ANALYSIS OF THE LINKS BETWEEN THE APPLICABLE DISTANCES AND VOLUMES USED IN A PROFILE ON FOREST ROADS. CASE STUDY

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Abstract

The work was carried out to establish solutions for the design, execution, maintenance and rational exploitation of forest roads, and analyzed some of the geometrical elements of a forest road or the volume used on the same cross section and lengths (distances) applicable.

Due to the complexity of the functions they perform forest roads (Lugoa A.E, et al 2000), the strategy for expanding road networks in the future should aim primarily forest management in strict compliance assurance idea of continuity of the production forest.

In the present study it was attempting to establish the existence of correlative links between certain characteristics of forest road design, to be subsequently studied in depth so that some concrete conclusions can be drawn regarding their design. The obtained results are presented to discussions that can provide some solutions to problems in the design. The study was conducted on forest road Ciripa-Stâna de Vale, a section with a length of 1280 m, located in the forest of Forestry Remeţi, U.P.II Molidiş and U.P. V Valea Iadului of the Forestry Directorate Oradea.

For description of linkages correlation between the volume used on the same cross section and lengths (distances) applicable were tested all kinds of regression equations, so that it can establish the existence of interdependence between them, to help improve the design and operation of forest roads. In order to identify possible links correlations between the volume used on the same cross section and lengths (distances) applicable results forest road Ciripa-Stâna de Vale, they were considered two rows of values that have been tested with the most popular regression equations or logarithmic, linear, power, polynomial, and exponential.

Analyzing the values relationships correlation obtained for the connection between the volume used the same profile and lengths (distances) applicable to found a correlation polynomial, with a ratio of correlation R = 0,391, so one distinctly significant in statistical terms, that allows drawing conclusions on this topic. Of regression equations with two pairs of factors best results were obtained using the correlation polynomial, which is distinctly significant in terms of statistics, which show a close interdependence between the volume used the same profile and lengths (distances) applicable.

Key words: forest roads design, volume used the same profile, distances applicable, forestry sector

INTRODUCTION

In forest management, taking into account the complexity of the functions they perform forest roads (Gucinski H. et al., 2001), future strategy for the development of road networks must meet rigorous guidelines established by forest planning in the interests of continuity assurance forestry production process on the one hand, and the protective role of forests along with a more efficient accessibility of forests (Ungur A. et al., 2003). To re-launch the design of forest roads, much needed sustainable forest management, it is necessary to modernize the conceptual

and execution thereof (Bradosche P., 2007), this process from a series of optimized multi-criteria analysis, respectively in step design (optimal solution) and subsequently the entire period of their operation and maintenance (Zarojanu D. et al., 2006).

Need to build forest roads and maintenance of existing ones is motivated by the need to ensure a transport network capable of serving all the needs of the forestry sector closely in line with environmental requirements current (ACF, 2006). To establish solutions for the design, construction, maintenance and operation of their rational, the paper studied some of geometry to a forest road, earthwork volumes that used the same profile and lengths (distances) applicable.

The research conducted in this paper are intended to show some correlations between the volumes used the same profile and corresponding distances applicable, to ensure optimal conditions for movement of vehicles inside the forest (Jeuffroy G., 1978).

In Romania, the forest roads are as worldwide support basic accessibility forest basins (Eskioglou P., Efthymiou P.N., 1996) so that their achievement in terms of rational forest management should respect the principles of managerial terms environmental and economic efficiency in general (Cretu O. et al., 2006).

MATERIAL AND METHOD

The study was conducted on forest road Ciripa-Stâna de Vale, situated in Budureasa, in U.P. II Molidiş and U.P. V Valea Iadului, Forest District Remeţi of the Forestry Directorate Oradea (Fig. 1).
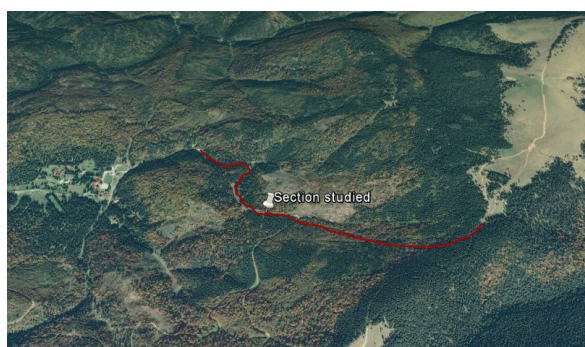

Fig. 1. Satellite image of the sector studied forest road (after www.google earth processing)

Total length studied is 1280 m. The road is located in the mountainous region, with moderate slopes tilt, tilt with torrential brooks and broad valleys (18 ***).

Due to the terrain, which required a considerable amount of earthworks mobilization for implementation of the platform, so that rock is

present in a proportion of 18% of the excavation and longitudinal slope of the road has an average value from 7.7 to 8.9%.

The elements studied in this paper, namely lengths (distances) applicable and earthworks volumes used the same profile, is the length of the respective sections, and earthwork quantities of deployed and used in the execution of the forest road (Dicu M., 2002).Distance (length) is applicable for the achievement of earthwork volume, which is determined by interprofiles, th help, at added up resulting total volume. Interprofiles is considered geometric body between two consecutive cross sections and separated laterally natural ground surface, platform and embankments (Olteanu N., 1996).

The values of this study are presented in Table 1.

<div align="right">*Table 1*</div>

Volume value used the same profile and distances applicable, used on forest road
Ciripa - Stâna de Vale

No. crt.	Volume on the similar profile (m^3)	Distances applicable	No. crt.	Volume on the similar profile (m^3)	Distances applicable
1	24	16,36	26	3	26,00
2	54	29,20	27	35	21,65
3	48	28,25	28	0	25,85
4	47	35,75	29	0	22,75
5	9	30,00	30	1	7,50
6	18	24,05	31	0	9,70
7	40	31,55	32	0	18,95
8	0	32,05	33	0	27,05
9	7	36,85	34	0	26,70
10	20	39,90	35	5	17,25
11	34	31,05	36	0	12,10
12	43	28,80	37	53	13,80
13	9	30,05	38	0	57,55
14	0	30,05	39	0	26,35
15	35	32,10	40	0	28,65
16	0	25,50	41	0	26,75
17	0	17,25	42	13	33,05
18	0	18,30	43	117	27,65
19	18	25,05	44	0	15,60
20	19	31,05	45	21	23,15
21	42	32,40	46	48	29,95
22	28	34,85	47	34	28,15
23	23	33,45	48	151	27,95
24	6	32,40	49	14	25,15
25	0	33,30	50	0	11,95

The volume of earthwork is calculated on interprofile, that added up to obtain the total volume.

Volume calculation embankments can be done by several methods, the method used in this paper are applicable length that changes embankments product is obtained from each cross section area with the average distance that

separates it from neighboring profiles. The relationship basic method is as follows:

$$\Sigma V = S_1 \frac{d_{1-2}}{2} + S_2 \frac{d_{1-2} + d_{2-3}}{2} + \ldots + S_n \frac{d_{n-1} + d_n}{2} \quad \text{(Olteanu N., 1996)}$$

where:

$S_1, S_2, \ldots S_n$ are surfaces each cross section;

d_{1-2}, d_{2-3}, d_n are distances between the transverse profiles;

To describe correlations and linkages between the volume used the same profile and distances applicable to them, they were tested several types of regression equations, so as to be able to establish any connection between them, which can help increase the quality of road design forestry, taking into account all aspects aimed at this activity (technical, environmental, social, etc.) (Horvat D., 1994).

RESULTS AND DISCUSSION

In order to identify possible links correlations between the volume used the same profile and distances relevant applicable, used forest road Ciripa-Stana de Vale, were considered two rows of values that were tested using the known equations regression or logarithmic, linear, power, polynomial, and exponential.

Thus, the analysis of correlation relations obtained for the link between volume used on the same profile and distances applicable, there is a correlation polynomial, with a ratio of correlation $R = 0.391$ (Fig. 2), so one distinct significant (Giurgiu V., 1972) in statistical terms, allowing conclusions to be drawn in this regard. This correlation polynomial, resulting regression equation $y = 0,0617x^2 - 3,0483x + 45\,098$, show that between the volume used on the same profile and there is a visible link distances applicable.
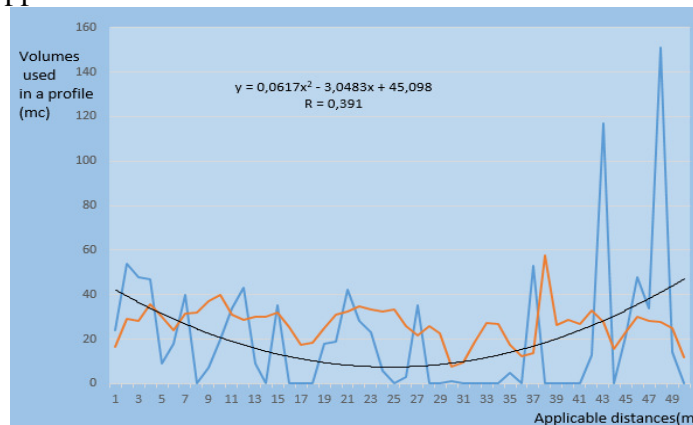

Fig. 2. The graphical representation of the correlation polynomial type between the volume used the same profile and distances applicable

By results or the very close interdependence between those two elements, it can be said that a more complex study of the links between all the forest roads can contribute to increasing the precision of relations account for them and obviously to increase the quality of the design phase.

CONCLUSIONS

Between regression equations with two pairs of factors best results were obtained using polynomial correlations distinct statistically significant, and showing a close interdependence between the volume used the same profile and distances applicable. In the future in order to have a sustainable forestry requires a new approach to the design, execution and maintenance of forest roads. Following the results obtained in this study may be proposed in the future to use GIS technology in order to increase design accuracy and quality correlated well with choosing routes and management of forest roads (Akay A.E. et al., 2008; Iovan C., Crainic G.C., 2009). It is recommended that in the future to conduct studies more depth the links between geometrical elements of forest roads and calculations needed later on volume and more particularly to the movement volume earthwork, ensuring the conditions most optimal choice of routes so that be able to establish new methods for increasing the accuracy and quality of the design and exploitation of forest roads. Analyzes the issues relating to the design and implementation of forest roads aimed at ensuring the development of the degree of improvement in this area, in order to equip the forests with roads, resulting in the elimination of overloading stands (Watkins R.Z. et al., 2003), providing improvement fund structure of production, superior capitalization forest products and reduce the loss of timber. The design activity forest roads must be the result of focused activities between all stakeholders so as to achieve development and better organization of forestry administration process.

REFERENCES

1. Akay A.E., Erdas O., Reis M., Yuksel A., 2008, Estimating sediment yield from a forest road network by using a sediment prediction model and GIS techniques. Building and Environment, Volume 43, Issue 5, Elsevier Press, pp.687-695
2. Bradosche P., 2007, Cu privire la modernizarea proiectării drumurilor forestiere. Meridiane Forestiere, nr. 1, pp.18-23
3. Creţu O., Pavel A., Popescu O., Stoica M., 2006, Drumuri Forestiere 2007-2017. Meridiane Forestiere, nr.4, pp.9-12
4. Dicu M., 2002, Unele tehnologii de lucru aplicate la construcţia drumurilor. Editura MatrixRom, Bucureşti
5. Eskioglou P., Efthymiou P.N., 1996, Alternative stabilization methods of forest roads for an efficient and gentle mechanization of wood harvesting systems.

FAO/ECE/ILO - Seminar on Environmentally sound forest roads and wood transport, Sinaia, Romania

6. Giurgiu V., 1972, Metode ale statisticii matematice aplicate în silvicultură. Editura Ceres, Bucureşti

7. Gucinski H., Furniss M.J., Ziemer R.R., Brookes M.H., 2001, Forest Roads: A Synthesis of Scientific Information. U.S. Department of Agriculture-Forest Service, Pacific Northwest Research Station Portland, Oregon, 10

8. Horvat D., 1994, An exponential correlation model for penetrating characteristics of soil and wheel slip curve. Proc. FORSITRISK, Feldafing/Munich

9. Iovan C., Crainic G.C., 2009, Some aspects with regard to the design of transport instalations in forestry fund using modern technologies. Revista Lucrări ştiinţifice, Seria Agronomie, vol. 52(1), ISSN 2069-7627, Editura "Ion Ionescu de la Brad", pp.351-358

10. Jeuffroy G., 1978, Conception et construction des chaussees. Tome 1, Eyrolles, Paris

11. Lugoa A.E, Gucinski H., 2000, Forest Ecology and Management. Vol. 133, Issue 3, pp.249-262

12. Olteanu N., 1996, Proiectarea drumurilor forestiere. Editura Lux Libris, Braşov, pp.194-197

13. Ungur A., Bereziuc R., Costea C., Popovici V., 2003, Actualitatea dotării cu drumuri a pădurilor României. Revista Pădurilor, nr. 3, pp.45-45

14. Watkins R.Z., Chen J., Pickens J., Brosofske K.D., 2003, Conservation Biology. Vol. 17, Issue 2, pp.411-419

15. Zarojanu D., Duduman G., 2006, Consideraţii privind stabilirea traseelor de drumuri forestiere. Revista Pădurilor, nr.6, pp.46-49

16. ***, 2006, A.C.F., Construcţiile forestiere în contextul gospodăririi durabile a pădurilor, Editura Lux Libris, Braşov

17. ***, Amenajamentul O.S. Remeţi, D.S. Oradea

18. www.google earth processing