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DRIVER'S TASKS IN THE CONTEXT OF THE INCREASE IN THE DEGREE OF AUTOMATION OF ROAD TRANSPORT

Zadania kierowcy w kontekście wzrostu stopnia automatyzacji transportu drogowego

Abstract: The publication adopts the SAE J3016 standard as the one that defines the level of vehicle autonomy. Gradually, the role of the driver, especially in terms of driving, will decrease, and the last 5th degree of automation will be achieved thanks to the complete elimination of the driver. Through the broadly understood research in the field of drivers' tasks (literature, information from enterprises and labor offices, face-to-face interviews), it can be stated that not all of them will be able to implement autonomous vehicles.

Keywords: autonomous vehicles, transport, drivers' tasks

Streszczenie: W publikacji przyjęto normę SAE J3016 jako tę, która określa poziom autonomii pojazdu. Stopniowo rola kierowcy, zwłaszcza w zakresie prowadzenia pojazdu, będzie maleć, a ostatni, piąty stopień automatyzacji będzie osiągnięty dzięki całkowitej eliminacji kierowcy. Dzięki przeprowadzonym szeroko pojętym badaniom w zakresie zadań kierowców (literatura, informacje z przedsiębiorstw i urzędów pracy, wywiady bezpośrednie), można stwierdzić, że nie wszystkie z nich będą w stanie realizować pojazdy autonomiczne.

Słowa kluczowe: pojazdy autonomiczne, autonomizacja transportu, szkolenia kierowców

1. Introduction

The role of drivers in modern transport processes is extremely important, if only because it is transport that is the main factor determining the development of the national economy, the development of regions, urban agglomerations, and socio-economic development.

The tasks of drivers are not limited only to the transport itself, but also include: loading and unloading of the transported goods, preparing documents and their correct handling, cargo control, monitoring the transport route, working time control, etc. Moreover, additional requirements / permissions are often required from drivers e.g. handling of forklifts, devices placed on vehicles, e.g. cranes for loading goods, servicing garbage trucks, cash registers e.g. in buses or taxis.

People who want to work as a driver must meet a number of requirements (good eyesight, reflexes, positive psychological test results, appropriate age, etc.) and pass exams that give the opportunity to practice as a driver. Professional drivers are required to be skilled, patient and responsible. The analysis of the tasks performed by drivers showed that they are not limited only to driving vehicles, in accordance with road traffic regulations, but also, depending on the types of transport performed, there are also specific activities (tasks) appropriate for a given type of transport.

The development of automated vehicles will not eliminate all tasks carried out by drivers, but may contribute to their reduction. Depending on the degree of automation of the vehicle, the driver's tasks may be more or less reduced. It would be advisable that the level 5 of the car's autonomy, eliminating the driver, should also eliminate his other tasks.

2. Development of automated cars

The current development of automated vehicles shows various possibilities of supporting the driver during the process of moving. Therefore, it is worth paying attention to how it was carried out, as before. There is currently no uniform definition for an autonomous vehicle. In addition, in the literature, you can often find different names for such vehicles, e.g. vehicles: automated, autonomous, automatic, self-propelled or without a driver. Similarly, a review of the literature showed [4, 19, 22, 24, 30] that we encounter different classifications of autonomous vehicles.

In Poland, an autonomous vehicle is defined as: "a motor vehicle equipped with systems that control the movement of the vehicle and enable its movement without the driver's interference, who can take control of the vehicle at any time" [34]. This definition indicates a vehicle that is not fully autonomous, as it requires a driver. Fully autonomous vehicles in the broad sense of the word are means of transport used to move passengers or goods without a driver or with his limited participation. They obtain such a possibility thanks to modern systems that allow them to drive such a vehicle. An autonomous vehicle

is often formulated in the literature as an automatic vehicle steering system that is composed of software and hardware that together are capable of driving the vehicle in a safe manner.

The history of the first attempts to automate vehicle control, and thus the beginning of their development, dates back to the 1920s, when in 1926 the Chandler company demonstrated a radio-controlled vehicle by an operator sitting in a second vehicle following an unmanned vehicle. Of course, it is not possible to speak of vehicle autonomy in this case, but it is the first time that a motor vehicle traveled unmanned on the road [11, 20]. In 1956, General Motors equipped the experimental Firebird II model with a receiver for signals coming from an electric wire in the ground of the so-called future highway, which was to constitute a vehicle guidance system [14]. In 1977, an autonomous car was tested in Japan by the Tsukuba Mechanical Engineering Laboratory [12]. The car followed the white street markers and was able to reach speeds of up to 20 km / h on a special test track. In 1979, the experimental vehicle, The Stanford Cart, was able to move in an enclosed space without human interference and used an image processing algorithm called "The Cart's Vision Algorithm." This algorithm was inspired by the Blocks World planning method and consisted in reducing the image to a set of edges, but it turned out not to be suitable for outdoor scenes, containing many complex shapes and colors [8]. The Blocks World method from 1960 is today one of the best known methods in the field of planning using artificial intelligence [17] and environmental recognition [16, 18].

Some specialists consider the first autonomous vehicle to be the experimental prototype of the VaMP vehicle, which in 1995 traveled over a thousand kilometers without human assistance in a specific area. The prototype was capable of driving in traffic and overtaking vehicles, and the implemented EMS-Vision autonomy system was based on data from bifocal camera systems (45 and 15 degrees) mounted on two-axis platforms [8]. Such a selection of cameras (newer solutions in the EMS-Vision system use a three-camera system) was associated with driving at high speeds, the observation of potential obstacles at greater and smaller distances, terrain unevenness and the ability to interpret the spatial layout [9].

The EMS-Vision system used [3]:

- road network maps;
- static objects on the map that were used as landmarks (markers);
- statistical data (e.g. lane width).

In this system, acquiring dynamic knowledge, i.e. collecting information about the environment while driving, consisted in identifying objects (markers), calculating the position of objects (location and orientation) in space, using the HTC (Homogeneous Coordinate Transformation) algorithm and creating a tree the scene containing these objects (the elements connecting the objects in the scene tree were their relative positions). The system additionally had decision-making units to keep important objects in the field of view (for analysis by specialized modules) for vehicle control and a central decision-making unit. The central unit had a decision-making priority. The specialized modules with which the EMS-Vision system was equipped are [3]:

- road recognition - the algorithm not only recognized the road, but also created a model of it from connected segments and on this basis determined the position of the vehicle;
- attention control - responsible for communication with the two-axis rotary head by performing jump (saccadic) maneuvers related to tracking objects;
- navigation - the module calculated several routes for the destination point, along with the travel start and end time, route length and the estimated travel capacity (planning phase). The calculations were sent to the central unit which decided about the choice of the route. The selected route was added to the list of tasks in the mission plan. The mission plan included tasks such as the selected route, objects to be tracked (road, waypoints) and others. The original mission plan could have changed in the course of the mission, when, for example, the expected intersection could not be found;
- vehicle control (control) - the module was responsible for the analysis of information from decision units and the execution of feedback control algorithms, feedback control and transition rules. The module assessed the resulting sets of equations, calculated the correction variables and controlled the actuators [15].

The above description of the EMS-Vision system does not include the modifications [9, 18] that were created after 1995, but it shows the degree of complexity and the number of algorithms used, understood as defined activities necessary to perform specific tasks in autonomous vehicle systems.

Many initiatives are contributing to the development of autonomous vehicles. Some of them stood out in particular. These include, among others DARPA (Defense Advanced Research Projects Agency) sponsored competition - Grand Challenge and DARPA Urban Grand Challenge, in which (in the former) participants were to construct a vehicle that could travel 241 kilometers (150 miles) through the Nevada desert. In 2004, no team completed the task, and the best team covered just 13 kilometers (8 miles). The problem was related to the analysis of the image and the difficulty of recognizing the environment in which there are no clear lines (e.g. roadside with a pavement) and the difficulty of interpreting a large amount of shadows on uneven desert terrain. Standard image analysis algorithms (contouring, line matching, etc.), object identification, and obstacle avoidance strategies failed in 2004. In 2005, machine learning started to be used in image analysis processes and five vehicles managed to complete the route [21].

The use of machine learning in image analysis gave rise to a new trend in building systems for autonomous vehicles. Large companies have started to build their own intelligent systems for autonomous vehicles, such as the Waymo project launched in 2009 by Google (the project was attended by members of the Stanley team, who won the DARPA Grand Challenge in 2005 [22]). The system software in the Stanley vehicle contained 100,000 lines of code and was responsible for interpreting sensor data and making navigational decisions [29].

In 2007, 53 teams participated in a (second) urban (urban) competition in Victorville, California - the DARPA Urban Challenge. 11 teams made it to the finals and 6 of them

managed to complete the tour. The software of the winner of the competition, the Tartan Racing team [5], consisted of 500,000 lines of code and allowed independent navigation through the city in traffic. The Boss vehicle developed (a Chevrolet Tahoe car model complete with hardware and software) used perceptual, planning and behavioral software to infer traffic and make decisions as it travels to its destination. The vehicle was equipped with over a dozen lasers, cameras and radars, which allowed it to plan the route taking into account static and dynamic obstacles (moving objects). Information about the surroundings was completed by systems containing algorithms for finding and recognizing lane restrictions, parking borders, road signs and others. Additionally, algorithms have been implemented to identify dangerous behaviors of other drivers.

The most important features of the technology developed by the Tartan Racing team are [6]:

- driving in accordance with road traffic rules (taking into account the right-of-way rules at intersections);
- detection and tracking of other vehicles over long distances;
- searching for parking places and parking;
- follow vehicles at a safe distance;
- reactions to unusual events (e.g. road blockage).

The great progress in research made it possible to use artificial intelligence and the possibility of using geographic information systems (GIS) and Global Positioning Systems (GPS). In the 1990s, the US Department of Defense promoted the development of self-driving for military use by funding projects in academia and automotive companies. As a result of the stimulus from this research, since 2000, several car makers including General Motors, Mercedes Benz, Volkswagen, Audi, Nissan, Toyota and Volvo have started designing and testing their own models of self-propelled cars. In addition, a number of automotive and IT companies such as Toyota, Volvo and Google are researching prototypes of self-moving vehicles that run autonomously all the time. In addition, truck manufacturers (Scania, Volvo) develop highly automated systems for their vehicles and vehicles for the public transport system.

Currently, research on systems for autonomous vehicles is carried out in most EU countries, China, Japan, the Scandinavian countries, the USA, etc. Universities such as Carnegie Mellon University, Environmental Research Institute of Michigan and SRI International formed the basis for the ongoing activities of major car manufacturers, Tesla Motors and Google, who are developing technology for autonomous vehicles. Until now, research related to automatic vehicles is carried out by so many entities that it is impossible to list them all. As a result of various studies, analyzes and tests, very modern systems have been constructed enabling safer and more efficient transport of people and loads. Some of them will be presented later in the publication.

With the development of technology and the construction of new systems in vehicles, various problems arose, including no possibility of free testing of autonomous vehicles equipped with systems that enable driving also without a driver on public roads. Nevada (USA) was the first state to authorize the use of autonomous vehicles in 2011. Currently,

most countries are changing regulations governing the possibility of testing autonomous vehicles on public roads.

In Poland, changes were also made to the law which made it possible to obtain a permit to test autonomous vehicles on public roads [34].

3. Classification of autonomous vehicles

The level of car autonomy will have a significant impact on the tasks performed by the driver. The International Society of Automotive Engineers (SAE) [30] developed in 2014 a classification system for defining motor vehicle driving automation. This system has been adopted by the US Department of Transportation and the United Nations. This classification is called SAE J3016 Autonomy Levels. The classification focuses more on the number of driver interventions and the need for attention while driving than on the technical ability of the vehicle. The classification presented in tab. 1 includes six levels of autonomy. In the case of the first three levels, the person is responsible for controlling the traffic situation and for making decisions based on his own observations.

Table 1

Vehicle autonomy classification, SAE J3016 of 2014

SAE	SAE name	SAE narrative definition	Execution of steering and acceleration/deceleration	Monitoring of driving environment	Fallback performance of dynamic driving task	System capability (driving modes)	BAST level	NHTSA level
Human driver monitors the driving environment								
0	No Automation	the full-time performance by the <i>human driver</i> of all aspects of the <i>dynamic driving task</i> , even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	Driver Assistance	the <i>driving mode</i> -specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	Partial Automation	the <i>driving mode</i> -specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the <i>human driver</i> perform all remaining aspects of the <i>dynamic driving task</i>	System	Human driver	Human driver	Some driving modes	Partially automated	2
Automated driving system ("system") monitors the driving environment								
3	Conditional Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> with the expectation that the <i>human driver</i> will respond appropriately to a request to intervene	System	System	Human driver	Some driving modes	Highly automated	3
4	High Automation	the <i>driving mode</i> -specific performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> , even if a <i>human driver</i> does not respond appropriately to a request to intervene	System	System	System	Some driving modes	Fully automated	3/4
5	Full Automation	the full-time performance by an <i>automated driving system</i> of all aspects of the <i>dynamic driving task</i> under all roadway and environmental conditions that can be managed by a <i>human driver</i>	System	System	System	All driving modes		

Source: Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems, On-Road Automated Vehicle Standards Committee, J3016_201401, SURFACE VEHICLE INFORMATION REPORT, Issued 2014-01

In 2018, SAE revised the 2014 records [32]. Several new terms and definitions have been corrected, errors have been corrected, and additional clarifications have been added to frequently misunderstood concepts. As in the previous version, the document provides a taxonomy describing the full range of driving automation levels in motor vehicles and includes driving automation definitions for different levels and related terms and definitions. This Recommended Practice does not specify specifications or otherwise impose requirements on automated driving systems.

The 2018 revision of the provisions from 2014 was also aimed at:

- explaining the role of a possible real (human) driver when turning on the driving automation system,
- answer questions about the scope of changes in the development of laws, rules, regulations and standards,
- providing a useful framework for the specifications of the travel automation and technical requirements,
- ensuring the transparency of information relating to driving automation as well as explaining useful acronyms.

The new document contains updates reflecting lessons learned from various discussions with stakeholders as well as from research projects carried out in Europe and the United States by AdaptIVe and the Automation Vehicle Research (AVR) Crash Avoidance Metrics Partnership (AVAMP) consortium, respectively.

This document also refers to the three main "entities" driving the vehicle: the user (human), the automation system and other vehicle systems and components. Vehicle systems and components (or the vehicle in general) do not include the driving automation system of this model, even though for practical reasons the driving automation system can actually share hardware and software components with other vehicle systems such as processing modules or an operating code.

4. Selected systems in autonomous vehicles

Most of the systems with which vehicles are equipped undergo a gradual evolution towards the last level of vehicle autonomy, capable of driving independently in any area (e.g. urban). Below is a description of the classification of selected systems, assigned to individual levels of vehicle autonomy:

- **Level 0** - systems at this level lack any automation functions. The vehicle systems and systems present at this level are: anti-lock braking systems (ABS) (closed-loop devices to prevent the wheels locking when braking and, consequently, maintaining vehicle stability) [4]; TCS traction control system preventing wheel rotation during take-off and acceleration [7]; electronic stability control system (ESC) control of the braking

power of individual wheels and / or reduction of engine power in order to restore the stability of the vehicle by detecting that skidding [3]. In contrast to the ABS and TCS systems, which only work longitudinally, the ECS improves the lateral dynamics of the vehicle, thus ensuring a stable driving in all directions [7]. Another device at this level is Advanced Emergency Braking Systems (AEBS), which automatically applies emergency braking when sensors monitoring the vehicle ahead detect situations where the relative speed and distance between two vehicles suggest that a collision is inevitable [30]. The second set of level 0 driver assistance systems that are present on the market help the driver perform certain operations, such as park or warn him, when certain conditions occur [19].

- **Level 1** - At this level, there are a number of advanced dynamic driving assistance systems. Examples of such systems are [19]:
  - ACC (Adaptive Cruise Control) – it is an adaptive cruise control with automatic distance control ACC. Uses a distance sensor to measure distance and speed relative to vehicles in front of the vehicle. The driver sets the speed and the required time interval using the buttons on the multifunction steering wheel or using the steering column lever (depending on model). The target and actual distance to the next move can be shown as a comparison on the multifunction display;
  - ACC containing stop-and-go function – It is an adaptive cruise control with stop and go function that includes automatic distance control (control range 0-250 km / h) and, within the system limits, detects the vehicle ahead. Maintains a safe distance by automatically applying the brakes and accelerating. It regulates braking and acceleration in slow-moving traffic;
  - LKA (Lane Keeping Assist) - LKA is automatically turned on at a certain speed (usually around 60 km / h) and up. The system detects the lane markings and determines the position of the vehicle. If the car starts to leave the lane, the system corrects the track. If the maximum action it can take is not enough to stay in the lane or the speed drops below 60 km / h, the system warns the driver by vibrating the steering wheel, for example. Then the driver takes corrective actions;
  - PA (Park Assist) – the system automatically steers the car to a parallel and bay parking space as well as a parallel parking space. The system supports the driver by automatically making the optimal steering wheel movements to park backwards on the perfect line. Parking space measurement, starting position assignment and steering wheel movements are automatically undertaken by the parking assistant - the driver only needs to actuate the accelerator and the brake. This means that the driver remains in control of the car at all times.
- **Level 2** – Level 2 systems should be considered as an evolution of Level 1 systems as they are activated in similar situations, but have greater functionality. Systems of this level are capable of automatic performance of the functions: acceleration / braking and steering, we can count them among them:
  - APA (Automated Parking Assistance) - An automated parking assist system capable of steering and accelerating / braking to park the car is now available on

the market. The evolution of this system is the so-called PA (Park Assist), which has more functionalities than on level 1. On the second level, it includes partial automated parking on and off the parking space in a public or private car park or garage. The process is initiated remotely, e.g. using a smartphone or a customized remote control. The vehicle maneuvers by itself. The driver may be outside the vehicle but must monitor the system and can stop the parking maneuver if necessary [19];

- TJA (Traffic Jam Assist) – the system monitors the vehicle's forward / backward and sideways movement to track traffic at low speeds below 30 km / h. The system can be viewed as an extension of ACC with stop-and-go functionality [19].
- **Level 3** – systems belonging to this level are mostly systems with greater functionalities, which were previously available on levels 1 and 2, including [19]:
  - Traffic Jam Chauffeurs – conditional automated driving in crowded conditions up to 60 km / h on highways and highway-like roads. The system controls the vehicle's forward / backward and sideways movements up to a threshold speed. The driver has to intentionally activate the system but does not have to constantly monitor the system. The driver can change or deactivate the system at any time. There is no driver takeover request from the system;
  - Highway Chauffeurs - conditional automated driving at speeds of up to 130 km / h on highways or highway-like roads. Highway Chauffeur operates from entry to exit, in all lanes, including when overtaking. The driver has to intentionally activate the system, but not constantly monitor it. The driver can replace or disable the system at any time. The system can ask the driver to take over driving within a certain time, if the automation reaches the system limits.
- **Level 4** – in urban areas, it is widely recognized that vehicles (cars, buses, high-speed transport) are likely to be equipped with highly automated (driverless) systems at this level and will initially move at low speed and / or in a defined infrastructure lane / enclosed spaces. At this level we can include systems such as [19]:
  - Parking Garage Pilot – This system has highly developed functions, including automated parking, including maneuvering to and from a parking space (driverless parking). In parking garages, the driver does not need to monitor the operation and can drive away when the system is active. The process is initiated remotely, for example with a smartphone or a customized remote key;
  - Highway Pilot - automated driving at speeds of up to 130 km / h on highways or highway-like roads from entry to exit, in all lanes, including when overtaking. The driver has to intentionally activate the system, but not constantly monitor it. The driver can replace or disable the system at any time. The system does not send any seizure requests to the driver when the system is in the normal highway operating area. Depending on the implementation of communication systems between vehicles and cooperation systems, vehicle convoys can also be created;
  - Highway Pilot with ad-hoc platooning - in addition to the functions described earlier, on level 4 there is an option for passenger vehicles to create vehicle

convoys. This requires the availability of communication between vehicles and depends on the implementation of systems that work together.

- **Level 5** - The final stage in vehicle automation is the realization of highly automated vehicles that are not designed to assist the driver but to perform autonomous maneuvers. These vehicles will be able to perform all driving tasks without any input from the passengers (therefore there will be no driver anymore).

This is only part of the systems found in autonomous vehicles, but it gives a picture of the differences between the different levels of automated vehicles. The algorithms of these systems are constantly being modernized, often not only to improve their functionality, but to extend it.

The European Commission, within its EU policy-making competence for autonomous vehicles, advocates a progressive approach, based on experience gained from testing, which will validate the safety of technologies [10]. This will be done through traceable automation systems, i.e. road situations in which the vehicle can move independently. The Commission has identified the use of autonomous vehicles from a public policy perspective for the next decade, but remains open to considering other possible new systems to be developed in the coming years [10]:

- **Passenger cars and trucks** capable of reacting independently in specific situations on the motorway (automation level 3 and 4) are to be available by 2020 (in particular, autopilot on the motorway for cars and trucks and convoys of autonomous trucks). Cars and trucks that are able to deal with certain situations at low speed may be brought into cities by 2020, e.g. garbage trucks (collaborating with employees) or cars equipped with a parking space drain function (passenger cars driving independently to a parking space). The capabilities of the vehicles will then be further developed to cope with increasingly complex situations (e.g. longer working hours or longer distances without driver intervention).
- **Public transport** - vehicles capable of responding to a limited number of road situations at low speed (automation level 4) are to be available by 2020 (in particular urban shuttles on specific routes, small delivery vehicles or small vehicles for mobility aid). These vehicles will most likely still require human supervision or will operate very short distances. The number of times these vehicles will be able to function will then increase over time (e.g. longer working hours or longer distances without human supervision, higher speed).

While automated vehicles do not necessarily need to be connected to the grid and connected vehicles do not require automation, it is expected that in the medium term connectivity between vehicles and vehicles and road infrastructure will be a major driver for the development of autonomous vehicles. Therefore, the Commission will pursue an integrated approach to vehicle automation and connectivity. As vehicles become more connected and automated, they will be able to coordinate their maneuvers with active

infrastructure support, enabling 'intelligent' traffic management to ensure the smoothest and safest possible traffic flow¹ [23].

Many vehicles are already connected to cellular technologies. By 2022, all new cars are expected to be connected to the internet [28]. This will ensure vehicles have advance access to information on traffic conditions (e.g. accidents, road works, environmental conditions) and allow public authorities to collect large-scale fleet data such as anonymised average real fuel consumption. / energy or real-time traffic conditions. From 2019, some series of new vehicles will also be equipped with short-range communication devices using Wi-Fi (C-ITS solutions). These technologies enable the provision of security-related services that require very little latency. They will also allow automated vehicles to coordinate maneuvers in complex road situations. From 2020, new 5G network technology will significantly expand communication options, providing more complex and improved services.

5. Contemporary driver's tasks

The driver's current tasks can be divided into two types. The first group includes those resulting from the regulations that apply to all drivers, regardless of the form of employment. On the other hand, the second group includes tasks resulting from contracts concluded with the employer or service provider.

The division and specificity of drivers' tasks can be varied depending on the type of transport performed. You can transport goods or people. As part of these transports, it is possible to carry out domestic, international, regional, local, city transport, etc. Some tasks of drivers are duplicated in many types of transport, but there are many tasks that characterize individual types of transport, e.g. special.

Returning to the first group of drivers' tasks, they result from the provisions of the law in force in the area where the transport is carried out. These tasks are determined by laws, regulations, directives, EU decisions, they apply to all drivers, regardless of the form of employment (employment contract, mandate contract, self-employment). on the working time of drivers, road traffic, digital tachographs, driver cards, etc. The website of the General Road Transport Inspectorate [13] presents 55 documents that directly or indirectly relate to the driver's profession (laws, regulations, EU decisions), in fact, there are many more.

The second group of tasks depends on the type of transport and the requirements specified by the employer or service provider. The analysis of the scope of duties for professional drivers shows many similarities for given types of transport, which may result from the standardization of tasks listed in the scopes of duties by employers or service providers themselves.

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¹ Research has quantified that automation without connectivity can lead to a potential deterioration in traffic conditions.

The tasks of a professional driver who carries out the transport of goods or passengers, differ depending on the type of transport or means of transport with which the transport is carried out. However, due to certain tasks that are similar in all transports, it was decided in this publication to include them in a uniform whole, despite the fact that there are also such tasks that are specific to only one type of transport, or also a means of transport.

A set of professional driver's tasks is presented below, compiled from various types of transport (domestic, international) carried out by various means of transport (e.g. lorries, buses, taxis, specialized vehicles, e.g. garbage trucks), distinguished on the basis of the analyzed responsibilities, job offers. These tasks can be divided into several basic groups, which include [26, 27, 31, 35]: preparation for transport; loading; execution of transport; unloading; settlement of operational driving. The tasks of the driver within the selected group are presented below.

Preparation for transport (documents and means of transport) - downloading and completing the necessary documentation, which the driver should always have with him during the transport. Very often this task is carried out by drivers. The driver's tasks in this area include preparation / possession / obtaining:

- personal documentation (passport, visas, driving license, digital tachograph cards),
- documentation of the means of road transport (vehicle registration certificate and semi-trailer (trailer) registration certificate with valid technical tests,
- transport permit,
- valid civil liability insurance,
- green insurance card (with a list of addresses of emergency commissioners),
- valid fuel card,
- ADR accident instruction (when the transport is carried out under the ADR convention in the languages of the countries through which it will be performed),
- a set of warning signs,
- valid FCR certificate (required for the transport of perishable goods - ATP),
- tanker's cleanliness certificate (required by the tanker - transport of chemicals),
- authorization to drive a vehicle / semi-trailer or other right to dispose of it (loan, rental, lending or lease agreement - with the required translation),
- certificates (Euro, L, S, ATP and others depending on the transport performed);
- cargo documentation (international CMR consignment note, along with the documentation attached to the letter (e.g. goods specification,
- proforma invoice or invoices,
- "bordero" statements, port documentation, etc.,
- an appropriate customs transport document (i.e. TIR carnet with a customs seal certificate or T1, T2),
- additional documents (for specialized transports), i.e. veterinary permit, certificate or phytosanitary permit, certificate of origin of goods, permit for the transport of waste, instructions on the route of transport, the indicated Customs Office of Departure, the indicated Destination Price Office, ATA Carnet etc.,

When preparing a means of transport for transport, the driver is responsible for the following tasks:

- technical inspection of the vehicle (truck, bus, taxi, garbage truck, etc.): e.g. brake, lights, marking, closing and opening doors (e.g. bus), condition of tires, operation of loading support devices or performance of services at specialized vehicles, e.g. garbage truck e.t.c.,
- connecting the trailer to the towing vehicle (semi-trailers),
- checking the condition and completeness of the vehicle with tools,
- checking the completeness of spare parts, such as: towing rope, first aid kit and fire extinguishing equipment and possibly the necessary additional equipment (straps, chains),
- checking the external appearance of the vehicle (and semi-trailer, trailer, etc.) and its cleanliness inside the cargo space (e.g. truck, bus, taxi, etc.),
- in the case of specialized semitrailers (trailers), such as refrigerated trucks - checking and controlling:
  - technical readiness (efficiency) of chillers and additional equipment of the cold store with thermometers and temperature recording devices,
  - the condition of seals, hooks, grilles, cool the cooler to the desired temperature,
- in the case of transport by tankers, checking: condition and quality of closing devices - taps, siphons, hatches, etc. mechanisms,
- checking the equipment related to the vehicle, e.g. loading cranes, booms, etc.

These are only some of the tasks performed by drivers within the selected group. Some of them appear to be irreplaceable, while others will be dealt with by future autonomous car systems. In the case of electronic document flow, activities are already underway without driver involvement. One example of such a company is Krone Telematics KSC ProPlus Cool, which supports document management via WLAN. Both the dispatcher and the driver can connect to the Krone Telematics device via WLAN and obtain the necessary documents [1]. This relieves the driver of the need to have a paper version of some documents. In addition, other solutions are also introduced that will relieve the driver from certain tasks, e.g. the German trailer manufacturer Krone will, as standard, equip all Cool Liner refrigerated vehicles with the Krone Telematics system with the following functions: monitoring and localization, control of properly closed refrigerator doors, current operating data, temperature control cooling, monitoring of the cooling device and the state of compression [4].

6. Summary

At the moment, drivers already use cars equipped with systems that support their driving, support the implementation of their tasks related to the transport of goods or people. Currently, level 0 driving assistance systems (without automation) and level 1 (driver assistance) and a smaller number of level 2 vehicles (partial automation) are already in use, mainly in passenger cars. Most of them are still simple systems (level 1 and 2), e.g. parking

support or motorway driving (monitoring of the "blind spot", or supporting or implementing emergency braking, etc.).

Due to Covid-19, the analysis of the available information shows that research on the development of autonomous vehicles is currently carried out at a lower pace, but will certainly be carried out in the subsequent periods. At the present stage of development of systems which autonomize driving a vehicle, manufacturers are investing in research and development of more advanced systems, designed for cars, from level 3 (conditional automation), thanks to which driving safety should be improved or drivers' fatigue reduced during long journeys. In parallel, research and testing of automated systems of the 4th and 5th level are already underway. Tests and pilot solutions in this area are continued thanks to the participation of various organizations, including vehicle manufacturers, IT and public companies, or authorities interested in implementing full self-propelling technologies.

In the perspective of the next few years, it does not seem that the driver's profession will be endangered, the more so as their shortage is still visible. Too many tasks performed by the driver should at the same time be reduced to make the transport more efficient, more effective and, as a result, safer. However, such changes will still have to be waited for.

From the perspective of levels 3 and 4 of the car's autonomy, the driver will continue to play a fundamental role in the implementation of transport tasks, while the implementation of level 5 autonomous vehicles is still so far in the long term that it is difficult to refer to it as a real threat to the disappearance of the profession of driver.

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