NATALIJA JOLIĆ, M. Sc.
Fakultet prometnih znanosti, Zagreb
Vukelićeva 4, 10000 Zagreb, Republika Hrvatska
MATO ŠIMIĆ, B. Eng.
Ministarstvo unutarnjih poslova
10000 Zagreb, Republika Hrvatska
SANJA BRNADIĆ-ZORANIĆ, B.Eng. of Transport
HAK
10000 Zagreb, Republika Hrvatska

Traffic Engineering
Review
U. D. C.: 656.615:65.012.34
Accepted: Oct. 16, 2002
Approved: Sep. 2, 2003

STRATEGY OF IMPLEMENTING AUTOMATED IDENTIFICATION SYSTEM - ITS IN PORT SYSTEMS

ABSTRACT

Careful consideration of the intelligent transport systems - ITS, shows that the efficiency of ITS solutions is reflected in the technologies introduced in the recent information age. Today, it is possible to collect, analyse and undertake various activities based on the data and information, that had not been possible before. The technological development in sensor technology and devices for data collection allow almost immediate, real-time analysis of information and simultaneous performance of feedback activities that are so fast that they can contribute to the functioning and operation of the transportation systems.

KEY WORDS

Intelligent Transport Systems - ITS, Automated Identification

1. INTRODUCTION

The port system is considered as a specific factor in the traffic subsystem - a part of the overall maritime system. A port is the starting and end point of the transportation process, and a transport and commercial node of various good flows and carriers of maritime and surface transport that does not belong to any traffic branch, but allows import, export and transit of goods depending on the weather and spatial differences between origins and destinations as well as information exchange in order to harmonise all the environmental requirements. The internationalisation from the aspect of the port system is reflected in the changes in the competitive environment and the occurrence of new markets for logistic services. The movement of cargo and the transport of resources within the ports need to be co-ordinated, and the role played by the port in the logistic chain depends on the port management.

The development of ITS is motivated by increased difficulties, both political and economic, and the increase in the transport capacities. ITS represents a possibility of improved management of the existing resources, suprastructure and infrastructure, through information management and through new possibilities of control, that is, ITS-s represent the intention of taking advantage of the possibilities provided by advanced technologies for the improvement of transport at many levels.

2. BASIC DIRECTIVES OF *ITS* IN PORTS

Ports are parts of the logistic chain, i.e. the transportation chain which unifies a number of customers and service providers. Information is the essence of ITS. One component is the preparation of terminal information, processed for internal planning of the terminal and for administrative purposes, and integrated with the information towards other members in the logistic chain (EDI). The improvement of the access to high-quality information when this is necessary is crucial for the port systems as well as for other links in the transportation chain, with the aim of increasing the safety and efficiency and reducing the costs and human errors.

In planning the ITS objectives, it is very important to determine the ITS products and services. In other words, it is necessary to define the groups of technologies in order to satisfy the needs of every market, for the operators to assist them in optimising the complex system flows. The next component is the throughput of information towards the customer in order to make an efficient choice. In this respect, information of interest include the data on the identification of vehicles, cargo or driver connected to the information system of the area.

Individual reasons for ITS implementation include:

– achieving and maintaining an acceptable level of mobility in order to meet the local, regional, and

national interests and the need for the people and goods to be carried to the desired destination,
- minimising of delay time due to congestion and respective fuel loss,
- establishing of institutional relations that will improve the traffic flows.

3. CONCEPT OF ESTABLISHING AUTOMATED IDENTIFICATION SYSTEM

Except for the ports with highly sophisticated equipment and annual turnover amounting to hundreds of thousands of tons, the system of identification and control of cargo at ports is performed manually, the documents that accompany the ship and cargo are in paper format and the booking and leasing of ship space is performed by means of data transfer by phone or fax. The application of automated identification of cargo at the entrance into the port and exit from the port and the integration with the system of electronic data transfer results in the improvement of handling operations, reduction of delay time in the port and in front of the port, reduction of errors and increase in the cargo throughput at ports, piers, and terminals (1).

The development of the integrated system consists of the following steps:

1. defining of the functions necessary for modelling of operations at ports;
2. development of basic architecture, including data model;
3. integrating of technical components and real-time control system.

Automated identification in port systems means:
- automated identification of cargo (AEI - Automated Equipment Identification) for loading units and automated identification of vehicles (AVI - Automated Vehicle Identification) for transportation means that carry the loading units;
- automated identification of drivers;
- combination thereof.

Automated identification at ports is a part of the larger system integrating several terminals into a transportation chain. The identification serves to:
- update information towards the customers about the status of the loading/unloading units in the transportation chain,
- as support to planning processes in the port system, to monitoring and control,
- as support to documentation accompanying the cargo flow.

Improved conditions of the system operation are, as a rule, the result of:
- successful architecture and specification for integrated AEI - EDI system,
- elaborated cost-benefit relations of different AEI concepts in different operations and standardisation,
- market pressure to use AEI in the transportation chain.

4. STRUCTURE OF THE TECHNICAL AND TECHNOLOGICAL *AIS* SUPPORT

Identification technologies can be supported by the frequency devices and smart cards. AEI and AVI use radio frequency devices, and smart card technology is used for the identification of drivers. The standard frequency of 2.45 GHz and 5.8 GHz is adequate for several reasons: the range and speed of communication is sufficient and enough products are available on the market that can operate in different environments at the port, frequency seems a good candidate for the standardisation since it can be used in many ports of the world. The problem can be focusing of the antenna in such a way as to eliminate undesired readings. This is a general problem resulting from the general lack of space causing delays and from the fact that targeted units move in all directions, often with several units moving simultaneously. The antenna can be directed at an angle of 45 degrees with the aim of reading the devices located on the containers in case these are lifted, avoiding the reading of containers transported on trucks. Errors may be caused by incorrectly interpreted readings that follow one after the other. The incoming units e.g. on railway ramps often enter and exit during loading and this can also cause confusion in the AEI system in case it is not correctly designed. The objects, persons who from time to time "cover" the devices represent also additional cause of error. With the aim of correctly determining – reading the units that enter and exit, double readers can be installed, equipped with adequate logic, thus increasing the costs. Many port systems are congested, and this further complicates the mentioned problems. The control system, which operates correctly in real-time conditions, and is based on the automated identification, requires well defined output and input points from the land and sea side, and precisely defined areas for parking and cargo transfer at the terminal. Once the land gate is well defined, the correct installation of the reader is no problem.

With the introduction of automated identification, the specific AEI solutions should be implemented and integrated in EDI systems. In this way the stored information about the cargo – its properties and status, adequate vehicles and drivers as well as the documents accompanying the travel and the cargo, become available to everyone interested.

Technical problems with the registrations (reading of devices), carefully installed at suitable places, are present at terminals that lack available space. The analyses of the overall transportation chain at ports show that the real-time control of the physical steps of the AEI concept in handling the intermodal transport units can reduce administrative costs, improve the service quality and management efficiency. However, this refers only to situations in which there is support in the management and in the communication system intended for handling, storing, and transfer of electronic information, internally and externally. Automated registration of incoming and outgoing transport units, vehicles or drivers has sense only if a system is available that can use the information in a cost-effective way. Operative analysis shows that the existing EDI for administrative and commercial information between the terminal and its customers is more of an exception than a rule. Neither small ports nor the majority of their customers have internal systems for processing, sending or receiving EDI messages. The mid-sized ports apply some EDI messages with their major customers, but the development is slow due to high costs of implementing new messages and the need to contract the usual range of definitions for the exchanged data.

The system architecture does not depend on the technology and organisational structures, so that the system can be easily adapted to technological and organisational changes.

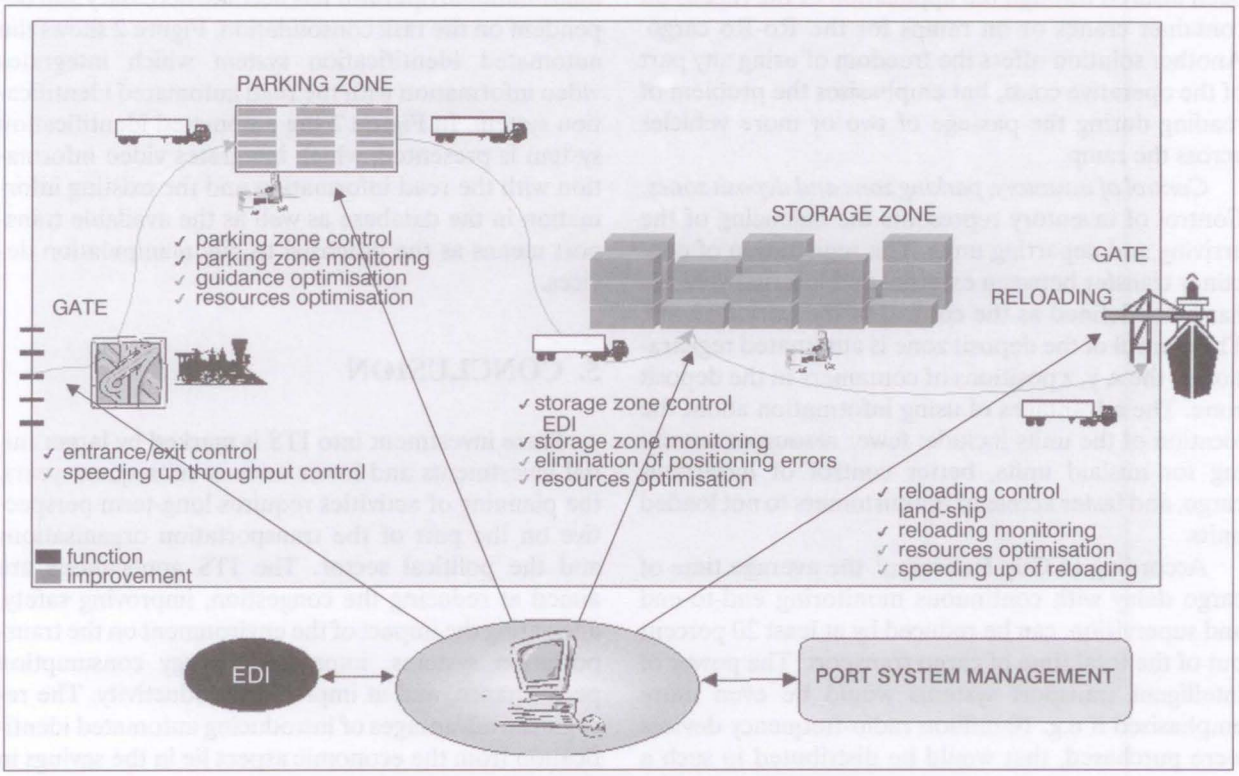
The covered functional areas, as presented in Scheme 1, include:

- access control,
- guiding of internal / external vehicles,
- control of loading / unloading,
- inventory control,
- generating of documents and communication.

Table 1 - Application of identification technologies

Function	RF device	Optical reader	Smart card
Access control	✓	✓	✓
Control of loading/unloading	✓		✓
Control of parking zone	✓		✓
Control of deposit zone	✓		

Access control (road and railway vehicles) is stipulated by the application of the automated identification system application. The drivers can be controlled by using the smart card technology. The driver has to insert the card into the reader and to key in his PIN, taking longer than the procedure often present today: control of those selected at random, especially since the readers do not function in cold and poor weather. The optical reader system can also be used.



Scheme 1 - Improvement of the operation of the port system.

Source: G. A. Giannopoulos: Innovative Approaches and Telematics for Ports and Transport Chain Management, 7th World Congress on Intelligent Transport System, Power Point Presentation, Torino, 2000, sld. 7.

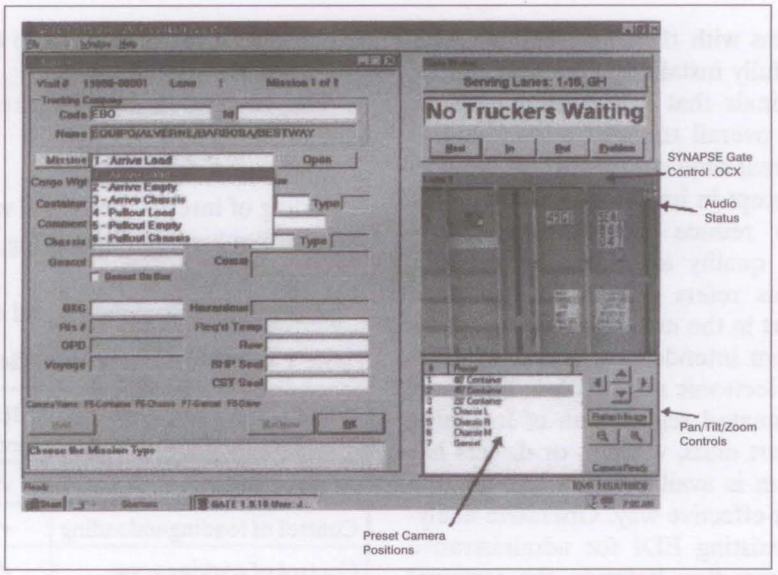


Figure 2: Integrated system of automated recognition control

However, the necessary 30 seconds at the gate are considered to be an acceptable price for the improvement of security. The next indicator justifying the introduction of automated identification is the fact that with the AEI system about 40 percent of costs of employees working in the control and 2/3 of the gates become superfluous.

Loading/unloading control. This function, which represents the access control from the seaside, has been insured through the application of the reader on container cranes or on ramps for the Ro-Ro cargo. Another solution offers the freedom of using any part of the operative coast, but emphasises the problem of reading during the passage of two or more vehicles across the ramp.

Control of inventory, parking zone and deposit zones. Control of inventory represents the balancing of the arriving and departing units. The registration of container transfer between external and internal vehicles has been defined as the control of the parking zone. The control of the deposit zone is automated registration of the x, y, z positions of containers in the deposit zone. The advantages of using information about the location of the units include: fewer resources searching for mislaid units, better control of hazardous cargo, and faster access of the customers to not loaded units.

According to Guy Robinson[1] the average time of cargo delay with continuous monitoring end-to-end and supervision, can be reduced by at least 20 percent out of the total time of cargo transport. The power of intelligent transport systems would be even more emphasised if e.g. 10 million radio-frequency devices were purchased, that would be distributed in such a way as to cover all the containers that take part in the traffic in Europe. The price of one device would be around 5 euros i.e. less than 0.2 euros per citizen of the European Union. Ports and piers can buy the necessary readers that would allow access to the database on cargo movement.

Future applications of automated identification include the possibility of undisturbed sharing of audio and video signals between the operative centre and the terminal, offering high level of opportunity for consolidation. Along with the processes of globalisation and liberalisation, the appearance of the multi-national operator has become necessary and dependent on the task consolidation. Figure 2 shows the automated identification system which integrates video information with the read automated identification system. In Figure 2 the automated identification system is presented, which integrates video information with the read information and the existing information in the database as well as the available transport means as the potential to buy manipulation devices.

5. CONCLUSION

Since investment into ITS is marked by larger initial investments and lower ones in subsequent years, the planning of activities requires long-term perspective on the part of the transportation organisations and the political sector. The ITS applications are aimed at reducing the congestion, improving safety, alleviating the impact of the environment on the transportation systems, improving energy consumption performance, and at improving productivity. The recognised advantages of introducing automated identification from the economic aspect lie in the savings in the number of employees and the equipment, increase of safety and protection of operations, savings in time and money and greater efficiency. By acquiring the

multi-national character, the operator can make great savings in operational costs by centralisation of administrative and operative staff and by applying the automated identification. Future applications of automated identification include the possibility of undisturbed sharing of audio and video signals between the operative centre and the terminal providing high level of consolidation opportunities.

NATALIJA JOLIĆ, M. Sc.
Fakultet prometnih znanosti, Zagreb
Vukelićeva 4, 10000 Zagreb, Republika Hrvatska
MATO ŠIMIĆ, B. Eng.
Ministarstvo unutarnjih poslova
10000 Zagreb, Republika Hrvatska
SANJA BRNADIĆ-ZORANIĆ, B.Eng. of Transport
HAK
10000 Zagreb, Republika Hrvatska

SAŽETAK

STRATEGIJA IMPLEMENTACIJE SUSTAVA AUTOMATSKE IDENTIFIKACIJE - ITS U LUČKIM SUSTAVIMA

Pažljiv pogled na inteligentne transportne sustave - ITS omogućuje uočavanje da se djelotvornost ITS rješenja ogleda kroz tehnologije uvedene u novije informacijsko doba. Danas je moguće prikupiti, analizirati i poduzimati ostale aktivnosti s podacima i informacijama koje prije nisu bile moguće. Tehnološki napredak u senzorskoj tehnologiji i uređajima za prikupljanje podataka omogućuju skoro trenutno analiziranje informacija u realnom vremenu i istovremeno poduzimanje povratnih aktivnosti koje su brze toliko da mogu pomoći funkcioniranje i odvijanje u transportnih sustava.

KLJUČNE RIJEČI

Inteligentni transportni sustavi - ITS, automatska identifikacija

REFERENCES

1. Guy Robinson is the manager of the European communication-related projects, at the European Commission at Bruxelles. Source: Splash out on Intelligence, ITS International, Route One Publishing Ltd., New Jersey, March/April 2000, p. 36.

LITERATURE

[1] **N. Maletić**: *Razvitak inteligentnih transportnih sustava u vodnom prometu*, Master Thesis, Fakultet prometnih znanosti, Zagreb, 2000, p. 55.

[2] **G. A. Giannopoulos**: *Innovative Approaches and Telematics for Ports and Transport Chain Management*, 7th World Congress on Intelligent Transport System, Power Point Presentation, Torino, 2000.

[3] **A. Thomas; S. Urban**: *Automated Gate Control Systems and Port Productivity*, Port Technology International, 13th Edition.

[4] **G. Robinson**: *Splash out on Intelligence*, ITS International, Route One Publishing Ltd, New Jersey, March/ /April 2000.

[5] *SPHERE Small/medium sized Ports with Harmonised, Effective, RE-Engineered Processes*, Final Report for Publication, European Commission, Transport RTD Programme, Brussels, 1999.

[6] *WISDOM, Deliver D6.1 Pilot Architecture Report*, Telematics Application Programe, European Commission, Directorate General Transport, Brussels, 1996.

[7] **C. Warnecke; J. Wehnert; M. Shinakis**: *Automated Identification of Unitised Cargo in Port Terminals - The INTERPORT Project*, 4th World Congress on Intelligent Transport System, CD-ROM, Berlin, 1997.

[8] **Q. Yongchang**: *The Advancing Maritime and Shipbuilding Industry Toward the 21st Century*, The International Maritime Conference and Exhibition, Shanghai, Kina, 1999.