DIGITAL TECHNOLOGIES IN POSTAL INFRASTRUCTURE

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ANNOTATION

The accuracy and validity of the recommendations obtained on the basis of the asymptotic approach largely depends on the validity of the parameters taken in the calculation of the values of the cost P_i, q_i, r_i .

Summing up the above, we can assume that the asymptotic calculation of the PO and PO options is very useful as the first, preliminary stage of choosing the characteristics of the service network as a whole. However, the results of such a calculation are not sufficient for the purposes of practical design. Indeed, it follows from formula (20) and the parameters L, L1, L11 included in it that they do not allow directly determining the optimal or expedient coordinates of the PO and the boundaries of the station areas. This part of the network synthesis should be performed on the basis of more detailed calculations described in the following paragraphs.

At the same time , the asymptotic approach is suitable for solving a fairly wide range of problems , as examples we will indicate:

1. Determination of the optimal quantity and density of the distribution, which are connected by an obvious formula:

$$N = \int_{\Gamma} v(x)\, ds \qquad (21)$$

2. Comparison of different zoning methods for given amounts of the same type of software.

3. Comparison of the costs of building or developing an urban transport network using equipment of various systems.

4. Choosing the optimal forecast for the development of urban transport networks.

Most of these problems can be solved in an analytical form using conventional methods of differential and variational calculus.

However, these calculations, as a rule, require setting a significant number of cost parameters, which are difficult to obtain. Therefore, we will limit ourselves to just one special case directly related to the topic of the work – a comparison of zoning options by the "cost" of paths.

Suppose that these urban transport routes (with the given W(x), F(x) and D) contain a fixed number of N of the same type of districts. Then the various variants of a fully connected network are completely determined by the placement of the software, characterized in the asymptotic model by the "station" density V(x); the length of the intra-district and connecting paths (L and L1) are expressed in terms of this density. Therefore, when comparing options, we can limit ourselves only to those terms (20) that depend on V(x):

$$\upsilon_0 = P_1 L + q_1 L^1 \qquad (22)$$

Discarding the constant part of the costs exaggerates the differences in options, which corresponds to the assessment of the gain from below.

For the methods of constructing urban transport routes (GTP) listed at the beginning of the paragraph, we obtain the following relations:

1. When constructing a GP with constant capacities of software, Mp, all subscribers of the network are divided into N groups with the same numbers of Mp = M / N. Each group is served by one of the software. The station density is determined from the formula:

$$M_n = \int_\Gamma W(x)ds \approx W(x_n)\, H(x_n) = W(x_n) / V(x_n) \qquad (23)$$

Hence follows:

$$V(x) = W(x) / M_n = N\, W(x) / M$$

$$L = L_c = \sqrt{M/N} \int_\Gamma F(x)\, W(x)^{-1/2}\, ds = 1/\sqrt{N}\, \left(\int_\Gamma W(x)\, ds\right)^{-1/2} \int_\Gamma F(x)\, W(x)^{-1/2}\, ds \qquad (24)$$

$$L^1 = L_c^1 = (N/M)^2 \int l(x_1,x_2)\, W(x_1)\, W(x_2)\, ds_1\, ds_2 =$$

$$\Gamma$$

$$N^2 \left(\int_\Gamma W(x)\, ds \right)^{-2} \int_\Gamma l(x_1,x_2)\, W(x_1)\, W(x_2)\, ds_1\, ds_2$$

$$L^1 = (N/M)^{-2} L^{11} \qquad (25)$$

Thus, the total length of the connecting paths between the PO in this case is proportional to the sum of the distances between the sensing points.

2. When constructing a GTR with permanent areas of station districts , the entire area of the city S is divided into N equal - sized areas with areas

$$H_n = S/N$$

Accordingly, the station density is constant: V(x) = 1/N(x) = N/S.

Formulas (9) and (16) take the form:

$$L = L_м = \sqrt{S/N} \int_\Gamma F(x)\, W(x)^{-1/2}\, ds = 1/\sqrt{N} \left(\int_\Gamma ds \right)^{1/2} \int_\Gamma F(x)\, W(x)\, ds$$

$$L^1 = L_м{}^1 = (N/S)^2 \int_\Gamma \int_\Gamma l(x_1,x_2)\, ds_1\, ds_2 = N^2 \left(\int_\Gamma ds \right)^{-2} \int_\Gamma l(x_1,x_2)\, ds_1\, ds_2$$

3. Finally, when zoning a GTR with a minimum cost inside the district tracks, it is necessary to determine the function V(x), at which the value of the functional P1 L of (22) takes the smallest value possible, provided that the number of stations N, determined by the integral (21), is fixed. This problem is equivalent to finding the conditional minimum of the total length of paths expressed by the functional (8).

To solve it, we apply the method of indefinite multipliers, the Lagrange functional [5]. The unconditional extremum of which coincides with the desired conditional extremum:

$$\Phi = L + \lambda N = \int_\Gamma F(x) W(x) (V(x))^{-1/2} ds + \lambda \int_\Gamma V(x) ds = \int_\Gamma [F(x\ W(x)(V(x))^{-1/2} + \lambda V(x)] ds$$

(26)

Obviously, integral (26) takes an extreme value if, for any fixed value $x_n = x_n$, its subintegral function also takes such a value. Thus, it is possible to differentiate this function by the symbol M = M(x), where x is considered as a fixed parameter. Let 's put:

$$\Psi = FWV^{-1/2} + \lambda V,$$

Then the extremum conditions take the form:

$$d\Psi/dV = -\frac{1}{2} FWV^{-1/2} + \lambda = 0 \qquad (27)$$

$$d^2\Psi/dV^2 = \frac{3}{4} FWV^{-5/2} > 0$$

The last inequality shows that the found extremum is the minimum. Accordingly, (27) really determines the stationary density:

$$V(x) = (FW/2\lambda)^{2/3} \qquad (28)$$

The parameter λ is determined by substituting (28) into (26)

$$N = (2\lambda)^{-2/3} \int_{\Gamma} F(W)^{2/3}\, ds$$

(29)

$$\lambda = 1/2 \left(\frac{1}{N} \int_{\Gamma} F(x)W(x)^{2/3}\, ds\right)^{3/2}$$

Hence the final formula for station density follows:

$$V(x) = N\, F(x)W(x)^{2/3} / \int_{\Gamma} (F(r)W(z))^{2/3}\, ds \qquad (30)$$

When substituting (29), the first formula (27) can be written in the form:

$$F(x_n)W(x_n)(H(x_n))^{3/2} = 2\lambda = \left(\frac{1}{N} \int_{\Gamma} (F(x)W(x))^{2/3}\, ds\right)^{3/2} = \text{const} \qquad (31)$$

Comparison of (31) and (5) shows that with optimal zoning, the total lengths of the routes of all service areas should have the same values. It follows from the above conclusion. that in the asymptotic approximation this criterion is also valid in the general case.

From (31), (9) and (23) we find:

$$L = L_0 = (1/\sqrt{N})\left(\int (F(x)W(x))^{2/3}\, ds\right)^{3/2};$$

$$L^1 = L_0^{\ 1} = N^2\left(\int_{\Gamma} F(x)W(x))^{2/3} ds\right)^{-2} \int_{\Gamma} \int_{\Gamma} l(x_1,x_2)\,(F(x_1)W(x_1))^{2/3}(F(x_2)W(x_2))^{2/3}\, ds_1\, ds_2$$

Similarly, it is possible to set a more general task of minimizing the total cost of district and inter-district connecting paths. However, finding the extremum of such a functional leads to a nonlinear integral equation, the solution of which is rather cumbersome.

Let 's compare the indicators of the three zoning options based on the formulas (24), (25), (31), and also (26).

The main conclusion from the calculation is that zoning with constant capacities of service areas is a completely satisfactory approximation to zoning with the maximum total cost for passage along intra- and inter-district routes. This option minimizes the costs of choosing urban transport routes, therefore it can be considered as a practically optimal approach to their design according to the criterion of minimum total costs for development or construction. The reserve of savings with this method of zoning is the correct choice of the standard capacity, and therefore the number of districts, improving the structure of the ways of approach to post offices, but not the choice of the optimal capacity of each individual district.

REFERENCES

1.Qulbaevich Q. Y., Jenisbaevna K. A., Yusupovna K. U. THE CREATION OF A SUPPLEMENTARY SOFTWARE DEVICE FOR PRODUCTION MANAGEMENT IN THE DIGITALIZATION OF AGRICULTURE //American Journal of Interdisciplinary Research and Development. – 2022. – T. 10. – C. 20-22.

2.Uteulievich U. N., Kulbaevich K. Y. ALGORITHM OF SOLUTION OF ONE TWO-CRITERIA STOCHASTIC ECOLOGY-ECONOMIC PROBLEMS OF AGRICULTURAL PRODUCTION //September–October. – 2017. – C. 141.

3.Uteuliev N. U., Qutlimuratov Y. Q., Yadgarov S. A. Using the methods and optimizing criteria in making the managing decisions of agricultural production

//2019 International Conference on Information Science and Communications Technologies (ICISCT). – IEEE, 2019. – С. 1-3.

4.Qulbaevich Q. Y., Yusupovna K. M. Principles of system approach to analysis of production in agricultural enterprises //European science review. – 2018. – №. 7-8. – С. 238-240.