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Original Contribution

THE ROLE OF INFORMATION FLOWS IN THE OPERATIONAL MANAGEMENT OF TRANSPORT

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ABSTRACT: *The management of transport flows is based on transmitting, receiving and processing the information related to them by applying the principles of the system approach. In a theoretical-applied aspect, it manifests itself as an economic activity for the development and implementation of methods for collecting, storing, processing and distributing information for specific functions and operations in transport infrastructure systems.*

KEY WORDS: *Operating point, Vertical and horizontal information flows, Technical assurance.*

An essential characteristic of the management process is its information environment, and the organization of the implementation of the decisions is carried out through a system of methods of influencing the personnel, using information on the progress of the implementation of the decisions (feedback). The more accurate and objective the information available to the management system, the more fully it reflects the actual situation and relationships in the management object, the more justified the goals and real measures aimed at their achievement. Precisely because the manager in his work relies on information about the state of the object and as a result of his activity creates new command information to transfer the managed object from the actual state to the desired one, the information is conditionally considered the subject and product of management labor. When characterizing an information system, the movement

of information flows, their intensity and stability, and a scheme of the work flow corresponding to these objective conditions are studied. Solutions are ideal descriptions of the desired state of an object and how to achieve that state. They are a product of limited use, as they are aimed at a specific object under clearly described conditions. A consolidated division model is built in the context of message groups. In this direction, the information model characterizes its internal structure, features of its activity, as well as relationships with other such [2].

The main purpose of the information model is effective complex planning and control of the movement of transport flows. In the modern conditions of fully developing integration processes in logistics, information provision must offer users effective information for the effective organization and implementation of logistics functions and operations for the movement of material and service flows, provide the information needed by transport managers and contractors in an appropriate form, to guarantee the completeness, reliability and timeliness of the necessary information in accordance with the functions performed, to appropriately differentiate the information by functions, activities, operations and tasks to be solved.

The information flow is a set of information that originates and circulates within the logistics system or between the logistics system and the external environment, and this information is necessary to carry out logistics operations and to control their progress, i.e. for control actions. **The information flow occurs either as a result of the movement of one or another material flow, or vice versa, it can be the cause of the corresponding material flow** [2].

Information flows can be classified by main characteristics, the most commonly used of which are:

• in their relation to logistics functions - key, basic, complex, elementary;

• in their relation to the logistics system and its external, internal, horizontal, vertical, incoming, outgoing units;

• according to the purpose of the information - directive (managing), normative-referential, reporting-analytical, auxiliary;

• by type of media - paper, magnetic, electronic, other;

• during occurrence and periodicity of transmission and use - regular, periodic, operational, online, offline;

• by means of data transmission - by telephone, telex and fax, by radio, by e-mail, by the telecommunications network [1].

In fig. 1 shows an information model of an operating point, as part of the structure of "State Enterprise National Railway Infrastructure Company".

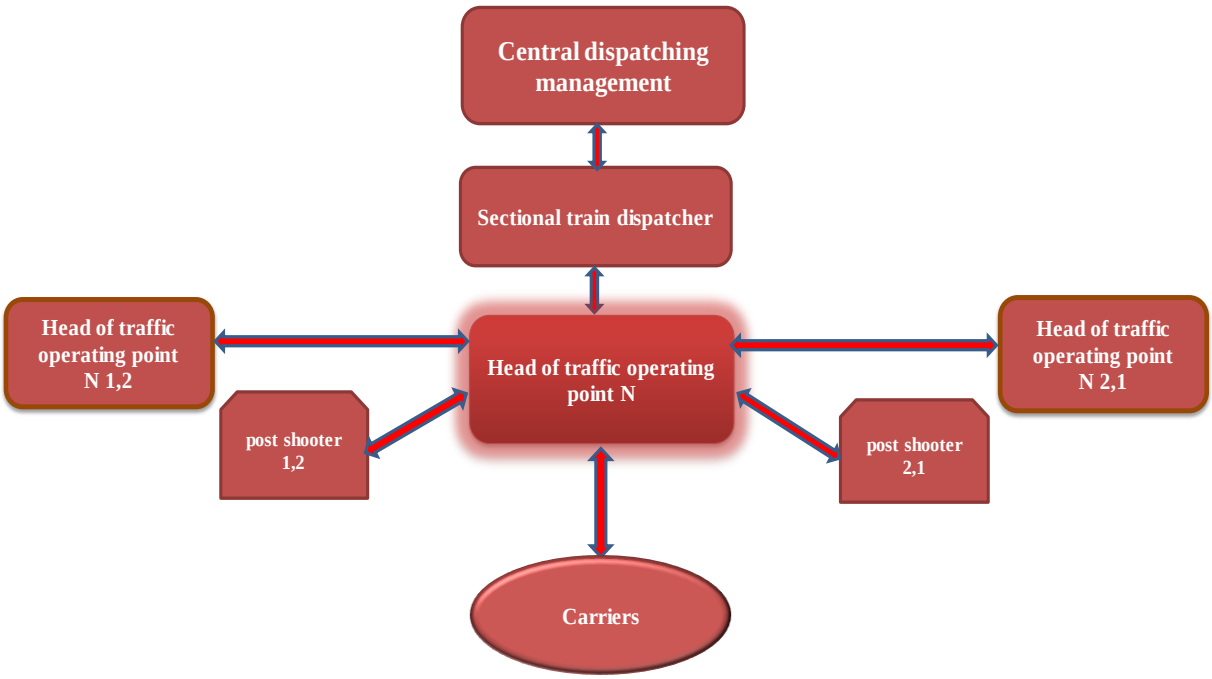

Fig. 1. Organization chart of information flows in the operational management of transport

Based on [4], the following types of information flows can be classified and synthesize the main activities in the operational work of the operating points and personnel:

A. Vertical directive (management) information flows:

Central dispatching management – directs controls and observes the movement of trains in the Republican transport network and the work of regional train dispatchers;

Sectional train dispatcher – directs controls and observes the movement of trains in his section and the work of a traffic controller at operating points (stations). Reports to central dispatching management.

From Fig. 1, it is obvious that the intersection point in the movement of information flows in the vertical and horizontal direction is the position of "Traffic Manager".

B. Horizontal (operational) information flows:

Head of traffic in an operating point - directs, controls, observes the movement, the composition of trains and vehicles in the operating point and the work of the station staff, the latter being subordinate to the person in operational order, ensures the movement of trains in the inter-station distance by means of automatic blocking or semi-automatic blocking, reports to the train section dispatcher;

Post signalman - monitors the integrity of the trains, as well as the serviceability of the technical equipment at the station, organizes shunting work, reports to the traffic manager.

In operating point N, to ensure the safe movement of trains and to carry out a maneuver, a "WSSB-GS1" type Route-Relay Centralization has been installed. It has two-level locking and section release of the routes. The execution of the maneuver becomes unrouted, where the arrows are controlled by the maneuvering consoles installed in the shooting cabins, and the signal for the movement of the maneuver is given by the post arrowheads [3].

Obviously, the existence and development of modern information logistics is unthinkable without the use of computer equipment and information technology. Thanks to them, it provides effective management of the movement of transport flows. Through modern information technologies, a unified information process is implemented, characterized by: accelerated effective transfer of information flows within the transport system; reliable storage of data in a database; filtering of information flows; unification and separation of information flows; information transformations - copying, grouping, summarizing, output; targeted processing of information in connection with the implementation of logistics operations [1]. Information technology is a system of methods and means for collecting, storing, processing and distributing information, which guarantees the fulfillment of requests, transportation of the necessary goods and material values in the agreed terms, ensuring high quality of logistics services.

One of the modern technologies for information connections in operational activity is the station concentrator. Through it, the duty manager makes various types of operational connections. All calls from the lines connected to the station concentrator are fed to the duty supervisor's main apparatus and are indicated on the display with an accompanying sound or speaker signal.

Fig. 2. Block Management, overview [5]

The types of operational-technological connections are clearly visualized by icons-buttons on the display. The events that occur (incoming and outgoing information flows) are displayed by changing the color of the icons-buttons of the links, and in some cases with a sound signal. This enables the video display operator to clearly understand the situation, react quickly and work easily.

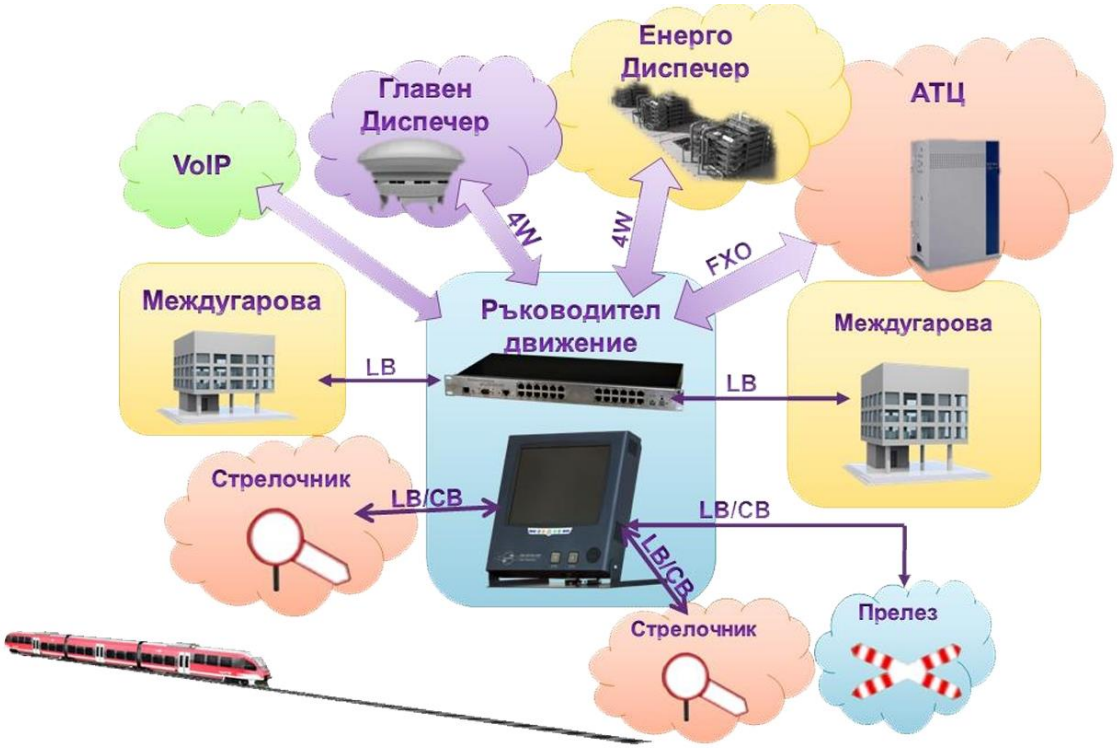

Fig. 3. Application of the station concentrator [5]

Shown in the figure is a diagram illustrating the communication and control structure in a transportation or railway control system. Here is an interpretation of the main elements shown:

- **Ръководител движение** (Traffic Manager) in the center is the main point of control, linking various entities and systems.
- **Главен Диспечер** (Main Dispatcher) and **Енерго Диспечер** (Energy Dispatcher) are connected to the Traffic Manager, likely representing supervisory roles or higher management levels in charge of energy and operations.
- **АТС** is likely an Automated Train Control system, connecting to the Traffic Manager for automated or regulated control.
- **Междугарова** (Interstation) buildings indicate connections between stations, possibly for communication or data exchange.
- **Стрелочник** (Switchman) and **Прелез** (Railroad Crossing) represent points along the railway network where monitoring and switching may occur.

- Arrows such as **4W**, **FXO**, **VoIP**, **LB**, and **LB/CB** represent different types of communication and signaling lines or protocols:
    - **VoIP** is Voice over IP for communication.
    - **4W** and **FXO** likely refer to specific telecommunication interfaces or connections.
    - **LB** and **LB/CB** might represent types of local or control signaling.

One of the latest developments of the research institutes and implemented in some operating points is the Route Computer Centralization which combines high computing power and a high standard of safety. With its universal interface, this product not only manages and coordinates all external objects in the railway infrastructure, such as traffic lights, turn signals and axle counters, but also ensures the smooth and trouble-free movement of trains.

Fig. 4. Route Computer Centralization Interface [6]

Route Computer Centralization has the highest safety standard SIL 4 (Safety Integrity Level (SIL) is defined as the relative level of reduction of the risk of accidental damage to technological equipment provided by a security system. In the current European safety standards four levels of safety are defined, the highest being level 4 reliability and two times two-by-two structural reliability, which ensure flawless real-time control and response. Combining technological innovation with the integration of various systems, such as

interlocking, level crossings, ETCS (translated from English-European Railway Traffic Control System) and others, Route Computer Centralization is key in the modernization of railway transport. The modular structure of the Route Computer Centralization provides a flexible and sustainable design that easily adapts to different technologies and systems. This approach facilitates the operators in the process of integrating new functionalities and technologies, quality information subsystem, without disturbing the sustainability of the system.

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