EVALUATION OF PARKING SITUATION IN PRESOV AND NITRA

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Summary: This paper is about current state of parking problem in two different housing estates. We have done a traffic survey in housing estate Klokocina situated in city of Nitra and similar survey in housing estate Sekcov in Presov. We have counted cars, which parked on the streets and also parking spaces. City offices in both cities had given us the necessary documentation about numbers of registered cars and flats in these areas. The results from traffic survey are alarming. The car parks have insufficient capacity and many cars stop at forbidden or dangerous areas of the streets. This paper includes results, which were used as a base data for transport planning. We have focused on the most critical areas of housing estates, where the problem with parking was emerged.

Key words: parking, car park, traffic engineering, road transport, city

INTRUDUCTION

Nowadays the parking is a growing problem of many cities not only in Slovakia. The transportation is everyday activity in modern world. It is a way of relocation of persons or goods thanks to some kind of vehicle. Every vehicle needs a place for parking or garaging both in the source and destination of every trip (1).

The increasing of registered vehicles in countries has bad influence to parking problems. It is very complicated to judge the situation of parking in the whole country. We have focused on two specific housing estates Klokocina and Sekcov. First is located in Nitra, second in Presov. Both cities are centres of its regions. It was not possible to perform total research of whole housing estates, but we have chosen some specific parts according requirements of city offices. The parking situation in other areas should be similar or better. Analysis of current state was based on materials which were obtained from city offices. At the end of this article is an example of parking situation presentation, which was created in CAD system. Last but not least it is important to show the most important issues of parking and also consider the main solutions, which were used or will be used in our cities.

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1. TRAFFIC SURVEY IN NITRA

The most problematic part of the city Nitra is the housing estate Klokocina, which is located in the south-west of the city. Klokocina is the biggest housing estate in the city. It had 18,835 inhabitants in 2017. Totally, the city of Nitra has 79,125 residents (2, 3).

1.1 Choosing of specific area

According to materials from city office, the area was divided into three smaller parts. These three parts are shown in the picture 1.

Source: (4)

Fig. 1 – The housing estate Klokocina divided into three parts

Analysis of the current state is based on data of registered vehicles, numbers of flats and parking spaces in all areas. Information about registered vehicles also includes the numbers of vehicles which belong to category M1 (passenger cars) and also vehicles from category N1 (vans). It was also possible to use the vector maps of Klokocina 3 which can be edited in AutoCAD software.

The absolute numbers of flats, vehicles and parking spaces cannot be compared. For this purpose we have calculated the following indicators:

- number of cars per one parking space NC_P (1),
- number of cars per one flat NC_F (2),
- and number of parking spaces per one flat NP_F (3).

$$NC_P = \frac{NV}{NP} \left[veh./\ park.space\right] \qquad (1)$$

$$NC_F = \frac{NV}{NF} \left[veh./\ flat\right] \qquad (2)$$

$$NP_F = \frac{NP}{NF}\left[parkspaces/\ flat\right] \quad (3)$$

In these three simple equations are used the following variables: NV is number of registered vehicles in area, NF is number of flats in area and NP is number of parking spaces in area.

Tab. 1 - Comparison of indicators in three parts of housing estate Klokocina

Area	NC_P [veh./park.space]	NC_F [veh./flat]	NP_F [park.spaces/flat]
Klokocina 1	1.58	0.78	0.49
Klokocina 2	1.50	0.96	0.64
Klokocina 3	**1.90**	**0.93**	**0.54**
Whole area	1.69	0.93	0.55

Source: Author

From the table 1 is obvious that third - south part of housing estate Klokocina has the most critical situation. One parking space is for almost two cars (exactly 1.90 vehicles per one parking space). From this we can say that almost half of all vehicles is parked in the wrong places of streets.

1.2 Counting of parking spaces

Many organizational and construction changes were performed in Klokocina 3. The best method for evaluation of parking spaces numbers is the manual counting of the parking spaces. It was also evaluated if the car was parked correctly or incorrectly according to §25 of Act No. 8/2009 about road traffic (5).

Tab. 2 – Numbers of parking spaces and vehicles in Klokocina 3

Street	Parking spaces	Vehicles M_1		Vehicles N_1	
		Correctly parked	Incorrectly parked	Correctly parked	Incorrectly parked
Banicova	134	123	3	1	0
Novomeskeho	665	548	55	9	4
Skultetyho	443	293	66	8	5
Nedbalova	129	73	4	1	0
Golianova	177	94	7	3	0
Petzwadova	441	270	32	9	0
Jedlikova	185	128	10	1	0
Totally	**2 174**	**1 529**	**177**	**32**	**9**

Source: Author

1.3 Counting of vehicles parked in area

The second important step was counting of parked vehicles during peak time. For parking it is a time during weekend evening. This counting was performed as in previous part of research.

During the survey there were 2,382 vehicles parked on the streets (table 3). Only 48 vehicles were from category N_1 (2.02%), other vehicles were passenger cars from category M_1. There was not parked any vehicle from other categories.

Tab. 3 – Numbers of parking spaces, vehicles and related occupancy

Street	Parking spaces	Vehicles	Occupancy
Banicova	134	134	100.00%
Novomeskeho	665	742	111.58%
Skultetyho	441	445	121.90%
Nedbalova	129	125	96.90%
Golianova	185	198	111.86%
Petzwadova	177	198	100.91%
Jedlikova	443	540	107.03%
Totally	**2 174**	**2 382**	**109.57%**

Source: Author

The calculation of the percentage occupancy of the car parks is based on the first part of the survey. If we use the numbers from City office of Nitra, occupancy will be about 200% in some streets.

If we compare occupancy of the streets (table 3), only one street has bigger capacity of parking spaces than number of parked vehicles. It was Nedbalova Street, where the occupancy was 96.9%. All vehicles were also correctly parked on Banicova Street, where the occupancy was exactly 100%. Other streets had some vehicles incorrectly parked, because its capacity is insufficient. The worst situation is on Skultetyho Street, where the occupancy had value of 121.9%.

2. TRAFFIC SURVEY IN PRESOV

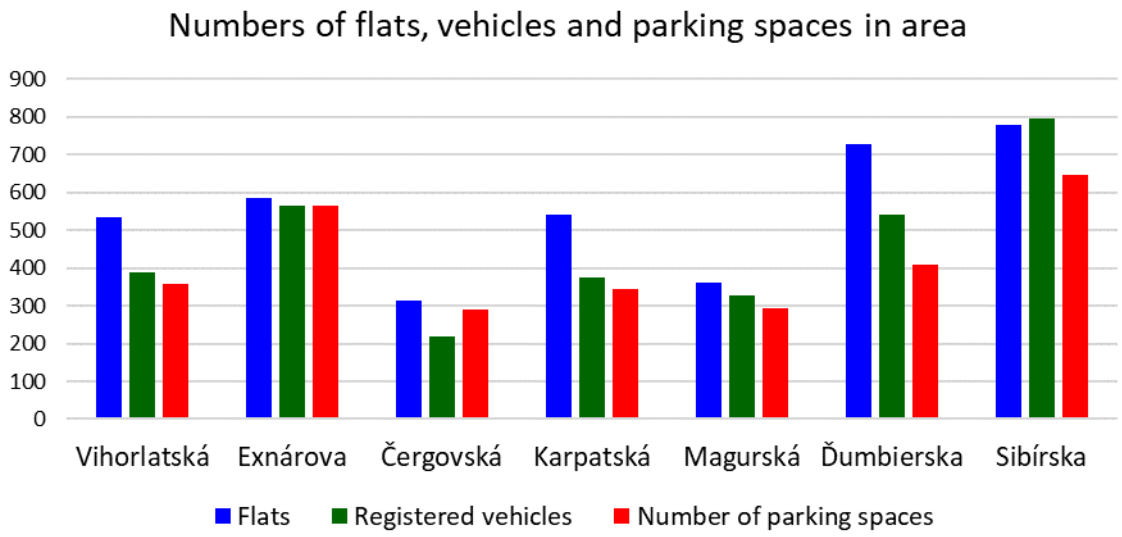
The most problematic area in city of Presov is a housing estate Sekcov. It is the biggest housing estate in city and it had 29 466 inhabitants at the end of 2017 (6).

For the traffic survey we have chosen only the most problematic part of the housing estate. The City office of Presov has specified these streets: Vihorlatska, Exnarova, Cergovska, Karpatska, Magurska, Dumbierska and Sibirska.

Source: (4)

Fig. 2 – The housing estate Sekcov with marked surveyed area

City office of Presov has given maps and other important documents, which was necessary for study of parking in area. Graph in the picture 3 is showing numbers of flats, vehicles and parking spaces in area according the streets.



Source: (7)

Fig. 3 – Relevant characteristics for surveyed area

From the picture 3 it is obvious that the biggest problem with parking spaces is on Dumbierka and Sibirska Street. It is important to to verify this theoretical assumption.

Counting of parking vehicles in Sekcov was performed in the evening on 14th March 2018. Results are shown in the table 4. Table contains also calculated occupation of parking spaces. The worst situation was on Dumbierska Street (135.29%) and Sibirska Street (124.62%). Only one street had free parking spaces. Totally 1,632 parking spaces are in surveyed area. During traffic survey there were 1,883 parked vehicles. Therefore the total occupancy is 109.57%.

Tab. 4 – Numbers of parking spaces, vehicles and related occupancy

Street	Parking spaces	Vehicles	Occupancy
Vihorlatska	292	320	109.59%
Exnarova	33	30	90.09%
Cergovska	273	289	105.86%
Karpatska	61	69	113.11%
Magurska	358	385	107.54%
Dumbierska	221	299	135.29%
Sibirska	394	491	124.62%
Totally	**1 632**	**1 883**	**115.38%**

Source: Author

3. COMPARISION AND PRESENTATION OF RESULTS

Parking situation in Slovak cities is similar, but it is difficult to compare parking in different areas. In the following summary, we tried to compare the results of the composition of parked vehicles in the surveyed areas. Results were obtained with the same methodology.

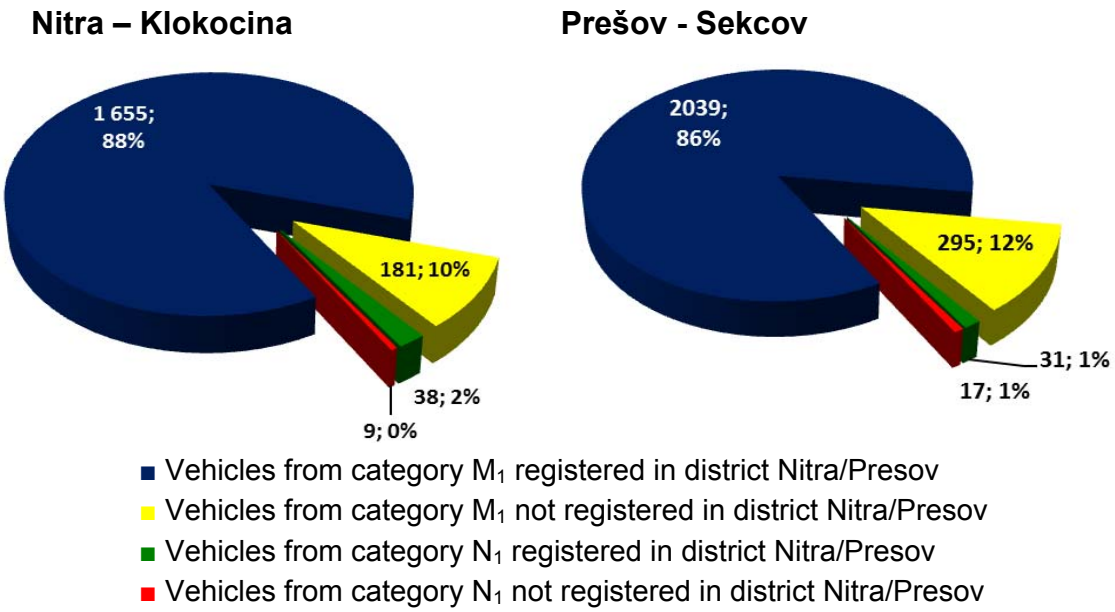
The next table shows population of districts Presov and Nitra and number of registered cars in these districts. Unfortunately, it is only possible to compare the districts, not the cities, because we only have numbers of vehicles registered in district. From the table 5 is obvious that numbers of passenger cars are increasing. Actually, district Nitra has 0.457 car per one inhabitant and Presov 0.334 car per one inhabitant.

Tab. 5 – Numbers of inhabitants and passenger cars in districts Nitra and Presov

Year	The population		Number of passenger cars		Cars per one inhabitant	
	Nitra	Presov	Nitra	Presov	Nitra	Presov
2013	78 351	90 923	62 406	49 156	0.390	0.287
2014	78 033	90 187	64 587	50 862	0.403	0.296
2015	77 670	89 959	67 356	53 344	0.420	0.309
2016	77 374	89 618	70 236	55 792	0.437	0.322
2017	77 048	89 138	73 636	58 290	0.457	0.334

Source: Author

The composition of the parking vehicles is shown by the circular diagrams in figure 4. Composition of the vehicle fleet is similar. Approximately 98% of all vehicles are passenger cars in both cities, only 2% of all vehicles are vans (vehicles with maximal total weight of 3,500 kg which are designed for transport of goods).



Source: Author

Fig. 4 – Structure of parked cars for both areas

During the traffic survey in Nitra, there 2,174 parking spaces were counted and 2,382 vehicles. Occupancy of all parking spaces had value of 109.57%. Worst situation was in Presov, where 1,632 parking spaces were counted and 1,883 vehicles. The occupancy of surveyed area in Presov was 115.38%.

Source: Author

Fig. 5 – Structure of parked cars for both areas

The last picture number 5 shows an presentation of parking spaces occupancy. It is created in AutoCAD software. The background map is from City office of Nitra.

4. RECOMMENDATIONS FOR PARKING

From the analysis of current state and from inhabitant‘s options, it was formulated these recommendations for elimination of parking problems.

- Forbid parking of vehicles from category N1 = vans. Probably this rule will be used in Nitra, but probably it won’t be sufficient, because only about 2% of cars are from category N1.
- Forbid parking of company vehicles, which are used for business, not for personal rides. This action can save a lot of spaces, but it is necessary to set up regulation of parking.
- Vehicle wrecks removal, because they block some parking spaces. This action can release small number of parking spaces.
- In regulated parking system only one parking space should be free, each other should be charged.
- Designation of parking spaces by horizontal traffic signs. It can ensure the better use of parking spaces.
- New one way streets, which allow the parking on both side of street.
- Building new underground garages and new car parks.

CONCLUSION

This article deals with problems of parking in two housing estates in two Slovak cities. Situation is critical, because the capacity of car parks and streets is insufficient for so big numbers of registered cars.

Our both studies were based on documentation from city offices. We have performed the traffic survey in areas. First we have checked the number of parking spaces. We have counted all parking spaces in given area. The total numbers are not exact, because many parking spaces were marked, but the horizontal traffic signs are damaged. Second step was counting of parked vehicles during peak hour – in the evening.

We have analysed the results and we have given the studies to city offices. This article summarise these two detailed studies, which also include the results from questionnaire and information about areas with regulated parking in city centre of Nitra and Presov.

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