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RAILWAY STATION EVALUATION FOR SYSTEMATIC TRAIN FORMING ON THE RAILWAY NETWORK

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Introduction

European Commission and governments of European countries declared in the documents aim to shift part of the volume of freight transport from road to rail [9]. This transfer should occur in particular in order to lessen environmental pollution, reducing the number of traffic accidents with fatal consequences and elimination of congestion on the road network in areas of large cities [7].

One of the tools by which this transfer will be possible to address is improving the flexibility and railway cargo carriers in the transportation services segment, each wagon shipments. It is necessary that for this purpose was created the right conditions, and these measures are known in the past to get back lost customers by offering innovative services offered. However, the provision of services does not mean an automatic transfer of the volume of freight transport from road to rail. It should handle the entire technological process, so that the service was acceptable from the perspective of the customer and acceptable cost for the carrier.

Requirements for the rapid, safe and affordable transport time for the customer may also provide a model of "just in time". As a starting point to assume the technology is time-discrete *train formation (night jump) in the light of the limitations of infrastructure and* technological progress in all types of stations on the infrastructure. Typology stations for time-discrete train formations are:

- operative marshalling yard
- railway satellite station
- and the loading station, where it is possible to wagon loading and unloading shipments.

1. Time discreet train formation

Trains, however, and they form only in a specified period during the day compliance with exact time-table, which is based on customer requirements for the implementation of the cost of handling the day-time in working days.

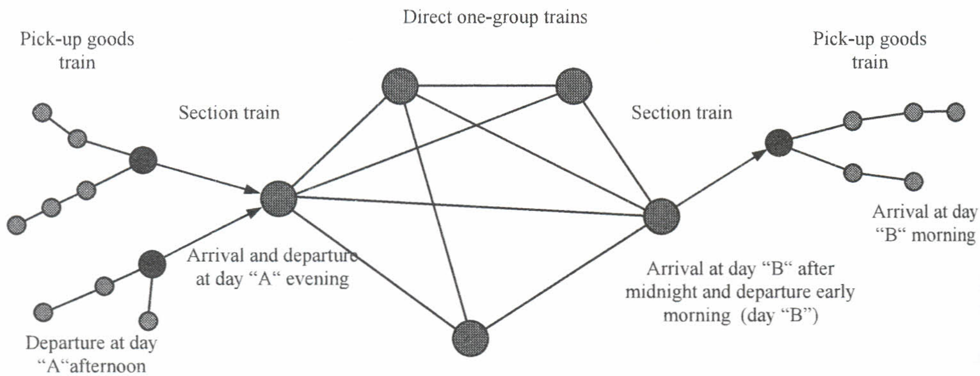

***Fig. 1** The figure caption is of the style Description; the figure itself is of the style Figure [4]*

After loading of wagons in the afternoon the first day of their collection is carried out in the main marshalling yard via satellite station. Subsequently, it starts processing the target sets of trains and creation of starting direct one-group trains to all other major marshalling yards. These trains leave in the evening hours.

The second day (day B), for remote sessions, exceptionally, the third day (day "C"), coming to main marshalling yard distance trains from other major marshalling yards to shunting. Their wagons are passed on to the section trains via satellite stations to stations base network.

One of the main objectives to optimize train formations now is establish the optimal number of main marshalling yards. The results of this optimization are the determination of the optimal variant of wagon and organizations identified in the current location of these stations.

2. Location main marshalling yards

The issues of location of marshalling yards in the time discrete formation of freight trains are generally characterized as the problem of placing depots (centres etc.). Network, which must simultaneously take into account several factors underlying the choice of placing a yard. From the number and location of these stations in turn depends overall transport performance of collection and distribution of shipments wagon. However, the optimization criterion is minimizing the total transport performance of collection and distribution, expressed in the observation unit [8].

Transport network represents the structure (graph), where a finite set of points called the points and final set of lines connecting some vertices representing a connection edges. Each peak in the network is assigned nonnegative number (weight peak), which reflects the importance of the peak [1].

The edge of the examined transport network represents the track section connecting two adjacent vertices. Each edge is valued nonnegative number, which represents the weight of the edges. Weight the edges should correspond to the coefficient of difficulty of each track section between the neigh boring peaks.

3. Multi criterions point evaluation

The task is to select a mathematical model of the points (theoretically appropriate) those that are best suited to the location of a marshalling yard. Given the above factors affecting the choice of placing a yard in the top as to be considered when designing the methodology, it seems best to use to evaluate the peak group of multi-criterions point evaluation.

Methods of multi-criterions evaluation can be generally used for comparison and subsequent selection of any objects on the basis of several variables [3]. Because of its ability to synthesize several different variables (features) into a quantifiable summary variable are particularly suitable for analyzing the status of the object (a yard) on the network. Make it possible to compare a set of several objects on the basis of several characteristics of their activities and determine the sequence location of analyzed objects.

The basis of evaluation is to multi-criterion baseline matrix of objects and their characteristics. Objects represent all the points (vertices) on the network [2].

When starting the matrix structures of objects, it is necessary to follow these steps:

- Selection of objects included in the analysis file.

- Added so-called „Model station“ to the list of objects.
- Choice of indicators characterizing the object.
- The choice of the weights of individual indicators.
- Establishment of the baseline matrix. (***Tab.1***)

To the matrix is also a fictional station (so-called "model station"), which all evaluation factors criterion meets in full. Then the value xm1, ... , xmn are maximally. Background objects matrix is in ***Tab. 1***.

***Tab. 1** Establishment of the baseline matrix of objects*

station \ indicators	a_1	a_2	...	a_i	...	a_n	$\sum$
1	x_{11}	x_{12}				x_{1n}	$\sum_{i=1}^{n} a_{1i}$
2	x_{21}	x_{22}				x_{2n}	$\sum_{i=1}^{n} a_{2i}$
...	...						...
j				x_{ji}			$\sum_{i=1}^{n} a_{ji}$
...	...						...
m-1	$x_{m-1,1}$	$x_{m-1,2}$				$x_{m-1,n}$	$\sum_{i=1}^{n} a_{m-1,i}$
m (model station)	x_{m1}	x_{m2}				$x_{m\,n}$	$\sum_{i=1}^{n} a_{mi}$

Explanatory note to the matrix:

a1,...,n ....individual evaluation factors;
xij ....value of the i-th variable in the j-th object;
n ....number of indicators;
m -1 ....number of objects included in the initial matrix;
m ....model station.

Aim of multi-criterions methods of evaluation methods is the transformation and fusion of the different indicators into one summary variable (the resulting characteristics), fully indicating the level of individual objects in a set of tested objects. By the overall level (importance) of the peak, respectively. Suitability for placement of a yard is a summary indicator of the peak [10].

Summary indicator of peak [2] - peak rate, which is given a weight (importance), which is calculated as the sum of one hundred times the share of the point's assessment of individual factors, each a sum a point evaluation so-called model station. Remuneration will reflect the percentage of each peak with respect to a model station.

$$Kj = \frac{\sum_{i=1}^{n} a_{ji}}{\sum_{i=1}^{n} a_{mi}} .100 \quad ; j \in 1,...,m-1 \tag{1}$$

where:

Kj ....coefficient of j-th peak;

$\sum_{i=1}^{n} a_{ji}$ ....valuation point the amount of j-th peak;

$\sum_{i=1}^{n} a_{mi}$ .... valuation point the amount of peak model station.

If the peak rate is a positive number, the weight coefficient is equal to the peak point. If the peak rate is a negative number, or the peak rate is zero, the weight of the peak will be the smallest positive measurable value in the specified range.

Summary indicator peak thus expressed the importance of the investigation and the point will have a substantial impact when deciding on the allocation of a yard to the peak. It is therefore important to choose the characteristics (variables) that best suit the specifics of the problem, therefore, take into account all factors that influence and determine the choice of location in the centre of the point.

Conclusion

The result of that assessment methodology formation yard is the possibility of classifying the various stations on the network as vertices of an oriented graph. Using graph theory is to determine the criteria for the assessment of individual stations, which will be used in further investigations formations role as a sub step comprehensive problem.

The appropriate technology movement in implementing the proposed railway transport enterprise can provide a service that will contact existing customers and attract new ones, respectively previously lost customers. The continuity of the art and the global trend of innovation, it is not possible to maintain the old ways of management and organization of traffic on the railways, but it is necessary to exploit the advantages offered by technological advances in science and technology. It is necessary to constantly seek new opportunities to improve the services provided.

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Resumé

HODNOTENIE ŽELEZNIČNÝCH STANÍC PRE SYSTEMATICKÚ VLAOTVORBU NA ŽELEZNIČNEJ SIETI

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Príspevok poskytuje pohľad na hodnotenie železničných staníc multikriteriálnym prístupom. Výsledné ukazovatele charakterizujú vlakotvornú stanicu ako hodnotiacu váhu pre vlakotvornú stanicu. Hodnotenie staníc je vhodné využiť pri investovaní do technického vybavenia staníc pri vytváraní časovo diskrétnej vlakotvorby na železničnej sieti.

Summary

RAILWAY STATION EVALUATION FOR SYSTEMATIC TRAIN FORMING ON THE RAILWAY NETWORK

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Paper submitted the evaluation of the railway stations by the multi criterions evaluation. The resulting indicator is characterized station as weight point in the valuation graph. The evaluation of stations is a very important element in determining investment in technical equipment stations using technology for time-discrete train formation on railway network.

Zusammenfassung

DIE BEWERTUNG DER EISENBAHNSTATION FÜR DEN SYSTEMATISCHEN WAGENSATZ AUF DEM EISENBAHNNETZ

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Der Artikel legt die Bewertung der Eisenbahnstation mit der Benützung der multikriterialen Methode vor. Der resultierende Index charakterisiert die Station als den Punkt mit dem Gewicht an dem Wertgraph. Die Stationswertung ist sehr wichtiges Element für die Investitionsbestimmung in der technischen Ausstattung. Es benützt die Technologie für den zeitgeteilten Wagensatz auf dem Eisenbahnnetz.