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17–19 May 2018, Zadar, Croatia

Road and Rail Infrastructure V

Stjepan Lakušić – EDITOR

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PILOT PROJECT FOR ROAD SAFETY IN ROMANIA USING THE CABLE ROAD BARRIER

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Abstract

In Romania, the largest road infrastructure manager is National Company for Roads Infrastructure Administration – C.N.A.I.R S.A., which manages approximately 17,000 km of national roads and highways. Due to the high responsibilities of the largest road manager in Romania, is required to implement pilot road safety projects to observe the behavior of the technical solutions in time. During 2017 a pilot project to separate the traffic routes using cable road barrier was implemented on a road under management, namely DN 2, with a low level of road safety. The cable barrier is not a modern solution from the point of view of international experience, which is used frequently in countries such as Sweden and the United States but in Romania it was the first project of its kind. In this article, the pilot project implemented with all the technical solutions adopted as well as the results obtained after the completion of the implementation works will be presented. The presentation of the results obtained and the way of implementation is important due to the differences from the countries with experience in this field, respectively in Sweden is mainly used on 2 + 1 roads, and in the United States, especially on motorways, where the area between the meanings traffic is very high. Where the area between the traffic directions is very high.

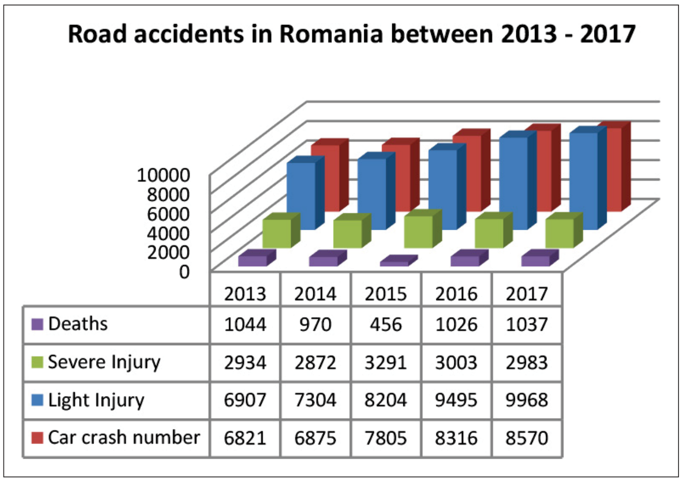
Keywords: road safety, pilot project, cable road barrier, crashes, victims

1 Introduction

Every year the lives of more than 1.25 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury [1]. Road traffic injuries cause considerable economic losses to individuals, their families, and to nations as a whole. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. Road traffic crashes cost most countries 3 % of their gross domestic product [1].

2 National content

Romania has been for many years one of the European Union least performing countries in the main road safety indicators. This trend is particularly worrying now that the number of road traffic victims has started to rise over the last few years, as you can see in Fig. 1.



	2013	2014	2015	2016	2017
Deaths	1044	970	456	1026	1037
Severe Injury	2934	2872	3291	3003	2983
Light Injury	6907	7304	8204	9495	9968
Car crash number	6821	6875	7805	8316	8570

Figure 1 The evolution of road accidents between 2013-2017

The main types of road accidents in Romania that resulted in deaths involving pedestrians (34 %), outgoing road conditions (20 %), frontal accidents (18 %) and side impact accidents (12 %) can be assigned to the existing deficiencies in road infrastructure, which can be solved through a structured road safety improvement program.
Increasing road safety by upgrading road infrastructure (technological countermeasures) can be achieved by focusing on them, because this is the area where long-term progress can be made in reducing road casualties, as opposed to administrative measures such as enforcement of legislation on speed limitation, alcohol and road legislation, etc.
One of the technological measures adopted to increase the road safety on the national roads was the implementation on a road with a low road safety level, respectively National Road 2 – DN 2, of a pilot project for the separation of the traffic routes through the use of cable barriers. Cable barrier is not a modern solution from the point of view of international experience, which has been successfully used in countries such as Sweden and the United States but in Romania it was the first project of its kind.
The presentation of the results obtained and of the implementation mode is important due to the differences between the countries with experience in this field and in Sweden – as can be seen in Fig. 2.a, it is used predominantly on 2 + 1 roads and in the United States America – as can be seen in Fig. 2.b, especially on motorways, where the area between the traffic routes is very high.

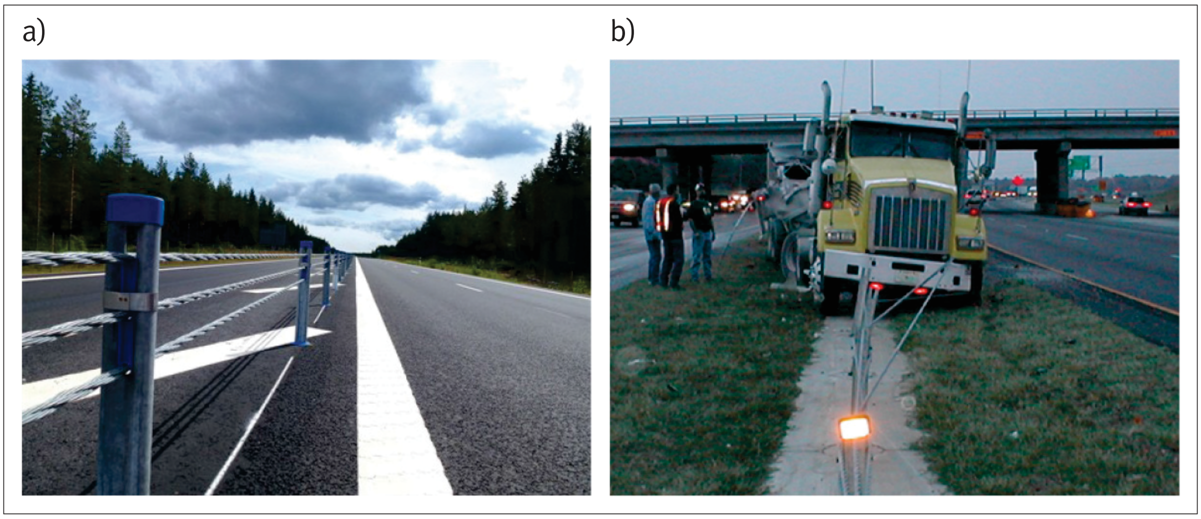


Figure 2 a) Wire rope cable barrier in Sweden; b) Wire rope cable barrier in USA

3 National Road no. 2 – situation and project implementation

3.1 Overview

The National Road 2 – presented in Fig. 3, is a national road in Romania which links Bucharest to the border with Ukraine through the Siret customs point. It crosses from the south to the north, the eastern part of Romania (the North-East, South-East and South-Muntenia development regions) and passes through the cities: Urziceni, Buzau, Râmnicu Sarat, Focsani, Adjud, Bacau, Roman, Fălticeni, Suceava , Siret. On the section between Bucharest and Urziceni it overlaps with the European Road 60, and in Suceava county it has a small overlap with European Road 58 [4].

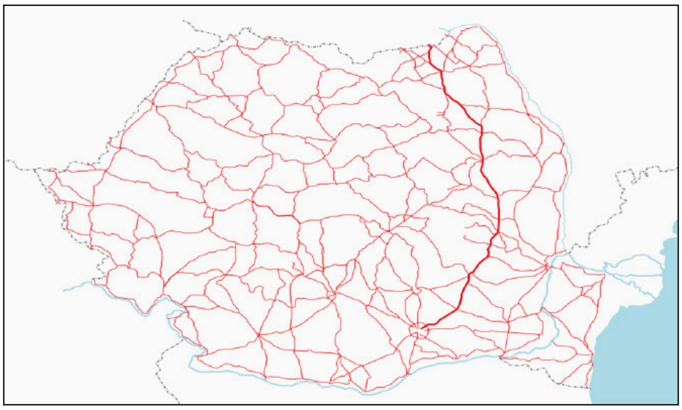


Figure 3 National Road 2 location

From Bucharest to the intersection with DN28 near Sabaoani locality, Neamt (north of Roman), the road presents two lanes on each direction, the marginal one from each direction is a narrow one, only 2.5 m width, officially designated as a stop for emergency stops [4].
The four lanes have a sufficient width for traffic (3.5 m) only on certain portions: between Bucharest and the exit from Afumati, between Buzau and the exit from Maracineni, about 8 km of the road between Poşta Câlnău and Oreavum Buzau County and on bridges. Between the intersection with DN28 and the crossing point in Ukraine from Siret, DN2 is a two-lane highway, one by the way [4].

3.2 Road accidents and causes between 2013-2017

The sector in question, which was the subject of the implementation of the pilot cableguard project, lies within the range of Afumati village, between km. 12 + 500 and km. 14 + 500, is a road sector of DN 2 with 4 lanes, each the traffic lane having of 3.5 meters width and a speed limit of 50 km / h, due to the location of the sector, inside the locality [4].
As can be seen in Fig. 5, the main causes of serious road traffic accidents on DN 2 during the period 2013-2017 were pedestrian indiscipline, non-compliance with traffic rules, risky maneuvers, inadequate driving behavior. All those above are the main causes for producing about 68 % of serious accidents in the last 5 years. On the above-mentioned road sector, new units with various economic profiles have been developed such as: commercial spaces, construction materials warehouses, restaurants, show-room, car service, gas stations. Due to the lack of return points on this road segment, the majority of drivers leaving the parks of these units violate traffic rules, respectively the longitudinal double marking that delimits the direction of travel, which combined with the high speed of travel generates serious road accidents, respectively 21 % of the road accidents produced during 2013-2017 have the main cause of the side collisions due to the lack of priority. At the same time, on this road sector, there are also contracts with private transport companies. Due to the lack of pedestrian

walkways or pedestrian crossings to ensure safe crossing of the national road, they choose to cross through forbidden places, leading to serious road accidents with injuries and even deaths among pedestrians. As can be seen in Fig. 4, road accidents that cause pedestrian impact represent 47 % of road accidents produced during 2013-2017.

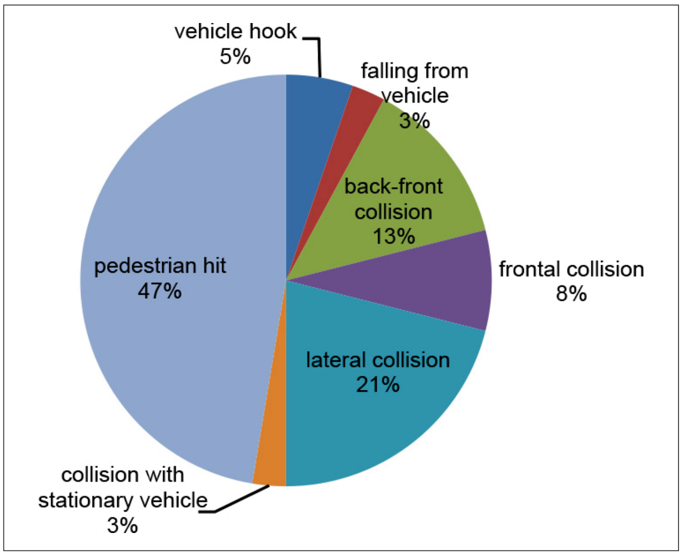


Figure 4 National Road 2 – "weight" road accidents by type of accidents between 2013-2017

3.3 Project implementation stages

The project was implemented performing the following steps:
- Identifying the technical solution from the international literature;
- Elaboration of the technical documentation for products and works necessary for installation of cable rails, for the public tender.
- Designate the winning bid of the 2 submitted offers and sign the contract;
- Project implementation and tracking of results.

3.4 The installation stages of the cable barrier

Mounting the temporary road signaling required to perform the work in the median area of the road, as can be seen in Fig. 5.

Figure 5 Temporary road signaling

As can be seen in Fig. 6.a, the first stage of the execution was the excavation of the foundation in which the anchorages of the cables were to be fixed. After the removal of the asphalt layers, the constructor and the road administrator found that above the road foundation there was a 30 cm thick cement concrete structure, built during the Second World War, which they hardly removed. After that, the second step was the fixation of the anchor device. The anchor device was fixed by casting C32/42 concrete, and after that the road infrastructure was repaired with asphalt concrete. As can be seen in Fig. 6.b, the third stage consisted in fixing the pillars. This stage was necessary for the introduction in the road structure of a sleeve made of galvanized steel, in which the pillars were fixed. The existence of concrete under the asphalt layer made the installation of the safety barriers almost impossible. Thus it was necessary to make drills, at a distance of 3 meters and on a depth of 45 cm to fix these elements in which the pillars were inserted.

a) b)

Figure 6 a) Existing road structure and anchor device; b) The post fastening procedure

In Fig. 7, is presented the insertion of the pillars into the fastening elements, followed by the extension of the cables and the mounting of the plastic separators, the reflective elements at the base of the pole and the ground coverings.

Figure 7 Mounting the cable barriers

Achieving the sector of 2000 ml of cable barrier was made by interconnecting sections with lenght of 150 meters. The cables were connected using tightened cable ties – Fig. 8.a. After completing the complete sector, the cables were mounted in the anchor clamp.
After completing the entire sector, the installers will stretch the cable from the ends of the clamping ears, operation followed by stretching it with a tensioning device depending on the temperature – Fig. 8.b. The entire process is repeated until it reaches the number of cables needed depending on the area and level of protection desired. Subsequently, the columns and the reflective elements were mounted.

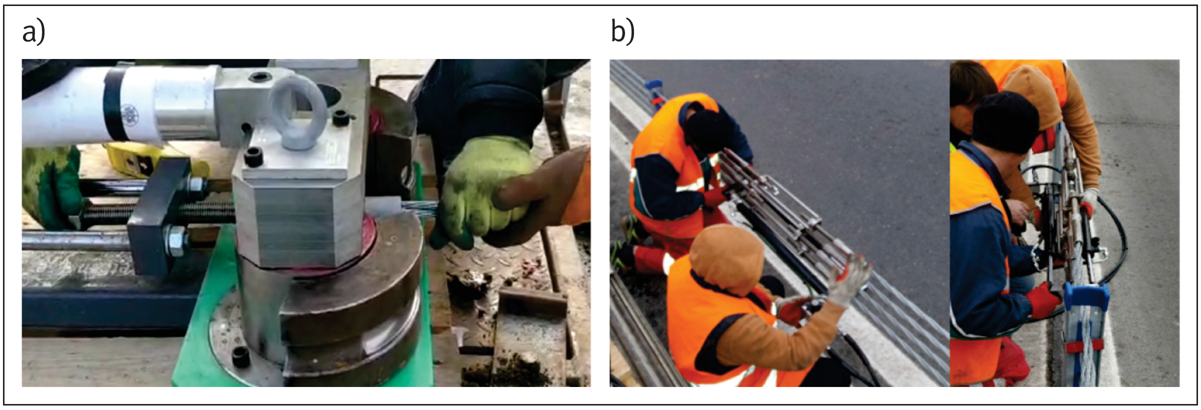


Figure 8 a) Cable wrapping procedure; b) Tensioning the cable barrier

Shortly after realizing this experimental sector, the barriers demonstrated its utility, preventing a frontal road accident between a vehicle that lost its direction and crossed the longitudinal marking, with a regular truck. Fortunately, this incident only resulted in minor damage to the vehicle and the damage of about 20 poles, which were replaced in a short time with minimum costs, as can be seen in Fig. 9.

Figure 9 Car accident and damages

4 Conclusions

The largest road network administrator in Romania, in particular C.N.A.I.R. S.A., constantly strives to increase road safety by implementing the most efficient technical solutions available on the market. The pilot project for the separation of traffic lanes by the use of cable barriers was a first in Romania, proving to be successful in the first few days of its effective implementation on the ground by diominating the results of the traffic accidents. From the international and national experience at this time, the efficiency of cable-barriers has proven to be effective due to the diminishing of the negative effects on vehicles, passengers and road users in case of traffic accidents. All pilot projects demonstrating their expected results are then widely used on the basis of the funds available for the entire managed road network.

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