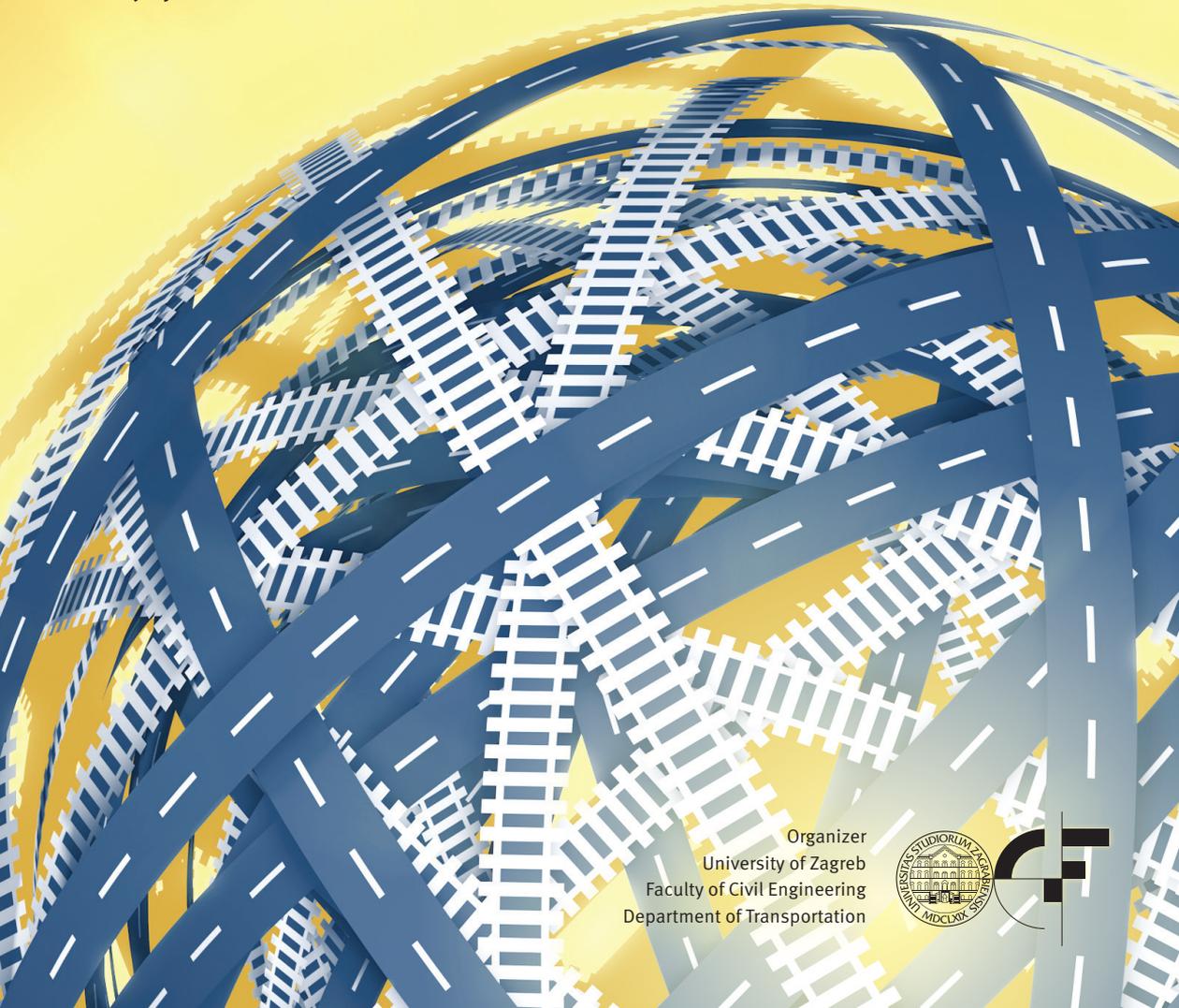


CETRA 2016

4th International Conference on Road and Rail Infrastructure
23-25 May 2016, Šibenik, Croatia

Road and Rail Infrastructure IV

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
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RECONSTRUCTION OF THE RAILWAY STATIONS SLAVONSKI BROD AND VINKOVCI

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Abstract

Railway stations Slavonski Brod and Vinkovci are situated on the Corridor RH1 railway line M104 Novska – Tovarnik – state border. The modernization of the Corridor RH1 also included the reconstruction of the railway stations Slavonski Brod and Vinkovci. Complex civil-engineering works included the removal of the shelter of the 1st platform at Slavonski Brod railway station, reconstruction of the platforms, construction of the glass and steel shelters, reconstruction of the rainwater drainage, reconstruction of lighting, installation of the sounding passenger information system, installation of platforms for mobility-impaired persons, and a range of other operations which have contributed to the modernization and functionality of the railway stations Slavonski Brod and Vinkovci, but also to their up-to date and modern appearance.

Keywords: reconstruction of the railway stations Slavonski Brod and Vinkovci

1 Introduction

Railway station Slavonski Brod and Vinkovci are situated on the RH1 Corridor of the double track railway line M104 Novska – Tovarnik – state border. Double track railway line M104 Novska – Tovarnik – state border is one of the four railway lines on the RH1 Corridor, or the former Pan European Corridor X; the Corridor was named RH1 in accordance with the Decision on Classification of the Railway Lines (Official Gazette 3/14) of the Government of the Republic of Croatia. Because of the deterioration of the shelters which began to lose their essential qualities through their use, but also because of the need to reconstruct other civil-engineering structures in the station in order to enhance the safety and quality of service for the railway transport users, were reasons, in accordance with the guidelines of the Study of Modernization of the Pan European corridor X (ŽPD LLC., TB4070, Zagreb 2009) the works on reconstruction and modernization of the railway stations Slavonski Brod and Vinkovci were started, based on the project documentation and main design approvals.

2 Current condition

Railway station Slavonski Brod is situated at km 220+691,14 of the double track railway line M104 Novska – Tovarnik – state border and is used for reception and dispatch of passengers and freight. The station consists of two platforms with asphalt flooring, one of which is situated by the railway station building and is 907 m long, on the average 13,30 m wide and 0,35 m high above the top of the rail (hereinafter ATR). The second platform is situated between the 5th and 6th track, and is 407,39 m long, 6,30 m wide and 0,35 m high from the ATR. From the station building to the second platform the pedestrian underpass extends, with two single-flight staircases on both sides, above which the five tracks, directly laid on the concrete

slab of the pedestrian underpass, are passing. On the 1st platform there is a 144,60 m long RC shelter, the structure of which is supported against the concrete posts, by the station building on one side, and on the other side it stretches towards the 1st track with its cantilever.

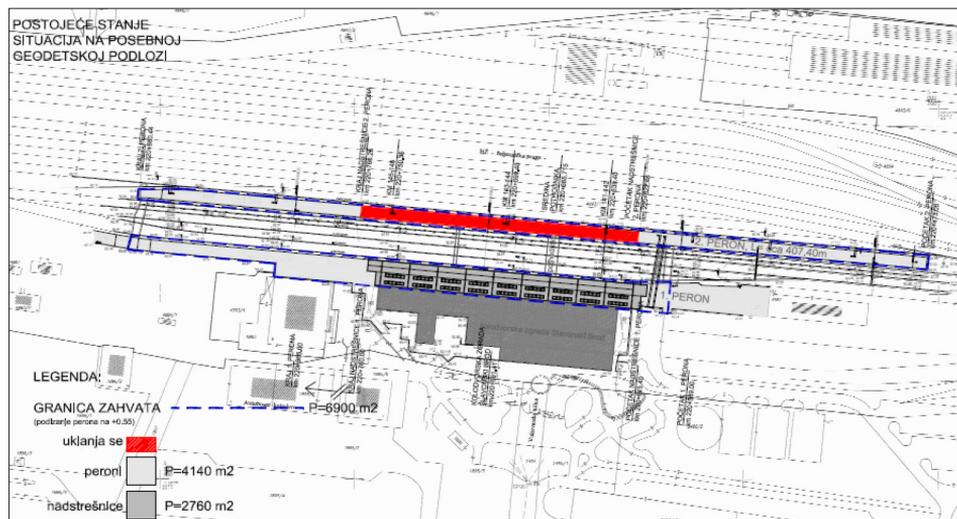


Figure 1 Railway station Slavonski Brod – the current condition floor-plan on the special geodetic lining

On the same railway line, at km 155+862,25 railway station Vinkovci is situated. It is operating as the combined transport railway station (passenger and freight transport). Railway station Vinkovci consists of the passenger part with five tracks. The station consists of three platforms connected by the pedestrian underpass also with the single-flight staircase on both sides of the pedestrian underpass, with exit to the three platforms where 1st, 2nd, 3rd and 4th track pass. The platforms are laid on the overburden above RC slab of the pedestrian underpass. The first part of the 1st platform is situated by the station building between the tracks 1 and 1c. It is 420 m long, 13,8 m wide, while the second part of the 1st platform is situated between the track 1A and the auxiliary business building. It is 75,0 m long and 15,0 wide. It has the entry ramp for access to the luggage pedestrian underpass which is placed in the centre. The third part of the 1st platform is situated in the western part between the tracks 1 and 1B. It is 13,8 m wide, and in the centre it has the exit ramp from the luggage pedestrian underpass. The 2nd and the 3rd platform are situated between the 2nd, 3rd, 4th and 5th track. They are 420 m long, 8,8 n wide and 0,35 m high ATR, and have asphalt flooring.

The RC shelter on 1st platform is a symmetric 13,7 m wide and 318,40 m long framework structure with cantilevers. It is constructed in two levels because of connection to the building, where the higher part in the width of up to 10,40 m is supported against the framework structure with the cantilever, and is made of 13 fields. In the lower part there is a 3,3 m wide RC slab with glass apertures, supported against the station building. The eastern part of the 69 m long and 9 m wide shelter of the 1st platform is also made of the framework structure of 9 fields, while the 65,30 m long and 16,0 m wide part above the platform 1A and auxiliary business building consists of 8 fields. The shelter of the station building and the auxiliary business building is connected between the two eastern parts into a single field of 64 m².

In the 2nd and 3rd platform there used to be the RC shelters which have been removed, except for the RC posts of 0,60x0,40, 0,60x0,25 and 0,40x0,40 m. They will be used for installation of the steel part of the new shelters. 1st and 2nd platform in station Slavonski Brod and the 1st platform by the station building in station Vinkovci are for the most part equipped with

4 Reconstruction operations

In addition to the scope of operation, the reconstruction operations also differed regarding the methods and manner of construction of particular structures. In the railway station Slavonski Brod the reconstruction of the 2nd platform included the reconstruction of the rain-fall drainage, installation of lighting and sounding system as well as reconstruction of the signalling and interlocking lines of the power electric infrastructure subsystem. In the reconstruction of the platform the existing length of the platform was retained, and the width reduced to 6,10 m, in order to meet the condition that the platform is at a distance of 1,72 m from the track axis (the Rulebook on technical conditions for the railway transport safety to be met by the railway lines OG 128/08). The height of the platform was elevated from 0,35 m to 0,55 m from the ATR by installation of the standard platform elements L₀ 55 on the concrete edge. Since the basic construction of the shelters has been conceived as the system of the fieldstone foundations (under each post), joined by the foundation beams in both directions on the sites where the foundations were, the adaptation of the existing foundations to the designed height was carried out, by concreting of the new 2,50 m x 1,6 m, and 2 m high posts, with the depth of the footing of -2,2 m, using reinforced steel B500B.

The platform inclination in cross direction is 2% from the track, which was accomplished by flooring by the 8 cm thick concrete elements, planted on the 3-5 cm thick sand layer, placed on the 30 cm thick sub base layer. At the platform edge, at the distance of 2,4 m from the track axis, the horizontal yellow 10 cm thick signalization was placed, and at 2,5 m from the track axis the 20 cm wide tactile surfaces with grooves carved vertically to the direction of the entry into the train, in order to enhance the safety of the passengers and to help movement direction of the mobility-impaired persons. Also, in the platform before the first step, the 40 cm wide tactile warning strip was placed in the full width of the staircase flight, with the grooves carved vertically to the movement direction. All platform ends have been accomplished at 7,5% inclination, thus having been adapted to the current official ramps which were situated at the platform ends. From western direction the access is provided for the ambulance and emergency vehicles. For the mobility-impaired persons the access to the platform is provided by the two pairs of moving platforms which are installed at one staircase flight. At the staircase of the platform the new 1,10 m railing is installed.

The steel structure of the shelter consists of the Y-shaped fixed posts with two-sided cantilevers between which the purlins are placed, which are additionally stabilized by the system of the roofing bonds and lateral constraints. The posts are welded into profile I of 3,6 m high variable cross-section, at the mutual distance of 7,2 m with two-sided cantilevers of 3 m in span and 4 m in length, except in the part at the exit from the pedestrian underpass, where in two fields, their distance is 14,4 m. The shelter cover is constructed of 1x0,75 mm trapezoidal sheet metal type Hoesh T40, and the view of grey HPL plates. In the centre of the shelter structure the drainage of galvanized sheet metal is constructed and is descending by 3%, which is evacuated through the steel posts into the drainage by the inox pipes in the platform. The view of the shelters houses the lighting installations and lighting and the sounding system. The display board and the clocks are mounted on the girders, and on the frontline of the structures on both sides the sign plates with the station names are mounted. Of urban equipment, the cabinet with the train timetable, banks for passengers, waste bins, and info-panels have been placed.

During execution of works, all transport operations took place on 1st platform, and after the works were carried out on 2nd platform, the 2nd platform was temporarily put into operation, and 1st platform was completely closed to be able carry out the works of dismantling of the shelter and reconstruction. The passengers arrived to the 2nd platform through the station building towards the basement where the passage was temporarily opened in the wall of the pedestrian underpass. After the 1st platform was closed for transport, the removal of the RC shelter structure began. The overhead parts, posts, beams and plates covering the surface of 1885

m² were removed using the “cutting” and “nibbling” method by the station building, which means that the structure was being removed part by part; the material was being sorted by the categories (armature, concrete, glass, sheet metal, etc) and was transported to be disposed of in an ecological way. After the removal works were completed, the reconstruction of the 1st platform began. The reconstruction of the 1st platform consisted of elevation of the platform from 0,35 to 0,55 m, so that the platform edge is at the distance of 1,72 m from the track axis, with the cross descent from the track and the station building of 1,5 – 2 % towards the centre, where in the full usable length the concrete drainage channel was constructed, from which the water is drained into the drainage in the platform. The final surface of the platform was constructed with the 5 cm thick asphalt layer due to the descents, and at 2,4 m the horizontal yellow signalization in the width of 10 cm along the entire platform length, while at the edge of the steps descending into the pedestrian underpass, the new 1,10 m high railing was installed. The existing foundations in the platform with the RC structure were reconstructed by elevating them to the designed height, but it was also necessary to concrete the new foundations since the grid of the posts is linearly 14,4 m by the station building, and 7,2 m by the outer platform edge, while in the cross direction the distance amounts to 10 m. Of other works, the works of reconstruction of the rainfall drainage and installation of lighting and sounding system were carried out. The 144,60 m long and 12,98 m wide shelter of the 1st platform consists of the steel structure of 10 m in span and 3,3 m high posts and the arch beam, while the frame on one side has the protruding 3 m long cantilever. The posts are placed every 14,4 m. The cantilever part of the shelter towards the track is flat and covered by the 1x0,75 mm trapezoid sheet metal, type Hoesch T40.

The shelter view is constructed of HPL grey plates which are attached from the bottom side of the grey colored purlins and into which the lighting and loudspeakers are installed. The part of the shelter from the posts towards the building in parts the arch shape is covered by the trapezoid sheet metal and the view by the HPL plates, while the flat part, descending towards the building by 4%, is covered by the arches of the glass surface of triangular shape. The arch surfaces are placed above the glass ones, and the purlins are recessed to the left and right on top of the arch girders, sheltering the free vertical space to prevent oozing of water. The peripheral parts of the surface have the trough grooves in full length, which direct the accumulated water towards the drainage. All sides of the triangle tip of the narrowed glass surface towards the building are encased into sheet metal creating a funnel which channels the water into a vertical by the building. The glass is 2x10,1 mm double-glazed laminated and toughened safety top glass with the 0,76 mm thick interlayer film in red, yellow, blue, green and translucent colour. The flank sides are blocked by the 2x10,1 mm thick glass with the interlayer film on both sides, while from the side of the tracks and the station building, there is the metal sheet trim.

On the platform the names of the stations were placed at the frontline of the structure, as well as two small displays and the central display, clocks, waste bins, banks and flower pots. In addition to the reconstruction works, the works of replacement of the materials in the pedestrian underpass, reinforcement of the track, asphalt replacement by the station building and in the part of the platform by the power electric plant were carried out. The replacement of the materials in the pedestrian underpass involved the removal of the tiles from the wall of the staircase, pedestrian underpass and floor, replacement of all step treads, drainage solution, plastering, smoothing and painting of the walls of the staircase, pedestrian underpass and the ceiling, laying of tiles and of tactile strips on the floor of the pedestrian underpass, for the persons with reduced mobility.

The works of reinforcement of the 1st track included the dismantling of the rails type 49E1 on wooden sleepers, machine excavation of the muddy ballast material, construction of the track with the re-used 49E1 rails on the re-used wooden sleepers, AT welding of the track, lifting of the CWR, installation of the Mathe equipment and manual planning and design of the shunting paths. On the 5th and 6th track the elevation of the track level line was carried out.



Figure 4 2nd platform of the railway station Slavovski Brod after the reconstruction

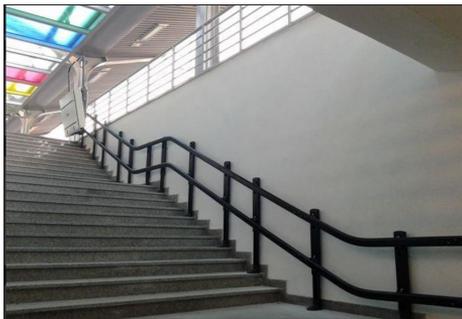


Figure 5 Ramp for the disabled persons and the pedestrian underpass of the railway station Slavovski Brod



Figure 6 61st platform of the railway station Slavovski Brod after reconstruction

Reconstruction of the 2nd platform of 3590 m² and the 3rd platform of 3577 m² of the railway station Vinkovci required the elevation of the platform from the existing 0,35 m to 0,55 m ATR. In this way the platform length of 420 m and width of 8,8 m was retained and the distance of 1,72 m from the ATR was accomplished by concreting of the 20 cm high concrete edge which was by 12 cm more retracted compared to the current platform edge. The surface of the platform in the cross direction was constructed in inclination of 2% from the track axis and was floored with the 8 cm thick concrete paving flags which were placed on the 3-5 cm thick sand layer. By the platform edge, at the distance of 2,4 m from the track axis the yellow signalization was outlined in the form of the 10 cm wide line and the tactile surface in form of the 20 cm wide warning strip at the distance of 2,5 m from the track axis was installed. In reconstruction, the ends of the 2nd and 3rd platform were adapted to the new height with the inclination of 7,5%, and from direction west the access ramps enable the access of the ambulance and emergency vehicles. In the platforms the reconstruction of the rainfall drainage, installation of the lighting and sounding systems as well as reconstruction of the signalling and interlocking lines of the power electric infrastructure subsystem were carried out.

On RC posts in the 1st, 2nd and 3rd platform the non-destructive and destructive tests were performed. The visual inspection included the detailed inspection of the outer surfaces of all posts, taking record of the damages; the ultra-sound method was used to determine the depth of the cracks in the non-destructive manner; the sclerometer index was then defined; the depth of carbonization and the concentration of the chloride ions in the concrete powder was examined by the RCT method, as well as the pressure hardness of the concrete which was extracted from the structure by drilling. Based on the obtained results, the guidelines were provided for the reconstruction of the posts on the 2nd and 3rd platform. It was established that the posts at the bottom on the 1st platform were highly damaged due to the grenade blasts, and that their retaining capacity is questionable.

After the tests and reconstruction of the posts were completed, on the 2nd and 3rd platform the shelters of 1021 m² of floor-plan surface were mounted. The shelter is made of the plane two-sided cantilevers of 4,4 m in span, made of HEA 300 steel profiles and placed on the posts which are fixed on the foundations. The joint of the cantilever and the post was made by the steel cap. The structure of the roof is made by the purlins made of IPE 270 steel profiles which are coupled to the main cantilever girders in the articulated joint. Between the purlins there is a couple of the pulling elements. The purlins are joined in the half of the span by the cross beam of round diameter, which is at the same time the vertical couple. The floorplan dimensions of the shelter are 116,0x8,8 m, the average height from the platform is 4,65 m. The structure consists of 16 symmetrical (two-sided) cantilever steel girders at the axis distance of 7,5 m. The shelter ends are made as cantilevers with the length of 1,7 m. The shelter cover is made of the 160 t=0,63 mm trapezoid steel plasticized sheet metal Hoesch HP41, and the view of perforated sheet metal type Hoesch 35/207 which is attached from the bottom side of the purlins and is of grey colour. The groove of galvanized sheet metal is constructed in the descent of 3% and is mounted into the shelter eaves. The drainage is constructed from the outer side of the posts through the drainage pipes. The lighting and sounding systems are installed in the space between the cover and the view of the shelter. On the flank sides of the shelter, i.e. the frontline of the structure, the names of the stations are placed, on the structures the displays and clocks and on the platforms the waste bins, banks and info-panels.

The access to the platforms is provided by the two-sided single-flight staircase connecting all three platforms and by moving platforms for the mobility-impaired persons. On the posts by the platforms the bell is installed, which after being pressed is activated in the traffic control office, signalling someone's presence and the need to help the persons of reduced mobility. On 1st platform the existing posts are torn down and the new ones are made of concrete, on which the identical structure as in 2nd and 3rd platform was placed. Since it is installed by the existing RC shelter, it is with its front supported against the shelter at one side, and at the other side it is the 1,7 m long cantilevers.

In addition to the above works, the replacement of the materials in the pedestrian underpass was carried out as well as reinforcement of the tracks 1A, 1C and of the 2nd track, reconstruction of the shelter roof of the RC structure of the 1st platform and asphaltting of the 1st platform. In the pedestrian underpass the replacement of the materials involved the removal of the cracked wall which was used as the protection wall behind which the drainage of the lateral sides of the walls of the pedestrian underpass was installed; removal of the tiles from the floor, walls and the stairs, drainage resolution, replacement of all stair treads, installation of the aqua panels, plastering, smoothing and painting of the walls of the staircase, pedestrian underpass and the ceiling, laying of the tiles and tactile strips for the persons of reduced mobility. The works of reinforcement of the 1A, 1C and 2nd track included the dismantling of the rails type 49E1 on wooden sleepers, machine excavation of the muddy ballast material, construction of the track with the 49E1 rails on new wooden sleepers, AT welding of the track, lifting of the CWR, installation of the Mathe equipment, 1st, 2nd and 3rd machine track regulation and the final track regulation.

On the 1st platform the reconstruction of the RC shelter was carried out. The reconstruction of the roof of the RC shelter structure of the 1st platform involved removal of the damaged and deteriorated hydro-insulation from the roof, and the broken glaze was smashed and removed. The surface which was cleaned was coated with the SN coating (SN vez). On which the glaze with descents was placed, hydro insulation membrane type V-4 in two layers and alumite paint as protection from UV radiation. The verticals and the gully grids have been replaced; the view of the structure has been smoothed and painted with grey colour, and on the ceiling the new lighting fixtures have been mounted. On the 1st platform the broken and deteriorated asphalt layer has been replaced by the 5 cm thick new one.

During execution of works, the passenger and freight transport operations in the railway station Vinkovci took place nonstop. During execution of works on 3rd platform, the transport operations took place along the 1st and 2nd platform. When the works on 3rd platform were completed, while the works were carried out on 2nd platform, the 3rd platform was temporarily put into operation and, together with 1st platform, was used for the passenger reception and dispatch. After the works were completed, all three platforms were operating, regardless of the fact that the technical inspection and issuance of the usage permit took place much later.



Figure 7 Railway station Vinkovci after reconstruction



Figure 8 Ramp for the disabled persons in the pedestrian underpass of the railway station Vinkovci and elevation platform



Figure 9 Shelter on the 1st platform and the view after reconstruction

5 Conclusion

Reconstruction of the railway stations Slavonski Brod and Vinkovci contributed to modernisation of the RH1 Corridor, aimed at harmonization with the Technical specifications for interoperability of the Trans-European conventional railway system for the civil-engineering infrastructure subsystem. Reconstruction of the railway stations Slavonski Brod and Vinkovci was carried out based on the project documentation and the approvals of the main design. It entailed complex civil-engineering works which included reconstruction of platforms, construction of shelters, reconstruction of lighting and sounding systems, of the passenger information system, construction of platforms for the transport of mobility-impaired persons, installation of the platform equipment, and a range of other civil-engineering works which were carried out in order to meet the technical conditions and the key properties of the structure, which contributed to modernization and functionality, a safer and better service, but also to the up-to-date and modern appearance of the railway stations Slavonski Brod and Vinkovci, as one of the parts of the Pan European Corridor.

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