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DEVELOPMENT OF NATIONAL CYCLE ROUTE INDUCED BY EUROVELO CYCLE NETWORKS – – DANUBE CYCLE ROUTE CASE STUDY

SUMMARY

National Cycle Route Development Strategy presents a basis for future development of cycle network in the Republic of Croatia. Stimulated by Euro Velo route development plan, The National cycle network will generate economic growth in regions and their positive impact will be felt across the country. Cycle routes will enable a safe way for employees to their workplace, as well as for children to their schools, and also for tourists an intense enjoyment of nature, recreation and raising health awareness.

This paper deals with issues of cross-border networking of cycle routes to European cycle routes, but also with the issue of the concept of induced building of “cycle network” on Croatian territory, which will provide better accessibility to tourist attractions and increase number of possible combinations of movement in a particular zone. This way, an easier access to workplaces and schools would be enabled for local population, and for tourist a long-term retention on a particular territory. This would significantly advance the generation of revenue for local community which is one of stated goals of cycle network building.

The main objective of this paper is to identify the concept and the strategy of the development of cycle network in the Republic of Croatia. Since the scope of paper does not allow detailed analysis, the paper does not address systematically the entire space of the Republic of Croatia, but focus is on the “Danube” or Euro Velo 6 cycle route, on the territory of Vukovar-Srijem County and Osijek-Baranja County. The paper will suggest solutions which can easily be applied to the other counties, with necessary upgrades.

Key words: International cycling routes, EuroVelo 6, Croatian national bicycle network, bicycle route "Danube", cyclotourism

1. Introduction

Population growth and economic development in the world have lead to an increasing number of personal vehicles, which have caused serious urban and transportation problems such as a global warming, air pollution and traffic congestion. Many countries, including the Republic of Croatia, take actions to reduce these problems by encouraging use of public

transport and green forms of transport - walking and cycling. Because of the higher-speed travel in the peak period, a relatively good accessibility to all points of interest, and easy stopping and parking, bicycle has recently been increasingly used means of transport. As an individual form of transportation or integrated with other modes of transport, bicycle allows intensive enjoyment of nature and beauty of the landscape, cultural and historical heritage and gastronomy, which favors the development of ecotourism, cultural, health and sports tourism, in both urban and rural environments. Tourists from the city want to experience the “other worlds”, that are clearly different from their everyday environment and usual life circumstances. Because of that, development of the cycle network is becoming a priority of development policy on national, regional and local level. Developed cycle network should allow cycle availability not only for tourism objectives, but also for the cycle movement within and between agglomerations, which means that it should at the same time be used by tourists and the local population. Since the principles of cycle network planning for travel to work, to school and for tourism purposes differ, although in the final construction, routes of cycle networks constitute a single entity, only tourist cycle routes will be analyzed in this paper.

2. Starting concept of the realization of cycling network

A question which appears is what should a cycle network that would make tourist potentials available to "tourists on bicycles," look like no matter whether they come as a "long distance" tourists, who only pass through a certain country/region, or as a "target tourists" who have a particular area chosen as the final destination of their journey. We must not forget “local cyclists”, who live in the region and use the bicycle for long or short trips or for sports and recreation. They are all directed to a well planned cycle route network.

In the realization of the concept of tourist cycling route network, the starting point should be the question which are the sources of bicycle traffic, and what are the interesting characteristics a place can offer to tourists, and only then seek for a solution how to connect generators and attractors in a ‘cycling’ way. To each solution, it is necessary to join “drivers” and “barriers”, and analyze their impact on construction of cycle network. The demographic analysis (number, structure and density of population...) and economic development certainly have the most important role in defining the trip generator. The land is the basis for determining the attraction of the journey. Configuration of the land, condition of the existing transport infrastructure, the number and the structure of vehicles on the road, vehicle speed, etc. have important impact on the proposal of the alternative solutions. (

Figure 1) proposes approach to the realization of the concept of cycle network [9].

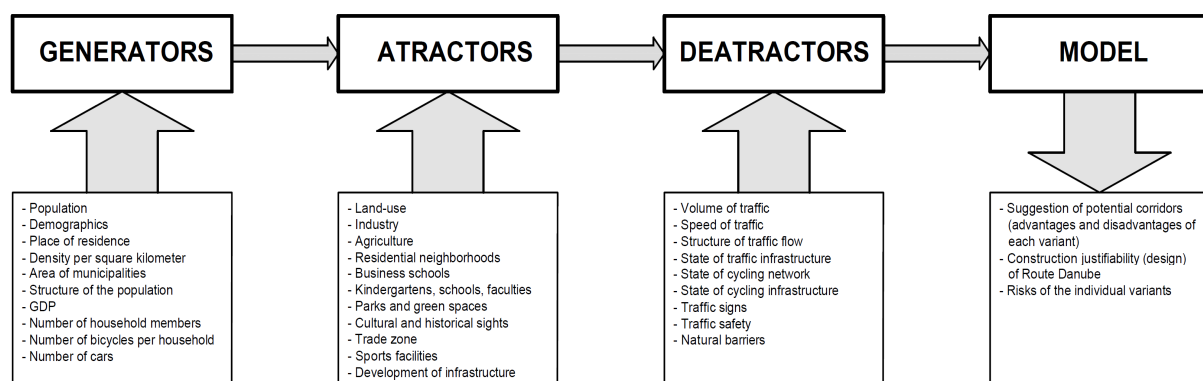


Figure 1. Concept of the realization of cycling network [9]

In order to get as credible data as possible, besides the standard procedures (counting and surveying), it is necessary to conduct research through workshops and forums with key interest groups. Counting is carried out within the regions and on border crossings in order to determine the number of cyclists in international transport. The distribution of trips between zones of the observed area is obtained by surveying. The result of trip distribution are S-D matrices (source-destination matrices), which are basis for forecasting the spatial distribution of trips.

3. International cycle network (EuroVelo)

EuroVelo (European Cycle Route Network) is a European network of bicycle routes that aims to connect the entire European continent. An idea of creating a network of international cycling routes appeared in 1995. The first EuroVelo coordinators were ECF, De Frie Fugle (Denmark) and Sustrans (Great Britain). The plan was to create 12 cycling routes. From August 2007, European Cycling Federation (ECF) in cooperation with national and regional partners, took full responsibility for the project. There have so far been various changes on the network. The best-known changes are two new routes added to the basic network in September 2011, so now there are 14 routes. There is an open possibility of the development of new routes (the new potential routes are Iron Curtain Trail – ICT No. 13 and Rhine Route No. 15). Today, EuroVelo has over 45,000 km of cycling trails, and when finished (approximately in 2020), it will have about 70,000 km [14].

The objective of the EuroVelo project is to ensure implementation of highly sustainable trans-European cycle network in all countries of Europe, encouraging large number of citizens to ride bikes, and promoting healthy and sustainable mobility – on the long tourist journeys, as well as on local, daily travels.

3.1. Major international cycling routes

International EuroVelo routes are marked with ordinal numbers from 1 to 15. Routes 1, 3, 5, 7, 9, 11, 13 and 15 extend from north to south, and routes marked with numbers 2, 4, 6 and 8 extend from west to east. Routes 10 and 12 are cycle routes. The name and length of the routes, as well as the start and the end of a route are given below [14]:

North-south routes:

1. "Atlantic Coast Route": North Cape - Sagres 8,186 km
3. "Pilgrims Route": Trondheim - Santiago de Compostela 5,122 km
5. "Via Romea Francigena": London – Rome and Brindisi 3,900 km
7. Middle Europe route or "The Sun Route": North Cape - Malta 7,305 km
9. "Baltic Sea to Adriatic Sea" ("Amber Route"): Gdansk - Pula 1,930 km
11. "East Europe Route": North Cape - Athens 5,984 km
13. „Iron Curtain Trail“: Barents Sea - Black Sea 6,800 km
15. „Rhine Cycle Route“: Andermatt - Rotterdam 1,320 km



Figure 2. International cycle routes Eurovelo [14]

West-east routes:

- 2. "Capitals Route": Galway - Moscow 5,500 km
- 4. "Roscoff-Kyiv" 4,000 km
- 6. "Atlantic Ocean to Black Sea" ("Rivers Route"): Nantes - Constanta 3,653 km
- 8. "Mediterranean Route": Cádiz – Athens and Cyprus 5,888 km

Cycle routes:

- 10. "Baltic Sea Cycle Route" ("Hansa circuit") St Petersburg - Helsinki - Stockholm - Copenhagen - Riga - Tallinn - St Petersburg 7,980 km
- 12. "North Sea Cycle Route" Bergen - Gothenburg - Hamburg - Den Haag - Harwich - Aberdeen - Inverness - Shetland islands - Bergen 5,932 km

EuroVelo Routes no. 6, 8, 9 and 13 pass through Croatia. The part of international cycling route EuroVelo 6, which passes through Croatia, is known as Route Danube. The figure 2 shows EuroVelo cycling routes in Europe.

3.2. The requirements and standards that must be met by the international cycling routes

The fundamental purpose of the existence of cycling routes is servicing of tourist attractions and encouraging tourism development. That is where the name “cycle-tourist” routes comes from. Thus, for example, foreign tourists in the Danube region are primarily interested in river Danube and the characteristic landscape (vineyards, protected areas, etc.), cultural heritage, or some thematic parts, and not the Danube Route as a road. The international cycling routes should, therefore, primarily be serve to cycle-tourists, or in other words, they should connect tourist destinations in a meaningful, systemic whole. At the same time, these roads should serve to local population as a safe route to work, school, shops, etc. Because these attractions are scattered in space, it is difficult to connect them with one cycle route, which presents a great problem. Therefore, in cycle route planning phase it is necessary to propose several alternative solutions.

In order to respond to such complex requirements as efficiently as possible, it is necessary to ensure good mobility and accessibility. Good mobility and accessibility of tourist destinations means that it is necessary to use various forms of transport and the possibility of transition from public to, so called, slow traffic (from the train, boat, bus to bicycle and pedestrian paths), which greatly enhances not only the rapid tourist transport to deep into the zone of "green nature", but also has positive environmental balance. Connection of the cycle network with public transport is particularly important for the arrival of international cycle-tourists. For international cycle-tourist routes, it is necessary to fulfill the requirement for the availability of public transport at every 150 km (93 miles) [14]. Integration of public and private transport can be improved by some organizational and technical solutions. One of these solution is to introduce a "uniform tariff - the ticket" for traffic in a region (transfer from train to bus or boat line, by free choice and without buying additional tickets). Very attractive solutions are related to the possibility of renting bicycles at railway stations, including the possibility of returning it at any other tourist destination or any public transport station, which provides additional flexibility in planning excursions. International, but also domestic tourists can as well come from their houses to main destination directly by bicycle, although this is less frequent (not a usual practice).

International cycle-tourist routes must satisfy high project standards as well as a number of requirements, such as a possibility to use routes 365 days a year, and accommodation at every 50 km (31 miles). Surface (abrading) layer of bicycle roads must be stable and firm and also paved to a minimum 80% of the length of cycling road. Average annual daily traffic on the road, on which cycling roads are placed, should not be greater than 1000 vehicles per day. Minimum width of bicycle routes must enable riding of two cyclists and a maximum longitudinal slope shall not exceed 6%. [6]. These routes must be attractive, safe and comfortable with a clear and unambiguous traffic signs.

4. Croatian national bicycle network

4.1. Functional classification of cycle roads

The division or classification of cycle roads represents an important process and step in future elaboration of traffic and urban issues. Division is not always so simple and clear in practice, especially because roads from one group often takeover the function of the roads in another group or they in specific area intersect, merge or partially overlap. Therefore, this paper will primarily deal with certain logistic help in classification of bicycle networks.

Croatian national bicycle routes connect centers of regional importance. It is necessary to connect them with the European bicycle network, and that way enable transit bicycle traffic through Croatia. Besides transit and arrival of mostly international cycle-tourists, the national bicycle routes should also ensure fast commuting of domestic bicyclists from distant parts of the country.

Regional bicycle routes are bound on long-distance national routes. These regional routes provide accessibility to the most important tourist areas and local centers in the region. They often have a theme (“*thematic tours*”) or educational character (“*instructive tours*”) with a focus on exploration of certain cultural heritage or landscape. Therefore, regional bicycle routes should be additionally equipped with sign boards in Croatian and one foreign (English) language, in order to inform bicyclists about each tour theme (

Figure 3).



Figure 3. Educational info board for bicyclist [14]

Capillary roads are bound to the „backbone“, major or regional routes, leading to all local destinations. These roads are often small wooden and unpaved field roads which have its beginning and the end in the same town or city. The capillary network of roads constitutes a functional addition to the backbone towards all specific, local destinations. These roads can serve as a recreational bicycle tracks as well, primarily intended for local population who use them during weekends or after work.

Division or classifying of bicycle network on national, regional and capillary, i.e. on major and secondary, has been carried out and is based on a function and role of bicycle roads in spatial and traffic organization. For a more stringent categorization of the bicycle network, it is necessary to consider the whole array of traffic-technical, spatial-organizational and formative aspects in projecting of the bicycle roads.

4.2. Proposition for national and regional bicycle routes

In line with the aforesaid and based on a function and role in the spatial organization i.e. traffic integration of space, length within a network and serving of the localities, the construction of national bicycle network is arising as a logical solution, which would consist from the following national and regional routes:

- Sava bicycle route

- Bicycle route from Hungary, through Zagreb up to Rijeka
- Bicycle route from Hungary, through Našice up to Slavonski Brod and further towards Bosnia and Herzegovina
- Mediterranean route from Rijeka up to Dubrovnik, along the coast and across the islands
- Bicycle route from Rijeka up to Dubrovnik through inland
- Bicycle route Danube connecting Hungary, Croatia and Autonomous Province of Vojvodina
- Drava-valley bicycle route
- Bicycle route from Zagreb, across Sisak up to Hrvatska Dubica and Hrvatska Kostajnica.

Figure 4. presents the illustration of existing and future bicycle network on the national level.

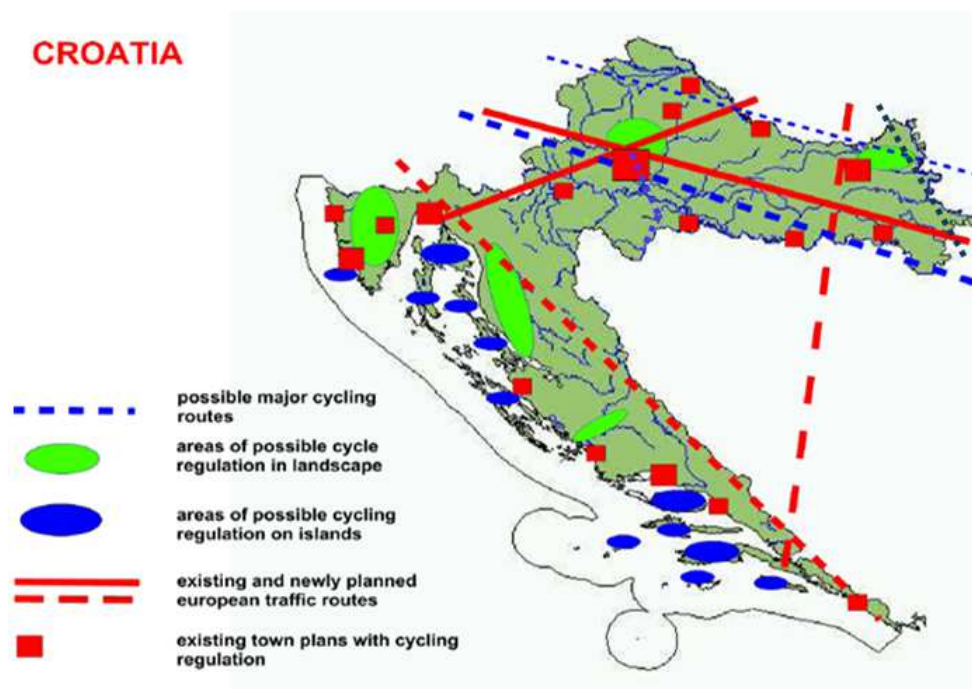


Figure 4. Illustration of existing and future bicycle network on the national level

4.2.1. Bicycle route Danube (induced by the plan for construction of Eurovelo route)

During 2005, routing of the structure of the route Danube through Croatia and installment of traffic signalization was carried out. Route Danube is a part of the international bicycle route Eurovelo 6, but it is also a national and regional route. It passes through the most eastern part of Croatia, through Vukovar-Srijem and Osijek-Baranja County, in the length of 140 kilometers. The route, within the Republic of Croatia, stretches from the Duboševica border crossing where it enters Croatia from Hungary (Mohac) through the city of Ilok, where it crosses the state border towards Vojvodina and continues towards the cities of Novi Sad and Belgrade. Through Osijek-Baranja County, the route Danube encompasses 87 km and in Vukovar-Srijem County 53 kilometers. From the Hungarian border the route follows state road No.7 to a smaller extent (1.047m), then it follows county roads No. 4011 and 4018 until the junction for Batina in length of 18.574 m, from which it continues along the state road 212 towards Kneževi Vinogradi (length 15084 m) and the route further follows county roads 4042

and 4257 until the entrance in the city of Osijek, in length of 22626 m. The length of the bicycle route through the city of Osijek, up to Nemetin amounts 7.580 m and it mostly follows the county road 4068. From Nemetin to Dalj, the route follows state road no. 213, and after that the state road no. 519 all the way until the entrance to Vukovar. The total length of this part of the route amounts 32.354 m. From Vukovar to Ilok, the route stretches along the state road no. 2 in length of 45,350 m. The Figure 5. shows the Danube route [9].

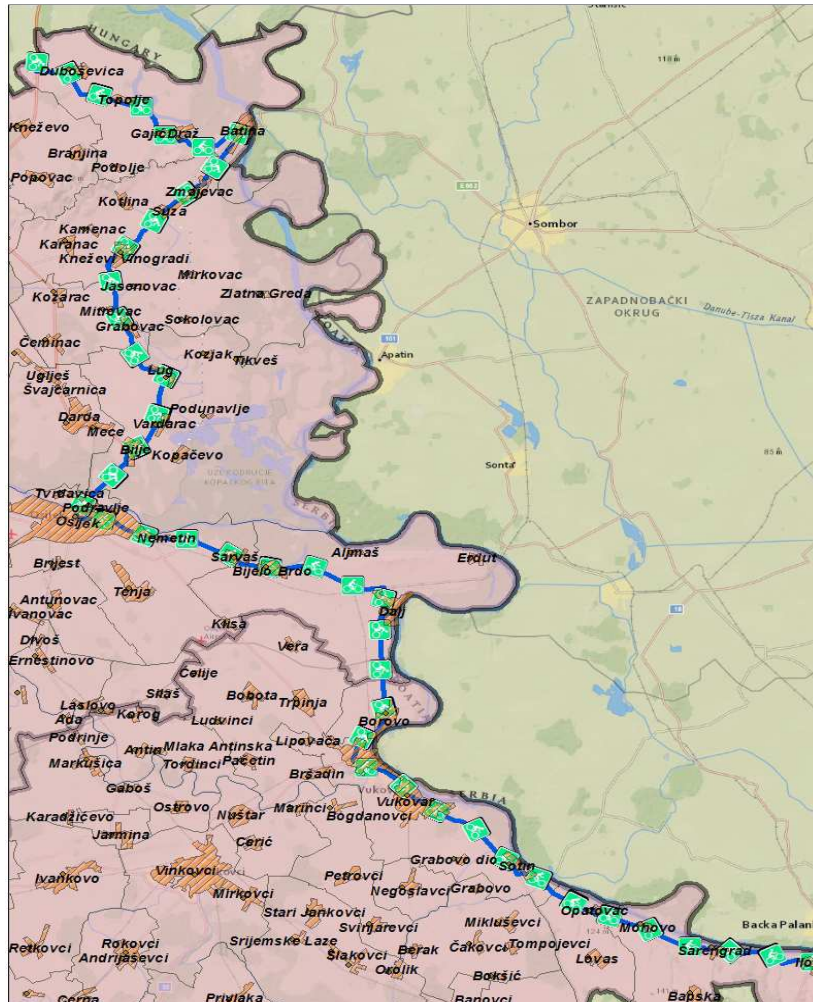


Figure 5. Cycle route Danube Croatia [9]

Danube Route mainly lies in the plain terrain, almost ideal for cycling, with some exceptions on the territory between Gajić and Batina where the terrain rises for some 100 meters – from 85 m above the sea level up to 185 m above the sea level, within the length of 2 km (this represents the highest ascent on the route 10%) and along the path from Vukovar towards Ilok, in the areas around Opatovac, Mohovo, Šarengrad and Ilok where the altitude varies between 90 and 130 m above the sea level. During the year 2007, more than 2000 cycle tourist from France, Germany, Austria, Great Britain, Netherland, Denmark and Switzerland have used this route, which amounts approximately 10 cycle tourists per day within 6 to 7 months which are favorable for cycling. Namely, in this area mildly warm and humid climate prevails, with hot summers (temperature in July amounts to 21-22°C), while the winters are somewhat colder (temperature in January amounts around -2°C). On the roads along which

the route is traced, both local and transit traffic (mainly cargo traffic) are allowed, which severely endangers the security of bicyclists.

According to the report of Osijek-Baranja and Vukovar-Srijem Police Departments, the number of bicyclists killed in traffic in Osijek-Baranja County in the last five years amounted from 1 (2009) to 10 (2010), while in Vukovar-Srijem County it amounted between 2 (2010) and 6 (2006). During that period, the number of injured bicyclists in Osijek-Baranja county amounted between 85 (2005) and 114 (2006), while in Vukovar-Srijem County it amounted between 34 (2010) and 72 (2007). Male persons aged 60 years and the most endangered group. Along the major bicycle routes, such as the Danube route, it is necessary to plan resting places, bicycle repair workshops and sites for tire pumping, as it is shown in the figure 6. and 7.



Figure 6. Possible solutions of resting places for bicyclists



Figure 7. Possible solutions of workshops for bicycle repair and tire pumping

The problem arising in the planning of the route Danube is defining the forbidden zones, into which bicyclists are not allowed. Therefore, it is crucial to exclude “forbidden zones” such as hunting-grounds and protected nature reserves, before any plans have been made. Afterwards, it is possible to precisely define the area of possible route location (“core area”) and after that to start with planning of the traces. It is, for instance, indisputable that the most attractive realization of Danube Route would be on the embankment along the river Danube. However, there are certain bans from the organizations *Hrvatske vode* (Croatian Waters) and *Hrvatske šume* (Croatian Forests), being against the entrance of bicyclists into these areas. Thus, it is necessary to secure access to the shore from different sites, in order to enable the experience of the authentic Danube scenery. Besides the bicyclists, similar desires would appear among the canoeists (docking and boarding, unloading), walkers, birdwatchers, swimmers and many other users of the Danube. In order to minimize the negative impact on

protected areas and the landscape, this issue should be resolved “synthetically”, i.e. combining different interest group’s points of view. This way, the cycle access towards Danube would be in the same direction the other interest groups have access to. The camp, bathing resort, organized picnic site, resting place for walkers and similar facilities could be organized on the same access to the rivers, and such a solution would also be more rational from the infrastructure point of view.

One of the important issues in bicycle exploitation of the Danube shores and pathways is the issue of cross-border routes, i.e. extensions leading to Vojvodina. For the cross-border routes, there are anticipated extensions, i.e. connections to bicycle roads in Batina, Dalj and Ilok and the transport of bicyclists by ferries.

Signs displaying border crossings, extensions for the nearby railway and bus stations, tourist destinations, nature parks, cultural heritage, centers of urban settlements where the ambulance, post office, ATMs etc. are usually located, are very important for providing the bicyclists with information, especially those from abroad. The figure 8. gives examples of EuroVelo cycling routes signs.



Figure 8. Examples of some bicycle signs [14]

4.2.2. Secondary bicycle network in Danube region

Bicycle route Danube forms a backbone for the bicycle network in Danube region. Route Danube is connected with the „secondary network, which stretches to all local destinations interesting for tourists. In the eastern part of Croatia these destinations are historic and cultural monuments (Tvrđa, Aljmaš, Vučedol, Eltz castle, castle of Ilok Odescalchi), nature park Kopački Rit, wine cellars and roads, ethno villages etc. Cycle-tourists usually arrive to these destinations in organized groups. Recently, so called “individual touring“ is becoming more and more popular. Namely, the guests take their bicycles and start sightseeing the area on their own, based on their individual preferences. Very often, the aim of a visit is enjoyment without a previously arranged theme, fishing, consumption of local dishes, such as the famous „*fiš paprikaš*“ (paprika fish stew) and wine. According to figure 9. cycle-tourists spend € 353 on average per single trip, or € 53 per day, of which € 16 is spent on food and drinks, € 21 on accommodation, € 8 on transport and other activities [2].

Daily spending cycle tourists

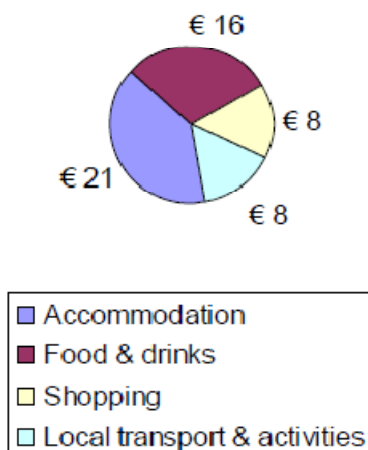


Figure 9. Structure of cycle tourist's daily consumption [2]

In this regard, there is a big chance for mutual development of cycling and rural tourism, and within the rural tourism and especially within the agro tourism (vacation on farms and ranches), tourism in nature (“nature tourism”), “green” tourism and active vacation (horse riding, walks etc.). Figure 10 presents the secondary cycle tracks in Osijek-Baranja and Vukovar-Srijem Counties.

a) Osijek-Baranja County



b) Vukovar-Srijem County

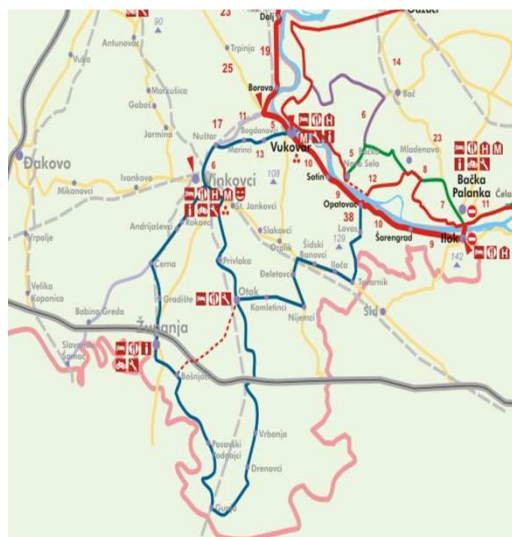


Figure 10. Secondary cycling tracks in a) Osijek-Baranja County and b) Vukovar-Srijem County [14]

5. Conclusions

Due to numerous advantages in using a bicycle for individual and public transportation needs, the development of cycle traffic, i.e. cycle network roads, represents one of the priorities of development policies on national, regional and local level. Developed bicycle

network enables bicycle accessibility not only to the tourist destinations, but also commuting by bicycle between the agglomerations. Successful concept of cycle routes assumes high level of integration of different attractions of the tourist area into one marketing relevant unit. Strategy of the development of bicycle routes on a national level should be based on existing and planned positions of European routes, i.e. EuroVelo routes. Such base is also very important for future development of regional and local bicycle routes which will generate economy benefit for the country, in a way that it will enable tourists to stay longer in a specific attractive area. It will also enable the local population a safe path to work, and children to their schools. The current study "Study analysis and ideal solution for cycle route Danube through Vukovar-Srijem County and Osijek-Baranja County" plays an important role in this development of bicycle route "Danube". It will incorporate all relevant and positive real-life examples in accordance with guidelines and goals of the EuroVelo 6 project.

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