

PROPOSALS FOR THE DEVELOPMENT OF BICYCLE TOURISM IN THE BANAT HISTORICAL REGION

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***Abstract:** Bicycle tourism consists of leisure travel and travel-related activities that are characterized by the usage of bicycles as the sole or primary mode of transportation. The main topic of this study is to determine and propose several bicycle routes in the historical Banat area, by taking into consideration recent transnational developments in this field, such as the Eurovelo network of cycling paths and the Timișoara-Zrenjanin path. Our proposals for bicycle routes are based on location attractivity (quantified by clustering historical and natural landmarks into a geographical model), acceptable road gradients and distances for an inclusive touristic experience and costs of construction.*

***Key words:** bicycle tourism, k-means clustering, location attractivity, bicycle routes, landmarks and attractions in the Banat area*

INTRODUCTION

The usage of bicycles as a means of transportation for the purpose of practicing tourism, in the sense defined by the World Tourism Organisation as “the movement of people to countries or places outside their usual environment for personal or business/professional purposes” [20], has been a regular occurrence almost immediately following their introduction in the second decade of the 19th century, in what can be defined in modern terms as the Western world, the United Kingdom, France, the United States and the territories that would later become Italy [9,12].

Considering this historical context and their usage by both men and women, bicycles and their earlier counterparts can be viewed as vehicles of both personal and emancipatory freedom, carrying people at speeds comparable or even surpassing stagecoaches [9]. Highly educated women enjoyed travelling by bicycle, with examples in this respect being the writer Elizabeth Robins Pennel, who wrote several chronicles of her travels [12], or Annie Londonderry, the first woman to bicycle around the world [15]. The popularity of bicycles was quickly superseded by that of automobiles, especially in the upper echelons of society, where those novel means of transportation were actually available.

At the same time, literary works in this period, such as those of H.G. Wells, extolled and romanticised the usage of bicycles as liberating for the lower middle class, placing them as the centrepiece of the novel *The Wheels of Chance*. The motif of liberation is obvious in this literary work, with phrases such as “your chains fall about your feet...” or “he wheeled his machine up Putney Hill, and his heart sang within him” abounding. [14]. We believe that while this feeling of freedom prefaced by Wells should not be subject to commodification and that bicycle paths should be considered a public service, certain marketing instruments utilizing the theme of freedom can be employed in order to promote the usage of bicycles as a viable alternative to cars, both in the context of urban transit and for holidaymaking, together with the implementation of bike-sharing platforms catered to the tourists' needs[1].

The modern approach to bicycle tourism emphasizes the health benefits, lack of traffic congestion caused, the speed and possible spontaneity, low costs and environmental

benefits drawn from the usage of the aforementioned way of transportation, as opposed to mass transit or cars. [3]

The relation between bicycle tourism and the development of rural areas has been underlined in the literature, the most significant benefits being increased local trade and business opportunities. [4] At the same time, the specific infrastructure required for the safe and inclusive usage of bicycles (consisting of “pathways, trails and dedicated tracks in rural areas” [11] can play a significant role in the tourist decision-making process when planning a trip. As such, depending on the goal of the tourist (if they participate in a cycling event or they travel purely for leisure), varying degrees of importance can be assigned to factors such as tourism infrastructure, scenery, event infrastructure, competition and event planning. [3]

On a continental scale, EuroVelo is “a network of 19 cycle routes (or long-distance cycling routes). The network connects the whole of Europe and currently totals 45.000 km” (figure 1) [16]. The paths that we will propose in the following article can be an important addition to this network.



Figure 1: The EuroVelo bicycle path network

Source: en.eurovelo.com

MATERIALS AND METHODS

The main presumption present in this research article is that the decision-making process of tourists practicing bicycle tourism, especially those who do so in a casual way (e.g., day-trips, people who need a short break from life in the city) are enticed by the attractions that they may visit along the way, therefore a bicycle path that is closer to places of interest which are well-known and popular would be more attractive than one that is not. In order to account for both the existence of attractions and their perceived attractiveness, we collected data from the Google Maps Places API [17].

The geographical area where the data was collected corresponds to the Banat historical region (figure 2). The Google Maps Places API has a limit of a maximum of 60 points of interest located in a radius of 50.000 metres around any given point. As such, in order to circumvent this limitation, we generated a list of 303 coordinate pairs (latitude and longitude) placed in a grid, with distances of approximately 10 km between coordinates (figure 3). The city centres of Timișoara and Arad were omitted. Timișoara was omitted due to the very high density of attractions that could negatively impact the clusters generated, as well as due to the fact that for the purpose of those proposals we consider Timișoara as the nexus and origin point of the bicycle paths. Arad was also omitted because it is considered to be located on the border between the Banat and Crișana historical areas. The locations from Arad that are included in the dataset are situated on the southern side of the Mureș river.



Figure 2: The map used as reference for generating the coordinates dataset.
 Source: Andrei Nacu, 2008

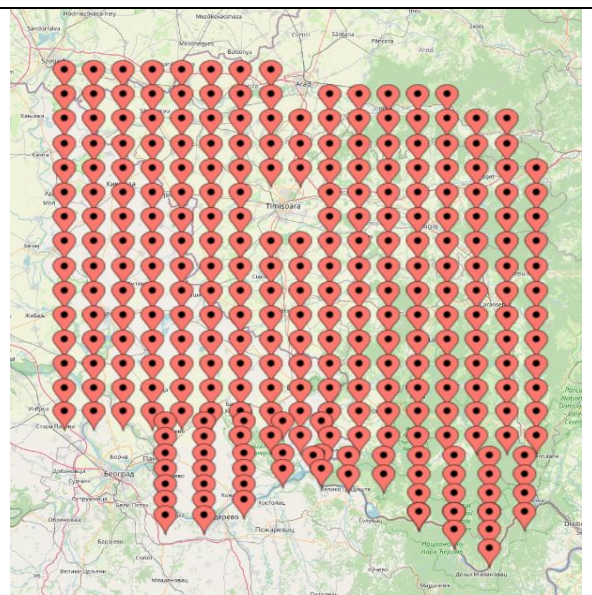


Figure 3: The map of coordinates used in the study
 Source: own elaboration

Using the “googleway” package in R [18], the results of the API query were individually processed, removing columns of data that were unnecessary for the study at hand. Columns removed were business status (possible inconsistencies with the actual situation of attractions), icon, icon background colour, icon URL (links to images of pins used by Google Maps to portray points of interest on the maps), opening hours (the data consists of a series of true or false statements, influenced by the time at which the data query was sent to the Google Maps Places API), photos (those are still present in the raw data set, future research can utilize those in order to assess the image of touristic attractions in the Banat historical area), plus code (used for referencing points on interest within the Maps framework, usable where no street name is available), scope and reference (deprecated in the API documentation, still fetched by the googleway commands). The columns kept contain the names of touristic attractions, latitude and longitude, place id (in order to remove possible duplicates), rating and total number of ratings.

For each of the attractions a popularity score was calculated by multiplying the normalized review score and the number of reviews. This value is used as a proxy for the actual attractiveness of the points of interest.

Preliminary proposals are formulated based on the most popular 20 attractions, provided they form easily noticeable clusters.

Following this, the touristic attractions were organised using the k-means clustering [10] method into 5 clusters. This step was done in order to provide a rough visual approximation for the paths that can be proposed. Following this, an in-cluster popularity score was calculated by summing up the individual scores of the points of interest situated in a cluster. This was undertaken in order to assess and rank the clusters and determine the optimal path that the bicycle paths should take.

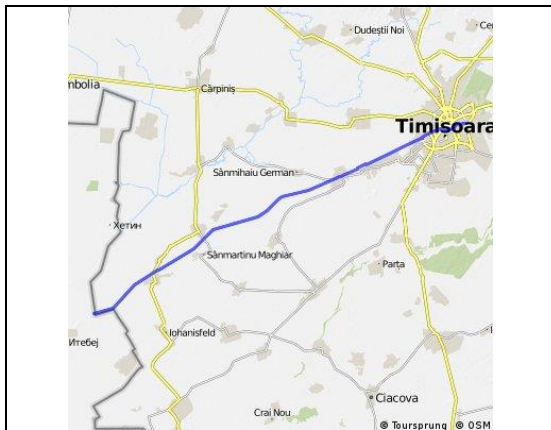


Figure 4: The Romanian side of the Timișoara-Zrenjanin bicycle path
 Source: bikemap, 2015 [10]



Figure 5: Pictures taken at the Timișoara-Zrenjanin bicycle path
 Source: Info Timișoara, 2020

Finally, we propose that bicycle paths should follow the road network or the rivers network. We consider that the availability of adequate facilities (stores, restaurants, pharmacies and other establishments satisfying basic needs) should be available to cyclists, which can be associated with the proximity to the road networks. At the same time, scenery and natural factors might play a significant role in the attractiveness of certain routes, in this case we consider rivers to be important additions to the natural landscape. Certain difficulties in building the infrastructure required for cycling can be alleviated by following our proposals, where possible, as both the road network and river banks tend to be flatter surfaces. The bicycle path already built in the Banat region, the one connecting Timișoara to Zrenjanin, trails the Bega River (figure 4., figure 5.)

Cost estimations are based on the costs per kilometre proposed by the European Cyclists' Federation [European cyclist], ranging from 50.000 Euros/kilometre for “simple cycle track in easy terrain outside built-up area, no significant challenges” to 200.000 Euros/kilometre for “mixed localisations and solutions, some challenges to overcome” [2]. Our proposals will not include the concept of the bicycle highway, as those are viable in regions where there is already a large number of cyclists in need of high-capacity infrastructure [5] and their prices jump to 500.000, 1.500.000 and even 10.000.000 Euros/kilometre depending on the traits defining the local terrain.

RESEARCH RESULTS

Following the methodology described in the previous chapter, we utilized the googleway package implemented in the R programming language and software environment, in order to fetch data describing tourist attractions in the Banat historical region. The search included only the “tourist_attraction” place type.

The raw data collected was further processed according to the methodology, resulting in a tibble (equivalent of a dataframe) with 513 rows, each corresponding to a

unique attraction. The most popular 20 attractions account for 62,13% of the total popularity score and are presented in the following table (table 1.)

Table 1.

The touristic attractions in the dataset with the highest popularity score

No.	Name	Address	Rating	Number of reviews	Popularity score	Popularity score (running %)
1.	Szeged Zoo	Szeged, Hungary	4.7	9389	8825.66	7.57
2.	Votive Church of Szeged	Szeged, Hungary	4.8	7932	7614.72	14.09
3.	Bigăr Falls	Bozovici, Caraș-Severin, Romania	4.6	6297	5793.24	19.06
4.	Rock Sculpture of Decebalus	Eșelnița, Mehedinți, România	4.7	5914	5559.16	23.83
5.	Sunshine Aquapolis Szeged	Szeged, Hungary	4.5	5659	5093.1	28.19
6.	Izvorul Bigar	Bozovici, Caraș-Severin, România	4.5	4672	4204.8	31.80
7.	Hercules' statue	Băile Herculane, Caraș-Severin, România	4.1	4159	3410.38	34.72
8.	Banat Village Museum	Timișoara, România	4.4	3832	3372.16	37.61
9.	St. Ana Monastery	Orșova, România	4.7	3482	3273.08	40.42
10.	Parcul Național Domogled-Valea Cernei	Băile Herculane, Caraș-Severin, România	4.6	3343	3075.56	43.05
11.	Botanical Garden of Szeged	Szeged, Hungary	4.8	3075	2952	45.58
12.	Elisabeth Park	Szeged, Hungary	4.6	3161	2908.12	48.08
13.	Nerei - Beușnița Ravine National Park	Lăpușnicu Mare, Caraș-Severin, România	4.7	2619	2461.86	50.19
14.	Water mills at Rudăria	Eftimie Murgu, Caraș-Severin, România	4.7	2523	2371.62	52.22
15.	Szeged Open-air Festival	Szeged, Hungary	4.8	2243	2153.28	54.07
16.	Móra Ferenc Museum	Szeged, Hungary	4.6	2223	2045.16	55.82
17.	CFR Museum - Steam Locomotives Museum	Reșița, Caraș-Severin, România	4.7	2083	1958.02	57.50
18.	Deliblatska Peščara	Kovin, Serbia	4.7	1936	1819.84	59.06
19.	Buziaș Park	Buziaș, Timiș, România	4.2	2165	1818.6	60.62
20.	Semenic - Cheile Carasului National Park	Carașova, Caraș-Severin, România	4.6	1923	1769.16	62.13

Those locations were plotted using the mapcustomizer.com online platform (figure 6), resulting in two possible major pathways that the bicycle paths proposed may take. The first one is centred around the Caraș Severin and the other one is centred in Szeged. Each route was generated using the bikemap.net platform. Those can be considered preliminary proposals for the bicycle paths, which can be viable alternatives to the ones proposed later in the study.

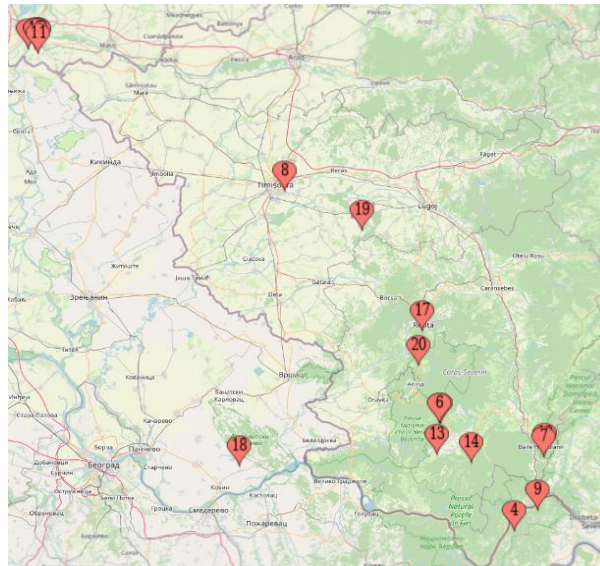


Figure 6. The touristic attractions in the dataset with the highest popularity score
 Source: Own elaboration

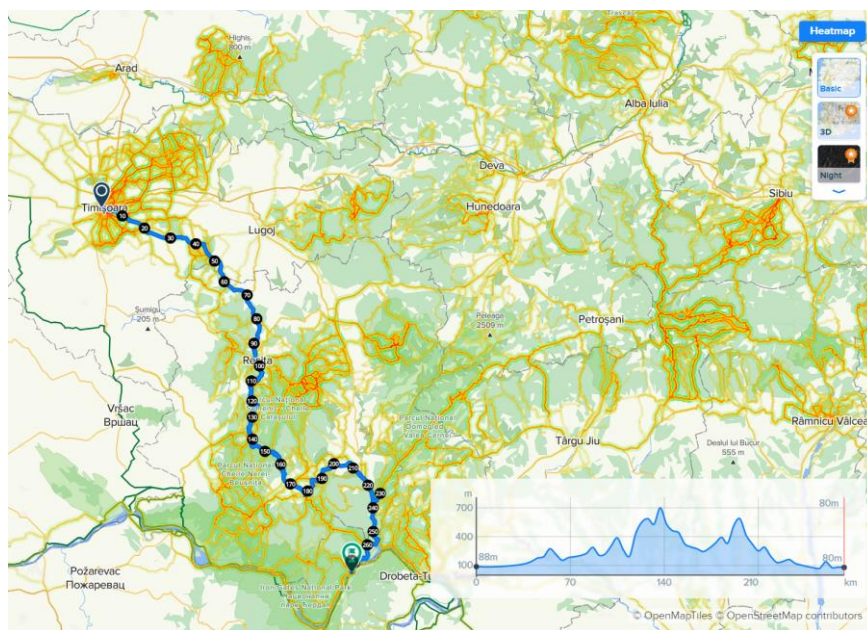


Figure 7. The first preliminary proposal for a bicycle path in the Banat region
 Source: Own elaborations

The first path connects Timișoara to Buziaș, Reșița, Băile Herculane and ends with the riverside of the Danube, near Orșova (figure 7). As the path progresses, the difficulty and physical effort of the cyclists tends to increase, with the section that is located between Timișoara and Buziaș being the easiest to traverse and the most accessible. The rest of the path is located in hilly and mountainous areas, as such they can be recommended to more experienced cyclists. The total length of the bicycle path is 274 kilometres and includes a detour to Băile Herculane. Without the detour, the length of the bicycle path is 262,4 kilometres. We consider that this route is suitable for a trip that lasts several days. This should provide the establishments in the area with a steady stream of tourists.

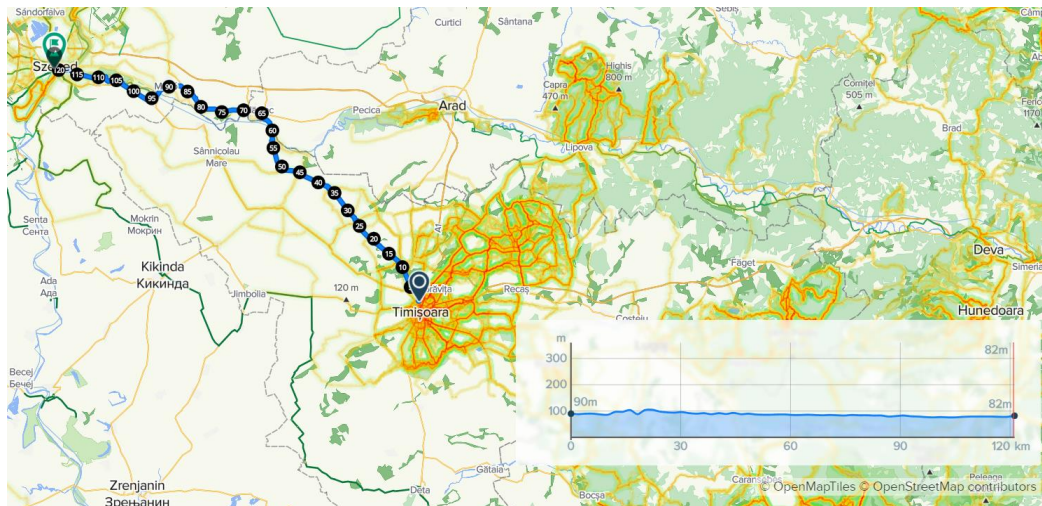


Figure 8. The second preliminary proposal for a bicycle path in Banat historical region

Source: Own elaborations

The second path connects Timișoara to Szeged and is 120 km long (figure 8). The terrain in this area is almost entirely flat and intersects from a certain point with the riverside of the Mureș River. We suggest either a two-day stay in Szeged or returning in the same day with a train.

Following this, we categorised all the points of interest based on their latitude and longitude using the k-means clustering method. In order to determine the number of clusters we utilised the “elbow method” [6] in R, as follows:

1. We computed the clustering algorithm for different values of k (numbers of clusters), where k ranges from 1 to 15.
2. For each value of k we calculated the total within-cluster sum of squares (sum of the square of variance).
3. We plotted the sum of squares for each iteration of k (figure. 9)
4. We determined the location of the bend (elbow) in the plot as the optimal value of clusters as k = 5.

This resulted in 5 clusters for which we calculated the centroid coordinates (central point), approximative centroid location, size and the sum of popularity scores (table 2).

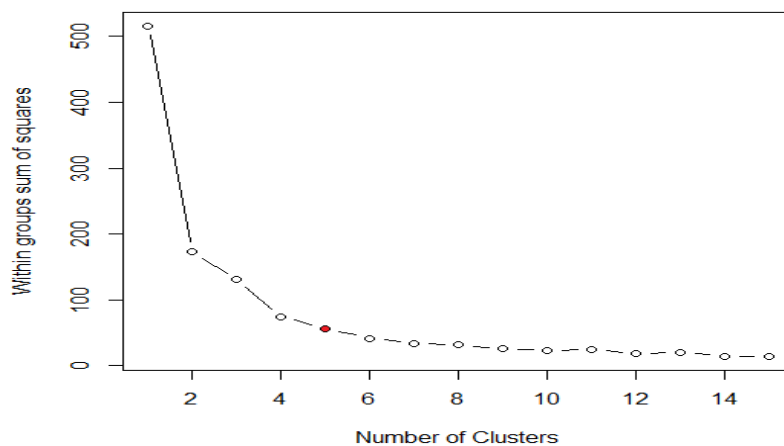


Figure 9. Application of the elbow method in determining the optimal number of clusters

Source: Own elaborations

Table 2.

Descriptive statistics for the 5 clusters

Cluster no.	Cluster size (attractions)	Centroid coordinates	Approximative centroid location	Sum of popularity scores
1	105	45.0358, 21.6746	Oravița, Caraș-Severin	25562.26
2	135	46.1228, 20.3293	Beba Veche, Timiș	46077.32
3	80	45.8729, 21.7732	Paniova, Timiș	11068.70
4	124	44.9147, 22.3622	Mehadia, Caraș-Severin	27632.12
5	68	45.1386, 20.6681	Covăcița, Serbia	6313

The resulting clusters and their contents are plotted in the following map (figure 10).

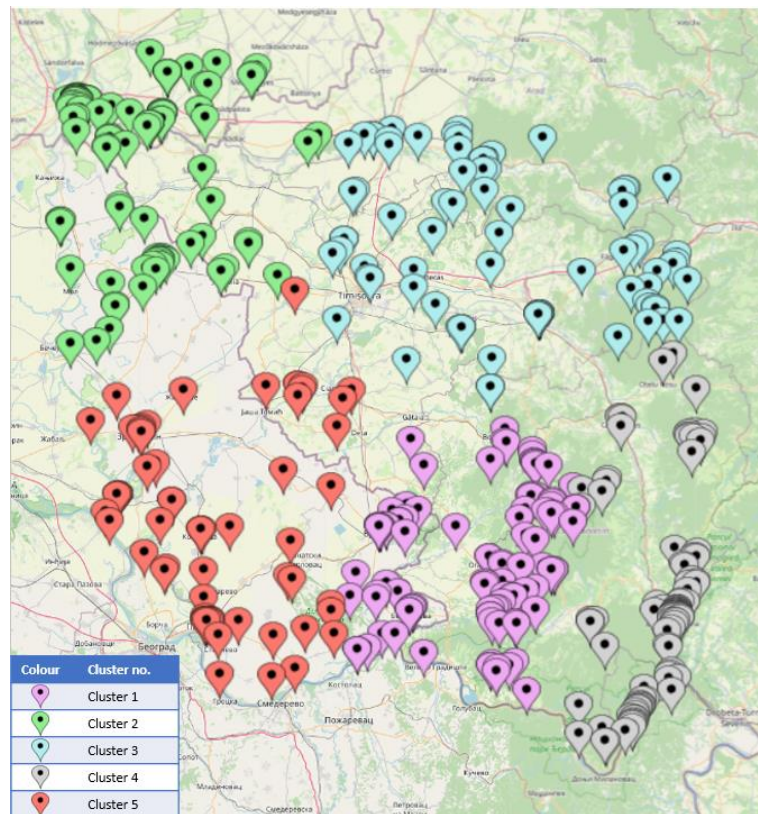


Figure 10. Clusters of touristic attractions

Source: Own elaborations

The cluster containing the most popular attractions is cluster number 2, with a large amount of the popular locations being centred in the Szeged area. As such, we consider that the preliminary proposal should be kept as is. Instead, should the desire and political momentum for a more comprehensive trans-national bicycle route become prevalent in public discourse in Romania, Serbia and Hungary, we propose as another viable concept a twist of the Timișoara-Zrenajin path, towards Kikinda and Szeged (figure 11). Such a path would be approximately 120 km long. As in the case of the Timișoara-Szeged route, the terrain is flat, therefore the costs should be reduced compared to the more hilly areas present in the Banatul Montan area, where the first preliminary proposal was located.

Clusters number 4 and number 1 contain the second and the third most popular attractions. As such, we consider that a scenic route on the Danube riverside would be an interesting continuation to the bicycle path, continuing up into the Cheile Nerei and Cheile

Carașului area, totalling 422 kilometres. Including those areas into the cycling network can be a positive factor influencing the influx of tourists in the area, while at the same time preserving the natural scenery by limiting the number of cars used by tourists to get to travel. The downside of this approach resides in the physical limits that cyclists have to endure. The path proposed is long and the terrain is not flat. An e-bike ridesharing program [13] The Costs of Cycling Infrastructure might alleviate this issue but not necessarily eliminate it altogether. This can be an advantage, as it forces cyclists to utilise the accommodation units in the area and in turn generate economic benefits for the local community and government.

Again, an alternative that could prove to be cost-efficient would be to build a bicycle path including only half of the Banatul Montan loop, trailing the Danube from Orșova to Pojejena and ending in the Cheile Nerei-Beușnița area. In this case, the total route distance would be 172 kilometres. This route wouldn't connect the Timișoara metropolitan area to the Danube but could still positively impact tourism in this area.

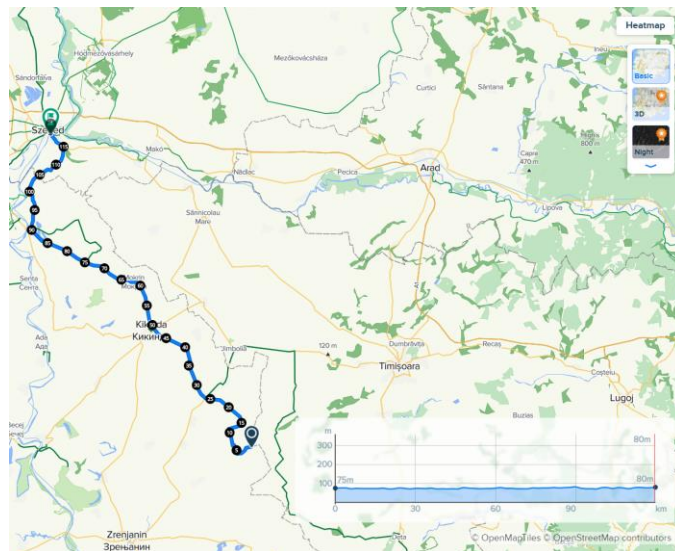


Figure 11. Route branching off the Timișoara-Zrenjanin path

Source: Own elaborations

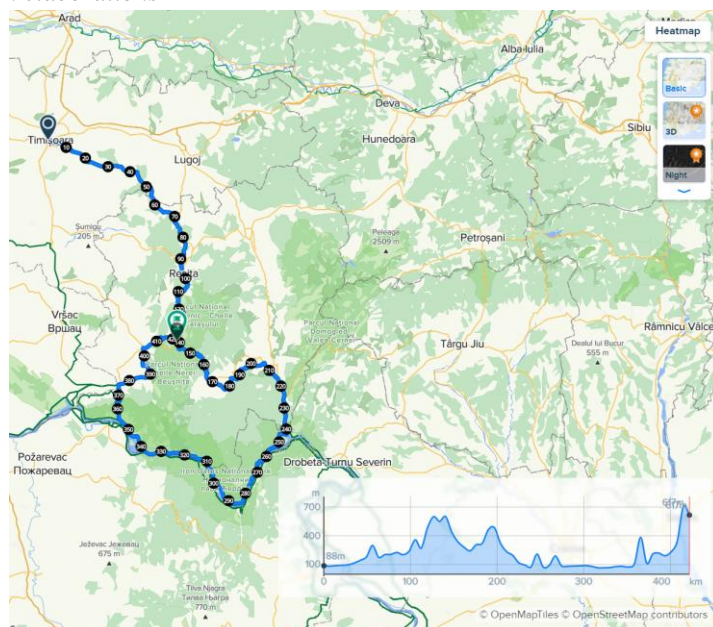


Figure 12. Route from Timișoara towards the Banatul Montan Area

Source: Own elaborations

Finally, the costs of the four proposed routes can be calculated based on those highlighted earlier in this paper, which is consistent with that of the Timișoara-Zrenjanin bicycle course. As such, on the Romanian side, the path is 37 kilometres long and costed 2,3 million Euros, leading to a per kilometre cost of 62.162 Euros. [19]

Table 3.

Cost analysis of the routes proposed

Bicycle route	Distance	Scenario 1 cost (50.000 Euros/km)	Scenario 2 cost (200.000 Euros/ km)	Scenario 3 cost (500.000 Euros/km)	Most likely scenario
1. Timișoara- Orșova	270 km	13,5 mil Euros	54 mil euros	135 mil Euros	95-100 mil Euros
2. Timișoara-Szeged	120 km	6 mil Euros	24 mil Euros	60 mil Euros	6 mil Euros
3. Timișoara- Kikinda-Szeged	120 km	6 mil Euros	24 mil Euros	60 mil Euros	6 mil Euros
4. Timișoara-Orșova-Clisura Dunarii- Cheile Nerei	422 km	21,1 mil Euros	84,4 mil Euros	211 mil Euros	140-150 mil Euros
5. Băile Herculane-Cheile Nerei	172 km	8,6 mil Euros	34,4 mil Euros	86 mil Euros	30-35 mil Euros

CONCLUSIONS

We consider that both connecting Szeged to Timișoara and connecting the Banatul Montan area to Timișoara are interesting prospects for governmental agents. However, the later route would prove to be more challenging to implement in a viable manner, both due to the large distances between the points of interest and due to the uneven, mountainous terrain. Furthermore, funding this endeavour can be difficult. Justifying this investment can also be a problem, considering that the general state of road infrastructure is not optimal.

On the other hand, building a route to Szeged, either directly or through the Serbian junction could be an interesting prospect. The easiest route to implement for the countries involved would be the direct one, as it would involve only Hungary and Romania. Both countries are members of the European Union. As such the burden of financing the building of this bike route can be shifted away from the local and national levels towards the supra-national level. Indeed, the same prospect can be applied to the Banatul Montan route, albeit the case for this route is certainly more difficult to make from both the attractiveness and the financial perspective.

Future research can explore the actual desire of cyclists to use the proposed bike paths or to propose new paths based on other datasets. Alternatively, more refined clustering methods could be employed in order to construct paths. An example of this is the density based spatial clustering of application with noise (DBSCAN) [7,8] approach. The very same dataset and approach can be utilised by research proposing routes for car or mass-transit users.

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