Roadside service as factor of regional development

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Abstract. The article presents results of investigation of roadside service in Irkutsk oblast carried out by the authors in order to improve the current network and for rational placement of new facilities. The major factors and problems of roadside service development were revealed and mathematical calculations and thematic maps were made. A geoinformation system based on applied GIS MapInfo with original database was created by the authors. The study is of great theoretical, methodological and practical value for future development of roadside service in all Russian regions. Particular practical significance of the study is that roadside service facilities scheme layouts for each municipality of Irkutsk oblast were created. Many of the calculations were made for municipality of the first level which is most useful and valuable for authorities and departments controlling roadside service market development, as well as for private entrepreneurs. The basic ideas and findings in the form of concrete recommendations for Irkutsk oblast as a whole and individual municipalities are currently used by the federal and regional authorities to address many problems of roadside service system development.

1. Introduction
Many developed countries have extensive experience in development of roadside service. The roadside service in Russia began to emerge recently and has a lot of various problems which are particularly typical for such underpopulated regions as Irkutsk oblast.

Relevance of the study is obvious; it is determined by the problem of improving the current network and efficient deployment of new roadside service facilities in Irkutsk oblast. It is also determined by the lack of theoretical and practical researches in this field in Russia, lack of roadside service facilities scheme layouts and development concepts, as well as lack of consistent information support for management optimization.

Roadside service is a sphere which provides for the needs of people and vehicles on the road. The structure of roadside service includes the following services [1]: Sale and hire of transport vehicles and spare parts, diagnostics, repair and maintenance services, supporting technical operation of vehicles (sale of fuels, supplies and accessories, car wash, etc.), roadside infrastructure of human everyday life (catering services, hotel, health and information services, trade, communication services, sanitary-hygienic services), etc. However, at present many services, including personal services, leisure, car hire, information, health care, communication services aimed at providing proper rest for drivers and passengers are not sufficiently developed in Russia [2].

The roadside service system is currently accumulated around the most significant service hubs: filling stations and complexes, service stations. The representatives of these segments are now most organized and competition rate among them is the highest. Therefore we will focus in greater detail on this segment of roadside service as it precedes the creation and development of the whole roadside service complex and indirectly affects the demand for other customer services.
Other roadside services such as automobile gas-filling station, NGV filling station and multi-fuel filling station are less developed.

2. Models and Methods

To analyze the current state of the roadside service in Irkutsk oblast we carried out a number of activities: a large amount of methodological and statistical material was collected and analyzed; inventory of existing network of filling complexes and roadside service stations was performed; roadside service facilities scheme layouts for municipalities of different levels were created; traffic capacity and motorization level were calculated; the demand for filling stations and complexes was defined; the thematic maps (the length of road network, the volume of consumed fuel, traffic intensity, the road length per one filling station, the amount of automobiles per one km and one filling station, etc.) were made.

We also created a geoinformation system based on applied GIS MapInfo with original database for Irkutsk oblast, plans of individual locations, network of all motorways and the option of enabling additional sources of information such as large-scale satellite survey and online cartographic services of third-party developers [3].

All activities mentioned above allowed establishing the location of 566 facilities in Irkutsk oblast which sell petroleum products of all types and 106 facilities of auxiliary roadside service (diagnostic services, minor repairs, washing, food trade and catering services, etc.). The shares of facilities according to the types of fuel are as follows: liquid motor fuel (filling stations and complexes) – 501, natural gas motor fuel (gas-filling stations) – 65.

Gas-filling stations are distributed unevenly in Irkutsk oblast, both northern cities and towns and most of rural municipalities lack them. Retail sale of liquefied natural gas in Irkutsk oblast is implemented mainly by special-purpose companies (OAO Irkutskoblgas, OOO Gasomarket, OOO Conterra+Kraisneft?). It is related to existing monopolization of trade of liquefied gas.

There is substantial lack of NGV filling stations in Irkutsk oblast, as in most of regions of Russia, due to the absence of main gas pipeline and distribution network to final customers, as well as due to stricter security requirements. At present there is only one NGV filling station in the city of Bratsk.

The developed and extensive filling stations and complexes network is concentrated around large cities of Irkutsk oblast. This is due to the fact that the demand for the services is significantly higher in a large location.

On the basis of comprehensive analysis and mapping of roadside facilities, we proved the territorial dependence: the farther it is from the big city, the less roadside facilities there are and the less diverse range of services there is.

Irkutsk oblast is one of the largest producers of petroleum products in the country. There is Angarsk Petrochemical Company (ANKhK) which is part of the structure of the largest petroleum company “Rosneft”. Delivery of petroleum products to Irkutsk oblast is not limited to ANKhK, provision for the retail network is also made by other enterprises of “Rosneft” from other regions of the country (e.g., Achinsk and Komsomolsk oil refineries). The average annual production for 2012-2013 at ANKhK made approximately 1300 thousand tons of diesel fuel and 960 thousand tons of gasolines [4].

The crucial factors for roadside service development are the car fleet and its growth trends. According to the data of the State Traffic Safety Inspectorate, there are 752 800 cars registered in Irkutsk oblast as of 2013. Their distribution across the territory is extremely uneven; most of them are concentrated in the regional center. We estimated the level of motorization (per 1000 citizens) in Irkutsk oblast which comprises 300-320 cars on average being slightly above nationwide rate. In municipalities with developed industries the level of motorization is higher (Zalarinsk, Bodaibinsk municipalities). The lowest rates are in rural municipalities and a number of northern municipalities with poorly developed road network. The indicator of the number of cars per 1000 citizens also emphasizes the level of welfare of the population and is a source of data in the calculation of
appropriate density of filling stations and complexes. Visual representation of some statistic data gives a clear picture of location of the resource, agricultural and industrial regions in Irkutsk oblast.

In general, the number of vehicles in the country tends to grow at average 10% a year. Therefore in the future, according to different sources, motorization level in Irkutsk oblast may reach maximum values of all regions of Russia (500-600 cars). The global motorization experience indicates marginal growth of 700-800 cars in developed countries; further growth is limited by the road infrastructure overload, well-developed public transport system and many other factors, including contrived limitations on the part of authorities [5].

Irkutsk oblast is lowly urbanized, therefore a significant growth of motorization level in larger part of its territory is possible under favorable economic condition. There is only one territory (urban agglomeration Angarsk Irkutsk-Shelekhov) where road overload and public transport development can limit growth of motorization level.

Location of roadside service facilities depends directly on car traffic intensity. Maximum traffic intensity of more than 10 000 cars per day (c/d) was registered on highways of the south of Irkutsk oblast which links the regional center with suburbs and large locations. Most of highways in the region have low traffic intensity of not more than 1000 c/d and only some parts of roads have significantly more intense traffic, like in that of Bratsk and Ust’-Illimsk.

3. Results and Discussion
By analyzing the estimated results, we can distinguish three groups of municipalities experiencing lack of filling stations and complexes: northern industrial regions, southern regions and cities (Irkutsk, Bratsk, Sayansk).

Southern regions and big cities, despite the general redundancy of filling stations and complexes, still have a deficit per transport unit due to the faster motorization progress and low quality of service at filling stations and complexes.

General redundancy of filling stations and complexes in the south of Irkutsk oblast is associated with the period of rapid development of petroleum products retail business and conditioned by a number of facts: rapidly increasing motorization in the country, low starting level of Russian retail prices for petroleum products, lack of state regulation of prices, etc. All of them allowed for high profitability and quick return of investment due to poor technical equipment and underdeveloped auxiliary services [6].

According to some estimates [7], for return of investment to a standard filling station / complex of more than 50 mln Ruble in five years and to profitability at profitability rate of 15% for petroleum products and 25% for related products, at least 4.5 thousand tons of petroleum products per year must be sold.

According to our estimation, there are an average of 3.5 thousand tons of petroleum products sold per year at one filling station / complex in Irkutsk oblast (figure 1).

This number is presumably somewhat overstated as there is no possibility to calculate fuel sales directly to customers, not counting intermediaries. Generally speaking, turnover of large network companies with filling complexes equipped with modern fuel dispensers which have favorable location exceeds 4-5 thousand tons a year. However, majority of filling stations and complexes sell much smaller volumes of petroleum products. Consequently, in order to maintain minimum profitability, the owners have to purchase and sell low-quality petroleum products, turning to illegal suppliers, or focus on auxiliary roadside services. This situation leads to gradual replacement of small businesses from retail market with large vertically integrated oil enterprises which have their own facilities for production, storage and transportation of petroleum products and can control retail prices in a wide range.

Filling stations and complexes of large oil enterprises can retain a lower price compensating for loss of profit at the expense of other items of income, such as oil extraction. Therefore independent filling stations and complexes can not compete and are forced to close down or move under control of
large oil enterprises. It should be noted that small filling stations and complexes in many developed countries earn mainly though auxiliary businesses (adjoining cafe, grocery shop, etc.).

Auxiliary services and roadside service facilities in Irkutsk oblast are well-developed only along federal highways and in large towns. There are the following types of facilities: service stations, tire centers, car washes, catering and recreational stations (cafes, hotels, shops) or complex of these facilities. Though there are very few such complexes. This is a characteristic feature of roadside service not only in Irkutsk oblast but in all Russian regions.

Having analyzed various factors, after having performed field surveys and some calculations, we concluded that the lack of comprehensive roadside service of high level along federal and regional highways is characteristic for Irkutsk oblast in general. At the same time, construction of such facilities on local road network is unprofitable due to low traffic intensity. As for countryside, it is logical to locate them in populated localities and target at local population. The majority of roadside service facilities in Irkutsk oblast do not meet international requirements.

![Figure 1. The amount of average fuel consumption at filling stations.](image)

The major concerns of roadside service development are:

1) Uneven placement of roadside service facilities on both federal and regional highways; pronounced deficit of facilities offering a complex of services. Personal, health care, communication services, recreational stations and sanitary-hygienic services stations almost are not presented.

2) Low level of service and lack of appropriate qualifications of roadside service workers. Physical infrastructure of a number of facilities often does not meet sanitary standards and rules; moreover, the assortment list provided in the menu is often not observed;
3) There is no integrated database of roadside service facilities in Irkutsk oblast, facilities location approval procedure is often not performed causing erratic development of roadside service and neglecting traffic safety requirements.

Thus, roadside service system remains unorganized. In these conditions an acute need appears for modernizing and reconstructing existing roadside service facilities or creating new stations with high level of service and a wide range of services provided. Development of roadside service in Russia falls significantly behind motorization of population. The possibility appears of replacement of small and medium-size businesses on major highways with large companies. As a result, regional and local motorways are left for small business owners. So, at the present stage of roadside service development in Irkutsk oblast, government regulation is of great importance as this development is associated with increasing significance of automobile transport for socio-economic life of society and growth of tourist-recreational industry. International experience shows especially important role of government participation in approval of planning and adequate provision of necessary services on roads with low traffic intensity [8].

Possessing rich natural and socio-economic potential and being a transit zone between the western and east parts of the country, Irkutsk oblast can become an important factor in the development of the economic corridor “China-Mongolia-Russia”.

4. Conclusion
Summing up the results of our study, the following findings can be formulated:

1) Roadside service market in Irkutsk oblast is underdeveloped. Fuel supply and maintenance services are currently the most important part of roadside service in the region. Other auxiliary services are poorly developed being located only at big cities and federal highways.

2) Placement of roadside service facilities in Irkutsk oblast is uneven; they are developed mostly in the south of the region (in big cities and along federal highways). It is conditioned by the fact that roadside service has been formed spontaneously, without consideration of the degree of satisfying needs of car owners and absence of monitoring.

3) Lack of information on roadside service facilities, their location and types of services has a negative effect on development and management. Hence, our paper is one of the first studies in Irkutsk oblast and the material collected can be the basis for creating a complex scheme of effective placement of roadside service facilities. We developed schemes of roadside service facilities placement for 36 municipalities of Irkutsk oblast using territorial planning schemes as municipality’s basic planning document.

4) In general, the region needs gradual modernization of filling stations and complexes network as well as of roadside service facilities, founding multifunctional complexes on transit highways that would offer a wide range of high quality roadside services and sell different types of motor fuel.

In our view, in countryside with low level of motorization low profit facilities combined with auxiliary roadside service should be built and their location should be regulated according to the amount of transport and distances between facilities. In many cases such facilities are socially important and their absence worsens quality of life of rural population.

Thus, in this article we presented main results of our study as one of the most important stages of integrated scientific and practical research.

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