INDEX RTSN – REGIONAL TRANSPORT SERVICE NEEDS

INDEX RTSN – INDEX POTŘEBY REGIONÁLNÍ DOPRAVNÍ OBSLUŽNOSTI

Patrik Pova[1]

Summary: Regional Transport Service is a widely discussed issue. The complexity of factors influencing Transport Services is comparatively wide, given by the high amount of factors and their different impact on the level of Transport Services. The factors are divided into two groups. One with short term invariability the other with short term variability. Index RTSN expresses the short term invariable factor of Residential Structure and Urbanization. The methodology of determining the RTSN index is explained on regions with hypothetical Residential Structure to show the behavior of the RTSN index. Further the RTSN index is applied on representative administrative regions of the Czech Republic. The RTSN index represents a useful base for research of further factor influencing the level of regional Transport Services.

Key words: Index RTSN, Regional Transport Service, Residential Structure, Urbanization

Anotace: Dopravní obslužnost území je široce zkoumaná tematika. Komplexnost faktorů ovlivňující úroveň dopravní obslužnosti je poměrně rozsáhlá a zahrnuje velký počet faktorů s rozdílnou váhou vlivu na dopravní obslužnost. Jednotlivé faktory jsou rozděleny do dvou skupin podle jejich časové schopnosti změny. Krátkodobě neměnné a krátkodobě proměnné faktory. Index RTSN vyjadřuje krátkodobě neměnný faktor struktury osídlení a stupně urbanizace. Je vysvětlen postup výpočtu indexu RTSN a jeho význam pro posuzování úrovně dopravní obslužnosti. Index RTSN je názorně vysvětlen na příkladě regionů s hypotetickou strukturou osídlení a stupněm urbanizace, tak aby byly zřejmé rozdíly jednotlivých struktur osídlení a jejich výsledný index RTSN. Dále je index RTSN aplikován na zvolené reprezentativní okresy ČR. Index RTSN poskytuje vhodný základ pro zkoumání vlivů dalších faktorů na úroveň dopravní obslužnosti regionů.

Klíčová slova: index RTSN, regionální dopravní obslužnost, sídelní struktura, urbanizace

1. INTRODUCTION

Economical theory divides factors into short term variable and short term invariable. In the long run all factors are variable. This idea is also usable in regional science by dividing factors into short term variable and short term invariable. Short term variable factors are mainly geographical factors. Factors short term variable are social and economical factors. In case of transport studies this means that factors influencing needs of mobility are independent and not influenced by transport itself. These factors have impact on regional transport and its arrangement. The second group of factors represent short term variable factors, which are in mutual interaction with transport itself and influence each other. A representative example for

[1] Ing. Patrik Pova, University of Economics Prague, Faculty of Economics and Public Administration, Department of Regional Studies, nám. W. Churchilla 4, 130 67 Praha 3, Tel.: +420 602 495 193, E-mail: povp01@isis.vse.cz

the first group of factors we can mention: 1) short tern invariable – level of urbanization, settlement structure, structure and spread of transport infrastructure; 2) short term variable – regional GDP, employment, social values influenced by fashion attitude.

For the research of regional transport arrangement this division provides the possibility to fix an index of some invariable factors and to use it as a base for research of further invariable and variable social and economical regional transport factors.

In this paper the index is provided by short term invariable factors: settlement structure, level of urbanization and the amount of inhabitant. In the purpose of regional transport research the index expresses the Regional Transport Service Needs "RTSN". Given by this index it should be possible to make further analysis of related short term invariable and variable factors.

2. EFFICIENCY OF TRANSPORT SERVICES AND SETTLEMENT STRUCTURE

The ability of regional competition is influenced by many economical, sociological and cultural factors. One of the economical factors is transport, respectively regional transport service. The need for mobility is given on one hand by the regional economic level and on the other hand by the supply of transport services. Demand and offer are in mutual interaction. To ensure a reasonable level of transport service financial and economic factors are necessary. The efficiency of transport services is influenced not only by economic factors, but also by geographical factors like settlement structure, level of urbanization and regional population density. (Wokoun 2006) The population density and the concentration of inhabitants into cities are influencing, in connection with the need of basic mobility, the efficiency of transport services. Assuming the same financial spending the efficiency of transport services is not the same in every region. The reason for this inequality is the different settlement structure.

„Factors influencing the amount of regional public transport links are especially the population size and the overall regional settlement character. These factors have direct impact on the efficiency of the transport links. Simply said: higher amount of customers covers the costs for transport services or at least lover the loss". (Marada 2010)

The decision making about the level of regional transport services is in the hand of local regional government, especially the local, regional and state government. For researching district and regional transport services, the competent institutions are the regional and local government.

The research of regional transport services in relation to regional issues is directly and indirectly subject of some papers. In the research project *WB-32-04: Dopravní obslužnost a technologie ve vztahu k regionálnímu rozvoji* (engl. Regional Transport Services and Technology in relation to Regional Development) (Wokoun 2006) the aim of the research is to give authorities involved into regional politics an overview about the relations between Transport Services and Regional Development. Two of the influencing factors in the mentioned research project were the settlement structure and population density. The results of the research, which were set in the intention "Optimizing the structure of Transport System

in relation to Regional Development and the function of territorial administration" were, also in relation to the RTSN index: deepening inequality of regional transport services, weakening the relation of regional transport streams to regional employment centers and insufficient transport service segmentation.

The intention of the RTSN index is to provide a base for giving responses to the conclusions mentioned above, by providing an index incorporating the settlement structure usable for research of regional transport services especially for Czech districts. „The settlement structure belongs to factors with the highest impact on transport processes and the range of regional transport. Important are the following factors: population density, settlement density and their average size, the diffuseness of settlement, urbanization degree and character, settlement allocation and hierarchy." (Wokoun 2006) The mentioned factors are involved in the RTSN index, explained in the following point. The paper *Vliv suburbanizace na dopravu v Pražském městském regionu* (engl. The Influence of Suburbanization in the Prague periphery region) (Urbánková, Ouředníček) notes a growth of automotive transport from the periphery to the center of Prague. The reason of this appearance is given by bad rail public transport and a low frequency and low comfort of road public transport. The expectation is, that the RTSN index should be quite high in these regions and thus the appearance of low quality public transport would correspond with the assumption of the RTSN index.

3. INDEX RTSN - REGIONAL TRANSPORT SERVICE NEEDS

From the view of regional transport the RTSN index can be interpreted as Regional Transport Service Needs. In other words, the RTSN index incorporates the following factors: settlement structure, diffusion of population and the level of urbanization. These factors are basically determining the level of regional transport services.

How do we concretely specify the RTSN index? The following regional variables are used:

$$RTSN = \frac{(I_C - I_M) \times (V_C - V_M)}{I_C} \qquad (1)$$

where I_C – total population
I_M – population in cities
V_C – total amount of communities
V_M – amount of communities with city statute

The RTSN Index reaches values from 0 to infinity. Low values up to 10 indicate a relatively high population concentration into cities. High index values above 70 indicate a relatively high population diffusion and a low level of urbanization.

Presumptions and restrictions of the RTSN index:

- only regions with a similar (about ±30% deviation of the average) area and population amount can be compared
- also the regional economic level (GDP) should not differ more than ±30%

For a better imagination how the RTSN index works some hypothetical region constellation are introduced. In table No. 1 five regions with different level of urbanization and different level of population diffusion are described. The region No. 1. Shows a 100% urbanization and population concentration into one city. The value of the ITSN index is 0. This means perfect conditions for realizing regional transport services. The second case represented by region No. 2 represents a 100% urbanization and a diffusion into five cities. The value of the RTSN index is also 0. According to the presumptions and the idea that one big city is divided into five smaller cities the value 0 is reasonable. The third case shows a region with a 95% urbanization and a diffusion into five communities, one of them the regional center. The value of the RTSN index is 0,2. We can explain the value of 0,2 as a easily servable region by regional public transport due to the big regional center with 95% urbanization. In the fourth case a region with only 50% urbanization and the same population diffusion into five communities is shown. The value of the RTSN Index is 2,0. This is quite higher than the index of the former three regions. A relatively low urbanization makes the realization of transport service more difficult and less efficient. The fifth and last hypothetical region represent a 50% urbanization but a diffusion twice higher than the former region. The value of the RTSN Index is 4,5.

As shown in these hypothetical regions the RTSN Index depends on the level of urbanization and population diffusion.

Tab. 1 - RTSN Model – Regions with a hypothetical settlement structure

		C	D	E	F
č	RTSN = (E-C)*(F-D)/C	I_C – total population	V_M – amount of communities with city statute	I_C – total population	V_C – total amount of communities
1	0,000	100 000	1	100 000	1
2	0,000	100 000	5	100 000	5
3	0,200	95 000	1	100 000	5
4	2,000	50 000	1	100 000	5
5	4,500	50 000	1	100 000	10

Source: ČSÚ, mesta.obce.cz, Author´s calculation

Application Method of the RTSN Index at the Level of Czech Republic Districts

Using the RTSN index we determine values of the RTSN index for chosen representative districts. As representative we can assume districts of the administrative region Plzeň, Ústí nad Labem and Vysočina. Why can we consider these districts as representative? Districts of the Ústí nad Labem region are highly populated, showing a high level of urbanization. Thus the RTSN index of these districts should be relatively low. Districts of the

Vysocina region have a relatively diffused population with a low urbanization level. The RTSN index should show relatively high values. Districts of the third region Plzeň are dominated by the regional center of Plzeň city. Plzeň city district is a centrally located huge regional center. Given this circumstances no other large center could develop in the districts of the Plzeň region. The RTSN index values should be relatively different.

The following data are used for the analysis. All following data apply on districts. The amount of communities, the amount of communities with a city statute, the amount of population and the amount of city population. All data, except population in cities, are from the Czech statistic department (ČSÚ) and apply to the year 2008. The data source is "základní charakteristika okresy; vybrané ukazatelé za okres 2008" (engl. Basic charcteristic of districts; selected figures for districts 2008). Figures for population in cities are from mesta.obce.cz selected from basic information of every city. All mentioned data are used for calculating values of the RTSN index and propose indicators of the settlement structure and population diffusion. By providing the RTSN index we characterize the districts from the view of transport service intensity. Assuming the same economic level and equal infrastructure fit up the RTSN index gives an idea about the financial intensity to ensure the same level of transport service in all districts.

4. RTSN INDEX VALUE ANALYSIS OF CHOSEN REPRESENTATIVE DISTRICTS

In the following table chosen representative districts of the regions Vysočina, Ústecký and Plzeňský are compared and analyzed from the view of regional transport service intensity. In the region Vysočina the RTSN Index reaches values from 38,7 (in the district Pelhřimov) up to 80,7 (in the district Žďár nad Sázavou). All other RTSN Index Values in the Vysočina regions are in between: 43,9 u Havlíčkův Brod, 72,8 Jihlava, 73,6 Třebíč. These are relatively high values of the RTSN Index, given by the settlement structure. The Vysočina regions is characterized by a high population diffusion and a low urbanization level.

Districts in the Ústi region provide values of the RTSN Index between 1,8 for the Most district and 34,1 for the Litvínov district. All other values: 3,1 Ústí nad Labem, 4,0 Teplice and Chomutov, 4,9 Děčín and 21,9 Louny. Exept Louny with 21,9 all other districts provide a RTSN index under 10. This is given by a high density of population and a high urbanization level.

The RTSN Index values of the district in the Plzeň region show values which are somewhere between districts of the two before mentioned regions. One exception is Plzeň city with a value of 1,2. All other districts provide values of the RTSN Index between 15,5 for the Tachov district up to 52,1 for the Plzeň sever district. The other values: Tachov 15,5, Klatovy 25,8, Rokycany 28,5, Domažlice 34,0 and Plzeň jih 46,3. We have a high population concentration into the Plzen city district and average population diffusion in all other districts of the Plzeň region.

Tab. 2 - Values of the RTSN Index for representative districts

			C	D	E	F
Region	District	RTSN[2] = (E-C)*(F-D)/C	population in cities [3]	amount of communities with city statute [4]	total population [5]	total amount of communities [5]
Vysočina	HB	43,9	58 381	8	96 079	120
	JI	72,8	70 843	5	112 031	203
	PE	38,9	47 555	9	73 227	120
	TŘ	73,6	61 924	6	114 028	167
	ŽR	80,7	62 395	6	120 046	174
Ústí nad Labem	DČ	4,9	118 073	14	135 710	52
	CV	4,0	112 234	8	126 353	44
	LIT	34,9	74 298	11	118 243	105
	LOU	21,9	56 825	7	87 197	70
	MO	1,8	106 753	6	117 294	26
	TP	4,0	109 457	9	130 070	34
	ÚL	3,1	102 200	3	121 024	23
Plzeň	DO	34,0	33 637	8	60 239	85
	KT	25,8	60 099	14	88 669	94
	PLM	1,2	168 179	2	185 125	15
	PLJ	46,3	26 926	7	60 856	90
	PLS	52,1	30 179	10	74 003	98
	ROK	28,5	25 616	6	47 341	68
	TCH	15,5	34 127	8	53 394	51

Source: ČSÚ, Města a obce, Author´s calculation

5. DISCUSSION OF THE ANALYZED VALUES

The organization of regional public transport depends on many factors. Among these factors we can include: area size, relief, structure and size of production, **settlement structure**, administration structure, regional development procedure, further economical and political factors. By using the RTSN Index for comparing regions we have to respect some limitations. We have to compare regions with similar area size and similar population density. Differences between urbanization centers and countryside are reflected in the RTSN Index. Social and economical factors are not part of the RTSN Index. These factors can be analyzed by using the RTSN Index as base.

Districts of chosen regions, representing the settlement structure of Czech Republic, we can divide into three categories by the view of regional transport service intensity: 1) districts

[2] Author´s calculation
[3] Author´s calculation; source: http://mesta.obce.cz/ (on-line 20.09.2010)
[4] Source: ČSÚ; základní charakteristika okresy; vybrané ukazatelé za okres (2008); (online 20.09.2010)

with a high efficiency of transport services; 2) districts with average efficiency of transport services; 3) districts with low efficiency of transport services.

Into the first category fit in districts of the region Ústi except Litvinov. Further Plzeň city. Into the second category fit in districts of the region Plzeň and district Litvinov. Into the third category fit in districts from the region Vysočiny and districts Plzeň jih and Plzeň sever.

In the Vysočina region the realization of transport service is quite difficult and inefficient. Implicationally the cost for the realization of transport service will be relatively high to other regions or the standard of the transport service will be low. The final result is low population mobility and rising costs for individual automotive transport in such a region.

A complete opposite to Vysočina is the region Ústí. Low values of the RTSN Index indicate a relatively simple realization of transport services and a high efficiency. Implicationally a high standard of transport services or low expenditures for average transport services can be expected.

In the region Plzen a high contrast between Plzeň city and its neighbor districts Plzen sever and Plzeň jih can be observed. The high gravitation power of the district Plzen city does not allow other regional centers establishing in its neighborhood. Thanks to these circumstances the value of the RTSN index in districts Plzen sever and Plzeň jih is very high. In all probability the streams from Plzeň sever and Plzeň jih will mainly route to Plzen city, these districts should profit of the public transport services of Plzeň city. In this case we may look at these districts as widen suburb of Plzeň city. It would also be reasonable to fuse these three districts into one district. By this, the value of the RTSN index would establish in the range of average for the Pilsen region.

6. CONCLUSION

Comparing values of the RTSN Index for hypothetical districts and chosen representative districts of Czech districts suggest a reasonable application of the RTSN Index in the research of regional transport services. The RTSN Index embodies the settlement structure and the urbanization rate from the view of regional transport service needs. By this, the RTSN Index can be used as base for research of further factors influencing the level of regional transport service.

LITERATURE

[1] BRÄCHETER F.: Das *Punkt-Axiale Prinzip in der Planung; Ruhr-Universität Bochum 2004* [online18.10.2010] http://homepage.ruhr-uni-bochum.de/frank.braechter/Deutsch/Studium/Geo/HA-PIPP-FB.pdf.

[2] MARADA M., KVĚTOŇ V.: *Diferenciace nabidky dopravnich přiležitosti v českych obcich a sociogeografickych mikroregionech;* Geografie 2010, čislo 1, ročnik 115.

[3] POVA P.: *Analýza dopravní obslužnosti s důrazem na dopravu jako významný faktor rozvoje regionu*; Perner´s Contacts Ročník 4., Číslo I., 2009.

[4] URBÁNKOVÁ J. OUŘEDNÍČEK M.: *Vliv suburbanizace na dopravu v pražském městském regionu*, [online 24.08.2010] http://web.natur.cuni.cz/~slamak/gacr/kniha/urbankova.pdf.

[5] WOKOUN R.: *Dopravní obslužnost a technologie ve vztahu k regionálnímu rozvoji,* Závěrečná zpráva projektu WB-32-04, 2006 [online 24.08.2010] http://www.mmr-vyzkum.cz/INFOBANKA/wb-32-04-dopravni-obsluzno-1999.aspx
[6] ČESKÝ STATISTICKÝ ÚŘAD: *základní charakteristika okresy, vybrané ukazatelé za okres* (2008), (online 20.09.2010)
[7] MĚSTA A OBCE: (on-line 20.09.2010) http://mesta.obce.cz/

ANNEX – RTSN Index for Czech Republic districts

		District	RTSN			District	RTSN
1	PH	Praha	1,2	40	LI	Liberec	7,7
2	BN	Benešov	48,8	41	SM	Semily	21,8
3	BE	Beroun	43,6	42	HK	Hradec Králové	24,3
4	KD	Kladno	29,7	43	JC	Jičín	41,1
5	KO	Kolín	40,6	44	NA	Náchod	17,4
6	KH	Kutná Hora	39,2	45	RK	Rychnov nad Kněţnou	29,5
7	ME	Mělník	24,2	46	TU	Trutnov	12,3
8	MB	Mladá Boleslav	43,4	47	CR	Chrudim	38,8
9	NB	Nymburk	35,7	48	PU	Pardubice	29,8
10	PY	Praha-východ	62,5	49	SY	Svitavy	52,3
11	PZ	Praha-západ	46,6	50	UO	Ústí nad Orlicí	40,9
12	PB	Příbram	47,2	51	HB	Havlíčkův Brod	43,9
13	RA	Rakovník	45,0	52	JI	Jihlava	72,8
14	CB	České Budějovice	28,1	53	PE	Pelhřimov	38,9
15	CK	Český Krumlov	20,8	54	TR	Třebíč	73,6
16	JH	Jindřichův Hradec	34,6	55	ZR	Ţďár nad Sázavou	80,7
17	PI	Písek	23,4	56	BK	Blansko	52,4
18	PT	Prachatice	25,2	57	BM	Brno-město	0,0
19	ST	Strakonice	40,4	58	BI	Brno-venkov	118,4
20	TA	Tábor	30,6	59	BV	Břeclav	25,5
21	DO	Domaţlice	34,0	60	HO	Hodonín	37,3
22	KT	Klatovy	25,8	61	VY	Vyškov	38,8
23	PM	Plzeň-město	1,2	62	ZN	Znojmo	77,2
24	PJ	Plzeň-jih	46,3	63	JE	Jeseník	8,3
25	PS	Plzeň-sever	52,1	64	OC	Olomouc	30,2
26	RO	Rokycany	28,5	65	PV	Prostějov	41,9
27	TC	Tachov	15,5	66	PR	Přerov	35,9
28	CH	Cheb	5,7	67	SU	Šumperk	33,7
29	KV	Karlovy Vary	6,8	68	KM	Kroměříţ	24,9
30	SO	Sokolov	25,6	69	UH	Uherské Hradiště	36,5
31	DC	Děčín	4,9	70	VS	Vsetín	21,5
32	CV	Chomutov	4,0	71	ZL	Zlín	21,9
33	LT	Litoměřice	34,9	72	BR	Bruntál	16,3
34	LN	Louny	21,9	73	FM	Frýdek-Místek	27,1
35	MO	Most	1,8	74	KI	Karviná	0,9
36	TP	Teplice	4,0	75	NJ	Nový Jičín	13,3
37	UL	Ústí nad Labem	3,1	76	OP	Opava	29,4
38	CL	Česká Lípa	8,4	77	OV	Ostrava-město	0,1
39	JN	Jablonec nad Nisou	4,9				