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NEW PERSPECTIVES OF COACH TERMINAL AS IMPORTANT ELEMENT OF TRANSPORT INFRASTRUCTURE

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The main topic of this article is the further development of the coach terminal as a passenger infrastructure object towards the formation of a passenger logistics hub.

The coach terminal is an important passenger exchange point with the potential to be a connecting point with other means of transport – this should be taken into account when designing the further development of coach terminals in Riga. The operation of the coach terminal, the minimum services provided and the financing of the inland passenger transportation in the coach terminal are regulated by normative acts and will significantly affect the development of the coach terminal in future.

In the article the author stresses the essential factors involved in the operations of the coach terminal: planning of transport and infrastructure, information systems and other trends of development using the example of the JSC “Riga International Coach Terminal”.

Keywords: *Coach Terminal, passenger logistics hub, information system, simulation modelling*

1. Bus and Coach Transport Importance in Public Transport

Bus and Coach Transport is the largest collective passenger mode in European Union-25: Over the last 10 years, the market share of bus and coach transport in Europe has stabilised at around 10%, with however a lower growth rate than in other transport modes. Nevertheless, bus and coach remains the most important mode of collective passenger transport in Europe, before rail.

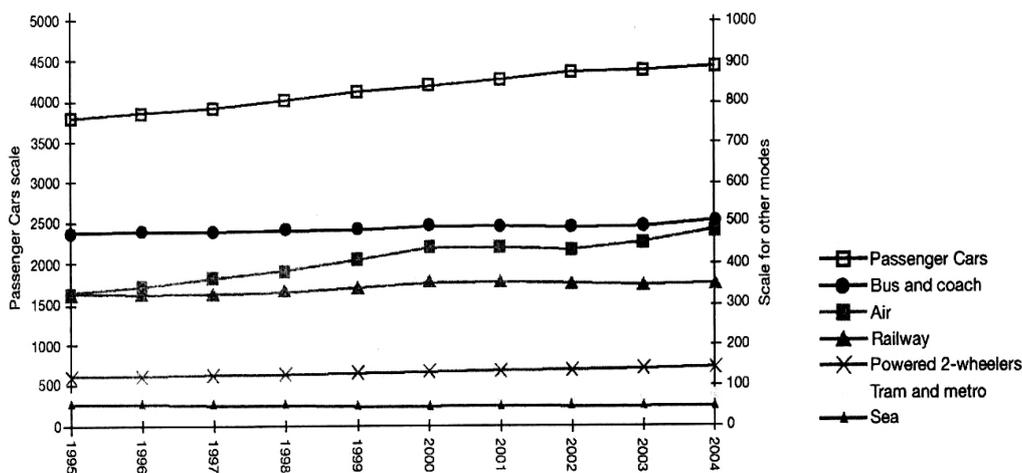


Figure 1. *Passenger traffic by different modes in Europe [1]*
 Billion passenger kilometres

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. Apart from the private car, the main market competitor for bus and coach operators is low cost airlines. This situation can largely be explained by the existing distortions of competition in terms of VAT, mineral oil taxation and various types of public subsidies that other modes enjoy.

The typical bus and coach transport company in Europe (50% of all companies) is a micro-company, owning 2 to 10 vehicles (the structure is similar to that in the USA). There are as many larger companies of up to 50 vehicles (20%) as one-man companies (26%). 4% of the companies operate more than 50 vehicles. Profitability ratios differ significantly. As a rule, EU operators display a profitability rate of between 0–5% (1–2% in the USA), whilst the third country operators report substantially higher rates.

The place of the bus and coach transport in public transport in Latvia (million passengers per year) is shown on Figure 2.

**Passenger traffic in public transport (buses)
(million people in a year)**

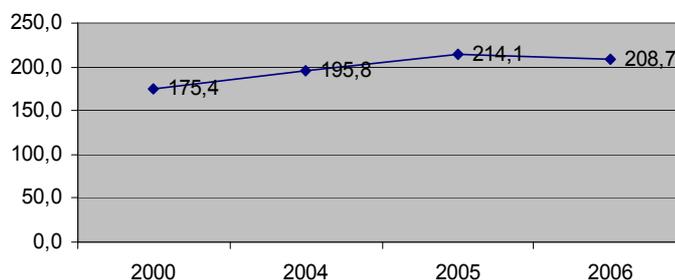


Figure 2. Passenger traffic in Latvia

2. Passenger Service and Providing of Intermodal Interchange in the Further Development of the Coach Terminal

Due to its geographic location Riga is not only the centre of Latvia, but of the whole Baltic area. Many important European transport corridors, state motorways, railway lines cross in Riga, the Riga international airport and the Riga port – navigable in all seasons – are located in Riga. These conditions are favourable for the development of all kinds of public transport, including passenger bus transport that is very flexible and can be deployed quickly in response.

The JSC “Riga International Coach Terminal” (“Rīgas starptautiskā autoosta”) is located in the central part of Riga and it provides services to regional, long-distance and international routes, in average rendering services to 510 local and 60 international routes per day. Every year in average 5–6 million passengers receive the services of the terminal.

The Investigation “Development of Public Transport Route Destinations in Riga City” performed in 2006 by the “SIA Imink” forecasts the following growth of bus routes and number of passengers outside of Riga (see Table 1) [2].

Table 1. The forecast of the amount of bus routes outside of Riga and the amount of passengers served

N	Types of routes	2006				2008				2018			
		Amounts of routes	%	Amounts of passengers (ts.)	%	Amounts of routes	%	Amounts of passengers (ts.)	%	Amounts of routes	%	Amounts of passengers (ts.)	%
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	International routes	60	5,2	1,9	6,6	65	5,3	20	6,7	70	4,1	2,2	5,2
2.	Long-distance routes	470	41,0	17,8	62,0	490	39,7	18,6	62,2	710	41,8	27,0	63,2
3.	Regional routes	616	53,8	9	31,4	680-700	55	9,3	31,1	920-940	54,1	13,5	31,6
Total		1146	100	28,7	100	1235-1255	100	29,9	100	1700-1720	100	42,7	100

In 2005 the company Solvers, Ltd. performed an investigation in order to determine the Riga International Coach Terminal as an interchange hub of passengers and linkage with the city public transport. The conclusions were essential for both the planning of the development of the Riga International Coach Terminal and the Riga public transport transit junction at Turgeņeva-Maskavas Streets [4].

While examining the passenger flow it is established that the services of the coach terminal are used by:

~4.0 thousand people in the morning rush-hours (9.00–10.00), including

- flow to the coach terminal ~1.4 thousand people
- flow from the coach terminal ~2.6 thousand people

~5.0 thousand people in the evening rush-hours (17.00–18.00), including

- flow to the coach terminal ~3.6 thousand people
- flow from the coach terminal ~1.4 thousand people

Most of coach terminal's visitors (~75%) moved in the direction between the coach terminal and the Central Railway Terminal Square, where most of the public transport stops are located.

Most coach terminal's visitors go to the coach terminal and leave it by public transport (70%–80%):

- by bus – 25%–30%
- by tram – 10%–25%
- by trolley bus – 13%–20%
- by maxi-taxi – 7%–15%
- by train – 1%–5%

An essential part of coach terminal's visitors come and leave as pedestrians (20%–30%). Obviously, basically they are people who come from the outskirts to Riga centre on business.

The coach terminal attracts transport vehicles: ~80–100 cars in the morning rush-hours and ~480–520 cars in the evening rush-hours. The coach terminal's attracted transport vehicles part in the evening rush-hours constitute ~9% from the transport flow along the following streets: 13. Janvāra, 11. Novembra and Krasta.

We can estimate from the research data that at present the JSC "Riga International Coach Terminal" is an important passenger transit hub that must provide inhabitants of Riga and passengers outside Riga with passenger transport services.

However, it is essential to improve the linkage with other means of transport. If in case with the railway station and the city passenger transport the linkage is marked and in the nearest future, due to the city transport infrastructure development, it will grow, then in case of the airport and port, the passenger transfer possibilities in future should be improved significantly.

If we consider the coach terminal's strategic location, the main argument today is to provide passengers with comfortable, quick access and transfer using a bus or any other means of transport.

Taking into account the demands of passenger transport and the development of Riga transport infrastructure, it is planned to develop public transport service in the following territories of Riga [2]:

1. Form out of town multi-modal transport hub (coach terminal-railway-Riga passenger terminal-airport);
2. In addition to the existing Riga International Coach Terminal, develop a new system of passenger services from three territories located in the buffer zone of Riga historical centre:
 - a. Close to Maskavas-Turģeņeva Streets – the town's public transport interchange hub. Necessary territory is approx. 1.3 ha;
 - b. Vienības Gatve – regional coach terminal. Advisable territory is about 1.9 ha (28 platforms, coach terminal's building);
 - c. Skanstes Street – advisable territory is about 1.2 ha (17 platforms, coach terminal's building).

3. Opportunities of Logistics Development

By definition a coach terminal is a linear construction consisting of specific buildings, platforms and a territory for the rendering of services to passengers and coaches during the routes. To ensure an effective operation of such a linear construction, to be able to render high quality services both to passengers and to haulers in conformity with their needs, the functions and operational activities of a coach terminal have to be evaluated at a larger scale. We would like to suggest considering a coach terminal as *a hub of logistics* [7, 8], taking the operational and development model of the JSC "Riga International Coach Terminal" as a basis.

The structure of the public transport sector has been changing in recent years with a move towards privatisation through Public Private Partnerships (PPP). In trying to bring the public and private sectors together, the government hopes that the management skills and financial acumen of the business community will create better value for money for taxpayers. The objective of the development concept of the JSC "Riga International Coach Terminal" is: "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 servicing and inter-linking with other types of public transport – the railway, urban public transport, sea port and airport".

To develop an effectively operating hub of logistics, there has to be an assessment of the main critical factors for the successful operation of such a hub: location, support by government labour forces, etc. (see Figure 3).

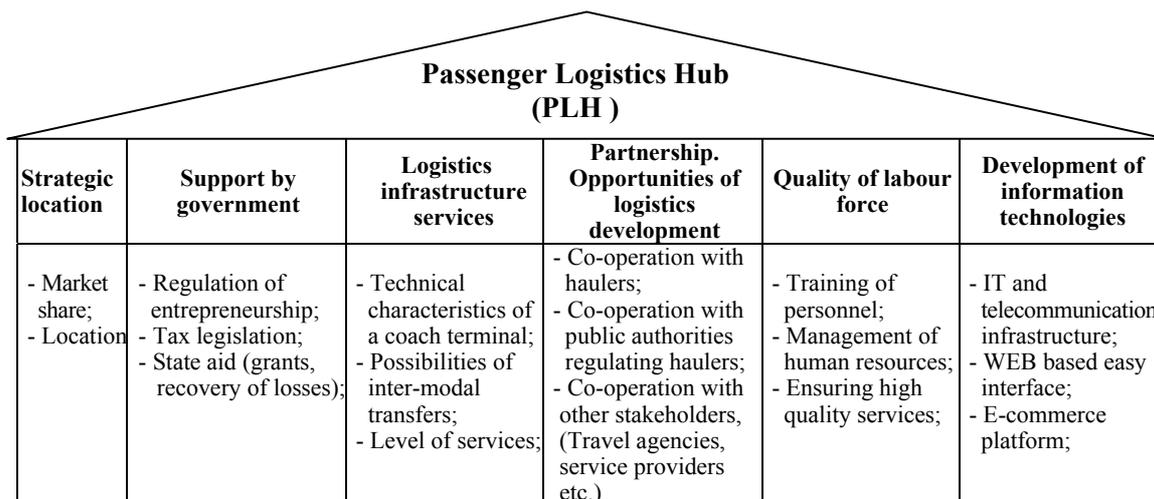


Figure 3. Critical factors for Logistics Hub

JSC “Riga International Coach Terminal” co-operates with 49 hauler companies and 2 travel agencies, including the concluded co-operation agreements with 20 passenger hauler companies engaged in international transfers, from them 11 are foreign companies. 13 foreign countries are the destination of coaches from Riga International Coach Terminal. Breakdown of routes by types and directions are characterised by the information in Table 2 [3].

Table 2. Average number of routes per day and breakdown by directions (at the rush-hours in 2006)

Routes	Average number of routes per day						
	Total number per day	7:00–8:00	8:00–9:00	9:00–10:00	16:00–17:00	17:00–18:00	18:00–19:00
International	60	5	7	1	6	5	7
Long-distance	471	25	35	37	43	48	43
Regional	39	1	1	1	1	6	1
Total	570						
By directions:							
- Kurzeme	112	6	4	7	9	13	8
- Zemgale	214	14	20	16	15	16	15
- Vidzeme	104	6	16	10	15	19	18
- Latgale	140	5	3	6	11	11	10

The international routes constitute only 8% of the total number of the serviced routes of the coach terminal, however for the strategy of coach terminal’s operation the development of the coach terminal as an international point of logistics and transfer is of significant importance.

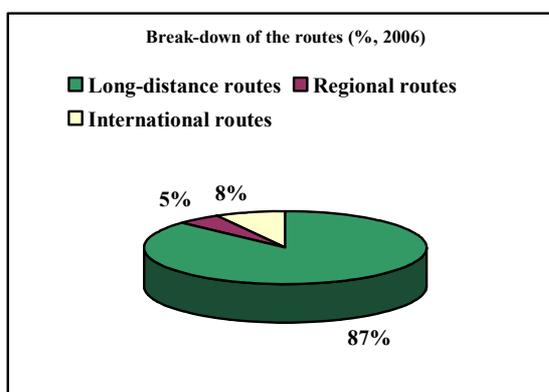


Figure 4. The distribution of routes in the Riga International Coach Terminal

The Riga International Coach Terminal has now developed into a significant international traffic infrastructure object of a previous coach terminal on the outskirts of the USSR. Such political and economical factors as

- accession of the Republic of Latvia to the EU;
- development of travel industry;
- movement of labour force;
- Visa facilitation, e.g. non-Visa entry for the EU citizens to the Ukraine etc., considerably increases the demand for international traffic. Even such factors as the operation of low-fare airlines, creating as if a competition for the international coach transfers of passengers, to certain extent enhance the promotion of coach traffic from those regions where there still do not exist the services of such low-fare airlines. Within the area of international transportation of passengers it is important to develop the transfer opportunities, and not just from one coach route to another, but to merge it with other types of passenger transport.

The Riga International Coach Terminal is a member of the Pan European Association of Coach Terminals, and one of the main objectives of this Association is to develop the logistics service within the area of passenger transportation for both passengers and haulers.

All the above listed factors are of great importance for effective planning of coach terminal's operations, and to ensure in future the perception of a coach terminal as a centre of logistics.

4. The Law Basis of Coach Terminal Operation

According to PLH concept, the most significant factors are the state and municipality support, including regulation of the coach terminal operation based on the normative acts of the Council of Ministers.

Public passenger transport and the relevant infrastructure development is one of the state's economic and social development indices. Due to this, the role of the state and local authorities in the solution of the matters is significant. Important changes in the regulation of passenger transportation according to the EU directions and attitude takes place in our country today. The operation of coach terminals is an entrepreneurship regulated by the state. In 2007 the state adopted new essential normative acts that regulate the operation. First of all, the law on the public transport and the relevant regulations the Council of Ministers, as well as the Regulations No 846, 11.12.2007 of the Council of Ministers of the Republic of Latvia on the registration order of coach terminals, on the mandatory services provided in the coach terminals and the order of buses' arrival, departure and parking in the territory of coach terminals are issued according to Transport Law, Article 33, Parts 5 and 6.

The Regulations No 846 of the Council of Ministers of the Republic of Latvia determine the registration order of coach terminals, the mandatory services provided in the coach terminals and the order of buses' arrival, departure and parking in the territory of coach terminals.

JSC "Riga International Coach Terminal" has to provide the following obligatory services [9]:

- use of platforms and placement of information on coach departures on the platforms (platforms are coach stopping places, separated from the general communication route, meant for comfortable and safe passenger boarding in and out of the coach);
- information on bus timetables, actual bus departure and arrival times, bus tickets and other travel document prices, number of seats and comfort level of the bus, other services provided in the bus, passenger and luggage transportation, also other information connected with passenger transportation services. This information has to be easily available and clear to the visitors of the Riga Coach Terminal. The information, acquired by the transport provider, is issued after being received from the according transport provider;
- sales of travel tickets and luggage tickets at cash-desks of the Coach Terminal;
- dispatcher services (dispatcher provides operational information about the actual departure and arrival times and seats in the bus station, bookkeeping of the actual departure and arrival times);
- maintenance of the Coach Terminal and access to it, if the operating time of the Coach Terminal is different from departure time. The Coach Terminal must be equipped with a number of seats, which corresponds to 5% of the average arrived coach seat number per hour, but not less than 10 seats;
- hand luggage, as well as lost hand luggage preservation found in the Coach Terminal;
- a possibility to use toilets, and provide place for child nursing and mother care;
- parking-place before and after the voyages, as well as between the voyages, in the territory, if technical possibilities of the Coach Terminal allow.

It is essential that the mentioned above rules provide prices for the services of the Coach Terminal [9].

Optional activities of the Coach Terminal must provide a separate inventory of the inland services provided both of income and expenses. The director of the Coach Terminal defines the total expense methodology in the accounting documentation of the organisation (proportional distribution and expense methods), following these criteria:

- direct expenses are attributed to the planned number of voyages, which has been requested or given rights to provide the services of the public transport by the transport providers (liabilities);
- general (indirect) expenses are distributed between methods of optional activity (directions), attributed to the gained income and indirect expenses, which are determined for providing of services in the field of public transportation, attributed to the planned number of voyages of the customer.
- The costs of the provided services of the Coach Terminal for the next financial year are defined, using the following formula:

$$C_k = \frac{I_{kop} + P}{N_{seats}} * AI,$$

where

- C_k – cost for the services provided by the Coach Terminal in the specific category of a coach;
- I_{kop} – total expenses of maintenance of the Coach Terminal, connected with capital investments;
- P – planned income of the next financial year;
- N_{seats} – planned number of the passengers (planned amount of coach seats per year) correspondingly to the categories of voyages provided by the customer;
- AI – coach capacity (number of seats).

Therefore defining the price for services, it is possible to take into account the following criteria:

- market conditions of services of public transport, optimal maintenance requirements of the Coach Terminal, permit possibilities of the Coach Terminal, enhancement of the quality provided, geographical position, standard requirements;
- disposition of the services, time, speed and frequency;
- Coach Terminal technical and physical peculiarities of infrastructure, Coach Terminal depreciation level;
- additional services of the Coach Terminal;
- maintenance and development expenses of the Coach Terminal, movement organisation and providing expenses;
- Coach Terminal management expenses.

5. Logistics, Infrastructure, Services as Key Factor of PLH

One of the main conditions in the activity of the bus station is providing its service range volume and quality, as it has been mentioned in the previous section. Its development is influenced by both EU standard acts, as well as good practice experience. The company has also take into account the growing level of passenger requirements and to comply with the passenger rights.

It is of great importance for running a coach terminal to have internal logistics of its operation, the level of infrastructure, the variety and quality of services rendered. The most significant preconditions are characterised by the following.

Access Possibilities

1. For passenger buses and coaches
 - 1.1. access roads (streets);
 - 1.2. location of getting on/getting off platforms;
 - 1.3. possibilities of parking between routes;
 - 1.4. possibilities of coach manoeuvring.
2. For participants of external traffic: pedestrians, bicyclists, taxis, users of personal cars, urban public transport
 - 2.1. pavements, crossings;
 - 2.2. access roads;
 - 2.3. organisation of getting on/getting off;
 - 2.4. parking places.

3. For passengers in the coach terminal
 - 3.1. for entrance and exit and getting on/getting off platforms;
 - 3.2. traffic/passenger flow to and fro the platforms;
 - 3.3. the access to coaches (getting on, getting off, location of luggage, assistance to disabled persons, etc.);
 - 3.4. transfer and crossing to other vehicles;
 - 3.5. a plan of the coach terminal, organisation of passenger servicing, compliance with the demands of capacity;
 - 3.6. possibilities of travel tickets reservation/purchase (at the coach terminal, distance reservations and purchases – via agencies, Internet).

Content and Layout of Information

1. General information on availability of services;
2. Information about coach routes/destinations, interim stops, potential alternative solutions;
3. Information about the coach time schedules at destinations, at interim stops, about the duration of travel, accuracy of compliance with the time-table;
4. Information about the travel costs, about possible cost relieves, bonuses. Order of ticket reservation and sales, various options of payment as well as the options of cost compensation in case of travel cancellation;
5. Information about ancillary services, e.g. movement of luggage, its storage, use of the waiting lounge (waiting lounge or rest rooms) in case of transfer from route to route, etc.
6. Information about physical assistance to disabled persons, persons with children;
7. Information about the rights and obligations of passengers.

Comfort

1. Quality of air, air-conditioner operation, temperature regime within the premises of the Terminal;
2. Sheds, elevators, staircases, escalators;
3. Ensuring clean environment;
4. Convenient lighting;
5. Noise isolation;
6. Waiting rooms, seats;
7. Premises of individual hygiene (toilets, showers, rooms for mothers and children);
8. Other services: ensuring communication services; services of public catering and trade; possible options for pastime etc.

Security/Protection

1. Video surveillance;
2. Presence of security officers;
3. Easy-to-locate first aid office;
4. Prevention of pollution;
5. Measures to prevent various risks (fire security, prevention of terrorism, preventive measures against accidents, etc).

6. Information Technologies as an Important Factor of Successful Development of Passenger Logistics

It is necessary to form and develop the information system (IS) of the coach terminal more efficiently in order to optimise the operation of the coach terminal, to improve the work with haulers and to make the services of the coach terminal and carrier companies more comfortable for passengers, thus providing a better access to coach and bus transport services.

The development of information technologies that includes the IT and telecommunication infrastructure, the WEB based easy interface and an e-commerce platform allows to ensure access to both the passengers and hauler companies, thus widening the range of the coach terminal operation and services.

Information System "Baltic Lines" used by the coach terminal was developed in 2003 and was introduced in all bus terminals in Latvia in 2004. The information system collects, processes, stores, analyses and disseminates the information providing the following principal functions [10, 11]:

- coach timetable and operative information about the changes;
- information about the coach movement – arrival, departure, location at the platforms, delay;
- ticket reservation and sales system, including:
 - planning of routes, using services of several hauler companies and vehicles;
 - different ways of payment and communication;
- observation of passenger rights in accordance with normative documentation;
- management and control system of the coach terminal's service processes;
- processing of operational information in economic activity accounts;
- and control.

In order to ensure these functions, the coach terminal must process a large amount of operatively changing data coming from multiple sources of information, both internal and external. The data processed in the system is exported both for the internal use at the enterprise and to external users. The information flow is depicted on Figure 5.

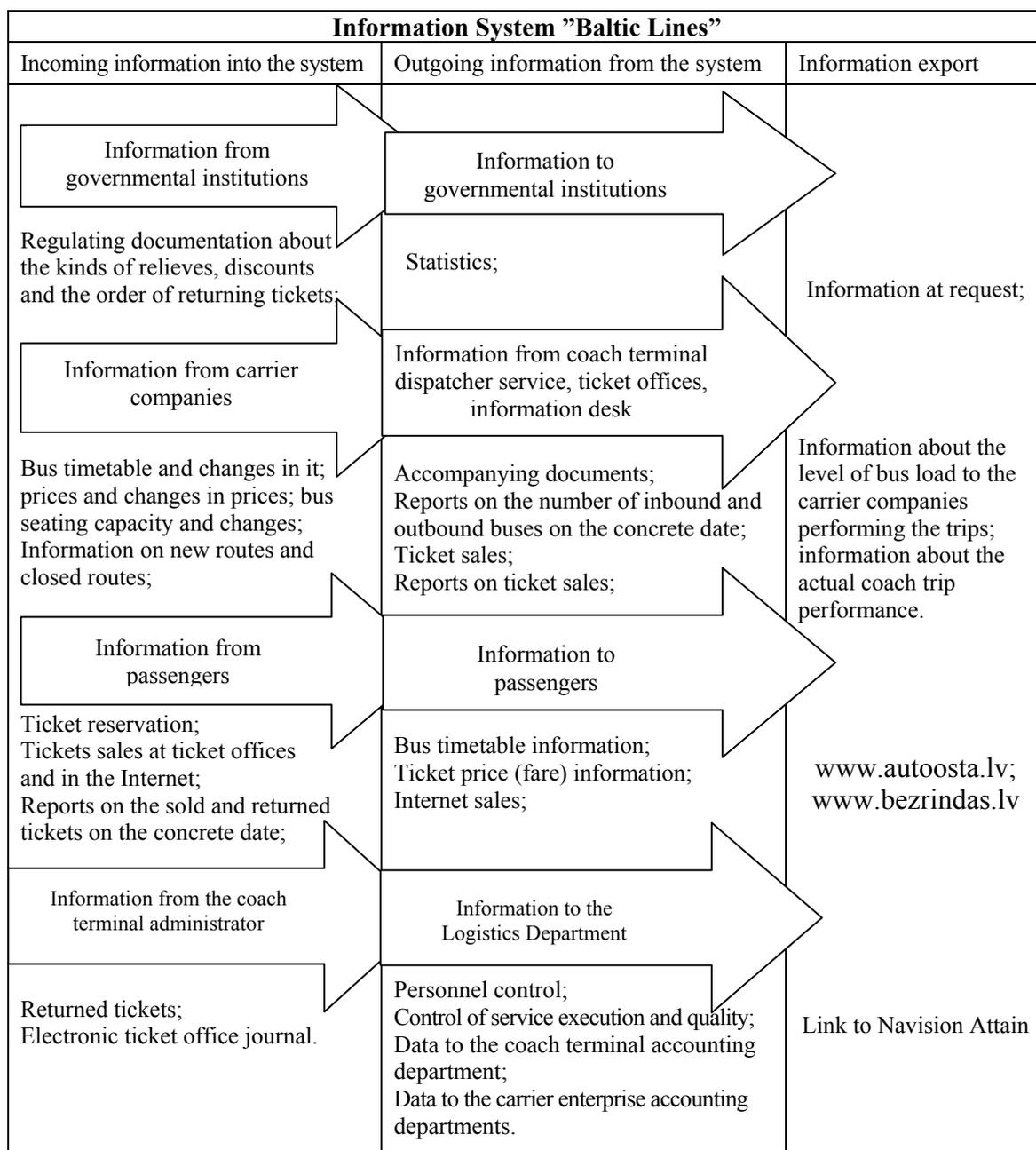


Figure 5. The information system's information flows of the coach terminal

In 2007, following information technology possibilities, JSC “Riga International Coach Terminal” and its partners JSC “Mikromaksājumi” and JSC “Baltijas Transporta Informācija – BTI” have implemented bus ticket sales in the Internet. www.bezrindas.lv (bus tickets on the web across Latvia). Although not all service providers are ready to implement such service, due to difficulties in the training of coach drivers, ticket sales in the Internet are growing and the total amount of sold tickets in 2007 was 19604 tickets. On December 1.4% of all tickets sold by JSC “Riga International Coach Terminal” were sold in the Internet, and the growth pace is increasing, which is showed on Figure 6.

A ticket can be bought online by printing it immediately (immediate print out), and sending by e-mail; in the nearest future it will be possible to receive it as a text message to a mobile phone or by simply remembering ticket ID number and naming it to the coach driver.

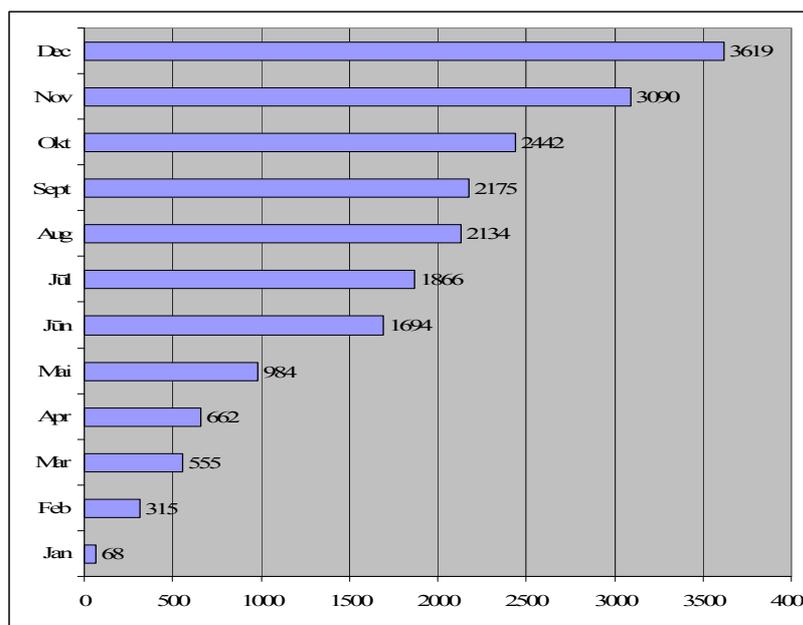


Figure 6. Tickets bought in the Internet (RIBT, 2007)

To use e-ticket, the passenger needs an ID, which can be asked by the driver to verify its data by bus passenger list.

The coach terminal’s information system is created to fulfil all the principal functions described in the work. The principal peculiarity of the information system lies in its diversity both from the points of information character and business interests (see Figure 7).

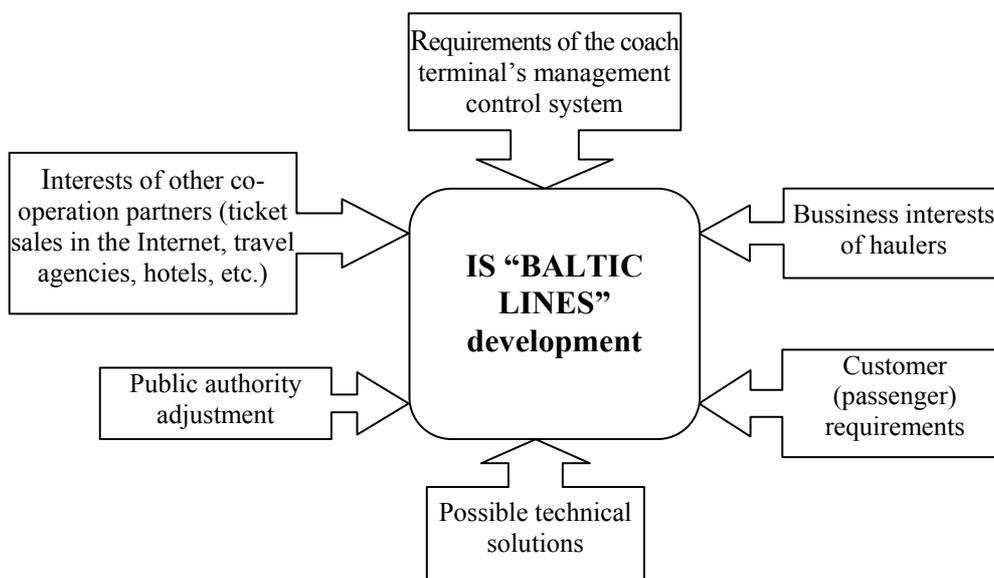


Figure 7. The interests of the users influencing the development of the coach terminal’s information system

Although the information system's principal function is to provide the coach terminal's daily operation of carrier and passenger service, it includes the functions of tactical planning and control, as well as the strategic planning. The development of the system is determined by the requirements of the users and changes in the business environment.

Strategic planning

The State LLC "Road Transport Administration" with the help of the "Baltic Lines" system performs the control of passenger transport implementation. The character and amount of information is sufficient to be used in making strategic decisions – on the further route network development and forming of the state order in passenger transport. The coach terminal's management, certainly, plans the terminal's future long-term economic activity by adopting strategic resolutions on the further market, the existing and new service development building them on the data of information system of the coach terminal. The determination of organizational objectives is also within the scope of strategic planning.

The further logical development and improvement of the program "Baltic Lines" is performed by the VSIA "Autotransporta direkcija", forming a unified public transportation ticket sales, reservation and accounting system.

The formation and the maintenance order of this system is defined in the Regulations on 02.10.2007 "Regulations on unified public transport ticket sales, advance booking and accounting system creation and support" by Cabinet of Ministers of the Republic of Latvia [12].

Such system is created and supported in order to:

- accumulate and summarize information on existing routes of the route network, determined travel costs (tariff), public transport time tables, stops, transportation providers, coaches involved in passenger transportation and other conditions, which have been defined according to standard acts, as well as public transport services client contracts or contracts on service providing in the route network (on a route) (e.g. availability with levied conditions, availability for people with functional disabilities, people with kids (babies in perambulators as well), oldsters);
- receive, process and actualise information in real-time about system user purchasing, advance booking and taxes used in accounting; as well as other information on payment registration electronic devices and equipment considering ticket sales, advance booking and cancellation in ticket boxes and public transport vehicles;
- receive and process information in real-time on global positioning and telematic devices mounted in public transport vehicles of transportation providers. The information considers bus position coordinates and coordinates of ticket sales places;
- receive, accumulate and actualise information on unplanned changes or events (e.g., rescheduled departure or arrival time of a public transport vehicle, cancelled or additional voyage, or any other changed provision, which has been defined in public transport services client contracts or contracts on service providing in the route network (on a route).

The current developing task in this system is the development of the system of quality indicators on the base of sampled data from IS "Baltic Lines". One of the indices is punctuality index [14]. This index indicates the magnitude of time gap between actual and scheduled arrival times. The realization of this task will give the possibility to analyse the reliability of the bus service and to improve the level of quality on the base of these results.

7. Decision-Making about Location of a New Coach Terminal with Models

The location of the coach terminal in the centre of Riga next to administrative, trade, cultural and educational centres is big advantage for the passengers. An additional advantage is the location of the coach terminal next to a railway station, close to the sea port and at a convenient distance from the airport, as well as with easy access to the urban public transport network.

However, one of the most serious critical factors for a sustainable future development of the coach terminal is the insufficient space of the territory for further development of the terminal. During the peak periods the coach terminal is already operating close to the limits of its capacity. Another critical factor for the activities of the terminal are traffic jams in Riga, having negative impact on the compliance with the timetable of coach arrival and departure.

After the assessment of the development of Riga transport system in future and the potential increase of the number of coach passengers, the experts ("Imink" Ltd) recommend to develop the sites for route destination of public transport at several locations in Riga, developing for passenger transport routes entering and leaving Riga a multi-modal transport hub on the outskirts of Riga: the coach terminal-railway-Riga passenger sea port-airport "Rīga", as well as to add the transfer functions to the Riga International Coach Terminal functions also.

To increase the carrying capacity of the Riga Coach Terminal according to the amount of the passenger flow, to the supply of services to passengers on the outskirts to develop an additional new system – from three territories located in the buffer zone of Riga historical centre.

One of the support points of the Riga International Coach Terminal is a new coach terminal under development in Riga, Pārdaugava, on Vienības Gatve 6. The territorial location of the land plot is close to the railway station “Torņakalns”, next to a newly developing administrative and cultural centre of the city. There is a possibility to develop a rather convenient transfer from buses and coaches to the urban public transport.

The critical factor could be the necessity to transfer to other means of public transport to get to the city centre. The coach terminal to be developed is not equally advantageous for all geographic directions of coach routes. The said negative factors are the main reasons for the determination of servicing sector of a new coach terminal – the coach routes from Kurzeme and Zemgale, according to the priorities of transport organisation in Riga.

A new coach terminal will ensure the possibility to implement the necessary reconstruction of the central coach terminal on Prāgas Street 1, having the temporary solution for servicing of coach routes on Vienības Gatve.

The selected method for analysing the offered decisions can be mentioned a simulation modelling. The most important benefits of modelling in decision-making are the cost of mistakes much lower in virtual experimentation and modelling allows the analysis and comparison of a very large number of possible alternative solutions. The availability of a simulation model at the pre-planning and planning stages will allow analysing the possible design solutions and finding out an optimal one.

There is the framework for decision-making with models on Figure 8. All stages of this process are important but we are paying a special attention to two stages: forecast planning variables and monitoring function. In order to test the solutions it is necessary to estimate the inputs to the model. It concerns knowing not only current values of these variables but also estimating the future values of these inputs. These forecasts have to use the future scenarios of territory development and are the object of other serious analysis and modelling. A monitoring function is the additional detail to standard process of decision-making with models [15]. This function is the key moment in improving the models. It concerns that the data, which can be requested additionally, models that can be reconstructed according to changing the strategy and so on. This adaptive decision-making is more flexible and can take into account the fast changing situation in transport system in total.

Simulation generally refers to a technique for conducting experiments (such as “what-if”) with a computer on a model of a studied system.

Advantages of simulation are the following:

- allows including the real-life complexities of problems; it is descriptive;
- can handle an extremely wide variation in problem types;
- can show the effect of compressing time;
- can be conducted from anywhere.

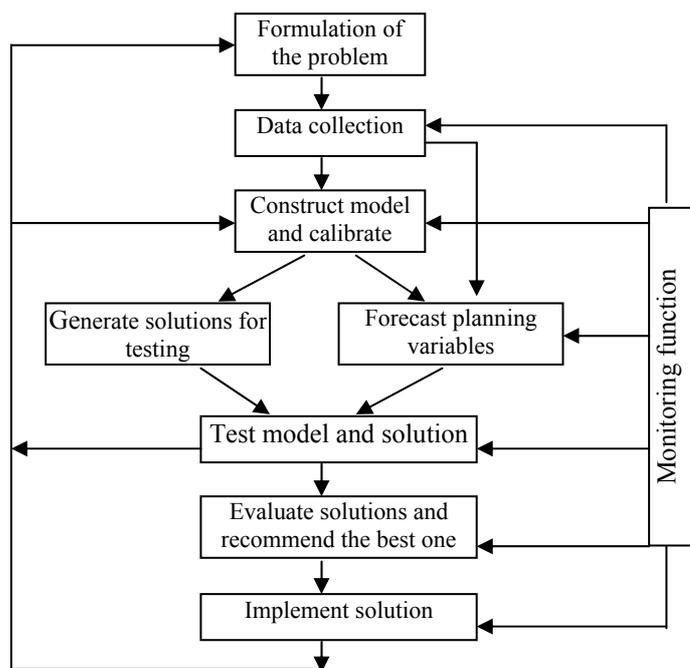


Figure 8. Planning and monitoring with models

So, the simulation model was used for the stage of new transport node (Coach Terminal) planning.

The objective of modelling was to develop a transport traffic diagram within the territory of the coach terminal, then adding to it the diagram of foot traffic (pedestrian movement) and the diagram of vehicles' traffic in the surrounding environment of the terminal. The design of a new coach Terminal is presented on Figure 9.

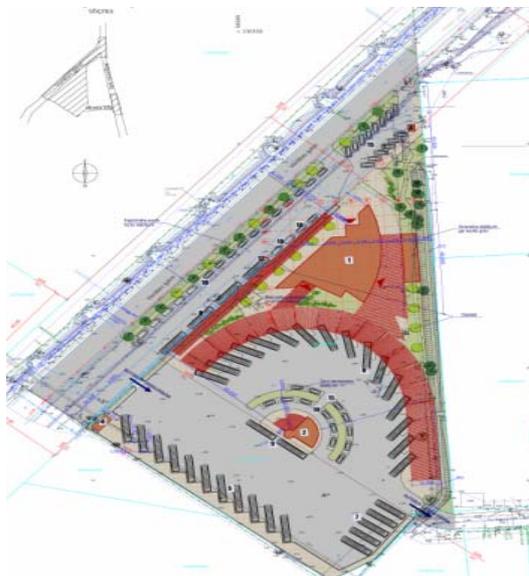


Figure 9. Plan of a new Riga Coach Terminal on Vienības Gatve Street in Pārdaugava

The process of model constructing on the basis the simulation package VISSIM, details of simulation model and making an experiment with it are described in the article [16]. It is noticed that in general a new coach terminal is able to provide the current schedule. However, the experiments with simulation model have shown that the scheme of transport vehicles' exits from the coach terminal territory suggested for today is not optimal and leads to a queue formation (Fig. 10). In the process of a model construction and its operation analysis the recommendations for the coach terminal design changes are suggested that results in the change of the bus station plan project taking into account the determined disadvantages.



Figure 10. The simulation model of a new coach terminal

All the mentioned factors are significant to develop the coach terminal into the Passenger logistics hub while planning the further development of passenger infrastructure objects. As it is already stated at the beginning of the article, the construction of several new coach terminals in Riga is being planned in the nearest time. Due to this, it is very essential to anticipate in good time the scenarios of development and the possible risks in the design, development and future exploitation of the objects.

7. Conclusions

The development of passenger transport infrastructure is a significant factor of passenger transport. It is essential to provide inter-modal interchange possibility when planning the location and construction of further coach terminals and other transport infrastructure objects in the city and construction.

The approach to Coach Terminal as a passenger logistics hub is considered and all factors which are important for it are discussed.

The most attention is paid to using of information technologies on the operating and strategically levels of coach terminal management.

The example of simulating model using on decision-making stage is described.

The engineering approach to logistics and transportation implies mathematical modelling and computers-based solutions to optimise the decision-making process. During the development of the modelling the critical points are identified and decisions are taken to reduce the risk of their occurrence.

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