The Impact of Forest Roads Construction upon the Environment and its Assessment

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Abstract: - The paper presents the impact influence upon the environment determined in the execution process of forest roads and their exploitation. The quantification methodology of the impact intensity upon the main environment factors, respectively air, water, soil and biodiversity is also mentioned.

Key-Words: - forest road, assessment, environment, biodiversity pollution.

1 Introduction

In the design and execution of the forest roads are adopted working techniques and technologies which protect the surrounding stands. More than that, the forest roads projects are the subject of the Environment Agency approval. In order to be approved, each project contains an impact study which establishes and quantifies the impact in conventional units. Considering that there exists a lot of quantification methods in the world wide specialty literature, in the following paragraphs is presented the methodology used in the impact studies elaboration. Thus, the impact assessment is made through an analytical method (quantitative type), through reliability grades (Nb) and through the grapho – analytical method which assess the global pollution index (I.P.G.). The study's specifications dispose the measure and the grade in which the environment is affected or not by the execution works.

2 Impact assessment

2.1 The Analytical Method

The analytical method for impact assessment takes in consideration a reliability scale, expressed through grades between 1 and 10, and which highlights the pollution effects upon the environment. The reliability scale, presented in table no. 2, accords the 10^{th} grade to the distribution which corresponds to the natural unaffected state and the first grade to the maximum pollution state. The reliability of a certain factor is assessed on the reliability scale in rapport with the admitted limits through the current normative. The main

analyzed factors are: air, water, soil and biodiversity. For these factors is applied the square variant as follows.

For air and water, the concentrations of different pollutants (C), which are compared with the maximum permitted concentrations (CMA) prescribed in STAS 12574/87 and Ord. MAPPM 642/93 (for air) and NTPA 001/2002 (for water). The environment pollution index (Ip) results from the above mentioned elements rapport:

$$Ip = \frac{C}{CMA} \quad (1)$$

The maximum allowed concentrations, prescribed in the mentioned standards, are presented in tale no. 1, and the real values of the pollutants are determined through laboratory tests. The environment pollution index (Ip) is determined for each pollutant, and in final are obtained through conversion, different reliability grades. The reliability grade for a factor is obtained as average grade. The technical dimensions conversion is presented in table no. 2. For soil, the quantification of the impact provoked by the road execution will be made by considering the following pollutants:

-Exceeding cut volumes situate next to road as non arranged depots outside the road territory, or disseminate on terrain, expressed in m^3/hm-road;

-Rock volumes resulted from local quarries, in order to obtain the necessary rocky material (superstructure, reinforcement, bridges and retaining walls), expressed in m^3/hm-road;

-Exploitation residuals volume, resulted from road corridor, expressed in mst/ha.

Each pollutant will be quantified through reliability notes (Nb). The average reliability grade is obtained as weighted average of the three grades, according to the relation:

$$Nbsol = \frac{4N_{bexcad} + 4N_{bderoc} + 2N_{rest.ex}}{10}, \quad (2)$$

where the numbers 4-4-2 represent the accorded grades.

The conversions for technical dimensions of the mentioned damages in reliability grades are presented in tables no. 3, 4 and 5. In tables no 3 and 4 were considered different transversal profiles. Table no. 5 considered that, according to the specialty research, the volume of the exploitation residuals varies between 0.5 and 10 mst/ha.

The technical dimensions from the above mentioned ideas will be established according to the transversal profiles in case of earth volume exceeding and rock volume, and through sampling in the exploitation residuals case.

For biodiversity, the impact must be assessed by using field information referring to the following:

-The biotypes from the road location (forests, swamps, wetlands, sands, etc.);

-Local flora;

-Animal and vegetal species and habitats.

There can be appreciated more or less theoretically, the percent in which is affected the biodiversity (P%), and the pollution index results from the relation:

$$Ip = \frac{P_{[\%]}}{100} \quad (3)$$

With this value can be used the conversion scale (table no. 7) in order to asset the reliability scale for biodiversity Nb.

Table 1: Maximum allowable concentrations for pollutants

Nr. crt.	Pollutants denomination	M. U.	Maximum allowable concentrations
A. AIR			
1.	CO	mg/m^3	2,0 (daily)
2.	Solvents	mg/m^3	2,0 (daily)
B. WATER (pluvial waters)			
1.	pH	-	6,5…..8,5
2.	Suspensions	mg/l	30
3	CBO_5	mg/l	12
4.	CCO-Cr	mg/l	30
5.	Total nitrogen	mg/l	5
6.	Total phosphor	mg/l	0,5
7.	Phenols	mg/l	0,02

Table no. 2: The pollution indexes conversion for air and water in reliability notes

I_p value $I_p = \frac{C}{CMA}$	Reliability grade N_b
0	10
0,0-0.25	9
0.26-0.50	8
0.51-1.00	7
1.10-2.00	6
2.01-4.00	5
4.01-8.00	4
8.01-12.00	3
12.01-20.00	2
>20.00	1

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Table no. 3 – Exceeding earth volume conversion in reliability grades

Cut exceeding m^3/hm-road	Reliability grade $N_{bexceed}$
Under 15	10
15.1-25	9
21.5-36	8
36.1-47	7
47.1-58	6
58.1-69	5
69.1-81	4
81.1-92	3
92.1-103	2
Over 103	1

Table no. 5 – Rock volume conversion in reliability grades

Rock volume m^3/hm-road	Reliability grade N_{bderoc}
Under 50	10
51-150	9
151-300	8
301-450	7
451-600	6
601-750	5
751-900	4
951-1050	3
1051-1300	2
Over 1300	1

Table no. 6 – Exploitation residuals conversion in reliability grades

Exploitation residuals [mst/ha]	Reliability grade $N_{brest.ex}$
Under 0,5	10
0,6-1,5	9
1,6-3,0	8
3,1-4,0	7
4,1-5,0	6
5,1-6,0	5
6,1-7,0	4
7,1-8,0	3
8,1-9,0	2
Over 9	1

Table no. 7: Biodiversity pollution in reliability grades Nb

Biodiversity pollution index I_p	Reliability grades
Under 0,10	10
0,11-0,20	9
0,21-0,30	8
0,31-0,40	7
0,41-0,50	6
0,51-0,60	5
0,61-0,70	4
0,71-0,80	3
0,81-0,90	2
Over 0,90	1

2.1 The Graph Analytical Method

The global impact upon the environment, presented as global pollution index IPG, can be assessed by using the pollution indexes determined above. leave two blank lines between successive sections as here. The IPG assessment can be made by considering the scale presented in table no. 9. According to the table no. 9, when IPG=1 the environment is not polluted. When the IPG>1 there appear quality modifications which are increasing up to the total degradation of the environment (IPG>6). The global pollution index value is determined through the grapho – analytical method, using the diagram presented in figure no. 1 and the following relation:

$$IPG = \frac{S_i}{S_r} \quad (4)$$

Where Si is the ideal state represented by square area in the diagram;
Sr – the real state, represented by the quadrangle area in the diagram.

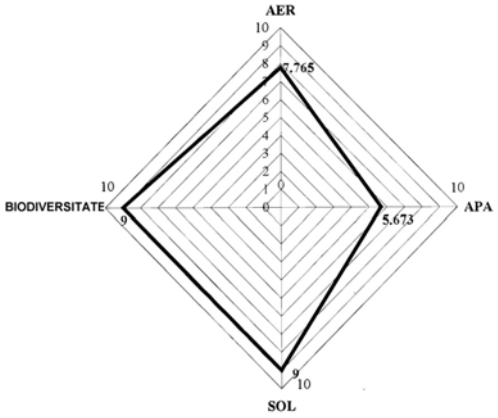

Figure no. 1 – Graphical representation for the IPG determination – square method

Table no. 8: Environment quality scale

Value	Environment quality
1=IPG	Natural environment, unaffected by human activity
1<IPG ≤ 2	Environment affected by human activity in admissible limits
2< IPG ≤ 3	Environment affected by human activity, with discomfort for life forms
3 < IPG ≤ 4	Environment affected by human activity, with disturbances for life forms
4 < IPG ≤ 6	Very affected environment by human activity, dangerous for life forms
6<IPG	Degraded environment, improper for life forms

3 Conclusions

There can be extracted some conclusions regarding the aspects presented in the present paper:

1. The impact study constitutes a mandatory piece in the forest road design, which is necessary in order to obtain all the approvals for road execution;
2. Through the impact study, the impact is quantified in accordance with Environment Protection Agency directives;
3. Impact assessment contributes to a better landscape solution through the extension of the wood as a construction material and the realization of bridges and retaining walls based on wood;
4. The national natural parks protection is assured through the respecting of the integral protection zones, the road tracks being lead only to the touristic and administrative boundaries.

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