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SECURITY ASPECTS OF THE CONSTRUCTION OF THE HIGH-SPEED RAILWAY BUDAPEST–BELGRADE – PIRAEUS IN GLOBAL SUPPLY CHAINS

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Review paper

Abstract: *The construction of the high-speed railway Budapest–Belgrade–Piraeus represents a significant infrastructure project with numerous economic, strategic, and security aspects. This railway, which passes through the territory of the Republic of Serbia, connects key European and Asian ports and is intended to enable faster and more efficient transportation of goods, thereby contributing to the improvement of global supply chains. However, along with these advantages, there are also security risks that may impact the stability and security of transportation. This paper analyzes a range of security aspects, including infrastructure security, protection against terrorist threats, cybersecurity, and risks associated with political and economic instabilities in the region. It also discusses measures that can be taken to mitigate these risks, such as enhancing security measures, international cooperation, and investments in monitoring and control technologies. The aim of this paper is to provide an overview of security risks and potential solutions in the context of the construction of the Budapest–Belgrade–Piraeus high-speed railway as a key part of global supply chains in Southeastern Europe. Special emphasis is placed on the importance of an integrated security approach, involving all relevant actors, from state institutions to the private sector, to ensure the safe and efficient transportation of goods through this important corridor that passes through the territory of the Republic of Serbia.*

Key words: *Security, Republic of Serbia, Railway, Global supply chains*

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1. INTRODUCTION

The construction of the high-speed railway Budapest–Belgrade–Piraeus represents one of the most important infrastructure projects in the region, with significant implications for global supply chains. This railway line connects Central Europe with the Mediterranean port of Piraeus, enabling faster and more efficient transportation of goods and passengers between these key points. As part of China's "Belt and Road" initiative, the railway holds strategic importance not only for the countries it traverses but also for the broader region and global trade flows and supply chains.

The security aspects of this project are crucial, both for the construction process itself and for its future operation. Given the complexity and diversity of the terrain, as well as potential geopolitical and socio-economic challenges, careful planning and implementation of security measures are necessary. This paper will analyze the key security aspects of the construction of the Budapest–Belgrade–Piraeus high-speed railway, with a particular focus on the existing railway infrastructure in the Republic of Serbia and its significance in the global supply chains that pass through this territory.

The Republic of Serbia occupies an important geostrategic position, serving as a key transit corridor between Europe and Asia. The existing railway infrastructure in Serbia, despite its significant potential, faces numerous challenges, including obsolescence, insufficient capacity, and the need for modernization. Understanding the current state of the infrastructure is essential for assessing the possibilities and limitations within the new project.

Global supply chains increasingly depend on efficient and reliable transport routes, and the construction of the Budapest–Belgrade–Piraeus high-speed railway can significantly contribute to their optimization. This paper will examine global trends in transportation and logistics, as well as the specific requirements and expectations for the new railway. Special attention will be paid to security risks, such as sustainable development, natural disasters, and cybersecurity issues in the modern context.

The aim of this paper is to provide a comprehensive overview of the security aspects of the construction and operation of the Budapest–Belgrade–Piraeus high-speed railway, analyzing the current situation and proposing appropriate measures to enhance security, so that this project can successfully contribute to global supply chains and the economic stability of the region and the Republic of Serbia.

2. CHARACTERISTICS OF THE RAILWAY INFRASTRUCTURE OF THE REPUBLIC OF SERBIA IN GLOBAL SUPPLY CHAINS

The railway infrastructure of the Republic of Serbia is over a century old, with more than 55% of all tracks built in the 19th century. The average age of the tracks is approximately 48 years. The total length of the railway lines in the Republic of Serbia is 3,739 km, of which 3,444 km are single-track and 295 km are double-track lines.

The most important railway lines in Europe pass through the territory of the Republic of Serbia: E 66 Belgrade–Vrsac (Stamora Moravita), E 70 (Tovarnik) Sid–Belgrade–Nis–Dimitrovgrad (Dragoman), E 79 Belgrade–Vrbnica (Bar), as well as E 85 (Kelebija) Subotica–Belgrade–Nis–Presevo (Tabanovci), which also includes the Lapovo–Kragujevac–Kraljevo–Pristina–Đeneral Jankovic (Volkovo) line.

Railway lines of importance for international combined and intermodal transport on the territory of the Republic of Serbia, according to their designations, are: C-E 85 (Kelebija) Subotica–Belgrade–Nis (Kraljevo)–Presevo (Tabanovci), C-E 70 (Tovarnik) Sid–Belgrade–Nis–Dimitrovgrad (Dragoman).

The high-performance railway network in Southeastern Europe includes 16 international railway axes, five of which contain lines within the territory of the Republic of Serbia. These axes are:

- Athens–Thessaloniki–Skopje–Nis–Belgrade–Zagreb–Ljubljana–Salzburg;
- Budapest–Subotica–Belgrade–Dimitrovgrad–Sofia–Plovdiv–Istanbul–Ankara–Adana/Sivas;
- Bar–Podgorica–Vrbnica–Belgrade;
- Bucharest–Craiova–Timişoara/Arad–Belgrade;
- Zagreb–Dobrljin–Banja Luka–Doboj–Tuzla–Belgrade. (Odluka o nacionalnom programu javne zeleznicke infrastrukture za period od 2017. do 2021. godine ("Sl. glasnik RS", br. 53/2017)

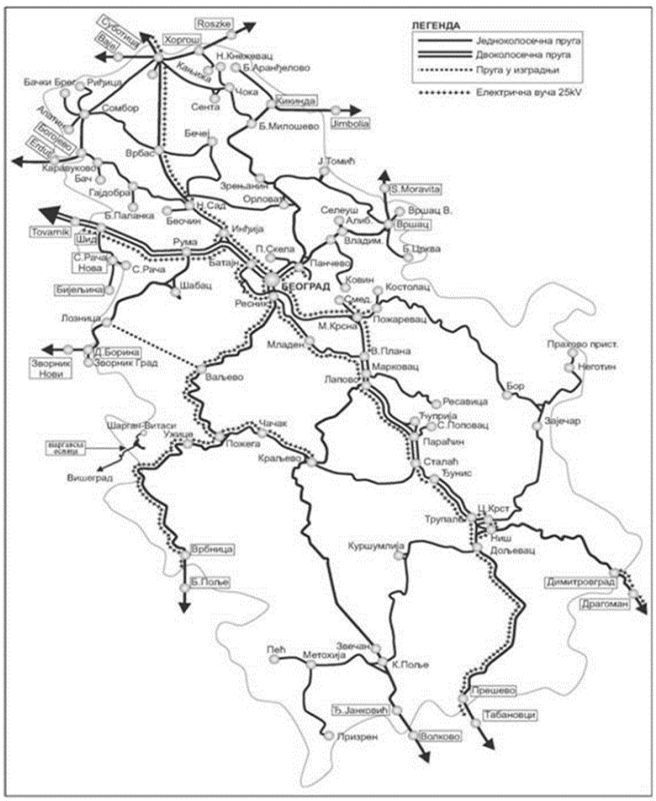

Figure 1. Railway Network of the Republic of Serbia
Source: Uredba o kategorizaciji zeleznickih pruga ("Sluzbeni glasnik RS", broj 115/13)

In global supply chains, the existing railway infrastructure of the Republic of Serbia requires balanced and even development with the aim of creating a system in which railway traffic on the lines of the Republic of Serbia operates in a safe, efficient, and reliable manner. The construction, reconstruction, and modernization of infrastructure capacities that are in function of realizing the basic principles of sustainable transport development should contribute to achieving the following goals:

- Improving traffic security and the reliability of infrastructure elements and schedules;
- Enhancing the level and quality of railway infrastructure services;
- Applying European railway interoperability standards;
- Increasing the accessibility of railway infrastructure;
- Protecting the environment by adapting development and maintaining infrastructure elements in accordance with ecological requirements;
- Enhancing energy efficiency;
- Contributing to regional development through the railway. (Odluka o nacionalnom programu javne zeleznicke infrastrukture za period od 2017. do 2021. godine ("Sl. glasnik RS", br. 53/2017)

The development of railway transport in the Republic of Serbia in line with these principles contributes to reducing the burden on road traffic, decreasing environmental pollution, lowering noise levels, saving energy, reducing road maintenance costs, decreasing depreciation costs, and reducing time and transport costs. The construction and reconstruction of railway infrastructure in the Republic of Serbia would also improve the quality of life and overall economic development by enabling mobility and accessibility, balanced regional development, strengthening territorial integrity, and preserving the state's unity. (http://demo.paragraf.rs/demo/combined/Old/t/t2017_05/t05_0426.htm) To achieve these goals, the railway transport system needs to reach the highest possible level of development.

3. THE BUDAPEST–BELGRADE–PIRAEUS RAILWAY WITHIN THE "BELT AND ROAD INITIATIVE"

The Belt and Road Initiative (BRI) is a Chinese endeavor designed to revive the significance once held by the ancient Silk Road. In 2015, the Chinese government issued a document titled "Vision and Actions on Jointly Building the Silk Road Economic Belt and 21st-Century Maritime Silk Road," which outlined the framework for key areas of cooperation within the BRI. The BRI encompasses the land-based Silk Road Economic Belt and the Maritime Silk Road, extending across Eurasia, East Africa, and even reaching South America. The BRI covers one-third of global trade and GDP and involves over 60% of the world's population. (Stojanovic et.al, 2021) China has signed cooperation agreements with nearly 150 countries in the implementation of this global project.

The railway infrastructure of the Republic of Serbia is part of the BRI through the railway sections of the Pan-European Corridor 10 and the maritime route, which leads from the port of Piraeus to the countries of Southeastern, Central, and Western Europe, forming an important part of the South Asian-European railway union that is expected to connect Asian railways with the European Single Railway. The Republic of Serbia is also part of the BRI through a significant section of the navigable Danube River, which enables it to serve as a multimodal link between the European railway and the network of European waterways. All these important corridors passing through the Republic of Serbia have created the need for the construction and modernization of the existing railway network. Within the framework of the BRI, the Republic of Serbia is investing in the modernization of its railway infrastructure in several ways:

- High-Speed Railway Belgrade-Budapest: This project aims to reduce travel time and improve freight transport capacity between the two capitals. Modernization includes upgrading tracks, signaling systems, and stations.

- Electrification and Double-Tracking: Efforts are underway to electrify additional sections of the railway network and add double tracks to increase capacity and efficiency.

- Intermodal Terminals: The development of intermodal terminals, such as the terminal in Belgrade, will facilitate the transfer between different modes of transport (rail, road, and water).

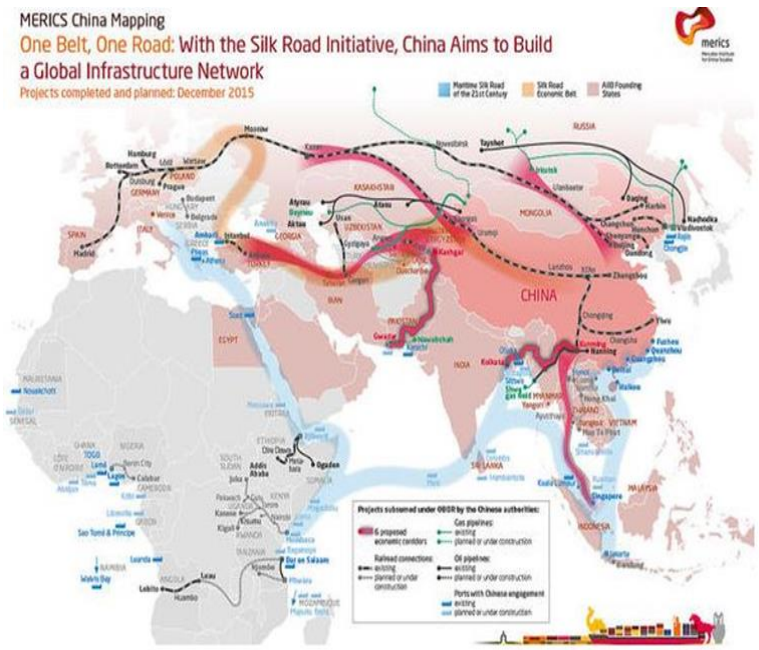

Figure 2. BRI
Source: https://www.cidob.org/en/publication/one-belt-one-road-chinese-dream-and-its-impact-europe

The construction of the high-speed railway Budapest–Belgrade–Piraeus is one of the most significant aspects of the BRI project in Europe. Construction work on this line has intensified in recent years, with the first section of the Belgrade–Subotica railway completed, the Belgrade–Nis section under construction, while the greatest challenge involves the absence of railway infrastructure between Nis and North Macedonia, which represents the most demanding part of this project.

The construction of the high-speed railway Budapest–Belgrade, financed through the Chinese Belt and Road Initiative, has continued on the Hungarian side with the goal of completion by 2025. The section of the railway from Belgrade to Subotica has been completed, allowing trains to travel safely at speeds of up to 200 km/h, in accordance with EU security standards under the European Train Control System. The Budapest–Belgrade railway is expected to become a key channel for freight traffic in Europe, integrating with the port of Piraeus to enhance global supply chains.

Figure 3. High-Speed Railway Belgrade–Budapest
Source: https://www.zeleznicesrbije.com/brza-pruga-beograd-budimpesta-strateski-najvazniji-projekat-i-simbol-prijateljstva-srbije-i-kine/

The Republic of Serbia holds special significance within this project as it is located at the intersection of important land and river routes that facilitate good east-west and north-south communications. Additionally, Serbia is in close proximity to the European Union, but as a non-member, it has the ability to independently regulate its relationships within the BRI initiative.

Participating in a major endeavor like the BRI offers numerous benefits for the Republic of Serbia, but it also brings many challenges. Among these, security aspects of the project are particularly significant.

4. SECURITY ASPECTS OF THE CONSTRUCTION OF THE BUDAPEST–BELGRADE–PIRAEUS HIGH-SPEED RAILWAY

As a crucial link connecting the Mediterranean port of Piraeus in Greece with the heart of Europe, the Budapest–Belgrade–Piraeus railway passes through the Republic of Serbia, positioning it at a strategic crossroads of major supply chains and having the potential to transform global supply chains through Serbia. However, major infrastructure projects come with significant security challenges related to transport security, geopolitical aspects, risk assessments in various areas, sustainable construction, digital transformation, and the security of the railway line itself. This project has the potential to enhance transport efficiency, reducing travel time between Central Europe and the Mediterranean port of Piraeus, which will positively impact global trade and logistics. Additionally, the construction of the railway could significantly contribute to the economic development of the Republic of Serbia by creating new jobs, increasing trade exchange, and stimulating investment in supporting infrastructure. The ecological aspects of the project also bring benefits, as rail transport, compared to road transport, reduces emissions of harmful gases, contributing to pollution reduction and climate change mitigation.

Rail transport presents a significant challenge when it comes to its security. Railway lines are particularly difficult to secure due to their high accessibility and wide extent, which conflicts with the need for security and mobility. While an open and accessible system allows for efficient transport of people and goods, this openness also exposes it to numerous risks, especially from terrorist attacks. Terrorist attacks in Munich (2016), Saint Petersburg (2017), and Paris (2015) indicate that railway transport systems are very challenging to adequately protect to withstand crisis situations and respond quickly to them. Moreover, such mass transport systems are attractive targets for terrorists due to the potentially far-reaching impacts of an attack. This implies that a comprehensive application of security measures is needed. On the other hand, implementing a large number of security measures can degrade the performance of the transport system. Therefore, institutions worldwide are increasingly sensitive to the growing need for the security of so-called Critical Infrastructure (CI), such as railway transport systems, and are adopting a range of regulatory measures aimed at finding ways to reduce risks and best practices that are technologically advanced, feasible, and reliable, to enhance the protection of infrastructure without affecting relevant transport system performance (Di Febbraro et. al, 2014).

The construction of the railway line should ensure safe transport of goods, which involves effective security measures, particularly in the field of cybersecurity, which is indispensable in the digital transformation of railway transport. Modern railway infrastructure uses advanced technologies for traffic management and communication, making it vulnerable to cyberattacks that could compromise the functionality and security of the system.

Geopolitical and political risks also play a significant role, considering that the railway passes through multiple countries, and political instability or conflicts may affect the continuity of construction and operation of the railway line. The construction of this railway line will further strengthen Serbia's strategic position, increasing its geopolitical stability and influence in the region, including cooperation with international security agencies to ensure the security of the railway line.

Ecological security of the railway line is reflected in the use of sustainable and environmentally friendly materials in construction and the inclusion of energy-efficient technologies to minimize environmental impact. Additionally, the line must be constructed to withstand natural disasters and other crisis situations, ensuring continuity of transport.

Security during and after the construction of the Budapest–Belgrade–Piraeus railway should include (Figure 4):

- Passenger, worker, and public security,
- Infrastructure and service security,
- Physical and technical protection measures,
- Crisis management.

The Budapest–Belgrade–Pireus high-speed railway is a key transport route within the Belt and Road Initiative (BRI) in Europe and a significant line for economic development and growth in the Republic of Serbia. The main aspects of constructing this line include security, reliability, punctuality, costs, travel time, and quality. The primary security challenges include (Hessami G. A., 2015): **Anti-social behavior and vandalism; cybersecurity; theft, extortion, and fraud; sabotage and terrorism and CBRN attacks (chemical, biological, radiological, and nuclear threats).**

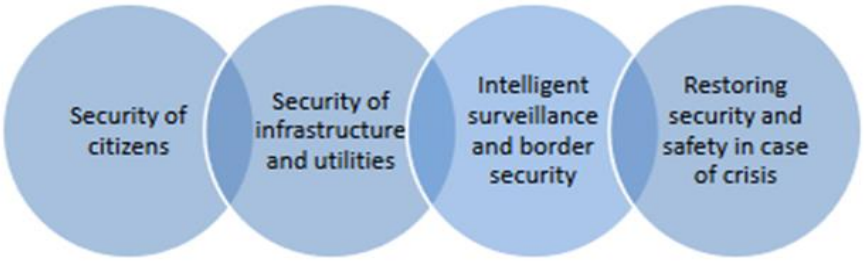

Figure 4. Railway Infrastructure Security
Source: Boudi et.al, 2016.

Effective assessment, control, and mitigation of security risks require a systematic and objective approach to understanding and proactively managing response processes. Traditionally, security focus has been on physical infrastructure and systems, but now it has expanded to include cyber systems due to the extensive use of modern communication and computing technologies in railways. A systematic approach to security along the entire railway line must address both physical and cyber threats and vulnerabilities to ensure adequate protection.

The construction of the Budapest–Belgrade–Pireus high-speed railway must be accompanied by increased investments in infrastructure, technology development, and growing awareness of carbon footprint and the impact of transport on global warming. Given the very favorable position of this railway line in terms of sustainability, energy efficiency, carbon footprint, convenience, and increasing speeds, it is essential to keep pace with technological advancements, increasing automation, land speeds, and high levels of security. Appropriate measures must be implemented to protect complex communication, monitoring, and control systems, consisting of advanced hardware, highly complex software, and vast amounts of data. The new railway line also entails integrating interoperable systems from various sources into a secure operational railway system and incorporating a security assessment and management framework to improve efficiency, effectiveness, and cost reduction include (Hessami G. A., 2015).

The construction of the Budapest–Belgrade–Pireus high-speed railway represents a crucial step toward enhancing global supply chains through the Republic of Serbia. While there are significant benefits in terms of economic gains and increased transport efficiency, careful management of security risks is essential for the success of this important project. With appropriate security measures and international cooperation, this project could lay the foundation for future development in the Republic of Serbia and the region.

5. CONCLUSION

In today's globalized world, the security in the construction and operational functioning of the Budapest–Belgrade–Piraeus high-speed railway line is a crucial element in maintaining the efficiency of global supply chains. This railway route, as a vital link between key economic centers, demands a high level of security. Security aspects should be integrated into all stages of planning and design, including risk analysis and the implementation of appropriate protective measures. This involves using advanced technologies and materials that can withstand potential threats and ensure the long-term resilience of the railway. During construction, stringent quality control and security measures are essential to prevent physical and operational failures. Monitoring and oversight of contractors also play a key role in ensuring compliance with security standards.

Upon commissioning the railway line, continuous monitoring and evaluation of security procedures and infrastructure are necessary. This includes the use of advanced threat detection and monitoring systems, as well as implementing procedures for rapid response in case of incidents. With increasing automation and integration of digital systems into railway operations, cybersecurity becomes a critical point. Protecting networks and communication channels from potential cyberattacks should be a priority, as well as regularly updating security systems and protocols.

Training for the staff managing and maintaining the railway is crucial for proper procedure application and quick response to potential threats. Investing in training and drills can significantly contribute to overall security. Effective collaboration with security agencies, as well as local authorities and emergency organizations, can enhance coordination during crises and ensure a quicker and more efficient response.

The security aspects of the Budapest–Belgrade–Piraeus high-speed railway line are a key component in ensuring its successful operation within global supply chains. An approach that combines proactive planning, continuous monitoring, cybersecurity, and staff training is essential for minimizing risks and ensuring the long-term resilience and efficiency of the railway infrastructure.

REFERENCES

Boudi Z., Koursi M., Ghazel M. (2016). The New Challenges of Rail Security, *Journal of Traffic and Logistics Engineering Vol. 4, No. 1,* DOI: 10.18178/jtle.4.1.56-60

Di Febbraro A., Papa F., Sacco N. (2014). *Security of Railway Infrastructures, Crisis Management: Concepts, Methodologies, Tools, and Applications*, IGI Global, DOI: 10.4018/978-1-4666-4707-7.ch027

Hessami G. A., (2015). *Railway Research - Selected Topics on Development, Safety and Technology*, Intechopen, Doi10.5772/59893

Odluka o nacionalnom programu javne zeleznicke infrastrukture za period od 2017. do 2021. godine ("Sl. glasnik RS", br. 53/2017)

Stojanovic-Visic, Lj.,Jelisavac Trosic, S., Simic M. (2021). Development of The belt and road initiative in Serbia, *Ekonomika preduzeca 2023, vol. 71, br. 3-4, str. 230-242*, DOI: 10.5937/EKOPRE2303230S

Uredba o kategorizaciji zeleznickih pruga ("Sluzbeni glasnik RS", broj 115/13)

http://demo.paragraf.rs/demo/combined/Old/t/t2017_05/t05_0426.htm

https://www.cidob.org/en/publication/one-belt-one-road-chinese-dream-and-its-impact-europe

https://www.zeleznicesrbije.com/brza-pruga-beograd-budimpesta-strateski-najvazniji-projekat-i-simbol-prijateljstva-srbije-i-kine/