THE OPTIMIZATION OF DIRECTING EMPTY WAGONS

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Abstract: *In this paper we will show how to apply the exact method of covering zeros at the transport problem of guiding empty wagons between two excess and deficiency centers after establishing the mathematic pattern. To automation and reduce the calculus volume for this method it is implemented on PC by using SOLVER, a component of EXCEL from MICROSOFT OFFICE PROFESSIONAL 2013.*

Keywords: *transport problem, mathematic model, optimization function, unknown, restrictions*

1.General introduction

In transport activity especially in railway transport the problem of optimal organizing is extremely complex because of the diversity of technical and economic factors which influence each different the volume, the rhythm, the quality and economic efficiency of transport process.

On a railway network there are main points of concentration of wagons named joint station. These joint station give empty wagons to intermediary stations. In both intermediary and joint stations the wagons are loading and unloading as a necessity of certain centers. Due to transportation applications of clients between these centers is a permanent exchange of loaded and empty wagons so there is a cross currents wagons which cannot be avoided but which can be reduced as volume and intensity trough the optimization of empty wagons routes.

2.The mathematic model

The optimization of empty wagons routes between excess and deficiency centers can be realized by using mathematic procedures. The main of these are specific to operational research (linear programming).

Mathematically speaking it is a transport problem which we can formulate like this: we have n centers A_i, i = 1 ... n with available excess of empty wagons and m centers B_j, j = 1 ... m with deficiency of empty wagons. Knowing the number of available wagons in every center A_i and the needs of wagons b_j from every center B_j, respectively transport distance d_{ij} between A_i and B_j centers we need a plan for transportation x_{ij} so the total wagons*kilometers to be minimum and the number of wagons in B_j centers to be mainly satisfy.

The mathematic model of the transport problem is like this: the minimum of the function need to be found:

$$f = \sum_{i=1}^{n}\sum_{j=1}^{m} d_{ij}x_{ij} \qquad (1)$$

conditions:

$$\sum_{j=1}^{m} x_{ij} = a_i, \quad i = 1 \dots n, \qquad (2)$$

$$\sum_{i=1}^{n} x_{ij} = b_j, \quad j = 1 \dots m, \qquad (3)$$

$$x_{ij} \geq 0, \; i = 1 \dots n, \; j = 1 \dots m, \qquad (4)$$

$$\sum_{i=1}^{n} a_i = \sum_{j=1}^{m} b_j = S. \qquad (5)$$