bypass project has not been changed after the decision on the project availability for financing of the Cohesion fund, consequently increased project implementation costs (18,7 millions €) had to be covered by the Republic of Lithuania; extra expenditures were divided into two equal parts: one for the administration of Vilnius city municipality and other for the Lithuanian road maintenance and development fund;

7. The main reason of increased costs can be consider changed main indicators of the project and enlarged work amounts after the preparation of technical projects and also the changes of work prices during long period. According the formal price catalogue the prices were increasing about 10 % per year;
8. The feasibility study of Vilnius southern bypass was prepared in 2003. This study was based on the prices increasing tendency, which even decreased during 2 years since 2000. According to the retrospective data the consultant could admit (in 2003) the index of construction price increasing about 2 % per year (this would be 6 percents growth to the end of 2006). In the period of 2003-2006 it had increased over 30 percents.
9. In planning the new projects with the EU co-financing, the mechanism of the evaluation of price change should be described in the work implementation contract – it is necessary to index prices (during fixed and concerned period of time), as the implementation of transport project isn't possible during short time – it takes several years till contract signing, and construction works can be executed during several years.

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QUALITY OF SERVICE AT THE RIGA COACH TERMINAL

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In this research the main attention is paid to the analysis of the reasons – why travellers choose train rather than bus in some regional directions in Latvia. This analysis is done on the basis of the results of questionnaire and in future it may be the basis for the Discrete-Choice models application. Also the analysis of the travellers' attitude to service of the Riga Coach Terminal is fulfilled on the basis of the annual questionnaire data.

Keywords: coach terminal, passengers, service quality, transportation, transit capacity

1. Introduction

The joint stock company „Rīgas Starptautiskā Autoosta" (Riga International Coach Terminal) being a leader in the area of passenger bus transportation services in Latvia, provides the international, intercity and regional trips. The objective of the development concept of the JSC "Riga International Coach Terminal" is as follows: „To develop the JSC Riga International Coach Terminal as a new passenger modular transfer and service point meeting the future requirements for high culture and diversity of passenger services and interlinking with other types of public transport – railway, urban public transport, sea port and airport" [1]. Recent studies on the role of buses and coaches seem to confirm the already excellent safety, environmental and social record of bus and coach transport [2]. In Latvia this mode of transport is in competition with railway (and private cars also) that is why the quality of services is of great importance from the viewpoint of travellers. At present the problem of raising the quality of transport services is one of the main conditions of competitiveness of one or another transport enterprise.

To become aware of a significance of the bus transportation quality service improving, it is important to be conscious of the existing situation in this area and the most considerably influencing factors and risks. The main topical issues were emphasizes at the 31st IRU World Congress on 15-16th May, 2008 in Istanbul [3]:

- The area of the passenger transportation is always regulated on a state and the EU scale, and also in the international cooperation world;
- Rapid growth of petrol price.

During the period of 1991-2000 the price of petrol has been rising to an average annual rate of 3.5%, which is more than twice the diesel rate. Road fuel prices in 2007 were dramatically higher than in 2000.

Table 1.

	2000	**2007**
Unleaded petrol	0.90	1.30
Diesel	0.70	1.10

- Also other costs that provide the qualitative and secure bus transportation management have grown: staff payments (wages/salaries), insurance, safety and environmental protection arrangements, various payments;
- State of roads - road and traffic safety;
- Economic activity recession, government work decrease in connection with the budget fiscal restrictions;

- Priority of private car from the viewpoint of traveller's choice, as well as a low prestige of the passenger transportation in comparison with other modes of transport of the passenger transportation [4].

For the further development of this area in conditions of difficult period it is important to ensure the attraction of customers-travellers by performing services that comply with the high quality standards.

2. Review of Approaches to Determination of Transport Service Quality

Nowadays a great attention is paid to the problems of passenger service quality both in theory and in practice. Let's consider several version of rating the measure of quality.

So, Galaburda [5] examines the methods of quality rating of transport services and gives the following definition of the "quality" concept. By the quality of goods and services the totality of typical properties, characteristics and peculiarities is implied that distinguishes them from other goods and services having the consumer value, i.e. capable to satisfy certain needs of users. On the basis of this definition the author makes several generalizations and conclusions relatively the quality of the transport output:

- relativity of the quality concept, and, it means that the quality coefficients should be defined not only in the absolute expression, but also in relative expression in comparison with the corresponding standards and coefficients achieved by competitors;

- a priority of the final consumer ratings of the quality coefficients compared to the intra-sector coefficients (the quality coefficients should comply with the customers` requirements and take into account the users` interests to the maximum);

- natural but not the value terms of quality. In market conditions the cost of transportation should be determined as a correlation of demand and supply for transport services (cost is an important indicator of competitiveness of the transport output, but not always it meets its quality);

- fixity and comparability of the quality coefficients of the transport services by modes of transport independently of their technological characteristics;

- necessity of the general integral coefficient of transport services quality determination for the generalizing assessment of the competitive possibilities of the uniform transport system elements.

Thus, the quality management of the transport output is formulated as the integrated and coordinated rating of the quality coefficients and decision-making on the best (optimal) transport support of users on the existing or potential transport resource basis and the solvent demand of customers. In [5] the dividing of quality coefficients into three groups is suggested:

1) indices of the transport supply and accessibility of territory for transport resources. This group of indices refers to a category of the general transport problems and it requires, as a rule, the considerable investments for modernization of the whole transport system. The analysis of these indices is necessary, first of all, for the development of the transport infrastructure, and the strategic regulation is needed for this purpose;
2) figures of the field (technological) operation of transport, which reveal mainly the departmental interests of the efficient use of the available transport resources;
3) factors of the passengers transport services, such as: speed, safety, service, level of time-schedule observance; level of passenger ride comfort.

N. M. Sheremet [6] in his works suggests considering a problem of quality from the point of view of the process approach. The given approach allows identifying and systemizing the quality coefficients in the sphere of passenger transportation by the following groups:

1. The quality coefficients of the transport output (the result of process, which functionality lies in changing the location of the transported object while maintaining constant it's all other properties) that include:
   - delivery of travellers to the destination point;
   - safety of travellers` luggage;
   - safety of travellers` health and life.
2. The quality coefficients of a single process, including:
   - observance of transportation terms;
   - technological safety – reliability criterion of the transportation process fulfilment from the point of view of the accident rate.
   - ecological compatibility of the process – a level of the ill effects of the transport industry on nature when performing the transportation process.

3. The quality coefficients of resources, including.
   - own quality of the used resources (by modes: a rolling-stock, staff etc.)
   - quality of the use of resources
4. The quality of the attendant and additional services, including: a range and level of services.
5. The quality of the transport company as a whole system, including:
   - accessibility of services.
   - availability of choice of services use.
   - transport communicativeness – coordinating in time the interaction of company with its customers.
   - reliability.

The measures of bus intercity, regional and international transportation quality can be classified in 2 groups by TCQSM (Transit Capacity and Quality of Service) [7] (see Table 2). The first group of measures provides availability. *Availability* is foremost provided by a network, within the limits of which service is carried out by a certain mode of transport and time-schedule (by time and frequency, to the proper queries of users). The second group of measures provides comfort and convenience from the traveller's viewpoint by a certain mode of transport. *Comfort and convenience* are connected with reliability of service, first of all, its interlinking with other modes of transport and passenger seating capacity. The given measures are closely interconnected.

Table 2. Quality of services, which are considered in TCQSM [7]

Service measures			
	Transit stops	**Roads Segments/ Corridors**	**System**
Availability	Frequency	Hours of service	Service coverage
Comfort and convenience	Passenger load	Reliability	Travel Time

From the viewpoint of travellers, the level of bus service can be assessed by different metrics. Unfortunately, a majority of them is qualitative but not quantitative. For example, reliability is one of the qualitative measures. It represents a very complex concept and can be defined in different ways. It is assumed that a punctuality of bus operation is a measure of reliability, which is a subject of the qualitative definition and consists of due fulfilment and stable uninterrupted traffic of bus sequence by TCQSM [7].

3. Quality Management System at JSC Riga International Coach Terminal

The coach terminal services are connected with the bus transportation services that are provided by the partner-transportation companies. From the viewpoint of a traveller as a user, this is a united service starting from information obtaining, making a choice, ticket purchasing, boarding, debussing, transit ensuring and other services that compile the satisfaction of needs of one trip (travelling).

Taking into account the above mentioned it is possible to distinguish the service quality coefficients that are significant just to the coach terminal activity as the transport infrastructure activity and that are still impossible to separate from transportation itself.

At the JSC Riga International Coach Terminal the quality management system that meets the ISO 9001:2000 standard requirements has been introduced.

The activity area of the quality management system is the passenger transportation services and supply, ticket sale and trip accounting management that is the base of the JSC Riga International Coach Terminal activity. [1].

The information systems are becoming tools of the service process management and control. A very important step for the improvement of the JSC Riga International Coach Terminal activity has been done when developing and introducing a new ticket sales and trip accounting program „Baltic Lines" (BL) at the enterprise.

The quality management system of the JSC Riga International Coach Terminal consists of three hierarchical levels:

1st level – the quality policy documents, which include the enterprise's quality policy, formulation of tasks, organizational structure, certification sphere, quality management etc.;

2nd level – all processes ongoing at the enterprise (total 32 procedures);

3rd level – data base that maintains the activity of the enterprise (methods of work performance, instructions, normative documents, ticket sales and trip accounting program „Baltic Lines" data base).

The introduced digital quality management system has helped:

- to improve more the activity of the enterprise;
- to define more precisely duties and the degree of responsibility of each employee;
- to improve the activity of each structural unit, to perform both internal and external audits;
- to determine the customers` needs and to try to satisfy them to the maximum;
- to have mutually beneficial cooperation with all those who need the coach terminal services.

According to the ISO quality management standard requirements, the JSC Riga International Coach Terminal has determined the main and support processes, developed the control criteria and procedures of these processes, organized opportunities for monitoring and gathering of the necessary statistic information for analysis and improvement.

- B01-B08 processes of the main activity are the most significant and they characterize the main directions of the enterprise's activity;
- C01-C15 supporting processes are of the instruction type and they characterize the everyday processes and regulate the JSC Riga International Coach Terminal internal activity, infrastructure and staff issues;
- D01-D07 system current processes describe preventive, correction activities and are considered as the obligatory ISO standard documentary procedures, especially D01, D02, D06 and D09, these processes characterize the enterprise's management and internal audit issues.

For each of the main activity processes (B01-B08) the quantitative control criteria are distributed, statistical data is generalized and diagrams are applied. Based on the collected information about separate criteria, there appears an opportunity to measure and analyse processes and to perform activities that would be directed to the results achievement and improvement. Every quarter the main activity process criteria are generalized.

For example:

✓ *B03 system application organizational management recommended by BL*

Criteria:

- Amount of the sold tickets of JSC Riga International Coach Terminal
- Amount of the sold tickets in other coach terminals for trips that are performed from the JSC Riga International Coach Terminal
- Amount of incorrect, wrongly printed tickets
- Amount of the returned tickets
- Income from tickets
- Income from ticket reservations and paid information
- Amount of the sold tickets in Internet
- Amount of tickets for travellers with discounts foreseen by the standard acts (100%, 50%)

✓ *B04 Bus time-schedule changes management*

Criterion:

- Amount of the done changes in bus time-schedules

✓ *B08 Controllers work*

Criteria:

- Amount of the cancelled trips
- Amount of the performed trips
- Complaints about controller's work
- Drawn up statements about violations

The statistical information about these criteria is submitted by the managers of the structural units.

The passenger transportation punctuality is necessary and it is the main parameter for the use of bus just at the *coach terminal or other stops*, where travellers start, continue or finish their trips. These passenger transportation infrastructure objects themselves cannot influence the service performance punctuality (or observance of time-schedule by bus), nevertheless it is important to inform travellers about variances, to help to make decision about their further actions (to wait, to change a trip route, time, to refuse from a service, to obtain compensation etc.), thus the services of the coach terminal are also considerable when supplying the transportation services.

Still, the main aim of the transportation punctuality analysis is to identify and to prevent delays and to escape risks in the scheduled transportation plan to the maximum.

In [8] research the main attention is paid to measure of reliability of coach and bus service and analysis of different factors influencing on this index. Because this mode of transport is in competition

with railway (and private cars also) in Latvia the measures that represent comfort and convenience are very important. Railway is the mode of transport, which doesn't feel the influence of congestion or weather conditions, and that's why it is more reliable mode of transport and also is the winner in competition with bus by travel time. On the other hand, it yields to bus transportation by the level of availability (absence of network in some districts, foremost). In this competition, multiplying comfort and service of bus transportation can play a solution role in the choice of this mode of transport. And, while time of travelling often differs insignificantly (example), reliability can become the problem for a bus travel. The exact observance of time-schedule becomes the important quality. Reliability is a measure determining bus service level from the viewpoint of users as well as operators. The considered reliability measure by [8] is a punctuality index. Punctuality of bus operation is a quantitative measure of reliability from the viewpoint of users. This index indicates the magnitude of time gap between actual and scheduled arrival times. Research of this index in combination with different factors influencing on this index and in an ideal development of the model for evaluation of punctuality is the important task for Quality monitoring.

4. Questionnaire as the Constant Process in Quality System

Questionnaire is constantly activated in the process of quality monitoring in the "Riga International Coach Terminal" JSC. On the basis of the questionnaire the management of the terminal analyses the coach operation, discovers merits and demerits of the offered services and introduces amendments or improvements as far as possible.

During the first part of 2008 two questionnaires were fulfilled.

One of them is the annual one starting from 2005, which has being performed from 19 February to 7 March 2008. *The aim of questionnaire is:* to study wishes and needs of the customers of the coach terminal, as well as to analyse the obtained information for the further perfection of the offered services. 100 respondents were covered. Three students of the Transport and Telecommunication Institute took part in organization of this questionnaire this year.

New questions, which concern the punctuality of trips, were included this year. We consider only answers on these questions.

The results of the respondents` answers on the question – How often do you use services of the coach terminal? – are presented on Fig.1.

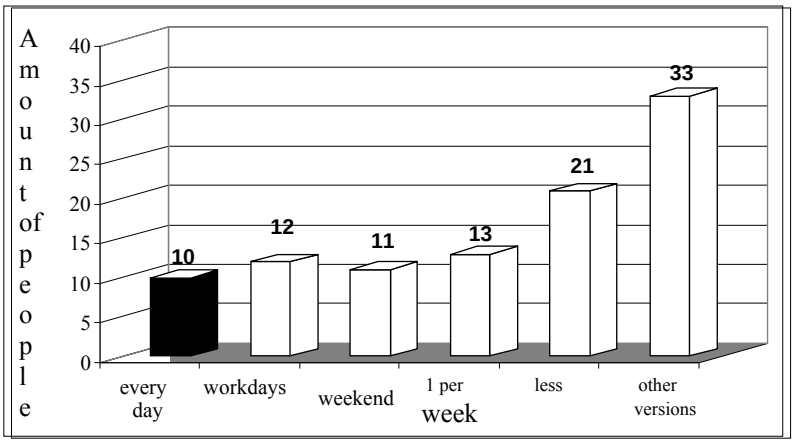

Fig. 1. Results of answers on question –How often do you use services of the coach terminal?

As it seems from the diagram on Fig.1 about 70% of customers use services of the coach terminal once per week and more seldom. Therefore, a great significance belongs to attracting these customers to the coach terminal services owing to satisfaction of their expectations. The distribution of the respondents` answers on question – Have you experienced the scheduled buses being late? – is presented on Fig 2. The results of the respondents` answers on question – When a bus was late, was it late during its departure or arrival? – are presented on Fig. 3. As shown in the diagram there is no evident differences in the previous experience of a customer between the departure service and the arrival service.

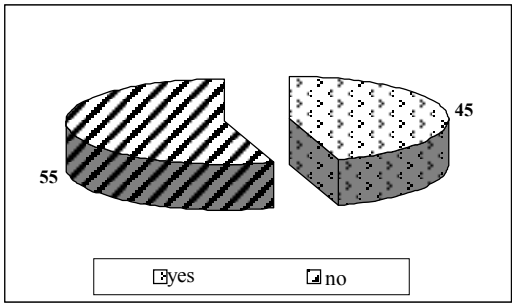

Fig. 2. Results of answers on question – Have you experienced the scheduled buses being late?

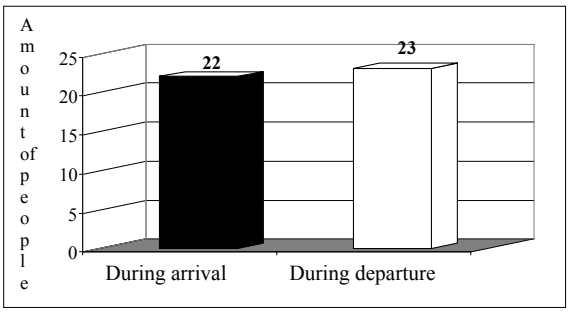

Fig. 3. Results of answers on question –When a bus was late, was it late during its departure or arrival?

The respondents` answers on question – What was the delay? – are presented on Fig. 4. As it is shown in the diagram most often the delay was 10 to 20 minutes. The respondents` answers on question – What delay of a bus is allowable from your viewpoint? – are presented on Fig. 5. As indicated in the diagram on Fig.5 the allowable delay of a bus from the viewpoint of the respondents is 5 to 10 minutes.

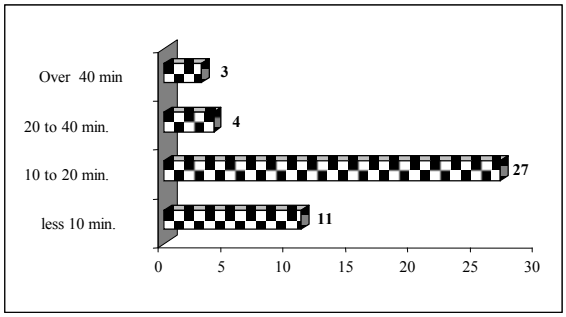

Fig. 4. Results of answers on question –What was the delay?

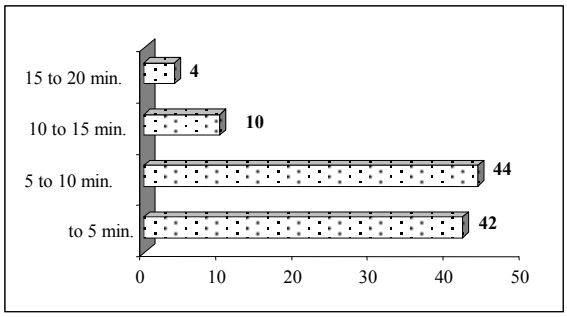

Fig. 5. Results of answers on question –What delay of a bus is allowable from your point of view?

Also, the questionnaire has allowed getting to know the wishes of travellers relatively the perfection of the coach terminal operation. It is possible to mention the following fact – travellers who use services of the coach terminal seldom are contented with everything. But, travellers who use services of the coach terminal every day have expressed many wishes. Complaints of travellers are always brought to the notice of the coach terminal management and problems of the JSC Riga International Coach Terminal are widely discussed in mass media.

5. Questionnaire as the Method of Analysing the Attitude of Users to a Certain Mode of Transport

As it has been earlier already mentioned the bus transport in Latvia has a strong competitor in many directions – it is railway. What is a determinant when choosing one or another mode of transport operating in one direction? Is it ticket price, travelling time, departure time, etc.? These questions can be set and solved on the basis of the Discrete-Choice models theory, which is developed by Ben Akiva, Lerman and others [9]. In this disaggregate models it is necessary to take into account the next factors affecting the generation and attraction of trips: social status, life style and other characteristics of an individual. Finally parameters of transport, such as travel costs, travel time, punctuality, comfort, availability and quality of the transport infrastructure have an influence on the behaviour of individual. To expose influence of numerous factors on the amount of passenger flow and to take into account transport necessities of every separate traveller is a very complex practical problem that requires the well-developed system of Transport Survey.

This year in the JSC Riga International Coach Terminal the pilot project of such kind of Transport Survey was implemented. The aim of questionnaire is to collect data on travellers` attitude. It is necessary

to obtain data from surveys about passenger market situations. Survey data have been collected on bus-based travellers and it concerns a very popular direction – **Riga-Daugavpils.**

Travellers have a choice between the railway transportation, i.e. a passenger train, and the bus transportation services. In the questionnaire month the amount of travellers with the initial point Riga to the end point Daugavpils is revealed in Table 3 showing the amount of tickets in the VIPUS ticket system (passenger train) and the sold BL tickets (buses and coaches) In fact, the amount of travellers is larger because tickets are also purchased directly from the bus driver. But there is an opportunity to use the mentioned vehicles for routes where Daugavpils is a transit point, for example, in July 2008 this opportunity has been used by 533 bus travellers.

Table 3. Amount of travellers Riga-Daugavpils in July 2008

Indices	Train	Bus
Amount	124	357
Sold tickets Riga-Daugavpils	8490	9941

The dates of questionnaire: 1st July,.2008 –10th July,2008. Interviewing was carried out face-to-face using an interview questionnaire. The distribution of the places for questioning is presented on Fig.6 (Riga Coach Terminal is the main one). The total amount of the filled in questionnaires is 117. There are some incorrect questionnaires, which have been detected in the described analysis. The 1st and 18th questionnaires are with answers only on half of questions, that's why they have been removed from further analysis. Consequently, 115 questionnaires have resulted in the following analyses.

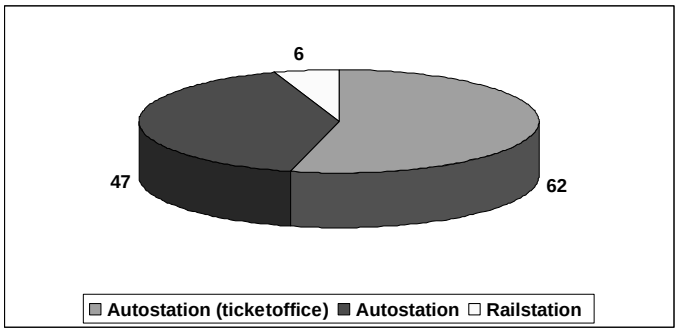

Fig. 6. The distribution of the places of interview

5.1. Common Analysis of Sample Structure

For the beginning let's mention that about one half of all passengers participated in questioning has an own car. This very fact is an interesting one and deserves a separate analysis. On Figures 7 and 8 a distribution of the respondents by age and sex is indicated. Mainly there are women and age of a half of the respondents is in the age interval 20 to 40.

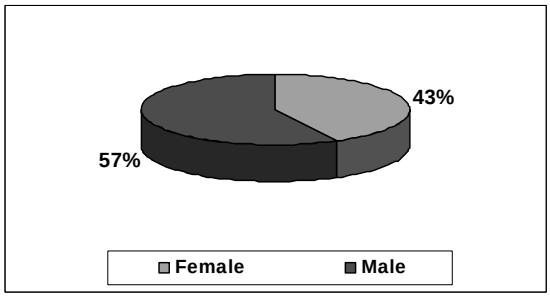

Fig. 7. The sample structure: sex

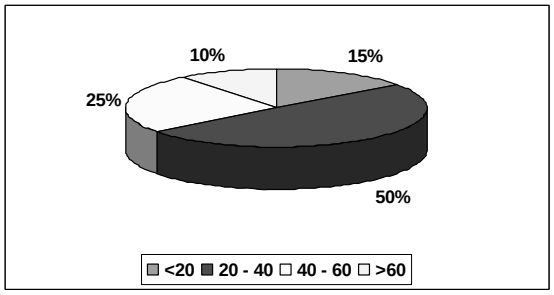

Fig. 8. The sample structure: age

A majority of the respondents has chosen Latvian as the language of communication (see Fig.9). Fig. 10 is of interest, where a distribution of income per head in a group of the respondents is presented; a majority has indicated a sum of income 200 to 500 Ls. But, among the users there are 17 % of those who have an income per head over 500 Ls.

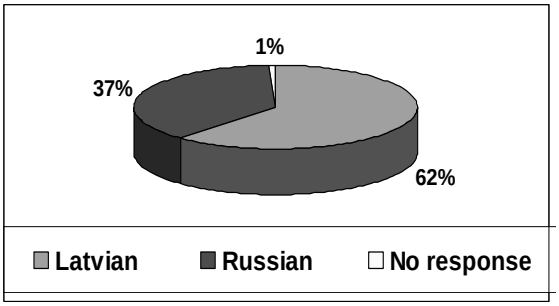

Fig. 9. The sample structure: language (%)

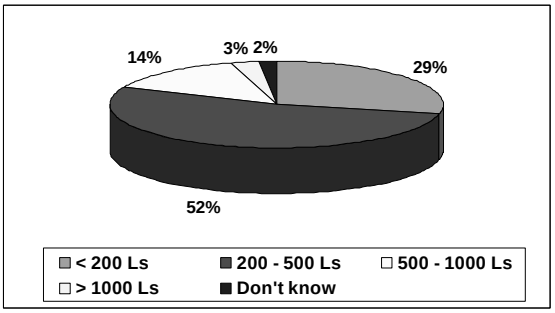

Fig. 10. The sample structure: income per person

5.2. Analysis of Trip Characteristics

Let's consider the answers on question concerning the trip characteristics. Basically, the respondents indicated that their trip had a private character (see Fig.11) and was a direct trip (see Fig.12).

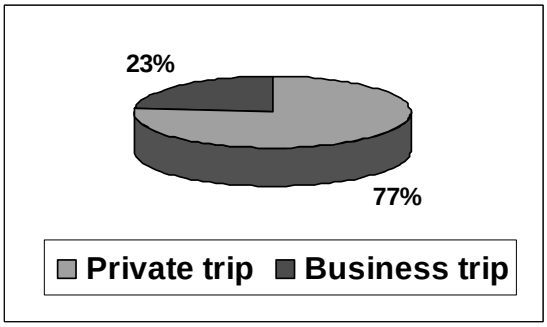

Fig. 11. Type of trip

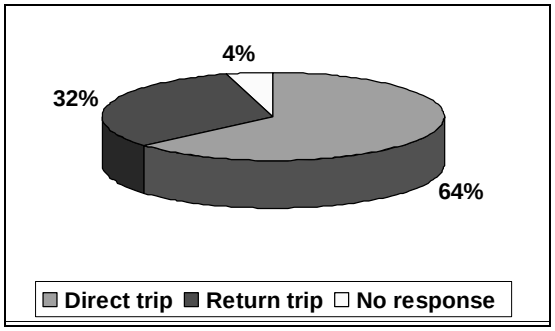

Fig. 12. Type of trip

Over 60% of the respondents have travelled straight to Daugavpils, however, the enough number of the respondents (~16%) has used Daugavpils as a transit point (see Fig.13). As to the departure time, it has been distributed almost equally with a slight advantage of morning hours from 9.00 till 12.00 (see Fig.14). Questionnaire has also shown that 65% of the respondents travel alone and 35% two or three, and 25% with luggage (additional seat).

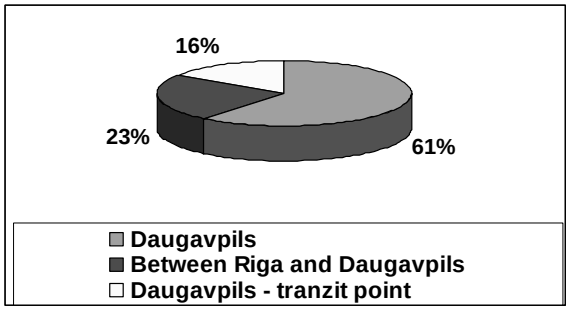

Fig. 13. End point

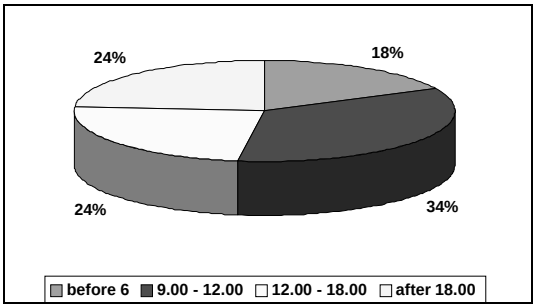

Fig. 14. Time

5.3. Analysis of the Attitude to Trip Cost

The answers on questions concerning the preference of one or another mode of transport are of peculiar interest. For the sake of truth, it should be mentioned that among the respondents there were only 5% questioned at Railway Station. So, this information is for the management of the coach terminal concerning the preferences of customers of the coach terminal exactly. In this connection quite a large percentage of those preferring travel by train, car and other modes of transport – over a quarter of the respondents – should be mentioned (see Fig.15).

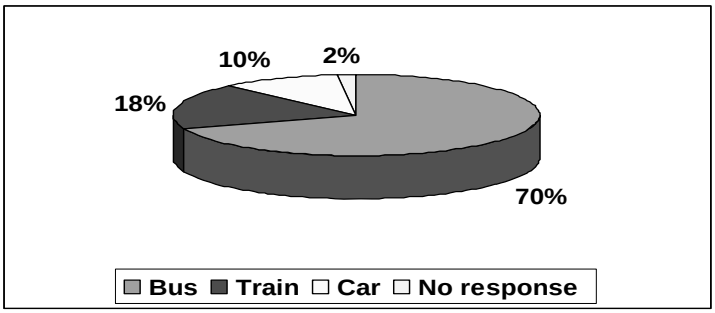

Fig. 15. Preference by modes of transport

On Fig.16 a distribution of reasons influenced on the coach terminal customers` choice in favour of bus is presented. In the first place is a suitable departure time and comfort, then – the nearness of a bus stop to the aim of trip (by the way, it could be the main advantage of bus over train).

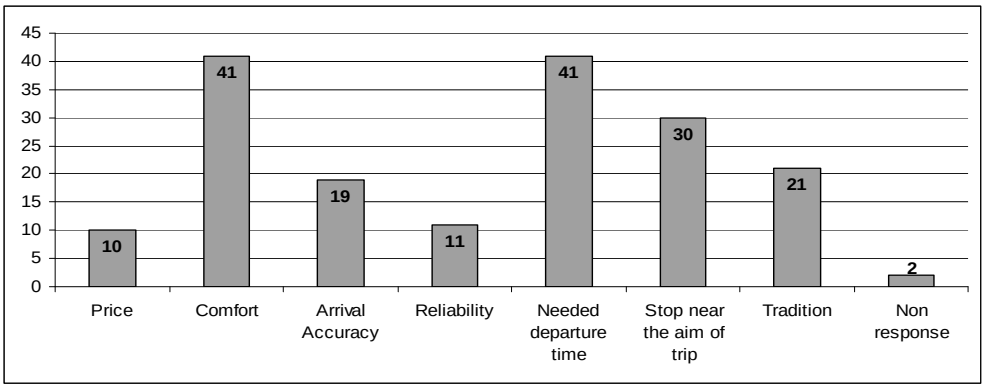

Fig. 16. Reason of choice of bus as a mode of transport

The fact that cost is in the last place attracts attention. In July a rise in the ticket prices took place that changed the tariff structure for bus services, as a result the bus ticket prices are more expensive, i.e. for trains depending on train ticket type prices are Ls 3,57 to Ls 4,57, and for buses depending on time and a carrier the prices are Ls 5 to Ls 5,60. At that, one of the following questions of the questionnaire is about the cost, namely: cheaper or more expensive is the price for the alternative modes of transport? Then, 41% responded that they did not know, and 34% – that for other modes of transport (train) it was more expensive.

Conclusions

Transport plays a significant role in a modern world and competition between various modes of transport including the public transport, and the public and private modes of transport is growing more and more. Therefore, in this competitive struggle a special attention is paid to the problems of the rendered services quality for the passenger transportation. In the paper a survey of the existing approaches to the analysis of the transport service quality, in particular, the passenger transportation service is performed. The passenger service quality system in the JSC Riga International Coach Terminal is

examined in details, and data obtained in the process of questioning of the customers of the JSC Riga International Coach Terminal is analysed. One of the questionnaires performed at the enterprise has been directed to data collection and analysis for determination of the transport mode preference of the customers travelling on Riga-Daugavpils route. Social and economic characteristics of travellers of this route are considered as well as the reasons of their preference of bus over train. The given research might become a basis for the Discrete-Choice models construction in future.

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REDUCING EMPTY CONTAINER FLOW BY PROMOTING BALTIC AND RUSSIAN'S WASTEPAPER EXPORT TO CHINA

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In 2006 out of one hundred imported marine containers from China to Europe, forty one were repositioned to China empty and from Russia at least seventy. To promote a healthy trade between these countries, it requires a more balanced cargo flows. It is of high importance that the marine containers filled with commodities sent from China to the Baltic and Russia would not be transported back to China empty. This paper provides a global analysis on freight flows by commodity to and from China with focus on a comparative analysis of potential export cargo to China. Our goal is to explore the possibility and to propose a logistics mechanism to promote the growth of container trade between China and Russia via Estonia. In developing our analysis, wastepaper is considered in this paper as one of the potential export commodities from Russia and Baltic through Estonia to China. The potential of this commodity to fill containers that would otherwise be repositioned empty to China, and the possibility of consolidating empty containers at the Port of Tallinn from other trade flows with China, is examined.

Keywords: Wastepaper, container, export, market, trade, port

1. Introduction

Russia's import in containers has been growing rapidly and similar trends are observed in Estonia, Latvia and Lithuania (Baltic countries). These countries have a similar problem in trade with China, where the cargo flow imported from China clearly exceeds the flow of exported cargo. For example Estonian cargo export flow in monetary value to China was 314 million USA dollars in 2006, and import from China in the same year was 536 million USA dollars, that means import from China to Estonia was 71% higher than export. Similarly, in 2007 Russian cargo import from China in monetary value was 28.7 billion USA dollars and export to China was 19.5 billion USA dollars. China export to Russia was 47.2% higher than Russian export to China. In addition to rapid growth of trade, China, Estonia, Latvia and Lithuania have experienced fast growth in GDP in recent years.

All countries actively trading with China have been searching for solutions to deal with the issue of empty marine containers returned to China. China experiences similar problems due to its imbalanced trade with Europe and Russia. As the majority of Port of Tallinn cargo flow is made up of transit cargo (about 84.4% in 2006) [1], mostly of it was oil products. These transit cargo flows could substantially decrease in the future when the development of Russian's owns ports become available. Therefore, it is important for Port of Tallinn to promote variety of transit cargoes and create possibilities in different countries between which the transit trade in the port would take place.

The biggest difference between the countries lies in the fact that Russia exports mostly its own energy resources, like oil and coal, to China. Estonia, Latvia and Lithuania lack their own energy resources. At the same time the three Baltic countries participate in the transport of Russian energy carriers and mineral resources as transit countries and import cargo from China in containers. The biggest potential of Port of Tallinn is to become one of the gateways through which containers from China to Russia will continue their trip to Russia by road and rail. As container flow to Russia is large it is highly important to consolidate from Russia and the three Baltic countries enough commodities returned to China in marine containers. This enables to keep the number of empty containers returned to China as minimum as possible, which surely serves as one important argument in cargo flow logistics.

Based on current logistics world practice we analyze different cargo groups transported to China and provide a comparative analysis of cargo exported to China. We are looking for possibilities to increase the number of containers sent from China to Russia via Estonia. We also offer a possibility to decrease the flow of empty containers returned from Russia to China.

2. Ports of Los Angeles and Long Beach – A case study on the Containerization of wastepaper exports

In this section, we will discuss a best practice on increased wastepaper export through Ports of Los Angeles and Long Beach (POLA/LB) as a way to reduce empty container repositions to China and to promote USA containerized cargo export market.

Southern California is home of two largest container ports of the USA - Ports of Los Angeles and Long Beach (POLA/LB). Los Angeles is the largest trading gateway of the USA, leaving behind such large cities as New York and Detroit. Based on GDP in 2005 the economy of the state of California with 1.55 trillion USD ranked among the world ten largest economies, which is in the same magnitude as the economy of entire Russia (1.59 trillion USD) [2]. POLA/POLB experienced a trade value of 294 billion USD in 2006, whereas the majority of cargo flow (almost 80%) is transported in containers.

In 2006, the ports handled a total of 15.76 million TEU (twenty-foot equivalent unit), ranked fifth in the top 10 world container ports after Port of Shenzhen in China and before Port of Busan in South Korea. The trade of POLA/POLB is mostly based on cargo flow originating from Asia. The largest trading partner of POLA/POLB is China with 102 billion USD, it comprises 36% of the entire trade between China and USA [3].

POLA/POLB are important gateways of the Asia-USA trade, as over 40% of the total cargo handled at the port continues its transport to major inland markets of the USA using intermodal transport by both road and rail [3]. This suggests a possibility of Port of Tallinn become transit gateway serving marine containers transported from China end route for Russia and Europe markets. Based on 2006 statistics, the share of empty export containers for example in Ports of Los Angeles alone was 64 %. Overall, 60% of total US containers were returned to Asia empty [4]. As demonstrated in Table 1, in monetary terms, wastepaper represents a significant commodity of export cargo handled at the port of Los Angeles in 2005 with almost 40% increased as compared to 2004. Among other fast growing reusable export materials also include copper, scrap metal and aluminum. Over half of the export commodities presented in Table 1 are destined for production and reproduction plants located in China.

Table 1. Top Los Angeles exports to China 2005 [5]

RANK	COMMODITY	VALUE USD	CHANGE
	Total all commodities	11 726 022 147,0	19,20%
1	Computer chips	1 181 243 360,0	6,70%
2	Cotton, not carded or combed	925 916 900,0	-1,90%
3	Scrap iron, steel	517 770 932,0	52,70%
4	Copper waste and scrap	317 928 411,0	92,80%
5	Sheepskins, horse hides	285 729 727,0	53,30%
6	Paper, paperboard scrap	284 271 913,0	39,60%
7	Polymers of ethylene	275 000 421,0	44,60%
8	Aluminium waste and scrap	246 520 713,0	125,80%
9	Motor veichles for transporting people	241 944 408,0	215,70%
10	Berylium, chromium, germanium, vanadium, etc.	204 907 392,0	736,10%

As shown in Figure 1, in term of TEU volume, wastepaper export constitutes the largest share of 40% (or about 165 813 TEU) among the top 5 export commodities handled by the port of Los Angeles in 2005. Follows wastepaper are 21% (or 88 369 TEU) in cotton, 14% (or 57 905 TEUs) in animal feed, 13% (or about 51 731 TEUs) in synthetic resin and scrap metal ranks fifth with 12% (or 50 864 TEUs) share [4].

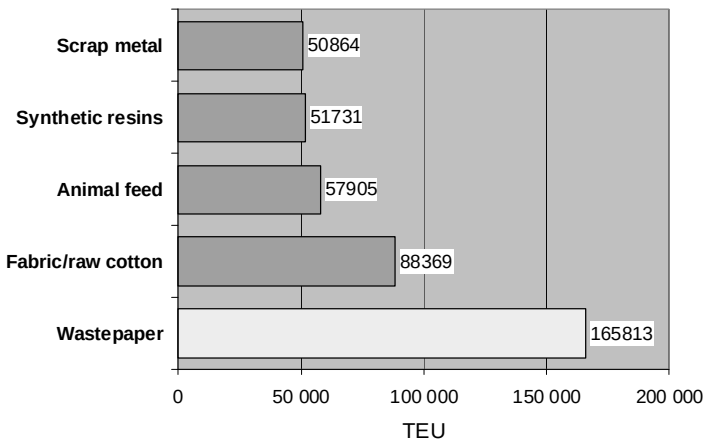

Figure 1. Top 5 Export Commodities Handled by the Port of Los Angeles in 2005 [6]

3. Wastepaper Volumes of Estonia, Latvia, Lithuania and Russia

Baltic countries and Moscow, St. Petersburg together with provinces are areas with rapidly increasing consumption. Together with increase in the economic growth of the countries also people's income will increase. By economic growth of countries Russia is not a country with most rapid growth (6,7% in 2006), but this economic growth is sufficiently big for Russia's retail trade to grow from 245 billion USD in 2006 to 526 billion USD in 2010. Thereby foodstuff retail trade will grow from 113 billion USD to 203 billion dollars during the same period. An important contribution into the commodities sold in Russian retail trade comes from China, which export to Russia in 2006 increased by 19.8% or amounted to 15.8 billion USD compared to 2005.

In Russia the population is 142 million while all together only 7.56 million people live in Baltic countries. We are going to use these figures in accounting wastepaper markets of Russia and Baltic countries.

Russian wastepaper market volume is estimated to be 9 million tons per year, of which only 3 to 4% is reused and the rest a 96% is ended up to the dump field. In Moscow and the province of Moscow wastepaper reused amounts to 20 % [7]. Moscow together with the province of Moscow produces 260 000 tons of wastepaper and cardboard per year in 2005. The province of Moscow and the city of Moscow accommodate a total of 15 million people, which makes 17.3 kg wastepaper collected per person. Calculating this amount for the city of St. Petersburg and the province of Leningrad, where the population is 6.4 million, the market volume will be 111 000 tons of wastepaper per year. Hence, the market volume of two Russian large centres is 371 000 tons per year.

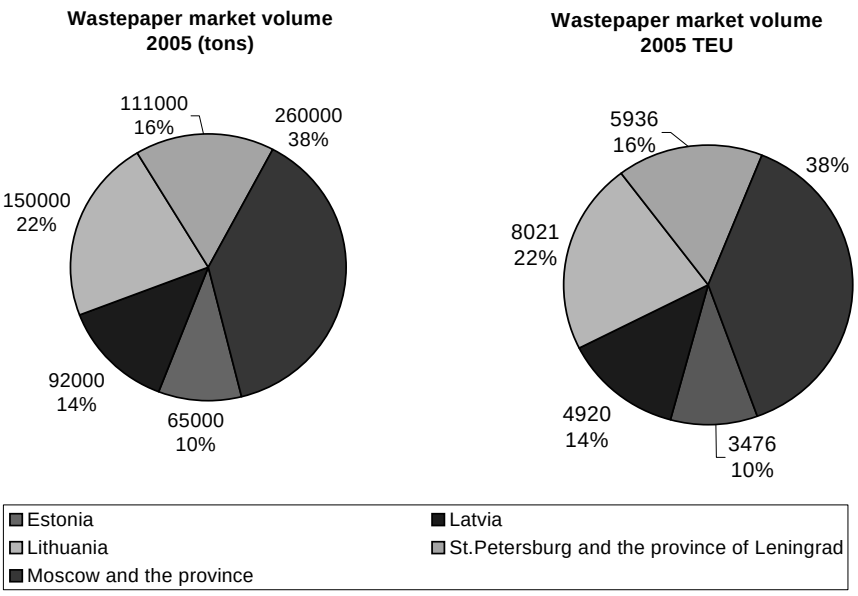

Figure 2. Wastepaper Market Share of the Baltic Countries, Moscow and Provinces of St. Petersburg and Leningrad in 2005 (tons) [7], [8], [9]

As demonstrated in Figure 2, the market volume of reusable wastepaper of the Baltic countries and the cities of St. Petersburg and Moscow, the provinces of Leningrad and Moscow totals to 678 000 tons per year. The share of the Baltic countries is divided as follows: Estonia 65 000 tons, Latvia 92 000 tons and Lithuania 150 000 tons. Considering the population of the Baltic countries the quantity of reusable wastepaper per person is the following: Estonia 49 kg, Latvia 41 kg and Lithuania 42 kg. Accommodating the corresponding amount of wastepaper into twenty foot containers on an assumption that one container accommodates 18.7 tons of wastepaper, the result will be a market volume with the size of up to 36 257 TEU per year. Taken separately by countries from Russia 19 840 containers, from Estonia 3476, from Latvia 4920 and from Lithuania 8021 containers could be returned to China by utilizing empty containers need to be repositioned to China. From the Baltic countries alone 17 417 containers could be added to container transport returned to China.

Large part of wastepaper collected from Baltic countries and the cities of Moscow and St. Petersburg together with provinces has been exported in recent years. However, wastepaper export has not been a systematic and separate export branch. The cause is not due to lack of wastepaper, but more likely due to poorly organized wastepaper collection system and the lack of wastepaper market as such together with lack alternative extensive export markets.

Based on the opinion of specialists the annual reusable wastepaper market volume in Estonia is 65 000 tons and according to the forecast the market volume will increase minimally by 10 % every year. The total market volume of reusable wastepaper in the Baltic countries is 307 000 tons per year [8].

These quantities indicate the actual potential of the market, considering the quantity of reusable wastepaper per one person in a year. Hereby comparing countries most producing reusable wastepaper as a ratio of the quantity of reusable wastepaper and population, we will get the following results (kg of wastepaper per one inhabitant in a year): USA 183 kg, Japan 158 kg and Germany 174 kg. The corresponding data for the Baltic countries is the following: Estonia 49 kg, Latvia 41 kg and Lithuania 42 kg. In Russia the corresponding figure is 4 kg and in the other neighbour of Estonia – Finland 162 kg. In China 13 kg of reusable wastepaper per person in a year was produced.

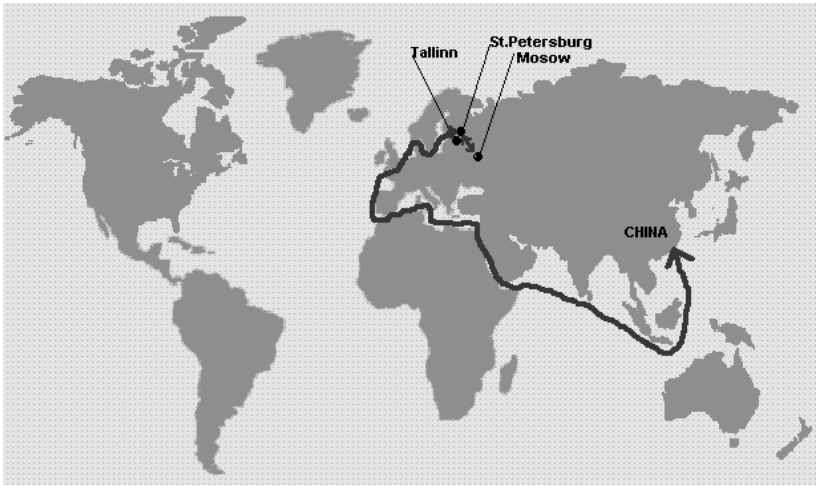

Figure 3. Container Flow Route from China to Russia and Back to China with Wastepaper Logistics

Wastepaper export in Russia is also favored by the price of transport, which for example in case of container traffic from Estonia to Moscow by auto transport already includes the price of return transport of the empty container. Rail transport of a full container to Moscow and back to Estonia has to be paid for in both directions, but is altogether four times cheaper than auto transport. Yet, in such a case there shall be wastepaper collection, sorting and container loading points in railway yards in Moscow. In case of auto transport such warehouses may have different locations, as auto transport is logistically more flexible. In addition to this auto transport to Moscow is 3.5 times faster than rail transport. Sending of a container directly to Moscow client's using auto transport takes up to two days, by rail transport up to a week. As majority of container transport is performed in different ports, like for example in Los Angeles to the extent of 72%, in St. Petersburg to the extent of 98%, in Hamburg to the extent of 67% and in Tallinn to the extent of 93% using auto transport, it is expedient to use auto transport also at the transportation of wastepaper [10]. Auto transport is also favored by the fact that wastepaper collection warehouses are not converged around railway shunting yards in Russia.

Sorting of wastepaper starts at everybody's home. Everybody of us can separate wastepaper from other refuse. It is possible to take wastepaper to a special collection point or refuse collection companies with special vehicles can collect scrap paper from people. Hence, it is important to educate the population to make people aware of the relevance of collection of wastepaper both in terms of economy and ecology. Statistically, for example in Estonia the majority, i.e. approximately 80% of the wastepaper market is contributed by the population and 20% by enterprises [8]. Here we should point out that levels of collection of wastepaper differ largely from country to country.

In Figure 4, there is a chart of wastepaper logistics. Wastepaper is collected in Russia, Estonia, Latvia and Lithuania. Next, the collected wastepaper is transported in containers by vehicles or trains to the sorting station of wastepaper located in Estonia. The sorting station is situated at the port or in its

close vicinity. In addition to sorting, wastepaper is baled and loaded into empty containers at the station. The containers filled with wastepaper are transported from the station of wastepaper to the container terminal situated at the Port of Tallinn. From the port the containers filled with wastepaper are shipped to ports in China.

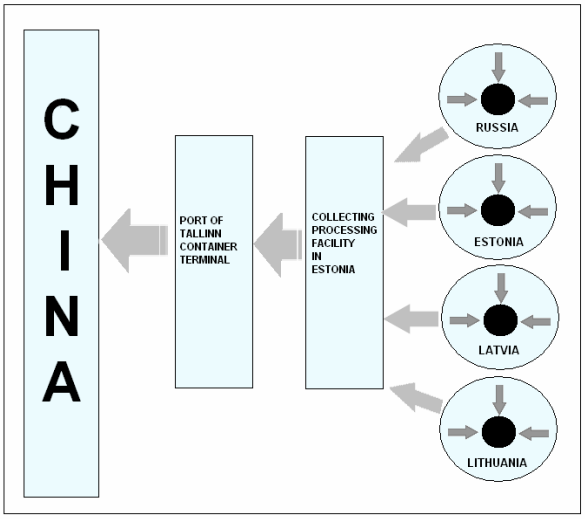

Figure 4. Chart of the system collecting wastepaper and sending through Estonia to China

We are going to analyze potential volumes of the wastepaper markets of the Baltic countries and the city and province of Moscow and the city of St. Petersburg and the province of Leningrad. We are using the example of Finland, where 162 kg of wastepaper per one person is collected a year. Now let's use the given quantity at the considering of a perspective wastepaper market based on the number of population of the given countries for 2014 and present the results in tons as well as recalculated in containers.

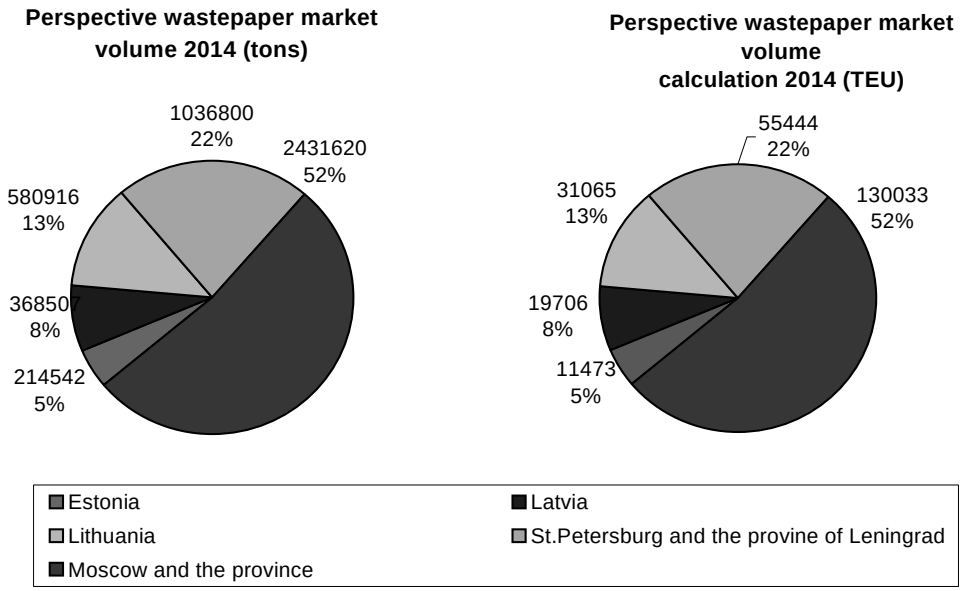

Figure 5. Perspective wastepaper market Market Share of the Baltic Countries, Moscow and provinces of St. Petersburg and Leningrad in 2005 (tons) [7], [8], [11]

Using calculations we get 4 632 385 tons as the wastepaper perspective common market volume. Let's calculate the given market volume into containers as a result of which we will get the results presented on

the graph. Potential common market volume in containers is 247 721 TEU. Let's recall that in 2005 Port of Los Angeles exported 165 813 TEU of wastepaper, hence this is a market volume to be taken seriously also in the future.

Conclusions

Due to increase in container traffic volume in Russia also container traffic through three Baltic countries increases. Growth of Russian import container flow is principally based on containers transported from China. For this extensive export articles have to be found for containers returned to China. As commodities imported in containers from China to Russia are directed to areas, where retail trade and purchasing power increase most rapidly wastepaper is a suitable export article. Population and consumption in Russia is largest in Moscow and the province surrounding the city and in St. Petersburg and the province of Leningrad.

Collection of wastepaper and shipping it in marine containers to China is a system that functions worldwide. The process enables to reduce the transport of empty marine containers back to China. This, in turn, is economically expedient since the transport of empty marine containers to China does not yield any profit, yet marine containers must still be returned there.

Wastepaper export from Russia to China is also supported by a large wastepaper market in rapidly developing areas with dense population of Moscow and the province of Moscow and St. Petersburg and the province of Leningrad. Presently Russian potential wastepaper export market volume amounts to 371 000 tons or calculated into containers a total of 19 840TEU. The wastepaper export market volume of Estonia, Latvia and Lithuania is 307 000 tons or 16 417TEU. The perspective wastepaper export common market volume is 4 632 385 tons or 247 721TEU, using Finnish statistics at the collection of wastepaper per one person a year.

A uniform system of collection, processing and transportation of wastepaper must be developed for the purpose. It is important to teach the population to collect wastepaper and to separate it from other refuse. The governments should also promote a more active collection of wastepaper through respective regulations.

As Port of Tallinn has experience as a port servicing Russian export, we have a possibility to become also the tender of Russian import and export containers.

For this we should be able to organize wastepaper export from Russia and the Baltic countries through Port of Tallinn into China. At the launching of the reusable materials plant Estonia can include additional transit container flows from China into the largest port in the ownership of the state – Port of Tallinn. Reusable materials plant would service wastepaper volumes collected from Estonia, Latvia, Lithuania and major Russian cities and provinces and process wastepaper into reusable wastepaper. This in turn enables to construct terminals supporting additional container transport and creating additional value in the port and creates additional volumes also for rail transport and the entire transit chain.

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THE FEASIBILITY STUDY TO TRANSFER GOODS BETWEEN PORTS OF KLAIPEDA AND SWINOUJUSCE

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The purpose of this article is to present results of the research of feasibilities of freight transportation by ferry between Klaipeda Seaport in Lithuania and Swinoujusce Seaport in Poland. The study is related to the BSR Interreg III B NP project Baltic Gateway PLUS. The study includes the following researches: (1) to specify freight flows to Region Berlin via Klaipeda Seaport; (2) to specify freight flows to Region Berlin via Kalvariju cross border check point. The applied method is the collection of official statistical data for years 2005 and 2006 from legal statistical bureaus and some freight operators. The study concluded that freight flow via Klaipeda port and Kalvariju check point (incl. Lazdiju) to the so-called Region Berlin defined as the destination point in which freight was unloaded was 199,59 thousand tons in 2005 and 229,96 thousand tons in 2006. Freight flow via Klaipeda port and Kalvariju check point (incl. Lazdiju) from the so-called Region Berlin defined as origin point in which freight was loaded was 48,88 thousand tons in 2005 and 78,45 thousand tons in 2006. About 10 % of freight flow in axis Kalvariju-Berlin is loaded/unloaded in the so-called Region Berlin. About 90 % of flow in the mentioned axe is a cross trade flow of Region Berlin.

Keywords: intermodal transport, transport statistics, short sea shipping, freight flows, trailer, ferry

1. Introduction

A short description of the background to this article, its purpose and scope and some definitions of important terms used as well as a method of the research is presented. The purpose of this research is to study feasibilities of freight transportation by ferry between Klaipeda Seaport in Lithuania and Swinoujusce Seaport in Poland. The study is related to the BSR Interreg III B NP project Baltic Gateway PLUS. Study aims to evaluate the existing demand for ferry line and contribute to the Motorways of the Sea concept.

The scope of the study is defined by Research Contract. The study includes the following researches:

- to specify freight flows to Region Berlin via Klaipeda Seaport;
- to specify freight flows to Region Berlin via Kalvariju cross border check Point.

The study not includes technical or economical characters that are relevant to the planning and pre-estimating of Klaipeda -Swinoujusce ferry connection.

Moreover the backward flow from Region Berlin is evaluated in the study.

Definitions. The Region Berlin as destination point is defined as three Federal lands in Germany – Berlin, Brandenburg, Mecklenburg-Vorpommern.

Method. Lithuania, Latvia, Estonia, Poland as well as other six countries join the European Union since 1st May, 2004. The last period for statistical freight trucking data based on Customs Manifests was April, 2004. In the past three years many changes happened. GDP, international trade and freight traffic increased dramatically in the new EU countries. The method selected is the collection statistical data for years 2005-2006 from official statistical bodies of Federal Lands of Germany as well as official statistical bodies of Lithuania. Statistical data on goods flow between Kalvariju Border/Klaipeda Seaport and Berlin Region was not founded in any known statistical bodies. The all necessary statistical issues that concerned the mentioned link was successfully collected for year 2005 and 2006. The interviews with Lithuanian freight operators contribute to the methodology of the project. The statistical data from DFDS Lisco Company that operates ferry lines from Klaipeda to Germany (Kiel and Sassnitz) is also evaluated.

2. Freight Origin and Destination Approach and Design

Theoretical assumption of freight origin and destination and origin and destination design for our research is presented.

Typical approach to freight flows distribution is based on origin-destination pairs. The point of origin is point of loading and point of destination is point of unloading or reloading. The points of origin and destination could be defined as manufactory, city, country, region or continent.

Figure 1. "Origin – Destination" approach

The task of our research is to identify road freight flow to Berlin Region:
- from Kalvariju/Budzisko (Lithuanian/Poland) Cross Border point and
- from Klaipeda Sea port.

So we have the destination point – Berlin Region. Unfortunately we have no certain origin point. The Klaipeda Ro-Ro terminal and Kalvariju/Budzisko border is only transit points. Theoretically and practically freight origin could be placed in very wide geographically area.

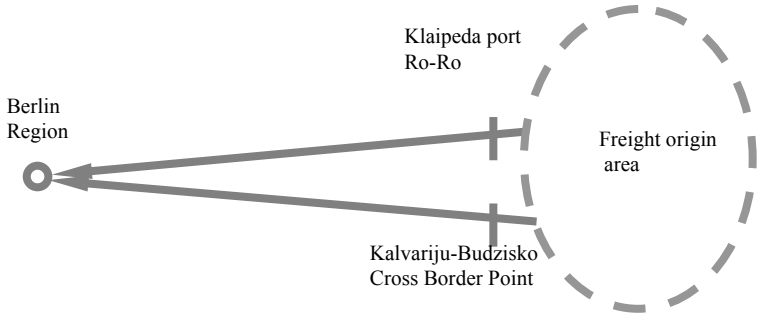

Figure 2. "Origins are – Destination point" approach

Identification of destination point. At first we identify destination point – Berlin Region. There is no unambiguous definition of Berlin Region in official documents and scientific literature. First definition of the Berlin is the Capital City of the Germany, second one – Federal Land (Bundesland) of the Country. The geographical positioning of Federal Lands of Germany is showed on Figure 3. Berlin Federal Land is very small in comparison with others. The definitions of Berlin Federal Land as Berlin Region do not match the aim of the research that is to evaluate possibility to open new ferry line to Swinoujusce. The wider approach of the Berlin Region is neighbouring Federal Lands. The Federal Land of Brandenburg is only one neighbouring Land of Berlin. The definition of Berlin and Brandenburg Lands as Berlin Region is also too narrow, such both of them is not-marine lands and do not match our aim.

Figure 3. Federal Lands of Germany*

*Federal Lands:
1 – Berlin; 2 – Hamburg; 3 – Bremen; 4 – Saarland

Here the 200 km radius from Swinoujusce approach we apply to identify the so-called Region Berlin that could be significant related with aim of the research.

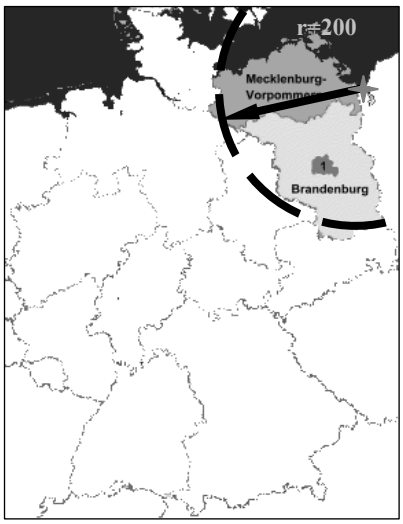

Figure 4. 200 km radius from Swinoujusce

Figure 5. The so-called Region Berlin

Region Berlin is defined territory as Federal Land Berlin, Federal Land Brandenburg and Federal Land Mecklenburg-Vorpommern.

Identification of origin area and transit routes

We should use the origin area approach instead of the origin point. In that case the origin area covers 5 countries – Lithuania, Latvia, Estonia, Belarus and Russia.

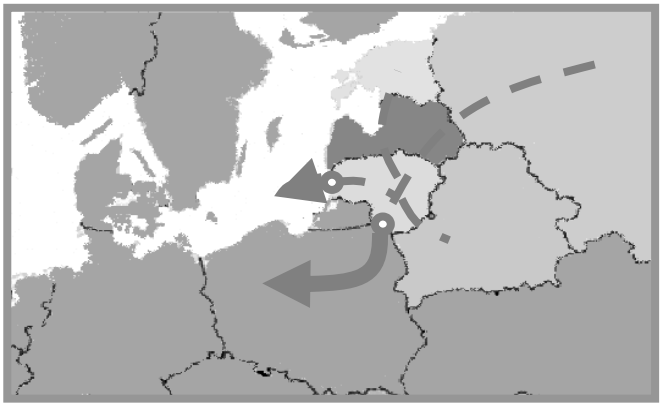

Figure 6. The origin area and Lithuanian cross points Kalvariju (incl. Lazdiju) and Klaipeda Seaport

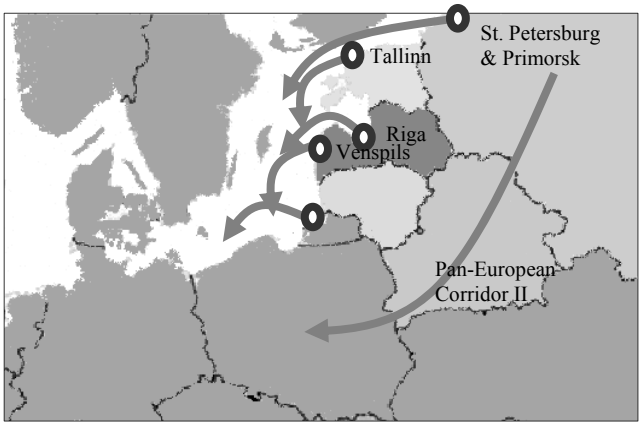

Figure 7. Alternative routes for the origin area

3. Cargo Flows Statistics From/To the So-Called Region Berlin

Here the statistics collected from German Federal Lands, from Lithuanian Statistical Department and ferry operator is numerically and graphically presented and overviewed.

Statistics from German Federal Lands

The statistics of freight flows is collected from Official bodies of Federal Land of Germany [1-6, 9-10]:

- Berlin Federal Land,
- Brandenburg Federal Land;
- Mecklenburg-Vorpommern Federal Land.

Table 1. Freight to the so-called Region Berlin in 2005, in thousand tons

Destination \ Origin	Lithuania	Latvia	Estonia	Belarus	Russia	Total
Berlin	15,98	1,40	5,45	7,80	20,45	**51,08**
Brandenburg	23,61	12,96	37,17	14,53	14775,91	**14864,18**
Mecklenburg-Vorpommern	80,54	6,10	329,24	15,56	1829,23	**2260,67**
Region Berlin Total	**120,13**	**20,46**	**371,86**	**37,89**	**16625,59**	**17175,93**

Table 2. Freight from the so-called Region Berlin in 2005, in thousand tons

Origin \ Destination	Lithuania	Latvia	Estonia	Belarus	Russia	Total
Berlin	12,36	2,53	1,17	2,53	72,43	**91,02**
Brandenburg	11,88	4,64	8,51	11,52	114,35	**150,9**
Mecklenburg-Vorpommern	13,89	18,64	6,74	1,91	79,01	**120,19**
Region Berlin Total	**38,13**	**25,81**	**16,42**	**15,96**	**265,79**	**362,11**

Table 3. Freight to the so-called Region Berlin in 2006, in thousand tons

Destination \ Origin	Lithuania	Latvia	Estonia	Belarus	Russia	Total
Berlin	22,52	1,44	4,86	4,20	974,60	**1007,62**
Brandenburg	12,95	6,53	28,95	12,35	14749,42	**14810,2**
Mecklenburg-Vorpommern	95,25	21,14	344,59	14,50	2493,62	**2969,1**
Region Berlin Total	**130,72**	**29,11**	**378,4**	**31,05**	**18217,64**	**18786,92**

Table 4. Freight from the so-called Region Berlin in 2006, in thousand tons

Origin \ Destination	Lithuania	Latvia	Estonia	Belarus	Russia	Total
Berlin	13,97	2,41	2,72	4,52	82,59	**106,21**
Brandenburg	20,45	18,41	7,33	14,51	116,43	**177,13**
Mecklenburg-Vorpommern	25,59	19,56	9,13	2,88	105,52	**162,68**
Region Berlin Total	**60,01**	**40,38**	**19,18**	**21,91**	**304,54**	**446,02**

On Figures 8–11 the distribution of freight flow is presented with focus to eastern side.

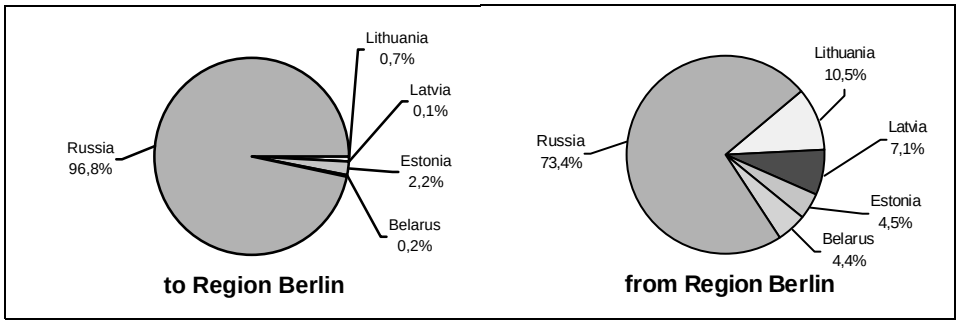

Figure 8. Freight flow between the so-called origin area and Berlin region in 2005

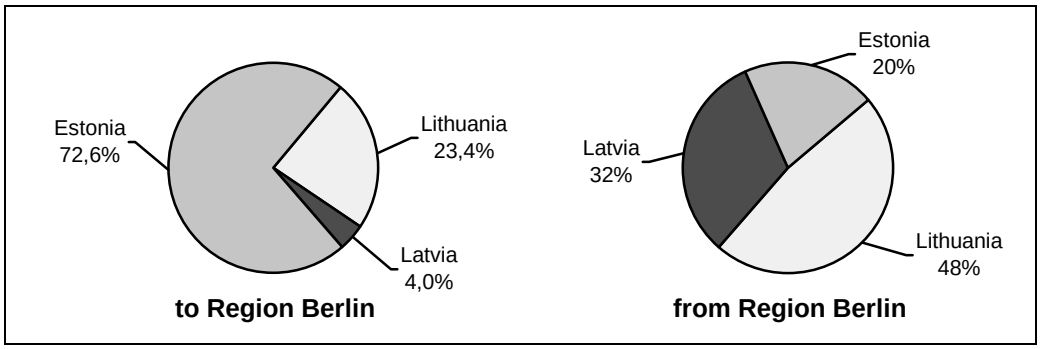

Figure 9. Freight flow distribution among LT/EE/LV and Berlin region in 2005

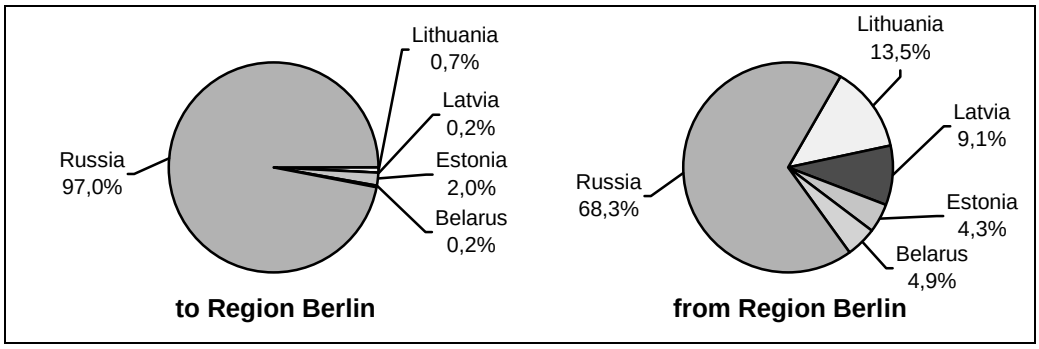

Figure 10. Freight flow between the so-called origin area and Berlin region in 2006

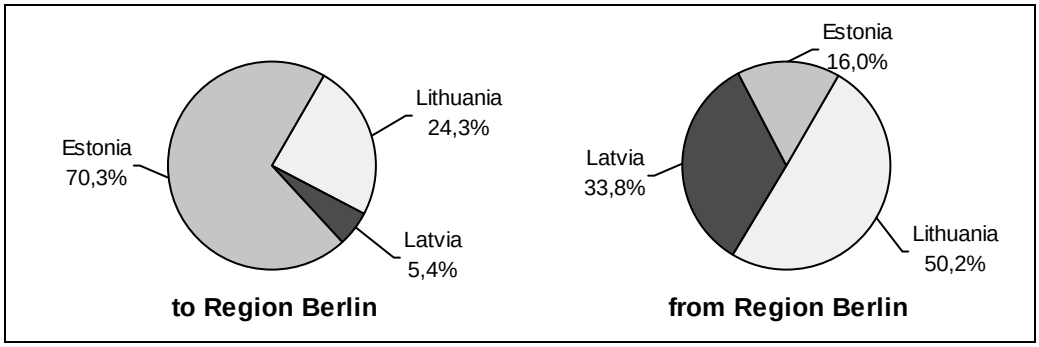

Figure 11. Freight flow distribution among LT/EE/LV and Berlin region in 2006

Cargo flow crossing Kalvariju (incl. Lazdiju) and Klaipeda Seaport

Table 5. Number of cargo vehicles

	2005	2006
Klaipeda Port [12, 13]	118492	147489
Lithuania/Poland Border*	649197	1462420
Total	767689	1609909

*Data from Ministry of Transport and Communication of Lithuania

*Data including Kalvariju and Lazduoju Boeder Check points

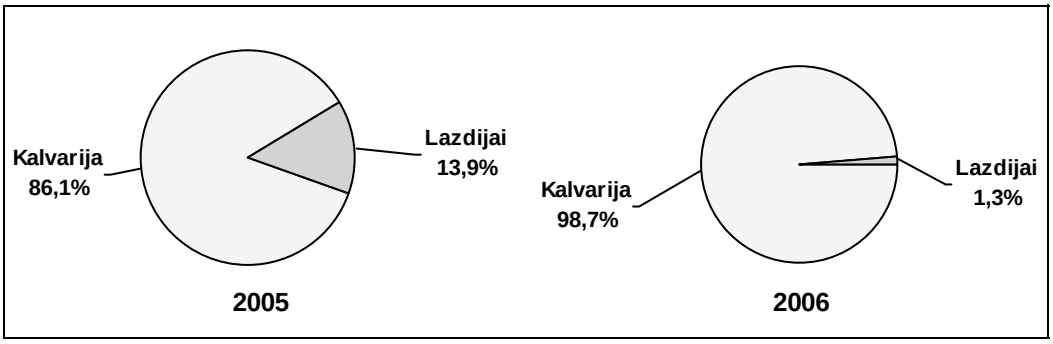

Figure 12. Cargo vehicles crossing Kalvariju and Lazdiju check points in 2005 and 2006

Table 6. Cargo vehicles registered in Russia and Belarus crossing Kalvariju (incl. Lazdiju) check points*

	2005			2006		
	Russia	Belarus	Total	Russia	Belarus	Total
Total	14395	5162	649197	35481	12114	1462420

*Data from Ministry of Transport and Communication of Lithuania

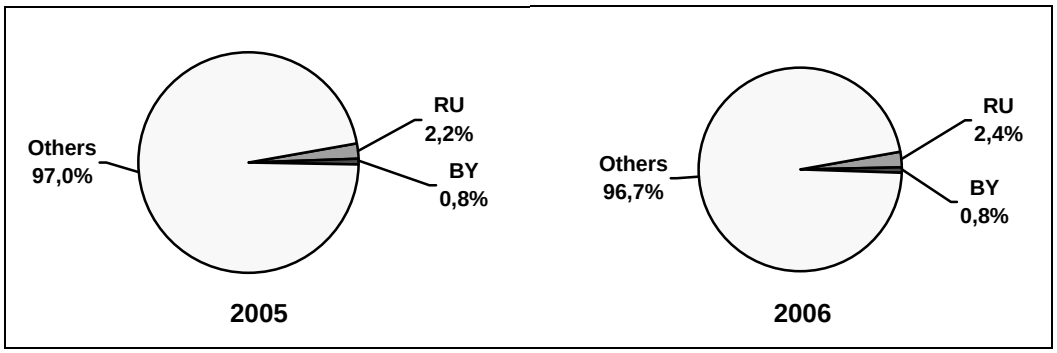

Figure 13. Cargo vehicles registered in Russia and Belarus crossing Kalvariju (incl. Lazdiju) check points

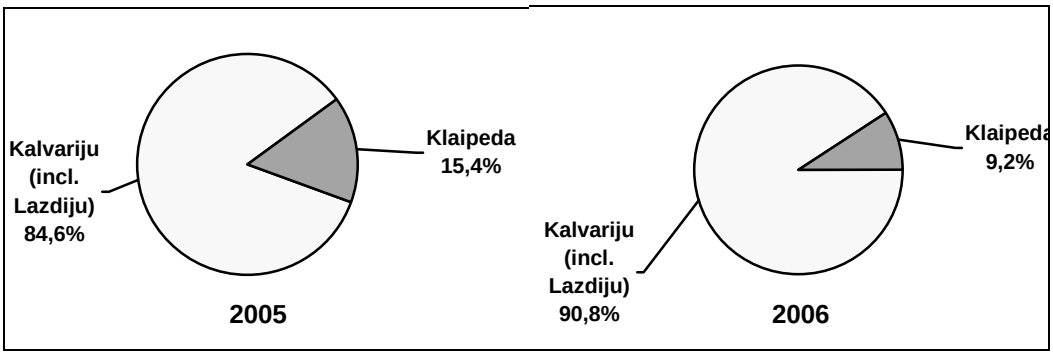

Figure 14. Cargo vehicles crossing Kalvariju (incl. Lazdiju) and Klaipeda check points

Table 7. Cargo flow by roads between Lithuania and Germany [12, 13]

In thousand tons	2005	2006
Loaded to Germany	579,9	667,3
Unloaded from Germany	668,4	776,8
Total	1248,3	1444,1

Cargo flow crossing Klaipeda Sea port to and fro Germany

Table 8. Cargo flow crossing Klaipeda Seaport to and fro Germany [12, 13]

In thousand tons	2005	2006
To Germany	2073,9	2065,7
From Germany	1517,0	1829,7
Total	3590,9	3895,4

Table 9. Cargo flow carried in vehicles crossing Klaipeda Sea [12, 13]

In thousand tons	2005	2006
To Germany	694,8	876,8
From Germany	909,4	1127,8
Total	1604,1	2004,5

*13,6 m trailers mostly

Table 10. Number of cargo vehicles crossing Klaipeda Sea to and fro Germany [12, 13]

In units	2005	2006
To Germany	54346	68059
From Germany	64146	79430
Total	118492	147489

Table 11. Average neto weight of cargo per vehicle crossing Klaipeda Sea to and fro Germany

In tons	2005	2006
To Germany	12,78	12,88
From Germany	14,18	14,20
Total	13,54	13,59

Table 12. Containers flow crossing Klaipeda Sea to and fro Germany [12, 13]

In TEU	2005	2006
To Germany	40596	44116
From Germany	60587	60422
Total	101183	104538

Evaluation of distribution of the cargo flows. The most significant transport flows between Russia and the EU are directed through the central ports of the Baltic Sea (the Gulf of Finland and the Baltic countries). The ground transport route through Byelorussia, Poland and Germany has a very modest role [7, 11]. The significance of this route will not be great in the future either due to barriers caused by the infrastructure and public authority activities in Byelorussia.

Evaluation of cargo flows via Klaipeda and Kalvariju (incl. Lazdiju)

Because there is no data accessible for Klaipeda and Kalvariju it could be calculated on simply proportional basis.

The whole flow F_{WhB} between the so-called Region Berlin and check points Klaipeda&Kalvariju (incl. Lazdiju) could be assumed as:

F_{LtB} – the sum of goods imported and exported from/to Lithuania to/from Region Berlin and

F_{CrB} – Lithuania cross trade flow between the so-called Region Berlin and Latvia, Estonia, Russia and Belarus.

Seeking to estimate cross trade flow is pragmatic to use the proportion between Lithuanian import, export and cross-trade expressed in tons.

Table 13. Import, export and transit by road in Lithuania [12, 13]

In thousand tons	2005	2006
Import Lithuania	2657,0	3164,37
Export Lithuania	3313,8	3705,06
Transit Lithuania	3403,5	4239,97

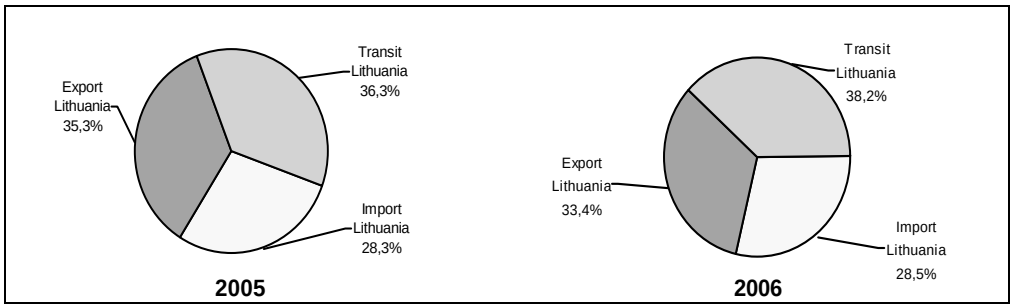

Figure 15. Distribution of international Lithuania related freight flow by road transport [12, 13]

36,3 percent in 2005 and 38,2 percent in 2006 international road traffic flow in Lithuania was transit or cross-trade based.

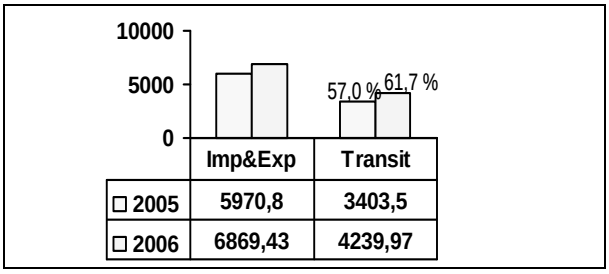

Figure 16. Share of transit comparing to import and export in Lithuania by roads [12, 13]

The share of transit comparing to import and export in Lithuania by roads could be expressed as transit coefficient $T_{coef.}$.

So total freight flow between the so-called Region Berlin and check points Klaipeda&Kalvariju (incl. Lazdiju) in both directions could be expressed as:

$F_{CrB} = F_{LtB}$ x $T_{coef.}$

$F_{WhB} = F_{LtB} + (F_{LtB}\ x\ T_{coef})$

$F_{WhB} = F_{LtB}$ x $(1 + T_{coef})$

Thus

$F_{LtB} = F_{LtBE} + F_{LtBI}$,

where

F_{LtBE} - export from Lithuania to the so-called Region Berlin;

F_{LtBI} – import to Lithuania from the so-called Region Berlin.

Consequently –

in 2005: $F_{LtB} = F_{LtBE} + F_{LtBI}$ = 120,13+38,13 = 158,26 thousand tons;

in 2006: $F_{LtB} = F_{LtBE} + F_{LtBI}$ = 130,72 + 60,01 = 190,73 thousand tons;

in 2005: F_{WhB} = 158,26 x (1+0,570) = 248,47 thousand tons;

in 2006: F_{WhB} = 190,73 x (1+0,617) = 308,41 thousand tons.

And

F_{CrBE} – export from Estonia, Latvia, Russia and Belarus to the so-called Region Berlin via Klaipeda&Kalvariju (incl. Lazdiju);

F_{WhBI} – import to Estonia, Latvia, Russia and Belarus from the so-called Region Berlin via Klaipeda&Kalvariju (incl. Lazdiju);

$F_{CrB} = F_{CrBE} + F_{crBI}$

Evaluated Latvian, Estonian and Belarus export/import proportion to/from the so-called Region Berlin are 7,39/1 in 2005 and 5,38/1 in 2006. Because of big number of Russian crude oil export the Russia export and import was not be taken in to account seeking to avoid an error.

F_{WhBE} – whole flow crossing check points Klaipeda&Kalvariju (incl. Lazdiju) to the so-called Region Berlin

F_{WhBI} – whole flow crossing check points Klaipeda&Kalvariju (incl. Lazdiju) from the so-called Region Berlin.

$F_{WhB} = F_{WhBE} + F_{WhBI}$

$F_{WhBE} = F_{LtBE} + F_{CrBE}$

$F_{WhBI} = F_{LtBI} + F_{CrBI}$

In 2005: $F_{CrBE} / F_{CrBI} = 7{,}39$
In 2006: $F_{CrBE} / F_{CrBI} = 5{,}38$
In 2005: $F_{CrBI} = F_{CrB} - F_{crBE} = F_{crB} - (7{,}39 \times F_{CrBI}) = F_{crB} / 8{,}39 = F_{LtB} \times T_{coef} / 8{,}39 = (F_{LtBE} + F_{LtBI}) \times T_{coef} / 8{,}39$ =(120,13+38,13) x 0,570 / 8,39 = 10,75 thousand tons
In 2006: $F_{CrBI} = F_{CrB} - F_{crBE} = F_{crB} - (5{,}38 \times F_{CrBI}) = F_{crB} / 6{,}38 = F_{LtB} \times T_{coef} / 6{,}38 = (F_{LtBE} + F_{LtBI}) \times T_{coef} / 6{,}38$ =(130,72+60,01) x 0,617 / 6,38 = 18,44 thousand tons
In 2005: $F_{CrBE} = F_{CrB} - F_{CrBI} = F_{LtB} \times T_{coef} - F_{CrBI} = (F_{LtBE} + F_{LtBI}) \times T_{coef} - F_{CrBI}$ = (120,13+38,13) x 0,570 – 10,75 = 79,46 thousand tons
In 2006: $F_{CrBE} = F_{CrB} - F_{CrBI} = F_{LtB} \times T_{coef} - F_{CrBI} = (F_{LtBE} + F_{LtBI}) \times T_{coef} - F_{CrBI}$ = (130,72+60,01) x 0,617 – 18,44 = 99,24 thousand tons
In 2005: $F_{WhBE} = F_{LtBE} + F_{CrBE}$ = 120,13 + 79,46 = 199,59 thousand tons
In 2006: $F_{WhBE} = F_{LtBE} + F_{CrBE}$ = 130,72 + 99,24 = 229,96 thousand tons
In 2005: $F_{WhBI} = F_{LtBI} + F_{CrBI}$ = 38,13 + 10,75 = 48,88 thousand tons
In 2006: $F_{WhBE} = F_{LtBI} + F_{CrBI}$ = 60,01 + 18,44 = 78,45 thousand tons
The next task is to analyse the freight flow distribution between Klaipeda and Kalvariju (incl. Lazdiju). Two Ro-Ro ferry lines are operated by DFDS Lisco Company: (a) Klaipeda-Kiel and (b) Klaipeda-Sassnitz.

Table 14. Lithuanian-Germany Ro-Ro freight

	2005	2006
In loading meters [8]		
Klaipeda-Kiel	718161	870451
Klaipeda-Sassnitz	54257	66122
Total	772418	936573
Average number of loading units		
Klaipeda-Kiel	43525	52755
Klaipeda-Sassnitz	3288	4007
Total	46813	56762
Average netwt (net weight) of freight in cargo vehicles in thousand tons		
Klaipeda-Kiel	587,59	717,46
Klaipeda-Sassnitz	44,39	54,50
Total	631,98	771,96

According to calculation of loading meter by DFDS Lisco, trailer is equate to 14 loading meters, and the truck&trailer is equate to 17 loading meters. The share of trailers without truck is 15-20 %. So the average length of transport unit is 16,5 meters.

Table 15. Total Ro-Ro freight loaded/unloaded in cargo vehicles in Klaipeda [12, 13]

	2005	2006
In thousand tons (without vehicles weight)		
Loaded	694,8	876,8
Unloaded	909,4	1127,8
Total	1604,1	2004,5
In units (vehicles)		
Loaded	54346	68059
Unloaded	64146	79430
Total	118492	147489
Average weight per unit (in tons)		
Loaded	12,8	12,9
Unloaded	14,2	14,2
Total	13,5	13,6

Table 16. Ro-Ro freight loaded/unloaded in cargo vehicles in Klaipeda in Sassnitz link

	2005	2006
Total Ro-Ro freight from Klaipeda	43 %	44 %
Total Ro-Ro freight to Klaipeda	57 %	56 %
Klaipeda-Sassnitz total	44,39	54,50
From Klaipeda	19,09	23,98
To Klaipeda	25,30	30,52

The evaluation of distances and routing peculiarities as well as notes of transport operators let us to formulate assumption that the flow via Sassnitz is related to the so-called Region Berlin. The flow via Kiel is related to the are outside the so-called Region Berlin. So having common freight flow from and to the so-called Region Berlin via Klaipeda and Kalvariju (incl. Lazdiju) and having separated freight flow via Klaipeda we calculated the part of flow via Kalvariju (incl. Lazdiju).

F_{KlBE} – flow crossing check point Klaipeda to the so-called Region Berlin,

F_{KlBI} – flow crossing check point Klaipeda from the so-called Region Berlin,

F_{KaBE} – flow crossing check point Kalvariju (incl. Lazdiju) to the so-called Region Berlin,

F_{KaBI} – flow crossing check point Kalvariju (incl. Lazdiju) from the so-called Region Berlin.

$F_{WhBE} = F_{KlBE} + F_{KaBE}$

$F_{WhBI} = F_{KlBI} + F_{KaBI}$

In 2005: $F_{KaBE} = F_{WhBE} - F_{KlBE}$ = 199,59 – 19,09 = 180,50 thousand tons

In 2006: $F_{KaBE} = F_{WhBE} - F_{KlBE}$ = 229,96 – 23,98 = 205,98 thousand tons

In 2005: $F_{KaBI} = F_{WhBI} - F_{KlBI}$ = 48,88 – 25,30 = 23,58 thousand tons

In 2006: $F_{KaBI} = F_{WhBI} - F_{KlBI}$ = 78,45 – 30,52 = 47,93 thousand tons

Conclusions

The so-called Region Berlin is defined as territory of three Federal Land of Germany – Berlin, Brandenburg and Mecklenburg-Vorpommenrn. The freight flow via check point Kalvariju is assumed as freight flow via cross border points Kalvarijų as well as Lazdiju.

Freight flow **via Klaipeda port and Kalvariju** check point (incl. Lazdiju) **to the so-called region Berlin** defined as destination point in which freight has been unloaded is as follows:

in 2005 – 199,59 thousand tons (**14,78 thousand trailers annually, ~40 per day)**;

in 2006 – 229,96 thousand tons **(16,91 thousand trailers annually, ~46 per day).**

Freight flow **via Klaipeda** port **to the so-called region Berlin** defined as destination point in which freight has been unloaded is as follows:

in 2005 – 19,09 thousand tons (**1,41 thousand trailers annually, ~4 per day)**;

in 2006 – 23,98 thousand tons (**1,76 thousand trailers annually, ~5 per day)**.

Freight flow **via Kalvariju** check point (including Lazdiju) **to the so-called region Berlin** defined as destination point in which freight has been unloaded is as follows:

in 2005 – 180,50 thousand tons (**13,37 thousand trailers annually, ~36 per day)**;

in 2006 –205,98 thousand tons (**15,14 thousand trailers annually, ~41 per day)**.

Freight flow **via Klaipeda port and Kalvariju** check point (incl. Lazdiju) **from the so-called region Berlin** defined as origin point in which freight has been loaded is as follows:

in 2005 – 48,88 thousand tons (**3,62 thousand trailers annually, ~10 per day)**;

in 2006 – 78,45 thousand tons (**5,77 thousand trailers annually, ~16 per day)**.

Freight flow **via Klaipeda** port **from the so-called region Berlin** defined as origin point in which freight has been loaded is as follows:

in 2005 – 25,30 thousand tons (**1,87 thousand trailers annually, ~5 per day)**;

in 2006 – 30,52 thousand tons (**2,24 thousand trailers annually, ~6 per day)**.

Freight flow **via Kalvariju** check point (including Lazdiju) **from the so-called region Berlin** defined as origin point in which freight has been loaded is as follows:

in 2005 – 23,58 thousand tons (**1,75 thousand trailers annually, ~5 per day)**;

in 2006 – 47,93 thousand tons (**3,52 thousand trailers annually, ~10 per day)**.

Seeking to check results the NEA Consulting Company was asked to provide freight flow in axe Kalvariju-Berlin. In year 2004 the flow in both directions consisted of 2,7-2,9 million tons (~**200 thousand trailers**). According to our calculation, the flow in axe Kalvariju-Berlin that are loaded and unloaded in the so-called Region Berlin consists of 248,47 thousand tons (**18,4 thousand vehicles**) in 2005 and 308,51 **(22,7 thousand vehicles)** in 2006. Consequently the share from **9 to 11** percent of freight flow in road axe Kalvariju-Berlin is **loaded and unloaded in the so-called region Berlin**. About 90 percent of that flows are originated or destinated in other Federal Lands of Germany as well as in Belgium, Luxemburg, Netherlands, North France, Spain, Portugal.

The existing freight flow between Kalvariju and Klaipeda cross border check point and the so-called Region Berlin is not enough for ferry line Klaipeda-Swinoujusce (**62 vehicle per day in both directions**).

The potential freight flow for ferry line Klaipeda-Swinoujusce is much wider than the flow crossing Kalvariju check point and Klaipeda Seaport. It is important to evaluate the Russian and Belarus

cargo on corridor II and freight which goes through neighbouring ports. Also attention should be paid on that fact, that the view to the **so-called Region Berlin as destination point is too narrow**. The freight could be delivered to other regions of Germany by Klaipeda-Swinoujusce ferry line, as well as to Berlin Region. The analysis of prices, time of delivery should be done for transit concept "Polen vs. Baltic Sea".

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THE COMPARISON OF COST REGIONAL PASSENGER TRANSPORTATION IN LITHUANIA RAILWAY AND ROAD TRANSPORT

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The railway and road transport are rival in the regional passenger transportation of the country.

The cost is a general index of passenger transportation. So, this article deals with the cost of the regional passenger transportation in the railway and road transport.

The cost is comparable to 1 passenger kilometres, according to train types and according to expense elements. There are described the factors influenced to the cost transportation in the vehicles in the given study.

Keywords: regional passenger transportation, railways and roads transport, train, bus, cost, route

1. Introduction

During the latter thirteen years the tariffs of local passenger railway transport have been constantly growing – if on 1 July 1993 the tariff was 1.6 Lithuanian cents (ct) per passenger/kilometre, so on 5 December 1999 it reached already 10 ct, and from 1 October 2006 it already grew to 20 ct at the 3rd class carriage and to 23 ct at the 2nd class carriage (with distance-related reduction).

The cost of long-distance passenger transportation by bus depends on the route, passenger flows at the route, bus type, and bus deterioration, salaries of drivers at the enterprise, fuel costs and other factors. Opinion polls showed that the cost of *1 bus/kilometre on long-distance routes fluctuates from 1.09 to 2.64 Litas (Lt)*.

2. Comparison of Tariffs of Passenger Transportation in Lithuania by Rail and by Road

The policy of costs has a direct influence on passenger flows, as the passenger transportation market is very sensitive to the proposed cost of service. Due to the increased tariffs of railway transport on 1st October, 2006, the passenger flows in June 2007, if compared with June 2006, decreased in certain sections from 14 % (Vilnius–Kaunas section) even up to 30 % (Vilnius–Kena and Radviliskis–Klaipeda sections).

If *in railway transport local tariff is applied on the whole territory of Lithuania* (except international trains), so *in road transport there are two tariffs – local/suburban* (related to the transportation on the territory of one municipality, and in certain cases on the territories of two adjacent municipalities) and *long-distance transportation tariff* (related to transportation on the territories of more than two municipalities).

The tariff of long-distance passenger transportation by regular routes in road transport has also been growing:

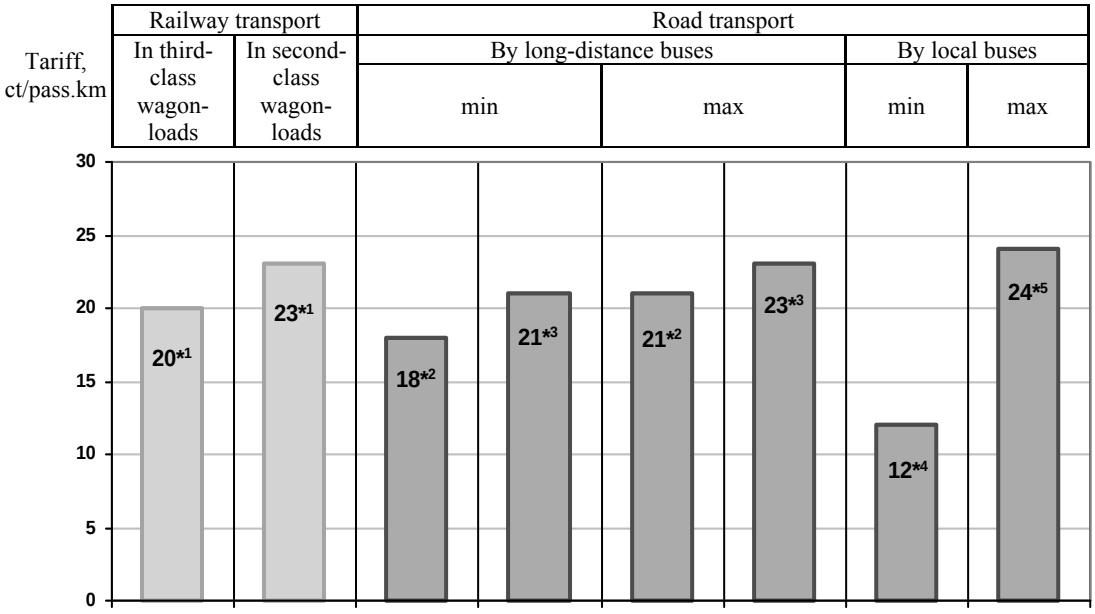
- In 1997 m. the tariff of long-distance passenger transportation by coach buses made 10 ct per passenger/km, in 2000 – 12.5 ct (with further reduction according to the distance of transportation), and on 2nd August, 2007 the tariff grew up to 21-23 ct (comparing with 1997 it grew by 2.1-2.3 times);
- In 1997 m. the tariff of long-distance transportation by buses with hard seats was 8 ct per passenger/km, in 2000 it grew up to 12.5 ct (with further distance-related reduction), and on 2nd August, 2007 the tariff grew to 18-21 ct (comparing with 1997 it grew by 2.25-2.63 times).

In 2000 the least tariff of local passenger transportation by road (suburban routes) was in Siauliai – 11 ct per passenger/km; however the highest tariff was in Pasvalys – 18 ct. The least tariff in 2007 was in

Vilnius district – 12 ct (it grew only by 1.09 times, if compared with the year 2000); the highest tariff then was in Kretinga district – 24 ct (it grew by 1.33 times, if compared with 2000). It should be noted that in 2007, in many districts the maximum tariff made 18 ct (as much as it was in Pasvalys in 2000), and in other districts it was even less considerable – 15-17 ct (Klaipeda, Siauliai, Panevezys, Kedainiai, Rokiskis).

It should be also noted that the tariff of local passenger transportation by railway routes in 2000 was less than the local passenger transportation by long-distance buses (respectively 10 ct and 12.5 ct per passenger/km) and also less than local/suburban passenger transportation by bus (relatively 10 ct and 11–18 ct per passenger/km).

The comparison of tariffs of passenger transportation by railway transport and by road transport is presented on Figure 1.



Remark: *1 – reduction by drive distance;
*2 – by buses with hard seats (without VAT);
*3 – by buses with soft seats (without VAT);
*4 – in Vilnius region;
*5 – in Kretinga region.

Figure 1. The comparison of tariffs at passenger transportation by road and railway, ct/pass.km

– It should be noted that in 2007 passenger transportation tariffs for longer distances were similar both in road and railway transport:

– In railway transport the local transportation tariff at 3rd class carriages is 20 ct per passenger/km (with distance-related reduction), and in long-distance road transportation by simple type buses the tariff fluctuates between 18 ct and 21 ct;

– In railway transport the local transportation tariff at the 2nd class carriage is 23 ct per passenger/km (with distance-related reduction), and in road transport the tariff of long-distance transportation by coach buses fluctuates between 21 ct and 23 ct.

3. Comparison of Passenger Transportation Cost in Road and Railway Transport

The cost of local passenger transportation has considerably increased within the period of 2000-2002 – it grew from 33.36 ct per 1 passenger/km to 48.922 ct, i.e. by 1.47 times. In 2004 the cost decreased and made 47.118 ct, and in 2006 it grew insignificantly – to 49.177 ct. During the period of 2002–2006 the cost grew only by 0.5 %. ***So it can be stated that during the period of 2002-2006 the Lithuanian Railways managed to stabilise the transportation cost of 1 passenger/km.***

It is reasonable to review the components of local transportation cost formation according to the elements of costs.

The most considerable part of cost in local passenger transportation consists of salaries; however within the period of 2000 to 2006 their share receded from 40.2 % to 27.4 %. ***Nevertheless, amortization accountancy has considerably increased – during the mentioned period it increased from 16.5 % to 21.7 % and makes the second largest part of the cost.***

The third largest part of the cost consists of miscellaneous expenses – their share grew from 4.3 % to 15.2 %. The fourth largest part is the fuel – its share decreased from 15.3 % to 10.1 %.

Aging rolling-stock raised the capital repair costs – their share in the cost grew from 2.3 % to 9.3 %. Social insurance share is also large – it has increased from 12.6 % to 15.2 %.

It should be noted that high infrastructure charges are characteristic to railway transport. One third of the cost in passenger transportation belongs to infrastructure costs, which influences the transportation cost, while in road transport there are no infrastructure charges for carriers.

The opinion poll carried out by the authors at various enterprises showed that the cost of long-distance passenger transportation by bus depends on the route, the passenger flow on the route, the bus type and its deterioration degree, drivers' salaries at companies, fuel costs and other factors. *The poll demonstrated that the cost of 1 kilometre on long-distance bus routes fluctuates from 1.09 to 2.64 Lt*.

The largest share of passenger transportation by long-distance buses belongs to the amount of fuel – even 27.4 %, then goes the amount of salaries – 16.7 %, in the third place is the degree of bus deterioration – 12.3 %, indirect production costs – 10.9%, general and administrative costs – 9.9 %, spare parts – 7.1 %, social insurance instalments – 4.5 %, etc. (according to the data of one of the largest national passenger transportation company).

Conclusions

1. The cost of local passenger transportation has considerably increased within the period of 2000-2002 – it grew from 33.36 ct per 1 passenger/km to 48.922 ct, i.e. by 1.47 times. In 2004 the cost decreased and made 47.118 ct, and in 2006 it grew insignificantly – to 49.177 ct. During the period of 2002-2006 the cost grew only by 0.5 %. So it can be stated that during the period of 2002-2006 the Lithuanian Railways managed to stabilise the transportation cost of 1 passenger/km.
2. The most considerable part of cost in local passenger transportation consists of salaries; however within the period of 2000 to 2006 their share receded from 40.2 % to 27.4 %. Nevertheless, amortization accountancy has considerably increased – during the mentioned period it increased from 16.5 % to 21.7 % and made the second largest part of the cost.
3. The cost of long-distance passenger transportation by bus depends on the route, the passenger flow on the route, the bus type and its deterioration degree, drivers' salaries at companies, fuel costs and other factors. The poll demonstrated that the cost of 1 kilometre on long-distance bus routes fluctuates from 1.09 to 2.64 Lt.
4. It should be noted that railway transport requires large infrastructure charges. One third of the cost of passenger transportation by rail consists of infrastructure costs, thus causing the increase of transportation cost, while in road transport there are no infrastructure charges for carriers.

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URBAN TRANSPORT SYSTEM AUDIT: REVIEW OF METRIC SYSTEM, METHODS AND PROBLEMS

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Urban transportation systems can be evaluated in various ways reflecting different perspectives concerning users, modes, land use, transport problems and solutions, as well as the means of measuring transport activity and the type of the used performance indicators.

As concerns the user the transport system is characterized by the following properties of transport system: mobility, accessibility and reliability. There exist various approaches and methods for estimating the given characteristics. Several indicators and the indices describing properties of the transport system that can be calculated by means of various approaches and methods are described in the article.

The purpose of the given article is the review of existing methods of the city transport system performance estimation from the user's point of view as well as the evaluation of mobility, accessibility and reliability. The article mentions the problems, which arise in the process of estimating the urban transport system's efficiency.

Keywords: transport system, performance measures, reliability, mobility, accessibility, data

1. Introduction

The purpose of each transport system is to satisfy the requirements of inhabitants for travelling. Everywhere the transport systems should support the relative balance between the speed of movement, on the one hand, and accommodation of habitation and visited objects, on the other, i.e. should provide connectivity, unity of city as those [1]. All urban transport systems are aimed at the direction of fuller satisfaction of needs of the population, however, social and transport mobility of the population is non-uniform and speed of development of transport system in the different countries is various due to different conditions of economy and a level of social development.

Management and planning of the urban transport system demands the exact representation both of the requirements of the population for trips and of the system in general.

Researchers and managers are interested in the concrete, quantitatively certain answers to questions to what extent the transport system of the concrete city is developed today. How is it he developing? Is it meeting the demands of the population? What are the results of its comparison to the transport systems of other cities?

The question of comparison requires the development of the methodology of comparison. To compare, it is necessary to consider the distinctions of cities as to population, topography, development of economy, ethnic structure of the population and many other things [1].

At the end of the last century there appeared the new term – the urban transport audit. The urban transport audit is the estimation of conformity of the urban transport system and its subsystems to the purposes of strategy of the city development and requirements of the population [2]. The urban transport audit is a combined process, the analysis and the complex estimation of the information on transport system and its subsystems with the purpose of developing the recommendations on the perfection of their working capacity.

To carry out the audit of the transport system it is a necessary to observe the general principles of audit:

- conformity of the reports on transport systems of cities to the certain standard;
- accuracy of the reports on transport systems;
- conformity of the transport systems of cities to norms, specifications, criteria and acts;
- conformity of the parameters of profitability and the efficiency to the established criteria [2].

The urban transport audit, as well as any other audit, has some chains (algorithms) of consequent steps in the basis [2] (see Fig. 1):

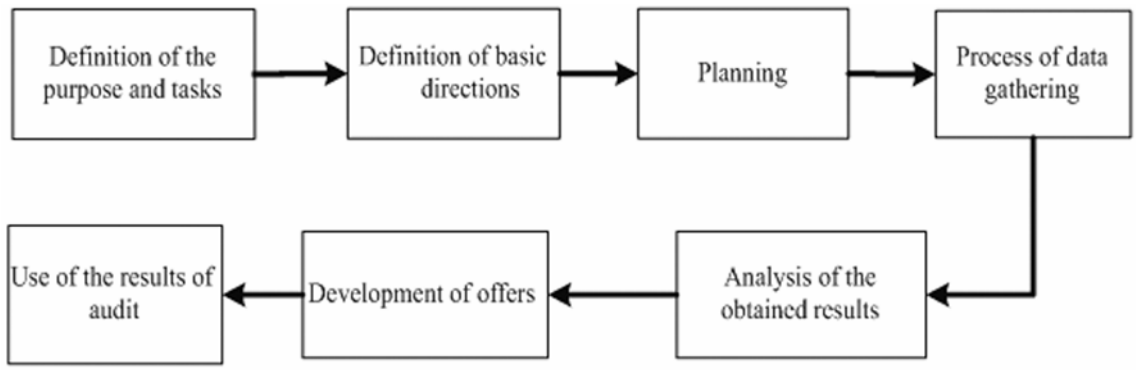

Figure 1. Procedure of audit

1. Definition of the purpose and tasks of audit should be established.
2. Definition of the basic directions: carrying out the inspections, calculations and analysis of the parameters describing the working capacity of subsystems.
3. Development of the plan of carrying out the audit: definition of the information on the financial and regular resources, a technique of inspections.
4. Organization of the work: gathering materials and carrying out inspections, grouping the received data.
5. Analysis of the obtained results: revealing the positive and negative sides and their reasons, revealing the prime directions of increasing the working capacity of the urban transport system.
6. Working out the offers on the development of the urban transport system.
7. Use of results of audit for the work of municipal bodies.

Thus, one of the main moments is gathering and processing the necessary data about the urban transport system. At first, it is necessary to develop methodology of data gathering for successful systematic realization of this sequence of actions. Also, the essence of the data, their quantity and the measurement moments depending on the indicators of the development of transport system, will be designed and analysed. So, definition of such set of the indicators reflects the level of development of the urban transport system, being one of the key problems of audit of the transport system.

For reviewing the different approaches to decision of the urban transport system problem some developed countries was choose at first, for example, in the North-American continent: in the United States of America and in Canada. In Australia and New Zealand the indicators and indices of performance of the urban transport system are developed as well and will be reviewed also. Last years the urban audit has been widely used in Europe, few research projects that concerned have been fulfilled [7-9].

2. Different Approaches to the Estimation of the Urban Transport System

The urban transport system can be estimated from the various points of view: from the point of view of traffic, of the mobility of the population, of the availability and land-use (see Fig. 2).

Thus, it is possible to distinguish between the following ways of measurement:

- **Traffic-based** measurements evaluate the motor vehicle movement;
- **Mobility-based** measurements evaluate the person and freight movement;
- **Land-use-based** measurements evaluate the efficiency of land-use;
- **Accessibility-based** measurements evaluate the ability of people and businesses to reach desired goods, services and activities.

The urban transport systems can be evaluated in various ways reflecting different perspectives concerning estimation objects, measurement of the transport activity and the type of performance indicators used, data sources, transport problems and solutions (Table 1).

Table 1. Different approaches to the estimation of the urban transport system

Approach	Main object	Measures	Data source	Problems	Solutions connected with
Traffic	vehicles movement	motor vehicle registrations; drivers' licences; traffic volumes; traffic speeds; roadway level of service, congestion delay, parking supply, vehicle operating costs and crash rates.	Traffic count	congestion, risk, cost	increase road and parking capacity, roadway traffic speeds, vehicle ownership and the affordability of driving
Mobility	movement of people or goods	person-miles; ton-miles; travel time; trip mode; travel speeds; transit vehicle speeds	Household Travel survey; Traffic count	constraints on physical movement	motor vehicle system capacity and speed; road and parking facility improvements; transit and ridesharing improvements; high-speed trains, aviation and intermodal connections
Land use	location of the attraction point	density; locating different types of activities; non-motorized conditions; work connection	Land-use surveys	congestions, pollution of the environment	more accessible land use; parking development; location of the attraction point; pollution of the environment
Accessibility	ability to reach desired goods, services, activities	time, money, discomfort and risk (the generalized cost) required to reach opportunities.	Household Travel survey; On-board survey; Interviews;	cost, barrier, risk that prevents people from reaching desired opportunities.	traffic improvements; mobility improvements; mobility substitutes; more accessible land use.

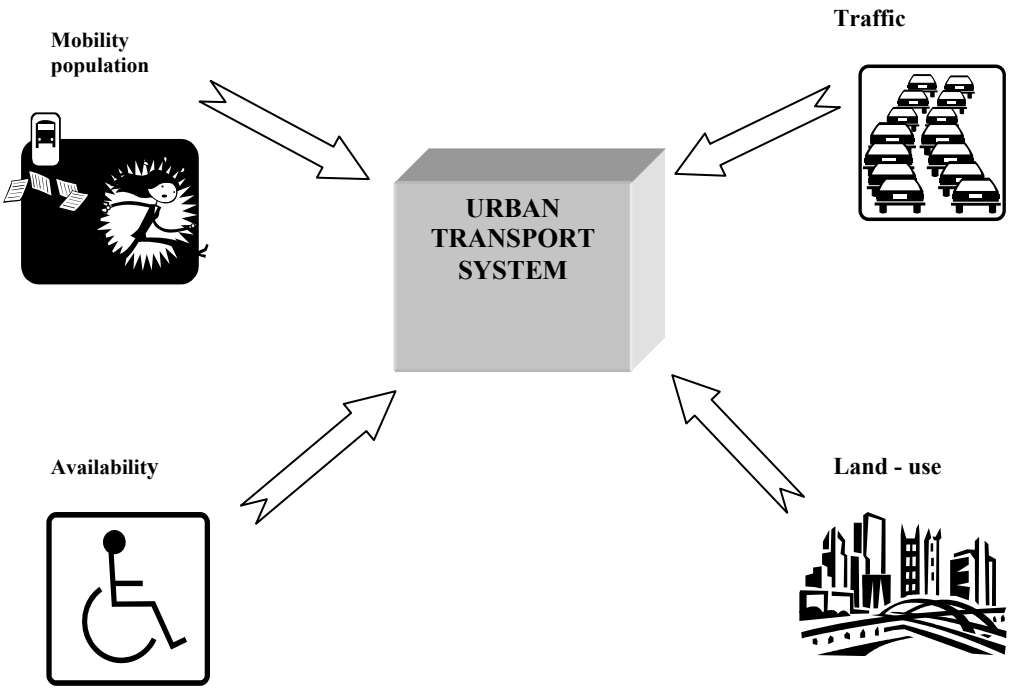

Figure 2. Different points of view on the estimation of the urban transport system

3. USA: Urban Mobility Report

The results of the urban transport system audit in the USA are published annually in the document - Urban Mobility Report [4], which uses data from federal, state, and local agencies to develop estimates of congestion and mobility within an urban area. The audit procedures have been developed by the Texas Transportation Institute. This methodology yields a quantitative estimate of the urbanized area mobility levels, utilizing generally available data, while minimizing the need for extensive data collection. The methodology primarily uses the Federal Highway Administration's Highway Performance Monitoring System (HPMS) database, with supporting information from various state and local agencies. The HPMS database is used because of its relative consistency and comprehensive nature. State departments of transportation collect, review, and report the data annually. Since each state classifies roadways in a slightly different manner, Texas Transportation Institute reviews and adjusts the data to make them comparable and then state and local agencies familiar with each urban area review the data.

The methodology consists on the determination the values which are divided on the constant values, variables and the main performance measures of the mobility:

1. *National Constants* - values used in all urban areas to estimate the effect of congestion. National Congestion Constants include: Vehicle Occupancy, Working Days Percent of Daily Travel in Peak Periods, Average Cost of Time, and Commercial Vehicle Operating Cost.
2. *Urban Area Constants and Inventory Values* - in addition, four urbanized areas or state specific values were identified and used in the congestion cost estimate calculations: Daily Vehicle-Miles of Travel, Population and Peak Travellers, Fuel Costs, Truck Percentage.
3. *Variables and Performances Measures* are presented in Table 2.

The basis for calculation all of these variables is connected with time spent on trips, speed of trips and the delay. The infrastructures of cities as well as the trips made on foot are not considered. Public, individual and the truck transport are considered as a single whole. The given report does not include the purpose of trips and requirement for trips, so the concepts of availability of the transport system and mobility of the population are not considered. Parameters of safety of the transport system are not included also. The transport system is examined only from the point of view of the traffic

Table 2. Variables and Performance Measures from the Urban Mobility Report of the USA

Variable and Performance Measure	Descriptions
Roadway Congestion Index (RCI)	the measure of vehicle travel density on major roadways in the urban area
Percent of Daily Travel in Congested Conditions	the ratio of daily traffic volume to the number of lane-miles of arterial street and freeway—to estimate the length of the peak period.
Travel Speed	the average speed for each element of the road system - is multiplied by the amount of travel on that set of roads
Travel Delay	the amount of the extra time spent in travelling due to congestions
Incident-Related Travel Delay	used to estimate incident delay
Annual Person Delay	the measure of the extra travel time endured by persons who make trips during the peak period
Travel Time Index	illustrates the comparison of the peak period travel time to the free-flow travel time
Wasted Fuel	the wasted fuel due to vehicles moving at speeds slower than free-flow during the peak period travel
Congestion Cost	combines the cost due to travel delay and wasted fuel to determine the annual cost due to congestion resulting from incident and recurring delay.
Percent of the Congested Cost	the percentage of travel in each urban area that is congested both for peak travel and daily travel

4. Canada: Urban Transport Indicators

In Canada for the first time the urban transport system investigation was fulfilled in 1994 on the basis of the data of 1991. The given survey was carried out by the Transportation Association of Canada (TAC). In 1999 TAC conducted a survey of 18 Canadian cities and by tabulating and interpreting the results regarded some 30 indicators measuring progress in achieving sustainable transportation. Indicators were subdivided into two groups: Quick Facts on Conventional Transit Service и Quick Facts on Specialized Transit Service [5].

Quick Facts on Conventional Transit Service: Number of Transit Systems Reporting, Number of Service Routes, Ridership (Regular Service Passengers), Boarding, Total Vehicle Kilometres, Total Vehicle Hours, Total Direct Operating Expenses, Total Operating Revenues, Total Employees, Energy Consumption, Diesel Fuel (million L), Bio-Diesel/E-Diesel (million L), Electricity (million kwh), Natural Gas (million m^3), Active Revenue Vehicles, Buses, Light Rail Vehicles, Heavy Rail Vehicles, Commuter Rail Vehicles.

Quick Facts on Specialized Transit Service: Number of Transit Systems Reporting, Rider-ship (Total Passengers), Total Vehicle Kilometres (dedicated service), Total Vehicle Hours (dedicated service), Total Operating Expenses, Total Operating Revenues, Active Revenue Vehicles, Total Employees.

Nowadays the Canadian system of the estimation of the transport system performance includes some approaches. The urban transport system is examined both from the point of view of the traffic, and from the point of view of expenses. But the greatest role in calculation of indicators is played by data on transit of passengers.

The estimation system of the urban transport system in Canada does not have measures of the delay and the congestions; influence on environment, there is no information about incidents. The used indicators do not open a current condition status of the urban transport system and only consider the urban transport system as transit transport system.

5. Australia: Austroads National Performance Indicators

Austroads National Performance Indicators reports benchmarking performance data for the road system and road authorities in Australia and New Zealand [6]. In 1993, Austroads defined the role and key outcomes of the road system, and from this sought to develop and implement a rigorous set of national performance indicators for the road system and road authorities. The indicators were selected following the exhaustive process of consultation with stakeholders including the road transport industry. They represent the economic, social, safety and environmental performance of the road system and road authorities. The printed reports were first published in 1995; the first web report has appeared in 2002. Austroads Council endorsed a full review of the National Performance Indicators, which were completed in January 2005. Indicators are subdivided into 10 groups:

1. *Road safety.* The Road Safety Performance Indicators measure road safety performance. They are based on the levels of serious road traumas - persons killed, persons hospitalised and serious injury crashes. The indicators measure safety in terms of rates per population and rates per travel. The former reflects the relative health risk to the community while the latter the risk based on travel exposure. The indicators also include the estimates of the costs of serious casualty crashes to the community per capita and per million vehicle-kilometre bases.
2. *Registration and licensing.* User Transaction Efficiency - monitor operational efficiency of maintaining registers of drivers and vehicles.
3. *Asset management.* It represents two kinds of indicators. The first – Road Maintenance Effectiveness – monitor cost effectiveness of road authorities' maintenance function. The second – Smooth Travel Exposure – to monitor whether roads are providing acceptable travel conditions. The proportion of travel undertaken each year on roads with conditions above the targeted conditions for those roads
4. *Environmental.* Include *Greenhouse Gas Emissions, Total Road Transport Greenhouse Gas Emissions, and Traffic Noise Exposure.*
5. *Object assessment.* Includes the following indicators: Return on Construction Expenditure – monitor the predicted community benefits from the road transport and traffic authority programs; Achievement Index – monitor the ability to predict community benefits and road authority costs; Non-Road Interventions – a summary of the economic returns from any non-road interventions involving major changes to policy, legislation or gazetted regulations so that the community, having the confidence in these interventions, possessed positive community outcomes.
6. *Travel speed*: Actual Travel Speed (AM, PM, Off Peak, AllDay), Nominal Travel Speed, Congestion Indicator, Variability of Travel Time.
7. *Lane occupancy rate*. Lane Occupancy Rate (Persons, Freight) (AM, PM, Off Peak, AllDay), Car Occupancy Rate
8. *User cost distance*. The purpose of those indicators is to provide the guidelines and outline procedures in providing the various users cost distance performance indicators on behalf of all States and Territories. *User Cost Distance Performance Indicators* show the cost of the users travelling and moving freight per unit of distance travelled. The data for the passenger's car indicator is provided by the NRMA. The other indicators are based on the data collected in the shadow shop surveys and represent the estimated cost of moving freight on the representative network.
9. *User satisfaction index* – the purpose of those indicators is to provide a qualitative measure of road users' perceptions of the performance of the road system
10. *Consumption of road, transport, freight and fuel* – the purpose of those indicators is to provide the indicator showing road transport consumption levels and changes over time. This indicator has the goal of understanding the extent of road-based transport need in socio-economic activities. Road transport consumption is graphed for separate periods in time to indicate changes and trends in road transport consumption.

In comparison to the considered approaches to the estimation of activity of the transport system accepted on North American continent, the urban transport system in Australia has been analysed fully. The indicators specifying the conditions of the traffic indicators of safety and satisfaction of the population are added, the influence on the environment and the cost of service of transport system is considered as well.

6. Europe: Urban Audit

The Urban Audit, launched by the European Commission in June 1998, aims to gather the comparable information and data at city, wider city ('Wider Territorial Unit' or conurbation) and sub-city levels. The overall aim is to provide a self-sustaining and dynamic information tool, to inform urban policy issues at the Europe Union (EU), national and city level. The end product will enable an assessment of the state of Europe's cities, providing the access to comparable information on participating cities in Europe, as well as facilitating the exchange of information amongst cities [7].

The 58 cities included into the Urban Audit pilot phase were identified by the European Commission. The largest cities (by population size within their administrative boundaries) within the EU member states have been included. The main exceptions to this principle are: the exclusion because of their large scale of London and Paris; and, in order to ensure a good geographical spread across the EU and to cover a significant percentage of the population in each country, some cities from the smaller EU countries were included even though they have smaller populations than some of those cities not included from the larger countries [7]

As it has already been mentioned above, the Urban Audit aims to provide information at three spatial levels (Table 3).

Table 3. Spatial levels provided in the Urban Audit

Level	Description
Core City	administrative definition, as the basic level (Label "A)
Larger Urban Zone (LUZ)	is an approximation of the functional urban zone centred around the town/ city
Sub-City District (SCD)	is a subdivision of the city according to strict criteria (5 000 – 40 000 inhabitants in each sub-town / city district).

The selection of participating / cities and the definition of the composition of the LUZ and the SCD in terms of spatial units need to respect certain criteria set by DG REGIO and statistical quality in general:

- the participating cities in each country should represent about 20% of the population in that country;
- the participating cities should reflect a good geographic distribution within the country (peripheral, central);
- coverage should reflect more medium-sized cities than was the case in the UAPP (medium-sized towns / cities having a population of between 50 000 – 250 000 inhabitants, large towns/cities with >250 000);
- there should be comparability of data to enable comparative analysis between towns/cities;
- data should be available [8].

This "sampling" procedure for the Urban Audit project was closely and specifically designed by Eurostat, DG REGIO, the NSOs and the cities in the countries. The final selection of participating cities in the Urban Audit has been a compromise between all aspects.

The indicators cover 5 fields:

- socio-economic aspects,
- participation in civic life,
- training and education,
- environment,
- culture and leisure.

A full list of indicators is defined within the 21 domains and has been produced for the Core Cities, Sub-City Districts and Larger Urban Zones. In most cases, the data obtained from Censuses, different administrative and statistical registers and national and local databases are used in a given country or a spatial unit.

Three data collection modes are distinguished: direct, indirect and mixed. Using sample surveys only allows a partial coverage of the population, whilst a Census provides the full coverage of the whole of the target population. Under this two-way classification, four special cases (or options) seem relevant

in the context of the Urban Audit: sample survey data using direct data collection, combined use of sample survey data and register data, Census data using direct data collection and Census data using indirect data collection methods. In many cases, different combinations of these data sources have been applied depending on the spatial unit of interest and the target variable.

A series of products have resulted from the Urban Audit:

- The *"Urban Yearbook"* of European Cities summarises the information available on the participating cities. The main objective of the "Urban Yearbook" is to enable comparisons to be made between cities. Scores for individual indicators are presented for all the cities where data are available. Thus, comparisons can be made quickly between all the cities in the areas of particular interest [7, 8, 9].
- The *Individual City Audits* present information and scores for indicators in each city included in the Urban Audit. The Individual City Audits are aimed at city officials interested in the situation of their own city and of other participating cities. The summaries provide direct comparisons with other cities. They present information through tables, maps and commentaries on a specific city, its WTU or conurbation and sub-city areas.
- The Urban Audit *Web Site* allows users to access results and products from the Urban Audit. It includes a general presentation of the Urban Audit, the indicators and their definitions, as well as the Individual City Audits of the cities that have already taken part in the Urban Audit. Those interested in the urban issues more generally are also able to consult the extensive bibliography and resource material posted on the site, and to find links to other relevant web sites that may be of interest to urban experts and policy-makers.

The overall purpose of the Urban Audit is to enable an assessment of the state of individual EU cities and to provide the access to comparative information from other EU cities. It is intended to facilitate the exchange of information amongst cities.

One of areas of Urban Audit is connected with an estimation of characteristics of transportation and refers to Travel Patterns. The systems of adhering data relevant to this domain vary. They are normally sample surveys on different categories of mode and purposes of travel. The list of 41 indicators is divided into 5 groups which are presented in Table 4.

Table 4. List of indicators

Groups	Name of indicators
Characteristic of journey to work/non work	Proportion of journeys to work by different modes
	Total number of journeys to work
	Proportion of journeys to work by public transport
	Average time of journey to work by different modes (minutes)
	Average distance per trip: journey to different purpose (km)
	Proportion of distance travelled for non work purposes (%)
Distance	Average distance per trip person (km)
	Annual distance travelled per person by all modes (km)
	Annual distance travelled per person by motorised transport (km)
	Annual distance travelled per person by rail/metro (km)
	Average distance from city centre to "centre" of sub-city area (km)
Number of trips	Total number of trips per year by residents
	Proportion of trips: journey to different purpose
	Average travel time by public transport to city centre (minutes)
Number of cars	Average number of occupants of motor cars
	Cars registered within the city boundary (per 1000 population)
Road accidents	Number of road accidents resulting in death or serious injury (per 1000 population)

Journeys to work, business, education, escort, shopping, personal business, social entertainment, holidays trips and walks are considered as trip purpose. Rail/metro, cars, buss, trams, bicycles, feet and other modes are considered as vehicles.

Variables requested in the Urban Audit for Travel Patterns domain can be informed in the following ways:

- the purpose of travel – sample surveys of individuals to determine purpose/mode and distance travelled during a given period (week or month). Ideally travel diaries would be maintained for a given period and checks made to verify estimates of distances travelled;
- the mode and other characteristics of journeys to work - either sample surveys or residents or of establishments (throughout the city or conurbation/WTU);
- the occupancy of private motor vehicles can best be measured by systematic road side surveys.

One result of the experience of the Urban Audit Pilot Phase was that the quality of the data needed to be improved. The experts entrusted with this work set-up ranges for indicators - where possible - against which the data were checked (Table 5). These ranges were just the first approach to the checking process and they have been reviewed. For some indicators it was not possible to set such ranges in advance but rather during data analysis. All the data were reviewed for anomalies. Together with the National Urban Audit Coordinators concerned, any anomalies were either validated or corrected [8].

Indicators and indices which are applied in the project consider urban transport system more from the point of view of mobility of the population that is a one-sided sight at so much complex and difficult system.

Table 5. Ranges applied to check the accuracy of indicators [8]

Indicators	Suggested ranges
Number of cars registered within the specified boundary per 1 000 population	20 ÷ 500
Road accidents resulting in death or serious injury per 1 000 population	0 ÷ 10
Proportion of in-commuters of persons employed in the city, %	2 ÷15
Proportion of out-commuters of persons employed living in city, %	2 ÷15
Total km driven in public transport per capita, km	0 ÷20

7. Approaches to the Analysis of the Urban Transport System in Russia

In Russia there is no uniform approach to the estimation of the urban transport system. One of the variant of indices set was offered by S.A.Vaksman and N. G. Kochnev; the set of indices, which characterized UTS, consists of 7 groups [10].

Table 6. Indices suggested by S. A. Vaksman [10]

Indices groups	Indices
Planning indices	• characteristics of the metropolitan area • supply indicators • private transport infrastructure indicators • public transport infrastructure indicators
Traffic indices	• passengers' cars per kilometre of road • total private passengers' vehicles per kilometre of road • total single and collective private passengers' vehicles per kilometre of road • passengers' car kilometres per kilometre of road etc

Indices groups	Indices
Financial indices	• financial transport cost • public transport operating cost recovery • public transport cost • charges on individual transport • overall transport cost • user's cost of transport
Transit indices	• public transport supply and service • private collective transport supply (taxes and shared taxis)
Mobility indices	• overall mobility • private mobility indicators • intermodal transport infrastructure indicators
Ratio of public and private transport	• public/private transport balance indicators • private transport supply
Indices of influences of transport on an environment	• transport energy indicators • air pollution indicators • transport fatalities indicators

Each group includes a set of indicators, total amount – about 100 indicators. The authors note that the given list of indicators fully reflects the valid condition of system from various aspects, grouping indicators in the basic directions.

8. Conclusions and Further Directions of Research

The most serious problem of the estimation of the performance of the urban transport system is the absence of the uniform standard approach to this question and absence of the terminological unity and high-grade statistical base. In different countries various approaches, terminology, methods and algorithms are used (Table 7).

Table 7. Approaches to the estimation of the urban transport system in different countries

Country	Object	Approach
USA	Traffic, congestion	Traffic-based
Canada	Transit	Accessibility-based
Australia	Traffic, Personal mobility Environmental User's satisfaction Object assessment	Traffic, mobility Accessibility-based
Russia	*Planning, Traffic Transit, Mobility Financial, Environment	Traffic, Mobility Accessibility Land-use-based
Europe	Mobility **Land-use **Environment	Mobility-based

* only are solved
**are indirectly connected with the transport system of city

Latvia as a member of the European Union has the common economic zone with the EU countries and accordingly has a set of economic relations with these countries. Therefore it should be guided firstly by the programs in the field of transport, which are realized by the EU countries.

To apply the experience of the European cities fully it is necessary to confirm the national program on gathering the information about the trips for calculations of the following indices and indicators:

- Mode of journey to work: rail/metro, bus, tram, car, cycle, walking;
- Characteristics of all travels of residents (purpose, distance and mode of travel);
- Number of cars registered within the specified boundary per 1000 of population;
- Road accidents resulting in death or serious injury per 1000 of population;
- Average number of occupants of cars.

For the complex estimation of the performance of the urban transport system of Latvia the following steps should be undertaken:

1. To choice the approach to the estimation of the performance of the urban transport system in Latvia (and first of all for Riga).
2 Development of the parameters system (indices and indicators) of the urban transport system performance, which will include:
    - planning indices;
    - traffic indices;
    - financial indices;
    - transit indices;
    - mobility indices;
    - accessibility indices;
    - reliability indices;
    - indices of influences of transport on the environment.
3. Development of the methods and tools on gathering the information:
    3.1. Development of the national program on data gathering about mobility of the population, availability of transport, reliability and safety of transport system and for this purpose the methodology of conducting the National Travel survey should be developed. The representatives of the inhabitants of all the areas (zones) of city and also of all suburbs should participate in such survey. The city of Riga and residential suburbs are divided into 143 statistical zones. For the account of movements of inhabitants of all zones, it is necessary to use cluster sampling method for the realisation of the sample for the survey, where each statistical zone being a cluster. 2 methods of data gathering can be offered: with the use of diaries of trips and the modern way of data gathering developing at present, with the use of the mobile personal GPS devices. Such survey will allow estimating the changes in mobility of the population.
    3.2. Development of the programs of the use of the technical devices for the constant monitoring and gathering data on the situation on roads (traffic count).
    3.3. Research and analysis of the technical and statistical documentation about the urban transport system. Here are included: technical road conditions, quantity of failures, quantity of victims on the roads, quantity of the registered cars, quantity of the registered driving licences, gassed conditions, etc.
4. Development of the centralized data storage.
5. Development of the methods of clearing, validation, estimation and analysis of the data.

The uniform approach should be developed for the estimation of the urban transport system and taken into account the main principles of the audit and algorithms of their conducting.

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CUMULATIVE INDEX

TRANSPORT and TELECOMMUNICATION, Volume 9, No 4, 2008 (Abstracts)

Vasiliauskas, A. V., Barysienė, J. Review of Current State of European 3PL Market and its Main Challenges. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 4–8.

This article examines basic reasons behind the use of 3 PL, i.e. the main drivers of outsourcing (Chapter 2) as well as explains the essence of 3PL service (Chapter 3). In Chapter 4 the analysis of current state of 3 PL market in Europe has been analysed. Finally, Chapter 5 gives an overview of the main challenges that European 3 PL service providers currently are facing.

Keywords: 3PL service, outsourcing, logistics service providers

Kamiński, T., Nowacki, G., Mitraszewska, I. Video Register Picture Evaluation to Support Drivers Training and Examination. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 9–14.

This paper refers to some problems on digital video recording of picture during driver's training and examination process for obtaining driving license. Since 10 April 2006, all examining institutions have to use video and audio recording devices in Poland. The legal regulations in force do not clearly determine the functional requirements and technical parameters for video recorders; hence the actual devices used do not meet user requirements. This paper describes a deterioration of recording quality parameters of the video recorder as well as construction of camera, its main elements and their influence on the recording quality parameters. The paper refers to attention to geometrical deformation of image that is made in optical camera system. The authors have made an attempt to determine camera parameters, their location and quality of the picture. In the mentioned case the objective and subjective picture validation methods will be presented.

Keywords: video register, quality picture evaluation

Griskevicius, A., Griskeviciute-Geciene, A. The Analysis of the Construction Costs of Transport Infrastructure Projects. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 15–21.

The significant rise of the construction costs of transport investment projects at present days is considered in the paper. The analysis of reasons of cost rise is accomplished on the purpose to use the EU financial support and other financing resources for transport sector more effectively and to plan the further usage of investments for transport infrastructure. Costs, acting factors, financing resources influence on the priority projects of transport infrastructure are analysed and changes of construction costs are defined and the problems of the implementation of infrastructure project are clarified. The recommendations are offered concerning preventive measures for up the costs of transport infrastructure works and their application possibilities, and to substantiate the development of infrastructure projects.

Keywords: transport infrastructure projects, financing resources, the evaluation of investment projects, construction costs, influence of external factors

Gromule, V. Quality of Service at the Riga Coach Terminal. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 22–31.

In this research the main attention is paid to the analysis of the reasons – why travellers choose train rather than bus in some regional directions in Latvia. This analysis is done on the basis of the results of questionnaire and in future it may be the basis for the Discrete-Choice models application. Also the analysis of the travellers' attitude to service of the Riga Coach Terminal is fulfilled on the basis of the annual questionnaire data.

Keywords: coach terminal, passengers, service quality, transportation, transit capacity

Tolli, A., Le-Griffin, H. D. Reducing Empty Container Flow by Promoting Baltic and Russian's Wastepaper Export to China. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 32–37.

In 2006 out of one hundred imported marine containers from China to Europe, forty one were repositioned to China empty and from Russia at least seventy. To promote a healthy trade between these countries, it requires a more balanced cargo flows. It is of high importance that the marine containers filled with commodities sent from China to the Baltic and Russia would not be transported back to China empty. This paper provides a global analysis on freight flows by commodity to and from China with focus on a comparative analysis of potential export cargo to China. Our goal is to explore the possibility and to propose a logistics mechanism to promote the growth of container trade between China and Russia via Estonia. In developing our analysis, wastepaper is considered in this paper as one of the potential export commodities from Russia and Baltic through Estonia to China. The potential of this commodity to fill containers that would otherwise be repositioned empty to China, and the possibility of consolidating empty containers at the Port of Tallinn from other trade flows with China, is examined.

Keywords: Wastepaper, container, export, market, trade, port

Jaržemskienė, I., Barysienė, J., Jaržemskis, V., Jaržemskis, A. The Feasibility Study to Transfer Goods between Ports of Klaipeda and Swinoujusce. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 38–48.

The purpose of this article is to present results of the research of feasibilities of freight transportation by ferry between Klaipeda Seaport in Lithuania and Swinoujusce Seaport in Poland. The study is related to the BSR Interreg III B NP project Baltic Gateway PLUS. The study includes the following researches: (1) to specify freight flows to Region Berlin via Klaipeda Seaport; (2) to specify freight flows to Region Berlin via Kalvariju cross border check point. The applied method is the collection of official statistical data for years 2005 and 2006 from legal statistical bureaus and some freight operators. The study concluded that freight flow via Klaipeda port and Kalvariju check point (incl. Lazdiju) to the so-called Region Berlin defined as the destination point in which freight was unloaded was 199,59 thousand tons in 2005 and 229,96 thousand tons in 2006. Freight flow via Klaipeda port and Kalvariju check point (incl. Lazdiju) from the so-called Region Berlin defined as origin point in which freight was loaded was 48,88 thousand tons in 2005 and 78,45 thousand tons in 2006. About 10 % of freight flow in axis Kalvariju-Berlin is loaded/unloaded in the so-called Region Berlin. About 90 % of flow in the mentioned axe is a cross trade flow of Region Berlin.

Keywords: intermodal transport, transport statistics, short sea shipping, freight flows, trailer, ferry

Butkevicius, J., Jarasuniene, A. The Comparison of Cost Regional Passenger Transportation in Lithuania Railway and Road Transport. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 49–51.

The railway and road transport are rival in the regional passenger transportation of the country.

The cost is a general index of passenger transportation. So, this article deals with the cost of the regional passenger transportation in the railway and road transport.

The cost is comparable to 1 passenger kilometres, according to train types and according to expense elements. There are described the factors influenced to the cost transportation in the vehicles in the given study.

Keywords: regional passenger transportation, railways and roads transport, train, bus, cost, route

Pticina, Irina. Urban Transport System Audit: Review of Metric System, Methods and Problems. *Transport and Telecommunication*, Vol. 9, No 4, 2008, pp. 52–63.

Urban transportation systems can be evaluated in various ways reflecting different perspectives concerning users, modes, land use, transport problems and solutions, as well as the means of measuring transport activity and the type of the used performance indicators.

As concerns the user the transport system is characterized by the following properties of transport system: mobility, accessibility and reliability. There exist various approaches and methods for estimating the given characteristics. Several indicators and the indices describing properties of the transport system that can be calculated by means of various approaches and methods are described in the article.

The purpose of the given article is the review of existing methods of the city transport system performance estimation from the user's point of view as well as the evaluation of mobility, accessibility and reliability. The article mentions the problems, which arise in the process of estimating the urban transport system's efficiency.

Keywords: transport system, performance measures, reliability, mobility, accessibility, data

TRANSPORT and TELECOMMUNICATION, 9.sējums, Nr.4, 2008 (Anotācijas)

Vasiliauskas A. V., Barisiene, J. Eiropas *3PL* tirgus pašreizējā stāvokļa pārskats un tā galvenie izaicinājumi. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 4.–8. lpp.

Šajā rakstā tiek iztirzāti pamata iemesli *3PL* lietošanā, t.i., līgumdarbu galvenie autovadītāji (2. nodaļa), kā arī izskaidro *3PL* pakalpojuma galveno būtību (3. nodaļa). Pašreizējā *3PL* tirgus stāvokļa analīze tiek dota 4. nodaļā. Un, visbeidzot, 5. nodaļā autors pievēršas pārskatam par *3PL* tirgus galvenajiem izaicinājumiem, kādi šobrīd pastāv Eiropas valstīs.

Atslēgvārdi: *3PL* pakalpojums, līgumdarbs, loģistikas pakalpojuma sniedzējs

Kaminskis, T., Novackis, G., Mitraševska, I. Video ieraksta attēla novērtējums, lai atbalstītu autovadītāja apmācību un eksaminēšanu. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 9.–14. lpp.

Šis raksts parāda dažas digitālā video attēla ieraksta problēmas, kas rodas autovadītāja apmācības un eksaminācijas laikā, lai iegūtu autovadītāja licenci. Kopš 2006. gada 10. aprīļa visām eksaminācijas institūcijām Polijā ir jālieto video un audio iekārtas. Tā likumdošana, kas pašlaik ir spēkā, skaidri nenosaka funkcionālos norādījumus un tehniskos parametrus video ierakstiem, tādējādi faktiskās iekārtas nenodrošina lietotāja prasības.

Autori ir mēģinājuši šajā rakstā noteikt kameras parametrus, to izvietošanu un attēla kvalitāti. Šajā gadījumā tiek parādītas attēla objektīvās un subjektīvās novērtēšanas metodes.

Atslēgvārdi: video ieraksts, attēla kvalitātes novērtējums

Griškevicius, A., Griškeviciute-Geciene, A. Transporta infrastruktūras projektu izstrādes izmaksu analīze. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 15.–21. lpp.

Transporta investīciju projektu izstrādes izmaksu nozīmīga palielināšanās mūsdienās tiek izskatīta dotajā rakstā. Izmaksu palielināšanās iemesli un to analīze tiek veikta, izmantojot arvien efektīvāk Eiropas Savienības finansiālo atbalstu un citus finansu resursus transporta sektorā un plānojot turpmāko investīciju izmantošanu transporta infrastruktūrās

Rakstā tiek izstrādātas rekomendācijas izmaksu palielināšanās preventīviem pasākumiem transporta infrastruktūru darbībā un tiek parādītas to pielietošanas iespējas, kā arī tiek pamatota infrastruktūru projektu attīstība.

Atslēgvārdi: transporta infrastruktūru projekti, finansu resursi, investīciju projektu novērtējums, izstrādes izmaksas, iekšējo faktoru ietekme

Gromule, V. Pakalpojumu kvalitāte Rīgas autobusu pasažieru terminālī. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 22.–31. lpp.

Autore šajā pētījuma galveno vērību velta iemeslu analīzei – kāpēc ceļotāji dažos Latvijas reģionos labāk izvēlas vilcienu nevis autobusu. Šī analīze tiek veikta, pamatojoties uz aptaujas rezultātiem un nākotnē tā varētu būt kā pamats nošķirtās izvēles modeļa pielietojumam. Bez tam arī autore veic analīzi par ceļotāju attieksmi pret Rīgas autobusu termināļa sniegtajiem pakalpojumiem, kur arī par pamatu tiek izmantotas gadskārtējās aptaujas.

Atslēgvārdi: autobusu termināls, pakalpojumu kvalitāte, pārvadājumi, tranzīta kapacitāte

Tolli, A., LeGrifins, H. D. Tukšo konteineru plūsmas samazinājums, veicinot Baltijas un Krievijas makulatūras eksportu uz Ķīnu. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 32.–37. lpp.

2006. gadā no simts importētiem jūras konteineriem no Ķīnas uz Eiropu četrdesmit viens tika atgriezts uz Ķīnu tukšs un no Krievijas vismaz septiņdesmit. Lai veicinātu normālu tirdzniecību starp šīm valstīm, ir jāveido sabalansētāka kravas plūsma. Tas ir ļoti svarīgi, ka jūras konteineri, kas ir piepildīti ar patēriņa precēm no Ķīnas uz Baltijas valstīm un Krieviju, netiktu sūtīti atpakaļ tukši.

Rakstā autori analizē globālas problēmas par kravu transportēšanu starp valstīm. Autori mērķis ir izpētīt iespējas un piedāvāt loģistikas mehānismu, lai nodrošinātu kravas konteineru tirdzniecību starp Ķīnu un Krieviju caur Igauniju. Makulatūra tiek izmantota kā potenciāla eksporta prece no Krievijas un Baltijas valstīm cauri Igaunijai uz Ķīnu, kā arī tiek piedāvāts mehānisms, lai netiktu sūtīti tukši konteineri no Tallinas ostas.

Atslēgvārdi: makulatūra, eksports, tirgus, tirdzniecība, osta

Jaržemskiene, I., Barisiene, J., Jaržemskis, V., Jaržemskis, A. Kravu transportēšanas iespējamības izpēte starp Klaipēdu un Svinoujusce. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 38.–48. lpp.

Šī raksta mērķis ir parādīt iespējamības pētījuma rezultātus par kravu transportēšanu ar prāmi starp Klaipēdas jūras ostu un Svinoujusces jūras ostu Polijā. Pētījums ir attiecināts uz *BSR Interreg III B NP* projektu Baltijas koridors PLUS. Pētījums iekļauj sekojošo: (1) precizēt kravas plūsmu no Berlīnes reģiona caur Klaipēdas ostu; (2) precizēt kravas plūsmu uz Berlīnes reģionu caur Kalvariju robežšķērsošanas punktu.

Apmēram 10% kravas plūsmu virzienā Kalvariju- Berlīne ir iekrauti/ izkrauti tā saucamajā Berlīnes reģionā. Ap 90% kravas plūsmu minētajā virzienā ir sajauktā tirdzniecības plūsma Berlīnes reģionā.

Atslēgvārdi: intermodāls transports, transportēšanas statistika, īsa jūras šķērsošana, kravas plūsmas, treilers, prāmis

Butkevicius, J., Jarasuniene, A. Reģionālo pasažieru dzelzceļa pārvadājumu izmaksu salīdzinājums ar autoceļu transportu. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 49.–51. lpp.

Valstī sacenšas divi pasažieru pārvadājumu transporti – dzelzceļš un auto.

Maksa par braukšanu ir galvenais rādītājs pasažieru transporta izvēlē. Tādējādi šis raksts ir veltīts reģionālo pasažieru pārvadājumu izmaksu analīzei.

Izmaksas pielīdzina vienam pasažieru pārvadājumu kilometram, saskaņā ar vilcienu tipu un izdevumu elementiem. Dotajā pētījumā tiek aprakstīti faktori, kas ietekmē pārvadājumu izmaksas katrā transporta līdzeklī.

Atslēgvārdi: reģionālie pasažieru pārvadājumi, dzelzceļa un autoceļu transports, vilciens, autobuss, izmaksas, maršruts

Pticina, Irina. Pilsētas transporta sistēmas audits: metriskā sistēma, metodes un problēmas. *TRANSPORT and TELECOMMUNICATION,* 9.sēj., Nr.4, 2008, 52.–63. lpp.

Pilsētas pārvadāšanas sistēmas var tikt vērtētas dažādos veidos, parādot dažādas perspektīvas, kas skar lietotājus, veidus, zemes izmantošanu, transporta problēmas un risinājumus, kā arī transporta izmantošanas laika noteicējus un lietotās darbības tipa rādītājus.

Ja runājam par lietotāju, tad transporta sistēma tiek raksturota sekojoši: mobilitāte, pieejamība un paļāvība. Pastāv dažādas pieejas un metodes, lai noteiktu minētās īpašības. Daži rādītāji, kas apraksta transporta sistēmas īpašības, var būt izskaitļoti, lietojot dažādas pieejas un metodes, kas parādītas dotajā rakstā.

Šī raksta mērķis ir apskatīt minētās transporta sistēmas darbības izvērtēšanas metodes un pieejas no lietotāja viedokļa, kā arī transporta mobilitātes izvērtēšana, pieejamība un paļāvība uz to. Rakstā tiek minētas problēmas, kuras rodas pilsētas transporta sistēmas efektivitātes vērtēšanas laikā.

Atslēgvārdi: transporta sistēma, darbības pasākumi, paļāvība, mobilitāte, pieejamība, dati

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