Forming of Architectural-Planning Organization Complex Enterprises in Front-Border Transport Units

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Abstract. Architectural and planning development of complex enterprises, located in the zones of transport hubs along the border of the Russian Federation is discussed in the article. Three main architectural and planning directions of complex enterprises organization are identified. Each type is characterized by a unique principles’ set of architectural and spatial organization. The first direction of the architectural and planning organization formation of complex enterprises in the zone of transport-border nodes is “autonomous”, the main direction feature is the location of construction object autonomously, the object’s grouping and architecture is formed, depending on the zonal type of natural conditions and throughput of an enterprise. The second direction of the architectural and planning organization formation of complex enterprises in the zone of transport and border nodes is “peripheral”, the main direction feature is the location of the construction object in the peripheral part of a settlement, grouping and architecture of the object’s construction is formed in part depending on natural conditions, urban infrastructure and enterprise capabilities. The third formation direction of the architectural and planning organization of complex enterprises in the zone of transport-border nodes is “integrated”, the main direction feature is the location of the object’s construction in the central part of the settlement, the grouping and architecture of the object’s construction is formed, depending on the city infrastructure and the throughput of an enterprise.

1. Introduction

In the modern world the active development of border transport hubs, including complex enterprises in their composition, is underway in connection with the increase in the flow of road transport. As transport hubs, as areas with service enterprises, organized for crossing the border by road transport, were taken [1,2]. Complex enterprises are multifunctional facilities for servicing the vehicles and passengers flow, consisting of several independent public and industrial facilities, organizing a set of activities for a comfortable state border crossing, mainly for tourism and logistics purposes. The complex enterprises include: the main enterprise for the passage of cars across the Russian Federation border - an automobile checkpoint (AChP), enterprises or complexes of roadside service (CRS) and customs and logistics terminals (CLT), if necessary, it includes zones for temporary or permanent residence [1,3]. The infrastructural organization of a complex enterprise, based on a transport hub in the border zone, depends on the development direction, composition of the enterprise, level of organization, planning structure and spatial organization, which includes objects of primary and secondary purposes, will be different [3].
2. Materials and Methods

In the studying process of the architectural and planning organization of complex enterprises, based on automobile checkpoints (ACHP), three main directions of the organization level formation, planning structure of a border automobile post (BAP) were identified (Figure 1): autonomous, peripheral and integrated.

The first formation direction of the architectural and planning organization of complex enterprises in the border transport hubs zone is "autonomous", the main direction feature is the location of construction object autonomously, and the autonomous formation of its elements, independent of the settlement’s planning structure, more free and manure. The grouping and architecture of the object is formed depending on the terrain zonal type, natural conditions and an enterprise capacity.

The second formation direction of the architectural and planning organization of complex enterprises in the border transport hubs’ zone is "peripheral", the main direction feature is the location of the construction object in the peripheral part of the settlement, grouping and architecture of the object’s construction is formed in part, depending on natural conditions, urban infrastructure and throughput enterprises.

The third formation direction of the architectural and planning organization of complex enterprises in the transport-border nodes’ zone is “integrated”, the main direction feature is the location of the construction object in the central part of the settlement, grouping and architecture of the object’s construction is formed depending on the city infrastructure and the throughput of the enterprise. It is the rarest type of space, but relevant to find a solution to dense placement, lack of reserve for development, etc.

![Figure 1. BAP objects placement models.](image)

The level of an object organization depends on throughput, an object grouping (differentiated or local) from natural conditions and in particular zonal conditions during the autonomous BAP objects development. Two zonal types of BAP can be distinguished, characteristic of this direction are:
- flat, the most widespread with the most free planning structure, the largest number of posts are located on flat terrain with large and largest posts;
- mountainous is the second most common place;
- mountain-coastal is subdivided into marine and river subtypes. Marine BAPs include BAP, based on Adler checkpoint (integrated type), river BAPs include BAP, based on Borisoglebsk checkpoint (autonomous type);

All object grouping schemes are encountered, generating BAP autonomously.

![Figure 2. Schemes for BAP objects grouping.](image)

The level of an object organization depends on throughput, an object grouping (differentiated or local) and from natural conditions (zonal) during peripheral BAP development. One can distinguish a zonal type of BAP, this direction characteristics are:

- flat, the most widespread with the most free planning structure, the largest number of posts are located on flat terrain with large and largest posts.

The planning structure of the settlement indirectly relates to BAP planning structure, since it was mainly formed on the bypass highway, bypassing the settlement, without its development interfering.

The most problematic is the third direction of BAP formation. The level of an object organization depends on the throughput and planning structure of the settlement within the integrated development of PAP. Two zonal types of BAP, which characteristic can be distinguished

- flat-coastal, this type facilities are located only in the river zone. It includes the RF BAP, based on the Ivangoord checkpoint and the Sovetsk checkpoint, these checkpoints have developed exclusively historically;
mountain-coastal is subdivided into marine and river subtypes. The marine BAP is based on the Adler checkpoint (integrated type) and the river BAP is based on the Borisoglebsk checkpoint (autonomous type) [3,4,5].

Within the integrated BAP formation, there is a problem of transit through the city to the checkpoint of vehicles (V), their fossilization at the border and along the main streets. In order to solve the problem, it is necessary to bring the transit of vehicles to the peripheral part of the city or at a certain distance from the settlement, the organization of a double checkpoint for the freight vehicles passage, inspection of goods can be organized in the settlement, which will create additional work places, exclude the rotational work of enterprises. Model location of CLT (warehouse area) and RSC facilities (service area) will be possible in the peripheral part of the city - linearly - along the main bypass transport highway within the infrastructural development of BAP with integrated placement. The method of grouping an object is differentiated or combined.

Architectural and planning of BAP facilities formation occurs in the conditions of urban infrastructure within an integrated model of a border car post location [6,7]. According to this model of placement, there is a problem of transit through the city to MACHP of freight vehicles (V) and their accumulation near the border of the Russian Federation and along the main trunk streets. In order to solve the problem, it is necessary to withdraw the transit of freight vehicles to the peripheral part of the city and to build a double MACHP for the freight vehicles’ passage. CTL (warehouse zone) and RCS (service zone) facilities location is possible in the peripheral part of the city - linearly - along the main bypass transport highway within the infrastructural development of PAP and integrated placement model.

The integrated placement model is currently present at two promising sites in the North-West Federal District. Infrastructure development is needed at the Ivangoled and Sovetsk checkpoints.

Consider the formation of **Ivangoled BAP**, which is based on the Ivangoled MACHP with a current capacity of about two thousand cars per day, located in the Leningrad region on the border with Estonia. It is the oldest customs and border post (Figure 3). Currently, BAP Ivangoled has a second - "Service" level of organization, since it includes roadside service facilities (gas stations, hotels, cafes, etc.) [1,2].

**ZONING BAP "IVANGOROD"**

![Figure 3. Zoning BAP Ivangoled (before reconstruction, after reconstruction).](image-url)
The analysis showed that the planning structure of PAP Ivangoedin has a combined scheme for grouping objects and a "customs and logistics" level of the infrastructure organization, so, BAP objects (MAChP and RCS) are currently located in close proximity to MAChP, and CLT is located far from the checkpoint. Roadside service complex (RCS) is represented by gas stations, which are located on both sides of traffic at entrance to the city, catering points, hotels, mini hotels and service stations located in urban development.

According to the development forecasts, an increase in passenger and cargo traffic through MAChP Ivangoedin is expected in the near future. In order to create a technologically organized complex of interconnected objects, it is necessary to consistently implement the Concept of Infrastructural Development, in terms of optimizing the adjacent territory use and developing infrastructure, which allows to saturating the elements necessary for the transit of passengers and goods (Figure 4). The Concept of Infrastructural Development implementation consists in the reconstruction of the real BAP, through the new BAP facilities construction, in accordance with the general plan of the functional and planning territory development [8,9].

Reconstruction involves the creation of a unified approach to the design of the architectural and technological environment, the creation of comfortable ones.

![Image](image_url)

**Figure 4.** Development of the site layout scheme for BAP Ivangoedin (1) and BAP Sovetsk (2).

The development of BAP Ivangoedin territory involves the construction of CLT and the expansion of RCS in the peripheral part of the city. In order to separate the technological streams, it is assumed that RCS facilities will develop on both sides. The primary task of the Concept is the organization of BAP traffic zone and the construction of MAChP back-up for freight vehicles, creation of parking lots network for various types of transport (trucks and cars, buses), passages towards the buildings, especially parking-sedimentation tanks are needed in the exit zone from the territory of the Russian Federation located at MAChP (Figure 4).
It needs the development of BAP Sovetsk is similar to BAP Ivangrod, creation of MACHP -backup for the trucks’ passage, organization of CLT and part of RCS takes place in the village. The RCS part must be taken out to the RCS -backup.

Sovetsk and Ivangorod have great potential for the development in the field of tourism and are essentially similar cities with their checkpoints. In this regard, BAP functional planning organization will be directly involved in the creation of a single tourist and service center. An important point in the formation of BAP integrated placement model is an integrated approach, based on the architectural and planning environment development of tourist activity: automobile tourism and excursion tours to historical buildings, attractions, museums with the possibility of recreation, etc. [10,11].

![Development of an integrated BAP placement model](image)

**Figure 5.** Development of BAP integrated placement model.

The study showed that BAP Ivangorod and BAP Sovetsk have similar development schemes. The development of BAP territory of the integrated placement model is due to:

- withdrawal of freight vehicles transit from the city and construction of MACHP -backup;
- organization of a hub for servicing passengers and vehicles in the outskirts of the city and along MACHP highway;
- restoration of buildings in settlements and the tourism cluster formation;
- reconstruction of urban recreational areas and creation of new recreational mini-zones at roadside service complexes (Figure 5).

### 3. Results

Thus, the analysis of BAP formation directions showed three models and need to consider each direction as a unique case, including a set of measures for organizing an architectural space that must meet modern requirements and include all the necessary elements for its formation as an autonomous planning solution and part of an urban structure or district in a settlement.

The Placement models reveal the need for a more in-depth detailed consideration of each case, a similar nature of directions, combining them into groups taking into account natural, environmental, geographical, urban planning and socio-economic factors. The functional and planning features of BAP territory development require scientific substantiation, taking into account the development prospects and the need to include an urban planning approach in work on similar projects to implement the concept of infrastructural development, as well as indicate the need to draw up master plans with the long-term perspective of BAP territory functional and planning development.
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