

## The Problems of Planning a Timetable for Transport by Road in Terms of Theft Protection

Jozef Gnap<sup>1</sup>, Dominika Rovňaniková<sup>1\*</sup>, Radmila Rakovanová<sup>1</sup> and Elena B. Dvoryadkina<sup>2</sup>

<sup>1</sup>University of Žilina, Department of Road and Urban transport, Univerzitná 1, 010 26 Žilina, Slovakia; Email: [jozef.gnap@fpedas.uniza.sk](mailto:jozef.gnap@fpedas.uniza.sk), [dominika.rovnanikova@fpedas.uniza.sk](mailto:dominika.rovnanikova@fpedas.uniza.sk), [rakovanova2@stud.uniza.sk](mailto:rakovanova2@stud.uniza.sk)

<sup>2</sup>Ural State University of Economics, 8 Marta, 62, 620144, Yekaterinburg, Russia; Email: [elena.dvoryadkina@yandex.ru](mailto:elena.dvoryadkina@yandex.ru)

**\*Corresponding Author:** Dominika Rovňaniková

**Abstract:** In each transport, it is necessary to take into account the risks that may occur during transport. Most of these risks are associated with criminal activity, whether on a shipment, the driver himself or the vehicles used in potentially hazardous segments. The aim is to design a planning and verification process on a selected route or routes within Europe. The proposed transport route starts with load in the Kechnec Industrial Park and continues with two unloadings in Teplička nad Váhom in the Kia Motors Slovakia and in the town of Wolfsburg in the Volkswagen. The transport route was designed in three alternatives by internet application Map&Guide.

**Keywords:** planning route, road criminality, parking areas, timetable, theft protection

### 1. Introduction

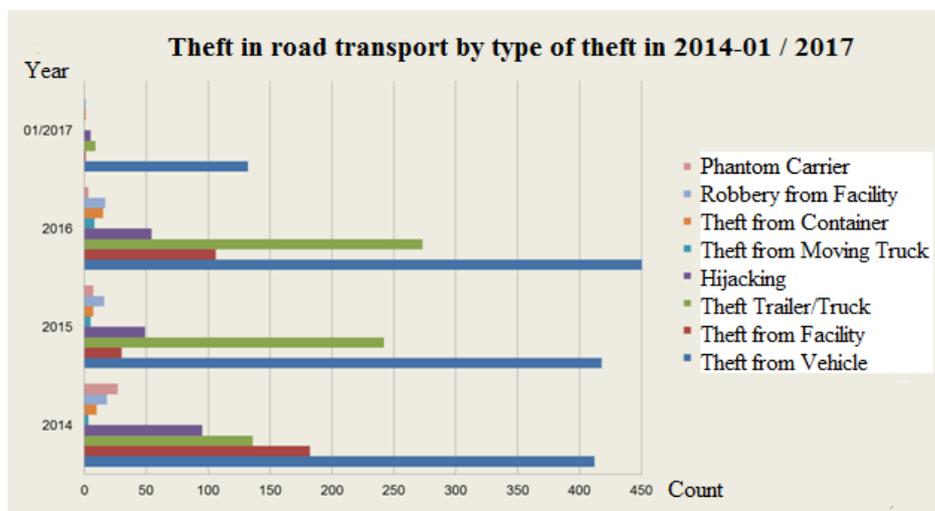
Planning and routing of transportation, mandatory breaks and rests presents one of the easiest preventions with regards to the issue of tackling the risks related to criminality. Criminal activity in road freight transport and the entire chain for all participating sides presents an enormous problem, which is on the rise. Thus, there is an increasing need for safer parking spaces and related services. Planning involves selecting a route that should bypass risky sections. A greater share of attacks and burglaries takes place at a time, when the vehicle isn't in motion, namely during refueling breaks and rests throughout the transport. The risk of criminal activity associated with freight vehicles is strongly linked with the actual amount of road freight traffic into a specific region, including transition countries. An economically strong continent makes for a higher demand for goods with higher value and is therefore more susceptible to such crimes.

It is, therefore, important to properly plan safe spots where the driver can stop the vehicle; this shouldn't be underestimated even in cases where his/her route goes through an economically weaker continent. In the interest of safety of road traffic, protection of the health of drivers, and

compliance with the rules relevant to the timing of the route it is necessary to build up a sufficient number of secure parking spaces.

## 2. Methods

Statistics EMEA related to road criminality show that the theft of goods from a vehicle that has an impact on business and consumers (Fig. 1) has become an international problem. In today's developed economy, raw materials, goods and resources for production and warehouses, finished products and consumers themselves are located in different parts of the world. Road hauliers are trying to avoid risky situations and also mitigate their impacts. Risky situations include particularly theft and robbery of cargo and semi-trailers.



**Fig. 1** Theft in road transport by type of theft in area EMEA [1-4]

TAPA, the Transparency Asset Protection Association, publishes the monthly Vigilant, which deals exclusively with the risks of crime during transportation. This monthly shows how many attacks on drivers or vehicles took place on unguarded parking lots. The number of attacks in 2013 was 39%, an increase of 45% in 2014, 46.25% in 2015, a slight decrease to 41% in 2016, and in January 2017, it reached the level of 64.7%. Other attacks, in addition to the parking lots themselves, occurred when vehicles were parked on roadsides, in warehouses in company buildings, and the like. Therefore, when planning, giving preference to safe parking areas where drivers can enjoy a safe and comfortable rest period is considered to be an important element in the protection of goods as well as the protection of the driver and the vehicle.

### 2.1.1 ESPORG – European Secure Parking Organisation

ESPORG is an association of secure European car parks that creates safe parking spaces to increase safety when transporting goods, protecting carriers and fighting crime in 15 different countries. It represents the first joint project based on which was created the network of secure car parking lots [5].

Due to the high demand from transport companies, insurance companies, drivers, manufacturers and authorities, ESPORG has developed a process and requirements to ensure certification. The process of obtaining a certificate and of self-assessment was developed in cooperation with DEKRA. Since 2016, services have been subject to audit within certification. An extensive catalogue of criteria has been developed, which experts from DEKRA are verifying, and the necessary software has been developed to enable the production of digital messages containing images. After a successful audit, gas stations can obtain the ESPOROG certificate which is a sign of recognition with a guarantee of a minimum standard of provision of parking and relevant services. This certification ensures a high standard of vehicle protection [6-7].

### 2.1.2 TRANSPark

TRANSPark is a modern, interactive and free web application for truck drivers operated by the International Road Transport Union (IRU). It helps drivers and road managers to easily and quickly find and add safe and convenient parking spaces.

The application contains:

- Searching for more than 4,000 parking spaces nearby for up to 400 km;
- Route planner;
- fuel price monitoring in over 40 countries around the world;
- monitoring of waiting times at border crossings;
- information on traffic situations and restrictions;
- Safety instructions and checklists (control records);
- Legislative support, legal advice and support.

Parking areas in TRANSPark are divided into four degrees:

1.  Uncertified parking areas
2.  Self-assessed parking areas
3.  Self-assessed and certified parking spaces certified
4.  Certified Parking Areas [4,8]

**Table 1** Classification according application TRANSPark [9]

Level	Type of level	Service
Security level 1 	Providing the basic	A requirement is that the site is recognizable as a parking area. Driving and pedestrian areas are well-lit. Elementary security check take place
Service level 1 	Providing the basic	Basic service features: toilets, water taps, waste bins
Security level 2 	Technical measures to improve security	TPA is either surrounded by a continuous fence or that there is a CCTV system that monitors the perimeter. The parking is well-lit. Security check take place by TPA staff or a professional organisation. CCTV images are clear and stored safely
Service level 2 		service criteria: washing facilities and more convenient lay-out of the parking area, more geared to a truck driver making a longer stop
Security level 3 	Security measures are combined, access of persons restricted	Both a fence and a CCTV system monitoring the perimeter need to be in place. Constant measures are taken to keep the fence in a good condition. Only truck parking users or staff are allowed access. Criminal incidents are reported
Service level 3 		service level: personal hygiene (showers) and shop / fuel station
Security level 4 	Real time monitoring of vehicles and persons by professional staff	On-site or remote staff monitor vehicles and pedestrians real time. Registration of vehicles and drivers take place. Guards and staff are trained professionals, their references are checked. They are equipped to be able to react quickly to an alarm situation. Pre-booking is possible. Gates are closed
Service level 4 		complete services: snack bar, laundry, spare parts shop, leisure facilities
Security level 5 	Verification of vehicles and persons by professional staff, site manned around the clock	The identify of all vehicles or persons that enter is verified and logged. CCTV covers the entire area of the TPA. The fence is equipped with an anti-intrusion system and protected against a truck intentionally driving through
Service level 5 		Providing the high end of comfort levels: a restaurant, truck wash, electricity, snow/ice removal equipment.

## 2.2 Limited conditions related to transport

Drivers' work regime in road transport is regulated by the legislation by which defined conditions must be observed, including EU Regulations, the AETR Agreement and national regulations. It is necessary to know when a driver's work is affected by a specific regulation. When carrying out

his/her job responsibilities, a driver from a transport company in the Slovak Republic must observe the following provisions:

- Regulation of the European Parliament and of the Council (EC) 516/2006
- AETR Agreement

### **2.2.1 Limited Conditions for Driving Vehicles**

Restrictive conditions in EU countries are currently uniform. They are adjusted by the national regulations of individual EU Member States, respecting national state holidays and restriction prescriptions. Prohibitions in EU Member States differ by category, namely vehicle type, which applies to a specific scope and period of validity [10].

## **3. Proposal for the Transport Route Planning Procedure**

When designing the route of transport, restrictive conditions such as social legislation requirements and driving bans, road infrastructure conditions [11] as well as conditions by insurers or customers must be taken into account [12,13].

In the transport and logistics chain, the problem is to maintain safety, especially with a steadily increasing crime rate causing considerable economic losses for interested parties. Therefore, a correct design of the transport route with the use of safe parking spaces is very important. The conditions for choosing a suitable parking space for vehicle shutdown are:

- To meet the expected standard of parking (especially when it comes to working mode - daily or weekly rest) - for example, parking equipment at a service station, shower, refreshments, lighting, fencing, camera system, watchguard service, accessibility to the police, etc. It is not always possible to use the expected standard on all offered parking spaces during transportation. For this reason, the driver must park the semitrailer also in the designated parking area, which may cause risk for him and the vehicle himself;
- To minimize the kilometers traveled by a roadside semitrailer - it is a journey outside of a scheduled route with the goal to arrive at a suitable parking area. The reason is an increasing distance outside of the planned route, which of course increases the carrier's own shipping costs.

Compulsory rest can be spent at service stations with the possibility of parking, on public landings for trucks or on other parking spaces that are used for parking, provided the truck is equipped with a bed or a sleeping deck. In the absence of such parking options, drivers often park in temporary parkings on roadsides.

In some countries (for example Belgium, France and Germany) it is not allowed to spend the regular weekly rest periods inside the vehicle so parking lots must be equipped accordingly. At

present, judicial proceedings are also pending vis-a-vis these countries, debating whether their legislation is in contradiction with EU law.

Planning should take into account the location of the parking lot itself, namely its positioning on the right or left side. In many cases parking spaces are built only in one route direction and the driver is not able to reach a parking spot without deviating from his/her scheduled shipping route.

### **3.1. Proposed Transportation Route**

The proposed shipping route for all alternatives starts with a 3 hour load in the Kechnec Industrial Park and continues with two unloadings in Teplice nad Váhom in the Kia Motors Slovakia car plant lasting 1 hour and 50 min and in the town of Wolfsburg in the Volkswagen car plant lasting 1 hour. 10 min.

The different alternatives will concern the design of transport routes using any car parks and, on the contrary, only safe parking spaces during transport. The Google Maps scheduler was used to determine the distance during the entire journey. The TRANSPark application was used for route planning, availability of parking capacities and other useful information. The application allows one to filter the car parkings based on the level of comfort and security. Criteria such as fencing, lighting, surveillance, and camera systems were all considered in the following proposals.

For each proposal, the impacts of the entire transport will be calculated in the form of travel and wage compensation for the driver. These impacts cannot be affected or reduced because their amount is based on the time spent by the driver in individual countries. Under the Act No.282 / 2002 Z.z. about travel allowances to a staff member posted on a mission, he/she is entitled to:

- Refund for proven travel expenses;
- Reimbursement of proven accommodation expenses;stravné;
- Replacement of proven necessary extra costs;
- Reimbursement of proven travel expenses related to a family visit or a visit between the employer and the employee.

In the case of an employee's work-related trip abroad, he/she is entitled to a sustenance allowance for each calendar day of said business trip in euros or in a foreign currency of that particular country. The amount of the meal vouchers is determined depending on the duration of the foreign working trip outside of the Slovak Republic on a calendar day. The duration of the trip abroad is divided into time zones [13].

### **3.2. The Assessment of the Proposal of the Selected Route or Routes in Europe**

The aim was to propose two ways of the drivers' rest stops for each alternative. These are ways that mean parking on any parking space and parking only on secure parking spaces that the driver came

across during transport. Safe car parks were searched through the TRANSPark internet application. However, it was complicated to design the condition for safe and long-term parking due to the irregular network of secure car parks.

Fencing of the whole area of the parking space and its lighting equipment were considered as the main security criteria. In addition, it was required that a camera system be introduced throughout the entire area and also supervision by a watch service 24 hours a day, 7 days a week. Because only a small fraction of the total number of registered car parks met the security requirements it was necessary to propose a mandatory break and daily rest also in parking areas that no longer met all the required security criteria. The GoogleMaps scheduler linked to TRANSPark was used to determine the distance.

**The route no. 1** passes through the Slovak Republic, Czech Republic, and Germany with a substantial portion of it going through Poland. This route includes breaks and rest breaks on any parking space with total distance traveled of 1,108.0 km for a total journey time of 32 hours 19 minutes.

It also includes breaks taken on safe parking spaces with a total driven distance of 1,142.7 km and a total transport time of 42 hours 27 minutes; map no. 3 a distance of 1,144.7 km and a transport time of 34 hours and 20 minutes. Their parts also are the breaks and rest taken when two drivers are deployed, where the total distance is 1,115.7 km in 31 hours 5 minutes.

**Route no. 2** passes through the Slovak Republic and Germany with a substantial portion through the Czech Republic. It consists of the breaks and rests taken on any parking lots at a total distance of 1,138.8 km for a total journey time of 32 hours 31 minutes. It also focuses on breaks and rests on secure parking lots with a total driven distance of 1,179.6 km for a total journey time of 33 hours 50 minutes. It includes breaks and rests when two drivers are deployed for the total distance traveled 1,172.6 km in 31 hours 55 minutes as well.

**Route no. 3** passes through the Slovak Republic with a substantial portion through Austria and Germany. It includes again the breaks and rests taken in any parking lots at the total distance of 1,552.1 km and a total journey time of 48 hours 26 minutes. It focuses on secure parking spaces with a total distance of 1 589.0 km for a total journey time of 49 hours 45 minutes as well. It also records the breaks and rests taken when two drivers pass the journey of a total distance of 1,586.0 km for in 37 hours and 54 minutes.

#### **4. Discussion**

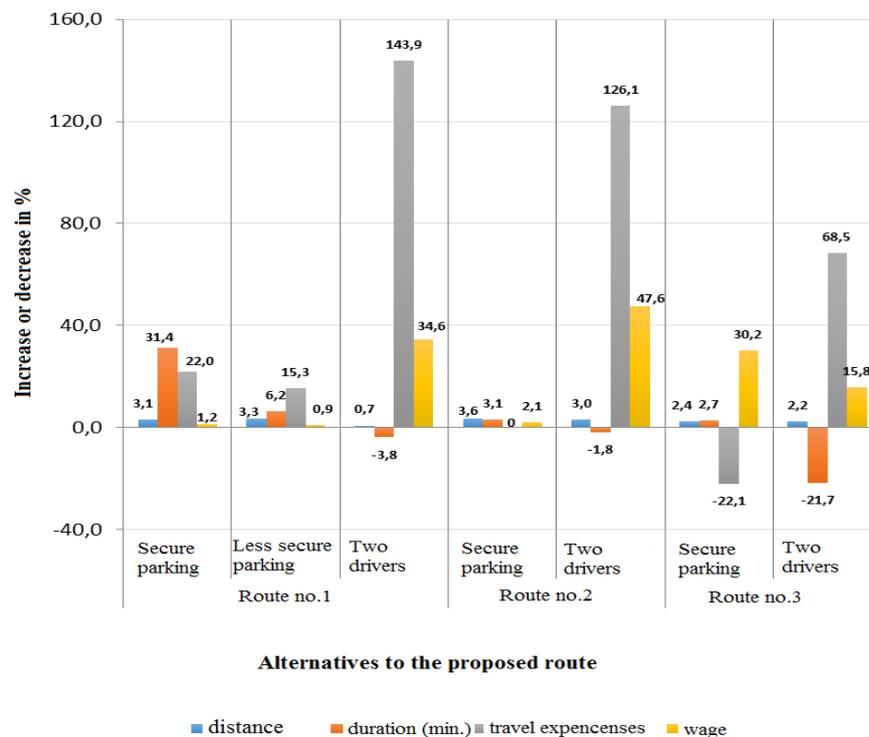
Table 2 shows all the alternatives already mentioned, indicating the impacts of the whole transport. It is apparent that when proposing breaks and rest stops only in secure parking lots, the total

distance and time of transport on all routes have increased. The impacts are also recorded when determining the fees payable by the employer to the driver. In this case, it is a refund and a wage.

**Table 2** Overall comparison of routes using different car parks

	Alternative	Distance (km)	Total duration of transport (hr., min.)	Travel expencenses (€)	Wage (€)
<b>Route no.1</b>	Any car parks	<b>1,108.0</b>	32:19	60.30	101.37
	Secure parking	<b>1,142.7</b>	42:27	73.55	102.61
	Less secure car parks	<b>1,144.7</b>	34:20	69.55	102.28
	Two drivers	<b>1,115.7</b>	31:05	147.10	136.47
<b>Route no.2</b>	Any car parks	<b>1,138.8</b>	32:31	43.65	99.03
	Secure parking	<b>1,179.6</b>	33:50	43.65	101.07
	Two drivers	<b>1,172.6</b>	31:55	98.70	146.1
<b>Route no.3</b>	Any car parks	<b>1,552.1</b>	48:26	85.45	178.95
	Secure parking	<b>1,589.0</b>	49:45	66.55	232.9
	Two drivers	<b>1,586.0</b>	37:54	144.00	207.24

The percentage of impacts from transport is shown in the following Fig. 2, which shows the increase or decrease in values associated with taking breaks and rests in secure parking lots. The values presented were expressed based on the values obtained during refuelling on any parking lots.



**Fig. 2** The percentage of impacts from transport

In case of deployment of two drivers it was necessary, in the light of social legislation, to propose for each route a compulsory daily rest spent only on safe parking spaces. So the total shipping time decreased only on route No.3 by 10 hours 32 minutes. On other routes, there was only

a slight reduction in time. On route 1 the time was reduced by 1 hour 14 minutes and on route 2 just by 36 minutes. However, it is necessary to take into consideration that when deploying two drivers, the carrier is obligated to cover higher costs than when only one driver is deployed. Such demonstrably higher costs can be observed particularly in the case of travel refunds. On route 1 the increase is by 143.9%, i.e. by € 86.80. On route 2 there was an increase of 126.1%, i.e. € 55.05 and on the last route # 3 by 68.5%, which is 28.29 €.

## 5. Conclusion

When selecting and designing a suitable route, the route that is most economical, or route at the lowest cost, from the perspective of stakeholders. A safe solution is often associated with increased economic costs for the entire shipment. In order to make it more efficient, it is important for planning to decompose the best way between driving, safe breaks and rest.

The evaluation of the individual proposals has shown us that the carrier may encounter a situation such as the lack of suitable safe parking spaces, or even the absence of parking areas, which affects the planning of transport itself, may occur in certain sections.

The impacts of the whole transport borne by the carrier can also be monitored by increasing the number of kilometers traveled, and of course, the increase in time. Furthermore, the effects can be observed in increasing travel allowances and wages, which must be legally paid to the driver by law.

For real transfers, the effects can also be seen in increased fuel consumption, tolls, due to the inability to plan single routes, as secure parking spaces are irregularly located in the countries concerned. The carrier can solve this situation by deploying a two-member crew that is advantageous in terms of time but not price.

## References

- [1] TAPA EMEA- Vigilant. (2015). Vigilant January Edition 2015. [http://www.tapaemea.org/fileadmin/public/downloads/vigilant/2015/TAPA\\_EMEA\\_Vigilant\\_E-magazine\\_-\\_January\\_2015.pdf](http://www.tapaemea.org/fileadmin/public/downloads/vigilant/2015/TAPA_EMEA_Vigilant_E-magazine_-_January_2015.pdf).
- [2] TAPA EMEA- Vigilant. (2014). Vigilant January Edition 2014. [http://www.tapaemea.org/fileadmin/public/downloads/vigilant/2014/TAPA\\_EMEA\\_Vigilant\\_newsletter\\_-\\_January\\_2014.pdf](http://www.tapaemea.org/fileadmin/public/downloads/vigilant/2014/TAPA_EMEA_Vigilant_newsletter_-_January_2014.pdf).
- [3] TAPA EMEA- Vigilant. (2017). Newsletter "Vigilant". <http://www.tapaemea.org/information/newsletter-vigilant.html>.

- [4] Kubáňová, J. (2016). Plánovanie doby odpočinku vodiča ako dôležitý prvok bezpečnej prepravy. 19. – 20. 10. (2016), 213-220. Proceedings of the 7th International Conference. (cited 2017-07-03).
- [5] Kos-Łabędowicz, J. (2015). Dependencies between Development of Information and Communications Technologies and Transport, Tools of Transport Telematics, (15-17 April 2015), pp 362-370), Wrocław, Poland, Communications in Computer and Information Science.
- [6] ESPORG. (2017). Certification Of Secure Truck Parkings, (cited 2017-10-03). <http://www.esporg.eu/what-we-do/certification-of-stpa/>.
- [7] ESPORG. (2017). Intelligent Transport Systems. (cited 2017-10-03). <http://www.esporg.eu/what-we-do/intelligent-transport-systems/>.
- [8] TRANSPark application. (2017). Parking Area Search. (cited 2017-09-02). <https://www.iru.org/apps/transpark-app>
- [9] TRANSPark application. (2017). Tackling Cargo Theft. (cited 2017-09-02). [https://www.unece.org/fileadmin/DAM/trans/doc/2013/ac11/Presentation\\_06.pdf](https://www.unece.org/fileadmin/DAM/trans/doc/2013/ac11/Presentation_06.pdf)
- [10] Skrucany, T. et al. (2015). Software simulation of an energy consumption and GHG production in transport, Tools of transport telematics. 15th international conference on Transport systems telematics, (April 15-17, 2015), 151-160. Springer, 2015.
- [11] Kos, B. (2015). Development of Electronic Payments in Poland Using the Example of Local and Regional Collective Transport, Tools of Transport Telematics, (15-17 April 2015), 352-361, Wrocław, Poland, Communications in Computer and Information Science.
- [12] Konečný, V, Gnap, J. & Šimková, I. (2016). Impact of fiscal decentralization on motor vehicle taxation in the Slovak republic. Transport and Telecommunication, 17(1), 28-39. DOI: 10.1515/ttj-2016-0004.
- [13] Gnap, J., Kalašová, A., Gogola, M. & Ondruš, J. (2010). The Centre of Excellence for transport service and control. Communications, 12(3A), 116-120.