



# Report of O. A. Struve, Candidate for the Chairmanship of VIII Department. Part 1



## News from the archives

An article in *Rail Business* [*Zheleznodorozhnoye Delo*] introduced 110 years ago to the readers the report of O. A. Struve, presented at the Solemn General Meeting of the members of the Imperial Russian Technical Society on April 15, 1911 on the occasion of the seventy-fifth anniversary of the beginning of railways in Russia, chaired by the Honorary Chairman of the Society His Imperial Highness Grand Prince Alexander Mikhailovich.

The publication of the report will be continued in the next issue.

**Keywords:** railway, history, railway availability, railway density, connectivity.

## Your Imperial Highness, gracious ladies and gentlemen!

«We are suffering from an excess of distance». This was the reading of the significant words spoken by the Emperor Nicholas the First to Melnikov, when Melnikov, as one of the builders of the railway, intended to connect two capitals of the Empire, introduced himself to the Emperor.

At that time, there was only one railway in Russia, from St. Petersburg to Pavlovsk, 25 miles long, but since then the conditions have changed – and, despite the widespread rail network and thousands miles of lines that penetrate the territory of Russia in all directions and connect its borders from the Baltic coast to the Pacific Ocean, from the Black to the White Seas, these words have nevertheless retained their meaning to this day, have not lost their deep meaning to this day.

The development of our railway network after the first slow beginnings, accompanied, as everywhere else, by mistrust, proceeded at an

accelerated pace, but internal productive forces of Russia and its needs developed at an even faster pace, the need for cheap, as for the cost of transportation, and reliable in terms of continuity of its activities, transportation routes was growing, and those transportation routes were associated with a new powerful tool – the railway.

Let me give you a few brief figures describing the progress in the coverage of Russia with railways over the past 75 years.

In the period up to 1850 inclusive, 468 versts were opened for public use within European Russia. 1019 versts were opened during the decade 1850–1860, 8734 versts in 1861–1870, and 10900 versts in 1871–1880.

Starting from a decade after, railway construction spread to Asian Russia. So, in the period 1881–1890 the network of European Russia increased by 5932 versts, while 1290 versts were built in Central Asia.

During the decade 1891–1900, 16 764 versts were opened for movement in European Russia,

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The text of the article originally written in Russian is published in the first part of the issue.  
Текст статьи на русском языке публикуется в первой части данного выпуска.

4633 versts in Asian Russia, in 1901–1910, respectively, 8233 versts and 3742 versts.

Currently, construction is underway, and the construction of 6287 versts will be started.

Thus, by the beginning of the current jubilee year, the operating railway network of Russia represents an impressive length of 61 715 versts, including 52 050 versts within European Russia, excluding Finland, and 9665 versts in Siberia and Central Asia.

Simultaneously and in parallel with development of the railway network the volumes of transportation also have increased. The measure of the transportation activity of the railway is considered to be the number of cargoes that travelled, on average, along each verst of the road, in other words, the amount of pood-versts per verst of the road.

In this regard, a significant fact can be noted, which is illustrated by the following data, namely: in 1884, with the operational length of the railways of European Russia of 22 500 versts, cargo turnover was expressed in 25,5 million pood-versts per verst, not counting economic transportation. As the network grew, the cargo turnover developed, and in 1907, with a total length of the network of 49 180 versts, 49,2 million pood-versts can be accounted per verst; in other words, and rounding up, per a verst of the network doubled in length, there was a doubled number of pood-versts, or summing up: the length of the network doubled, while the total cargo turnover quadrupled.

Isn't this eloquent fact, consistently observed over the past decades, the best proof that coverage of Russia with railways is still far from being exhausted? It is an indicator of responsiveness with which the country's productive forces meet the developing railway network, of the need, the need that is felt by the industrial and commercial life of the country in the ways of communication, providing cheap and uninterrupted transportation of mass products of the vast state throughout the year.

It is safe to say that further development of the network, in any case, for a sufficiently long time should be accompanied by approximately the same increase in the average cargo turnover per verst of the network, indicating the country's far from exhausted demand for railways.

A very clear indicator of how much Russia is not yet sufficiently served by railways can be compared to other countries in this area. Limiting ourselves only to the borders of European Russia and comparing its network with the railway network of other states, we have the following data on the length of railways in different states per hundred square kilometres and per 10 000 inhabitants (Table 1).

We see that Russia, with current development of its railway network, takes the last place in relation to the density of the network both in terms of space and population, and this position will not change significantly, even if we introduce an allowance in the sense of not accounting a vast northern region, sparsely populated and poorly served by railways.

However, the above characteristics of railway coverage in different countries and in Russia in relation to space and population, i.e., to two elements that are not directly related to each other, do not represent such an indicator that would simultaneously consider both main factors, on the totality of which the right of a given country to a certain development of railways in it could be justified.

Meanwhile, an assessment of the comparative coverage of different countries or individual regions and regions of a given country by railways is undoubtedly of significant importance when judging about the greater or lesser need for development of the railway network in a certain area.

If we proceed from the basic principle that the state as a whole is obliged to strive to endow with railways in an equally fair measure all the constituent parts of the common state territory, then, of course, it is desirable to indicate a meter that could serve to assess the right of a certain region to this or another development of railways within it.

It is clear that this meter would have to embrace a whole range of economic conditions and take into account various elements, such as population and productive forces of the area, considering at the same time the topographic and hydrographic features of the region in order to obtain the value of the meter applicable for assessment, but it is just as clear that it is precisely this indicated dependence of it on the most varied conditions that would give it such a complex appearance that the selection of such a meter would seem, if not impossible, then at least extremely difficult.

Therefore, it seemed to us quite appropriate, when trying to establish such a meter, to proceed from the most basic elements influencing it, by no means denying that in each particular case, for its correct assessment, a number of other circumstances will have to be taken into account.

The need of a given country or region for railways, undoubtedly, under the same conditions, depends on two factors: on the size of the serviced area and on the density of the population within this area.

Obviously, this area is the more served by railways, the greater their length per unit of surface is, i.e., the greater is the density of the network.



**Table 1**

Name of the state	Kilometres of railways accounted	
	per 100 sq. km	per 10 000 inhabitants
France	8,9	12,2
Germany	10,7	9,4
Great Britain	11,8	8,4
Austria-Hungary	6,7	9,2
United States of North America	3,8	43,1
European Russia	1,2	4,4

The area is considered richer endowed with railways, the greater is the length of those per unit of population, for example, ten thousand inhabitants, or, conversely, the smaller is the number of inhabitants per unit of length of railways.

Combining these two conditions and giving to their totality the value of a conventional indicator or coefficient of coverage of a given country with railways, we come to the conclusion after appropriate calculations that: the coefficient of railway coverage of a given country is proportional, other things being equal, to the square of the density of the network and is inversely proportional to the density of the population.

It seemed interesting to check the plausibility of this meter and to trace the values in which the coverage ratio determined by such a technique will be expressed for different countries; and consequently the following figures were obtained:

For France	103
For England	98
For Germany	100
For Austria-Hungary	61
For Belgium	100
For Switzerland	154
For United States of North America	149
For European Russia	4,3

The above conclusions indicate the same coverage in France, England, Germany, Belgium, for which the coefficient turned out to be about one hundred. In these countries, as is known, further railway construction is already manifested to a limited extent, as if indicating that they are satisfactorily served by railways.

Higher rates were revealed for Switzerland and America. Switzerland, as you know, is located at the junction of an integral series of transit routes and is a favourite of tourists and travellers; it is distinguished by the density of the network, almost equal to the density of the network of England, moreover, with a population density of only 80 people per sq. km. In England, per sq. km there are 140 inhabitants.

As for United States of North America, the widespread development of the network is for them a well-known distinguishing feature among cultural countries and an indicator of powerful industry and trade. Suffice it to recall that there are over 40 km of railways per 10 000 inhabitants, that is, approximately four times more than in Germany and France, moreover, with a relatively weak population density of 9 inhabitants per sq. km.

For European Russia, the coverage factor will be 4,3, with a network density of 1,1 versts per 100 sq. versts and an average population density of 27,9 inhabitants per sq. verst.

At the same time, however, the vast areas of Arkhangelsk, Vologda and Olonets provinces, with an area of 1 213 000 square versts, are taken into account, with a population of 2 387 000 inhabitants. Excluding this region and the railways located within its borders, with a length of 1 063 versts, the coverage ratio will slightly increase and turn out to be 5,6, still significantly inferior to the coverage indicators of other countries we have mentioned.

Moreover, 1,44 versts of railways and a population of 36,8 inhabitants per sq. verst relate to 100 sq. versts.

In order to be equal per degree of coverage to that of England, France or Germany, which all have almost the same degree of coverage, the network of European Russia should increase to approximately 190 000 versts, that is, in addition to the 55 570 versts currently under construction, about 135 000 versts must be built.

For comparison with Austria-Hungary in terms of coverage, our European network should expand to 150 000 versts, i.e., increase by about 95 000 versts.

At first glance, these figures may seem excessive, exaggerated, but let me shed light on this issue from another angle.

To be continued.

**O. A. Struve**  
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