RESEARCH ON THE GEOMETRY ELEMENTS OF TRANSITION CURVES IN THE DESIGN OF FOREST ROADS. CASE STUDY

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Abstract

Given the complexity of the functions they perform forest roads, future strategy on expanding road networks should primarily pursue strict compliance assurance forest management in order to continuity of production forest

In order to establish solutions for the design, implementation, maintenance and operation of their rational, in this paper studied some geometrical elements of a forest road, length, enlarge and curve radii.

This study seeks to establish the existence of correlative links between certain geometric characteristics of transition curves of forest roads, which are then studied in depth, so that it can be developed some concrete conclusions regarding their design. The obtained results are presented some discussions that may offer some solutions to problems in the design. The study was conducted on the forest road Ţiganului Valley, with a length of 1180m, located in the forest of the Forestry Sudrigiu, UP I Băiţa, from the Forestry Department Oradea.

To describe correlative links between the length, enlarge and curve radii connecting, were tested all regression equations, so that they can establish the existence of interdependence between them, which help improve the design process of forest roads.

Analyzing the correlation relations obtained for the geometrical relationship between the three curves, revealed a second-degree polynomial correlation, with correlation ratio R = 0.6940 and R = 0.6889, so very significant statistically, allowing conclusions to be drawn in this direction.

From the regression equations with two and three pairs of factors best results are obtained using polynomial functions of degree II, which are statistically significant, which shows that there is close interdependence between geometric elements of transition curves of the sides polygon based on forest roads.

Key words: forest sector, forest roads, curved connection, geometric elements, correlations;

INTRODUCTION

In forest management, given the complexity of the functions they perform forest roads (Gucinski H. et al., 2001), future strategy on expanding road networks should aim primarily to rigorous forest management for the purpose of continuity assurance timber production on the one hand and the protective role of forests exercise along with a more efficient accessibility of forests (Ungur A. et al, 2003).

To relaunch work on forest road design, so necessary in sustainable forest management, it is necessary to modernize their conceptual and execution (Bradosche P., 2007), this process from a series of optimized multicriterial analysis, namely the stage of design (optimal solution) and subsequently throughout the period of their operation and maintenance (Zarojanu D., et al, 2006).

The need for the construction of 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 current environmental requirements (Lugoa A.E., et al 2000), that the more the as it is not at all recommended starting execution of a single road, unless project there is a whole network of roads in an area (Ungur A., 2005).

In order to establish solutions for the design, implementation, maintenance and operation of their rational, in this paper studied some geometrical elements of a forest road, length, enlarge and curve radii.

Research on forest roads are made with the intention of showing some correlation between the geometrical characteristics of transition curves in order to improve design and construction works (Watkins RZ, et al, 2003).

This study seeks to establish the existence of correlative links between certain geometric characteristics of transition curves of forest roads, which are then studied in depth, so that it can be developed some concrete conclusions regarding their design. The obtained results are presented some discussions that may offer some solutions to problems in the design.

In Romania, the forest roads are considered as the basic ways to open forest basins, so their construction in terms of rational forest management should respect the principles of management in terms of environmental and economic efficiency in general (Crețu O., et al. , 2006).

MATERIAL AND METHODS

The study was conducted on the forest road Țiganului Valley, which has a length of 1180m, located in the forest of the Forestry Sudrigiu, UP I Băița, from the Forestry Department Oradea (17 ***), in 2006-2007.

The road is located in the mountainous region, with slopes inclined, the entire route is conducted as road slope, ground conditions that crosses are heavy because kneaded relief, which required the deployment of a large volume of earthwork to achieve the platform, so that the rock is present in an amount of 11% of the volume of excavation and the longitudinal slope of the road is on average 7-8%.

It is known that for connecting alignments is necessary to provide basic polygon curves (ACF, 2006), which can be of two kinds: circular or progressive. In this study were used circular curves (arcs) (Lazăr Ș., et al., 2008), whose main geometric elements (figure 1):

-U - peak angle, or the angle between the two alignments which are connected by a circular arc curve;

-R - arc radius, in m;

-T_i, T_e - tangent input and output, in m;

-B - bisector, in m ;

-I,E - entry and exit points of the curve;
-S- extralarge from curve, in m;
-L - curve length (arc), in m;
-V - peak curve;
-α_c - central angle, in degrees;

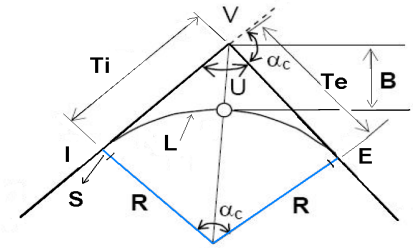

Fig.1 Geometric elements of circular curves

Geometric elements studied in this work, namely length, enlarge and curve radii connecting, represent space vehicles traveled between entry and exit points of the curve (I, E), increase the width for width platform to facilitate their entry vehicles in curves (N. Olteanu, 1996), the radius of the arc that connects the base polygon (the regulations are adopted as regulations in force for the design of forest roads).

The values of the geometric elements study are presented in table 1, below:

Table 1

The value of the geometric elements characteristic circular road curves studied

No. crt.	Lenght of curve (m)	Radius curve (m)	Curve extralarge (m)
1	20,5	30	1,14
2	20	100	0,38
3	24,6	80	1
4	44,2	125	0,32
5	13,22	30	1,14
6	15,9	50	0,71
7	22,6	40	0,87
8	10,74	60	0,3
9	8,42	40	0,87
10	20,26	30	1,14
11	17,44	20	1,66
12	15,55	60	0,6
13	31,42	200	0,2
14	23,26	120	0,32
15	10,5	20	1,66
16	9	15	2,18
17	35	30	1,04
18	58,9	300	0,14
19	23,56	150	0,26
20	46,73	50	0,71
21	25,12	80	1

To describe correlative links between the length, extralarge and curve radii connecting, were tested all regression equations, so that they can establish the existence of interdependence between them, which help improve the design process of forest roads, following all aspects targeting this activity (technical, environmental, social, etc.) (Horvat, D. 1994).

RESULTS AND DISCUSSION

In order to identify possible links correlative connection between geometrical characteristics curves related to this forest road, were considered 3 and 2 rows of values, which were tested using regression equations best known, namely linear, logarithmic, polynomial, power and exponential.

Analyzing the values of correlation relations obtained for the relationship between curve radius and its length, revealed a second-degree polynomial correlation, with correlation ratio R = 0.6940 (figure2), so very significant (Giurgiu V., 1972) in statistically, allowing conclusions to be drawn in this direction.

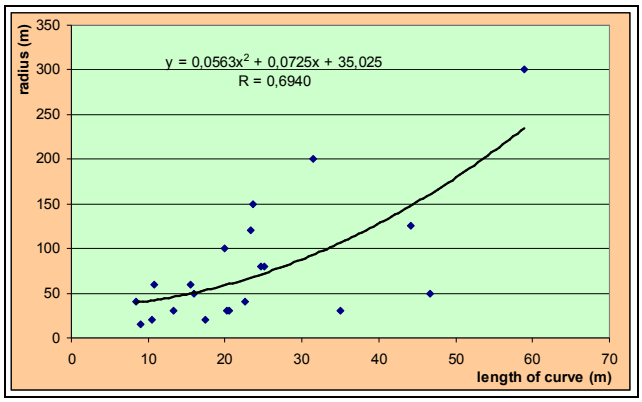

Fig.2 Graphical representation of type polynomial correlation between the radius and length curves

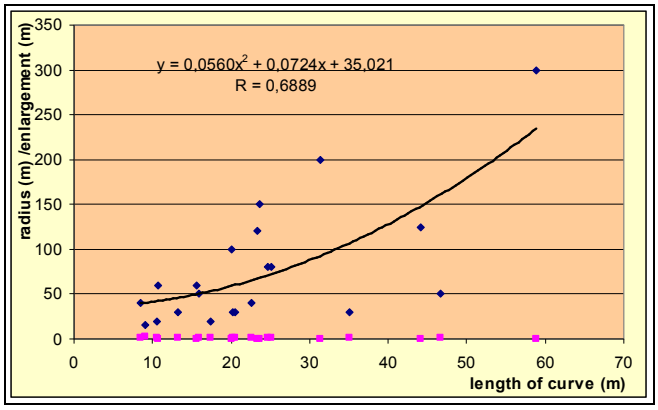

Fig.3. Graphical representation of type polynomial correlation between the, length, extralarge and radius curves

Taking into account the values obtained for bond correlation relationships between all three geometry (length, extralarge and curve radius), revealed all to a second degree polynomial correlation, with correlation ratio R = 0.6889 (figure3), also highly statistically significant.

The second degree polynomial correlations with regression equations results $y = 0{,}0563X^2 + 0{,}0725X + 35{,}025$ and $y = 0{,}0560\ X^2 + 0{,}0724\ X + 35{,}021$ respectivly, shows that between length, extralarge and curve radius there is a particularly close. The results, the very close interdependence of the three geometry elements, it can be said that a more complex study of the links between all geometric elements of transition curves of forest roads can help to improve accuracy relations for calculating lifting them in automatically to increase the quality of the design phase.

CONCLUSIONS

From the regression equations with two or three pairs of factors best results are obtained using second degree polynomial correlations that are statistically significant, which indicates that there is close interdependence between geometric elements of transition curves of the sides base polygon on forest roads.

The purpose of practicing a sustainable forestry is necessary to rethink the design, implementation and maintenance of forest roads. Following the results obtained in this study may propose in the future to use GIS technology in order to increase the accuracy and quality design well correlated with the choice and management of forest roads routes (Akay A.E., et al, 2008; Tamas Ş. et al. , 2006).

It is recommended that further studies be carried out more extensive and complex calculations the decisive contribution of the geometric elements of curves, choosing the most optimal routes of forest roads, from all points of view.

Tracking problems concerning the design and implementation of forest roads have as main objective demonstration that the equipment forest with forest roads can be eliminated overuse stands (Eskioglou P., et al, 1996), providing improved production fund structure, reducing the loss of timber and better use of forest products.

Given the complexity of the effects resulting from forest to forest roads endowment, it becomes obvious that their design work must be the result of close collaboration between all participants in the proper performance of forest economy.

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