

Road Plantations and Optical Comfort

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Abstract

Critical situations that appear along the way (crests, curves without visibility, junctions), the insufficient signalization on roads, are common causes of accidents. Traffic at night, fog or rain, are aggravating factors in terms of road safety. In this context, road plantations can help the driver to focus better, so that his reactions to road conditions become improved. This paper addresses some critical situations in terms of driver's perception and ways to solve these situations by road plantations.

Keywords: optical comfort, critical points, road plantations, roundabout, crest

1. Introduction

The World Health Organization estimates that about 1 million people die each year on roads around the world, 50 million are injured, causing damage of 578 billion dollars. Without intervention, it is estimated that the number of deaths due to car accidents will reach about 2.3 million in 2020. In Romania, the situation is one of the worst in Europe. In 2008 there were 142 deaths / 1 million people.

Regarding distribution by place where the accident occurred, the largest increase in the number of accidents on unincorporated area roads in 1999-2008 was recorded in Romania (210%), reaching 53 deaths / 1 million people. [6]

The interaction between driver-road routes is important in a large percentage of road accidents. Traffic is subjected to the action of a multitude of variables that are difficult to manage. The most important factor, which is also the most difficult to control, is the human factor. [3]

In one study, the Department of Education and Training in New South Wales Australia found that:

- The human factor is the cause in 67% of accidents;
- The vehicle is the cause in 4% of accidents;
- Elements of the road are due in 4% of accidents.

In reality, these factors combine. Under these conditions, road elements already have a higher contribution, of 28%, combined with human and vehicle factors, as shown in Figure 1.

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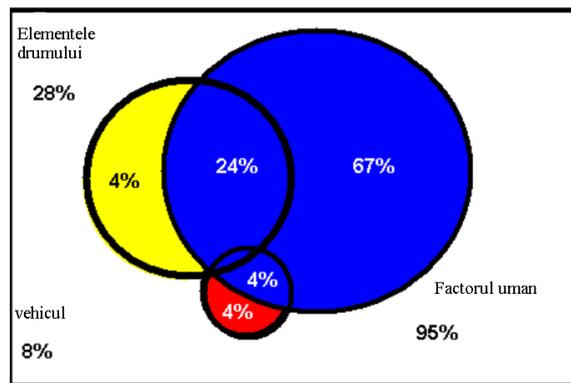


Figure 1 - Percentage of factors involved in accidents

Optical comfort is the characteristic of a road which is resulting from the superposition of all the geometric elements of horizontal alignment, vertical alignment and cross sections. It defines the quality of a road on referring to the perception, from a sufficient distance of the platform and the configuration of the route to be traveled, as well as framing the surrounding landscape. [4]

Road plantations are carried out in areas bordering roads in order to reach a set of functions: technical (slope protection, water sanitation, etc.), road (road benchmarking, comfort and leisure, etc.), ecological (favorable microclimate, pollutants filter, etc.) and landscape (aesthetic improvements of the area, masking unpleasant aspects etc.) [5]

Road function has a special role in traffic safety as plantations must mark the road and provide the accentuation of the route, increasing visual comfort.

By their shape, composition and role, the main categories of plantations carried along the route are as follows:

- Row plantations – both trees and shrubs
- Plantations with isolated trees and shrubs
- Group plantations
- Plantations in rows alternating with groups
- Band plantations
- Plantations for strengthening embankments
- Hedge plantations
- Grassings

Also, with an appropriate setting, usually in bands, on more rows with different heights, road plantations may be protection curtains against heavy snow falls and strong winds.

According to the “Instruction regarding the road plantations”, developed by National Road Administration, the trees and shrubs size is classified in table 1:

Table 1: Clasification of trees and shrubs

Size	I	II	III
Trees	>25 m	15 – 25 m	7 – 15 m
Shrub	3 – 10 m	1 – 3 m	<1 m

The species usually used are selected under the following criteria: adaptation to climate and soil, resistance to wind, drought and pollution, root system, inexpensive maintenance etc.

2. Particular cases in the development of road plantations

There are some critical situations in planning road plantations, such as:

- Arranging road plantations development on crests with vertical convex connections of high gradients of the slopes (bumps);
- Arranging road plantations on the central island of roundabouts;
- Arranging road plantations on T-junctions between a main road and a secondary road

2.1 Road plantations on crests

In the case of crests, for a good perception of the route by road users, it is important for the type and size of trees to be fully consistent with the geometry of the route. Fitting poor road plantations can create feelings of trampoline. It is important that, in such situations, the tree crown height will faithfully follow the road geometry without alternating the heights of the trees. By placing small trees in the maximum peak of the route, followed by tall trees on the descent, the drivers perception of the route to follow is disturbed, and the lack of adaptation of the driving speed to the trail conditions often creates the effect of trampoline, even though in terms of geometric elements, the route meets the standards.

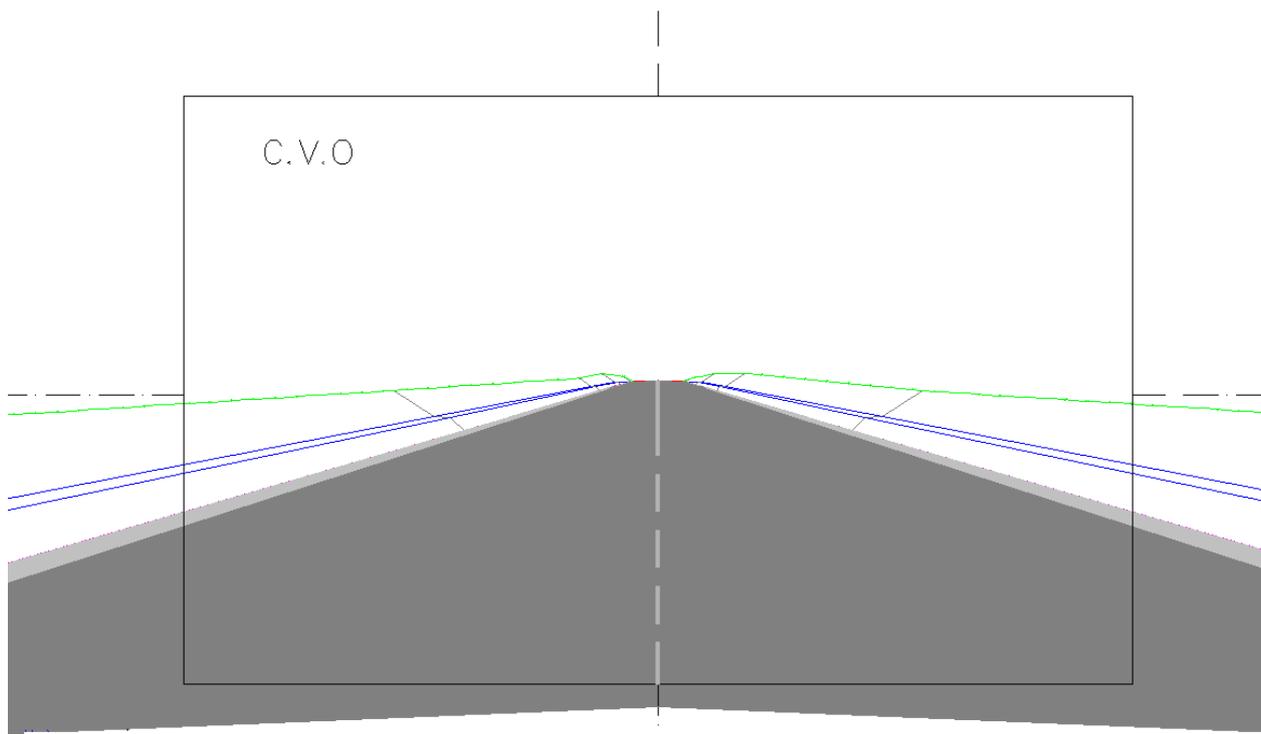


Figure 2. Road crest

In these sectors is useful to plant trees in rows. The trees shall be size II or III (according to the road plantation guidelines), with a pyramidal port. Planting rows of trees is normally performed on the safety zone on both sides of the road, placed symmetrically and parallel to the axis of the road. To enhance the guiding effects, untrimmed hedges can be planted in front of the row of trees. The planting distances, between trees on the same row, shall be 50 m, in order to avoid the impact with

vehicles which could leave the carriageway. The hedge shall be of small or middle size, planted on one or two rows and width shall be at most 100 cm.

The most productive trees to use on our roads are European Ash (*Fraxinus excelsior*), Field Maple (*Acer Campestre*) or Silver Linden (*Tilia Tomentosa*). For the hedges can be used Loncera, Mahonia and Ligustrum.

2.2 Road plantations in roundabouts

In crossroads where the traffic circles, road plantations play an important role in carrying the traffic in conditions of comfort. For proper operation of the road, it is important that drivers entering the crossroad focus on the crossroad without having insight into the route following the crossroad. This can be achieved by illuminating the crossroad, the heightening of the central island fortified with proper planning of road plantations, to shorten the perspective on the route after the crossroad. In this case, alignments of trees will not be planted near the turning point, to avoid creating a sense of continuity on the road.

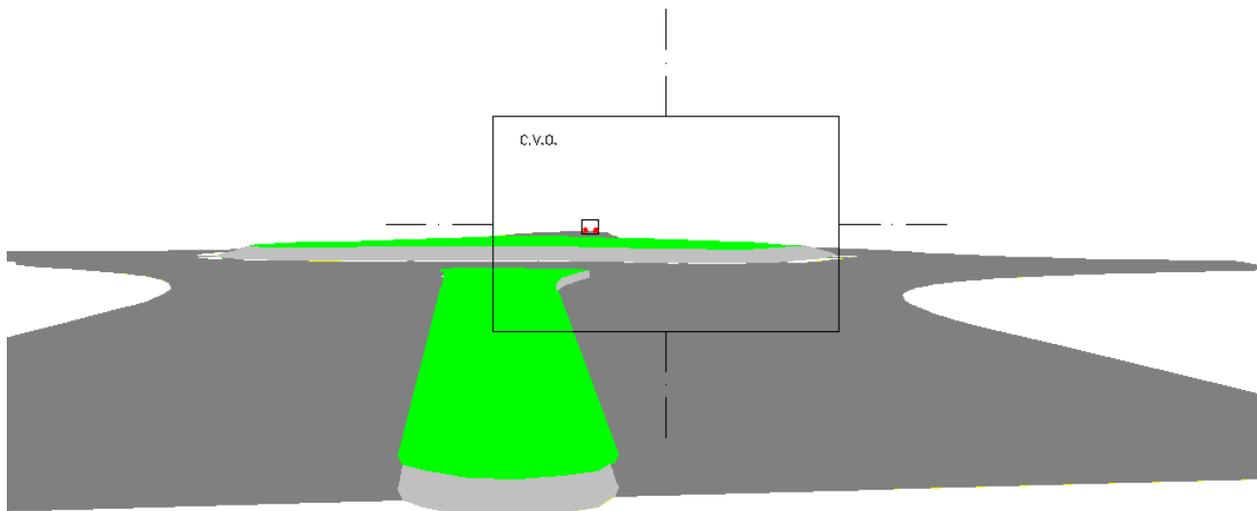


Figure 3. Roundabout crossroad which needs road plantations

In the image above you can see that the entry into the turning point, the driver has an optimal field of view (O.F.V) on the of stoplights of the vehicle that has already passed the crossroad, even if the central island is heightened.

In conditions of night driving, without proper illumination of the road route, drivers tend to follow the front vehicle stoplights. In the situation of a roundabout crossroad, it is necessary that through the landscaping of the central island, in conjunction with a careful choice of road plantations, to remove the vehicles that have already passed the crossroad, as well as the route after the crossroad

from view, drivers are thus forced to follow and be guided by the road signs, crossing the crossroad conditions fluently.

On the central island, ornamental shrubs of low height shall be planted, which will obstruct the vehicles on the main road. The most appropriate for this purpose is *Pinus mugo*, a small evergreen dwarfed tree, forming a dense shrub. It has a size about 50 cm, with a slow grow rate.



Figure 4. Roundabout with landscape [<http://french-windows.blogspot.ro/>]

2.3 Road plantations on junctions between main road and secondary road

When arranging road plantations at the junction of a main road located in a curve and a secondary road prolonging the curve entrance alignment, it is important to avoid that the main road plantations continue on the secondary road. In these situations, the driver's attention focuses on the secondary road, and they will not adjust the speed on the main road entering the curve or will mistake the route. The situation is aggravated if the curve on the main road is not properly fitted (converted or heightened).

To avoid these unpleasant situations, the curve on the main road will have a converted or heightened profile and the main road will be outlined with isolated trees or shrubs. A continuous trimmed hedge could also be useful.

The trees can have globular or pyramidal crown. Recommended species are the mulberry tree (*Morus Alba*, *Morus Nigra*), elderberry (*Sambucus Nigra*), mahonia.

3. Conclusions

Road plantations must be located after a thorough study of the route, having an important role in the optical comfort of drivers and thus traffic safety. Marking the route through plantations, its visual benchmarking, are important elements contributing to increased driver comfort, allowing him to focus better on the road. Also, with an appropriate setting, road plantations may be protection curtains against heavy snow falls and strong winds.

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