Conjugations of transport networks between southern regions of the Russian Far East and neighbouring countries

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Abstract. All modes of transport are developed in the Far East region of Russia, namely: the railway, road, river, maritime, aviation and pipeline ones. The following groups of functions performed by regional transport are distinguished like provision of the intra-district, inter-district, foreign economic and transit links as well as the joints of various modes of transport, including those between land and maritime transports. The various types and spatial structures of conjugations of railway transport in the southern regions of the Russian Far East with neighbouring countries, PRC and DPRK are determined. The main connecting role in such conjugations is played by the trans-boundary links of the transport network and the pairs of cross-border transport nodes. Generalized assessments of conjugations between the different modes of transport in the Far Eastern region of Russia as well as the presence of conjugations of different modes of transport in the region with transport networks of neighbouring foreign countries, PRC, DPRK, USA and Japan, are given.

1. Introduction

The Russian Far East as a whole is a frontier region, which borders on foreign countries in the south and east. In-land in the south, the region borders on China for 4,209.3 km and DPRK for about 17 km. In the east, by a huge coastline of about 26 thousand km, the region faces the seas and the Pacific Ocean, including bordering on the US over the Bering Strait and Japan (Hokkaido Island) over the La Perouse Strait and the Kuril Strait. Thus, the Far Eastern region has about 4,200 km of the total length of terrestrial state borders, and over 20 thousand km of the maritime borders.

Taking into account the geographic location of the region, both terrestrial and maritime modes of transportation were created here. By now, nearly all modern modes of transportation are represented in this vast space: railway, road, river, sea, aviation, and pipeline. All of them are used to implement various foreign economic relations with neighbouring and more distant foreign countries. Availability of various connections of the Russian transport links with foreign ones is a required condition in this process.

2. The statement of the problem

Many studies have been devoted to the development of the transport network in the Far Eastern region, including those by V.N. Bugromenko, R.G. Leont'ev, Ya.N. Semenikhin, L.B. Vinokur, R.V. Vakhnenko, and others. They analysed the geographical features of the transport network both in the region as a whole and in some of its southern portions, where the transport network is more developed

[1, 2]. In a row of works, the problems of development of seaports and formation of their specializations were considered [3].

Since the 90s of the last century, foreign economic ties have increased significantly in Russia and in its eastern regions, especially in the Far East. That led to the growth of scientific interests to the development of international transportation and the formation of the international transport corridors in the Far East [1, 2, 4]. However, geographic analysis of the conjugation between the transport networks of the Russian Far East, both terrestrial and maritime, with foreign transport networks has received insufficient attention so far. Recently, international conjugations started to form in pipeline transport and in the transmission of electricity, which also requires its relevant consideration.

In addition, in the long term, a significant increase in export orientation of the region is expected due to forming the territories of advanced development in the Far East, giving the status of a free port to several seaports in the region. It will also require new studies.

3. Key findings and discussion

Taking into account the most important features of the economic and geographical situation of the region - its considerable remoteness from the central most developed areas of the country and its direct access to the state border of a number of the countries like PRC, DPRK, Japan and the USA as well as its broad exit to the seas of the Pacific, its regional transport system performs four groups of functions: 1) ensuring internal transport socio-economic links; 2) ensuring a connection of land transport modes with maritime ones; 3) realization of many more effective foreign economic relations of the region through exits to foreign countries and their markets; 4) providing of transit export-import shipments of cargoes and goods from other regions of Russia. As it follows from the content of the functions, the second, third and fourth groups are directly tied with the implementation of various foreign economic relations.

Spatial features of the basic infrastructure, which ensures the performance of all these functions, namely - transportation of goods, cargoes and passengers in general, have a linear-node network expression. Transportation takes place in the linear links, and processing of cargoes and conjugation of various modes of transports occurs in the nodal links. The conjugation of land transport modes - railway, road, pipeline transports with maritime transport is of particular importance for the Far Eastern region (table 1). Such connections and conjugations are realized in specially engineered sections of the coast - seaports, which are linked with ground-based modes of transport and where cargoes handling takes place. At the same time, practically all modes of transport have connections and conjugations with the corresponding links of transport systems of foreign countries (table 2). Land transport modes like railway, road and pipelines have the most pronounced connections and conjugations.

Table 1. The presence of conjugations between the different modes of transport in the Far Eastern region of Russia.

Transport Modes	The presence (+) or absence (-) of links between modes of transport					
	Railway	Highway	River	Sea	Aviation	Pipelines
Railway	+	+	+	+	+	-
Highway	+	+	+	+	+	-
River	+	+	+	+	+	-
Sea	+	+	+	+	+	-
Aviation	+	+	+	+	+	-
Pipeline	-	-	-	+	-	+

The conjugation with transport networks of neighbouring countries is understood here as availability of one or several transport links joining national transport arteries (or sections of the transport network), passing at some distance from the state border.

Table 2.The presence of conjugations of various modes of transport in the Far Eastern region of Russia with foreign countries.

Transport Modes	Presence (+) or absence (-) of links with countries				
	P.R.C.	DPRK	Japan	USA	Other countries
Railway	+	+	-	-	+
Highway	+	-	-	-	-
River	+	-	-	-	-
Sea	+	+	+	+	+
Aviation	+	+	+	+	+
Pipeline	+	-	-	-	-

The links connecting the national transport networks (sections of railways or highways, etc.) and crossing the state border, are essentially trans-boundary ones. They consist of two national sections of the transport network and direct transport crossing the border. The latter may have certain equipment, for example, for a change of wheel sets to another track, for changing locomotives, electric locomotives, buses, etc. Within the border crossing sites, transfer of cargoes from one vehicle to another, compilation of new trains and so on take place. Therefore, the cross-border transport link is generally represented by a section of the transport network (of one or another type of transport), which crosses the state border, and by two national frontier transport nodes, where cargoes handling, logistics, technical maintenance, etc. are performed (figure 1).

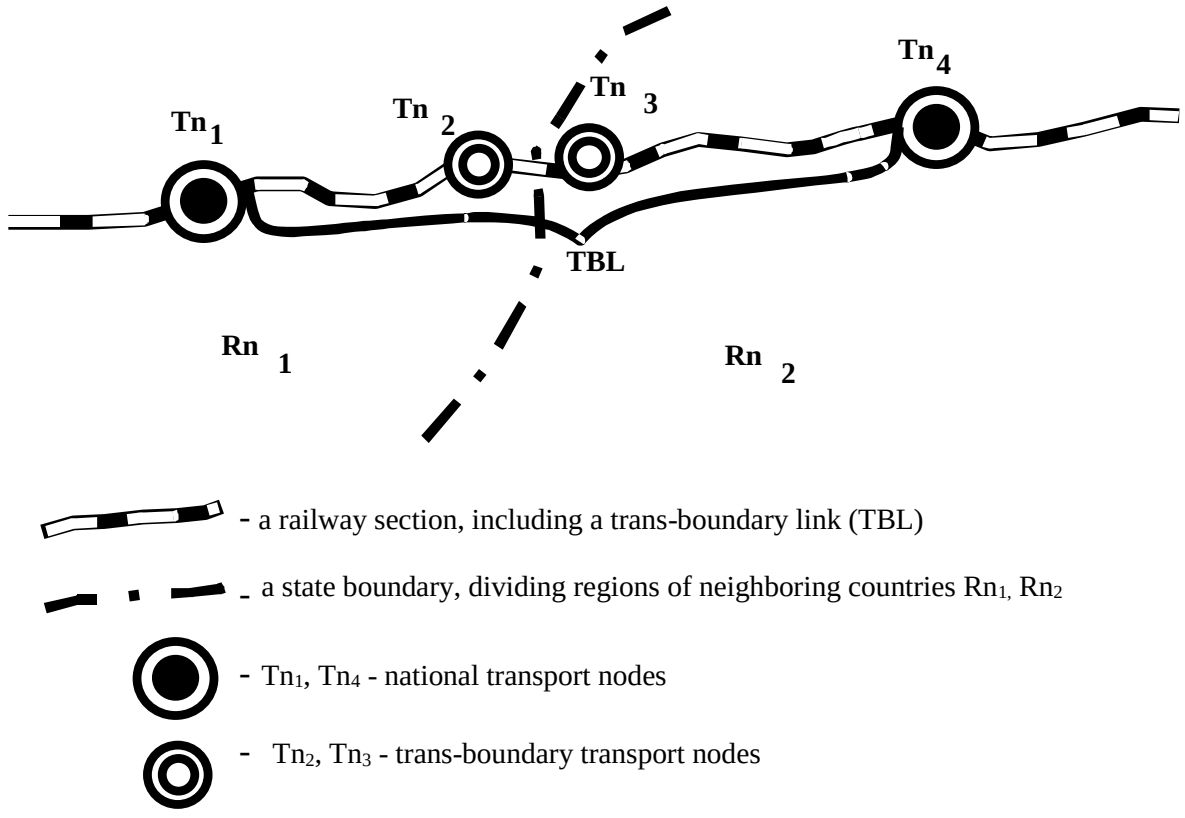

Figure 1. A cross-border transport link in the conjugation of the railways of two neighbouring countries.

In terms of spatial features, trans-boundary transport links may have different types of conjugations with national transport networks or its parts (figures 2a, b, c, d).

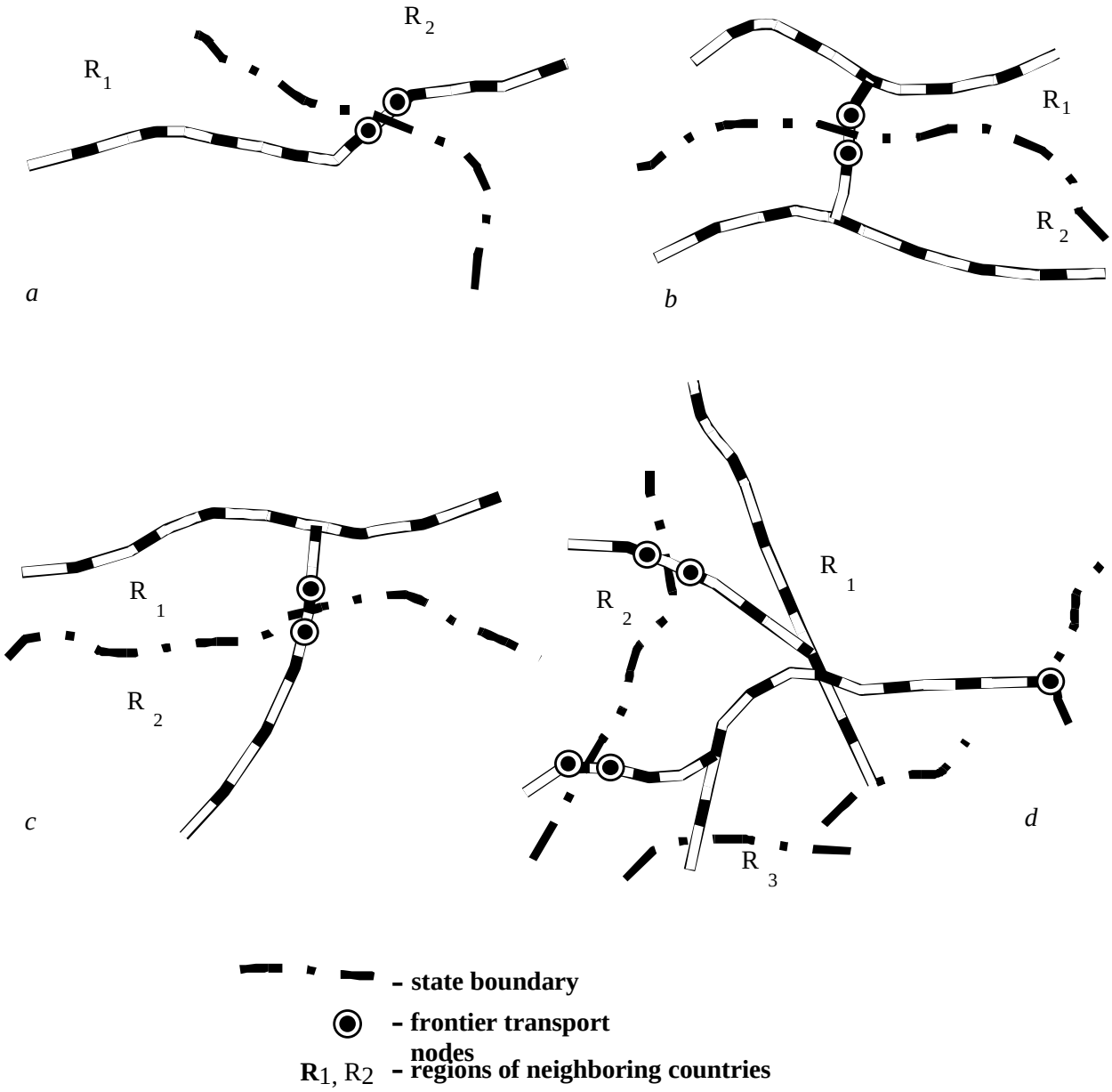

Figure 2. The types of conjugations of transport links of two neighbouring countries (*a-d*).

Type a is represented by an essentially unified transport artery that crosses the state border. At the same time, the national section of the road goes to a trans-boundary link, and then to another national road section. Prior to the trans-boundary link, domestic and international transportations are carried out generally along such national areas, and only international transportations along the trans-boundary link.

Type ***b*** is typical of the regions of neighbouring countries with sufficiently developed internal transport networks. At the same time, at some stage of its development, the trans-boundary transport links connecting them are being built.

Type ***c*** is formed at various levels of development of a transport network in neighbouring regions of two countries. For example, in R1 the transport network is more developed, and domestic transportations are more developed. A branch to a neighbouring country (region R2) was built from one of the transport arteries. The section of this branch is a trans-boundary transport link, and then it goes into the national transport line.

Type ***d*** reflects the option where a large transport artery terminates, approaching, for example, the seashore. At the same time, several branches are developed from it: firstly to seaports, where maritime transport is matched with foreign countries, and, secondly, for transport transitions to other neighbouring countries, to its ground transportation networks. This type is the most complex, it is typical, e.g., for the final portion of Trans-Sib, which approaches Vladivostok and has the branches to the ports of Nakhodka and the cross-border transitions to PRC and DPRK.

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