Management and Operational Planning of Train Service with the Support of Information Systems

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Abstract. This article focuses on the operational planning and management of rail transport with the support of information systems. The sectoral and specific information systems present the major support for management decisions. Timeliness, accuracy and validity of the information has a significant share in decisions particularly in stochastic process that is transport. In field of Slovak Railways the infrastructure manager has built the Operating information system, which helps manage those decisions. A separate part of OIS consists Shift plan, which is the basic document for the operational management of traffic on the Slovak railways. It is important to note that the information systems decide on a particular real situation. Our paper deals the process for planning and managing the railway running with this OIS.

Introduction

Transport is one of the key factors in the development of any modern society. Transport alone is not an aim but a means of economic development and a prerequisite to achieving social and regional coherence. The provision of rail infrastructure is a key precondition for achieving a competitive at rail service market.

Management and operation of infrastructure carried out by the Infrastructure Manager (IM). It is generally owned by the state. This body is responsible for non-discriminatory access by railway undertakings (RU) providing transport of trains in passenger transport and freight transport. The access of RU to railway infrastructure is a complex process, which is defined by precise legal conditions and procedures. But also it provides the infrastructure manager space for business and marketing behavior [8, 9].

The RU as customers purchase the infrastructure manager of railway infrastructure capacity in the form of train paths. Allocation of railway infrastructure and its assessment presupposes knowledge of technology traffic control, track line technology, and economic implications of these processes. This complex question is closely related to the determination of railway infrastructure capacity, which represents the maximum potential offer of infrastructure manager. The compiled timetable is operating plan and offer to potential customers [3].

The basic precondition in managing the issue is a defined process management of railway infrastructure capacity, particularly in determining the procedure for identifying the model railway infrastructure capacity [2]. This process depends on the definition of optimal performance permeable elements of railway infrastructure and is also an important basis for decision making on investments for its development.
The Information’s in Rail Traffic Management

In the conditions of a liberalized transport market, it is necessary to select the information according to the new criteria. They result from the different actors in the transport market, whose existence is the result of the transformation process [10].

Transport market rail transport performs on the supply side, RU offering transport performances for the transport of persons and goods in space and time. On the demand side is the customer who requires relocation to specific destination. The customer can be the carriers themselves, for whom a service is provided or the intermediary, such as a freight forwarder. [1] The customer buys a transport service - transportation.

On the market of transport services in rail transport are also other entities - mainly the infrastructure managers. From these RU buying the railway infrastructure capacity. Special categories are the regulators. What is important is perfect cooperation between various entities involved in the final product, because the end customer perceives the quality of the transport process as a whole [10]. That of rail transport means in particular the coordination of technological processes, IM and RU.

When evaluating the tasks of information system is necessary to know the relationships and technological processes in the processes of railway traffic and transport operation, as well as economic relations [10].

The Operational Management of Train Traffic

Before entering the train on the infrastructure must be secured activities that relate to the order of the route for the train to the existing rules for the allocation of network capacities. In terms of the Slovak Railways IM (ZSR) establishes so called Shift plan for 12 hours [3]. The Shift plan includes a request train paths for exactly 6 hours and for the next six hours prospectively. Based on this plan of shift is processed subsequently admitting trains on the railway infrastructure according to these routes by the various RU.

Path request must include [4]:
· Identification of the train path,
· Departure station,
· The date and time of departure,
· Destination station.

After confirmation of the route and its subsequent reservation carrier performs operations leading to the assembly and preparation of the train to departure [7]. To ensure the comprehensive preparation of train the sending RU must have access not only to the disclosure of infrastructure constraints, but also to the technical data of the rolling stock and the reference database of goods, in particular with regard to the transport of dangerous substances. [1] After processing and compiling train dispatching carrier must provide information on train composition to IM.

Train report contains:
· Train number and path number,
· Initial station with the date and time of departure,
· Destinations, with expected date and time of arrival at the station,
· Designation of locomotive,
· Length, weight and maximum speed of the train with respect to the technical characteristics of the wagon,
· Train composition with combination of placing and by specifying the beginning and end of the train,
· Application command and control system,
· Information on deviations from the agreed specifications of wagons,
· Code UN and labeling of hazardous goods, if such a position in a train wagon,
· Train braking mode and technical specifications used wagons.
Figure 1. Activities and information in the relationship between the railway undertaking and infrastructure manager.

After entering the train to the rail infrastructure the IM takes responsible for the train. Throughout the transport route the IM must inform the RU train running. The RU has the right to ask you to send your location information of the train, information about train location include [1, 19]:

- Current location of the train,
- Train identifiers,
- Plan the train is running on a particular track section,
- Train movement plan for all track sections.

The process of delivering the train may be performed for a whole one RU, or RUs different parts of the route. In taking responsibility for a train between two RUs takes place exchanges of information about [6]:

- The consignments,
- The train.

For the organization of traffic and transport processes, the consignments exchange the following information:

- Notification of the transfer wagon between RU and customers,
- Notification of departure wagon from the departure station,
- Notification of the arrival of the wagon to the train station on the way,
- Notification of departure from the station wagon on the way,
- Notification of the arrival of the wagon to the destination station,
- Notification of delivery wagon to the customer,
- Delivery confirmation of wagon.

Information Systems in Railway Transport

In the field of railway transport information systems addressing issues concerning the optimal use of means of transport, reducing labor needs, streamlining management work, improve safety and productivity and reduce the cost of transport activity [1].

In terms of management of traffic and transport processes in railway operation it is for managers and proposers need to determine operational requirements for information and communication systems and thus to know the operational processes and information flows [10].
The role of information systems in the transport business is in real-time capture operational situation, support to the efficient management and information providers of transportation services connect with customers [2]. Modern RU are focused on process management, whose purpose is to streamline the company's business processes and customer service support [7].

To increase the level of management is required to analyze and improve their own decision-making processes and modify the organizational structure of the management system. Information system mainly depends on the complexity of the management of the system (i.e. the number and nature of the links and behavior of the elements) and system used with the control (control of the deviations, of targets and so on.) [4]. While demands on the scope, speed and frequency of information depend on the type of process control, level control and management system applied. Generally, these demands at the operational management level. Demands on the level of processing to increase from operational level to the level of strategic management. All these facts underline the close connection of information systems and decision-making processes [2, 11].

The binding rate of information system for managing the process and the related level of versatility is an important consideration in the classification systems. In terms of the bonding strength of the information system management processes we can talk about two main stages of development:
- Information System,
- Management information system [8, 9].

The information system is characterized by the integration of various functional subsystems into one unit. The problem is not so called access to the agenda processing tasks [3]. Whilst achieving some degree of information integration processing subsystems, the bond of this process on their own decision-making processes rather loose and subsystem information is relevant enough independence from the control subsystem in the management system.

Management information system already provides a closer connection to the decision-making processes. Generally, entails changes in the organization, methods and quality control work. The management system are widely applied mathematical methods [1, 8]. Such a system has an absolute requirement for application of the principle of data warehousing.

The Operational Information System

On the side of the IM are the business processes (in terms of operational processes) supported by information systems ensuring supervision of railway routes and traffic management on the railroad. In addition to these two groups it uses them for IS to ensure communication with other infrastructure managers to support decision making (management information systems) [8, 9].

The IM on Slovak Railways (ZSR) has for its activity created several information systems that support the activities linked to the fulfillment of their main activities as well as ancillary activities.

Basic information systems built to support the "core business" of the Infrastructure Manager is operating information system (PIS). It is based on the proven technology of dynamic motion tracking, status and composition of all kinds of trains on the network of Slovak railways. Its principal task is a strategy encompasses the whole operation of infrastructure and transport of infrastructure with one compact IS [1]. Entering information into the system requires precision and observe the time limit in order to avoid hampering traffic operations [3, 11].

Provides informatics support for process related with [5]:
- planning of train transport,
- operation and management of trains transport,
- communication with other IS,
- assessment of trains operations,
- billing of railroad usage,
- „Life cycle of train“.

This information system consists of three subsystems and 12 custom modules.
The Process of Operational Planning with the OIS

Operational management of traffic on the Slovak railways the IM determines the principles of operational management services for all levels of management. It is binding for all employees who are involved in managing the traffic on the Slovak railways and the RU under a contract between the IM and RU [4].

Operational management of traffic on the Slovak railways is a summary of activities of the IM involved in managing, organizing and providing transport on Slovak railways with every RU’s [7]. The planning of train service is carried out at all levels of operational management. It is provided of shift plans. The proposal of the plan of shift for freight transport is the timetable and requirements RU. Proposals of shift plans submitted for approval to the head changes [1].

![Planning and operations management of transport](image)

**Figure 2. Planning and operations management of transport.**

Based on an analysis of traffic conditions they are announced targets to ensure optimization in operation. The announced job by own measures are binding on the management by dispatching apparatus of all degrees of operational management and executive offices. [1] It is also binding for all carriers involved in the operation and the management of traffic on the Slovak railways [4, 7].

The planning of train service is carried out at all levels of operational management. It is provided of shift plans. Shift plan is one of the modules around the OIS. Module is first basis for billing of railroad usage [3]. The module also information from an actual Timetable from ZONA IS and from train path requests. Focus module gives detail of running train for next 6 hours [4].

**Summary**

A further development and the development of information technology for railways is a comprehensive operating information system (PIS). Its principal task is a strategy encompasses the whole operation of infrastructure and transport of infrastructure with one compact information system (IS) [6].

The allowance approached the functionality of current information systems to support traffic management on Slovak railways. It is important to note that the information system decides on a
particular situation. IS only provide comprehensive support for making a decision to be taken by designated manager.

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References