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DEVELOPMENT OF TRANSPORT CENTRALITY OF THE TOWNS IN CENTRAL AND NORTHERN BOHEMIA

In 1963 the publishing establishment of the Czechoslovak Academy of Sciences published a collective study, „On the Problem of Economic and Geographic Centres. The Centres of Central and Northern Bohemia", which was prepared for publishing by C. Votrubec. The degree of centrality is evaluated with a view to four standards: the number of inhabitants, the extent of industrial production, the transport intensity, and the standard of services (retail shop network, education and health service).

The lables given to the four standards themselves indicate that the resultant summary index referred to the general, particularly *economic importance,* of the location rather than to its *actual centrality.* This is conditioned, in the first instance, by a uniform application of the overall index of the number of inhabitants, but also the number of industrial inhabitants, because industrial concentration may basically be understood as the dialectic counterpart of the concentration of centre facilities. (Compare, e. g., in the Atlas of Austria „Industrieort" and „Zentralort"). In the socialist countries Känel (1968) was the first to express his opinions on this matter. He thinks that one can refer to a location as a centre only when the number of inhabitants, employed in transport and services, *exceeds* the number of inhabitants, employed in industry. However, E. Neef, professor in the University of Dresden, expressed himself as being in favour of this differentiation as early as in 1950, when he distinguished between the „distribution" and „singular" functions (including the industry) of towns.

Considering the comments to the 1963 publication mentioned, it follows that only the third and fourth of the four indices used are fully justified. Since it was not possible to enter into new collective co-operation, the author of this contribution was restricted to the transport criteria, more over to municipal communities, of which there are 48 in the region. The differentiation between towns, semi-urban „small towns" and communities of other types in the ČSSR was carried out by means of a special, detailed statistical investigation in 1961. A special committee, including statisticians (particularly population statisticians), as well as geographers, urbanists, sociologists and other specialists, processed the results of the investigation mentioned, and unified their opinions on treating the controversial cases. The list of towns was published in the Czech geographic journal (Srb-Kučera) and it is being respected in geographical, statistical and other papers.

The study of centrality is very popular in all the sciences of space. The most effective contributions have recently come from the field of mathematical construction of *centre models,* a good review of which was presented by Olsson (1967). If the 1963 publication mentions „more than one hundred papers", this

was already an underestimate at the time. This is substantiated by the bibliography, published independently in 1961 (Berry and Pred) and the supplements of 1965 (Barnum, Kasperson and Kiuchi), and possibly other, supplements published later in the Regional Science Research Institute in Philadelphia. The literature on central towns has now reached such an extent that it is unthinkable to evaluate the individual *trends* as regards importance, attributed to transport, in this contribution. The author, on the one hand, had the possibility of acquainting himself with some of the unpublished work at the institutes of the neighbouring countries, but on the other hand, he has not studied a number of published American and Soviet papers, particularly those having the nature of monographies on small groups, or individual centres.

The importance of the transport criteria in determining the degree of centrality has *increased,* rather than decreased, since Christaller's classical introduction to this problem was published (1933), and later supplemented mainly by Lösch (1954) and Isard (1956). This can also be seen in the catalogue of representative centre facilities, which Christaller published in 1950. The status of transport, among the other features of centrality, differs considerably from author to author, Thus, Christaller gave it priority over health service facilities, Schlier (1937) even gave it priority over public services, H. Lehmann (1951) over cultural facilities, etc.

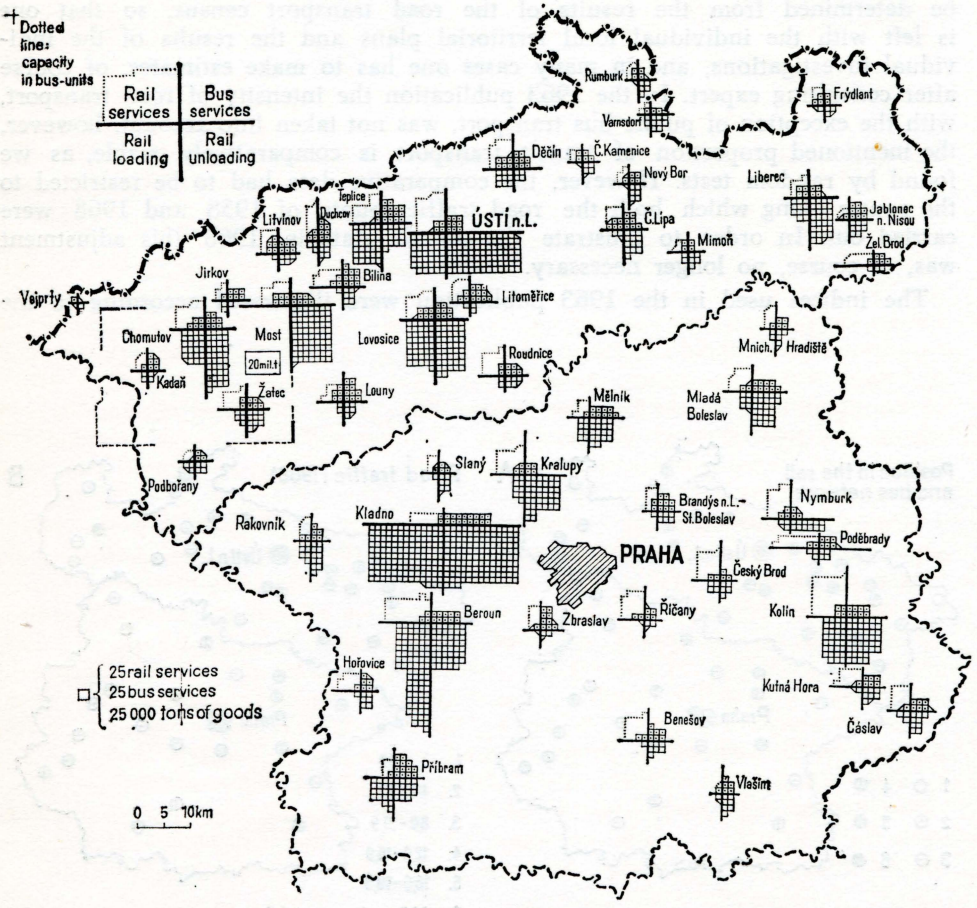
The simplest and easiest method of determining centrality is based on the *economic structure data of the inhabitants.* The transport employees are always included in the „centre stratus" of inhabitants, however, as early as in 1937 a proposal appeared (Schlier) to consider only those transport employees who were actually doing the transporting, and to exclude the employees, particularly workers, working in the „transport industry". Even more serious is the distorting effect of the non-uniform distribution of commuting, because statistics only provide data on employment concerning the employees in residence (Wiebel 1954). Schneider (1959) attempted to make the appropriate correction when he supplemented Arnhold's method (1951), which takes into account the number of employees in commerce, transport and public services, decreased by 10 % of the inhabitants of the town to achieve „the centre excess of inhabitants", by adding the total number of commuters. Another difficulty which is frequently encountered is the differentiation between employees in municipal and local transport systems.

The difficulties with the statistics of the economic pertinence of the inhabitants led to a revival of the interest in *measuring the phenomenon itself,* the endeavour being to find a single sufficiently representative criterion, e. g, the number of telephones (Christaller), or the relative magnitude of retail turnover (Neef). This is more easily achieved with facilities which are divided into categories according to importance, particularly if they are differentiated with a view to the hiearchic degrees of the centres. Of the indices, to which a larger weight is assigned than to transport, these represent the categories of the authorities, the wholesale, financial and insurance institutions, possibly also of publishing establishments (particularly the press, local weeklies included). Some authors were of the opinion that they would avoid bias if they combined both the methods, i. e., the economic structure of the inhabitants and the selection of centre institutions. Bousted (1957) also investigated the degree of variety in the production fields.

As regards the measuring of the degree of centrality by applying the transport criterion, one must undoubtedly give priority to indices referring to facili-

ties over the number of inhabitants employed in transport. To the most important criteria undoubtedly belongs the number of *people coming to town,* seconded by the volume of *imported goods.* The application of the passenger transport index is easier and fortunately also more valuable, because with some towns it is dificult to eliminate the mass substrates, which are not indicative of the centrality of a town (coal, construction material, etc.). Moreover, there are the difficulties with road freight transport, which requires investigations to be made at the individual firms, and also frequently at their subsidiaries. The Transport Research Institute, which studies this problem, has, however, only processed the northern half of the investigated region. It should also be pointed out that one is only capable of recording 70 % of the goods at the outside, which is carried over the roads.

A critical comment is due to the merging of the railway loading and unloading into a single index, as adopted in 1963 publication, because the unloading data are more significant for the given purpose. The attached diacartogramme



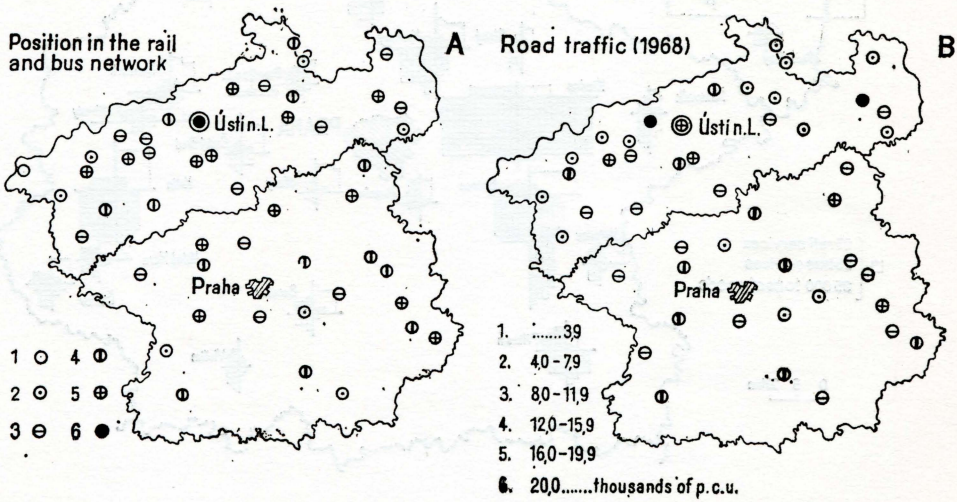
1. Transport centrality of the towns of Central and Northern Bohemia 1967.

according to the 1967 status differentiates between both quantities, however, the cartogramme illustrates the changes over the previous ten years (Fig. 3b) only compares the turnover for the reasons mentioned.

It is very time consuming to determine the number of passengers and this can only be carried out for individual centres, or small regions. In the same way as in the 1963 publication, one had to make do with the number of vehicles. As regards public transport it is in fact the number of *transportation possibilities,* i. e., the number of possibilities of travelling into town over 24 hours. This index can be determined with the help of the railway and bus timetables. In comparison to the index in the 1963 publication the presented diacartogramme also indicates the *capacity of the means of transport* by transforming trains into „bus units", which approximately correspond to 50 seats. The dotted line in the left-hand upper corner of the individual diagrams determines the capacity of the railroad transport and makes an immediate comparison with bus transport possible.

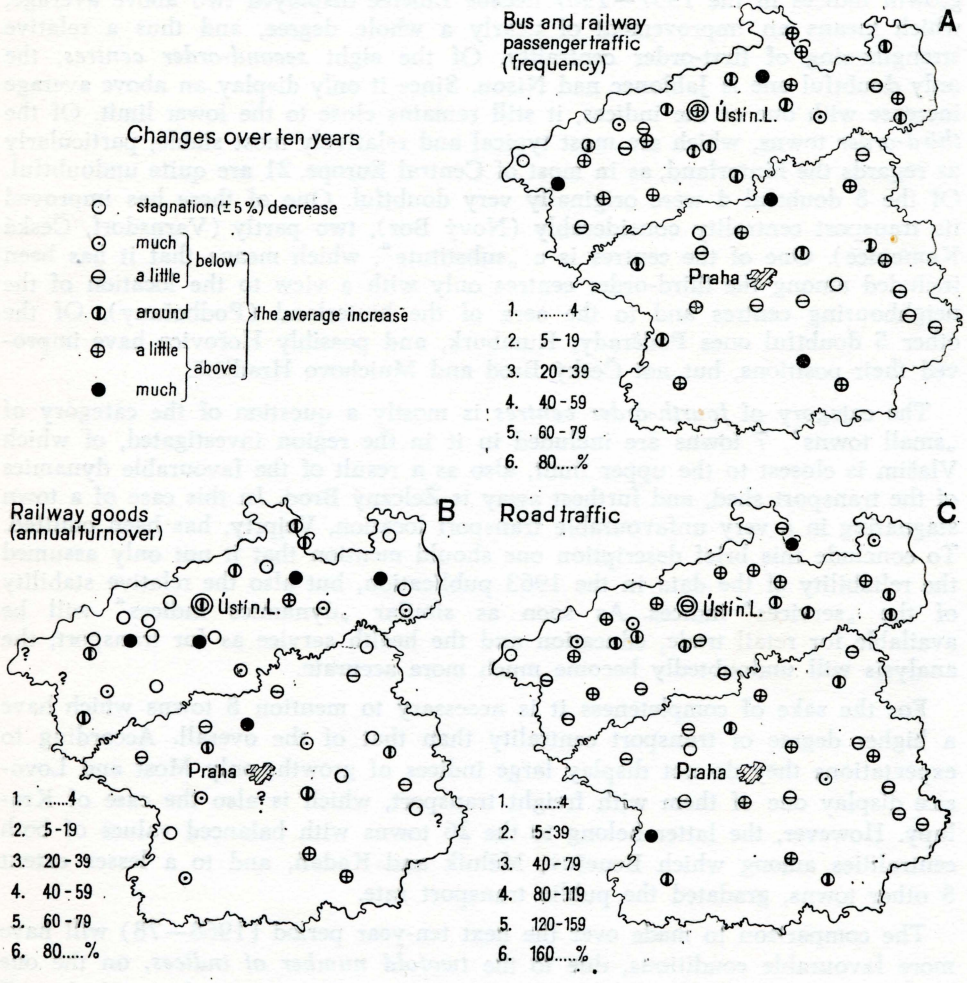
The main difficulties in achieving similar results in road transport are the corrections in respect of *transit transport.* The corresponding proportion cannot be determined from the results of the road transport census, so that one is left with the individual local territorial plans and the results of the individual investigations, and in many cases one has to make estimates, of course after consulting expert. In the 1963 publication the intensity of road transport, with the exception of public bus transport, was not taken into account, however, the mentioned proportion of transit transport is comparatively stable, as we found by random tests. However, the comparative data had to be restricted to the routes along which both the road traffic counts of 1958 and 1968 were carried out. In order to illustrate the overall state in 1968 this adjustment was, of course, no longer necessary.

The indices used in the 1963 publication were illustrated according to the



2. Transport position and intensity of road transport (1968).

1967 status by means of diagrams, the advantage of which is shape adaptability. This property makes it possible to solve the problem of the lack of space for a symbol, which in one case (Most) had to be solved by introducing the mere contours. The state metropolis could not be included into the diacartogramme. The intensity of road transport in 1968 was illustrated separately (Fig. 2B), and in a similar way also the position indices in both transport networks (Fig. 2A). This index includes express train routes and A-class roads by two points, and the remaining railroads and B-class roads by one point. It is an *elementary index* which is suitable for retrospective investigations of the development of the centrality of towns over long periods, as the author has shown in his article on the effect of transport area on the development of administrative centres (1972), in Bohemia already since the 13th century.



3. Development of transport centrality 1957—67, and 1958—68.

The next three maps (Fig. 3) represent *dynamic expressions.* They illustrate the development of the number of public transport connections, the development of the turnover in railroad transport, both over the 1957—1967 decade, and finally the development of the intensity of road transport over the ten-year period of 1958—1968. For the sake of better comparison and illustration these maps have a common scale, determined according to the appropriate average values.

The graphs are supplemented by a tabular list, which differentiates the degree of transport centrality by means of Roman figures with a triple index, whereas the Roman figures in brackets denote the overall centrality. From the ratio of both degrees of classification it can be seen that one of the *first-order centres* was undoubtful in 1957 (Ústí nad Labem), whereas the other (Liberec) displayed a transport centrality lower by two degrees. However, of the three growth indices in the 1957—1967 decade Liberec displayed two above average, which means an improvement of nearly a whole degree, and thus a relative strengthening of first-order centrality. Of the eight *second-order centres,* the only doubtful one is Jablonec nad Nisou. Since it only display an above average increase with one of the indices, it still remains close to the lower limit. Of the *third-order* towns, which are most typical and relatively most stable, particularly as regards the hinterland, as in most of Central Europe, 21 are quite undoubtful. Of the 8 doubtful 4 were originally very doubtful. One of these has improved its transport centrality considerably (Nový Bor), two partly (Varnsdorf, Česká Kamenice). One of the centres is a „substitute", which means that it has been included among the third-order centres only with a view to the location of the neighbouring centres and to the aera of the hinterland (Podbořany). Of the other 5 doubtful ones Poděrady, Rumburk, and possibly Hořovice have improved their positions, but not Český Brod and Mnichovo Hradiště.

The category of *fourth-order centres* is mostly a question of the category of „small towns". 7 towns are included in it in the region investigated, of which Vlašim is closest to the upper limit, also as a result of the favourable dynamics of the transport shed, and furthest away is Železný Brod. In this case of a town stagnating in a very unfavourable transport location, Vejprty, has been omitted. To conclude this brief description one should mention that it not only assumed the reliability of the data in the 1963 publication, but also the relative stability of the „services" indices. As soon as similar „dynamics indices" will be available for retail trade, education and the health service as for transport, the analysis will undoubtedly become much more accurate.

For the sake of completeness it is necessary to mention 8 towns which have a higher degree of transport centrality than that of the overall. According to expectations they do not display large indices of growth; only Most and Lovosice display one of them with freight transport, which is also the case of Kralupy. However, the latter belong to the 26 towns with balanced values of both centralities among which Benešov, Mělník and Kadaň, and to a lesser extent 8 other towns, gradated the public transport rate.

The comparison to made over the next ten-year period (1968—78) will have more favourable conditions, due to the *twofold number of indices,* on the one hand, and to the even more reliable unification of the procedure, which will eliminate the danger of ambiguity of results of some of the partial indices, which is quite considerable with many of the centres.

Tab. 1. Development of transport indices of centrality of Central (A) and North (B) Bohemian Towns over the period 1957—1967

A.	Benešov (III)	III—655		Děčín (II)	II—445
	Beroun (III)	I—523		Duchcov (II)	II—312
	Brandýs n. L. (III)	III—425		Frýdlant (IV)	IV—412
	Čáslav (III)	III—303		Chomutov (II)	II—545
	Český Brod (III)	IV—112		Jablonec (II)	IV—514
	Hořovice (III)	IV—416		Jirkov (IV)	IV—412
	Kladno (II)	I—341		Kadaň (IV)	IV—603
	Kolín (II)	I—333		Liberec (I)	III—365
	Kralupy (III)	III—564		Litoměřice (III)	IV—413
	Kutná Hora (III)	III—333		Litvínov (III)	II—215
	Mělník (III)	III—635		Louny (III)	III—513
	Mladá Boleslav (II)	II—534		Lovosice (III)	II—464
	Mnich. Hradiště (III)	IV—313		Mimoň (IV)	V—124
	Nymburk (III)	III—413		Most (II)	II—362
	Poděbrady (III)	IV—545		Nový Bor (III)	V—565
	Příbram (III)	III—524		Podbořany (III)	V—343
	Rakovník (III)	III—433		Roudnice (III)	III—423
	Říčany (III)	III—343		Rumburk (III)	IV—543
	Slaný (III)	III—133		Teplice (II)	I—415
	Vlašim (IV)	IV—554		Ústí n. L. (I)	I—543
	Zbraslav (—)	IV—305		Varnsdorf (III)	V—546
B.	Bílina (III)	III—514		Vejprty (V)	VI—103
	Česká Kamenice (III)	V—615		Žatec (III)	III—525
	Česká Lípa (III)	III—454		Železný Brod (IV)	IV—420

N. B. The Arabien numerals 2—6 denote the degree of the increment of the number of transportation opportunities, the turnover in railroad freight transport and the intensity of road transport. The numeral 1 indicates decrement or stagnation (± 5 %). The Roman numeral preceeding the three Arabian numerals indicates the centrality with a view to the transport indices, whereas the number in the brackets following the name of the town, the overall degree of centrality.

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The other papers can be found in the references of the 1963 publication (Votrubec et al.) with which the present paper ties up.

VÝVOJ DOPRAVNÍ CENTRALITY MĚST VE STŘEDNÍCH A SEVERNÍCH ČECHÁCH

Příspěvek je pokusem sledovat vývoj střediskovosti měst z hlediska dopravy během údobí 10 let. Děje se tak na základě porovnávání dvou ukazatelů k r. 1957 z kolektivní práce o centralitě středních a severních Čech (red. C. Votrubec), a jednoho dalšího ukazatele — který bylo možno retrospektivně určit (z výsledků sčítání silniční dopravy 1958) — se stavem o 10 let později. Počet *cestovních příležitostí* v dopravě železniční i autobusové, jakož i železniční *nakládka a vykládka,* jsou podle stavu v r. 1967 znázorněny kvantitativními symboly (diakartogram, obr. 1). U veřejné dopravy je tam znázorněna i *kapacita,* a to převodem vlaků na autobusové jednotky (zhruba 50 míst). Terčové kartogramy znázorňují jednak intenzitu silniční dopravy, jednak jako doplňkovou charakteristiku polohy v dopravních sítích (obr. 2). Mapky téhož typu znázorňují pak změny v počtu cestovních příležitostí celkem, v obratu železniční přepravy a v intenzitě dopravy silniční (obr. 3).

Grafická znázornění doplňuje tabelární seznam, v němž z porovnání římských číslic lze vyčíst rozdíly mezi centralitou celkovou a dopravní v r. 1957, resp. 1958, a hlavně podle trojice arabských čísel vývoj dopravní centrality v následujících 10 letech.

Z mapek i tabulky lze zjistit, že Liberec — původně s velmi sporným zařazením mezi centry prvého řádu — si postavení upevňoval, stejně jako Nový Bor, Varnsdorf a Česká Kamenice mezi centry třetího řádu. Z 8 měst s nižší centralitou má relativně nejpříznivější vyhlídky Vlašim a nejmenší Železný Brod. Stejný je počet měst, která mají větší centralitu dopravní nežli celkovou. Podle očekávání nestupňovalo žádné z nich výrazně osobní dopravu. Naproti tomu u 26 měst s vyrovnanými hodnotami obou centralit zjišťujeme takový vývoj u Benešova, Mělníka a Kadaně, a v méně výrazné formě u dalších 8 měst.

Srovnání za další údobí (1968—78) bude mít příznivější podmínky jednak dvojnásobným počtem ukazatelů, jednak ještě spolehlivějším ujednocením postupu, jímž se zcela odstraní nebezpečí nejednoznačnosti některých dílčích výsledků, které je u některých center dosti velké.