

## Strategic Planning of Forest Road Network in Croatia – Analysis of Present Situation as Basis for Future Activities

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### Abstract:

*Establishing the optimal forest road network in the field, is obligatory through the following work phases: planning, designing, construction with supervision and maintenance/repair (Pentek et al., 2004). In addition to these, always present phases of forest traffic infrastructure optimization, occasionally, two work phases are also included: reconstruction phase and phase of road removing/restoring.*

*Significant variations in Croatian forestry in terms of terrain orography (lowland, hilly, mountainous and karst region), site and stand characteristics and forest management practices (regular, selective), different patterns of forest road network (road network layout) and different levels of road density, show the need of good planning in forestry as well as in timber harvesting and forest opening. High quality and responsible planning, in this case of forest roads, is a guarantee of rationalization (a set of procedures to achieve cost reduction), in one part of the forestry production.*

*Planning of forest roads, due to the level of planning, its complexity, planning period and operation area, can be divided into three levels:*

- ⇒ *Planning of forest road network at state level or relief area level (lowland, hilly, mountainous and karst relief region). This is the highest and initial level of planning (global planning – strategic planning).*
- ⇒ *Planning of forest road network on management unit level – represents an intermediate level of planning (general planning – tactical planning).*
- ⇒ *Planning of a specific forest road – result of tactical planning leads to planning at the lowest level (local planning – operational planning), after which follows design phase.*

*Planning of forest roads on strategic level (the highest level) must: define relief areas considering measurable terrain and stand characteristics together with forest openness, and its analyses; develop guidelines for appropriate models of primary and secondary forest opening in different relief areas (road layout/pattern); develop guidelines for appropriate and achievable harvesting systems in different relief areas (considering stand characteristics and existing (present) road density).*

*The objectives of this study are:*

- ⇒ *classification of Management Units (MU) and Forest Administrations (FA) into relief categories,*
- ⇒ *identification of existing primary classical openness by MU, FA and relief categories,*
- ⇒ *calculation of the length of the planned forest road network, per FA's and relief regions, for achieving planned (targeted) primary road density,*
- ⇒ *cost calculation of the planned forest road network, per FA's and relief regions, for achieving planned (targeted) primary road density,*
- ⇒ *proposing guidelines for further opening of the Croatian forests.*

*The study was done in 15 Forest Administrations within the company "Croatian Forests" Ltd. Zagreb. Due to lack of data, FA Split was not included into this research.*

**Table 1: Minimum necessary (Šiki et al., 1989), minimal in year 2012 (Hodi & Juruši, 2011), planned (targeted) (Hodi & Juruši, 2011), and planned in year 2030 primary road density for various relief areas in Croatia**

<i>Relief area</i>	<i>Minimum RD 1990<sup>th</sup></i>	<i>Minimum RD 2012<sup>th</sup></i>	<i>Planned (final) RD</i>	<i>Planned RD 2030<sup>th</sup></i>
	<i>[km/1000 ha]</i>			
<i>Low-land area</i>	7.00	10.00	13.00	15.00
<i>Hilly area</i>	12.00	15.00	20.00	25.00
<i>Mountainous area</i>	15.00	20.00	25.00	30.00
<i>Karst area</i>	No data	10.00	15.00	15.00

*Planned primary values of openness at the level of relief categories are guidelines that should be followed, but in the final design of primary forest road network they should not and must not be rigidly complied. It is recommended to review and, where necessary, redefine values of the planned primary classical openness by relief areas, taking into consideration all the factors that have an influence on the calculation of the planned density of primary forest transportation system.*

*At the level of tactical planning, possible deviations from the strategic level are possible, in both positive and negative values, but within reasonable intervals.*

*Analysis of existing primary road density in the study area (by FA's and by different relief areas) on the date December 31 2011, it is concluded that the planned primary road density has not been achieved in most of the state forests. Moreover, in a majority of state forests not even minimal necessary primary road density is achieved, which has a negative impact on the quality, efficiency and rationality of managing these insufficiently opened forests.*

*Extending the time period in which intended values of primary road density should be considered, while simultaneously intensifying the construction of forest roads on an annual basis. It should take into account the financial, technical and infrastructural capacities of company "Croatian Forests" Ltd. Zagreb. In addition to existing sources of funding, funding through current operations and funds from non-market forest values, other possible sources of funding (for example EU funds) of all phases (always and periodically present) should be gained in order to create an optimal primary forest road network.*

*Large disparity of forest openness of the same relief areas is noticed. In the future, when planning investments in the upgrade and development of primary forest traffic infrastructure, it should be taken into account the priority of redirecting funds to poorly opened forest areas, until balance in primary forest road density in relief areas is achieved.*

**Keywords:** primary forest roads, secondary forest roads, road network planning, road density, Croatia