

Robert MUHA

University of Ljubljana, Faculty of Maritime Studies and Transportation
Pot pomorščakov 4, SI-6345 Portorož, Slovenia
Corresponding author. E-mail: robert.muha@fpp.uni-lj.si

**REAL-TIME TRANSMISSION OF WORK-RELATED DATA OF DRIVERS
AS AN ELEMENT OF FLEET MANAGEMENT**

Summary. The introduction of digital tachographs does not bring much novelty in terms of time limits for drivers involved in road transport, but rather narrows the space for workload restrictions abuse. Combined with the telematic systems (GNSS - Global Navigation Satellite System), which in addition to tracking bring a multitude of data on the vehicle, this device allows for a direct transmission of data on driver's work in real time (the hours worked and rest-time used) into the dispatch centre of the Carrier. The paper will present the importance of monitoring the driver's activity and the observance of time limits for fleet management.

**ПЕРЕДАЧА В РЕАЛЬНОМ ВРЕМЕНИ ДАННЫХ, СВЯЗАННЫХ С РАБОТОЙ
ВОДИТЕЛЕЙ, КАК ЭЛЕМЕНТ УПРАВЛЕНИЯ ПАРКОМ ТРАНСПОРТНЫХ
СРЕДСТВ**

Аннотация. Введение цифровых тахографов не вносит большой новизны в определение временных границ для водителей, участвующих в дорожном движении, а скорее сужает место для злоупотреблений с ограничениями на рабочую нагрузку. Объединенное с телематическими системами (GNSS - Глобальная Навигационная Спутниковая Система), которые в дополнение к отслеживанию сообщают множество данных по транспортному средству, это устройство предусматривает прямую передачу данных по работе водителя в режиме реального времени (часы работы и время отдыха) в центр отправки транспорта. Работа представит важность контроля деятельности водителя и соблюдения сроков работы для управления транспортными средствами.

1. INTRODUCTION

For all carriers operating in road transport, the cost of fuel and labour are the weightiest items in the overall cost structure. Figure 1 presents the cost structure of a major Slovenian haulier operating in international freight transport (V&V). The share of fuel rose to 30% in the structure of all cost in the year 2008. Ten years ago, that cost represented about 20% in the cost price of the hauler. Tolls rose considerably over the last few years, from 9% in 2003 to 15% in 2008. The share of labour reached 27% in the structure of all cost in the same year.

The costs involved in transport by road are increasing at a higher rate than the Carriers are able to get reimbursed from their customers in this extremely competitive environment. The only way to

remain competitive is to streamline the operation and observe the cost management in all segments. Savings can be higher in segments with the highest share in cost price. Some costs, like the price of fuel, are beyond the Carrier's control. On the other hand, the Carrier is in the position to influence its efficiency and reduce the fuel consumption, which results in lower cost. The approach leading to that achievement is quite complex and demands a sound knowledge of technology and operation, a thorough preparation of the cost estimate which serves as a basis for the measures to be introduced for streamlining.

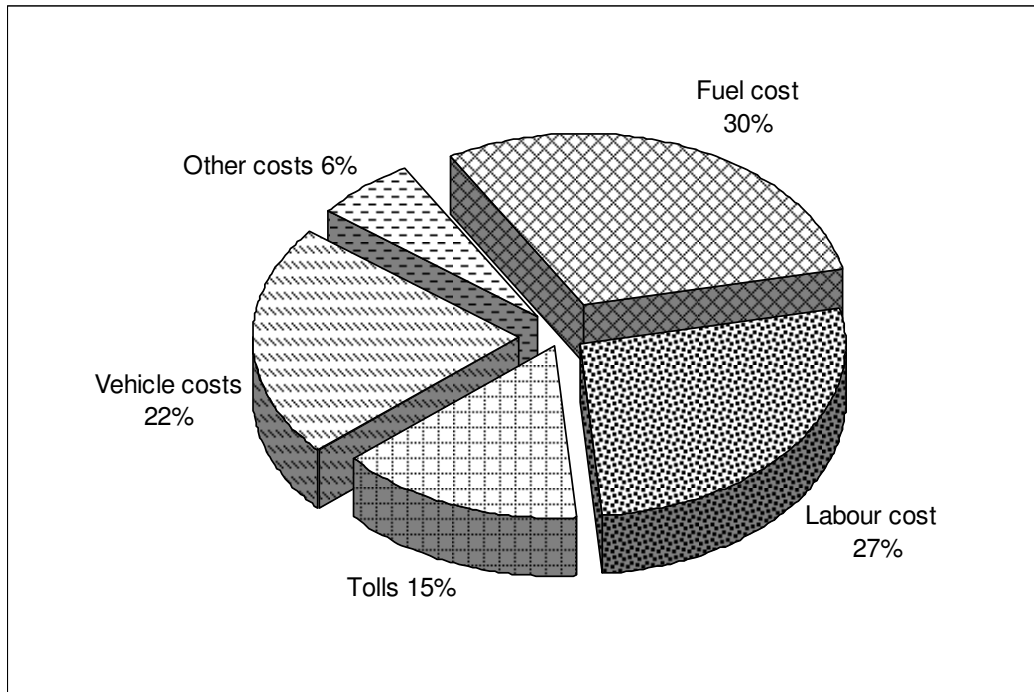


Fig. 1. Cost structure in international transport by road (year 2008)

Рис. 1. Структура стоимости в международных автоперевозках (2008 год)

Establishing efficient fleet management is an important task for each Carrier. The efficiency of such system is then shown in the Carrier's reliability, it allows keeping the customer currently informed on the status and position of the goods and it contributes to a well organized transport process, and results in lower operating cost.

2. TELEMATIC SYSTEM (GNSS) IN VEHICLE FLEET MANAGEMENT

Fleet management has got a lot of different applications and their common characteristic is gathering information connected with localization and vehicle movement parameters. Data gathering is made by management centre in order to use this information for movement organization in real time and for further, different analysis.

The first solution consisted in reading information concerning for example route course, time of journey, tanking up, etc. after coming back to base. Newer solutions bring possibility of data transferring in real time from built-up measurement systems installed on vehicles. The vehicle fleet management systems (GNSS) gives a lot of advantages. The most basic advantages are the following:

- presentation of actual position of moving object on the background of digital map;
- increase of effectiveness in using vehicles;
- shortening realization time of order;
- increase of punctuality of provided services;
- improvement of people's safety, safety of charge and vehicles (alarm connections);

- limitation and even elimination of abuse committed by drivers;
- possibility of entering gathered information directly to computer systems of enterprise in order to carry out further analysis. [2, 11-12]

More advanced GNSS's also support monitoring the fuel consumption data in addition to tracking (the level of fuel in the tank, current fuel consumption, alerting in the event of pumping the fuel out of the tank, etc.), as well as on the defects on the engine. They also enable controlled navigation which allows for directing the vehicles to the point assigned (for servicing, delivery, on-loading, unloading), simple communication with the driver and internally among the drivers, which contributes to lower telephone costs.

In addition to digital tachographs as compulsory equipment of each newly registered vehicle after May 2006, modern technology allows for data transmission concerning the actual hours worked (driving time) and rest periods sent directly to the Carrier's control center in real time. The control over such data enables the Carrier to directly monitor the driver's work and set up a system for per-diem allowance accounting, which such control renders possible, thus preventing any abuse in time account that quite frequently occur in road transport.

3. WHY RESTRICTIONS IN DRIVERS' WORKING TIME?

In the cost structure of a road haulier, the labour cost is a relevant item and can be compared with fuel costs. The latter can be addressed by purchasing more economical vehicles, by training the drivers on efficient driving and by measures to control fuel consumption.

The only simple measure to cut the labour cost is by reducing the wages to drivers, which is by no means a popular and acceptable cost-saving measure. The other alternative, which is frequently applied in practice, burdens the driver beyond the time restrictions permitted by law and thereby increases the operability time of the vehicle. The interest of capital is very clear: to gain as much as possible within the longer working time possible.

Unlike in most professions, the nature of work of professional drivers in road transport does not enable a regular (evenly spread) scheduling and an even distribution of working hours during their work (performing the services). Numerous elements affect the fragmentation of the working day of a driver, which the organizer of road transport has to bear in mind, in particular:

- Customer's (the ordering party) demand for punctuality regarding the collection of goods,
- Consignee's demand for punctuality of delivery of goods/consignment,
- Weathering situation,
- Unforeseeable traffic hold-ups and congestions on roads,
- Activities required on the collection/ delivery point,
- Arranging other administrative issues (procedures at border crossing and similar).

The interest of employers is based on economy – employment of their vehicles and technical means to the greatest extent possible, which means as long working hours as possible. The use of a vehicle directly depends on its operator, i.e. an individual driver. In production industries, work time is scheduled and limited to shifts, a definite number of working hours per week or month. On the other hand, the characteristics of the services involved in road transport, as mentioned above, cannot bear any restrictions of that kind and hence they cannot be applied to drivers. The driver's work is not only driving – the journey, but involves many other indispensable activities that take place during the work time of the individual worker and necessary for the execution of transport by road. It concerns the idle time a professional driver spends during individual manipulations or the time used in arranging obligatory administrative formalities with the Customs Administration, which counts in the work time of each individual.

Moreover, it should be noted that driving – operating the vehicle in road traffic - demands complex psycho-physical activities, as well as the requirement for 'active period' compliance, i.e. sufficient rest times for physical regeneration and thereby the readiness of the driver for safe operation of the vehicle after the rest.

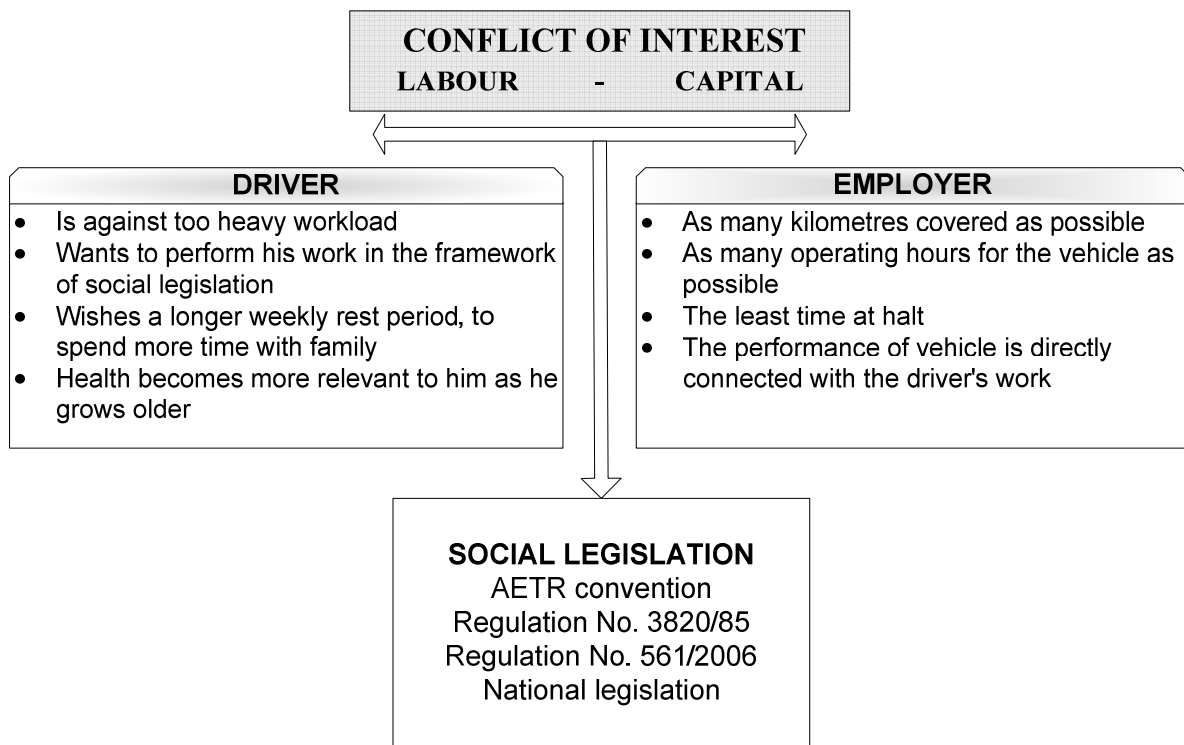


Fig. 2. Conflict of Interest between Employers and Drivers

Рис. 2. Конфликт интересов между работодателями и водителями

As the professional driver's work cannot be determined in advance and converted into standard work schedule, regulations were prepared that regulated this segment in a rather flexible way that was acceptable to both parties, the employer and the driver. The interest of the former for the longest exploitation time of vehicle possible was met with a counterbalance that followed the interest protecting the drivers' health and establishing suitable work environment for them. Sufficient, but first and foremost correctly scheduled rest in terms of time, are underlying for good health condition of drivers during their work.

Certain "Regulations or Rules" were adopted long ago (the Convention Regulating the Working and Rest Times for Drivers (AETR), the Regulation No. 3820/85, the Regulation 3821/85 and other) regulating the permitted number of driving hours and mandatory rest periods for professional drivers and mandatory equipment for commercial vehicles. These restrictions aimed at achieving the required psychophysical readiness of the driver, which has an immediate influence on his rational acting and handling at the wheel and thereby contributing to a better safety on the road. The purpose of such regulations was to protect the driver's health over his entire service life. We need to be aware that driving is a complex and demanding activity; the nature of work, physical and psychical load on the driver often results in disability from work. Workload above the permitted extent, lasting over many years, can only add to the harmful effect on the health of an individual driver, and raise the probability of detrimental health defects. The disabled fall to the burden of the whole society, not only the responsible. legal entities from which the disability from work may result.

4. DIGITAL TACHOGRAPHS

Before digital tachographs were introduced, the activities of drivers of commercial vehicles over 3.5 t capacity and drivers of most buses and coaches were recorded by analogous tachometers on paper record sheets. After 1 May 2006, when Regulation EC 561/2006 came into the force, the digital tachograph has to be installed in all newly registered vehicles in the EU. Instead of analogue recording

on paper record sheets, the digital tachograph uses memory cards, the so-called 'smart' cards, which bear the driver's name (each driver has to obtain his own card). Such smart card looks like a credit card and is non-transferable; it accompanies the driver on his route even if he changes the employer. Driver's activities for the preceding 28 days are recorded on the card.

Why digital tachograph? A simple and straightforward question, to which connoisseurs can easily find a number of reasonable and substantiated responses:

- Experience and trends in the road transport business shows that economic pressures and tough competition have been pressing some drivers and haulers to such extent that they on purpose violate the rules on driving and rest times, as they are defined in the EEC Regulation 3820/85, Regulation EC 561/2006 and other regulations in that field.
- Such malpractices and misuse are a threat to road traffic and unacceptable for the driver or hauler who 'plays by the rules'.
- The Regulation 3820/85 contains the requirements concerning the restrictions on daily driving times and rest periods, obligatory weekly rest, as well as the total driving time in two weeks. Such data are not simply recorded in hours over a particular day, but rather need to be taken from on several daily record sheets. Because of that it was difficult to monitor the compliance of his doings with the requirements at an inspection (check-up) during driving.
- The Regulation 3820/85 and 561/2006 also contains the requirements on how any reduction of daily and weekly rest periods can be compensated for - spread over two or three weeks periods.
- New, modern and technically perfected equipment (electronic tachograph, personal card of the driver) are introduced in order to stop the most frequent malpractices or misuse in the present control system. The new solution retrieve the recorded data for the past 28 days and check them any time against the print out. Therefore, such data must be a reliable and unquestionable record of the work pattern of the driver involved.
- Safety in road traffic can be improved by providing for regular control over the data on work and conduct of the driver, on the part of the employer or competent authorities. Automatic and precise recording of driver's work will greatly contribute to the desired goal – higher safety.

While reading these findings, one can feel that both the effectiveness of drivers' control in road traffic and taking any measures on the offenders are not at a satisfactory level. More or less, these findings apply to the entire European segment of road transport. It is therefore not difficult to conclude that the reasons for introducing the digital tachographs are quite straightforward: **Restricting the malpractices in driving hours and rest periods, in view of protecting the health of drivers, and thereby to raise the level of safety in road traffic.**

5. REQUIREMENTS TO REGULATE THE SCOPE OF WORK AND STATUS OF DRIVERS

Some prerequisites underlying for achieving adequate work conditions for drivers and supporting personnel need to be satisfied:

- Preparation of regulations (social protection and labour legislation),
- Adequate measures in the area of fleet management (technical means for recording actual activity of the driver) and
- Appropriate supervision and sanctions against offenders.

The authorities responsible for regulating this complex area were well aware of these facts, so they spent much time preparing a solution that would present the driver's work in a systemic and objective way, and protect against violations on the part of users. The occurrence of digital tachographs (as the basic equipment underlying for the fleet management concept) and a comprehensive upgrading of social legislation and administrative elements, such as the protected user cards, brought about a major contribution towards regulating this critical area.

The preparation of adequate legislation is the pre-condition for starting to regulate any area that the legislator wishes to accomplish. Of course this is just the necessary condition, not the sufficient requirement. In practice, the implementation of the provisions adopted is only possible when a network of interactive links has been established by the supervisory bodies and enabled a factual operational condition in a given area. Figure 3 shows a matrix with the dependency of adequately prepared legislation and the mode of work of supervisory bodies in achieving the prescribed mode of work in any given area.

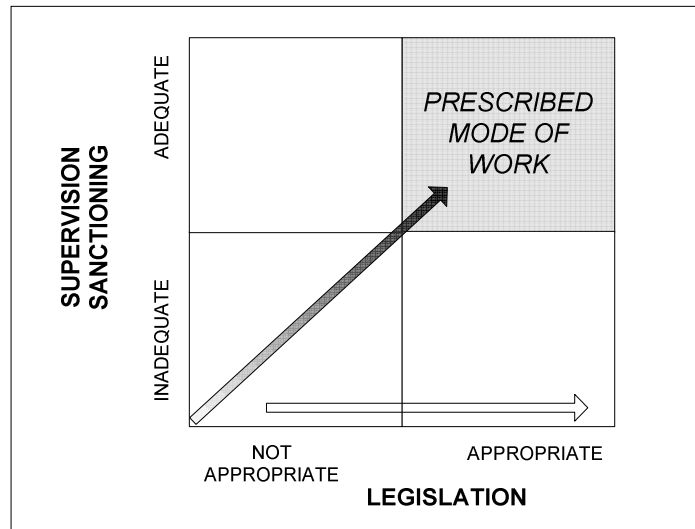


Fig. 3. Achieving the prescribed mode of work in a given area

Рис. 3. Достижение предписанного способа работы в данной области

6. DRIVER'S WORK PLANNING

The Regulation 561/06 gives more emphasis on the length of the weekly rest periods of drivers, as well as on the actual utilization of reduced (shorter) weekly rest periods. Highlighted are periods of longer one-off rest period in which a driver can better regenerate for further work. It is known that a reduced daily rest period is no longer being compensated under the new regulation. Instead it is prescribed that the driver must use his entire weekly rest period (45 hours) every second week, and in between he can use the reduced weekly rest period between 24 and 45 hours.

These changes certainly have an impact on the practices applied in drivers' work planning and also on the planning of availability of the vehicle. Particular attention should be dedicated to the planning of longer rest periods of the driver that are directly linked to the permitted hours of driving in any two weeks – limited to 90 hours. Owing to a cyclic occurrence of the weekly rest period, there are two options, in principle:

- Balancing the number of driving hours during each week to ca. 40 – 50 hours and acting in line with the demand not to reduce the shortened weekly rest period in between too much – aiming to avoid too frequent requests for compensation of unused hours of weekly rest – see Figure 4;
- Using the maximum number of hours of driving in one week, and then using the remaining time of the shortened weekly rest period during the other week with less driving hours scheduled – see Figure 5.

The rule that the unused hours of weekly rest period need to be used with any 9-hour rest period within the time limit of three weeks aggravates the planning of driver's availability. If that happens regularly and insufficient attention is paid to that issue, it may often occur that the time limit for compensation will expire. Therefore I find the first option slightly more appropriate, when the availability is planned on each fully used weekly rest period of a driver.

These are only two roughly framed options: each carrier will seek the most suitable mode of planning for itself, depending on the demand-side. Compliance with the carry-forward and actual

utilisation of unused weekly rest periods on a current basis will become a fairly demanding task for each carrier. Planning of driver's work will become one of the more relevant elements in the planning of transport service in terms of time and costs. It can be expected that some indicators of physical utilisation of the fleet (truck-accounting day) will deteriorate. As a result, the costs of transport services will rise and that can only be achieved by joint effort and unified approach of all road carriers appealing to their customers towards a compromise, understanding their position in the newly created operating environment.

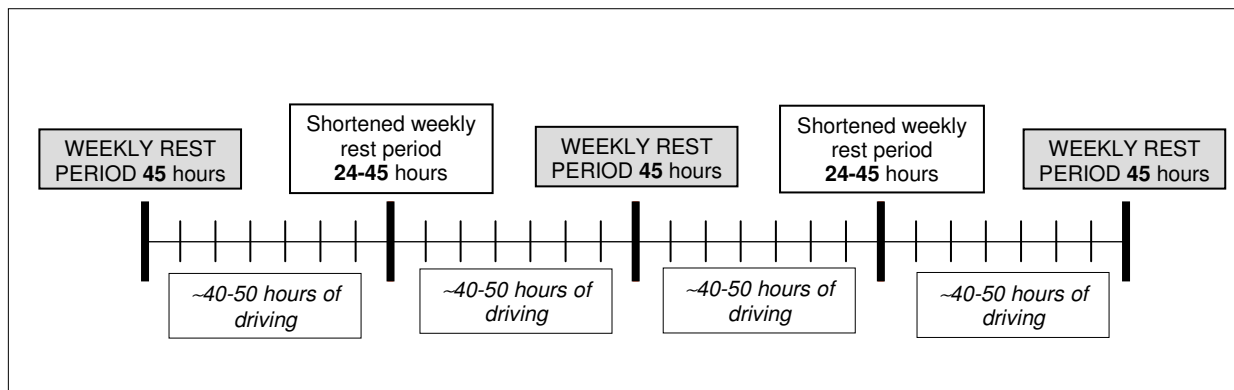


Fig. 4. Balancing the number of driving hours over several weeks

Рис. 4. Изменения количества часов работы водителя за более чем несколько недель

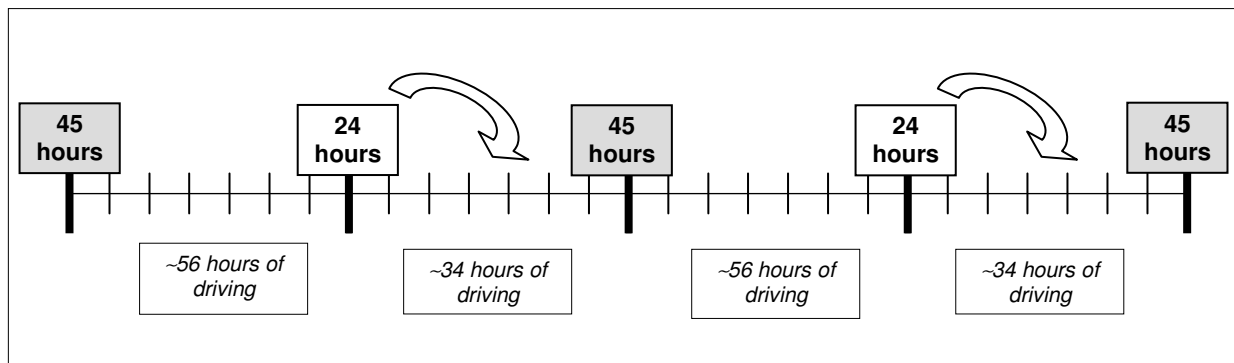


Fig. 5. Carry-forward of unused hours of weekly rest on a current basis

Рис. 5. Перенос неиспользованных часов еженедельного отдыха при данном подходе

The Global Navigation Satellite System (GNSS) supports data transmission on the actual number of hours worked and rest-time used, in real time and directly into the operational centre of the Carrier, which improves the optimization of transport planning (of trips). That has a bearing on the fleet management and trip planning. Indirectly, in the event of breach against the rules on working and rest time for drivers, as imposed by the law, the responsibility is shared with the Carrier's dispatcher who receives current, real-time data that are traceable and cannot be counterfeited.

7. CONCLUSION

When choosing an appropriate fleet management system, a haulier can decide for mere tracing of vehicles, without any connections to the management systems in the company, or opts for a more complex data transmission. Establishing real-time data transmission between the vehicle and Carrier by the telematic systems (GNSS) is a great help in fleet planning and cost management in the transportation process in general. The great number of data which are thus transmitted to the head-

office of the Carrier can be directly included in the information system supporting the process control in the company, and it could further contribute to reducing the administrative workload, prevent mistakes and improve control.

It is expected that tracing in general will sooner or later be offered by mobile network operators, in particular because cellular phone sets incorporating the GPS receiver are already on the market: it will only take to upgrade these sets by corresponding software. Tracking tools providers will focus on specialized solutions for specific use or branches of industry, aiming to optimize fleet management.

The paper highlights the potential gains of data transmission which directly disclose the operational burden on drivers as regards to the workload (number of hours worked) and compulsory rest periods. The availability of mobile workers for driving is directly linked to the operability of their vehicles and thus the efficiency of both. Thanks to direct data transmission, the Carrier can monitor and analyse the working time of its mobile workers on a current basis. In specific transport orders, the Carrier may decide, on the basis of such data availability, to employ a double crew into the transportation process. Although a double crew means a double labour cost, it may save a double mileage for the particular order. In all cases in which the transport time is an important element in the order execution, and the marketable price on the border of cost price, the detailed and correct information on the work of drivers is a decisive factor in business decision-making.

The introduction of digital tachographs in commercial vehicles was a measure aiming to eliminate the abuse of regulations on permitted working time and rest periods of mobile workers, which occurred with analogous tachographs. Such malpractices that disregard and exceed the permitted working hours of mobile workers also affect the safety in road traffic. Imposing a higher workload on drivers over a longer period of time has an adverse effect on their safety as well, increasing the risk for occupational diseases. Real-time data exchange with the fleet of vehicles makes it possible for both, the Carrier and dispatcher, to monitor the work of each driver. The information is direct and allows no subjective influence of the driver involved. The planning and fleet management can be considerably improved.

The implementation of laws regulating the scope of work of drivers in practical life greatly depends on the control system and sanctions in the country. In environments with stricter control and consistent sanctions for the offenders, any abuse will be less likely and the fleet management based on the lawful workload of drivers will be gaining ground. The enforcement of law in practice mirrors the efficiency of each country. The higher the efficiency level, the better for the sound fleet management compliant with the restrictions required for mobile workers by law.

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