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V.

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Comparative analysis of Székesfehérvár and Veszprém based on geoinformatic methods

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Abstract: In our actual investigation our goal was to compare the inhabited areas of Székesfehérvár and Veszprém based on social claims. To survey the opinion of people we used a questionnaire. Our investigations were based on GIS so we represented the results of the questionnaire in form of geoinformatic layers so that we could model the opinion of residents. The histories of these cities show numerous similarities. We can also find identities and detect many parallels between the opinion of respondents of the two cities. The distance seems to be the main factor which influences the judgement of inhabited areas. The boundary of Veszprém in the narrow sense - thus if we do not consider those parts (former villages), which were annexed later to the city - is everywhere within 3 kilometres from the city centre. In case of Székesfehérvár this value is about 5-5,5 km. That is why in Veszprém the average score is of the inhabited area is double of the same value of Székesfehérvár.

Introduction

The inhabited areas of cities and towns of Hungary are in the centre of our research. The methodology of the analysis was firstly used on the area of Pécs (Gyenizse P. et al. 2008, Ronczyk L.–Trócsányi A. 2006). We examined the populated areas of settlements based on social claims. Our main question was how the opinion of population about the inhabited area could be modelled regarding Hungarian cities. Firstly, only cities of more than 100.000 inhabitants were studied, but for several years we have been extending our research field to smaller settlements, too. We realised that the size of Siófok (about 24.000 inhabitants) is the smallest, where our modelling method can be used.

Applying GIS techniques like computer-aided evaluation makes possible to set enormous databases for quantitative analyses and to make evaluation faster, more effective as well as more cost-effective (G. Demeter–Sz. Szabó 2008). So it was not accidental that GIS was firstly used in the field of traffic and transportation and was applied to support the more powerful operation of settlements. Nagyváradi L.–Pirkhoffer E. (2008) stated that nowadays the fundamental task of the settlements' management is the encouragement of a powerful economy and support of a healthy living environment with the means of territorial organization, physical planning and environmental protection. In our opinion with the results of our researches municipalities may be able to make well-established decisions regarding city development easier.

In our actual investigation, our goal was to compare the inhabited

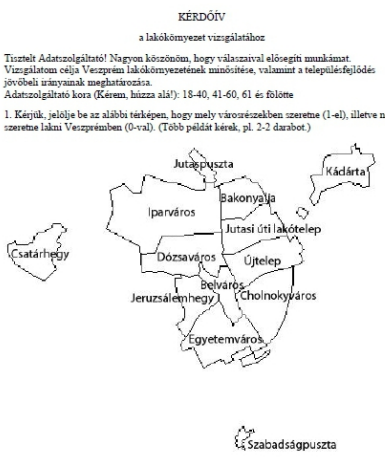
areas of Székesfehérvár and Veszprém based on social claims. We chose this two cities, because they are one of the oldest cities of Hungary, they have relatively extensive old town, and there are more similar tendencies in their development. In 2013, we carried out investigations related to Székesfehérvár, and in 2014 we dealt with Veszprém. In our recent research we compare these cities by many methods. Firstly, we will present the questionnaire on which we based our investigation, and the geoinformatic method with which we modelled the social opinion about the populated area of these cities, then we will show how we compare this results, and what the reasons of similarities and differences could be.

Materials and methods

Questionnaire

To survey the opinion of people, we used a questionnaire, which is illustrated in the Figure 1 as an example of Veszprém. It contained three main parts. In the first part we asked the respondents to choose at least two quarters, where they would live with pleasure, and two where they would not move to.

The second part of the questionnaire was the most important. Here we listed 26 factors which generally influence people when they look for a new place to live. The question we put to them was the following: „How would



2. Milyen mértékben befolyásolnák az Ön választását az alábbi tényezők, amennyiben jelenlegi lakhelyéről el kívánna költözni? Kérem, pontozza az alábbi tényezőket.
Pontok:
-2 (igen hátrányos), -1 (kissé hátrányos), 0 (semlegas), 1 (kedvező), 2 (igen vonzó)
Ön legszívesebben milyen távolságra lakna az adott tényezőtől?

Tényező	*pont*	*távolság*
Bölcsőde, óvoda, általános, vagy középiskola közelsége		
Egyetem közelsége		
Kórház, rendelőintézet közelsége		
Forgalmas főútvonal közelsége		
Vasútállomás közelsége		
Vasútvonal közelsége		
Helyi járatú buszpályaudvar közelsége		
Buszmegálló közelsége		
Belváros közelsége		
Többfunkciós (Plaza-jellegű) üzletközpontok közelsége		
Hipermarket (Tesco) közelsége		
Nagyobb ABC (elsősorban élelmiszer) üzletek közelsége		
Vendéglátóhely, étterem, nagyobb szórakozóhely, mozi közelsége		
Műszaki, kertészeti, lakberendezési nagyáruházak közelsége		
Templomok közelsége		
Ipari üzemek közelsége		
Park / nagyobb zöldterület közelsége		
Sportpálya közelsége		
Vezetékes víz, szennyvízhálózat megléte		x
Távfűtés megléte		x
Egyéni fűtés megléte		x
Saját kert megléte		x
Hátrányos helyzetű társadalmi rétegek jelenléte		x
Felújításra szoruló építészeti , gépészeti részek az épületben		x
Magasabb légszennyezettség		x
Az épület anyaga: tégla		x

3. Amennyiben költözne, akkor mennyire befolyásolja az ingatlan ára a döntését? (A megfelelő választ húzza alá!)
semennyire, kicsit, közepesen, jelentősen, ez lenne a döntő tényező

4. Milyen épületben lakik jelenleg? (Kitöltése nem kötelező.) (A megfelelő választ húzza alá!)
panel tömbház, tégla tömbház, társasház, családi ház, egyéb:.....

5. Milyen épületbe szeretne költözni (ha nem elégedett eredeti lakhelyével)? (A megfelelő választ húzza alá!)
panel tömbház, tégla tömbház, társasház, családi ház, egyéb:.....

6. Anyagi lehetőségei milyen épületbe való költözést tennének lehetővé? (Kitöltése nem kötelező.)(A megfelelő választ húzza alá!)
panel tömbház, tégla tömbház, társasház, családi ház, egyéb:.....

Figure 1. The questionnaire which was used in Veszprém

these factors influence your choice, if you wish to move from your actual residence?". On the basis of this question they could value the factors with different scores: -2 (very disadvantageous), -1 (slightly disadvantageous), 0 (indifferent), 1 (advantageous), 2 (very attractive). Among the factors there were 6 which applied to buildings or groups of buildings. These elements were for example the existence of district heating, individual heating, private garden or deteriorated parts in the building and so on. There were 20 other objects in the list which had radius, so they had effect on more extensive area. These were for example the shops, bus stops, schools etc.

We did not satisfy with getting know the scores, the respondents valued these factors. We were also curious about the radius till which these factors exert their effect. So, if the factor is attractive, then which is the longest distance the respondents would do from their home to reach that. If the object is repulsive, then which is the radius outside of that the factor does not have effect on the respondent yet. Naturally, people were not asked to give radius to objects which are related to buildings or groups of buildings.

The third part of the questionnaire was related to real estates. We tried to find out, how the price of realty influences the decision of inhabitants. We also asked them, what kind of building they live in, and what kind of building they would choose in case of moving. The answering of the last question was not compulsory: what kind of building their financial position makes possible to move in.

Representation of the results

Our investigations were based on GIS techniques. Our goal was to represent the results of the questionnaire in form of geoinformatic layers, so that we could model the opinion of residents.

The first part of the questionnaire was processed in MS Excel. We collected, how many votes arrived to each quarters in respect of positive and negative opinions. Then we calculated that from all of the votes what the percentage of positive and negative answers was. We also computed what the average number of votes was as well as how and why the number of votes differed in regard of the city quarters.

During the processing of the second part of the questionnaire we got scores, which we used later in the course of geoinformatic analyses. After the summation of scores we got values between -240 and +240 in case of each factor. We had to simplify them so that they could be managed easier. So we transformed them into percentile form, then we divided them by 10

to get values between -10 and +10. We also computed the values of distance, so we calculated the average of the answers. Then, we started to evaluate the geoinformatic representation of the results.

First of all, we needed a map from which we digitised the point, line and polygon objects. We used the appropriate sections of the civil topographic map of the 1980s. With the help of ArcGIS we digitised all of the objects - which were represented in the questionnaire - separated into different layers. After this method, we rasterized these layers in Idrisi software. In case of the factors which did not have radius, we reclassified the value of the area of objects with the relevant derived result of the questionnaire. Representing the objects was a more complicated process. Firstly, we created such layers, where the area of object got maximum score (255), and moving away from there the values of pixels reduced linear till the boundary of the range of effect which belonged to the object. Those pixels which were at the boundary of the range or outside of that got minimum value (0). Then we reclassified these scores with the result of the questionnaire. The area of the objects got the positive or negative values, which were derived from the answers of the inhabitants. In case of attractive factors the values of pixels reduced, in case of repulsive factors the values of pixels increased to zero from the area of the object to the boundary of the radius. So we got 26 layers, which we added in the next step. We previously digitised the inhabited area of the examined city so we could multiplied it with the final layer which summarized the results. It was an important operation, because we would have liked to get the average of scores referring to city quarters. With this step we could miss the areas which were not populated for example the industrial areas, because they modified the results in wrong direction. We could get the clearest, the most correct and usable results in such a way that we take these scores to refer to solely the inhabited areas.

We completed the summary of the third part with MS Excel. We represented in diagrams that how many votes arrived to the options.

Results

As we mentioned in the introduction, we dealt with numerous cities, applying our model to them in the previous years. In our recent research we stepped forward, and examined how to compare the results of two cities, which we formerly investigated. We chose two settlements, which had something in common. Veszprém and Székesfehérvár were the ones of the oldest cities of our country. Their castles (including that of Esztergom) are the oldest in

Hungary. Their historical development showed many similarities.

On the basis of more viewpoints we compared the chosen cities. Firstly, we represented the opinion of residents concerning the factors, which may influenced them in case of moving (*Table 1*).

In January 2013 99247 people lived in Székesfehérvár and 60876 people were permanent inhabitants of Veszprém[1]. Not only from these data but also from the areal differences we could be sure the opinion of residents would differ in more cases. In addition, Veszprém can be considered rather a compact city. A ring road surrounds that, which does not prevent the settlement from spreading, but has such a consequence, that the expansion can be solved only against high infrastructural costs (M. Praznovszky 2002). The boundary of Veszprém in the narrow sense - thus if we do not consider those parts, which were annexed later to the city - is everywhere within 3 kilometres from the city centre. However in case of Székesfehérvár this value is about 5-5.5 km. Therefore, the distance values may differ in the answers of residents of these

Table 1. The opinion of residents of Székesfehérvár and Veszprém concerning the factors

Examined object	Relative score		Radius	
	Székesfehérvár	Veszprém	Székesfehérvár	Veszprém
Proximity of nursery, kindergarden, primary or secondary school	3,9	3,6	1800 m	1870 m
Proximity of high school or university	2,1	1,8	5750 m	3130 m
Proximity of hospital or clinic	5,4	6,1	3310 m	3240 m
Proximity of busy highway	-2,4	-4,8	1470 m	1200 m
Proximity of railway station	-0,2	-1,2	2330 m	2280 m
Proximity of railway line	-2,2	-4,5	2100 m	1470 m
Proximity of coach station	3,4	4,6	1120 m	1040 m
Proximity of bus-stop	6,2	5,8	480 m	470 m
Proximity of city centre	4,5	4,8	940 m	940 m
Proximity of shopping mall	0,9	-0,3	1310 m	2420 m
Proximity of hypermarket (Tesco, Interspar…)	3,4	0,0	1220 m	
Proximity of supermarket	6,2	7,2	770 m	610 m
Proximity of place of entertainment (pubs, cinema)	1,1	1,9	960 m	780 m
Proximity of technical, horticultural or furniture store	1,1	1,1	1220 m	1300 m
Proximity of church	1,4	0,6	860 m	830 m
Proximity of factory	-6,1	-6,3	6490 m	5060 m
Proximity of park	7,1	8,6	560 m	540 m
Proximity of sports ground	5,9	5,0	980 m	790 m
Existence of tap water and sewer	8,8	8,8		
Existence of district-heating	5,5	0,8		
Existence of individual heating	7,3	6,5		
Existence of private garden	5,9	6,9		
Presence of disadvantaged strata	-6,7	-4,6	4200 m	5150 m
Deteriorated architectural, mechanical parts in the building, which are needed to be renovated	-3,6	-5,6		
Higher air pollution	-7,4	-7,6	7190 m	6370 m
The material of the building: brick	4,6	6,6		

[1] http://www.ksh.hu/docs/hun/hnk/hnk_2013.pdf

cities.

In spite of the existing areal difference between the towns we did not find so many divergences in the derived distance data. For example, according to the respondents of Veszprém the radius of university is smaller. Although the proximity of railway line is a more repulsive factor in Veszprém based on the answers of residents, the radius they gave was smaller than the value in case of Székesfehérvár. Maybe the cause of it is that the railway crosses Székesfehérvár, so people are used to the existence of this object in the urban area, but if they could do, they would move farther from it. In case of Veszprém, the railway leads at the boundary of the city, so the respondents did not feel necessary to give higher value, because it is far from their home anyway.

There was an interesting difference in case of shopping malls. The values were close to zero in both cities, so this object did not evoke considerable interest, but while in Székesfehérvár it is an attractive factor, in Veszprém it is a bit repulsive. That is why we could find very different distance values, whose meanings were contrary. (In case of Székesfehérvár the proximity of shopping malls is attractive, and according to the respondents they elicit their attractive effect in a circle with 1310 m radius. However, these objects had a repulsive effect till 2420 m in Veszprém as our results showed.)

In Veszprém, hypermarkets were indifferent factors, so they naturally was not given any radius in our research. In addition, there was quiet a big variance between the opinions of the two cities regarding district-heating.

Geoinformatic representation

In the followings, we represent the results on geoinformatic layers. We had to emphasize that the values which appeared in the layers were relative points. We also indicated those areas which achieved more than the 80% of the maximum score of the layer with black contour, and the areas which have less than 30% of the maximum with white contour. Summarized layer of Székesfehérvár can be seen in Figure 2.

According to the respondents the most attractive areas of this city are very close to the centre. Most of them are within 1 km from the centre. Especially those storeyed houses which are made from brick achieved the highest scores. In our opinion it was not only because of the proximity of downtown but also for the fact, that generally the factors which were needed for the everyday life concentrate in the centre of city. Farther from downtown those areas got higher scores which belonged to the detached house zones. Almássy-telep and Felsőváros are relatively popular parts of the city, because they are covered by

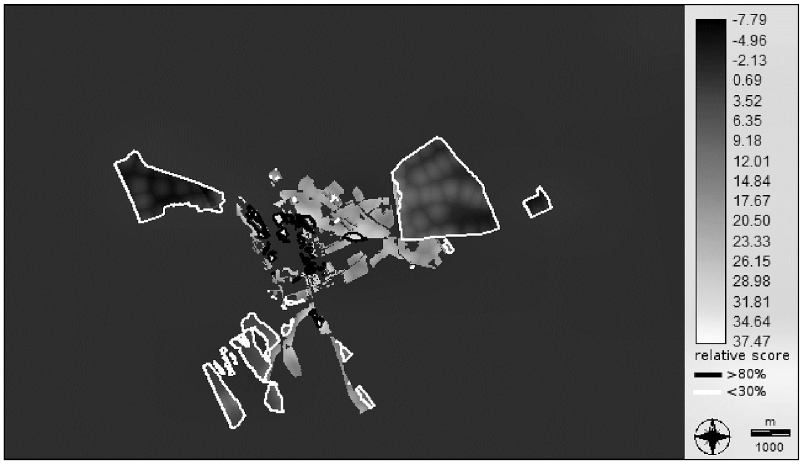


Figure 2. The qualification of the inhabited area of Székesfehérvár based on the opinion of respondents

mostly detached house, nevertheless are close to the centre.

We can see that result regarding Veszprém which we reached by applying the same method as in case of Székesfehérvár (*Figure 3*). Our experience regarding Veszprém was comparable to that of Székesfehérvár, because the highest scores we could find near the city centre. In these areas we can solely see detached or storeyed houses made from brick.

We can state that in each cities the outer parts are the most disadvantageous, which are quite far from the centre as well as from those important objects which people need for their everyday life. They can approach these factors only by bus or car. Especially middle-aged people likes these parts who have family, because they need rest, garden (for the children) and

Figure 3. The qualification of the inhabited area of Veszprém based on the opinion of the respondents

usually have car by which they can easily reach the downtown, the school or their work place.

We completed our research with a theoretical issue. We divided the area of cities according to the points of compass and took these areas in focus. Ónodi Zs.–Lovász G. (2013) did similar researches relating to the expansion of settlements. With the Extract module of Idrisi software we carried out a calculation, whose result showed the average scores of the inhabited areas according to the points of compass. It proved our previous thoughts, that the outer areas definitely decreased the average scores at all case (*Figure 4, 5*).

We also investigated, how the respondents qualified the different types of residences. Four main types we examined which are the followings:

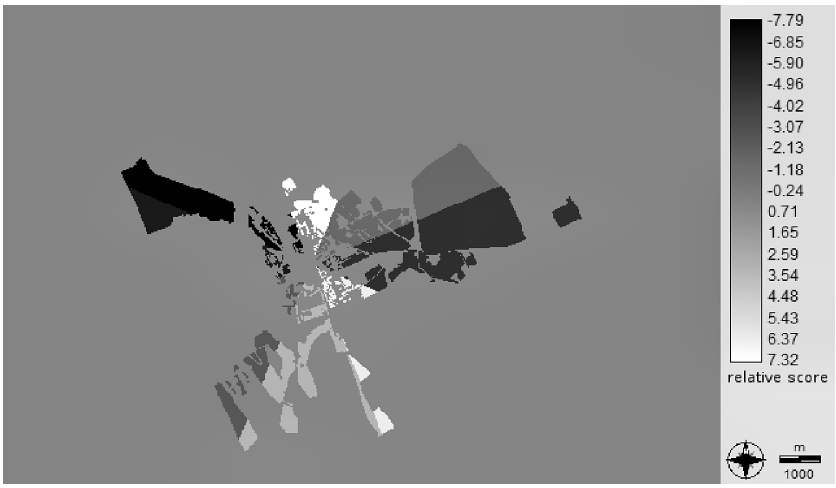


Figure 4. The average points according to the points of compass in Székesfehérvár

Figure 5. The average points according to the points of compass in Veszprém

prefabricated house, storeyed house made from brick, terraced house and detached house. As we digitised the geographical position of these buildings, we could find out what the opinion of the residents is about these building types. We used the Extract module of Idrisi for this operation. We could compare these results with the last questions of the questionnaire, too. We prepared a diagram which shows how the relative scores changed in case of the examined cities (*Figure 6*).

Before we started to analyse the Figure 6, we had to note that the average score of the inhabited area was 9.08 in Székesfehérvár and 19.4 in Veszprém. There was a big difference because those inhabited areas which were far from the city centre and; therefore, got lower scores are more extensive in Székesfehérvár. There were two values at each cities in the diagram at the category of detached house, because we completed a calculation regarding a buffer zone which was 2000 metres in width and whose centre was the old town and one regarding to the detached house areas of the whole city. In case of Veszprém those detached house areas, which were within 2000 metres from the city centre got far the highest scores. In Székesfehérvár this kind of value was also high, 2.5-fold of the value which related to the whole city, but comparing to the other types of residence it was not outstanding. In Székesfehérvár the storeyed brick houses got the highest score (24,07). While in Székesfehérvár the terraced houses got the lowest score, in Veszprém the prefabricated houses possess the last position.

With the help of the results, which are shown in Figure 7 we can approach the question from a different direction. Here can be seen the distribution of the answers concerning the last questions of the questionnaire. As we asked

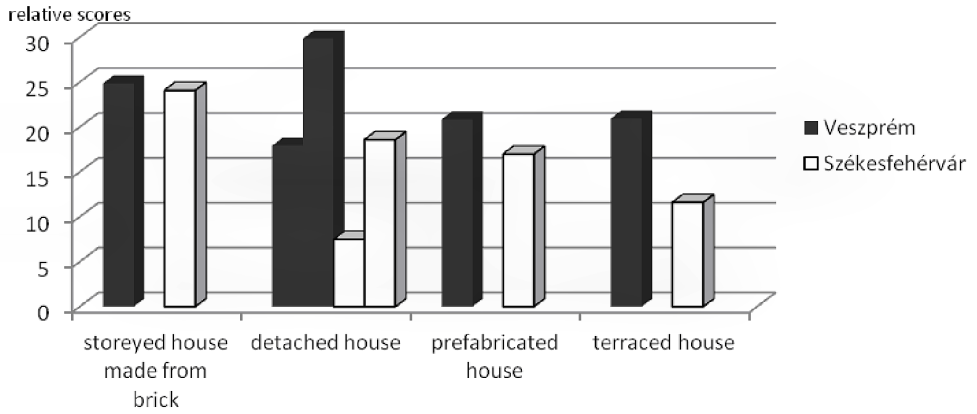


Figure 6. The opinion of respondents about building types (geoinformatic processing)

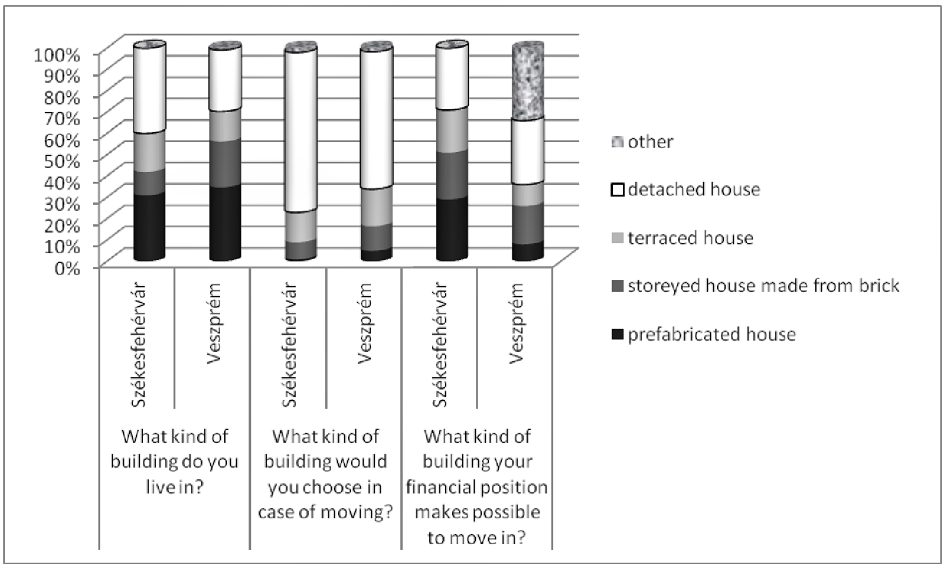


Figure 7. The results of the questions, which are related to building types

residents at different parts of the cities, the proportion of people's answers was similar in the two cities regarding that what kind of building they live currently in. The proportion of answers of the second question showed huge divergence comparing with the first question. In case of each cities more than the two-thirds of the respondents would move to detached house, if they could take this (in Székesfehérvár this value reaches 75%). However, the reality is quite different. Their financial position makes possible for only the third of the respondents to move into a detached house. In Székesfehérvár the other third of the respondents chose prefabricated house (which meant the cheapest possibility to them), and in Veszprém they chose the 'other' option (saying their financial possibilities does not make possible to move from their actual residence).

Conclusions

The history of these cities show numerous similarities, and it seems, applying this kind of comparison we can also find identities and detect many parallels between the opinion of respondents of the two cities. However the distance is the main factor which influences the judgement of inhabited areas. That is why in Veszprém the average score is of the inhabited area is double of the same value of Székesfehérvár.

References

G. Demeter–Sz. Szabó (2008): Identifying lithological features using morphometric parameters derived from DEM, Acta Geographica ac geologica et meteorologica Debrecina, Debrecen, 105. p.

Gyenizse P.–Nagyváradi L.–Pirkhoffer E. (2008): Pécs lakott területének minősítése – természeti adottságok és társadalmi igények elemzése térinformatikai módszerekkel. – Földrajzi Közlemények, 132. évf. 3. szám, pp. 323–333.

Nagyváradi L.–Pirkhoffer E. (2008): A modern geográfia kihívása: a térinformatika önkormányzati alkalmazásának új lehetőségei Kozármisleny példáján. - Földrajzi Értesítő, 57. évf., 3-4. füz., pp. 299-311.

Ónodi Zs.–Lovász G. (2013): A térinformatika alkalmazási lehetőségei a település-alaktani vizsgálatokban. - Településföldrajzi Tanulmányok 1, pp. 114-125.

Praznovszky M. (2002): In: Kasza S. (szerk.) Veszprém CEBA Kiadó, Budapest, 24. p.

Ronczyk L.–Trócsányi A. (2006): Some changes in urban environment in Pécs. – In: Ronczyk, L. – Tóth, J. – Wilhelm, Z. (ed.): Sustainable Triangle, University of Pécs, Institute of Geography, Pécs, pp. 174–182.

Magyarország közigazgatási helynévkönyve 2013. január 1. pp. 26-27. http://www.ksh.hu/docs/hun/hnk/hnk_2013.pdf
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