PUBLIC ROADS IN THE OPENING OF FORESTS IN FOREST MANAGEMENT UNITS OF SARAJEVO CANTON

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Abstract: The primary network of forest roads consists of public and forest truck roads. Public roads in one forest area have been mainly built due to needs of local communities, access to rural areas, the development of tourism, recreation and so on. Forest truck roads have been built and maintained by those who manage forests (the forest management), while public roads have been managed by the Directorate for Roads of the Federation of B&H and cantonal and local governments. In the last twenty years, the sector for wood assortments transport in the Federation of B&H is in charge of the private transport operators which use vehicles of large capacities and high axle loads for the purpose of transport of as large as possible quantities of wooden mass per time unit. Due to this fact, the roads have deteriorated faster. The accelerated deterioration of the roads used for the transport of wooden assortments imposes the need for the allocation of larger funds for their maintenance. Due to the increasing damages on the roads the prohibitions of use of some public roads for wooden assortments transport occur more frequently. The aim of the research is to determine the total length of public roads which open Forest Management Units of Sarajevo Canton (FMU of SC) and to investigate the possibility of using these categories of roads for forestry. For examination and analysis possibilities of using public roads for wooden assortments transport qualitative research- polls methods have been applied within the framework of the key representatives of the target groups such as forestry and the local community. In the questionnaire, two sets of questions were specified, the first one which is designed to determine the possible existence of problems of using public roads for the transport of wood assortments and possible causes of occurrence of the problems. The second group of questions gives some of the possible solutions for solving the problems of using public roads for the purpose of transport of wood assortments. The results of the survey show that the share of public roads for opening forest truck roads of Canton Sarajevo amounts 44.94%. The given results illustrate that the cases of prohibition of use of public roads for wood assortments transport are rare. The largest proportion of respondents (65%) pleaded that there are no problems (conditions) for using public roads within their territory. A share of 32% of respondents said that there are some requirements for the use of public roads for the transport of wood assortments in their territory and those are mostly demands that FMU covers the costs of maintenance of these roads. A share of 58% of respondents gave the answer that those requirements originate from self-organized groups of citizens. A share of 42% of respondents gave the answer that these requirements originate from the local community (municipalities and lower levels). In the second group of questions, where the proposal for resolving the problems of wood assortments transport in case of inability of use the existing public roads have been given the majority of respondents consider that the solution of problem is making agreement on the
INTRODUCTION AND RESEARCH ISSUES

The public and forest truck roads make the primary network of roads which opens forests. For the calculation of forest area accessibility public and forest truck roads have been taken according to classification (Šikić et al., 1989.)

- Roads which pass through the forest have been taken in the calculation with their entire length,
- Roads which pass along forest edge or pass through forest at the distance of 300 m from forest edge have been taken in the calculation with 50% of their length,
- Roads which come vertically to the forest edge and end at the forest edge have been taken in the calculation with the length of 500 m and
- Soft soil roads used only during dry time period have not been taken in the calculation of accessibility.

Public roads in a particular forest area have been mainly built due to the needs of the local community, access to rural areas, tourism development, recreation, etc. The basic difference between forest truck roads and public roads in a particular forest area is the place of management or the funding source. Forest truck roads are managed by those who manage forests (Forest Management Units - Forest Enterprises), while public roads are managed by the Directorate for roads of the Federation of B&H and cantonal and local governments. The funds for the construction of forest truck roads have been extracted from the Fund OKFS (multi-beneficial functions of forests) held by Forest Enterprises, while the funds for public roads have been extracted from tolls, sales of oil derivates, vehicles registration, etc.

Recently, wood vehicles of high capacities and high axle loads have been increasingly used for the transportation of wood assortments by public as well as by forest truck roads (Kozar et al., 2009). The key specify of traffic load on the roads used for the wood assortments transportation are very high pressures of the wheels which the most frequently cause deformation of carriageway in the shape of a rut. The formation of a rut occurs due to the use of roads for the transportation of timber by new vehicles with higher traffic loads than those for which the carriageways are dimensioned. The accelerated degradation of roads used for wood assortments transportation imposes the need for providing higher funds for their maintenance. Due to increasing the damage on roads the bans on the use of some public roads for wood assortments transportation have been more frequent (Sokolovic & Bajric, 2011.).

Recently the increase of share of public roads in forest opening is evident. In accordance with the investigation of Sokolovic & Bajric (2011), which encompassed approximately 70% of the total forest area of the Federation B&H, the share of public roads amounts to approximately 50%. The results of the researches Jeličić & Butulija (1978) and Dobre (1985) indicate a significantly lower share public roads in the availability of forests in B&H.

Planned accessibility needed for the mechanized and economical management of different relief areas is different and ranging from 15 to 25 m/ha (Pentek, 2005).

When we have built the primary network of roads in a particular forest area, which provides accessibility, our plans will not be focused on the building of new roads. At the same time, it happens that the use of some roads from the primary network is difficult or even forbidden because they are public roads. So, the specified image of the accessibility is not realistic. Because of the specified facts, the public roads in forest opening should be analyzed into more detail.
THE AIM AND METHODS OF RESEARCH

The aim of research is determination of the share of public roads which open up Forest management Units of Sarajevo Canton and whether there are potential problems for using public roads for forestry needs. In this sense the tasks for carrying out were defined:

- Introduction to legal legislative framework regarding public roads.
- The determination of the existing data on accessibility (the length and spatial position of public and forest truck roads).
- Calculation and analysis of the share of public roads in opening up all Forest Management Units of Sarajevo Canton (“Igmanjsko”, “Trnovsko”, “Gornjebosansko” and “Bistričko”).
- An analysis of the possibility of using public roads for the needs of wood assortment transportation.
- Writing conclusions of the research with the proposal of measures for the improvement of the determined status.

The method of theoretical analysis will be carried out for the processing legislative guidelines related to public roads in order to define the basic terms based on a law. The illustration and description of all road networks is going to be carried out by descriptive – analytical means. The aim of this method is to determine possible defects as a basis for the improvement of registration and illustration of different roads after the illustration of the existing way of registration of type and length of different type of roads and their analysis.

The qualitative research – questionnaire method will be applied for the test and analysis of the possibilities of use of the public roads for the needs of wood assortments transportation.

The poll is going to be carried out within frameworks of the key representatives of target groups, such as forestry and local community. In the questionnaire, two groups of questions were specified, the first one with the goal of determination of possible existence of problems of the use of public roads for the needs of wood assortments transport and possible causes for the occurrence of problems. In the second group of questions some possible solutions for resolving the problems for the use of public roads for wood assortments transport have been offered. For each question several answers were offered. So, each respondent should round up the answer which is the closest to his/her consideration regarding the observed issues (Appendix 1). The software Microsoft Excel 2007 is going to be used for data processing.

THE AREA OF THE RESEARCH

The areas of the research are all Forest Management Units (FMU) of Sarajevo Canton (SC): FMU „Igmanjsko”, FMU „Trnovsko”, FMU „Gornjebosansko” i FMU „Bistričko”. The total area for the all analyzed Forest Management Units amounts 71.171,5 ha.

THE RESULTS OF RESEARCH

The legal framework related to roads which open up the forest area

The ownership of the public roads according the Law on public roads of the Federation of B&H (15) is state property in common use, where it is not possible to acquire the ownership right or other rights on any basis. Under this Law, all roads are divided into: highways, regional and local roads and streets in settlements and towns.

Uncategorized street is defined as an area which is used for transport on any basis accessible for numerous users. The use, maintenance, protection, construction and reconstruction of uncategorized roads, as well as supervision of those roads are regulated by the city and municipal regulations.

The issue of connection of forest truck roads to public roads is regulated by the following legal guideline: “If newly constructed or reconstructed road intersects or connects to the existing roads which have a macadam carriageway, the existing roads have to be performed with a modern carriageway curtain over the length of at least twenty meters counting from the point of intersection or connection. The costs of construction or reconstruction of the intersection or connection place
or performances of contemporary carriageway curtain are covered by the investor of the road which caused these costs“.

According to The law, the control of axle pressure, total allowed weights and vehicle dimensions on public roads is in charge of the Directorate for roads and the authorized cantonal authority accompanied by the presence of representatives of inferior authorities. If the control determines that the vehicle weight, its axle load or dimensions exceed the allowed values, and that transport is carried out without a license for exceptional transport or a load and dimensions of exceptional transport do not correspond to the values in the license for exceptional transport, the vehicle is excluded from the traffic and the transport operator has to pay a ten times higher amount for the route passed than the amount determined for exceptional transport on public roads due to performed overload on the road. This transport operator has to pay control costs too.

The low and physical persons whose activities cause excessive use of the public road are obliged to pay a fee for an excessive use of the public road. The criteria for determination of excessive use of a public road have been determined by the Federal Minister for transport and communications. In the process of determination of criteria for the excessive use of public road, it is necessary to take into account the activities and frequency of transport by vehicles of particular low or physical person and loading public road.

The total length of roads in the analyzed Forest Management Units of Sarajevo Canton

The existing data on accessibility of FMU of SC were taken from the Forest management plan (FMP) for a particular FMU for the previous arranging period. Tabular data provide the lengths of public and forest truck roads which open up the forest area (Table 1).

On the basis of the data given in Table 1 it can be seen that the total length of public roads for FMU “Igmansko” amounts 286.6 km. The total length of forest truck roads of the FMU “Igmansko” amounts 101.4 km, so the total length of the primary network for this FMU amounts 370 km. The total length of all roads in the FMU “Trnovsko” amounts to 140.7 km, the length of 67.5 km are public and 73.2 km forest truck roads.

The length of public roads for the FMU “Gornje bosansko” amounts to 139.06 km, the length of forest truck roads amounts to 396.69 km, so the total length of all roads for this FMU amounts to 535.75 km. The length of public roads for the FMU “Bistricko” is 25 km, the length of forest truck roads for this FMU is 41.4 km, so the total length of the primary network for this FMU amounts 66.4 km. When we consider the summary data for all FMUs of SC, the total length of the primary network is 1.112.85 km of which 500.16 km are public roads and 612.69 km are forest truck roads.

Table 1. The total length of the roads of FMU of SC on date 31.12.2013. according to FMP

<table>
<thead>
<tr>
<th>Forest Management Unit (FMU)</th>
<th>The length of roads in km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public roads</td>
</tr>
<tr>
<td>FMU Igmansko</td>
<td>268,6</td>
</tr>
<tr>
<td>FMU Trnovsko</td>
<td>67,5</td>
</tr>
<tr>
<td>FMU Gornjebosansko</td>
<td>139,06</td>
</tr>
<tr>
<td>FMU Bistricko</td>
<td>25</td>
</tr>
<tr>
<td>All FMU of SC</td>
<td>500,16</td>
</tr>
</tbody>
</table>
The share of public roads in opening up the FMUs of SC

The share of public roads for all FMUs of SC according to FMP is given in Graph 1. In accordance with the data given in Graph 1, it is clear that the share of public roads is the highest for the FMU “Igmansko” which amounts 72.59%. For the FMU “Trnovsko” the share of public roads amounts to 47.97%, and for the FMU “Gornjebosansko” the share of public roads is 25.96%. The share of public roads for the FMU “Bistricko” amounts to 37.65%. The share of public roads considering all FMUs of SC amounts to 44.94%.

The data on the length of roads which were opening up the FMUs of SC twenty or more years ago were not available. In accordance with the investigation of Jeličić (1978), the share of public roads in the total roads network which opens up B&H forests amounts to 35%.

The result of this research illustrates that the public roads of the FMUs of SC amount to approximately 45% on average. It is clear that the share of public roads in opening up forests increased. The reasons for an increase in the share of public roads in opening up forests in the analyzed area could be more intensive building of public roads or transformation of forest truck roads into public roads.

The reason for the increased share of public roads besides the increased construction of public roads is less and less intensive construction of forest truck roads.

The intensity of forest truck roads construction in the time period from 2007 to 2011 was 41 km on average annually for the area of the Federation of B&H (Sokolovic & Bajric, 2013).

Unlike the less intensive construction of forest truck roads recently, forty to fifty years ago, the intensity of forest truck building was several hundred kilometers per year (Jeličić, 1978). In last ten years FMUs have been planning the building of forest truck roads but due to the shortage of funds the plans could not be implemented entirely.

In accordance with the research of Sokolovic & Bajric (2011), the implementation of planned building amounted to 66% for the time period 2004-2009 in the area of the Federation of B&H.

The analysis of the possibility of use of public roads for the needs of wood assortment transportation

Sokolovic & Bajric (2011) analyzed the ownership relations, rights and requirements for the use of forest transport infrastructure in the Federation of B&H regarding access, connection to public infrastructure and fees for its use according to legal regulations. The authors have come to the data that users of the primary network of forest roads are numerous and the most frequent of them are: the customers of timber (private transport operators), concessioners (stone pit, coal mine, etc.), owners of private forests, tourism, access to villages, etc. A large number of the specified users have been achieving financial benefits by using the primary network of forest roads, but have not covered any costs for their maintenance. The authors proposed introduction of obligatory financial participation for using the primary network of forest roads which should be regulated by a specific price list. This participation would be paid into a special dedicated account for maintenance.

By questionnaires of the FMUs Sokolovic & Bajric (2011) have got the following data on the occurrence of prohibitions in the terrain for the use of public roads for the needs of wood assortment transportation:

- After reconstruction of particular forest truck roads by the local community they have been declared as “public” and after that the local community requires conditions for the use of that road for the needs of the FMU.
For the use of public roads for the needs of the FMU, that local community requires specific conditions (ban on use in a determined time period, fee, maintenance etc.). These are only some reasons which initiated the need for the determination of indicators which should be the basis for getting the global picture of possibilities for using public roads for the needs of wood assortment transportation in all FMUs of the SC.

The key stakeholders were allocated for these questions such as forestry and the local community. The questionnaire was created in order to receive the answers to the two groups of questions. The first group of questions was related to the determination of problems for the use of public roads and identification of causes for the occurrence of problems. In the second group of questions some of solutions were offered.

The determination of problems for the use of public roads

The questions whether the problems for the use of public roads for the needs of wooden assortments transportation exist and in which way they occur, 65% of the respondents have answered that those problems in their area do not exist, 32% of the respondents answered that in their area such problems occur if specific conditions had not been fulfilled, and 3% of the respondents answered that those problems occur in the form of total prohibition of use (Graph 2).

On the question from whom those problems come 42% of respondents have answered that the problems come from the state institutions (municipalities, the lowest level of local communities ...), while 58% of respondents have answered that the problems come from self-organized groups of citizens (graph 3).

To the question whether forest truck roads in their area has been connected to public roads in accordance with the Law on public roads: 32% of respondents have given the answer that none of them has been connected according to relevant law; 32% of the respondents answered that a large number of them had been connected according to the relevant law; 15% of the respondents answered that some of the roads had (occasionally) been connected properly; 12% of the respondents answered that a minor number of roads had been connected properly; none of the respondents have rounded the answer that all

Diagram 2. The problems for the use of public roads for the needs of wooden assortments transportation

Diagram 3. The number of forest truck roads which have been connected to public roads according to the law

Diagram 4. Allocation of the place from which the conditions (bans) for the use of public roads originate
roads had been connected according to the relevant law. A share of 9% of the respondents did not answer this question (Graph 4).

The question of who invested in the construction of the roads on which the requirements for use occurred recently, 44% of the respondents answered that those roads had been constructed by the local communities and local citizens; 29% of the respondents gave the answer that those roads had been built by joint funds of the FMU and the local community and local citizens; only 9% of the respondents answered that those roads had been constructed by the FMU; 18% of the respondents did not answer this question (Graph 5).

The question of possible reasons for the occurrence the problems in the use of public roads for the needs of wood assortments transportation, 35% have answered that the reason is disobedience of legal regulations by the FMUs and private transport operators; 3% of the respondents answered that the reason is dissatisfaction of the local community with fund allocation collected by the sales of wood assortments; 59% of the respondents consider that both of the two causes specified in combination make problems; 3% of the respondents have got given the answer to this question (Graph 6).

**Possible solutions to problems in the use of public roads**

The first possibility which was offered is reaching the agreement on the way of use, where 62% of the respondents rounded up the answer that they agree; 35% of respondents answered that they fully agree; 3% of respondents have given the answer that they disagree in any case; and none of the respondents answered that he/she is not sure or that he/she neither agrees nor agrees (Graph 7).

The second possibility is the introduction of a more intensive control of axle load of truck which transports wood assortments across public roads. A share of 76% of the respondents answered that they fully agree with the introduction of a more intensive control; 12% of the respondents answered that they are not sure; 6% of the respondents answered that they neither agree nor disagree; 6% of respondents answered that they do disagree in any case (Graph 8.).
For the option of timely informing of the local community on planned exploitation as the possible solution, the statistics are as follows: 70% of the respondents answered that they fully agree; while 15% of the respondents answered that they are not sure; 9% of the respondents answered that they neither agree nor disagree; 3% answered that they do disagree in any case; and 3% of the respondents did not answer this question (graph 9).

**DISCUSSION AND CONCLUDING CONSIDERATIONS**

The results of this research show that the share of public roads which open up the FMUs of SC amounts approximately 45%.

The newer data on the share of public roads in Croatia are that it amounts to 18.5% out of the total length of all roads in forest opening up (Pentek et al., 2007).

Žáček and Klč (2008) published the results of research. According to these results the share of public roads in forest opening up in Czech Republic amounts to 26% and the share of different categories of forest roads amounts to 74%.

By comparison of the data obtained by the carried out analysis on the share of public roads which open up the FMUs of SC with the data from past times it is clear that the share of public roads has been increased by approximately 10% in last twenty years.

Some of possible reasons for this increase are:
1. More intensive building of public roads,
2. The violation of regulations during taking into account public roads in the calculation of forest accessibility and
3. The transformation of forest truck roads into public roads.

The higher share of public roads in opening up forests in the area of SC imposes the need for the determination of occurrence of possible problems in the use of these roads for the needs of wood assortments transportation in order to enable undisturbed delivery of timber to processing centers. Sokolovic & Bajric (2011) obtained results on the existence of specific problems in the use of public roads for the needs of forestry on the basis of investigations carried out within the framework of all cantons in the Federation of B&H. The analysis carried out in this article is a result of considerations of key representations of targeted groups, i.e. the FMUs and local community regarding the issues of existence of problems in the use of public roads for the needs of forestry, identification of those problems and possibilities for resolving those problems. Generally, it could be said that in the analyzed area, the cases of prohibition of the use of public roads for forestry needs have not been registered. Certain dissatisfaction due to damaging public roads because of the transport of wood assortments by trucks of high axle loads has been always resolved by achieving an agreement among stakeholders. The possibilities for resolving the issue of undisturbed use of public roads for the needs of forestry...
the majority of respondents see in further negotiations and reaching of agreements.

On the basis of all results of the research carried out and given conclusions, the following recommendations are given:

- The engagement is necessary in order to achieve recognition of the forest truck roads category in legislative and technical regulations.
- Due to the fact that a significant length of public roads has been located in the areas of settlements which are very often far from forest areas, it is necessary to create buffers at a 300 m distance from the road edge for the accessibility calculation. After that, for the sake of accessibility, it is necessary to take the road length in accordance with the recognized professional classification.
- Although according to the Law forestry has the right and obligation to build and maintain only forest truck roads, in the cases of intensive use of public roads forestry also has to participate in their maintenance costs. Due to that fact, continuous cooperation with the local community is recommended in order to avoid possible problems in the use of public roads for the needs of wood assortments transportation.
- Forestry should support all legal obligations (connections to public roads, regulations on allowed axle load etc.), because in this way long-term use of both forest truck roads and public roads is enabled with a minimum investment in maintenance.

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Appendix 1
QUESTIONNAIRE

The analysis of public roads in the opening of forests in Forest Management Units of Sarajevo Canton

Date:_______________

1. In the “our” area the problems of the use of public roads for wooden assortments transport in last ten years have been occurring in these ways:
   a) total ban
   b) use if specific conditions have not been met
   c) do not exist

2. The origination of bans:
   a) from state institutions (municipalities, the lowest level of local communities)
   b) self-organized groups of citizens

3. In the “our” area forest truck roads have been connected to public roads in accordance with Law on public roads:
   a) all roads
   b) great number
   c) some
   d) minor
   e) none of roads

4. The public roads prohibited for the wooden assortments transport recently have been built by following funds:
   a) Forest Management Units (FMU)
   b) local communities and local citizens
   c) joint funds of FMU and local community and local citizens

5. The cause for the occurrence of public roads usage problems in the “our” area is:
   a) disobey to legal regulations from the side of FMU and private transport operates
   b) dissatisfaction of local community related to allocation of funds collected by sale of wooden assortment
   c) jointly a+b

6. The solution of wooden assortments transportation problems could be:

<table>
<thead>
<tr>
<th>Agreeement amongst stakeholders regarding the way of usage</th>
<th>a) I fully agree</th>
<th>b) I agree</th>
<th>c) I am not sure</th>
<th>d) I neither agree nor disagree</th>
<th>e) I do not agree in any case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation of more intensive control of axle load of truck used for transportation of wooden assortments across public roads</td>
<td></td>
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<td>Timely informing of local citizens on planned exploitation</td>
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<td>Other (specify):</td>
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