

# RAILWAY TERMINALS - ACCESSIBILITY FOR PERSONS WITH REDUCED MOBILITY

**Zdenka Popović<sup>1</sup>**, University of Belgrade, Faculty of Civil Engineering, Belgrade, Serbia  
**Ksenija Stevanović**, University of Belgrade, Faculty of Architecture, Belgrade, Serbia  
**Leposava Puzavac**, University of Belgrade, Faculty of Civil Engineering, Belgrade, Serbia

*In the era of integration of all means of transport, there is revived interest in railway transport, which cannot any long exist as a transport system on its own or as an independent part within the growing cities. This renaissance of railway transport, and its integration with other means of transportation, led to a great production of exclusive terminals in recent days. High demands and investments related to these objects gathered together the most prominent architects and constructors, and as result offered a diversity of modern terminals, which integrate the static and dynamic character of the building into a unified whole, and celebrate new technologies and speed. Removal of barriers for customers, abundance of daylight, space filled with views, easy orientation and safe passage through space are some of the most important imperatives for modern railway terminals. Among other things this includes accessibility of railway infrastructure for persons with reduced mobility. The paper explores conditions for implementation of "Technical Specification for Interoperability – People with Reduced Mobility" on Serbian Railways.*

**Key words:** Railway terminals, interoperability, accessibility, people with reduced mobility

## INTRODUCTION

At the beginning of the 21<sup>st</sup> century, the European Union defined a common transport policy in its document entitled EU White Paper "European Transport Policy for 2010: Time to decide". This policy is based on regulated competition and connecting various modes of transport, a reduction of congestion points in traffic systems and it puts users' needs in its focus (European Commission, 2001). Placing users in the focus of transportation policy enables the realization of transport which satisfies human needs.

In the field of designing a railway infrastructure, this approach may resemble, at first sight, a simple application of Le Corbusier's human

measurements principle. However, the realization of railway transport in accordance with human needs represents a contemporary approach in the design of a railway infrastructure, which equally encompasses all categories of passengers. A modern railway infrastructure must provide equal conditions for all age categories of passengers: children, adults and the elderly. It must provide safe and simple use regardless of a potential visual, hearing, stature, mobility or intellectual impairment (European Commission, 2006). With regard to this, an intensive effort has been employed recently aiming to find and apply technical solutions for the equal participation of people with reduced mobility, the blind and the visually impaired, people with hearing impairment and the deaf. The application of such technical solutions should, at the same time, simplify and make the participation in railway transport easier for all the categories of passengers, especially those with heavy or

bulky luggage, people with children, foreigners and others.

According to official statistical data, in Serbia today, there are around 800,000 people (around 10% of the total population) with various levels of impairment and around 16.5% are people above the age of 65. This data is similar to other European statistical data (Economic Commission for Europe, 2005). Specific studies into the determination of the number of railway passengers with reduced mobility have not been performed in Serbia until now. At present, the results of studies carried out in France and Germany are used in Serbia, bearing in mind the similarity of the Serbian statistical data on regarding the number of people with reduced mobility and the elderly to the European data. These studies show that 20-30% of passengers have some kind of reduced mobility. Further increases of in the number of people with reduced mobility can be expected, due to the changes in the age

<sup>1</sup>Bulevar kralja Aleksandra 73, 11000 Belgrade, Serbia  
[zdenka@grf.bg.ac.rs](mailto:zdenka@grf.bg.ac.rs)

structure of the Serbian population, as well as an increased percentage of the population over the age of 65.

The transportation needs of people with reduced mobility are directed to different modes of transportation. In that respect, new services provided by the railway should be defined, in order to be competitive within the transportation market. At present, the competitiveness of the Serbian railway in comparison with the other modes of passenger transport is based mainly on low fares, which in turn determines the structure of passengers, the highest percentage being passengers with low income: secondary school students, university students, low-paid people, pensioners, and people on social welfare. The extension of working life until the age of 65 also affects the number of people with reduced mobility in passenger transport.

By finding suitable technical solutions for vehicles and infrastructure as well as by applying telematics, the Serbian Railway is making an effort to increase the number of users in the regional and long distance passenger railway transport. Essential in to this process is the role of the designer, who needs to provide easy and safe transfer from one mode of transport to another, clear route identification, availability of information, effective ticket service, optimally equipped waiting rooms, parking facilities, toilets, shops, restaurants, and other services within stations, for all categories of passengers.

## LEGAL AND TECHNICAL REGULATIONS IN THE REPUBLIC OF SERBIA

Unobstructed access to rolling stock for all passenger categories represents practical fulfilment of the requirements to facilitate safe access and egress and comfort for people with visual, hearing, stature, mobility or intellectual impairments. This prevents the discrimination of passengers in railway transport. The prevention of passenger discrimination is a part of Charter on Rail Passenger Services which was issued by CER - The Community of European Railway and Infrastructure Companies, and UIC - Union Internationale des Chemins de fer on 22<sup>nd</sup> October 2002.

In the Republic of Serbia, intensive efforts are being made to create legal basis for the introduction of accessibility standards (unlimited access for passengers with special

needs) into all areas of social life. This paper shall be limited to the field of railway transport.

The right of all passengers to unobstructed access to transportation in the Republic of Serbia is stated in the Prevention of Discrimination of People with Disabilities Act which was passed by the National Parliament on 17<sup>th</sup> April 2006 (Prevention of Discrimination of People with Disabilities Act, 2006). The term people with disabilities, according to this Act is used for "people with congenital or acquired physical, sensory, intellectual or emotional disability who, due to social or other impediments, are unable or are partly able to participate in social activities on the same level as other people, regardless of whether they are able to perform the mentioned activities by using technical aids or support services."

Article 13 of the above mentioned Act bans discrimination based on disability with regard to availability of services and accessibility of public buildings and other public areas: parks, squares, streets, pedestrian crossings and other public traffic facilities, etc. Article 27 bans the discrimination due to disability in all types of transport. Act regarding the employment of people with disabilities was passed by the National Parliament on May 2009.

It should be noted that this Act was preceded by Regulations on conditions for planning and the design of buildings for unobstructed access of children, the elderly, the handicapped and the disabled in 1997 (The Official Gazette of Republic of Serbia, issue no, 18/97). These Regulations refer to technical conditions for planning and designing

pavements, footpaths, pedestrian crossings, parking places, public transport stops and access to buildings (pedestrian and wheelchair ramps, steps and staircases, lift platforms).

The Planning and Construction Act passed in 2006 introduced new standards of accessibility in the form of mandatory technical measures, standards and conditions of design, planning and construction, which ensure unobstructed movement for people with disabilities, children and the elderly (Law on Planning and Construction, 2006). Article 42 of this Act introduces a new rule of construction i.e. special conditions which make public areas and public buildings accessible to people with disabilities in keeping with the accessibility standards. This Act prescribes a mandatory fine for the investor or the authorised person (Article 153) if there is no access to the building of public interest available, which is in accordance with accessibility standards.

A strict application of the accessibility standards increases the construction of infrastructure costs by a small fraction: 0% up to 2%. Later alterations demand a much higher investment (according to some research, as high as 30%, depending on the type of building or the type of alteration). Therefore, a timely application of accessibility standards is not only a humane and a legal obligation but it is also a profitable investment.

Respecting legal obligations and bearing in mind the public interest of accessible areas, the Serbian Railway has been performing new constructions as well as reconstructions in accordance with the accessibility standards. For that reason, the Railway Directorate has been formed, by the Railway Act in 2005, for

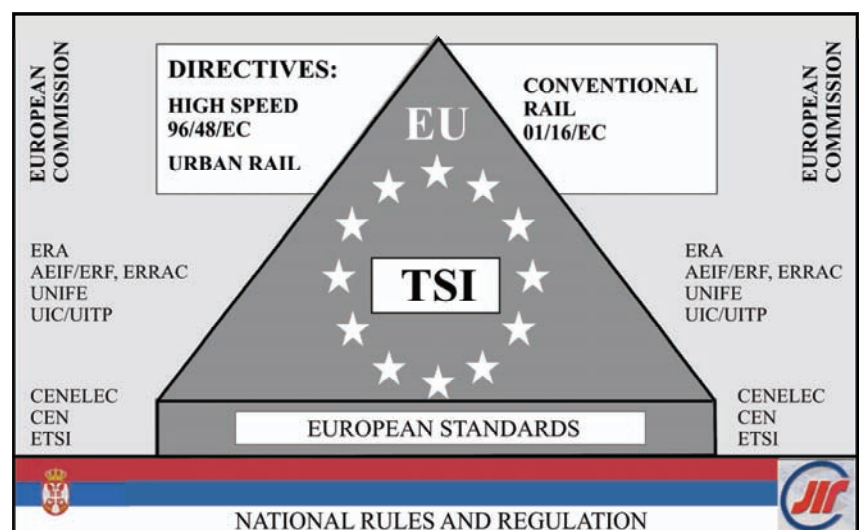


Figure 1: Harmonization of standards of the Republic of Serbia with EU standards in railway transport (Popović, 2007b)



the purpose of providing professional services in the field of railway transport, regulations and other tasks determined by this act (Railway Act, 2005). One of the tasks for the Directorate is drafting technical regulations, norms and standards in railway transport, as well as suggesting the measures to harmonize and increase the level of interoperability and modernization of the railway (Directive 96/48/EC, 1996; Directive 2001/13/EC, 2001) (Figure 1).

The document TSI PRM – Technical Specification for Interoperability – People with Reduced Mobility is used for the purpose of regulation of unobstructed access to rolling stock, in Pan-European and Trans-European railway corridors, therefore in Corridor X as well, passing through the Republic of Serbia, which comprises 17.6% of the railway network in the Republic of Serbia (Figure 2).

standards and gradual adaptations must be planned for the existent railway infrastructure in Serbia.

Creating a legislative base and sanctions for failure to fulfil the legal obligations is a necessary but insufficient precondition for the application of accessibility standards in planning, designing and construction of the railway infrastructure. The current “Regulations on conditions for planning and the design of buildings for unobstructed access for children, the elderly, the handicapped and the disabled” from 1997 has not been made compliant with TSI PRM from 2006. For example, according to TSI PRM, the following categories of passengers have difficulties when using trains and the surrounding infrastructure: wheelchair users, other people with reduced mobility (people with broken limbs, people with difficulties in walking, people with children,

all categories of passengers (both people with or without reduced mobility), as well as a faster flow of passengers on platforms. In the economic sense, gradual investments into new and existing infrastructure should increase the number of passengers who can use the railway services, and it should also lower the expenses for damages paid to injured passengers or to the families of the railway casualties. The increase in comfort and safety for all categories of passengers should also increase the competitiveness of the railway in comparison with other means of transportation. For the effective and practical implementation of TSI PRM regulations in planning, design and construction of railway infrastructure in the Republic of Serbia, it is necessary to draw up a suitable set of regulations.

Apart from this, the media (the press, radio, TV) are used to promote the public importance of the accessibility to all types of transport without discrimination. In this way, the citizens of Serbia are provided with necessary information on the measures undertaken in order to make the entire surroundings accessible (eg information, etc.) to the benefit of the whole society. The media promote good examples in practice and point at cases of non-conformity with accessibility standards. Associations of citizens (The Association of the Blind and Visually Impaired, The Association of the Paraplegic and Quadriplegic of Serbia, etc.) as well as the professional associations also contribute to raising public awareness and to undertaking specific actions for the implementation of accessibility standards in transport.

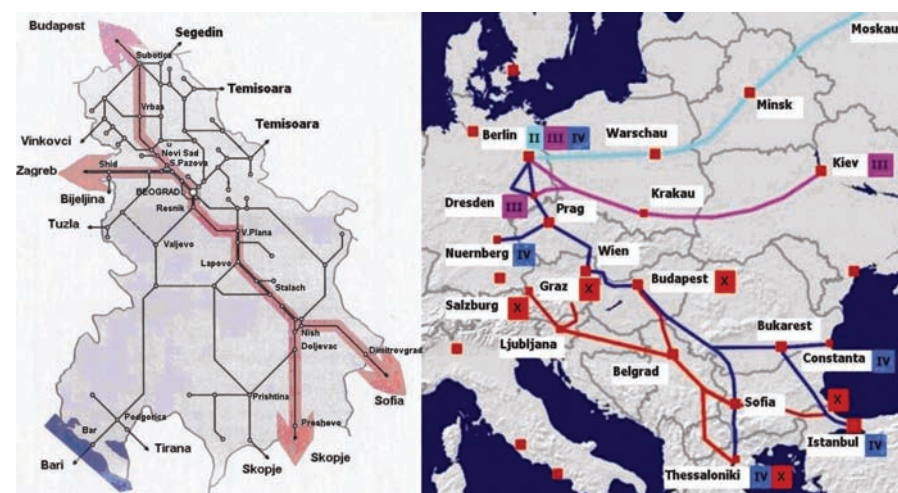


Figure 2: European Corridor X passing through the Republic of Serbia (Popović, 2007a)

The document TSI PRM covers the following scope of specific interest: the station infrastructure including platforms, rolling stock, the gap between platform edge and the vehicle, and regulations on gradual implementation of TSI. The TSI PRM regulations also refer to the conventional railway systems as well as the systems of high speed railway lines of the EU member states and Norway. However, the non-EU states have a common economic interest to apply the technical specifications of interoperability on main international lines and even further on. In this paper on TSI, we shall focus on the so called “infrastructure subsystem”.

In order to apply the TSI PRM regulations, all new rolling stock and railway terminals must be in compliance with the accessibility

people with heavy or bulky luggage, elderly people, pregnant women, visually impaired people, blind people, those with hearing impairment, and deaf people), people with communication impairment (people who have difficulties in communication or understanding written or spoken language, including foreigners with insufficient knowledge of a language, people with mental, psychological or intellectual difficulties), people with small stature and children.

For all the above mentioned categories of passengers, according to TSI PRM, a safe and unobstructed access to rolling stock should necessarily be made possible, ensuring their preserved dignity and integrity. Also, the applied measures and technical solutions should contribute to the increase in safety for

The contents of accessibility standards for railway traffic have been included in the curricula of relevant technical faculties (The Faculties of Civil Engineering, Architecture, Traffic Engineering, and Mechanical Engineering) and in professional seminars in Serbia. The education of students and engineers is an important foundation for the introduction of uniform services and appearance of railway passenger terminals in Europe, in order to provide consistency in the application of measures for easy access for people with reduced mobility.

## ANALYSIS OF PASSENGER TRANSPORT IN SERBIA

Two out of ten traffic corridors in the European territory, as defined at the Helsinki conference in 1997, pass through Serbia: the river corridor VII – The Danube Corridor and the road-railway

Corridor X Vienna – Zagreb – Belgrade – Niš – Thessaloniki, with a branch X1 Belgrade – Budapest. General objectives of the strategy development of multi-modal transport corridor X are defined in (Milijić et al., 2003).

The following international railway routes pass through Serbia, in accordance with AGC Agreement ("European Agreement on main international Rail Lines", Geneva, May 1985) (Economic Commission for Europe, 1985):

1. E 771 Subotica - Vinkovci - Strižvojnje Vrpolje - Sarajevo-Ploče,
2. E 79 Beograd - Bar,
3. E 85 Budapest - Kelebija - Subotica - Beograd - Niš - Preševo - Skopje - Gevgelija - Idomeni - Thessaloniki - Athens,
4. E 66 Beograd - Vršac - Stamora Moravita - Timisoara,
5. E 70 Paris - Macon - Amberieu - Culoz - Modane - Torino - Rho - Milano - Verona - Trieste - Villa Opicina - Sežana - Ljubljana - Zidani Most - Zagreb - Šid - Beograd - Niš - Dimitrovgrad - Dragoman - Sofija - Plovdiv - Dimitrovgrad - Svilengrad - Kapikule - Istanbul - Haydarpasa - Ankara - (Kapikoj (Razi - Iran)/Nusajbin (Kamichli - Syria)).

The basic characteristics of the railway lines in the Republic of Serbia are listed in Table 1.

Out of the total number of stations in the network which are open for passenger arrival and departure, more than a half (about 58%) are situated on international routes. About 36% of stations are in Corridor X together with those on Branch X1.

The percentage of participation of passenger railway transport in comparison with other forms of transport is declining in the Republic of Serbia as well as in the EU. Analyses show that the highest number of journeys is made by car, which means that for the majority of passengers, time spent on travelling is more important than the cost. A specific

characteristic of the total passenger transport in the Republic of Serbia is certainly a remarkable dominance of the domestic transport over the international one. The reason for this is the unfavourable visa policy for the citizens of Serbia.

The predictions for the total passenger transport in the Republic of Serbia until 2012 (data taken from a study done by CIP- Institute of Transportation) show the same dominance of the domestic transport over the international one, as shown in Figure 3. The data include neither the influence of the world economic crises on the mobility of citizens in the Republic of Serbia, nor the possibility of liberalization of the visa policy for EU countries. The data also does not include urban public rail transport.

Figure 4 shows an irregular use of the existing network of different modes of transport in Serbia. One of the main aims of the transport policy in Serbia is the stimulation of long-distance railway transport. The realization of this aim requires the integration of Serbian Railway network into the European rail network, based on the concept of interoperability and harmonization of regulations, as well as on stimulation of multimodal transport of passengers and goods. The reconstruction and modernization of the railway infrastructure and the improvement of the railway transport would contribute to lower pollution of the environment, increased road safety and lower energy consumption. All this also contributes to the successful fulfilment of obligations which the Republic of Serbia has, according to international agreements and UIC Leaflets

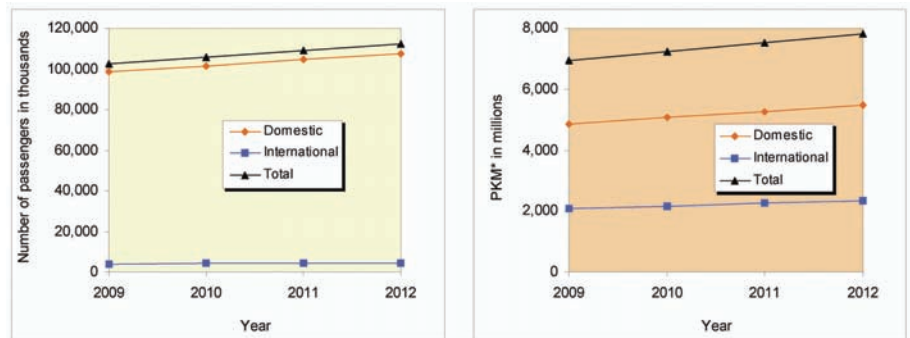


Figure 3: Predictions for the total passenger transport

\*PKM – the number of passengers multiplied by the number of kilometres

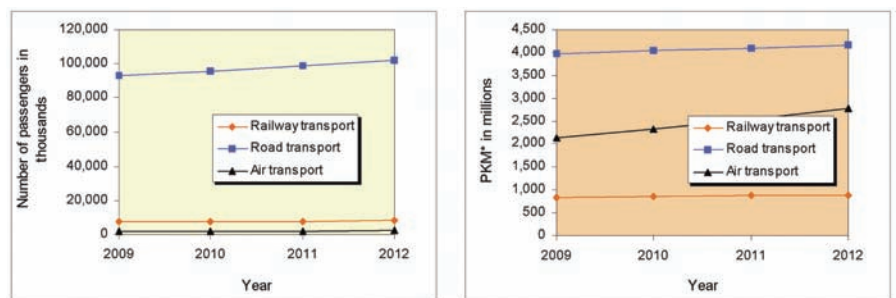


Figure 4: Predictions for the total passenger transport by modes of transport, excluding urban public transport

\*PKM – the number of passengers multiplied by the number of kilometres

Table 1: Basic characteristics of Serbian Railways lines

No.	Characteristics	Length (km)
1	Construction length	3,809
2	Single track railway	3,533
3	Double track railway	276
4	Main rail lines	1,767
5	Electrified railway (25kV, 50Hz AC)	1,247
6	The total number of stations for passenger transport on main international railway lines	324
7	The number of stations for passenger transport in Corridor X	176
8	The number of stations for passenger transport in Corridor X1	23
9	The number of stations for passenger transport in Corridor X and X1	199



(Economic Commission for Europe, 1985; Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1998; SEEC (South East European Cooperation Process, 2006; UIC Leaflet 140, 2001; UIC Leaflet 413, 2000).

The current situation in passenger railway transport in the Republic of Serbia, regarding the number of passengers, or the quality of services for all categories of passengers is unsatisfactory. The loss of customers' trust in the quality of railway services results in a decreased number of passengers which, in the long run, can cause very negative effects for the railway.

An increase in the quality of service for people with reduced mobility is to be primarily realised at railway passenger terminals. Bearing in mind that the improvement of accessibility must be done gradually, it is believed that the accessibility should be improved first at stations with the highest number of passengers. Analyses show that the highest number of local and international passengers per day leaves the Belgrade railway hub.

### APPLICATION OF ACCESSIBILITY STANDARDS ON RAILWAY TERMINALS IN SERBIA

The application of accessibility standards in railway terminals is a legal obligation for the construction of new infrastructure. For the existing infrastructure, the gradual removal of obstacles for the purpose of accessibility for all categories of passengers without discrimination has been planned, bearing in mind financial and time limitations.

Transportation of wheelchair users has been planned on all major railway terminals, at least 30 km apart. Other solutions would require an unacceptably high financial investment and delaying of the trains in stations. Therefore, it is necessary to organize "door to door" transport for the disabled in specialized vans. This solution has been applied in the territory of the City of Belgrade.

The adaptation of passenger trains for the transport of the disabled is already under way, which will enable the use of the existent infrastructure planned for an unobstructed access of the disabled to platforms. For example, in the "Vukov Spomenik" station, in the Belgrade railway hub, where more than 2,000 passengers leave daily, there is a special entrance for wheelchair users with nine

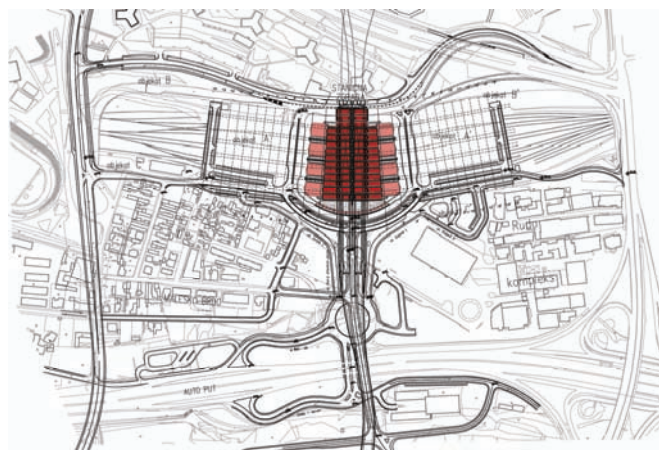


Figure 5: New station "Beograd centar" designed by Prof. S. Rogan and CIP – Institute of Transportation



Figure 6: Long distance passenger transport – existing situation

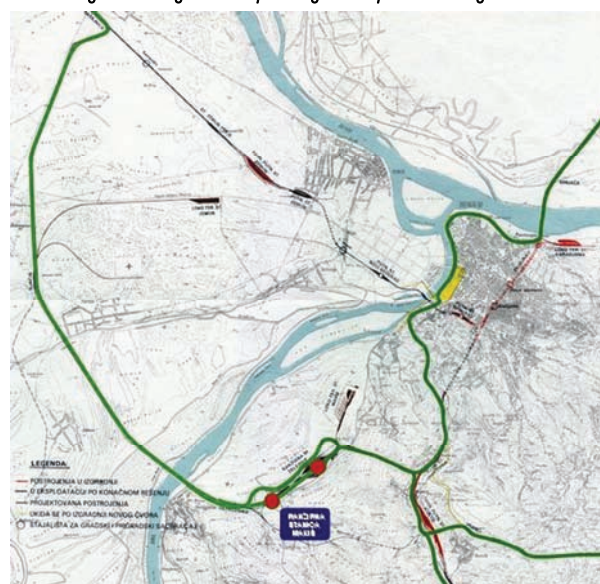


Figure 7: Freight transport - existing situation



parking places reserved for their vehicles and a lift for wheelchair users to descend to the platform.

The reconstruction of the Belgrade railway hub is under way, which should enable separation of the passenger and freight transport, as well as the dislocation of the main passenger railway station (Figures 5, 6, 7, 8 and 9).

The new station "Beograd centar" is planned to have a concept of transit type railway station

which is more acceptable than the existing head type railway station. This transit type is more suitable for the city giving large abilities for smooth and easy interchanges. Generally, new railroad terminal are pass-through ones, and, through time, the pass-through type railway stations evolved into a developed vertical plan, where segments of the station premises are in vertical superposition (Stevanović, 2008b). These solutions

emphasize studies of movement and facilitation of vertical communications in cases when the number of customers is big. Thus, solutions offering multiple accesses, from several sides and levels, are far better. The main goal is fading of obstacles, plenty of daylight, a pleasant ambience, easy resourcefulness and reliable visual aids, therefore all those becomes an categorical imperative (Stevanović, 2007; Stevanović, 2008a). New sophisticated concept is entirely in the service of a great number of customers. Special attention is given to proper orientation, shortest possible routes, as well as pleasant stay and movement through a space full of different views. Fluxes of great numbers of people were studied, entrances were cleared, parking spaces provided along with easy access from different modes of transportation. The new railway station "Beograd centar" complies with accessibility standards.

The reconstruction of the existing railway terminals in Serbia shall include sufficient parking facilities for wheelchair users (reserved and properly indicated) in the proximity of the entrances to railway stations (no further than 100 m away), designed in compliance with the regulations for unobstructed access for people with reduced mobility.

Passenger routes and footpaths with unobstructed access for people with reduced mobility must enable safe access from the station's front area i.e. the entrance to all services within the station, and finally, to the platforms (Figure 10). For this purpose, ramps or platform lifts must be provided in all access points with denivelation (different floor levels). All access points, subways, footbridges; staircases must have an obstacle-free area of a minimum of  $2 \times 800 = 1600$  mm in width and headroom of 2300 mm throughout.

All information for passengers must have a simple and unified concept for the purpose of easy comprehension. The process of introducing induction couplers is under way in all major railway stations. In the existing terminals, there is a problem of visibility of visual information signposts and their consistence with the spoken ones. Information boards in the Braille alphabet are currently being installed for blind and visually impaired people in all major terminals. In Serbia, tactile signage for the visually impaired is regulated in accordance with the domestic standard JUS U.A9.202.



Figure 8: Long distance passenger transport – final solution

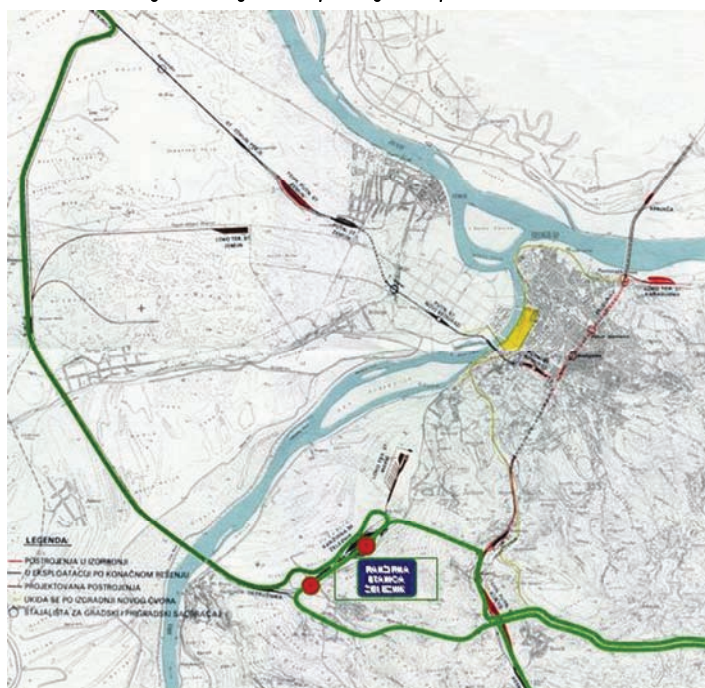


Figure 9: Freight transport – final solution

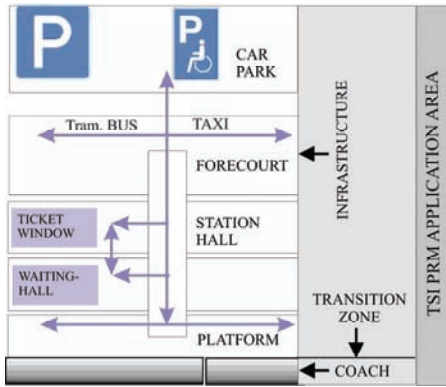


Figure 10: Communications scheme (European Commission, 2004)

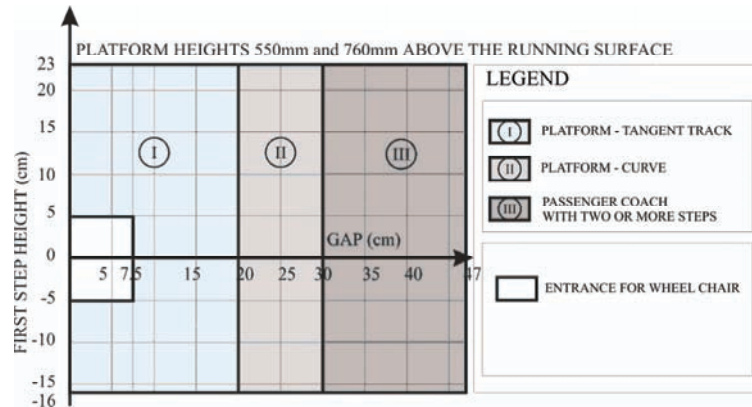


Figure 11: First step heights and gaps according to TSI PRM (Ernst and Kieffer, 2006)

Mobile and free-standing devices are often placed as obstacles which disrupt the movement in the existing stations. Such obstacles must be easily detected with a stick for the blind and visually impaired. Transparent glass and Plexiglas obstacles (doors, boards, partitions, walls, etc.) constitute a danger. However, they are rare in the existing stations. In the new ones, they must be visibly marked at eye level, in accordance with TSI PRM, for the purpose of keeping the safety and dignity of the blind and visually impaired. The height of markings must be suitable for children, wheelchair users, and people of small stature as well as all other adult passengers. Therefore, lines should be placed on two standard levels, in order to protect all categories of passengers.

In the existing railway terminals there are no toilets for wheelchair users. At least one toilet wheelchair accessible cubicle must be provided at stations. Apart from pictograms on toilet doors, tactile markings are compulsory at a height of 900-1300mm.

All service counters (ticket sales, information desks, etc.) must be accessible for wheelchair users and other people with reduced mobility, and provided with seating facilities. On platforms, waiting areas and all other areas where people wait for trains, a weather-protected area fitted with ergonomic seating facilities and spaces for wheelchairs must be provided.

TSI PRM determines two nominal values permissible for platform height: 550mm and 760mm above the running surface. It also determines the allowed gap, and the position of the first step (Figures 11, 12, 13). The reconstruction of all stations in Corridor X shall include platform height adjustment and application of coaches with barrier-free passenger access (Ostermann and Rueger, 2006). Along the platform edge, at a distance

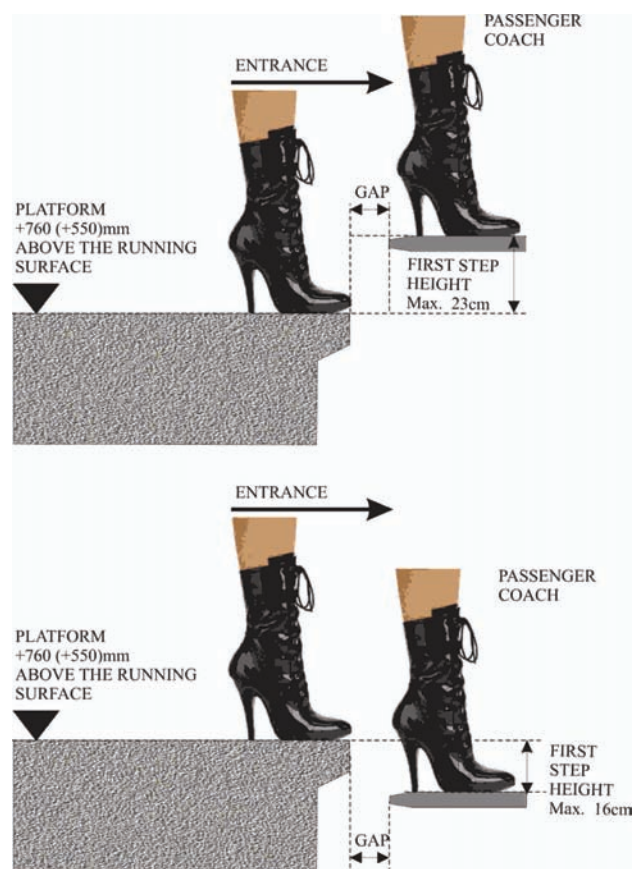


Figure 12: Position of the first step vis-à-vis the platform (TSI PRM) (Popović and Puzavac, 2008)

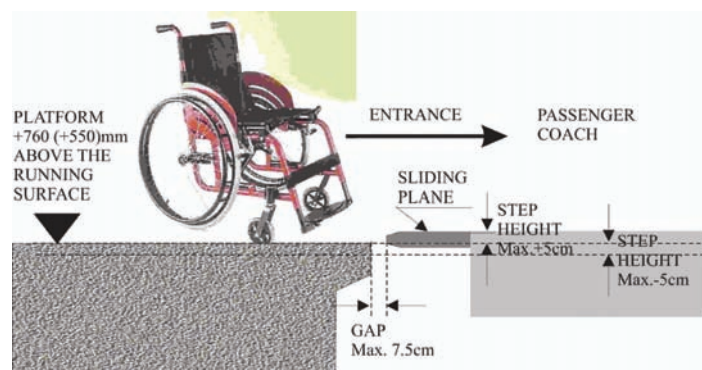


Figure 13: Ideal position of the train floor vis-à-vis the platform (TSI PRM) (Popović and Puzavac, 2008)



of 80cm there should be a tactile line of warning.

Timely evacuation must be provided for all passengers in hazardous situations. These measures must particularly include all passengers with reduced mobility.

## CONCLUSION

The European Union has enacted various legislative measures aimed at achieving the opening up, integration and harmonization of national railways to form a European railway network. One of the essential preconditions for the integration of the Serbian Railways with those of the European Union is to approximate Serbia's railway regulations and standards to those of the EU. The Railway modernization project is a strategic project for the development of transport infrastructure in the Republic of Serbia and connecting it to the European network. The project covers the railway lines in the European Corridor X that runs through Republic of Serbia and interconnects the railway routes of Central and Eastern Europe with the Middle East and the Adriatic Sea. Among other things harmonizing includes accessibility of railway infrastructure for persons with reduced mobility.

Having analysed the existing legislative regulations in view of the rights of people with disabilities, we can conclude that the Republic of Serbia has harmonized its laws with the European regulations. However, a lack of technical regulations for the implementation of these regulations in railway infrastructure is apparent. The Railway Directorate is expected to take an initiative and adequate steps in order to set down Regulations for the accessibility of railway infrastructure for people with reduced mobility. In the construction of new railway terminals, it is mandatory to apply the accessibility standards.

The existing railway infrastructure is being gradually adjusted through measures of reconstruction and modernization of railway transport, in accordance with accessibility standards. The stations on main lines with the highest number of passengers are a priority in the process of compliance with accessibility standards.

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