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DETERMINATION OF THE CONFIGURATION OF DELIVERY POINTS IN THE SERVICE AREA

N. Ptytsia, Ph. D., Ass. Prof.
Kharkov National Automobile And Highway University
K. Kovtsur, Ph. D., Ass. Prof.
Kharkov National Automobile And Highway University

The retail supply chain under the pressure of a high level of competition in the market forces other participants in the process to sharpen their focus on increasing the efficiency of operations and determining the parameters of the delivery process. A feature of the delivery of small consignments is the territorial distribution of trade points, which determines the dispersion of the cargo flow in space and time. The existing ways of improving the efficiency of the organization of the movement of material flow are historically formed technological processes in the logistics supply chain: development of schemes for the delivery of goods to trading points, determination of rational batch sizes and frequency of deliveries, formation of rational routes and schedules for the delivery of goods, determination of the structure of the fleet of rolling stock, and others technological processes that allow optimizing logistics costs.

The distribution of material resources through the logistics channel necessitates the involvement of additional participants (distributors, carriers) in the delivery process. The correctness of the choice and the economic validity of the involvement of participants are the main factors that determine the rationality of the structure of the supply chain. The territorial location of small-format retail outlets forces suppliers to consolidate consignments of goods to provide various trade facilities located next to each other [1-2].

Ways to improve the efficiency of the material flow organization are historically formed technological processes at enterprises participating in the logistics supply chain: schemes for the delivery of goods to trade points are developed, rational sizes of delivery lots and delivery frequency are determined, rational routes and schedules for the delivery of goods are developed, the structure of the rolling stock fleet is determined, and other technological processes that allow to optimize costs for the promotion of the material flow. It is important to choose the right supplier for organizing delivery. When choosing a supplier, it is necessary to take into account certain criteria: the supplier's distance from the consumer, the terms of execution of current and emergency orders, availability of reserve capacity.

In the studies on city planning, it is stated that the main goal of urban planning is the creation of planning, which is characterized by the presence of equidistant zones of maximum pedestrian accessibility (districts). In the centers of each microdistrict, service enterprises of trade, shops, schools, hospitals, etc. should be located. In the works of scientists studying the delivery process, the service area is considered in the form of a circle. This approach assumes that trade points in such neighborhoods are evenly spaced. Evenness of dispersion and concentricity are taken as basic principles in the organization of the delivery process in retail trade [1-3].

The main parameters characterizing transportation conditions and affecting the technological and economic performance of transport during the delivery of goods to the retail trade network of cities are:

- cargo delivery distance;
- the size of the consignment;
- and car mileage between adjacent check-in points on the route.

The mileage of a car between adjacent arrival points on the route can be determined by the density of the location of delivery points (trade points) in the territory of the service area. It is common knowledge that when expanding a retail network, the location of the trade points is chosen with a view to maximum proximity to consumers. According to the model of revealed advantages, the concentration of a group of small-format trade points increases their purchasing appeal. This is true

for trade points of small formats, which are usually located near each other, forming trading platforms that represent certain clusters.

For the study of processes, they can be attributed to certain defined categories (groups). The process of grouping elements of a segment based on common features and differences from other elements is called clustering [4]. The purpose of clustering in this study is to divide a set of objects into groups with similar characteristics (clusters or classes).

Guided by observations on the spot and data from the Internet, the objects that officially registered there are marked on the city map. These data are taken as the basis of cluster analysis. The initial data are the values of X and Y, respectively, the latitude and longitude of each individual retail outlet on the map of the city of Kharkiv. Such objects were analyzed in the amount of 413 units.

Multivariate economic and statistical analysis uses a variety of methods, one of which is cluster analysis. This method allows you to group outlets into clusters with similar properties, which helps to account for the effect of multidimensionality in the data and simplifies the explanation of complex multidimensional structures. In addition, cluster analysis makes it possible to objectively describe the observed data, their structure and relationships using factors or main components, which allows for a simple and accurate analysis of the original data. A hierarchical tree was created using the STATISTICA program.

Using the method of averages, we obtained the grouping of objects into clusters based on their similarity and the central points that represent each cluster. Due to the fact that the spatial location of the analyzed objects is insignificant, it is necessary to transform the raw data for analysis. To do this, we convert them from absolute to relative values and standardize them in statistics. Initial centroids can be random or chosen based on known data [4, 5]. Each object is assigned to the nearest centroid, and the centroids are calculated based on the mean values of the objects in each cluster. This process is repeated until convergence is reached, when the displacement of the centroids becomes negligible.

According to the results of clustering, five clusters were obtained. Therefore, having the parameters of the clusters, it is possible to build a more accurate model of the distribution of cargo flows in the service areas. Such a model can be used both by carriers - to determine the parameters of transport, and by local authorities - to plan strategies for the development of urban cargo transportation. The high density of location of retail outlets of each cluster also creates a high incoming cargo flow. Large volumes of cargo cause traffic inconvenience, for example traffic jams due to vehicles parked for unloading. This is due to the lack of specialized sites for vehicles delivering goods. Therefore, further study of this issue is an important direction both for improving the efficiency of cargo delivery and for taking into account the road safety situation.

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