

The Influence of Brownfields on Urban Economy of a Settlement

ENDEL Stanislav^{1, a}, WERNEROVÁ Eva^{2, b} and KUDA František^{3, c}

^{1,2,3} VSB-TU Ostrava, Faculty of Civil Engineering, Ludvíka Podéště 1875/17, 708 33
Ostrava-Poruba

^astanislav.endel@vsb.cz, ^beva.wernerova@vsb.cz, ^cfrantisek.kuda@vsb.cz

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Abstract. Brownfield structures often occupy extensive areas in urban areas of our cities. Owing to this fact, the compactness of built-up area of settlements and their overall urban economy is strongly impaired, which affects adversely primarily the expenses on operation of cities. This paper makes efforts to identify the main factors impairing the urban economy and is related to the existence of brownfields. These factors are then analysed and quantified generally. The data are subsequently applied to the inventory of brownfields carried out in the city of Hlučín and the expenses, resulting from the existence of brownfields in the city spent by the city or by other subjects uselessly, are expressed in numbers.

Introduction

The adverse influence of brownfields on the amount of operating expenses of our settlements is quite apparent and indisputable. It is logical that in case of the existence of brownfields, there are unused areas in the structure of the city that impair the urban structure of the settlement and cause overall loosening of the ground plan [1,2]. Considering that the investment costs on restoration of brownfields often exceed the investments spent on building of a similar new structure from scratch several times, the revitalization of most of the brownfield objects is not attractive for private investors [3,4]. However, these meditations do not take into consideration the operating costs of future facilities on one hand and any other costs connected with the existence of brownfields on the other hand. Owing to this situation, the ground plans of our cities are continuously extended and new farmland is occupied for new building development whereas there are deserted objects in urban residential areas calling for reconstruction and re-use [5,6].

The existence of deserted premises and areas also impair the overall urban economy of our settlements. The term "urban economy" itself has been found in professional literature since the second half of the last century and it can be said, in general, that it is a science dealing with purposeful and efficient spending of funds on building and operation of urban units. In light of urban economy, the ideal settlements are those, the ground plan of which is the most compact without any useless and unused areas [7]. In case of impairment of the settlement compactness, namely the driving distances within settlements are extended and there are inefficiencies in maintenance and operation of traffic infrastructure network and public utilities, which has consequences on public budgets. The question is whether it would not be more purposeful to invest the funds spent uselessly due to the existence of brownfields in regeneration of these areas or to use them for mitigation or elimination of the cost gap and to support private investors in regeneration of the deserted areas. However, the answer to this question is not simple as it interferes with the problem of delimitation of individual areas in which it is invested uselessly and with subsequent determination of a global amount at least.

Factors influencing the urban economy

As mentioned above, the decision on the extent of urban economy of a settlement is made by the overall compactness of the build-up area and by related travel distances and the amount of built, operated and maintained traffic infrastructure and public utilities [8]. When fixing the amount which is uselessly spent on building and operation of traffic infrastructure and public utilities, it is necessary to specify firstly the lengths of structures of this infrastructure that is operated inefficiently. Here, it

can be based on the fact that the land of each brownfield is adjoined to a relative length of traffic infrastructure and public utilities which can be measured and categorized during the enumeration of deserted objects and the subsequent global determination of unit prices of construction and maintenance of the infrastructure from available data does not represent a significant problem. The public utilities operating costs may include the losses of media that are growing logically with their increasing lengths.

In case of setting the costs of transport due to increasing travel distances, the situation is a bit more complicated. The calculation of these costs is based on sociological surveys that found out that a common man estimates one hour of his time to approx. 35 % of his hourly wages [9]. Based on the measurement of a section of road adjoining to the brownfield and on the average vehicle speed, it is possible to set the time which drivers spend uselessly by driving round the deserted structure and convert the time to money on the basis of the previous statement. Based on the data from transport census, it is then possible to find out which amounts the drivers spend uselessly on a daily basis. It is necessary to increase these costs with the price of fuels consumed. Here, it is enough to the average vehicle consumption, the length of the road and the average fuel price and then the calculation is not complicated.

Practical application

For practical application of the indicated facts and for the calculation of the amounts spent uselessly due to the existence of brownfields, the city of Hlučín was selected. It is a city situated in the north-east part of the Czech Republic and it is part of the Ostrava Residential and Industrial Agglomeration.

A detailed analysis of brownfields mapping the deserted areas larger than 0.01 ha was carried out in the city – the influence of smaller brownfields can be neglected. For each brownfield, a length of road adjacent to the land of the deserted area and the corresponding lengths of public utilities were measured. These data were found out from the territorial-analytical background data of the city. In case that the brownfield occurs along one side of the two-directional street build-up area, these lengths are multiplied by the coefficient 0.5; in case that the brownfield used is partly, these are multiplied by the coefficient corresponding to the percentage utilization of the deserted area. The position of individual brownfields in graphic is evident from Fig. 1 the analytical results are then indicated in Table 1 and Table 2.

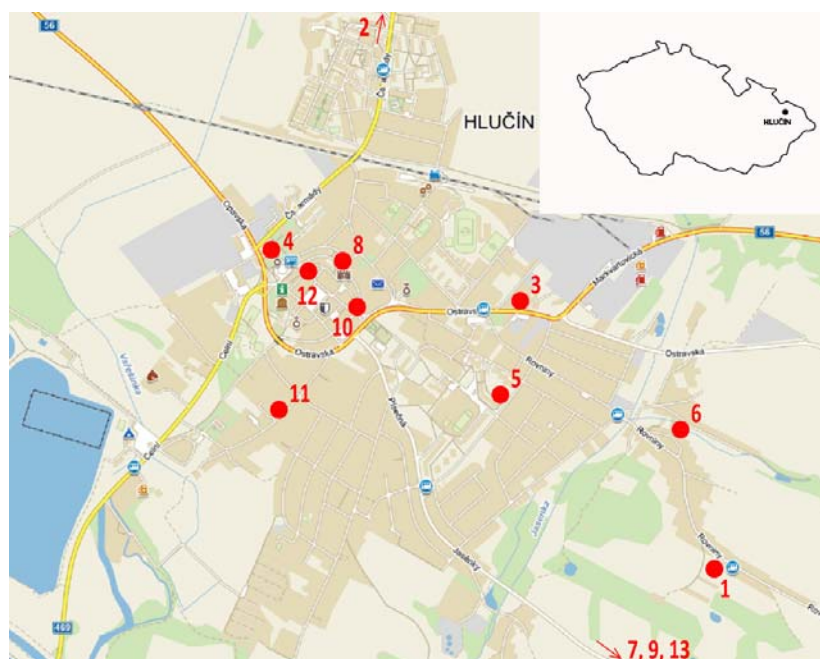


Fig. 1 – Position of brownfields in Hlučín

Table 1 – Lengths of public utility lines operated uselessly

Brownfield number	Name, street	Lengths of public utility lines operated uselessly [m]					
		Water main	Drainage	Gas main	Power line	Telecom. line	Hot-water pipe
1	Kindergarten, Rovniny	29	29	29	29	96	0
2	Restaurant, Jandova	25	20	20	25	25	0
3	House, Ostravská	11	11	11	11	34	0
4	Granary, Opavská	25	24	23	35	17	0
5	Control station, J. Seiferta	48	48	48	33	25	20
6	Ruin of house, Boční	13	25	25	13	14	0
7	Garage with a plot, Malánky	12	20	12	35	36	0
8	House, Na Valech	12	12	7	12	22	0
9	House, Spodní	25	25	25	25	26	0
10	Block of flats, Hrnčířská	7	7	7	7	10	0
11	House, Dlohoveská	5	5	5	5	18	0
12	House 2, Na Valech	11	11	0	11	11	0
13	Sweet shop, Osvoboditelů	12	17	17	17	55	0
TOTAL		235	254	229	258	389	20

Table 2 – Public utilities operated uselessly

Brownfield number	Name, street	Length of adjacent road [m]	Maximum speed limit [km/h]	Number of vehicles/24 hours [10]	One vehicle passage time [s]	All vehicles passage time [h]	Vehicle kilometres
1	Kindergarten, Rovniny	29	50	3771	2,1	2,19	109,36
2	Restaurant, Jandova	20	50	1248	1,4	0,50	24,96
3	House, Ostravská	11	50	14403	0,8	3,17	158,43
		23	20	214	4,1	0,25	4,92
4	Granary, Opavská	36	50	8423	2,6	6,06	303,23
5	Control station, J. Seiferta	16	50	1547	1,2	0,50	24,75
		13	50	853	0,9	0,22	11,09
6	Ruin of house, Boční	13	20	30	2,3	0,02	0,39
7	Garage with a plot, Malánky	11	50	1784	0,8	0,39	19,62
8	House, Na Valech	6	20	142	1,1	0,04	0,85
		6	20	135	1,1	0,04	0,81
9	House, Spodní	25	20	148	4,5	0,19	3,70
10	Block of flats, Hrnčířská	3	20	210	0,5	0,03	0,63
		4	20	150	0,7	0,03	0,60
11	House, Dlohoveská	5	50	947	0,4	0,09	4,74
		13	20	15	2,3	0,01	0,20
12	House 2, Na Valech	11	20	10	2,0	0,01	0,11
13	Sweet shop, Osvoboditelů	12	50	1784	0,9	0,43	21,41
		5	20	20	0,9	0,01	0,10
TOTAL		262				14,17	689,90

The analytical results evident from Table 1 and Table 2 indicate clearly the considerable influence of brownfields on overall urban economy of the city. Several hundreds of metres of public utility lines in the city are operated inefficiently and the results regarding the traffic infrastructure are even more interesting. It was found out that the drivers driving through the city of Hlučín spend more than 14 hours in their vehicles uselessly and they travel almost 700 km a day.

If we would like to recalculate the indicated data to a financial value, it is necessary to find out an average unit price of construction and operation of individual traffic infrastructure and public utility

lines and the price of fuels and the average wages of the people living in the city. However, in case of traffic infrastructure and public utilities it is relatively difficult to specify these costs as they fluctuate considerably depending on DN, stress, pressure, etc., in case of traffic, on the road category. The prices for lines of the lowest categories are always indicated and the minimum costs are given in these items, not the average ones [11]. The particular amounts were found out in Czech crowns and converted into euros according to the current exchange rate. The data for the city of Hlučín are presented in Table 3.

Table 3 – Fixing of prices for calculation

Pricing of prices recalculation			
Public utilities	Water main	Price for construction [€]	110,- for 1m plastic line DN80
		Price for maintenance [€]	1,48 for 1m line and year
	Drainage	Price for construction [€]	354,- for 1m plastic line DN250
		Price for maintenance [€]	3,60 for 1m line and year
	Gas main	Price for construction [€]	89,- for 1m plastic line DN63
		Price for maintenance [€]	1,05 for 1m line and year
	Power line	Price for construction [€]	53,- for 1m line 3x120 under 22kV
		Price for maintenance [€]	0,59 for 1m line and year
	Telecommuni- cation line	Price for construction [€]	6,- for 1m line coaxial cable
		Price for maintenance [€]	0,11 for 1m line and year
Hot-water pipe	Price for construction [€]	290,- for 1m line 2 x DN100	
	Price for maintenance [€]	3,14 for 1m line and year	
Traffic infrastructure	Local roads	Price for construction [€]	335,- for 1m of bitumen road, 7m wide
		Price for maintenance [€]	3,43 for 1m line and year
Average vehicle fuel consumption [12]			6,2l/100km
Average fuel price [13]			1,11/1l
Average gross wage in the region [14]			870,-

Based on the data in Tables 1, 2 a 3 and on previously indicated facts, it is possible to make a simple calculation and fix which amount of funds is spent annually in the city additionally due to the existence of brownfields. Results for traffic infrastructure and public utilities are indicated in Table 4.

Table 4 – Enumeration of costs connected with the existence of brownfields – traffic infrastructure and public utilities

	Unit price for construction [€]	Unit price for operation and maintenance [€/year]	Length of line	Total price for construction [€]	Total price for operation and maintenance [€/year]
Water main	110	1,48	235	25850	347,8
Drainage	354	3,6	254	89916	914,4
Gas main	89	1,05	229	20381	240,45
Power line	53	0,59	258	13674	152,22
Telecommunication line	6	0,11	389	2334	42,79
Hot-water pipe	290	3,14	20	5800	62,8
Local roads	335	3,43	262	87770	898,66
TOTAL				245725	2659,12

Based on the results indicated in Table 4, it is evident that in case of regeneration of Hlučín's brownfields, almost € 250,000 would be saved for the construction of traffic infrastructure and public utilities and another approx. € 2,700 for the administration of this infrastructure would be utilized purposefully and adequately every year.

In case of costs that are covered in most cases by private persons, i.e. by users of the cars passing through, the calculation is very simple. Based on the presented data, it is possible to find out that costs for 100 kilometres covered are on average amounting to € 6.68 and if the drivers travel uselessly 689.90 km a day, this means that due to the existence of deserted areas in the city, fuels for € 46.82 are consumed annually and then the amount ascends to almost € 16,800. If we take into account also the lost time of the drivers and if we come out of the above given presumption that the average man estimates an hour of his time to 35 % of his average hourly wages, we will get interesting results as well. If we consider 170 worked hours a month, the average gross hourly wages are € 5.11 whereas 35 % of this sum is € 1.79. The overall lost time of the drivers per day can be evaluated by the amount of € 25.39, then this sum is more than € 9,200 annually. In this connection, it is necessary to point out that we reckon with only one man per car in these meditations. However, more people may travel in their vehicles and this sum could be even higher though it can be expected that the increase would not be so dramatic due to average occupancy of the vehicles. When adding the amounts for consumed fuels and lost time, we will get the sum of € 71.42 daily and € 26,066 annually. If we add the price for maintenance of traffic infrastructure and public utilities, the aggregate annual amount of those used inefficiently is € 28,725 with the fact that 9.26 % thereof is covered from public budgets and the rest is paid by private persons.

Finally, it is necessary to state that the mentioned funds will not be saved by regeneration of the said brownfields; these areas cannot be taken out of the urban structure and "cut short" the city in this way; these funds will only be used much more efficiently and purposefully. The exception is constituted by the costs for the acquisition of structures of traffic infrastructure and public utilities. These costs will be saved in case of comparison of the regeneration of brownfields and construction of similar objects from scratch using the comparable types of infrastructure.

Conclusion

Based on the above mentioned procedure, it is possible to quantify the costs spent uselessly that results from the existence of brownfields in every city, namely on the basis of the detailed analysis of brownfields and by fixing several cost prices. It is seen on the example of Hlučín that these are not small sums at all and the total sum can reach the costs for regeneration of the selected brownfield in several years.

Nevertheless, it is necessary to point out that overall results are relatively strongly dependent on the recognized unit prices and that these prices vary every year quite significantly. The example mentioned here indicates only the procedure for the calculation and perhaps the way how to fix the overall costs; however, the presented prices are rather of an informative nature and they must be put more precisely before application of the given procedure to any other city.

Nevertheless, based on the data presented, it can be stated that the investments in regeneration of the majority of brownfields pay off in the long run as we will obtain savings in uselessly spent funds by the regeneration. It is a pity that the data are almost never taken into account in meditations upon regeneration of brownfields.

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