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BEZBEDNOST PUTNIKA NA PERONIMA U ŽELEZNIČKIM STANICAMA I STAJALIŠTIMA

SAFETY OF PASSENGERS ON PLATFORMS IN RAILWAY STATIONS AND STOPS

UDK: 656.2+625.1/.5

REZIME:

Savremena železnička infrastruktura treba da omogući konkurentnost i održivost putničkog saobraćaja. Osnovni uslov je da se obezbedi pristupačnost železničke infrastrukture i vozila za sve kategorije putnika. U radu se predstavljaju tehničke specifikacije interoperabilnosti koje treba da zadovolje peroni u novim i rekonstruisanim železničkim stanicama i stajalištima. Razmatra se bezbednost putnika koji se kreću i zadržavaju na peronu. Definiše se pojam bezbedne i opasne zone na peronu. Analizira se uticaj položaja stepeništa i lifta na potrebnu širinu perona. Date su smernice za određivanje sadržaja i minimalne širine bezbedne zone perona u novim i rekonstruisanim stanicama. U razmatranja su uključeni zahtevi bezbednosti prema potrebama svih putnika, uključujući invalidna lica u kolicima i lica sa privremeno i trajno ograničenom mobilnošću. Prikazane smernice imaju primenu u projektovanju novih stanica i rekonstrukcij.
Ključne reči: pristupačnost, interoperabilnost, lica sa ograničenom pokretljivošću

SUMMARY:

Modern railway infrastructure should provide the competitiveness and sustainability of passenger traffic. The essential requirement is to ensure the accessibility of railway infrastructure and vehicles for all categories of passengers. The paper presents the technical specifications of interoperability that have to be met by platforms in new and reconstructed railway stations and stops. The safety of passengers moving and staying on the platform is considered. The term safe and dangerous zone on the platform is defined. The influence of the staircase and elevator position on the required width of the platform is analyzed. Guidelines are given for determining the content and minimum width of the platform safe zone in new and reconstructed stations. Safety requirements for all passengers, including disabled persons in wheelchairs and persons with temporarily and permanently reduced mobility, are included in the considerations. The presented guidelines are applicable in the design of new stations and reconstruction.
Key words: accessibility, interoperability, persons with reduced mobility

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1. INTRODUCTION

Until the beginning of the 21st century, railway transport systems were developed independently in the frame of state borders, which significantly reduced their competitiveness in overall traffic transport. The modern railway transport system has to be a part of the transport system and a sustainable form from economic, social and ecological aspects. Furthermore, the European Union defined a common transportation policy in two White Papers (European Commission, 2001, 2011). This policy is based on regulated competition and connecting various modes of transportation, the reduction of congestion points in traffic systems and multi-modal transportation. The basis for the application of modern transport policy is the interoperability of the railway system at the level of the European railway network and beyond.

In this paper, the safety of passengers on platforms is considered. The consideration was based on the interoperability of the railway system and the transport chain, which connects different types of traffic, transporting passengers "door to door" in a simple, safe, competitive and comfortable way (Figure 1, left).

Based on the requirements defined in the technical specifications of interoperability (Commission regulation, 2014a, 2014b), the considered safety has to include all categories of passengers (Figure 1, right) who are offered the use of the railway infrastructure under equal conditions, without discrimination and with the protection of their dignity. In other words, the level of comfort and safety must be adapted to the needs of passengers with the greatest mobility reductions, with the possibility that all passengers can use the same infrastructure and vehicles.

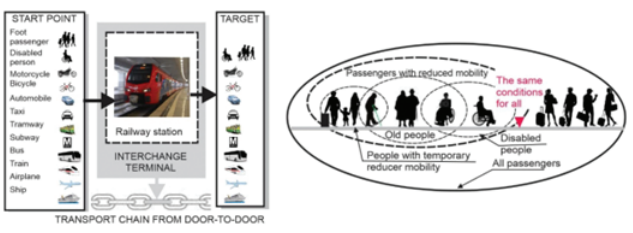

Figure 1. Integration of the railway station in the transport chain from door-to-door (left) and passenger categories according to mobility and disability (right)

The Serbian railways are an important part of the European railway network. Several publications have investigated the accessibility of the railway infrastructure, including:

- the application of accessibility standards in the Belgrade railway junction (Popović et al, 2009),
- guidelines and recommendations for modern passenger terminals on the European railway network (Popović et al, 2012),
- general guidelines for ensuring the competitiveness of railway passenger traffic with a focus on sustainability and accessibility (Popović and Lazarević, 2013),
- and analysis of legal framework and examples of practical application of accessibility standards in Czech Republic and the Republic of Serbia (Popović et al, 2018).

For the safety of all passengers on the platform, the platform has to be accessible without barriers, covered, well-lit, and slip-resistant. Moreover, its length and width are determined according to the needs and requirements of passengers and vehicles.

This paper considers the theoretical principle of human scale, as defined by Le Corbusier, which pertains to the design and organization of spaces to provide comfort and practicality for people. This principle is amended by inclusive design that benefits not only individuals with disabilities but everyone.

The considerations in this paper should guide the design of middle and side platforms according to the requirements of safe containment and movement of passengers. The paper specifies the safe and dangerous zone on the platform and gives guidelines for their dimensioning.

2. PLATFORM HEIGHT IN INTEROPERABLE RAILWAY STATIONS AND STOPS

The height of the platform is a significant safety factor for boarding and disembarking of passengers in the doorway area. Furthermore, the height of the platform has to be aligned with the requirements of the rolling stock and vice versa. Figure 2 shows the situation in America, where there are no interoperability standards for harmonization of the technical performance of vehicles and infrastructure respecting the needs of all categories of passengers.

To overcome such situations on European main railways, the technical specifications of interoperability PRM TSI (Commission regulation, 2014b) specify two platform heights of 55 cm and 76 cm regarding the top of the rail. It should be noted, full compliance with (Commission regulation, 2014b) is

mandatory for projects which receive the Union's financial support for the renewal or upgrading of existing rolling stock or parts thereof or the renewal or upgrading of existing infrastructure, in particular a station or components thereof and platforms or components thereof.

Figure 2. Inconsistency of the platform height with the entrance to the vehicle (https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/businessplanning /Amtrak-Five-Year-Service-Plans-FY18-FY23.pdf, 28.08.2023.)

It is recommended that the Infrastructure Manager adjusts the platform heights to match the rolling stock and considers this during the tender process for the eventual purchase of new vehicles on the railway network under their management. Figure 3 shows two types of double-decker trains with the door position above and between the bogies. The Railways of Serbia opted for a platform height of 550 mm and therefore acquired double-decker trains with doors placed between the bogies (Figure 3, right).

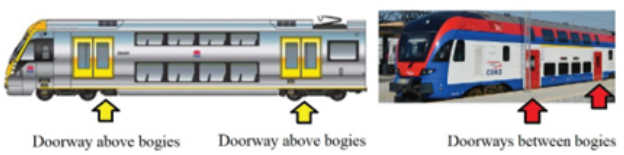

Figure 3. Doorway position at passenger double-decker train

Level access from a platform to the doorway of rolling stock is preferable. This access meets the following requirements: (a) the gap between the door sill of that doorway (or of the extended bridging plate of that doorway) and the platform does not exceed 75 mm measured horizontally and 50 mm measured vertically, and (b) the rolling stock has no internal step between the door sill and the vestibule.

3. SAFETY AND DANGER ZONES ON THE PLATFORM

The width of the platform should provide safety for all persons (passengers, officials and other persons) who stand, sit or move on the platform when trains are passing or arriving (Figure 4). The width of the platform includes the safety and danger zone. Following (Commission regulation, 2014b), the danger zone at the trackside edge of the platform is defined as the area where passengers are not allowed to stand or move when trains are passing or arriving. The width of the danger zone primarily depends on the speed of the train moving along the track.

Figure 4. Safety and danger zone (left) and passenger safety at the borderline

The border between these two zones is most often visually marked with a contrasting borderline. The minimum width of the borderline is 10 cm (Commission regulation, 2014b). This warning line is a part of the safety zone. However, the person who finds himself on the borderline has to be safe. The contact of luggage or loose clothing with the vehicle must not be allowed. Figure 4 shows an additional extension for luggage 23 cm, which for safety reasons is increased by min. 10 cm. Therefore, the width of the danger zone should be increased by min. 33 cm to avoid contact with a passenger moving along the borderline (Table 1).

Table 1. Recommended minimum width of the danger zone

Maximum speed (km/h)	Minimum width of the danger zone (cm)
90	83
120	93
140	103

There is a possibility of placing a physical barrier that limits the safety zone. Installing high or low barriers with automatic door opening when the train stops is the safest, but also the most expensive solution. Therefore, its application is limited. It is used most often on frequent platforms of metro stations.

The platform floor has to be sufficiently resistant to slipping and help the passengers understand how to use the platform. Furthermore, it has to include guide paths for visually impaired persons (Figure 4).

The width of the platform can be variable over the entire length of the platform. The minimum width of the platform (without obstacles) is defined by (Commission regulation, 2014b) and encompasses the width of the danger area plus the width of two opposing freeways of 80 cm (160 cm). This dimension may taper to 90 cm at the platform ends.

The safe zone includes space for movement and seating (if provided) for passengers on the platform (Figure 5). At large passenger stations, passengers are not allowed to stay longer on the platforms, so seating at the terminal and entry of passengers onto the platform is organized immediately before the train enters the station. In this way, the required width of the platform is significantly reduced (Figure 6). A staircase, ramps and an elevator to access the platform can be found in the safe zone.

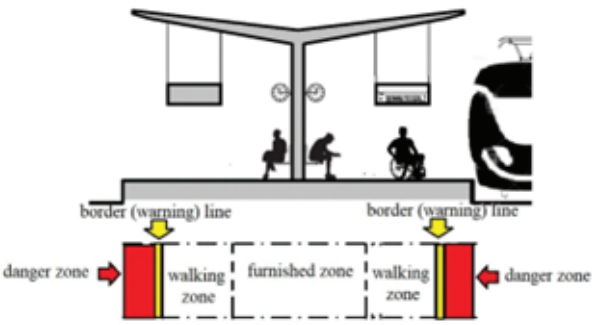

Figure 5. Zones on the middle platform

Figure 6. Terminal (left), access to the platform (middle and right) at Beijing railway station

The width of the staircase should be at least 2 m to allow two-way movement of passengers with luggage. For all passengers who are unable to use the stairs, it is necessary to provide access to the platform by elevator.

The dimensions of the elevator are defined based on the requirement to provide access to the platforms for people in wheelchairs (Figure 7). Lifts should be preferred to long ramps to shorten the time needed (Office for Official Publications of the European Communities, 2004).

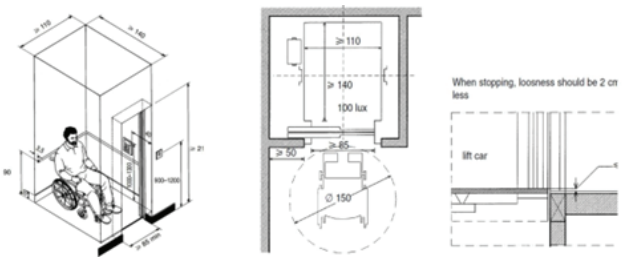

Figure 7. Minimum dimensions of the elevator for disabled persons by [COST Action 335]

Following (Commission regulation, 2014b) and from the aspect of passenger safety, the platform length shall be sufficient to accommodate the longest passenger train intended to stop at the platform in normal service in an interoperable railway station.

4. PLATFORM WIDTH

A centrally placed staircase (Figure 8, left), a seating area or an elevator on the platform represents a physical obstacle, which passengers bypass at the risk of being in a danger zone (Figure 8, right). On each platform where passengers are allowed to wait for trains, there shall be a minimum of one area fitted with seating facilities and a space for a wheelchair (Commission regulation, 2014b).

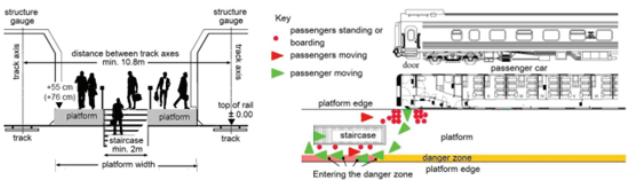

Figure 8. Width of the middle platform with centrally positioned staircase zone (left) and entering the danger zone by passengers (right)

Special attention is paid to the dimensioning of the space between the physical obstacle and the edge of the platform. Given that people in wheelchairs can be found in this zone, a width of at least 2,5 m from the obstacle to the edge of the platform should be applied at new and reconstructed stations (Figure 9) (Office for Official Publications of the European Communities, 2004). Based on the width of the physical obstacle and the required distance to the edge of the platform, the required width of the platform is defined.

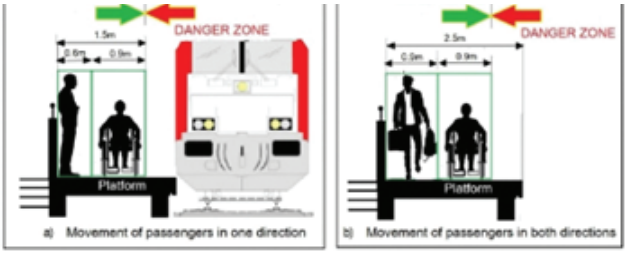

Figure 9. Movement of passengers between the physical obstacle and the edge of the platform

Figure 10 shows the width of the middle platform with a centrally placed staircase and elevator. In the case of reconstruction, when there is not enough space for central installation, the staircase and elevator can be designed at the end of the platform. In that case, the distance between the tracks should not be less than 9 m.

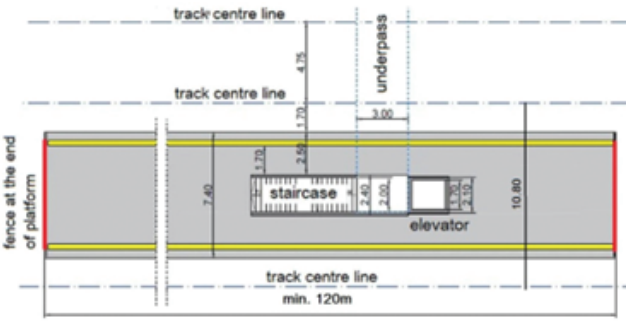

Figure 10. The minimum distance between tracks along the middle platform with the central position of the staircase

The side platforms connected by the underpass/overpass by PRM TSI are most often installed at railway stops. On the platforms, space can be provided for the installation of elevators, if needed. It is important to allow wheelchair users to access the railway infrastructure every 30 km along the railway line. Access for disabled people to the railway stops can be solved by setting up a stair platform lift. The minimum width of the side platforms is 2,5 m, if the staircase is placed at the end or on the side of the platform.

5. CONCLUSION

When designing the new and reconstructing the existing railway stations and stops, it is necessary to determine the required width of the safe zone for the passengers on the platform, taking into account the type and position of the infrastructure for access to the platforms, the permitted staying of passengers on the platform (organization of the seating area) and the necessary space for moving and standing. Access to the infrastructure using elevators for wheelchair users should be provided at a maximum distance of 30 km along the railway line. Also, the width of the danger zone primarily depends on the speed of the train and must be additionally increased to prevent contact with the vehicle when the passenger moves along the borderline. Special attention should be paid to the zones between the physical obstacle (e.g. stair railing) and the edge of the platform in order not to compromise the safety of passengers in wheelchairs.

It should be noted that, despite the evident increase in infrastructure investment, the expected increase in the number of passengers with reduced mobility (PRM) was not observed. To boost the number of PRM on railways, it's crucial to ensure a seamless transport chain from the door to door (i.e. the platform edge/vehicle floor). Additionally, the design guidelines must be regularly updated by incorporating feedback and recommendations from PRM.

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