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FUNCTIONAL REQUIREMENTS FOR INFORMATION SYSTEM OF INTERMODAL TRANSPORT TERMINALS

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Introduction

The development of the combined or intermodal transport has been solved on a long-term basis. The issues of the development of the intermodal transport has been dealt by Slovak government a number times, it has also the support in the framework of the Operational programme Transport for the years 2007 – 2013. The building of the terminals of the intermodal transport terminal (ITT) aims to prefer the freight transport by railway to road transport even in short transport distances within Slovakia. Wider use of intermodal transport can be expected in relation to foreign.

General description of solution

The network of logistics centres, or intermodal transport terminals, in Slovak Republic is only at its start. There is a conception of building of logistics centres in Slovakia, as well as the studies of individual centres and terminals. The growth of economy, foreign investments and the structure of Slovak economy is already requiring adequate modern logistic and transport conditions. Therefore the building of logistics centres with adequate intermodal transport terminals is a necessity. The logistic backbone of SR will be formed by 5 public terminals [1]. Logistic network built like that should fully cover the needs of Slovak economy, it would reduce the load of road network and environment.

Generally transport chain of intermodal transport activities can include these steps:

- transport preparation (order, order approval, filling the shipping documents – consignment note),
- loading of intermodal transport unit (ITU) on a vehicle of the initial transport mode (typically road transport),
- transport of ITU by the first transport mode,

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- transhipment of ITU, or unloading and temporary storage in the terminal with consequential loading on a vehicle of the second transport mode (railway, or waterway transport),
- transport of ITU by the second transport mode,
- transhipment of ITU, or unloading and temporary storage in the terminal with consequential loading on a road vehicle,
- transport of ITU by the road transport,
- delivery of ITU to the consignee.

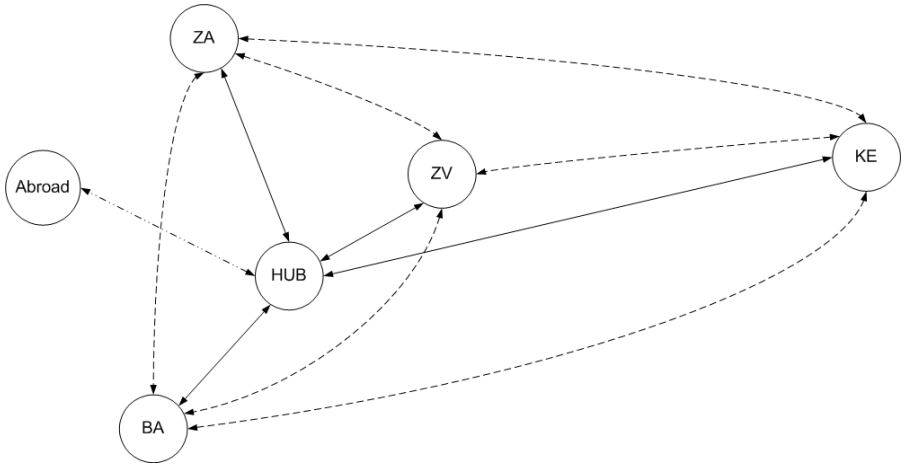

Fig. 1 Illustration of interterminal flows

The design of the solution of the information and control system of ITT follows not only from the analyse of shipping and technological processes but also from the foreign experiences from the deployed similar systems (sometimes referred to as terminal operating system) or the outputs of the European projects.

Methodology of European intelligent transport system (ITS) architecture allows functionally and procedural approach to build up information and software systems. This approach is based on functional decomposition of system and on analyse of procedures and data flows. The output of this approach is hierarchical ordered set of system functions that represent of particular processes [1].

Information system of intermodal transport is divided into basic subsystems that include functions responsible for control of processes on the lower level of system. These functions communicate in the system mutually with each other, with data stores and external

terminators by means of data flows. Terminators represent carrier and operators by means of data flows.

Considering range of functions and flexibility to execute them, structure of information system of terminal was chosen as modular [2]. From point of view of realisation of particular functions it is not necessary to keep following classification, it is also possible other grouping of some modules or allocation of functions of some module. The modular configuration (with corresponding functions) responds general view of such system and follows from customer requirements.

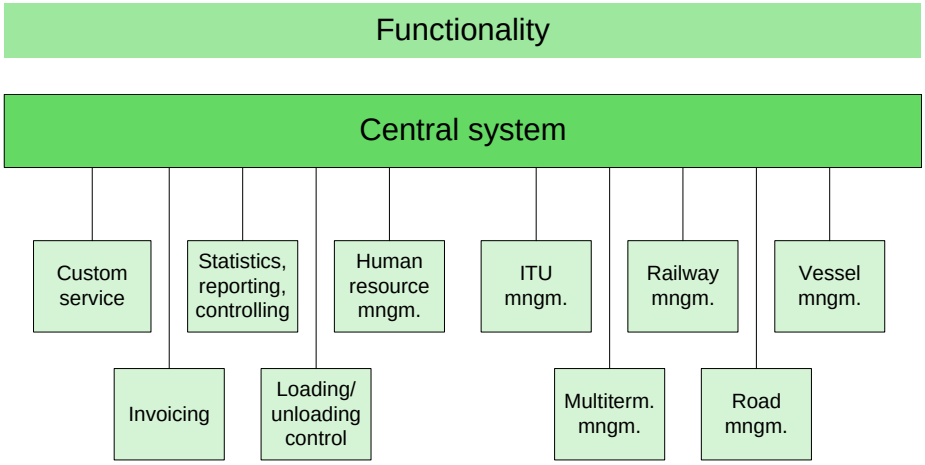

Fig. 2 Modular solution of ITT control system

Description of modules of functions of ITT control system

CENTRAL CONTROL SYSTEM

Central control system:

- is control node of operation progress and ITT activities with suitable interfaces, it represents fully patchable and interoperable solution,
- executes module administration and their dynamic integration, supports automated terminal control, schedule of activities according to orders, delegation to particular modules and processes synchronisation,
- functionally is formed as relational database,
- manages and monitors all activities and controls administration in terminal including internal management and terminal operation,
- provides support of systems supplied by third parties,
- provides general configuration of user rights administration.

LOADING/UNLOADING CONTROL

Loading/unloading control provides:

- registration and check-in of arriving and outgoing ITU,
- automatic or manual vehicle, ITU, drivers move monitoring,
- making and activation of loading and unloading operations, schedule of activities associated with order, verification of its fulfilling, making of plan for containers, etc., monitoring of all relevant activities,
- real-time monitoring of loading and unloading process and effective distribution of resources, i.e. personnel and technical means,
- movement control of ITU from/to yard, it projects these changes to graphical output in real-time,
- effective (optimal) yard utilisation, minimisation of time associated with stacking with differentiating of areas for empty ITU, dangerous goods, swap bodies and trailers,
- advanced system of organisation that maximise available space,
- decision performing on ITU stacking that is realised primary in automatic or alternatively in manual mode,
- implementing of different procedures of managing and planning of yard and according to operation plan goals,
- yard inventory, i.e. inspection of accounting and real status on yard,
- information on yard occupancy, location and dimension of containers, type, registration number, specifics,
- identification of situations that require dispatcher intervention,
- to user possibility to display graphically overall situation with possibility yard control and coordination of all activities to support terminal,
- automated real-time planning and control of handling devices and personnel according to operation needs,
- better utilisation of existing devices,
- monitoring of operations for invoicing and personnel purposes,

- communication with cranes control system, automatic preliminary crane position,
- integration of crane system that also involves control and diagnostics, settings (adjustments, default modes), alert indicator and alert management containing links to the instruction manual and component specifications with user editable text, data logger and statistics (service intervals, operating hour counter, handling and energy measurements, average travel range), black box for recording operating history, maintenance schedule and log book, maintenance and operating instructions and remote administration.

INVOICING

Invoicing provides:

- administration of orders,
- administration, control and electronic data holding on loading and unloading (database for each cost unit, all actions and time) and data concentration on other actions subject of charging,
- automatic calculation of debts and obligations of clients in connection to ITU handling and provided services and their accounting,
- issuing of invoices of provided services,
- list generation, tracking of each performed transaction,
- checking of administrative and financial obligations, demand for payment,
- pricing, offer, tariffs administration, contracts administration,
- integration with existing accounting systems,
- additional functions: views, various invoicing types.

HUMAN RESOURCE MANAGEMENT

Human resource management provides effective and flexible planning and management of labour and working hours according to current needs of terminal operations at keeping of all labour-law restrictions and safety regulations.

STATISTICS, REPORTING, CONTROLLING

Statistics, reporting, controlling:

- represents central data warehouse of detailed technical, operation and economic data on terminal operation serving the purpose of analyses, evaluations and decisions,
- processes statistics including detailed statistics on productivity of terminal,
- real-time monitors and evaluates key operation indicators, offers alert system, bottleneck finding,
- stores to database all actions and crane movements for all cost unit with time,
- simulates and models system,
- monitors, control and evaluates system of quality management.

CUSTOM SERVICE

Custom service:

- serves the purpose of effective and secure communication of a customer with the system, acceptation/creating/sending/modification of electronic documents and orders and monitoring of their fulfilling with the possibility of gathering of historical data,
- is a module of customer service for interactive applications (M2M) to provide real time accurate information,
- enables client to monitor status of freight (ITU) and progress through operation-administrative chain via internet and provides value added services,
- provides to get information on transported freight, estimations for client on time of finishing of action, documents for custom clearance of freight and perform inspection,
- supports communication with customers, business partners, executive administration, carriers, supported forms of communication: EDI/EDIFACT, XML, HTML, e – mail, FTP, fax,
- provides user friendly interface, multifunctional with interoperable possibilities,
- allows integration with software of a client of any format and info-communication solution,
- involves web forms and allows sending of electronic documents through internet,

- enables to reserve capacity.

ROAD MANAGEMENT

Road management:

- ensures registration and checking of arriving and departing containers transported by trucks to and from terminal,
- disposes reliable mechanism of automatic identification at entering or departing of vehicle respectively – identification of container and vehicle through OCR/RFID, recognition of damaged ITU, recognition of licence plate, ensures additional videodocumentation,
- provides planning/reservation of vehicle arrival/departure, optimised schedule for vehicles,
- plans activities of loading and unloading, classification, work strategy, distribution of work performance,
- identifies driver automatically,
- compares expected and real times of arrivals/departures,
- has a connection to automatic barriers and lights, information panels, driver navigation what leads to minimising waiting time and congestions,
- supports decision, administration and planning of loading and unloading for arrival/departure of ITU, minimise time of manipulation with vehicles,
- offers services of collecting/distribution – supports terminal operator at scheduling, administration and planning of own (or rented) freight vehicles to collect or distribute of load units including real-time tracing of location and status of vehicle and ITU.

RAILWAY MANAGEMENT

Railway management realises:

- checking and management of train service,
- preparation of block trains planning (check of weight, length a ITU),
- automatic receiving and sending of train configuration, track allocation and working out of container loading and unloading plan,

- visualisation of track and wagon occupancy,
- automatic identification of trains and wagons trough camera, transponders or manually,
- real-time monitoring of trains paths that originate from or deliver to terminal controlled by ITS or from third terminals,
- enables to send/receive plan of ITU loading on a train to/from deliver/originate terminal.

VESSEL MANAGEMENT

Vessel management:

- monitors and controls of container vessel handling, plans and controls of loading and unloading,
- has a connection to navigation administration, determines anchor position in terminal,
- automatically compiles and optimises plan for vessel loading and unloading with the possibility of pattern formation with predefined sequences for loading/unloading,
- optimises vessel loading and unloading according to transport and technical requirements and restrictions, signals threshold exceed,
- allows to send/receive ITU loading plan on vessel to/from deliver/originate port,
- controls quay cranes on various operation strategies.

ITU MANAGEMENT

ITU management:

- carries out automatic organisation, delegating and monitoring of all ITU movements within terminal,
- enables to enter requirements and rules for handling and ITU transport,
- provides means for management of administrative and additional operations with containers: check, repair, cleaning, maintenance planning, temperature monitoring and power source, ITU renting, T&T (track & trace),

- concentrates/processes/updates information on ITU in compliance with used standards: registry number, weight, dimension, type, seal, (de)blocking, location.

MULTITERMINAL MANAGEMENT

Multiterminal management:

- makes possible to monitor and manage multiple terminals through communication network centrally from one place (HUB),
- concentrates data from particular ITTs to optimise ITU shipping, delegates related actions to particular ITT and involved subjects,
- is characterised by simplified document flow, their automatic delivering what leads to reduced duplicities, regulating and automating some procedures,
- manages HUB specific functions – planning and reserving of resources for train composition for export and vice-versa, managing and optimising of train – train transloading,
- supports terminal operator at decisions, administration and planning of own (or rented) freight vehicles to collect or distribute of load units including optimisation of collecting and distribution from different terminals connected to HUB.

CROSS-SECTIONAL FUNCTIONS AND FEATURES

From overall aspect ITT control system is characterised by following functions and features as well:

- system is scalable – ready to increase of container transport, number of new customers and new business processes,
- used optimising methods allows to minimise terminal operations from point of view of time and economic costs, it increases productivity through better utilisation of human resources, handling devices and yard,
- it is used automated services and transactions management,
- uses wireless network (WLAN) to exchange of messages and commands with handling device operators,
- all functions enables manual intervention, surveys and outputs (print),

- uses EDI, interface with RIS, CIS, CESAR, ISs of cargo operators and infrastructure manager, with monitoring and information system for dangerous goods transport monitoring,
- handling devices are equipped by automatic position control systems,
- graphical interface displays vessel and train storage, yards, other specific data,
- system is in Slovak language and supports different language mutations.

Further ITT control system is equipped by security system (TV monitoring system, safety and checking of entrance of unauthorised persons), private branch exchange, system of light signalling and information tables, etc.

Conclusion

Intelligent control system would be able to manage particular intermodal transport terminals, shipment between them, optimise haulage and delivery of intermodal transport terminals from ITT and ensure information transfer between participants of intermodal transport chain and maximise quality and performance of whole system. It is necessary to stress that such formulated required attributes put on ITS standards in ITT are very challenging because it concerns resolution of system of internal radius (terminal) and external radius (terminal network) including their cooperation with other systems.

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