

# Oil and gas pipeline system of the Tyumen Oblast: social and spatial analysis

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**Abstract.** The article describes the spatial analysis of the trunk oil and gas pipeline system running on the territory of the Tyumen Oblast, in combination with the near-route populated utilitarian settlements forming a unique territorial production cluster.

## 1. Introduction

Pipelines that originate in the Tyumen oil and gas fields represent a unique transport system both in terms of their production capabilities and in terms of the resonant impact on the character of the region's economic and social development [1], [2]. Throughout their entirety within the boundaries of the Tyumen Oblast, they have become an integral feature of its industrial landscape, an important factor in the organization of social space. At the same time, it is the spatial aspect of the functioning of this system that remains outside the field of view of researchers. It would seem that this aspect is closest to the problem of transport geography. But here the main works (not so numerous) are concentrated on two main areas: the interaction of transport and settlement [3] and the morphology of transport networks [4]. And both these areas are connected, as a rule, with more branched networks of automobile and railway transport. It is clear that the tools used in this case are not suited to studying the peculiarities of pipeline transport. Some efforts are required to modify and adapt the methods and models used. Such an attempt is made in our work.

## 2. Methods

In this case, the concept of the support frame put forward in his time by N.N. Baran and developed by his disciples and followers may prove promising [5]. It allows one to combine the advantages of both morphological and settlement areas in the geography of transport and at the same time consider the region as an integral structural and communicative formation.

An analysis of the structure of the settlement of the modern Tyumen region shows that along with the main frame, which unites large oil and gas production centers and support-rear facilities in the south of the region, there are also relatively autonomous settlement clusters. One of them is represented by the settlements that gravitate towards the main oil and gas transportation network. And although in the economic-geographical in administrative-territorial, communicative and other relations these settlements are sometimes presented as unconnected, the commonality of their production purpose and socio-cultural appearance is unquestionable. Nevertheless, this cluster is an



almost unexplored socio-spatial phenomenon, and we see our task in proposing an initial theoretical sketch of this phenomenon and thereby set the impulse for its further research.

The autonomy of the cluster under consideration is due not only to the specifics of the territorial organization of the industry subsystems that make up the oil and gas complex, but also to the peculiarities of the settlement of these areas. The urbanized settlement system was formed in the Tyumen region in just three to four decades in the course of a new industrial development in a sparsely populated, and in some places uninhabited space. Unlike the old-developed regions, where such systems mature not so rapidly and, as a rule, on the basis of rural settlement, the picture of urbanization in the Tyumen region was different. The pattern of settlement here was first drawn up sketchily, then projected onto a supposedly clean space, more consistent with the matrix of geological markup of the territory than with the previously established settlement scheme. This was due to the involvement in the economic turnover of an extensive oil and gas province, with its intensive industrial development, based on the location of production facilities confined to hydrocarbon deposits. People were seen as resources mobilized and distributed in the necessary amount for their erection and functioning. As a result, the formed system of settlement and its support framework acquired characteristic features of utilitarianism [6].

As for the main transport of oil and gas, the basic principle of its development at the time of the beginning of the development of oil and gas fields was based on the logic of centralized management of the national economy and the existing specialization of the economic regions of the country. It was believed that the enterprises for the preparation and processing of hydrocarbon raw materials should be concentrated in places of mass consumption, remote from the mining areas by thousands of kilometers. In addition, the essential in this strategy was the export of oil and gas outside the country. An accelerated construction of ultra-long oil and gas pipelines was required, which to this day determine the configuration of the main pipeline network in Russia and CIS countries.

However, from the point of view of the organizing influence on the regional settlement system, the ground objects of the transport network are most significant. These are, first of all, oil pumping stations and gas compressor stations (OPSs and CSs). There are a number of methods for arranging the OPSs and CSs on the pipeline route [7], [8]. However, theoretical calculations is only a preliminary outline of their location. The practice of building pipelines is based on the fact that pumping stations are preferable to locate near settlements, sources of energy and water supply, the existing network of railways and highways. In addition, certain requirements are also imposed on the sites of these stations. Thus, in the developed regions their location is set initially. It is clear that everything was more complicated in the Tyumen Oblast. Since the upper limit of the normative distance between two neighboring stations can not be exceeded, the choice of their locations was often associated with the need to build new settlements, build a minimum of production and social infrastructure facilities, and redo the majority of communications. But even in the existing villages, sometimes serious modernization of buildings, facilities, production facilities, and the whole life-support complex was required.

The main characteristics of pipeline transport in the Tyumen Oblast at the final stage of network formation are given in Tables 1 and 2 [9].

**Table 1.** Oil pipelines of the Tyumen Oblast.

Main characteristics	1980	1985	1990	1995
Length of the route, <i>km</i>	3395	4204	6178	6085
In a single-line version, <i>km</i>	6275	8159	10684	10597
Number of oil pipelines, <i>pcs</i>	12	20	32	34
Average diameter of pipes, <i>mm</i>	1057	1029	988	988
Number of OPSs, <i>pcs</i>	60	80	83	83

**Table 2.** Gas pipelines of the Tyumen Oblast.

Main characteristics	1980	1985	1990	1995
Length of the linear part, <i>km</i>	9279	18024	27672	27790
Number of gas pipelines, <i>pcs</i>	7	12	18	20
Average diameter, <i>mm</i>	1320	1369	1386	1395
Number of CSs, <i>pcs</i>	27	42	50	50

Since then, the number of settlements with ground network facilities that require constant stationary services has remained virtually unchanged. But the ratio of the generators of settlement factors has changed. However, this almost did not affect cities, but in many villages and towns, including suburban ones, the factor of servicing the transport main became predominant, and sometimes the only factor.

It would seem that these are weighty arguments in favor of considering a network of pipelines and near-route settlements as a linear part and nodal elements of a supporting framework for settlement. But, despite the obvious organizing importance of pipelines, this structure does not form the framework of settlement in its classical sense. Oil and gas mains can not be called communication routes in the usual sense, as well as technological roads along the pipeline route. Passenger and cargo communication between rural settlements is organized via other roads, and in some cases carried out by air transport. Therefore, the nodal elements of such a framework are deprived of two basic functions: region-forming and communicative (interaction factor). That is, they have only a development role [4]. This is mainly the expansion of the zone of influence of the settlement on the adjacent territory, its involvement in economic circulation, as well as the use for other purposes, including recreational ones. In this regard, the entire structure of this cluster by its characteristics is closest to the development frame. But this is not its only purpose. This structure is unique in that it combines both generative and conservative mechanisms of impact on the population. This is a kind of a proto-frame. On the one hand, it facilitates the expansion of the area of territory settlement, the emergence of new accommodation microcracks within the administrative district and at the inter-district level, and, on the other hand, preserves and consolidates the dominant position of the near-route settlements in the expanding settlement scheme.

The question of the place and role of this cluster in the socio-cultural space of the region deserves special consideration. An analogy with closed cities, or, more precisely, with settlements that fall under the category of closed administrative-territorial entities (CATE), may be useful here. Earlier, these cities and towns with a strict regime of secrecy were known only from the rumors. Now they are much more open and even became the subject of special studies (including geographic ones). Their closed nature is officially stipulated and provides for a number of prohibitions and restrictions.

It is clear that in small settlements along the pipeline route, isolation and closed nature are of a completely different kind. This, in fact, is "another Tyumen region," not so populous (here live less than 10% of the population of the region), little-known, unattractive, deprived of public attention. But it deserves such attention. Like closed cities, this place of life and work is specialized, it closely intertwines everyday life and a high degree of responsibility for the results of work. A lot depends on the social well-being of these places, including the energy and environmental security of not only the specific region, but the whole country [1], [10].

### 3 Conclusions

The cluster considered in this paper has a number of features. This combination of unique (single) and universal (typical) factors for a whole range of parameters: severe natural and climatic conditions, the scale of construction and operation of facilities, utilitarian structure of settlement and reproducing its social infrastructure, etc. All this turns it into a kind of representative facility, a kind of model of theoretical analysis and decision-making.

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