CASE STUDY ON THE INFLUENCE OF DRAINAGE DITCHES ON THE QUALITY OF FOREST ROADS

Iovan Călin Ioan *

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: calin_iovannn@yahoo.com;

Abstract

The paper proposes to establish links between the longitudinal gradients of the forest roads and the degree of warping of the drainage ditches, respectively the degree of wear of the road by means of correlation analysis between them.

For this purpose, a number of 25 sections of a forest road have been taken into account, known to be the longitudinal gradients, the degree of warping of drainage ditches and the degree of wear of the road.

In order to find solutions for their design, execution, maintenance and rational exploitation, a series of correlative links have been studied in order to identify the existence of some influences of the warpingof the drainage ditches and the longitudinal gradients on the degree of wear of the forest roads .

The study was carried out on the forest road Şopoteasa, namely a section with a length of 1088,41m, situated in the Băiţa locality, in U.P. I Băiţa, Forest District Sudrigiu, from the Oradea Forestry Directorate, between 2017-2018

The regression equations obtained by linear correlations, which are significant and very significant statistically, show the existence of a close interdependence between the longitudinal gradients, respectively the degree of warping of the drainage ditches, and directly the degree of wear or the quality of the carriageway part forest roads.

Key words: forest roads, declivities, longitudinal profile, drainage ditches, warping, correlations;

INTRODUCTION

In order to establish the connections between the longitudinal profile of the forest roads and the degree of warping of the drainage ditches, respectively the degree of wear of the road, a series of correlation analyzes were proposed between them.

In forest management, considering the complexity of the functions performed by forestry roads (Gucinski H. et al., 2001), the future strategy for the extension of road networks must first aim at rigorous observance of forest arrangements in order to ensure continuity of the forestry production on the one hand and the exercise of the protective role of the forests together with the most efficient access to the forestry fund (Ungur et al, 2003, Iovan, 2017).

The need to construct forest roads as well as to maintain existing ones is motivated by the need to provide a transport network capable of meeting all the needs of the forestry sector in close harmony with current ecological requirements (Lugoa et al 2000, Lazăr et al. 2008), all the more so since it is

not recommended to start a single road in the absence of a project for the entire road network in an area (Ungur, 2005, Iovan, 2017)

In order to find solutions for their design, execution, maintenance and rational exploitation, a series of correlative links have been studied in order to identify the existence of some influences of the warping of the drainage ditches and the longitudinal profile on the degree of wear of the forest roads .

For this purpose, a number of 25 sections of a forest road, which are known for the longitudinal profile, the degree of warping of the drainage ditches and the degree of wear of the road, which are presented in table 1.

The roads, which are the basic ways of opening the forest basins, are represented by forest roads. A rational management of the forestry fund must respect a technical, managerial, economic and environmental principles. (Murphy, 1985, Creţu et al., 2006).

MATERIAL AND METHOD

The study was carried out on the forest road Şopoteasa, namely a section with a length of 1088,41m, situated in the Băiţa locality, in U.P. I Băiţa, the Forestry District of Sudrigiu, from the Oradea Forestry Directorate (17 ***), between 2017-2018. The road is located in a mountainous region with sloping slopes, and develops along an existing road from the Țiganu Valley. The entire route runs as a sloping road on both slopes of the Șopoteasa Valley to Hm 5 + 13.50, where it crosses the left slope with a 2.0 m long pedestal and is maintained there until the end, where the road reaches the point final at hectometric position 10 + 88.41.

Drainage wells and drains must be carried out in all parts of the road in the area and along small backfills (less than 0.5 m) where there is not a sufficient level difference between the edge of the platform and the slope of the slope and there is a danger of flooding the platform (Olteanu N.,1996).

Most often are used the trapezoidal or triangular sections, the trapezoidal section being used in this case. Regardless of their shape, the trench section and slope must be sufficient to ensure that all collected water is discharged to the nearest transverse drain (ACF, 2006), warping them causing a number of physical actions on the quality of the carriageway . This warping is in turn influenced by the longitudinal profile declivity.

In order to analyze the influence of the mentioned factors on the road wear, a number of 25 sections of the studied forest road were taken, the values of which are presented below, together with the extreme average values and the average mean deviation:

Table 1

The value of the longitudinal profile, the degree of warping and the degree of wear of the road

No. Crt.	**Hectometric position** (from Hm to Hm)		**The lenght (m)**	**Longitudinal declivity** (%)	**Degree of warping** (%)	**Degree of Wear of the road** (%)
1	0+00.00	0+16.40	16,40	9,5	45	30
2	0+16.40	0+76.50	60,10	10,9	22	10
3	0+76.50	1+40.70	64,20	10,4	20	12
4	1+40.70	1+99.85	59,15	10,8	22	12
5	1+99.85	2+69.25	69,40	10,0	20	15
6	2+69.25	2+81.25	12,00	11,2	21	10
7	2+81.25	3+24.95	43,70	10,8	20	15
8	3+24.95	3+69.05	45,90	10,6	20	15
9	3+69.05	4+07.10	38,05	9,8	32	24
10	4+07.10	4+44.39	37,29	11,5	15	5
11	4+44.39	4+74.85	30,46	10,9	14	5
12	4+74.85	5+00.97	26,12	11,5	10	5
13	5+22.12	5+78.25	56,13	11,2	10	5
14	5+78.25	5+96.25	18,00	11,8	12	5
15	5+96.25	6+20.50	24,25	10,5	18	10
16	6+20.50	6+31.70	11,20	11,9	12	5
17	6+31.70	6+80.40	48,70	9,7	22	15
18	6+80.40	6+98.90	18,50	10,6	18	15
19	6+98.90	7+81.50	82,60	9,4	30	25
20	7+81.50	7+96.95	15,45	11,1	14	10
21	7+96.95	8+07.70	10,75	9,3	25	20
22	8+07.70	10+13.50	205,80	9,6	25	20
23	10+13.50	10+55.71	42,21	10,7	19	15
24	10+55.71	10+88.41	32,70	9,8	28	20
25	10+88.41	11+70.00	81,59	9,2	29	25

Table 2

Minimum, maximum, mean, and mean standard deviation of the parameters analyzed

Values	**The lenght (m)**	**Longitudinal declivity** (%)	**Degree of warping** (%)	**Degree of Wear of the road** (%)
Mean	46,026	10,508	20,92	13,92
Maximum	205,8	11,9	45	30
Minimum	10,75	9,2	10	5
Mean standard deviation	38,93963	0,78939	7,719689	7,126963

In order to describe the correlation between the degree of wear of the road and the gradient in the longitudinal profile, respectively the degree of warping of the ditches, all types of regression equations were tested, so that the interdependence can be established, which helps to improve the process of designing forest roads, following all aspects of this activity (Horvat, D. 1994).

RESULTS AND DISSSION

In order to identify the possible correlative correlations between the longitudinal profile declivities, the degree of warping of the ditches and the degree of wear of this forest road, three strings were taken into account,

which were tested using the most known regression equations,respectively linear, logarithmic, polynomial, power and exponential.

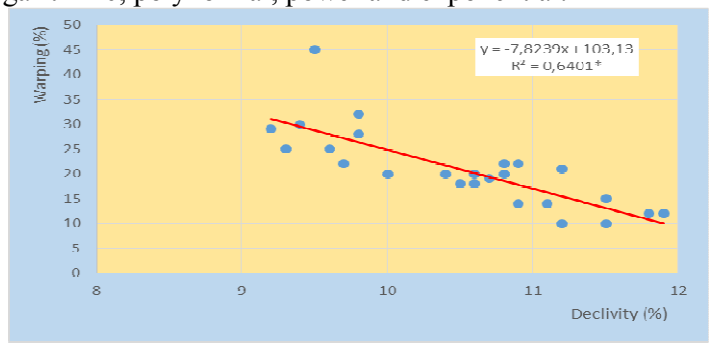

Fig.1. The graphical representation of the linear relationship between the declivity of the ditches in longitudinal profile and the degree of warping

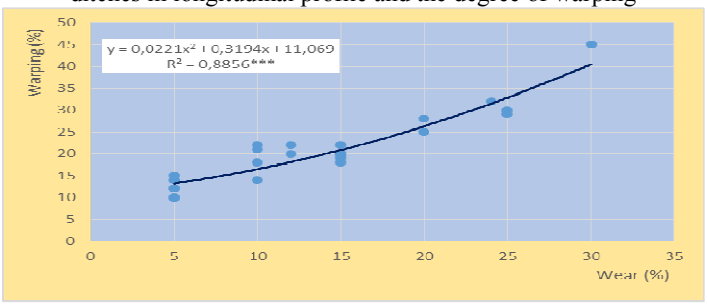

Fig.2. The graphical representation of the linear correlation between the degree of warping of the ditches and the degree of wear of the carriageway

The values of the correlation ratios obtained for the connection between the longitudinal profile declivity, the degree of warping of the ditches and the degree of wear indicate the existence of a linear correlation with a correlation ratio $R^2 = 0,6401$ (Figure1), thus significant (Giurgiu V., 1972) from the statistical point of view, regarding the connection between the declivity and the degree of warping of the ditches.

This linear correlation, with the resulting regression equation $y = -7,8239\ x^2 + 103,13$, shows that there is a very close link between the declivities of the ditches in longitudinal profile and their degree of warping.

Regarding the relation between the degree of warping of the ditches and the degree of wear of the carriageway, it shows the existence of a linear correlation with a correlation ratio $R^2 = 0,8856$ (Figure 2), thus very significant (Giurgiu V.,1972) din punct de vedere statistic.

The regression equation of linear correlation results, y = 0,0221x2 + 0,3194x + 11,069, clearly indicates that there is a very direct link between the degree of warping of the ditches and the degree of wear of the road section, more precisely the warping of the drainage dams directly determines the wear of the road section or the quality of the road.

CONCLUSIONS

In order to make the administration more efficient for the purpose of practicing sustainable forestry, a reorientation is needed on the design, execution and especially the maintenance of the forestry roads. From the obtained results in this study it can be proposed that GIS technology be used in the future in order to increase the precision and quality of the design that are well correlated with the choice of the paths of the forest roads and then to make practical and efficient decisions regarding the maintenance of these roads (Martínez-Zavala L.,, et al,2008; Tamaş Ş. et al., 2006).

The regression equations obtained by linear correlations, which are significant and very significant statistically, show the existence of a close interdependence between the declivities in longitudinal profile, respectively the degree of warping of the ditches and directly the degree of wear or the quality of the carriageway part forest roads.

One aspect that must be mentioned is that not only the degree of warping of the ditches influences the wear of the carriageway, another decisive factor being the water leakage from the slopes of the slopes into the areas of the digging, which trains and transports the soil and the vegetal materials into the ditches and the carriageway .

Carrying out much wider studies on the effect of warping of drainage ditches on the weariness of the road, could make a significant contribution to achieving the most efficient and effective methods for the long-term exploitation and maintenance of forest roads.

By establishing a significant and very significant correlation between the analyzed elements it can be said that they are directly involved in the determination of the quality of the road section of the forest roads, respectively the degree of wear of the road (Dodson Coulter E., et al,2006).

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