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Modern russian approach to developing the system of public and freight transportation

Moderno enfoque ruso para desarrollar el sistema de transporte público y de carga

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Content

ABSTRACT:

The article is a description of the type of organizing public passenger transportation between the airport and the central parts of cities, which is new for Russia. It is used in large European cities and is based on timing timetables. This type of timetables is applied both in regional transport networks of a number of European countries, and in long-distance traffic. Such type of timetables is based on a wide awareness of passengers about the traffic of transport means. Waiting time and total time of the trip under possible transfers from one means of transportation to another is minimized. The article represents potential opportunities of developing Russia and its transportation system that are related to the development of the Trans-Siberian Railway (Transsib). It considers the impact of Transsib on transportation and transit opportunities of the Russian Federation, competitive advantages of the railway, including as compared to freight transportation by sea. It shows various ways of implementing potential opportunities of the Trans-Siberian Railway by creating the terminal network, consolidated shipping of freights

RESUMEN:

El artículo es una descripción del tipo de organización del transporte público de pasajeros entre el aeropuerto y las partes centrales de las ciudades, lo que es nuevo para Rusia. Se utiliza en grandes ciudades europeas y se basa en calendarios de cronometraje. Este tipo de horarios se aplica tanto en las redes de transporte regionales de varios países europeos como en el tráfico de larga distancia. Este tipo de horarios se basa en una amplia sensibilización de los pasajeros sobre el tráfico de medios de transporte. Se minimiza el tiempo de espera y el tiempo total del viaje bajo transferencias posibles de un medio de transporte a otro. El artículo representa oportunidades potenciales de desarrollo de Rusia y su sistema de transporte que están relacionados con el desarrollo de la Trans-Siberian Railway (Transsib). Considera el impacto de Transsib en las oportunidades de transporte y tránsito de la Federación Rusa, ventajas competitivas del ferrocarril, incluso en comparación con el transporte de mercancías por mar. Muestra diversas formas de implementar oportunidades potenciales del ferrocarril transiberiano mediante la

in accordance with the timetable, introducing the clearing system of payment. Besides, the article considers in more details the work of the terminal network through the example of the development of the Trans-Siberian Railway, and its strong features. It shows the system of terminals priority and their interrelation with one another. A network model of the carriers' alliance was made. It was demonstrated graphically as a scheme. Its operation, optimization, advantages and consolidation were considered.
Keywords: airport, timing timetable, integral timing timetable, regional transportation systems, transport management, passenger transportation.

creación de la red de terminales, el envío consolidado de fletes de acuerdo con el calendario, la introducción del sistema de compensación de pago. Además, el artículo considera más detalladamente el trabajo de la red de terminales a través del ejemplo del desarrollo del Ferrocarril Transiberiano y sus fuertes características. Muestra el sistema de prioridad de los terminales y su interrelación entre sí. Se hizo un modelo de red de la alianza de los transportistas. Se demostró gráficamente como un esquema. Su funcionamiento, optimización, ventajas y consolidación fueron considerados.
Palabras clave: aeropuerto, calendario de cronometraje, cronograma integral de cronometraje, sistemas regionales de transporte, gestión del transporte, transporte de pasajeros.

1. Introduction

The goal of the work is to analyze the existing type of public passenger and freight transportation in Russia. The article considers two aspects in stages:

- Organization of public passenger transportation between the airport and the central part of the city through the example of large European cities,

- Problems related to developing the terminal network of the Trans-Siberian Railway.

2. Analysis Of Aspect No. 1: Organization Of Public Passenger Transportation Between The Airport And The Central Part Of The City Through The Example Of Large European Cities

Modern cities and urban conglomerations are large territorial formations. Ideally airports as objects of the transportation infrastructure are established rather far from cities to decrease the impact of such factors as noise from planes that are taking off, and to provide additional safety in case of possible plane crushes when taking off and landing. The opposite side of this ideal solution is the need to organize the passenger service from the airport to objects of the urban transportation infrastructure. For large European airports this distance is 18 km on average. Airports of Oslo (Gardermoen - 51 km), Milan (Malpensa – 46 km), Rome (Leonardo da Vinci – 35 km), and Stockholm (Arlando – 41 km) are the most remote from cities. In order to get to the majority of airports where regular commercial flights make up a considerable share, they use regional transport – electric trains, trams, and subway (Glinskiy, et. al. 2014; Kryizhanovskiy and Shashkin 1998). In some regions regional trains are used. To a great degree the development of regional transport is related to the development of economy of regions (Palagin, 2009; Glinskiy and Butrina, 2014). Herewith, they say both about the development of the transportation infrastructure and improvement of transport means, and their characteristics. This improvement is related to demography and economy of regions, which defines transportation flows, including the passenger flow in airports (Glinskiy, et. al. 2014; .

(Glinskiy and Butrina 2014; Markusen 1996) give a system analysis of managing transport in the context of market economy under a great variety of forms of ownership and competitive market of transportation services. The book is principally peculiar of the fact that the issues related to managing the transportation complex are based on the unified stochastic economic and mathematical model of the transportation activity. The transportation activity is generally reflected by a casual vector, a function from parameters and characteristics of the state.

Large airports in economically developed regions of both Europe and Russia (Moscow) are characterized by using a direct speedy railway service between terminals of airports and railway

stations. For smaller airports they use only the bus passenger service where several bus lines can function depending on the specificity of the regional transportation network (Badcock 2002; Lawrence 2004).

It goes without saying that in any airport it is possible to use services of taxi, and chartered buses are used for organized tourists and to transfer people from and to hotels. Every airport has entry and exit roads for personal motor vehicles and parking lots for cars.

The share of passengers who use public transport differs from airport to airport. According to the data published in statistical reports of airports, it is from 30 to 64%. Herewith, it is possible to observe the tendency that the larger the distance between the airport and the city center is, and the better the passenger service is organized, the greater share of passengers prefers public transport (Belyiy 2011; Kryizhanovskiy and Shashkin 1998).

Besides, to a considerable degree, airports employees, as well as those who meet and see out departing and arriving passengers can also use services of public transport (Lawrence 2004; Belyiy 2012)

2.1. Interval Timetable

The method to form a timetable of public transport (buses) generally accepted in Russia is the interval method (Badcock 2002; Lawrence 2004). According to this method, the hour capacity of passenger flow is defined. On the basis of these loadings, and determining the approximate interval of traffic, a type of the means of transportation is defined according to its passenger capacity (big, medium and small capacity). Then the required number of transportation means on the route is defined, taking into account the deficit or the excess of the available buses, and then the actual interval on the line is clarified. The required number of buses is determined for other periods on a daily basis. The general result is as follows on the basis of Bus 13 run according to the route Pulkovo 2 airport – Moskovskaya Subway Station (Table 1) (Data as on November 2013).

TABLE 1. Parameters of Bus 13 Run according to the Route Pulkovo 2 Airport – Moskovskaya Subway Station

Bus No.	Time (working days)	Run interval (min)
13	5.33 - 10.00	9
	10.00 - 16.00	9
	16.00 - 20.00	10
	20.00 - 01.02	12
K13	06.30 - 10.00	15
	10.00 - 16.00	20
	16.00 - 20.00	15
	20.00 - 22.30	20
K213	06.30 - 10.00	15
	10.00 - 16.00	20

	16.00 - 20.00	15
	20.00 - 01.02	20

2.2. Timing Timetable

The notion “timing timetable” means that on the lines all means of transportation run according to the determined, exactly set intervals. The exact times of arrival and departure are specified. As a rule, they are complied with. This interval is constant during the day. It is attached to hours. During the decreased loading (early morning and late night) this period of time is increased (Belyiy 2012; Advisory Council for Aeronautics Research in Europe).

In large European airports, in interregional service, the regional transportation networks use timing timetable (Belyiy 2011; Dedyukin, et. al. 2008). Table 1.2 shows the timetable of departure time from some airports to the city center.

TABLE 1.2. Timetable of Time Related to Departure from Foreign Airports to the City Center

City, airport	S-Bahn line to the station (or other)	Time of departure every hour (at the day time)
Dusseldorf Int	S11	: 04 : 24 : 44
Munich	S1 to the main station S8 to the Eastern Station	: 04 : 24 : 44 : 11 : 31 : 51
Stuttgart	S2 S3	: 08 : 38 : 18 : 48
Hamburg	S1	: 04 : 14 : 24 : 34 : 44 : 54
Zurich	S2 S16	: 20 : 51 : 02 : 32
Basel	Bus 50	: 00 : 07 : 15 : 22 : 30 : 37 : 45 : 52
London	Heathrow Express	: 03 : 18 : 33 : 48
Amsterdam	RE Sprinter (NS)	: 28 : 58 : 16 : 46
Vienna	City Airport Train S7	: 06 : 36 : 17 : 42

In Table 1.2., S with a number specifies a high-speed train used both in the city

and on the suburbs with a number of specific regional network. IR is an interregional train. Heathrow Express and City Airport Train are direct high-speed trains from the airport to the railway station in the airports of Heathrow in London and Vienna, respectively. RE is a train, regional express, and Sprinter (NS) is a type of high-speed train in Holland.

It is possible to see from the table that the time period for the Dusseldorf airport is 20 minutes – 1/3 of an hour. It is the same for Munich. For Stuttgart, it is 30 minutes – ½ of an hour. In Hamburg, it is 10 minutes. For Hamburg and Geneva, it is 10 minutes – 1/6 of an hour, and for Basel - 7.5 minutes – 1/8 of an hour (Kryizhanovskiy. and Shashkin 1998).

When moving on the route, the stopovers will specify another time shifted for the time of run and stop.

The departure (arrival) time of the same means of transportation from the station to the airport is shown in Table 1.3.

TABLE 1.3. Time of Departure of Transport from Station to Airport

City, airport	S-Bahn line to the station (or other)	Time of departure every hour (at the day time)
Dusseldorf, main station	S11	: 03 : 23 : 43
Munich	S1 S8	: 03 : 23 : 43 : 15 : 35 : 55
Stuttgart	S2 S3	: 25 : 55 : 15 : 45
Hamburg	S1	: 04 : 14 : 24 : 34 : 44 : 54
Zurich	S2 S16	: 27 : 55 : 17 : 47
Basel	Bus 50	: 00 : 07 : 15 : 22 : 30 : 37 : 45 : 52
Amsterdam	RE Sprinter (NS)	: 28 : 58 : 16 : 46
Vienna	City Airport Train S7	: 06 : 36 : 17 : 42

When visualizing timing timetables, there is no need to specify full time of arrival and departure at every stop. Only minutes are specified, because the run of transportation means has already been attached to an hour.

Such timetables are referred to inelastic, carefully followed. Admissible delays are considered to be 5 minutes for buses and 3 minutes for trains for regional passenger service. The standard of punctuality is considered to be not more than 10% of delays above the admissible. Such

system is convenient for passengers with its simplicity and predictability.

The service at prime time and days is regulated by increasing the passenger capacity through using doubled means of transportation (electric trains, trams, double-decked trains), and articulated buses. Another method is to use reduced lines with the intermediate shifted period of time (Gudkov, et. al. 2004).

2.3. Integral Timing Timetable

An important principle peculiarity of the regional network is its coherence. When establishing the transportation network infrastructure and timetables, they strive for minimizing the waiting time when transferring from one means of transportation to another (Dedyukin, et. al. 2008; Belyiy 2012). Here a hierarchical principle is used. For example, the run of buses is coordinated with the electric trains run, and the run of regional trains is coordinated with the run of interregional trains. The time of changing several transport means is minimized by using the "Rendez-vous" concept. The brightest example of applying this concept is the work of the Stuttgart Railway Station in the K212 variant. In this variant above ten trains meet simultaneously at the station every two hours (time of high-speed trains' trips - ICE). Passengers are transferred in many directions. Trains arrive and depart according to the rotating principle. Interregional high-speed trains have the minimum stopping time, and regional trains of the lower rank according to the hierarchy (local electric trains) have the maximum stopping time. If the "rendez-vous" concept is used on the regional level, and hubs for meeting are small stations or stopovers, the system of coherence between lines is considered to be an integral timing timetable (European Commission; Global Mass Transit).

The example of the integral timing timetable is a run from the Stuttgart Airport. Figure 1 shows a part of the schematic map of electric trains (S-bahn) run.

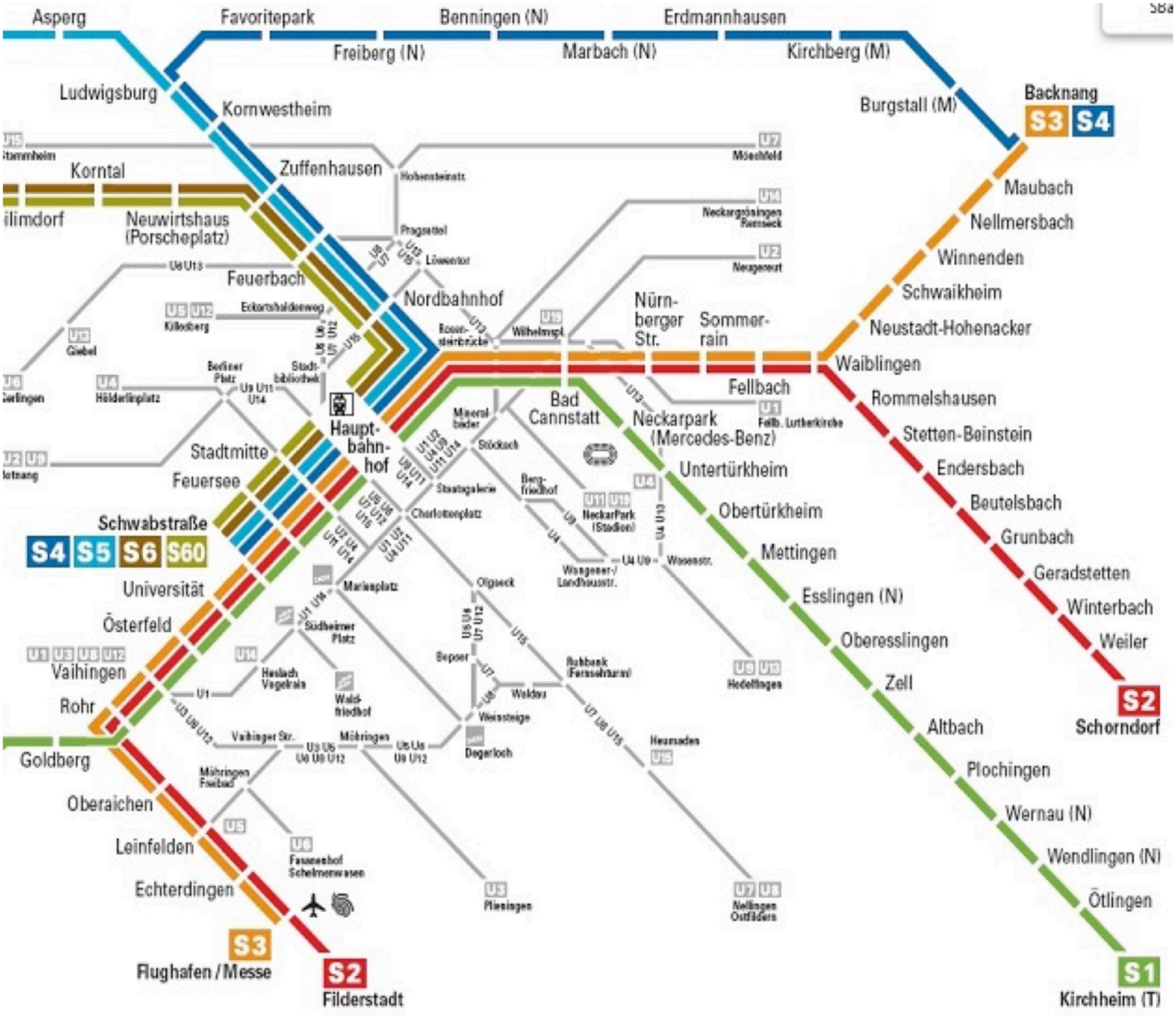

Fig. 1. Fragment of the Schematic Map of S-bahn Run

The airport is located in the south-west of the city. It is possible to access it by electric trains of S2 and S3 lines. S4 line connects the central and northern parts of the city. The run by the S2 line is coordinated with the run by the S4 line. Convenient transfer is at the Schwabstrasse stop. When going towards the airport, the arrival by the S4 line is every hour at :28, :58, and departure to the airport by S2 line from this stop is at :30, :00. The time for transfer is 2 minutes. When going from the airport by S2 line, the arrival at this stop is every hour at :00 and :30, and the departure by the S4 line is at :03 and : 33. The time for transfer in this direction is 3 minutes.

The organization of the integral timing timetable in order to minimize time of transfers is a very difficult task (European Commission; UTIP). The first reason is different time of run at various lines of public transport due to differences in the demand for transportation. The above example coordinates only timetables of S2 and S4 lines. S3 and S4 lines are not coordinated. Here when departing the airport by S3 line, the waiting time when transferring to the S4 line at the Schwabstrasse stop will be 23 minutes.

In Germany the first serious attempt to organize the integral timing timetable was the creation

of the Allgäu-Schwaben-Takt system that included transportation entrepreneurs in the south of Germany. The airport of Munich is also referred to this area. The system of interrelated transportation lines was implemented in 1993. The passenger flow on these lines was thought to increase considerably. During the first year it was 25%. The success of this system was proved by introducing Rheinland-Pfalz-Takt in the south-western region of Germany. The nucleus of this program was the extension of the network of regional express trains (Global Mass Transit; The Sustainable Urban Transport Project).

The integral timing timetable is often identified with the system of organizing the Swiss railway service (Gudkov, et. al. 2004). The Bahn2000 program was implemented by consistent infrastructure measures (reconstruction of stations and stops, increase in the road capacity). At the first stage 6 large transportation hubs were included in the network. At the second stage the interrelations between 14 hubs will be carried out. One of such hubs is the city of Zurich and its airport.

2.4. Tariff Policy

The work of the regional transport is regulated, and tariff policy is pursued by the transportation unions. The airport of Stuttgart is in the network regulated by Verkehrs- und Tarifverbund Stuttgart GmbH (VVS) (Federal Statistical Office). The airport of Dusseldorf is in the network managed by the transportation union Verkehrs Rhein Ruhr (VRR), etc. Such organizations define the price of one-time trip, tickets per day, week, month, year, group tickets, and holiday tickets.

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3. Analysis of Aspect No. 2: Problems Related To Developing The Terminal Network Of The Trans-Siberian Railway

Russia has a large transit potential, both freight and passenger. At the present time this potential has been scarcely used. Above all, it is related to insufficient quality of developing the network of the transportation infrastructure and logistics centers located on the territory of the Russian Federation.

Advantages of transportation by using the Transsib (Transport Research & Innovation Portal) are the following:

1. Reduction of time of freights transportation more than two times: the time of run of the container train from China to Finland by the Trans-Siberian Railway is less than 10 days, and the sea time is 28 days,
2. Low level of political risks: up to 90% of the route is on the territory of the Russian Federation – the state with the stable democratic system of state government, stable political climate and steadily expanding economy, and
3. Minimizing the number of freight transshipment. It decreases expenses of freight owners and prevents the risk of occasional damage of freights when transshipping.

At the present time a considerable part of freight flows in the East-West direction go by sea. The dominating or almost monopole position of sea carriers in this direction does not allow consignors to rely on the decrease in the transportation component in their expenses. Due to it, railway transportation is a reasonable economic alternative to sea transportation (Advisory Council for Aeronautics Research in Europe).

The development of the terminal network at this railway would allow to

1. Create an alternative to a traditional sea way from the Far East and South-Eastern Asia around India and through the Suez Canal,
2. Create service with the Trans-Asian Railway and Asian Highway,
3. Investe in the infrastructure of the Trans-Siberian Railway on the territory of the Far East that

includes, above all, the development of the Vostochny-Nakhodka transportation hub, and

4. Modernization of railways of the Eastern Siberia and Transbaikal. It will allow to ensure a considerable growth of volumes of freight transportation with China (World Transit Research).

Terminals can be constructed depending on the role of terminal in the transportation system (Table 2).

First three terminals are main terminals and process freights that arrive at or transit through the territory of Russia from other countries that have the transportation connection with these terminals. Access terminals are those connecting the main terminals of the Trans-Siberian Railway with other transportation lines and corridors (Federal Statistical Office).

TABLE 2. Roles of Terminals in the Transportation System

Priority number	**Main terminals**	**Importance in the transportation system**		**Terminals of approach**
I	Moscow	Local freights	Europe	Saint-Petersburg
	Vladivostok		China, South Korea	
	Novosibirsk		Middle Asia (Turkestan and Siberian Railway)	Semipalatinsk
II	Iekaterinburg		Transit potential, it connects Transsib and South-Ural Way	
	Omsk		South-Ural way	Petropavlovsk
III	Ulan-Ude		Trans-Mongolian line	Naushki
	Chita		Trans-Manchu line	Zabaykalsk
	Taishet (Irkutsk Region)		Baikal-Amur Railway (BAR)	

The development of the terminal network of the Trans-Siberian Railways will make it possible to improve international transportation and more efficiently interrelate with other types of transport (VVS Stuttgart).

The terminal technology (of transportation), terminal system of transportation (hub and spoke system) is the division of the process of freight delivery into three interrelated elements: transportation of small shipments to the terminal and consolidation of small shipments at the terminal, inter-terminal transportation, and deconsolidation of the consolidated shipments to initial small ones, and their delivery to consignees. The terminal technology assumes the interrelation of various types of public transport (motor transport enterprises, air companies, etc.) that can be controlled in a unified manner. The practice shows that the coordination of timetables and improvement of the efficiency of interrelation of transport enterprises allow to improve the use of the rolling stock and to considerably decrease the delivery terms (Markusen 1996).

The related elements of the Hub-and-Spoke system form an alliance of carriers. It is possible to do it when one of the end hubs is managed by the same company as the main hub (Figure 2) (European Road Transport Research Advisory Council).

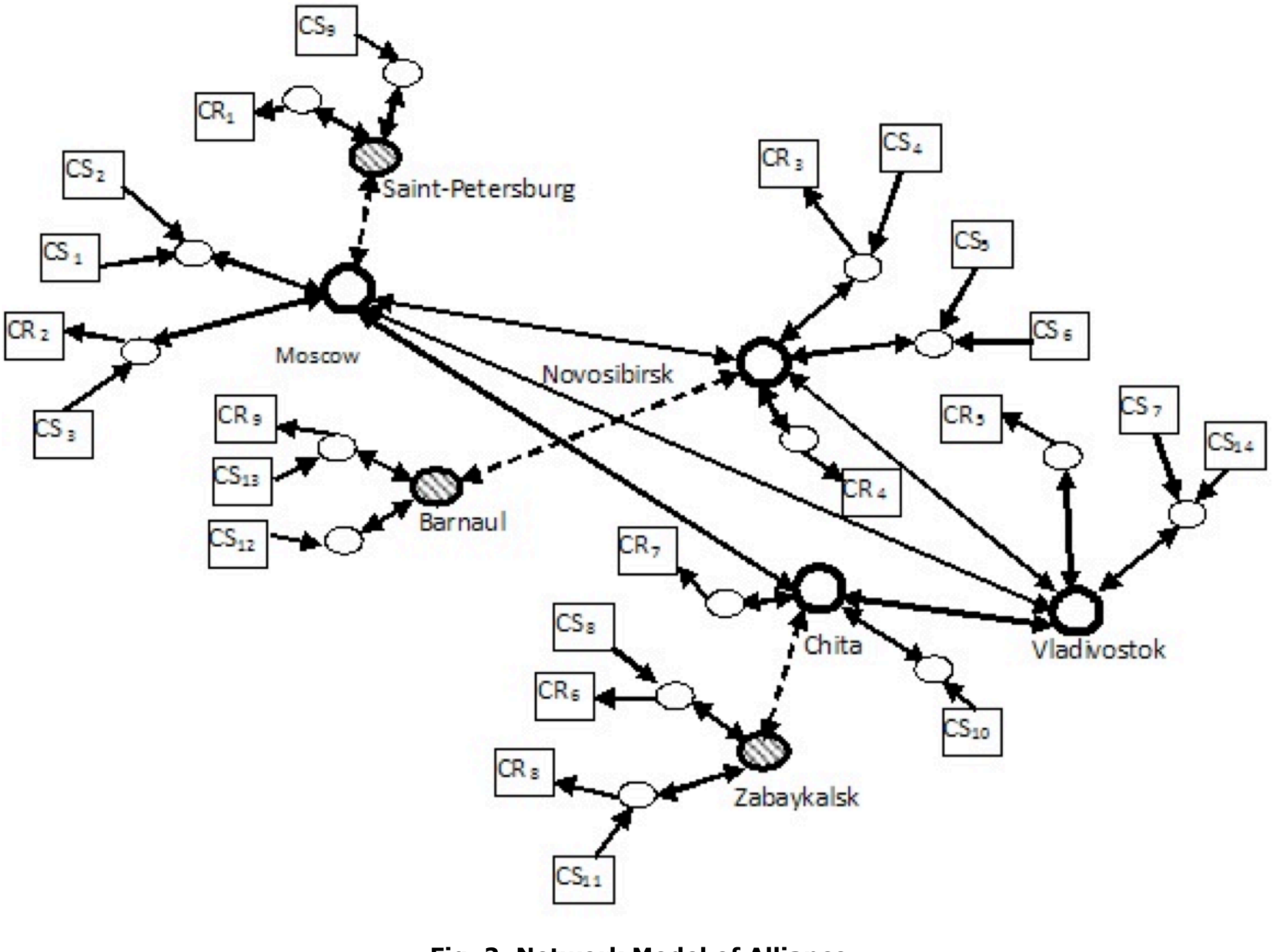

Fig. 2. Network Model of Alliance

The alliance network on the basis of the Hub-and-Spoke model has a number of the following advantages:

1. Expending the clients base,
2. Reduction of expenses,
3. Optimal loading of the transport mean,
4. Common tariff system,
5. Timetable changing (up to introducing container trains that are operated on the timetable basis,)
6. Extending the route network,
7. Introducing the discount system for loyal clients,
8. Uniting assets,
9. Common system of tariffs,
10. Common system of mutual settlements up to establishing the clearing chamber, and
11. Common system to regulate the activity.
12. For the purpose of increasing the speed of settlements, the work of the alliance will make it possible to implement bank transfers – clearing. Besides, the solution about using consolidated freights forwarding from terminals is as important.

There are several variants of implementing consolidation in the network of terminals of Trans-Siberian Railway:

1. Freights are accumulated in main terminals (Moscow and Vladivostok), and then delivered to the destination points,
2. Double consolidation – interrelation between the main terminal (Moscow) and transit one (Novosibirsk). In the latter the secondary loading of freights will take place. Such method will allow to consolidate freights of different consignors to the same destination points, and
3. Consolidation on the run way – de-completing the consolidated forwarding in several terminals of

the network during the run.

The latter variant of the consolidated forwarding is efficient if not more than three points are involved. On the contrary, it will be more profitable to use a smaller container and transport by direct forwarding.

Using an empty container is an important aspect in order to minimize expenses. It is also one of the consolidation components. Secondary use of the container is possible because agents know the dates of freights arrival, and consequently they can form a new forwarding at the moment of the freight arrival.

The terminal network of the carriers' alliance assumes (**Trinity College Dublin)**:

1. Creation of the freight transportation network – transporting and processing freights,
2. Creation of the warehousing network,
3. Creation of the mixed network,
4. Availability of logistic parks (development), and
5. Creation of specialized and auxiliary networks.

The creation of the terminal network alliance is preceded by the contractual work, creating the network of freight agents in hubs of the terminal network, organization of the informational exchange and documents flow, as well as the creation of the attractive system of mutual settlements. An important element of the terminal network alliance is the development of the (neutral) pro-form of the consignment that is common for members of the alliance.

The development of the terminal network by using the offered methods can improve the efficiency of the international freight turnover and decrease transportation expenses when delivering the freight.

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4. Conclusion

The work describes the type of organizing public passenger transportation between the airport and the central parts of cities, which is new for Russia. It is used in large European cities and is based on timing timetables. This type of timetables is applied both in regional transport networks of a number of European countries, and in long-distance traffic. Such type of timetables is based on a wide awareness of passengers about the traffic of transport means. The waiting time and the total time of the trip under possible transfers from one means of transportation to another are minimized. Russia does not have a methodology of forming such timetables. Foreign professional references also have few publications on this theme, although in every day practice these timetables have been functioning for many years already.
The opportunity to strengthen relations with Asian countries will be potentially attractive for Russia during the introduction of sanctions against our country by European countries. At the same time national transportation companies can achieve even more benefits when establishing an alliance of carriers that would work in transporting by the Trans-Siberian Railway.

References

Advisory Council for Aeronautics Research in Europe. (N. D.). Date Views: 01.12.2016 http://www.acare4europe.org/

Badcock, B.A. (2002). "*Making Sense of Cities: A Geographical Survey*". London: Arnold, pp. 63–94,

Belyiy, O.V. (2012). "*Problemy postroeniya i formirovaniya transportnyh system*" [Problems of Constructing and Forming Transportation Systems]. Saint-Petersburg: Elmor, pp. 145

Belyiy, O.V. (2011). "*Problemy formirovaniya i organizatsii transportnyh potokov*" [Problems of Forming and Organizing Transportation Flows]. Saint-Petersburg: Elmor, pp:186

Dedyukin, V.V., Petrov, A.I. and Karnauhov, V.N. (2008). "*Gorodskoy passazhirskiy transport*"

[Urban Passenger Transport]. Tyumen: Publishing House of the Tyumen IUT, pp. 272.

European Commission. (N. D.). Date Views: 01.12.2016 http://ec.europa.eu/

European Road Transport Research Advisory Council. (N. D.). Date Views: 01.12.2016 http://www.ertrac.org/

Federal Statistical Office. (N. D.). Date Views: 01.03.2016 https://www.destatis.de/DE/Startseite.html

Federal Statistical Office. (N. D.). Date Views: 01.12.2016 https://www.bfs.admin.ch/bfs/de/home.html

Glinskiy, V.A., Butrina, P.V., Timonin, A.V., Eliseeva, A.V., and Varlamova, O.V. (2014). *"Mezhdunarodnyie intermodalnyie perevozki: "Konsolidatsiya gruza v terminalnoy seti gruzovyih agentov pri intermodalnoy dostavke"* [International Inter-modal Transportaiton: "Freight Consolidation in the Terminal network of freight Agents in Case of Inter-modal Delivery"]. Saint-Petersburg: Civil Aviation University, pp. 152

Glinskiy, V.A. and Butrina, P.V. (2014). Razvitie kontseptsii terminalno-setevogo biznesa v mezhdunarodnyih multimodalnyih perevozkah [Development of Concept of the Terminal and Network Business in Internaitonal Multimodal Transportation]. *Bulletin of Saint-Petersburg State Civil Aviation University*, 1(6), 96-106.

Global Mass Transit. (N. D.). Date Views: 01.12.2016 http://www.globalmasstransit.net/

Gudkov, V.A., Mirotin, L.B., Velmozhin, A.V. and Shiryaev, S.A. (2004). "*Passazhirskie avtomobilnye perevozki*" [Passenger Motor Transportation]. Moscow: Goriachaya Liniya-Telekom, pp. 447.

Kryizhanovskiy, G.A. and Shashkin, V.V. (1998). "*Upravlenie transportnymi sistemami*" [Managing Transportation Systems]. Saint-Petersburg: AkademiyaGA, pp. 165

Lawrence, H. (2004). "*Aviation and the Role of Government*". London: Kendall Hunt, pp. 227–230,

Markusen, A. (1996). "Sticky Places in Slippery Space: A Typology of Industrial Districts". *Economic Geography*, 3, 293–31.

Palagin, Yu. I. (2009). *Logistika – planirovanie i upravlenie materialnyimi potokami* [Logistics – Planning and Managing Material Flows]. Saint-Petersburg: Politehnika, pp. 286

The Sustainable Urban Transport Project. (N. D.). Date Views: 03.12.2016 http://www.sutp.org/en/

Transport Research & Innovation Portal. (N. D.). Date Views: 01.12.2016 http://www.transport-research.info/

Trinity College Dublin. (N. D.). Date Views: 01.12.2016 http://www.tcd.ie

UTIP. (N. D.). Date Views: 01.12.2016 http://www.uitp.org/

VVS Stuttgart. (N. D.). Date Views: 04.04.2016 http://en.vvs.de/home/

World Transit Research. (N. D.). Date Views: 06.12.2016 http://www.worldtransitresearch.info/

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