

TRANSPORT INFRASTRUCTURE AND LOGISTICS

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Abstract

At the time of the pandemic, direct supply without storage capacity turned out to be a short-term solution. Many have hence found out that it is necessary to have operational stocks, and thus storage space; the most advantageous for this purpose are warehouses. The companies either focus on the construction of their own halls, or they deal with the situation by leases in logistic centres. That is why the industrial, and warehouse real estate market is currently doing exceptionally well, with record volumes of construction, and rental activity, historically lowest vacancy levels, and significant increase in rent prices. The share of warehouse construction in the Czech Republic represents only 2 to 3% of the structure of construction in the country. When we take into account the development of the last two years, a significant increase can be expected.

Keywords

Transport infrastructure, storage areas, logistics areas

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Introduction – Transport infrastructure

In the Czech Republic, there is generally an insufficient quality of transport infrastructure, and also an uneven distribution of logistic centres. Due to the fact that the current quality of transport infrastructure in the Czech Republic is not optimal, it does not meet the need of logistics. When planning, and setting up warehouses, it is necessary to take into account the fact that each individual logistics centre must be located at the meeting point of transport routes.

According to the Transport Policy of the Czech Republic, a number of problems in the past, and the present years should have been solved a long time ago. The main goals of transport infrastructure development in two segments, namely road, and rail, were gradually defined. However, the network of motorways, and expressways is still not completed in the country, and the condition of the 1st class roads is unsatisfactory as well. In the area of railway construction, it is necessary to continue the modernization of railway corridors as well as regional lines.

Where to place logistics centres is a difficult question; it depends on the suitability of the site, transport accessibility, land use plan, and many other factors, making the choice of location limited. In any case, in the design and subsequent construction of logistics centres, it is necessary to pay attention to the environmental friendliness, waste-free character, and usability of the suitable materials, and especially to the use of recycled materials in the entire construction process. In addition to the actual construction or solution of warehouses, and areas with the provision of services in the form of lease, another segment of activities is opening up, such as: ensuring the renegotiation of leases, and important conditions for existing leases, restructuring of lease agreements, possibly implementation of interior renovation, etc. [1] [2].

Logistic centres

Activities in this time, currently related to the covid pandemic, around freight transport, and logistics make appropriate use of connections to two or more types of transport. The logistics centre is a hub connecting suppliers and customers with the use of different means of transport within individual ways of transport. The key is that it provides suitable conditions for the combination of transport chains, creating road-railway junctions, as well as road-water ones. Placing the logistics centre at the combined transport terminals is also advantageous. It must be assumed that logistics activities in the use of various types of transport increase business flexibility and thus achieve higher production and ultimately benefits to the entire economy of the state.

The logistics centre has a number of functions, however, the main one is the storage, and transshipment of products from the manufacturer or another distributor to the customer. It was provision of products of various business subjects on a national, and international level that was a problem during the Covid pandemic. The increasing interest in the construction of new expansion of existing warehouses, complexes, and logistics centres is currently conditioned by interconnections between regions, and foreign countries.

A number of public logistics centres have already been established in the Czech Republic, and their further construction is being prepared. This will not only improve the movement of goods, but will also eliminate the ever-increasing load on the road network by freight transport. The services of logistics centres are accessible to all subjects, meaning public, and private. Their functions too are always specific in the form of private centres, but also centres that cover the needs of public services; public logistics centres are common in Western European countries. The appearance of individual centres differs on the basis of the valid legal framework of the given state, but also on the overall economic development. [1]

The impact of Covid-19 on the real estate market, and renegotiation

In general, the initial decline in demand for logistics services is currently being regrouped, and is increasing. Although logistics withstood the negative predictions of Covid-19's impact on the real estate market, the development of 2021 shows reduced demand in connection with the cooling of the market; the situation, however, is partially offset by an increasing share of renegotiations.

Many subjects using the services of logistics centres have gradually reduced the use of their services in recent years. The situation is now the opposite and in the last year, renegotiation or reconsultation of lease terms in order to extend existing leases has become a significant factor. The share of renegotiations increased sharply, and a number of tenants decided to make significantly higher use of services.

Interestingly enough, the market is currently showing rising demand for smaller distribution centres; during the year 2021, interest in short-term leases increased due to the increasing use of online purchases, with logistics companies offering warehouses in central warehouses.

In 2021, developers began a pre-investment, and investment construction of warehouse space. Surprisingly, in many cases they did not even have a pre-contracted tenant. Large volumes of this type of project are projects are being prepared, and implemented in the Moravian-Silesian, and Pilsen regions. Projects that were under construction in the so-called pre-Covid period are gradually being completed. The start is being delayed only for some non-started projects. Nevertheless, it can be concluded that large development activity can be expected, especially from investment funds, and large companies. [3] [4]

Existing logistics centres, and future development

In the media you can read or hear proclamations such as "Czechia is being filled with halls, renting halls is profitable, etc."; it must be said that logistics centres, and production halls in the Czech Republic earn more in comparison to construction, and operating costs in Germany.

According to the Industrial Research Forum, the total area of modern industrial, and warehouse space for rent in the Czech Republic at the end of September of 2021 was a total 9.49 million square metres. It is worth mentioning that in 9 months of 2021, 176.6 thousand square metres of new capacity was completed in 12 different parks. Compared to the same period of the previous year, it was an increase of 16%, and even 68% more areas were completed quarter-on-quarter. What's even more brilliant is that approximately 94% of the projects were already pre-leased at the time of completion.

In addition – at the end of the third quarter of 2021, almost 897.3 thousand square metres of warehouse, and production space were under construction, which is 33% more than in the previous quarter. [5]

Rents for new logistics complexes rose by 10% year-on-year, as the share of vacant industrial halls, and warehouses in the country was 2.5% at the end of the third quarter, down 1.9% year-on-year. [9]

Optimization of the location of logistics centres

Choosing the right location is a critical moment in the decision-making process for most businesses, and organisations. The right decision can lead to significant cost optimization, improved distribution network, and new promising markets. As previously mentioned, the logistics centre is located in a so-called geographical point from which it can operate economically. The logistics centre must be physically, and permanently located so that it optimally fulfils its main tasks. When choosing a location for the logistics centre, it is necessary to proceed systematically, as this is a later unchangeable decision.

A systematic approach is to compile a set of criteria that should ideally meet the appropriate site, location, and region sought. Furthermore, the choice consists in finding an existing, and available place in the field, then in evaluating the information, and proposing variants for placements; for the optimal location of logistics centres, criteria such as the location of industrial plants according to the number of employees, the location of consumption centres, connection to the transport infrastructure, the size of transport flows, etc. are all taken into account.

Construction in the regions – in Prague the demand for warehouse space is still strong; the problem arises from the lack of vacant land for construction. This is associated with pressure to increase rents. Some developers are addressing the situation by moving construction to other regions. Infrastructure is generally improving in the regions in connection with the gradual involvement of the entire Czech Republic in the European, and Central European infrastructure network.

Location methods

In practice, methods belonging to the group of so-called location-allocation tasks are used to solve the task of locating logistics centres. A common aspect of these tasks is the choice of location for one or more centres, the next point of view remains the number of deployed centres, the quality criterion of the solution, and the method of operating the sections.

A mathematical model is used to choose the location of logistics centres, in which it is necessary to take into account the potential location in the district; without sufficient workload, the location of the logistics centre at a given location is inefficient. It is also necessary to take into account the already mentioned transport infrastructure – i.e. good connection to road, and railway infrastructure.

In SW applications modelling the location of centres, we work with stored spatial data, with a spatial index. Elements can be directly linked to simple elements to create a relationship between feature classes; if the elements are in one element class, and have the same value, the selected columns are defined. It is possible to define e.g. topological rules only at the level of subtypes. When designing a database, it is necessary to correctly decide which groups of elements to separate using subtypes, and which, on the contrary, to move to separate elements of class. This is then referred to as the feature class, which is a set of features with the same attributes.

As a result, a distinction is made between simple element classes (simple; often referred to as “element classes”), which contain simple elements, and element classes, which store other element types, such as annotation element classes.

A Feature Dataset contains a set of class features that have the same coordinate system. Topological relationships can be defined between element classes in a single dataset. The coherence of the coordinate systems of the participating element classes is required.

For example, the ER – diagram (Entity Relationship diagram – database diagram with marked entities (tables, and relations) of the data block is used to work with location design. Most of the necessary data blocks can be obtained from the real estate cadastre or similar geographical databases.

Topological relationships between element classes (subtypes) ArcGIS allows you to define topological relationships between elements classes or subtypes, and store these relationships in the geodatabase in the form of a so-called topology. The actual topological relationships of two element classes or the topological properties of one element class are stored in the topology as topological rules. The validity of the defined rules can be checked at any time, and any errors can be corrected; it is possible to ensure their observance even when editing elements. Each element class has a defined topological importance. Proposed topological importance for elementary classes Topological rules thus ensure the integrity of VFK spatial data.

Warehouses are located on the transport network, which is graphically represented in the model by vertices, and edges. The vertex in the transport network means the crossroads of roads, or important cities. Each vertex in the network is assigned a vertex height, i.e. a non-negative number that expresses the importance of the vertex. The edges represent a section of a road connecting two adjacent vertex. Each edge is assigned a non-negative number or edge value in the network, which expresses the kilometre distance between two vertices. The goal of the mathematical model is to select from a number of vertices the ones that best suit the location of logistics centres. [6]

Requirements for hall buildings

Hall buildings are specified into various industries according to the requirements for indoor spaces. Two-storey, large-volume halls, and combination of monoblocks guarantee more economical use, and design of the construction work.

Hall constructions allow the creation of interior spaces with a small number of supports or completely without internal supports. Hall constructions are used where the operational layout of the building does not require more height levels. When designing the building, it is necessary to include operational requirements as well as safety, aesthetic, economic, and health requirements.

Among the important operational requirements that affect the quality of a healthy environment in hall buildings include air exchange, lighting, ensuring safe use, safe evacuation, and ensuring acoustic, and thermal comfort. The thermal technical properties of the building are significantly affected by the casing construction.

The space requirements result from space required for the function. These requirements depend on road clearances, door dimensions, underpass heights, etc. Safety requirements for hall buildings can be divided into two categories; the first category concerns the recovery function, the second ensures safe evacuation from the building.

The choice of construction, and material of the building is influenced by the requirements for span, installation, heating, size, necessary durability, labour, economic requirements, and the environment in which the construction will be carried out. The shape of the building belongs to the aesthetic requirements of the building. Aesthetic requirements address size, colour, lightning, and overall affect the perception of a given construction work. [6]

Economic demands on the building are defined by the effort to minimise the construction in terms of construction time, and costs. These are direct construction costs, and operating costs, which represent the maintenance, and operation on the building. [7] [8]

Conclusion

Direct supply without operative storage have proven to be a short-sighted solution, and the need for companies to have their own warehouses for their stocks is essential. Therefore, the focus on the construction of our own halls or logistics areas is now very topical. E.g. the number of completed non-residential buildings for industry, and storage in 2020 was 247, the investment costs for the exhibition mounted to CZK 11,245 million, and, for example, the floor area for non-residential buildings for industry, and storage totaled 718,758 square metres in 2020. Although the statistical data are given in the sum of objects for industry, the data are nevertheless informative about the share of these constructions for companies doing business on the Czech construction market. It follows from the text of the article that these volumes will be exceeded in 2021, and will increase in the following years. This conclusion is in relation to the current economic situation, which requires an increase in storage space, and thus optimization of rental prices. The construction of warehouses may partially offset the expected decline in small private sector investment in building materials growth, and rising interest rates.

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