CETRA\textsuperscript{2012} \\
\textbf{2nd International Conference on Road and Rail Infrastructure} \\
7–9 May 2012, Dubrovnik, Croatia \\

\textbf{TITLE} \\
Road and Rail Infrastructure II, Proceedings of the Conference CETRA 2012 \\

\textbf{EDITED BY} \\
Stjepan Lakušić \\

\textbf{ISBN} \\
978-953-6272-50-1 \\

\textbf{PUBLISHED BY} \\
Department of Transportation \\
Faculty of Civil Engineering \\
University of Zagreb \\
Kačićeva 26, 10000 Zagreb, Croatia \\

\textbf{DESIGN, LAYOUT & COVER PAGE} \\
minimum d.o.o. \\
Katarina Zlatec · Matej Korlaet \\

\textbf{COPIES} \\
600 \\

A CIP catalogue record for this e–book is available from the National and University Library in Zagreb under 805372 \\

Although all care was taken to ensure the integrity and quality of the publication and the information herein, no responsibility is assumed by the publisher, the editor and authors for any damages to property or persons as a result of operation or use of this publication or use the information’s, instructions or ideas contained in the material herein. \\
The papers published in the Proceedings express the opinion of the authors, who also are responsible for their content. Reproduction or transmission of full papers is allowed only with written permission of the Publisher. Short parts may be reproduced only with proper quotation of the source.
Proceedings of the
2nd International Conference on Road and Rail Infrastructures – CETRA 2012
7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

EDITOR
Stjepan Lakušić
Department of Transportation
Faculty of Civil Engineering
University of Zagreb
Zagreb, Croatia
ORGANISATION

CHAIRMEN

Prof. Željko Korlaet, University of Zagreb, Faculty of Civil Engineering
Prof. Stjepan Lakušić, University of Zagreb, Faculty of Civil Engineering

ORGANIZING COMMITTEE

Prof. Stjepan Lakušić
Prof. Željko Korlaet
Prof. Vesna Dragčević
Prof. Tatjana Rukavina
Maja Ahac
Ivo Haladin
Saša Ahac
Ivica Stančerić
Josipa Domitrović

All members of CETRA 2012 Conference Organizing Committee are professors and assistants of the Department of Transportation, Faculty of Civil Engineering at University of Zagreb.

INTERNATIONAL ACADEMIC SCIENTIFIC COMMITTEE

Prof. Ronald Blab, Vienna University of Technology, Austria
Prof. Vesna Dragčević, University of Zagreb, Croatia
Prof. Nenad Gucunski, Rutgers University, USA
Prof. Željko Korlaet, University of Zagreb, Croatia
Prof. Zoran Krakutovski, University Sts. Cyril and Methodius, Rep. of Macedonia
Prof. Stjepan Lakušić, University of Zagreb, Croatia
Prof. Dirk Lauwers, Ghent University, Belgium
Prof. Giovanni Longo, University of Trieste, Italy
Prof. Janusz Madejski, Silesian University of Technology, Poland
Prof. Jan Mandula, Technical University of Kosice, Slovakia
Prof. Nencho Nenov, University of Transport in Sofia, Bulgaria
Prof. Athanassios Nikolaides, Aristotle University of Thessaloniki, Greece
Prof. Otto Plašek, Brno University of Technology, Czech Republic
Prof. Christos Pyrgidis, Aristotle University of Thessaloniki, Greece
Prof. Carmen Racanel, Technical University of Bucharest, Romania
Prof. Stefano Ricci, University of Rome, Italy
Prof. Tatjana Rukavina, University of Zagreb, Croatia
Prof. Mirjana Tomić-–Törlovčić, University of Belgrade, Serbia
Prof. Brigita Salaiova, Technical University of Kosice, Slovakia
Prof. Peter Veit, Graz University of Technology, Austria
Prof. Marijan Žura, University of Ljubljana, Slovenia
ANTI–SLIP RUBBER BASE FOR PEDESTRIAN CROSSINGS

Marko Hoić¹, Igor Keser²
1 HŽ–Infrastructure d.o.o., Croatia
2 Elasto d.o.o., Croatia

Abstract

On the HŽ–Infrastructure network there are 242 stations, 338 train stops, or a total of over 600 pedestrian communications for the movement of passengers and railway staff. If we add this 71 pedestrian crossing on the open line – we get the total number of spaces for movement and pedestrians crossing the tracks.

The footpath in the track is mainly performed as a wooden construction of railway sleepers. Such a surface is already slippery from the impregnation of sleepers, but under the influence of rain, snow and ice also very dangerous for pedestrians.

In order to ensure the safe movement of pedestrians across the track and extend the lifespan of wooden construction of railway sleepers – in this paper is proposed simple and inexpensive solution of 'rubbed' of new or already used pedestrian communications with a special rubber elements attached to the upper surface of the wooden structure.

Keywords: pedestrian cross–communications, railway track, anti–slip modular elements, rubberized

1 Introduction

Places for movement pedestrian over the railway track in the same level are called pedestrian crossings. In the railway station those are pedestrian cross–communications for the movement of passengers and railway staff. They connect station building with the railway tracks and platforms for the reception of travelers, so they are equally in use from railway workers and passengers. On the open line there are singly pedestrian crossings, or connected with a railway–crossing.

The footpath in the track is mainly performed as a wooden construction of railway sleepers. Such a surface is already slippery from the impregnation of sleepers, but under the influence of rain, snow and ice also very dangerous for pedestrians. Since the movement of pedestrians on the station tracks is only possible over such wooden structures it is inevitably that a lot of falls with mild or severe injuries of railway staff and passengers happens in railway traffic. Therefore it is necessary to upgrade an existing solution so the movement of pedestrians across the track is safer, and the wooden construction more durable.

2 Improvement proposal

On the HŽ–Infrastructure network there are 242 stations, 338 train stops and 71 pedestrian crossings on the open line. Because several of them are in every station, in total there are over 1000 pedestrian communications for the movement of passengers and railway staff. Almost all were made as wooden construction of railway sleepers.

Current legislation in this area is very poor. 'HŽ–Rulebook for permanent way track maintenance' (Rulebook 314, article 26. paragraph 2.) referred only to wooden construction of railway
sleepers with the prescribed statutory breadth and depth of groove for passage of railway vehicle wheel rim.

In order to ensure the safe movement of pedestrians across the track and extend the lifespan of wooden construction of railway sleepers – in this paper is proposed solution of 'rubberized' of new or used pedestrian communications with a special modular rubber elements attached to the upper surface of the wooden structure.

3 Technical solution of improvement

As a technical solution 'rubberized' the existing wooden construction it is proposed creating modular rubber–metal anti–slip elements that are tightened with screws to the existing structure. So fixed they are a compact solution to the problem of extremely slippery trampling surfaces of pedestrian communications.

In geometric terms anti–slip modular elements on its upper surface are striated in a manner that provides increased adhesion tread surface. Area between the grooves is covered with micro–roughness which further increases the friction of tread surface. Hardness of the rubber body is chosen in the range 55–65 ShA (Shore A), which enhances the feeling when using 'rubberized' pedestrian cross–communication.

![Anti–slip element](image)

Single anti–slip modular element is very small (26×26 cm) what we consider the advantage of the larger elements, since in case of mechanical or other damage, one can be replaced very easily and without major cost.

During manufacturing (vulcanization) of elements in their body are built–in four steel rings for receiving bolts for attach to the substrate, which creates a virtually unbreakable bond between the metal inserts and rubber body of anti–slip element, which results in extremely high durability. Additionally, steel rings are galvanized which leads to high resistance to corrosion. Rubber body of elements should be made of Chloroprene rubber due to its extremely compliant properties.

3.1 CR – Chloroprene rubber – features and benefits

Among the large number of specialized elastomers – CR chloroprene rubber occupies an important place in world rubber consumption with the annual needs of around 300,000 t worldwide. CR was first produced 1932nd in DuPont company (responsible for the invention of Kevlar), and since then CR, widely known as Neoprene®, thanks to combination of very good technical characteristics, ranks high in world practice.
CR by its characteristics does not belong at the top among elastomers because CR is not characterized by one outstanding property, but its balance combination of properties is unique among the synthetic elastomers. It has:

- Good mechanical strength
- High ozone and weather resistance
- Good aging resistance
- Low combustibility (one of the rare elastomers with self-extinguishing properties)
- Good resistance toward chemicals
- Moderate oil and fuel resistance
- Excellent adhesion to metals

Because of all these positive characteristics we believe that the chloroprene is ideal choice for use in making anti-slip trampling surfaces of pedestrian communications.

4 Installation of modular anti-slip elements

Installation of modular anti-slip elements is essentially a very simple process that requires no highly skilled labor nor sophisticated or expensive machinery and equipment. Installation consists of the following five stages:

- Preparation of the existing wooden construction
- Tentative laying of anti-slip elements
- Marking the position of the fixing screws
- Drilling screws holes in the wooden base
- Finally screws fixing

4.1 Preparation of the existing wooden construction

Surface preparation consists mainly from visual inspection of the existing wooden structure, followed by removal any of foreign matter that could interfere with installation. If visual inspection determines that certain elements of wooden structures are so dilapidated that they are not suitable for screw fixing of anti-slip elements, such parts must be replaced with the new or appropriate wooden structure.

4.2 Tentative laying of anti-slip elements

The objective of this phase is to determine the final layout of all elements, to avoid the possibility of overlapping the position of screws for fixing elements with the position of the screw for fixing wooden surface to the railway sleepers. During this phase it is necessary to slightly move anti-slip elements in the direction of the axis of the track until they come to a suitable position.

4.3 Marking the position of the fixing screws

Marking the position of the screws to attach anti-slip elements performed using simple handy tool, and aims to precise positioning of future holes for mounting screws in order schedule anti-slip elements remain exactly as defined in the previous phase.

4.4 Drilling screws holes in the wooden base

Drilling holes appropriate diameter and depth is performed with drill for wood using simple hand-held electric drill. During this operation is necessary to pay attention to the perpendicular of holes in relation to the upper surface of the wooden structure. Allowed a deviation
is up to 10° because construction of the fastening place of anti-slip elements is such to compensate this discrepancy.

4.5 Finally screws fixing

The purpose of this operation is finalizing of installation anti-slip modular elements. For this operation also uses standard electric power drill which is equipped with an adequate key for hexagon head bolts.

Figure 2  Anti-slip element fixation

5 Conclusion

In order to ensure the safe movement of pedestrians across the track, avoid falls with mild or severe injuries, and extend the lifespan of wooden construction of railway sleepers – in this paper is proposed solution of ‘rubberized’ of new or used pedestrian communications with a special modular rubber elements attached to the upper surface of the wooden structure. Based on the above we consider that an acceptable solution is described primarily as an efficient, simple, fast and relatively inexpensive way of solving problems of extreme slippery pedestrian cross-communications made of wood. Although today there are other solutions to this problem, in conditions of global recession and stagnation of investment, we believe that the proposed solution could be bridge between the current situation and the future, which certainly belongs to comprehensive, sophisticated and demanding financial-technical solutions.

References

[4]  HŽ – Rulebook for permanent way track maintenance (Rulebook 314)