SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2026
ORGANIZATION AND MANAGEMENT SERIES NO. 247

THE ROLE OF ERGONOMICS AND DRIVER SAFETY IN ENHANCING COMPETITIVENESS IN THE TRANSPORT SECTOR

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Purpose: The purpose of this conceptual paper is to analyse how ergonomics and driver safety contribute to the competitiveness of the transport sector by improving work efficiency, reducing operational risks and strengthening the employer's market position.
Design/methodology/approach: The article adopts a conceptual research approach based on a structured review of scientific literature and selected industry reports (e.g. EU-OSHA, Deloitte)**.** The study does not include original empirical research but develops a conceptual framework explaining the relationships between ergonomic working conditions, driver safety and competitiveness indicators in road transport companies.
Findings: The analysis indicates that ergonomically designed driver workplaces and safety-oriented management practices contribute to lower accident rates, reduced sickness absence, improved service quality and higher employee retention. These factors strengthen operational efficiency and support competitive advantage in the transport sector.
Research limitations/implications: As a conceptual study based on secondary sources, the paper does not provide quantitative empirical verification. Future studies should include empirical research among transport companies to measure the economic and operational effects of ergonomic interventions.
Practical implications: Transport companies may strengthen their competitive position by investing in ergonomic cab design, modern driver-assistance technologies and safety management culture.
Social implications: Improved safety standards contribute to the protection of workers' health, reduce accident risks for other road users and support sustainable development goals related to decent working conditions.
Originality/value: The article conceptualises ergonomics and driver safety as **strategic determinants of competitiveness**, rather than merely operational costs.
Keywords: ergonomics; driver safety; competitiveness; transport sector; occupational safety; human factor in transport.
Category of the paper: Conceptual paper / Literature review.

1. Introduction

Driver work represents one of the most physically and mentally demanding occupations within the transport industry. Drivers spend extensive hours in confined vehicle cabins, often under harsh weather conditions and continuous time pressure. Such conditions require constant concentration, precise motor coordination and high physical endurance, resulting in cumulative strain that significantly impacts drivers' health, well-being and overall road safety. Consequently, ergonomics and occupational safety have become central topics in contemporary research on improving working conditions in road transport.

Ergonomics in driving concerns a comprehensive set of factors: the design of the driver's workplace, optimal arrangement of vehicle controls, visibility, seating comfort, as well as environmental influences such as noise, vibrations, microclimate and lighting. Safety measures, in turn, include preventive strategies, implementation of driver-assistance technologies, adequate training, and systems aimed at reducing the likelihood and severity of accidents (Szulc, 2022). A holistic approach to ergonomics and safety therefore ensures not only physical protection, but also supports cognitive efficiency and stress reduction.

Technological advancement is profoundly transforming road transport and driver support systems. Telematics and GPS-based fleet management allow real-time monitoring of vehicle performance, improving logistics efficiency and safety management. Advanced Driver Assistance Systems (ADAS), such as blind-spot detection, adaptive cruise control, lane-keeping support and autonomous emergency braking enhance comfort, reduce error-related incidents and contribute to road risk mitigation. Furthermore, mobile platforms used for communication, navigation and load planning optimize workflows, reduce operational costs and improve delivery accuracy. These innovations strengthen the driver's position within an increasingly digitalized transport environment.

Beyond their operational importance, ergonomics and safety emerge as strategic determinants of competitiveness in the transport sector. Companies that invest in safe and ergonomic working environments experience lower absenteeism, reduced turnover of professional drivers and enhanced service reliability. The growing shortage of qualified drivers in Europe intensifies the need for transportation enterprises to build a positive employer brand based on well-being and safety culture. As customers increasingly expect punctuality and risk-free logistics, safety performance becomes a relevant criterion in the selection of carriers. Thus, ergonomically optimized workstations and robust safety standards contribute directly to quality of service, cost optimization and business sustainability.

Table 1.
Conceptual relationship between ergonomics, driver safety and competitiveness

Area	Key factors	Impact on transport companies
Ergonomics	Seat design, control layout, vibration reduction, cab lighting	Reduced fatigue, improved driver performance
Driver safety	ADAS systems, fatigue detection, driver training	Reduced accident risk and operational interruptions
Organizational effects	Lower absenteeism, driver retention, employer branding	Increased operational efficiency
Market outcomes	Reliability of deliveries, service quality	Improved competitiveness

Source: own study.

This article investigates key aspects of ergonomics and driver safety, presenting current developments and technological solutions that support drivers in road transport. It emphasizes their role as crucial elements shaping operational efficiency and long-term competitiveness of transport companies.

2. Ergonomics of the driver's work

Ergonomics, as defined by the International Ergonomic Society, is the science that studies the interaction between humans and other system components, and the practice of using theory, principles and data to design for improved system efficiency and human well-being (Szulc, 2022). The Polish Ergonomic Society, in turn, defines ergonomics as a discipline that strives to optimally adapt tools, machines, equipment, technology, and the organization of work and the environment to the physiological, psychological and social needs of humans (Adamski, 2021). Adherence to ergonomic principles is crucial in many occupations, including the work of a commercial driver. Prolonged driving in one position, in an uncomfortable seat, on uneven roads and in poor-quality vehicles often leads to various ailments, such as sciatica. Based on the recommendations of the International Labor Organization, guidelines for driver's cab ergonomics have been created, which include (Kowalski, 2020):

- proper positioning and adjustment of the seat, steering wheel and pedals,
- good visibility of the dashboard and the markings on it,
- adapting the workstation to the driver's posture,
- providing adequate training, especially when introducing new bus models.

The driver of a motor vehicle, especially in the long-distance transportation sector, spends most of his time in a sitting position, which carries numerous health risks. Therefore, one of the key elements of driver ergonomics is the proper design of the workplace, which takes into account the physiological needs of the user. The driver's seat should be tailored to the individual needs of each driver, with adjustable height, backrest angle and armrest position. Adequate spinal support and lumbar relief are key to preventing chronic back pain, which is one of the most common health problems among drivers (Kowalski, 2020).

It is important that the steering wheel does not obscure the driver's indicators and displays located on the dashboard. The driver's seat significantly affects the driving comfort. The bus driver, when sitting behind the wheel, should be able to adopt a posture that is comfortable for him. The correct posture in the driver's seat is a back that is flat against the backrest, buttocks pumped into the recess in the seat and thighs which should be in contact with the seat. A professional driver's seat should provide both tall and short drivers with a comfortable position behind the wheel, be equipped with the ability to adjust vertically (100 mm) and horizontally (at least 150 mm), be equipped with lumbar supports that allow for adjustments to the thickness and height of the driver have a damping and cushioning system, and be able to be set at different angles, both backrest and seat, not cause back muscle tension and be made of upholstery that is not slippery and soft (Starkowski et al., 2007). Prolonged sitting, particularly in inadequately adjusted chairs, can lead to a number of conditions, including the so-called "chronic back pain syndrome". Studies have shown that improper sitting positions increase the risk of developing back problems, such as discopathies and circulation problems in the lower extremities (Siedlecka, 2006). To counteract these phenomena, vehicle manufacturers are introducing modern ergonomic solutions, such as hardness-adjustable seats that allow the seat to be adjusted to the individual's needs.

Another important element affecting driver comfort and safety is the optimal placement of pedals, steering wheel and information displays. The steering wheel should be horizontally and vertically adjustable so that each driver can find the most comfortable working position. Pedals, on the other hand, should be positioned in such a way that the driver's legs can work in a natural rhythm, which reduces fatigue and the risk of injury (Bartuzi, 2012). Displays should be easy to read and intuitive to use. Modern HUD (Head-Up Display) systems, which display key information on the windshield, significantly improve driver safety, as they minimize the need for drivers to take their eyes off the road (Zając, 2023). Another important thing is to match the steering wheel to the position of the arms. After adopting the proper posture in the driver's seat, the bus driver should be able to, after fully stretch his arms to place his wrists at twelve o'clock. This allows the hands to be gently bent at the elbows when performing a turning maneuver. Requirements concerning the steering wheel and dashboard are as follow (Starkowski et al., 2007):

- wheel diameter not exceeding 500 mm,
- steering wheel adjustable along the axis of the column (height adjustment) and additionally equipped with independent angle adjustment,
- dashboard made of soft and flexible material to minimize injuries to the body that could,
- arise during an accident,
- all indicators clearly visible from the driver's seated position,
- arrangement of indicators depending on the function frequency of their use,

- indicators and their descriptions legible and clearly visible from the driver's seated position,
- indicators easy to operate, not requiring the use of considerable force at startup.

When taking a seat behind the wheel, you should also pay attention to the distance of your legs from the brake, accelerator and clutch (depending on the type of transmission). If you need to brake suddenly, your legs should be bent, allowing you to leave room to press down on the brake pedal and make the most of it. In the event of a traffic accident, the upright lower limbs, specifically the knee and hip joints, can be damaged.

Lighting in the driver's compartment is a key component of work ergonomics, affecting both comfort and safety. Properly designed lighting aims to provide the driver with optimal viewing conditions, especially when driving at night or in difficult weather conditions. Good lighting inside the cab allows the driver to easily and quickly find key controls, such as buttons, displays and switches, without having to take his eyes off the road.

Too much or poorly placed lighting can cause glare that distracts the driver, leading to faster eye fatigue and general discomfort. Modern ergonomic solutions for cabin lighting take into account adjustable light levels and the use of special technologies such as ambient lighting, which minimizes glare while providing clear visibility inside the vehicle. Adequate lighting of the dashboard is also an important aspect, and it must be legible but not dazzling, which promotes driver concentration (Kowalski, 2020).

Taking care of the quality of lighting in the cabin is therefore important not only for comfort, but also for reducing visual fatigue, which directly affects driving safety.

The vibrations to which drivers are exposed pose a significant threat to health and comfort, especially for those who drive trucks and buses over long distances. Prolonged exposure to vibrations, which are generated by the engine, road irregularities and other mechanical factors, can lead to a number of health problems, including musculoskeletal ailments, fatigue and conditions related to blood circulation.

The most commonly observed effects of vibration are back pain, especially in the lumbar region, which results from prolonged strain on muscles and joints. Vibration can also lead to damage to intervertebral discs, which over time increases the risk of chronic health problems such as sciatica and osteoarthritis (Nowak, 2021). In addition, prolonged exposure to vibration can affect a driver's ability to concentrate, which directly reduces safety on the road.

Driver ergonomics play a key role in ensuring driver health, comfort and efficiency. Proper workplace design, including adjustable seats, optimally positioned pedals, steering wheel and displays, is essential to reduce the physical strain of prolonged driving. Proper posture, minimization of vibration, and the use of technologies that improve visibility and comfort, such as ambient lighting, all contribute to reducing fatigue, thereby improving road safety.

Improving ergonomic working conditions is not only a matter of occupational health but also an important economic factor. Drivers who operate in comfortable and well-designed cabins experience lower levels of fatigue and higher work efficiency. For transport companies this translates into fewer errors, reduced absenteeism and improved service reliability. Consequently, ergonomic workplace design becomes an important factor supporting competitiveness in the transport sector.

3. Elements of driver safety

Driver safety is a key issue from both individual and organizational perspectives. Due to the nature of their profession, drivers are exposed to numerous risks related to working conditions, physical and mental strain, and external factors such as weather conditions, road infrastructure and time pressure. These hazards can be divided into three main categories.

1. Physical hazards

- fatigue and prolonged sitting: Long hours behind the wheel lead to fatigue, which significantly increases the risk of accidents. Driver fatigue is associated with insufficient sleep, monotony of driving and time pressure. Studies indicate that fatigue may contribute to up to 20% of traffic accidents (Åkerstedt et al., 2000). Prolonged driving, particularly on monotonous highways and without sufficient breaks, reduces concentration and reaction time, increasing the likelihood of errors.
- vibration: Mechanical vibration is another important health risk, especially for drivers of trucks, buses and construction vehicles. Vibrations originate mainly from the engine, suspension system and road irregularities and are transmitted to the driver's body through the seat, floor and steering wheel. Long-term exposure to vibration may lead to musculoskeletal disorders, back pain, joint problems and nervous system disturbances (Griffin, 1990).

2. Mental hazards

- stress and time pressure: Professional drivers often operate under constant time pressure related to delivery deadlines and changing road conditions. Traffic congestion, weather conditions and responsibility for the safety of passengers or cargo increase stress levels. Chronic stress may lead to fatigue, reduced concentration and higher accident risk, as well as health problems such as cardiovascular diseases or mental disorders (Broughton et al., 2007).

- social isolation: Drivers involved in long-distance transportation often spend extended periods away from home and work alone in the vehicle cabin. Irregular working hours and long separations from family may lead to feelings of loneliness and reduced social interaction. Social isolation can negatively affect mental health, job satisfaction and motivation (Johnson et al., 2011).

3. External hazards

- road conditions: Weather conditions, traffic congestion and changing road infrastructure pose constant challenges for drivers. Increasing traffic intensity, particularly in urban areas, contributes to a higher risk of collisions and accidents. Therefore, drivers must remain vigilant and anticipate the behaviour of other road users while following traffic signs and regulations (Evans, 2004).
- safety of transported cargo: Professional drivers are often responsible for transporting valuable goods, which requires proper cargo securing and compliance with weight regulations. Incorrect cargo placement or insufficient securing may pose serious risks both to the driver and other road users (Vilalobos, 2010).

The profession of a driver requires long hours of concentration and involves a high level of responsibility. For this reason, regulations concerning drivers' working time have been introduced in the European Union. According to these rules, the maximum daily driving time is generally limited to 9 hours, and drivers are required to take a break of at least 45 minutes after 4.5 hours of driving. These regulations aim to reduce fatigue-related accidents and improve road safety.

Compliance with working time regulations is essential not only for protecting drivers' health but also for ensuring the safety of all road users. Adequate rest periods improve concentration and reaction time, reducing the risk of accidents and operational disruptions in transport activities.

Driver safety management also has direct economic implications for transport companies. Organizations that invest in preventive safety measures, driver training and modern technologies experience lower accident rates and reduced operational disruptions. This improves delivery reliability and strengthens the company's reputation among logistics partners and clients, thereby supporting long-term competitiveness.

4. The latest technologies to support driver safety as a competitive advantage in the transport sector

With the rapid development of transportation technology, the importance of innovations to improve safety and ergonomics in drivers' work is growing. Today's technological systems and solutions are not only changing the way vehicles are driven, but also affecting the health and

comfort of those working in the transportation industry. Safety is a key issue in the driver's job, and new technologies are making a significant contribution to improving it. Today's vehicles are equipped with a number of assistance systems. The most important systems will be described below.

Blind spot monitoring systems are advanced technologies that improve road safety by eliminating the dangers of a driver's limited field of vision. These systems use sensors, radar or cameras to monitor areas on the sides and rear of the vehicle that are difficult to see from the driver's cabin. When the system detects a vehicle in the blind spot, it alerts the driver with visual, audible or vibrating signals, helping to prevent collisions during lane changes. Studies indicate that these systems significantly reduce the risk of side-impact accidents, improving safety for both drivers and other road users (Davies, 2020).

Adaptive cruise control is an advanced driver assistance system that automatically adjusts a vehicle's speed to match traffic, maintaining a safe distance from the vehicle ahead. The cruise control system's operation is based on sensors, most often radars, which monitor the speed and position of other cars. If the system detects a vehicle traveling slower in the same lane, it automatically reduces speed and, if necessary, applies the brakes. When the road in front of the vehicle is slow, cruise control restores the programmed speed. Studies show that adaptive cruise control not only increases driving comfort, especially on highways, but also reduces the risk of collisions due to insufficient distance between vehicles (Muir, 2019).

The next innovation is the automatic emergency braking system is a key safety-enhancing technology designed to prevent or minimize collisions. The system works by using radar sensors, cameras and lidar to monitor the road ahead. When the system detects the risk of a collision with an obstacle, it first warns the driver visually and audibly. If the driver does not react in time, the brakes are automatically activated, reducing the speed or stopping the vehicle completely. There is no doubt that the use of automatic emergency braking significantly reduces rear-end accidents and effectively protects both drivers and pedestrians (Anderson, Doecke, 2018).

Lane Assist is an advanced driver assistance system that helps keep the vehicle in the designated lane. The system uses cameras that monitor lines on the roadway and reacts when the driver unintentionally approaches the edge of the lane. When it detects a potential lane departure without signaling the maneuver, the system can warn the driver visually, audibly and even gently correct the lane by automatically moving the steering wheel. The system is particularly effective on highways, where the risk of lane departure can lead to dangerous accidents. It should be noted that the lane assistant significantly improves safety. It is a great support for a driver burdened by monotonous driving. It contributes to reducing the number of accidents caused by driver inattention (Bärgman, 2020).

Reversing camera and parking sensors are technologies that assist the driver when maneuvering in tight spaces, increasing safety and comfort. A reversing camera, usually located in the rear of the vehicle, allows the driver to view the area behind the car, minimizing the risk

of collisions with unseen obstacles. Parking sensors, on the other hand, operating on the basis of ultrasound or radar, detect objects in close proximity to the vehicle and warn the driver with audible or visual signals of an approaching obstacle. These systems are particularly useful in crowded urban conditions, where limited visibility and limited parking space can lead to damage to the vehicle or other objects (Smith, 2019).

Head-Up Display is a technology used in modern vehicles that displays key information on the windshield, allowing the driver to keep track of important data without taking their eyes off the road. This system most often shows information such as speed, navigation, road signs or safety system warnings. It allows drivers to react more quickly to changing road conditions, improving safety and driving comfort, reducing the risk of accidents related to lack of attention. A very big advantage of this system is the reduction of the driver's reaction time, which is especially important in emergency situations, such as sudden braking or the appearance of an obstacle (Flannagan, Sivak, 2018).

Mobile apps for drivers are playing an increasingly important role in optimizing the work of professional drivers and in the daily use of vehicles by private individuals. Thanks to apps such as Google Maps, Waze or dedicated fleet solutions, drivers can effectively plan routes, avoid traffic jams, monitor fuel consumption and manage work and rest times in accordance with regulations. These apps also often offer functions for monitoring vehicle health, warning of road hazards, and even support in managing transport orders. Their versatility helps improve driving safety and efficiency, which translates into time and fuel savings, as well as reduced driving stress (Dowling, 2019).

In addition to safety aspects, modern technologies are helping to improve drivers' ergonomics. The following describes innovative solutions that assist drivers in the aspect of improving workplace ergonomics.

The Driver Fatigue Detection System is an advanced technological solution that monitors driver behavior and alerts the driver when it detects signs of fatigue that could lead to an accident. The system uses a variety of methods, such as analyzing steering wheel movements, reaction time, and even monitoring faces and eyes with cameras. When it detects abnormal behavior, such as frequent lane drifting or micro-sleeping, it suggests a rest break to the driver using audible or visual signals. Fatigue detection systems can significantly reduce the risk of accidents caused by drowsiness, especially during prolonged highway driving. They are a great support for drivers and improve their comfort (Schmidt, Heuer, 2019).

Ergonomic control systems and vehicle seating are designed to increase comfort and reduce driver fatigue during prolonged driving. Modern seats offer a wide range of adjustment in many planes, allowing drivers to customize their positions to reduce strain on the spine and muscles. In addition, control systems such as height-adjustable steering wheels, intuitive dashboard button placement and automatic power steering make it easier to operate the vehicle, reducing physical stress and improving ergonomics. Ergonomic solutions in the driver's compartment, as well as a properly designed vehicle interior, can significantly improve the health and

performance of drivers, especially in occupations that require long time behind the wheel (Johnson, Withey, 2020).

Vehicle information and multimedia systems play a key role in enhancing the comfort and safety of drivers and passengers. These advanced systems integrate navigation, communication and entertainment functions, allowing easy access to information about traffic, weather conditions and local points of interest. User interfaces are often designed with intuitiveness in mind, allowing drivers to use system functions without taking their eyes off the road. In addition, many modern systems are compatible with smartphones, making it possible to integrate mobile apps and use social media while driving. Well-designed information systems can increase travel efficiency and reduce driver stress while improving the overall driving experience (Lajunen, Summala, 2021).

The introduction of new technologies into driver work has a significant impact on safety and ergonomics. Assistive systems and innovative ergonomic solutions are helping to reduce accident risks and improve working comfort. As technology continues to evolve, more innovations can be expected to further raise safety and ergonomic standards in the transportation industry. Supporting drivers by investing in modern technology should be a priority for employers and policymakers to ensure a safe and comfortable work environment.

5. Conclusions

Ensuring proper ergonomics and safety for professional drivers is not only a legal and ethical requirement but also a strategic factor influencing competitiveness in the transport sector. With the growing intensity of global transport flows and rising customer expectations regarding timeliness and service reliability, companies are increasingly recognizing that comfortable and safe working conditions directly affect productivity, employee retention and operational performance.

Ergonomic vehicle design, including adjustable seating, optimized control placement and reduced musculoskeletal strain, contributes to improved driver concentration and reduced fatigue. Likewise, advanced technological systems such as adaptive cruise control, blind spot monitoring, lane-keeping assist and automatic emergency braking significantly support the driver by mitigating the risks associated with human error, stress and monotony. Their integration into fleet operations results in fewer accidents, shorter downtime and lower maintenance and insurance costs, all of which reinforce a company's competitive position.

Compliance with regulated working and rest times, a healthy cab environment, and preventive health programs are additional elements helping maintain drivers' physical and mental fitness. In a labour market characterized by a shortage of qualified drivers, organizations

that care for the well-being of their employees become more attractive employers — strengthening employer branding and improving workforce stability.

Future research should focus on empirical verification of the proposed relationships through quantitative studies conducted in transport enterprises, allowing the measurement of the economic impact of ergonomic and safety improvements.

In summary, investment in ergonomics and safety technologies should be perceived as an investment in long-term competitive advantage. Safer and more efficient drivers contribute to higher-quality transport services, reduced operational risk and increased customer trust. Future research should focus on the optimisation of technological implementation, as well as on assessing the direct economic benefits and sustainability impacts that improved driver safety and ergonomics can bring to the transport industry.

References

1. Adamski, K. (2021). Ergonomia i bezpieczeństwo pracy w transporcie drogowym. *Transport XXI wieku, 9(3),* 20-35.
2. Åkerstedt, T., Peters, B., Anund, A., Kecklund, G. (2000). Impaired alertness and performance driving home from the night shift: a driving simulator study. *Journal of Sleep Research, 9(4)*, 355-360, https://doi.org/10.1046/j.1365-2869.2000.00205.x
3. Anderson, R.W., Doecke, S.D. (2018). Effectiveness of Autonomous Emergency Braking in Preventing Crashes. *Journal of Road Safety, 29(2),* 45-58.
4. Bärgman, J. (2020). Evaluating Lane Keeping Assist Systems for Road Safety: A Systematic Review. *Accident Analysis & Prevention, 135*, 105-119.
5. Bartuzi, P. (2012). *Ergonomiap racy kierowcy pojazdu ciężkiego*. Warszawa: CIOP-PIB, 25-27.
6. Broughton, J., Baughan, C., Pearce, L., Smith, L., Buckle, G. (2007). *Work-related road accidents*. TRL Limited, 157-160.
7. Davies, M. (2020). Advanced Driver Assistance Systems (ADAS) and Their Role in Road Safety. *Journal of Transportation Safety, 12(3),* 215-230.
8. Dowling, R. (2019). The Role of Mobile Apps in Modern Transport Systems: Enhancing Driver Performance and Road Safety. *International Journal of Automotive Technology, 36(4),* 98-110.
9. Dz.U. 2004, Nr 92, poz. 879.
10. Evans, L. (2004). *Traffic safety*. Michigan: Science Serving Society of Bloomfield Hills, 67-70.
11. Flannagan, M.J., Sivak, M. (2018). Head-Up Displays and Their Impact on Driver Performance and Road Safety. *Journal of Transport Safety, 54(3),* 120-130.

12. Griffin, M.J. (1990). *Handbook of human vibration*. Academic Press, 234-235.
13. https://drabpol.pl/pl/automotive/ergonomia-miejsca-pracy-kierowcy/, 11.08.2024.
14. Johnson, A., Miller, R., Thompson, S. (2011). Driver fatigue and road safety: Understanding the causes and effects. *Journal of Transportation Safety, 28(3),* 145-159.
15. Johnson, M., Withey, T. (2020). Ergonomic Design in Vehicle Interiors: Impacts on Driver Comfort and Safety. *Journal of Automotive Ergonomics, 14(2),* 89-101.
16. Kowalski, B. (2020). Wpływ układu pedałów i kierownicy na zmęczenie kierowców. *Transport i Logistyka, 10(2),* 56-57.
17. Kowalski, J. (2020). Wpływ oświetlenia kabiny na ergonomię pracy kierowcy. *Przegląd Transportowy, 8(2),* 45-52.
18. Lajunen, T., Summala, H. (2021). The Impact of In-Vehicle Information Systems on Driver Behavior: A Review of the Literature. *Transportation Research Part F: Traffic Psychology and Behaviour, 78*, 100-114.
19. Muir, H. (2019). Automated Driving and Adaptive Cruise Control: Safety and Efficiency Impacts. *Transportation Research Journal, 45(4),* 112-125.
20. Nowak, M. (2021). Analiza wpływu wibracji na zdrowie kierowców. *Przegląd Techniczny, 15,* 89-92.
21. Schmidt, P., Heuer, H. (2019). Driver Fatigue Detection Systems: Effectiveness in Reducing Road Accidents. *Journal of Road Safety Research, 32(1),* 57-66.
22. Siedlecka, J. (2006). Wybrane problemy zdrowotne związane z pracą kierowców pojazdów komunikacji miejskiej. *Medycyna Pracy, 1,* 14.
23. Smith, J. (2019). Advanced Parking Assistance Systems and Their Impact on Urban Traffic Safety. *Journal of Urban Transportation, 33(4),* 67-79.
24. Starkowski, D., Bieńczak, K., Zwierzycki, W. (2007). Samochodowy transport krajowy i międzynarodowy: Środowisko pracy kierowcy. *Logistyka, T.3.* Poznań, 23-25, 31-35.
25. Szulc, A. (2022). Ergonomia pracy kierowcy samochodu ciężarowego. *Journal of Ergonomics, 12(4),* 34-45.
26. Vilalobos, J. (2010). Safety and security in road freight operations. *Facilitation of Transport and Trade in Latin America and the Caribbean, vol. 285, no. 5*, 5-7.
27. Zając, P. (2023). Nowoczesne systemy wspomagania kierowcy. *Bezpieczeństwo na Drodze, 5*, 112-123.