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INFORMATION SYSTEM IN THE FUNCTION OF RAILWAY TRAFFIC MANAGEMENT

Summary. Rationalization of economic operations, increasing productivity and internal resources exploitation trends are one of the basic tasks of an individual economy that is gained by regular installation of information system. The article presents information system in the function of railway traffic management as it becomes extremely important for every company to get information by means of information system in order to assure successful business deciding process, for mastering, optimization and integration of business processes. Railway traffic is an economic activity that concerns with the freight and passengers traffic and supports transport problems by using information system.

The development of information railway system results in freight and passenger traffic management of the Slovenian railways (SŽ) and in connection with foreign information systems by means of Hermes network for transferring data about freight and passenger traffic among railways. Due to the widespread information railway network, the article presents only the use of freight information transport system, in details its shunting.

The application of freight transport management (FTM) presents freight traffic mastering and controlling on the Slovenian railways as the whole, at any time and in real time. It enables the receiving, control, monitoring and supervision of freight wagons and trains. The managing programme of shunting station is a constituent part of the Slovenian railway information system and is included into the application for freight traffic management at the Slovenian railways.

SYSTEM INFORMACYJNY ZARZĄDZANIA RUCHEM KOLEJOWYM

Streszczenie. W artykule przedstawiono system informacyjny zarządzania ruchem kolejowym, ponieważ staje się on niezwykle ważnym dla firmy aby uzyskać informacje w celu zapewnienia udanego procesu podejmowania decyzji biznesowych.

Ruch kolejowy stanowi aktywność gospodarczą, która dotyczy przewozów towarowych i pasażerskich oraz wspiera zagadnienia transportowe za pomocą systemu informacyjnego.

Rozwój kolejowego systemu informacyjnego znajduje zastosowanie w zarządzaniu ruchem na kolejach słoweńskich (SŽ) oraz w powiązaniu z zagranicznymi systemami informacyjnymi (zasoby sieci Hermes) służy do przesyłu danych o ruchu towarowym i pasażerskim pomiędzy różnymi operatorami kolejowymi. Ze względu na powszechny dostęp do sieci informacji kolejowej, w artykule przedstawiono jedynie wykorzystanie informacji w systemie transportu towarowego (w szczególności podczas rozrządzania pociągów).

Aplikacja zarządzania transportem towarów (FTM) przedstawia sterowanie ruchem towarowym i nadzór na kolejach słoweńskich jako całości, w każdej chwili i w czasie rzeczywistym. Umożliwia odbiór, kontrolę, monitoring i nadzór nad wagonami towarowymi i pociągami. Program zarządzania stacjami rozrządowymi jest integralną częścią systemu informacji kolejowej Słowenii i jest włączony w aplikację do zarządzania transportem towarowym na kolejach słoweńskich.

1. INTRODUCTION

By introducing information and communication technology into traffic flow the life, the way of thinking and working conditions of individual systems have been changed. For the same reason working conditions in railway system have been changed, too. The users of railway system tend to gain the quickest and most qualitative transport service, quality and arranged quantity of wagons at certain time and place. Not only the machine equipment has developed, but also the applicative software and operational systems. To satisfy customers in all ways, certain demands have to be appreciated, especially by using modern information technology.

Information flow presents an important segment for qualitative management and operation of railway traffic. Its significant role can be seen in management and operation of freight transport as well as in shunting subsystem of trains, where it is used for freight transport planning and train composition shunting. The database that is formed through acquisition of data over the terminals, which are set at different points of railway network, plays an important role in it, too. Such railway network points are boundary, shunting, arranging, larger unloading and loading stations. The number of working terminals for data acquisition depends on the number of working places at certain point. The whole process presents the freight traffic management in real time.

The article deals with freight transport management and with shunting system at Zalog railway station. There are several characteristics of railway traffic that acquire an enormous quantity of data and information that were gathered and checked in a certain period and present the indicators of the work done. Due to economical operations, the rise of productivity and exploitation of internal sources, the level of prompt changes has to be gained in a way the market directs. For logistic purposes in railway traffic, the latter could only be achieved by introducing information systems that are supported by computers.

2. INFORMATION SYSTEM MANAGEMENT

Information system in logistics assures people who deal with logistics certain tools that enable rapid solutions. These tools make possible yielding and arranging of data in railway traffic and the usage of analytical models on the basis of graph's presentation. The latter serves for better comprehension and connection of logistic options and solutions. Complex data arrangement presents the base for data acquiring in logistics, and that helps in better understanding of problems and opportunities that are usually offered to logistics' professionals.

Information system that is used for freight traffic management as well as railway shunting system represents an important part of train traffic project. It enables registration, control and surveillance of technological activities of freight traffic in real time. Out of such basic data, all the prints needed can be formed and statistics for the need of management and decision-making in traffic. Information system for freight traffic management is based on systematical analysis of all activities in railway tecnological domain. At any moment, the system allows insight into the data that include wagons or freight, the station or the train the freight is located.

The function of freight traffic management can be presented in three basic points:

1. Information management – aviso of a train, i.e. information that has occured in parallel with technological process at the station and can be used for wagon planning;

2. Current information – movement of the train on the track, i.e. where the train is situated;
3. Database – archives of the train, i.e. what has happened to the train formerly.

2.1. Optimum regime of shunting system operation

The existing researches established that planning of shunting work is multilayered. Shunting station appears in the railway system network as a network of system of mass wagon flows. In accordance with operation of marshalling yards, various mass wagon flows can be anticipated in the network complex: train handling in the reception sidings in order to prepare wagons for splitting and final assembling; train handling in order to prepare the train for dispatch; and, dispatch of trains from stations. Individual tasks depend on number of maintainance channels which can be divided into several parallel maintainance systems.

In function are correspondence of wagon flows and numerous factors of individual stations, i. e.:

- ⇒ quantity of shunting work and employment of shunting capacities,
- ⇒ detention time of wagons,
- ⇒ wagons gathering time at the station,
- ⇒ costs of shunting work.

Wagon flows for the next timetable period have to be planned on grounds of established wagon flows and requirements in the previous period. The basis for establishing wagon flows can be the waybill as a consignment document of the wagon and it is appropriate for handling.

The fundamental goal of shunting at marshalling yards is assembling and splitting of train compositions. Therefore, shunting work is the most important part of working technology at marshalling yards. By rationalization of shunting work the station shunting ability and other numerous work indicators can be established.

Indicators of shunting work at stations, according to exploitation of shunting capacities, are:

- ⇒ number of marshalled wagons according to structure of flows,
- ⇒ frequency of wagon flow dispatch,
- ⇒ number of dispatches for stations for which the marshalling yard performs marshalling of train formations, for domestic and international traffic.

The number of dispatches for individual stations for which the trains are being marshalled as well as frequency of wagon flows depend on location and tasks of the marshalling yards in the railway system. Besides trains, split in the marshalling yards, trains in transit arrive at the stations. Therefore, certain tasks for the further journey of transit trains also have to be performed. If the personnel are performing work at both types of trains, the marshalling and the transit trains, the task is not excluded from other tasks into a separate system, but it is in the common system. Time of detention of wagons at the station is thus shortened, especially on commercial receiving of the train. If separate work groups of personnel perform tasks on transit trains and other at handling of trains in the marshalling yard, then the function has to be separated in separate systems.

System network of mass operation which presents system operation of belonging stations with track sections and marshalling yard in conditions of continuous splittings of trains on the hump can appear as presented in the picture:

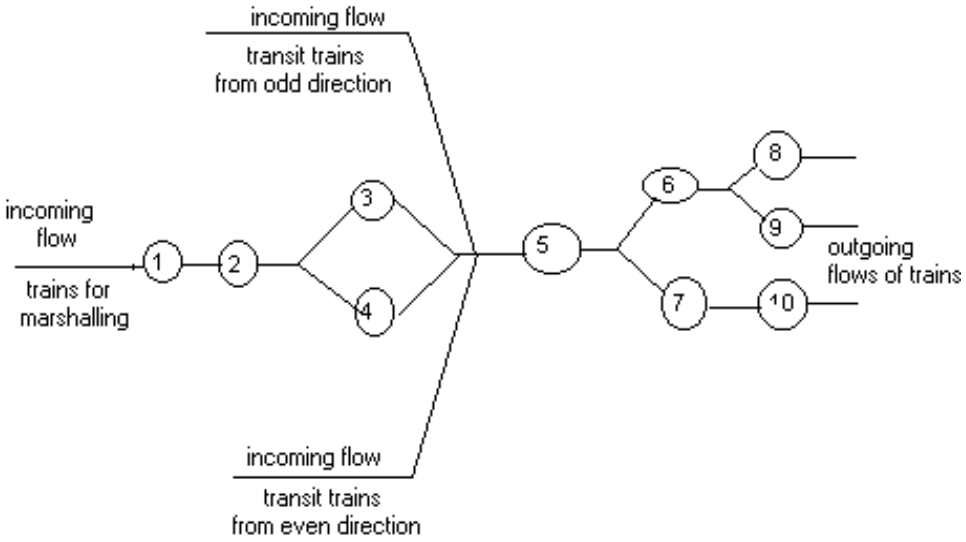

Fig. 1. Service system network
Rys. 1. Sieć systemu obsługi

⇒ System 1 – incoming route sections – reception sidings or IRS – RS;
⇒ system 2 – reception sidings – hump or RS – H;
⇒ systems 3 and 4 – sorting sidings. In this group as many systems are known as there are shunting engines or shunting areas. In this example two shunting engines were employed, therefore there are two systems;
⇒ system 5 – departure sidings - DS;
⇒ systems 6 and 7 – providing a working engine. There are two systems in this example since an electric and a diesel locomotive have to be available;
⇒ systems 8, 9 in 10 – departure sidings – outgoing route sections or DS – ORS.

In this example three route sections are known since there are three systems. Each system has to be separately dealt with since in each system detention time of wagons for commercial and partly also technical control of train formations can be shortened.

Taking into account the mentioned facts and presentation of work at the station, and regarding the modern capacities, the shunting station Zalog has been treated as example of wagon flows in the Slovenian Railways network. Above all, the extent of marshalling yard has to be considered. It is known that detention of wagons at marshalling yards requires certain time for splitting and assembling of new train formations. Splitting and assembling train formations is performed at bigger marshalling yards over the shunting hump. In this respect, the hump is of great importance when deciding about tasks of individual stations and all the stations of the Slovenian Railways.

3. MANAGEMENT OF ZALOG SHUNTING STATION

The application for management of Zalog shunting station is composed modular. The application moduli include several spheres by which the technological management of Zalog shunting station is carried out.

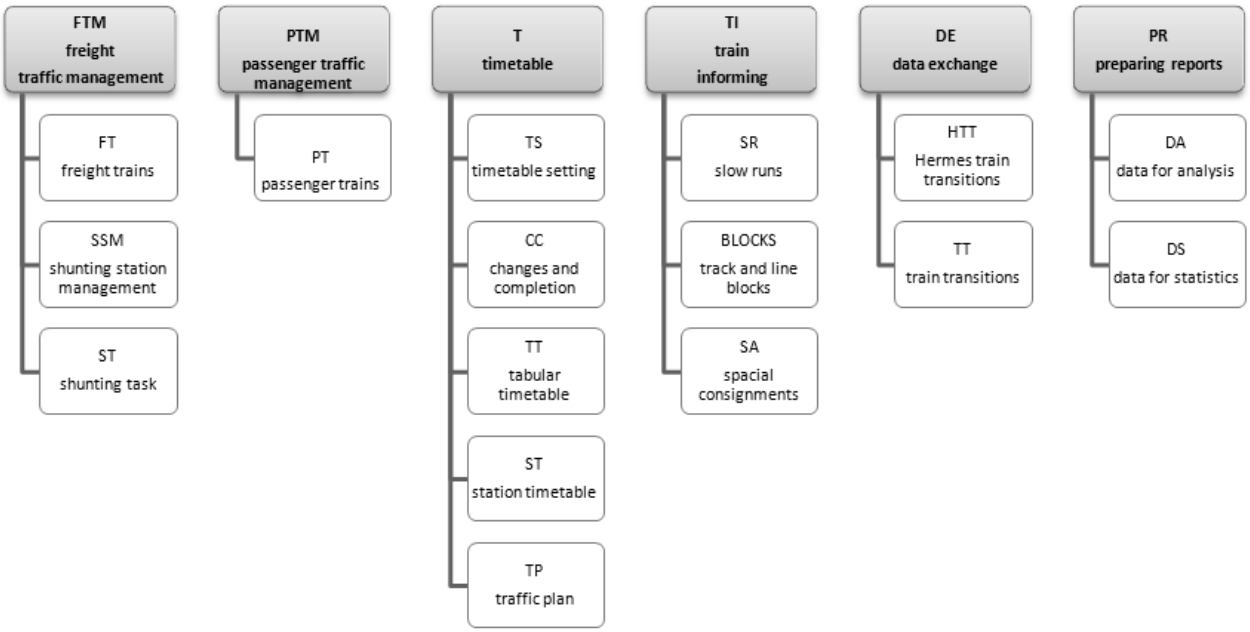

Fig. 2. Application modules for the management of trains at Zalog shunting station
Rys. 2. Moduły aplikacji do zarządzania pociągami na stacji rozrządowej Zalog

3.1. The role of Zalog shunting station

The Zalog shunting station deals with shunting of train compositions. The latter consist of wagons that are intended for various stations and destinations. It is up to the station to split and assemble wagons when they arrive. This is accomplished by support of shunting engine that shoves the trains up and over the hump to the group of railway tracks, where the wagons are gathered in order to form new trains. Such splitting and assembling of trains from one train to another is called shunting. Information system at Zalog station covers the entire activities of wagons passing through all stages of shunting. Therefore, accurate information is provided at any moment about the number of wagons on tracks and their microlocation. Such precise system management enables the composition of trains to be made in advance and the analysis of work that was done in certain time. Informational programme is connected with other systems of railway and enables the data transfer to the services that concern with logistic planning for customer communication needs.

3.2. Information system organization

Information system organization is divided into several sectors:
- ordering of shunting tasks,
- technical operations,
- control,
- statistics.

Assembling of wagons on tracks is organized according to the principle of shunting tasks. The latter are divided into separate tracks. Defining of shunting tasks is made when a new timetable is set up or at any tecnological change. On the other hand, the change of shunting task means that the purpose of directional track can be changed at any time due to the new shunting task.

A group of programmes that provide data entering during the technological procedure belongs to technical operations. Technical operations are the most important part considering accuracy and punctuality of data entering. Due to them a total information about shunting at Zalog station is given.

In the scope of surveys there are some programmes available that contribute different reviews of data and information that were recognized by technical operations. The programmes enable us to

examine the waggons on tracks, examine the waggons according to shunting tasks, to class letters of wagons, to ownership, to wagon status and to wagon type.

Statistic sector includes all the relevant data that are run by entering data through the working process procedure. They are meant for copying out various records, such as train traffic diary and different reports about the work done in tabular and graphic form. Statistical data are divided into two basic forms:

- the work done in reception sidings and setting over the hump;
- the time of wagons' holding up at directional track due to the assembling and the time of final operations.

4. CONCLUSION

All the facts mentioned are leading to the following conclusions:

- by assistance of well-composed programmes the objective daily information about the range and quality of shunting work for all levels of the Slovenian Railways and for traffic operation needs are provided;
- in information system the project »SSM« presents the beginning of defining the type, form and quantity of information that is used for logistic purposes;
- the analysis results point out that by introducing of information system the percentage of mistakes that are consequences of human factor has fallen but the percentage of information flow has risen;
- since the information system at Zalog station was introduced, the time for carrying out individual operations that consider the realization of certain levels of technological work process has been shortened and consequently, that leads to rationalization of information system usage for logistic purpose.

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