Information system
for safe parking places

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ABSTRACT

The paper describes problems of model of information system of safe parking places for trucks and other types of vehicles in Poland. The need for implementation of this kind of system is required by EU legislation because large number of transport crime incidents was committed during vehicle parking. Currently no such system is implemented and no standard is set. The number of parking places in Poland is limited. Functional and technical requirements of such information system are presented.

KEYWORDS: parking, transport, safety, information system

1. Introduction

Polish Central Statistical Office offers data showing that in 2011 in Poland 1596.2 million tonnes of goods were transported by road, recording 7.0% increase over 2010 – table 1. Poland represents 21% of EU international road goods transport, placing first before Spain and Germany.

Table 1. Transport of goods by mode of transport (based on [10])

Transport of goods	2000	2005	2010	2011
Total in thousand tonnes	1 271 529	1 422 576	1 838 492	1 9121 178
Road transport	1 006 705	1 079 761	1 551 841	1 596 209
Railway transport	187 247	269 553	216 899	248 606
Pipeline transport	44 342	54 259	56 208	54 488
Maritime transport	22 774	9 362	8 362	7 737
Inland waterway transport	10 433	9 607	5 141	5 093
Air transport	28	34	41	45

Central Statistical Office in 2012 has shown that in 2011 road transport of goods measured in tonnes represented 84% of all goods. Additionally, 90% of dangerous goods is transported by road (159.6 million tonnes in 2011), and just 10% by railway (24.8 million tonnes in 2011). 159.6 million tonnes equals over 430 thousand tonnes daily and over 24 thousand road tractors with standard 18-tonne semitrailers daily.

In European Union countries about 72 % of all freight is performed by means of road transport. It turns out that 33% of fright crime related to load theft happens during parking. This fact is very unsettling in connection to laws mandating use of daily or weekly rest for the driver.

According to Resolution of Council of European Union [2], prevention and fighting road freight-related crime should be realized through, amongst others, the following objectives:

- obtaining a clear picture of the national situation regarding road freight crime;
- motivating all partners of the road transport supply chain to take their responsibility and to foresee all necessary preventive security measures;
- exchanging best-practices concerning road transport supply chain security measures;

- providing a single point of contact in order to exchange non-operational information between Member States about secured truck parking areas;
- facilitating the establishment of secured truck parking areas, but without establishing legal liability towards these parking areas;
- identifying where parking areas exist today and where black spots occur;
- reaching out to current and future initiatives for secure truck parks by providing them with information on preventing and combating cargo theft and on the current European model agreement for labelling parking areas;
- ensuring that national models are consistent with the model agreement.

Because of so high share of road transport in total freight numbers it can be proper to declare that sufficient number of secure parking places is key to freight-related crime. Parking places have to be adjusted to needs of contemporary logistics in road transport. Safe parking places can contribute to free flow of people and goods, in agreement with fundamental rules of European integration. Application of one model may lead to implementation of safe and protected parking places on the whole area of European Union.

According to requirements of Directive 2010/40/EU of the European Parliament and of the Council [1], every member state should provide information services about secure parking places for goods vehicles.

In Poland there is shortage of parking places and there is no functioning system for realisation of above goals. It will be important to describe means necessary information services about safe and protected parking spaces that would be based on intelligent transport systems (ITS) and would provide data for goods vehicles, especially at petrol stations and parking places, through:

- availability of parking information for end-users,
- electronic data exchange between parking places and vehicles,
- appropriate ITS equipment in vehicles and at parking places to enable updating free parking place availability data for the purpose of reservation.

2. Information system characteristics

2.1 General requirements

Insufficient number of parking places, usually with no safety guarantee and lack of widely available information makes it impossible to determine rest places in advance. It renders it difficult to determine optimal freight route. Goods vehicles' drivers lack information about places to rest without fear about cargo, truck and personal safety, so they often park at petrol stations. However, choosing appropriate parking place is important because of type of goods carried. Road transport is used for e.g. dangerous materials, for which parking place should meet particular requirements. It's not always advisable to park other vehicles close by because of additional threat.
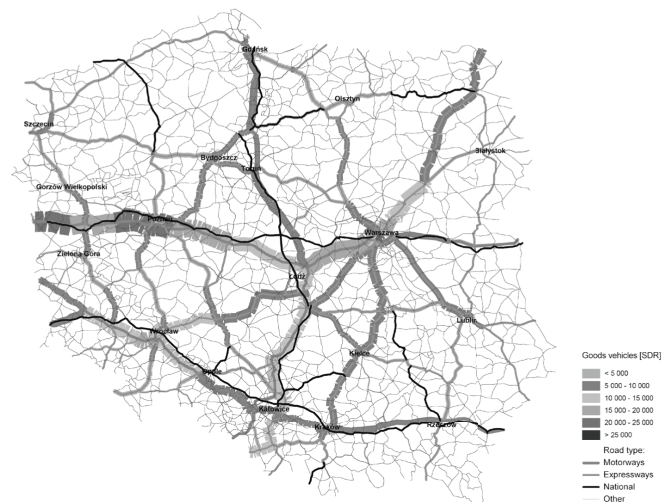

Fig. 1. Intensity of traffic for goods vehicles over the network of motorways and expressways in Poland – forecast for 2025

Information about parking places on all communication routes in Poland and supplemental information about parking place infrastructure (hotel, restaurant, etc.) may fundamentally impact route planning for drivers. Always up-to-date parking place assessment will allow choosing proper place with no fear about driver, truck and cargo.

Motor Transport Institute started own research project which aims to create information system model about safe and protected parking places according to Directive 2010/40/EU [1] and Resolution of Council of European Union [2]. Data exchange about parking places primarily concerns trucks and supply vehicles, but it will make allowance for other vehicles and data will include social infrastructure information.

Proposed system sets an objective to enable travel route determination with possible choice of parking places located close to national roads, expressways and motorways. It is expected that the system will be an open one, allowing for extending with other information important to the driver.

In accordance with European Commission guidelines in EU 5000 parking places are expected for 70 000 km of highest category roads. As in Poland a total of 7 000 km of motorways and expressways are planned in the long range (meaning 10% of UE road network) about 500 parking places should be anticipated and planned for, with average capacity of 20 or more goods vehicles. Additional parking places should be considered on other roads with high goods vehicle traffic and even on roads with lower traffic intensity but in high distance to the closest secure parking place.

2.2 Functional and technical requirements

Functional requirements describe desirable functions from user's point of view and specify what the system has to provide. According to EU requirements, proposed model contains 5 categories, from the least (1) to the most secure (5), with higher levels including all lower levels' security features. Implementation of the suggested measures should comply with Member States' national legislation.

Category 1. Requirement is that the site is recognisable as a parking area and it is accessible to anyone, including passenger cars

and other vehicles. Relatively inexpensive measures are suggested, such as reducing greenery and ensuring sufficient lighting for CCTV usage and visual inspection. This should allow the police or security staff to survey the entire parking area without leaving the road. Site has to be under surveillance through regular security checks.

It is recommended to place indication of the most relevant phone numbers (police, fire brigade, first aid, etc.) and other safety information in several languages.

Category 2 adds the requirement that the parking area is fenced off or that there is a CCTV system that monitors the perimeter. A sign indicates which vehicles are allowed to park (only freight and other authorized vehicles) and preferably it is enforced by parking staff. A digital recording CCTV (at least 25fps) monitors all inbound and outbound traffic at all entrances/exits, ensuring that all vehicles, drivers and pedestrians (if they use the vehicle entry and exit point) are identifiable.

Not only parking area but also the perimeter and entry/exit is easily visible and well-lit everywhere and at all times. Security checks are carried out by the parking area staff and professional organisation.

CCTV should be fully functioning with quality images that allow for clear visibility. Access (physical/via network) to the CCTV recording and controlling hardware as well as to the software elements should be strictly controlled. It should not be possible for (security) staff to edit or delete recordings.

Category 3 requires that both a fence and a CCTV system monitoring the perimeter is in place and CCTV system is able to cover the whole perimeter and ensure that all activities near or at the fence can be clearly recorded. Constant measures are taken to keep the fence in good condition; a clear zone at least on the inner side of the parking area is maintained. Only users of the truck parking area and truck parking area staff are to be given access to the parking area. This is ensured by entrance control or by signs stating that unauthorised entry is forbidden.

The parking area is fenced or provided with barriers (e.g. man-high fence, ditch with water) which prevent or hamper casual entry and intentional unlawful entry.

Category 4 adds the requirement that on-site or remote staff monitor vehicles and pedestrians in real time. The vehicles and drivers are registered. Guards and staff are trained professionals and their references are checked. They are trained and equipped to be able to react quickly to an alarm situation. Pre-booking system is available.

All entrances and exits must provide a physical protection and gates must be closed and monitored in real time by on-site or remote staff to ensure that only authorised entries/exits are taking place, including pedestrians.

Where a gatehouse is in place to facilitate the duties of staff, it must be constructed in such a way that it protects the staff from an external attack. The door must be closed. Staff on site have to be equipped with a personal communication and alarm device to a responsible person on duty who will coordinate the follow-up.

The registration procedures cover, at least, the logging of the licence plate number of a truck/tractor and the name and picture of the driver. The driver and vehicle should be linked and this makes it possible to verify that the driver does not leave with a different

vehicle. It should be possible to check that every registered vehicle is present in their designated parking space. All alarm activations must be documented. Procedures must be in place to deal with the event of power failure.

Category 5 adds the requirement that the site should be manned 24/7. The identity of all vehicles or persons that enter is verified and logged. The continuous fence is equipped with an anti-intrusion system and protected against a truck intentionally driving through and secondary physical barrier covers the perimeter and is sufficient to stop a truck driving through the fence (e.g. ditch, natural structures, trees, green field, river, rocks, grass verge). The parking is separated by a continuous fence (or alternative barriers) which prevents casual entry and intentional unlawful entry or delays entry for the time required for a security intervention. An anti-intrusion system must be in place (i.e. passive infra-red detector (PIR), trembler, electrified topping).

Additional requirements. Motor Transport Institute has taken the initiative to define minimum social and localization features required for the secure parking places to function, such as presence of toilets and wash basins in the parking area. In higher category secure parking areas showers, bars, shops, etc. will be recommended.

2.3 Technical specifications proposal

To ensure appropriate data exchange about secure parking places it is important to plan solutions taking into consideration all factors. System should be connected and integrated with peripheral devices. Only an integrated system will allow for coordination of monitoring and indicating free parking places for individual vehicles and type of goods carried, description of route to parking places, charge collection for parking and for security level provided and parking places infrastructure and data transmission.

System should gather information about safe and protected parking places with CCTV and data archival. CCTV system should meet requirements of EN 50132-7 standard [3]. System goals require verified algorithms to be used.
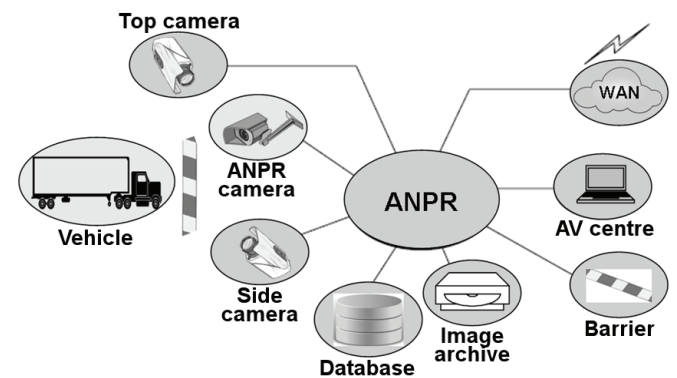

Fig. 2. Architecture of simplified automatic nameplate recognition system (based on [12])

In this scope requirements for control and management of parking places may be fulfilled by automatic number plate recognition (ANPR) – Fig. 2. To provide parking service system should have a database of recognized vehicles' number plates and connected data

such as driver and/or owner information, vehicle type, parking place entry and exit time stamp, archived CCTV images [12].

Minimum camera specifications are crucial, as even one substandard camera lowers accuracy of the whole system. Cameras of standard resolution – BW 480 lines, colour 420 lines – serve their purpose in observation system. In the case of person verification and ANPR in the case of secure parking place high resolution cameras should be installed with 630 and 540 lines, respectively, for BW and colour imaging.

Parking place should use intrusion detection system with at least PIR sensors and trembler security system. PIR sensors detect movement with infrared light or are combined with microwave sensors – for high threats dual sensors are recommended. Sensors meeting above requirements may be sourced from Satel, Bosch, Paradox etc.

Trembler system is not expensive while it significantly improves security. It is easy to install, may be wireless, does not need additional cabling. It detects sudden movements or vibrations and triggers loud alarm siren. After 15 seconds alarm goes off and becomes armed again. Battery operation can offer 2 years of service. Sensitivity, alarm type and additional connections can be set by the user.

For data exchange, both in road safety and in secure parking places, DATEX format (CEN/TS 16157) or fully compatible DATEX II is proposed. All data gathered in the system will be available in DATEX II, both for service operators and for national contact point [5].

DATEX is a set of specifications for standard route and traffic data exchange in Europe. It was envisioned as a mechanism for facilitating data exchange between traffic management centres and information systems for drivers. Due to information systems and ITS developments the standard was updated in 2003 to DATEX II format. New specification broadens applications from highways and national roads to urban roads, from traffic management centres and road administration to independent ITS service providers. Services for transport companies and individual users should be consistent and comparable in EU.

Technical specifications are significant because variety of service providers and types of network access may generate high volume of potentially conflicting or incompatible data. Basic requirements for data exchange should be provided to assure interoperability on technical, terminology and procedural levels. The most important issue is to define scope of responsibility and restrictions for service providers relating to up-to-date and reliable information.

Additionally services should take into consideration:
- announcements shown for road users on road-side displays,
- employment of FM/VHF radio stations (national, civil, local),
- FM radio traffic message channel (RDS-TMC), both public and private,
- TPEG-DAB, system similar to RDS-TMC developed for DAB digital radio,
- cellular operators.
- Technical specifications should define:
- scope of open data access to planned rests, changing vehicles and departures,
- description of standards, e.g. Transmodel, IFOPT, SIRI, NeTEx,
- responsibility of service providers and users for data security,

- rules and conditions of restricted access according to fair play principles,
- real world data set, including fees.
- IFOPT (CEN/TS 00278207) is CEN standard describing data model identifying objects in public transport, such as stops, rests, stations, connections etc. [4].

PN-EN 12896 standard describes reference data model [9], data and information requirements for maintenance and development of processing programs, interactions and connections in integrated information system, its organisation and information management in multiple functional areas of public transport according to existing telematic environment.

ISO TS 18234 standard [8] concerns applications developed for public transport to facilitate efficient and language independent supply of public information, directly from service providers to end users.

NeTEx concerns exchange of data needed for public transport services information exchange. NeTEx part 1 describes topology of data exchange format – roads, lines, route points, rest places and other sites connected with transport network, i.e. administration, gastronomy and accommodation information. NeTEx is based on older Transmodel V5.1 EN12896, IFOPT and SIRI (CEN/TS 00278181, 1 to 5) [4, 6, 7, 9].

Period of data archival in monitoring systems should consistent with domestic regulations and should not be longer than 30 days, unless in well-grounded cases.

3. Conclusion

Considerable increase in road freight in Poland causes increase in threats about cargo theft and possibly terrorist attacks.

Poland, as a member state of European Union, is obligated to observe EU regulations, to provide safe and protected parking places on the area of the country and to provide information services about such places to drivers of goods vehicles.

To enable these goals, Motor Transport Institute started own research project to create information system model "Safe and secure parking places". In this paper general, functional and technical requirements for such a model were shown.

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