

R. TER BRUGGE**THE WORK TRIP IN MEDIUM SIZED
CITIES ANALYSED BY POST CODES****1. INTRODUCTION**

For some time I have done research on the possibilities of energy savings by means of physical planning. Heating and transport turn out to be the most important areas dealing with the subject of energy saving (ter Brugge, 1984). This conclusion was for example also reached by Beaumont and Keys (1982) in their book on spatial analysis of energy issues. From that point it was an easy step to return to much of the common research in transport geography, because an efficient transport in many cases also has a higher energy efficiency. From my already mentioned article it may also be clear that the most relevant level of analysis is the regional scale; the city region. A great number of trips are of rather small distances and, also because of their relative inefficiency, these trips use the bulk of energy consumption in transport.

Reviewing the work done on transport on a regional level the emphasis on the major metropolitan areas is striking. Nevertheless the greatest number of people in the developed parts of the world are living in medium sized towns (50.000 to 250.000 inhabitants), as is illustrated by Drewet (1984). Apart from the quantitative argument there is another, more important reason to take the medium sized town as an object of research. These towns have commonly a relatively simple spatial structure and therefore are a better start to explore and explain spatial processes. This argument especially accounts for the Dutch circumstances, because of the complicated polynuclear structure of the metropolitan area. This fact was vividly described by Peter Hall (1966) in his famous book on the World Cities. Nevertheless also in the Netherlands transport researchers tend to concentrate their efforts on the Fringingtown or Rimcity.

There are several reasons to focus on the work trip in studying the transportsector. The work trip (18% of all trips) does not outnumber other trips,

but the distances involved are relatively long (25% of personkilometers) and because of the regular pattern people tend to optimise the trip. Thus the possibilities of scientific exploration are greater and manipulating by physical planning can be more effective. Moreover the diurnal character of the trip will cause a disproportional impact on energy use and infrastructure. Within the scope of the broadly defined problem we ought to know more about how people choose their residential location, the route to go to work and their mode. This mainly is a behavioural problem within the constraints of the physical environment. This type of behaviour is considered to be the demand on the housing market, the labour market and transport market. It is obvious that the physical environment — being the supply side — is not autonomous; surely not in a democratic society with free enterprise like ours. However the inflexibility of the supply side urges us to be very alert on changes in activity and behaviour of people to avoid too great a friction.

A summary of the above statements can be given by quoting the conclusion of Kowalski (1983) in his paper on energy costs and the changing spatial structure of cities: "That the changes in the physical structure of the city have not been detected comes as no surprise. Such changes in buildings, roads, factories, offices etc. come much slower than the changes in the distribution of people and their activities within the existing physical structure. This means that the data on the actual use of the existing facilities, buildings, apartments, work-places in the intra-city disaggregation would be needed before more deep analysis of the internal changes of the city structure is possible. Such data do not exist in Germany and would have to be gathered specially."

Gathering data on the choice of the residential location in relation to the localised workplace is the theme of this paper. The activities monitored here are the choice of a residence related to the way people arrange their work trip. In not looking to the metropolitan area, in contrast to the statement of Kowalski, we think the intra-city level is too small. This analysis concerns the whole city region.

2. POSTCODE ANALYSIS

Analysing spatial structure and behaviour on a regional level makes it necessary to get data on small spatial units. One of the main sources for this are censuses. In the Netherlands the last census was held in 1971, but these data are not reliable because a number of people deliberately gave wrong answers. Fear of an abuse of personal data has made it impossible to have a census ever since. The statistical bureau gets its information since by sampling,

but the weak regional basis of them will be shown. Also the secret nature of the data can not always be guaranteed in a regional break down, in which case figures are not made public.

To overcome this problem we asked companies to deliver lists with postcodes or ZIP-codes of their workers. Although companies are always very careful with information on their employees, this questionnaire did not cause serious problems. More the 70% of the contacted establishments reacted positively, because of the anonymity of the postcode. In the Netherlands the postcode consists of four numbers and two letters, indicating a block of houses only at maximum several hundreds of meters apart. Allocating the postcodes of the workforce of every company is such a detailed way turned out to be too time consuming. By taking only the four number code subdivisions within the city and municipalities or parts of municipalities beyond the urban borders can be indicated. An advantage of this procedure was that about these spatial units statistical data were available on the surface, number of inhabitants etc. So we were not left with the problem of assigning features to geographical points. Within the city of Groningen 31 quarters are distinguished and 60 municipalities upto 35 kilometers of the city centre. In Zwolle there were 23 regions inside and 36 outside the city (See map 1 and 2).

With a computer programme PENDEL the shortest distances were computed between the coordinates of the companies and the coordinates of the gravity points of the regions. In addition the programme assigned a travel time based on an estimate of the crossing speed during rush hours according to a methodology available at the Traffic Study Centre in Groningen. For every company the area of the workforce could be delimited in a very specific way with the inquired information. A problem was the unspecified nature of the postcode, what kind of an employee was he or she?

Information was gathered of the companies, type of activity, shares of income classes, number of women, distance to parking lots, stations and so on. Also about the residential regions a lot is known; surface, number of inhabitants, numbers of houses built in past periods. A value of the level of shopping, schools, socio-cultural establishments and parks was computed by a potential equation and scaled by clustering. In this way some specification of every postcode was possible.

Although with great hesitation we also asked the companies to deliver information for every postcode about the sex of the employee involved and the year he or she entered the company. To our surprise this also did not cause main problems and we wished we had pushed it harder from the start. Now we ended with 6246 postcodes in Groningen (and 4576 in Zwolle) from 48 establishments (55). Of these 2306 (607) are specified to sex and 4204 (2883) to

year of entrance in that company. After the allocation with PENDEL it turned out that 4,2% (5%) lived beyond the border of our region under investigation and so they travel distances of 35 kilometers or more. The sample concerns 8,0% of the overall workforce in Groningen and 11,8% of those in Zwolle.

Until now one could easily get the impression that the choice of the cities and the companies was at random. This certainly is not the case. Apart from the fact that both Groningen and Zwolle are examples of medium sized European towns that have been a subject of research of our geographical institute for a long time, they have a number of important features. Both are capitals of a province, dominating a relative large and empty rural area. The assessability of both cities by highways and railways is rather good, as is shown in map 1 and 2. Both have an old, concentrated city centre within the medieval walls and just outside those walls the railwaystation is locate. Moreover both cities have been — and still are — important growth poles within the Dutch urban planning. Remarkable differences are the size (Groningen 165.000 inhabitants and Zwolle 85.000), the constraints posed by the river IJssel west of the city Zwolle and the farreaching traffic policy of the city planners in Groningen during the last 20 years. For instance the differences in size may point to a different stage in urban dynamics of both cities.

By collecting data on two cities one of the most fruitfull approaches in geography can be used — the comparative analysis.

The companies chosen have all employees working at a fixed point or at least starting their workday at one specific place. Categories chosen are industry, wholesale, retail, (public) services. They are located in four specific districts within the city. (See map 3.) First of all this is the city centre within the medieval walls. Secondly the area upto 500 meter walking distance of the railwaystation was chosen as a district. Thirdly and fourthly post-war industrial terrains at the urban fringe in two distinct directions in comparison to the city centre were taken. For a complete description of the research see ter Brugge (1984,b).

3. *SOME RESULTS*

Only recently we finished collecting data and the analysis just started. In this paper a few of the first results are presented. In the description it is intended to follow the lines of thinking of Nystuen (1963), who tried to define fundamental concepts to delimit movements. He distinguishes distance, direction and connectivity. Distance being the distance decay effect as expressed in gravity models. Direction is an expression for spatial inequality leading to

complementary areas which are related to each other and for this reason they are also directed.

Connectivity is fundamental to transport geography but also very difficult to define and operationalise. It concerns the differences imposed by the quality of transport infrastructure.

3.1 *Distance*

Uptil a certain level the distance feature is very simple to show and quantify. The two or three dimensional world is wrapped into one axis of distance, and distributions of intensity can be drawn. Graph 1 represents a curve like that for cumulative percentages of the sample.

The resemblance of the curves for both cities is striking. It would not be a surprise if similar curves could be produced for many medium sized European towns. The enormous distance decay is worth notifying. 50% of the workforce lives within 5 km of their workplace and 80% within 15 km. Also in not cumulating the percentages there is a striking similarity (See graph 2).

Two peaks are shown on 2-3 km and 14-15 km. Are we looking at the Christallerian or Löschian landscape? Or has physical planning based on Buchanan's ideas of green belts had this effect? The smaller peaks beyond 20 km should be interpreted with caution, because some municipalities in the fringe of the city regions have a great size, while population is assumed to be concentrated in the points of gravity.

The curves still leave us with the question, is the decay a result of the physical supply side of cities bounded together by agglomerative forces or are people really trying to optimise their location of work and residence? Some further information on that question is given by the tables in appendix 1. There are some big differences in the mean distance according to a number of features, although the arithmetica mean distance for the samples in both cities is almost equal, 7,68 km versus 7,62 km in Groningen and Zwolle. Individual circumstances like sex or the subsidy given by companies in travel costs have their influence on the mean distances of such subgroups. It should be noticed that a lot of variables are correlated to the location of the workplaces in the less accessible city centre. For instance retailing and services are located in the city centre, they have a larger number of female employees and no parking space in the neighbourhood. All these aspects result in shorter travel distances.

3.2. *Direction*

In map 3 the points of gravity of the workforce of the four distinguished districts are shown. The differences are minor, all within 1 km of the city

centre. For the city centre the point is just beside the overall value. For the station district the deviation is directed to the main commuter lines. For Groningen they are evidently located east, and rather unexpected it turns out that the northern lines of Zwolle are of greater importance. This can be caused by the main centres of activity along the south and southeastern lines: Deventer, Apeldoorn and the Twente-region. The points of gravity of the industrial terrains outside the city centre surely show a directional bias.

There is a lot evidence about the direction element into the data although not quantitative illustrated here. For instance when the share is taken of workers in the sample compared to the number of inhabitants of the region, there are striking differences. Within the city, subdivisions built since the sixties, have a high score. Beyond the city limits differences can as well be explained by the unequal spread of activities in the region, as by the existence of a railway station, being a part of the connectivity concept. The wealthy centers with high shares of commuters show scores comparable to regions with little economic activity and high unemployment.

3.3 *Connectivity.*

The importance of regions with a railway station was already mentioned. Companies located in the railway district — especially in Groningen — have their workers on a greater mean distance. Together with the points of gravity shown in map 3 these facts illustrate the impact of the railway connections. But the railway has lost most of its importance during the last twenty years. Car traffic resulted in a spread effect, given the more even distribution of motor-roads. Parking facilities of companies and easy access to highways tends to result in longer work trips. Suburbanisation was made possible by a higher motorisation. This is clearly demonstrated in graph 3.

For every year employees started to work at the companies a mean distance is computed. The mean figure has increased from 5 km before 1960 to about 8 km afterwards, but it has tended to stabilize since. The impact of connectivity is also shown in graph 4 with the distribution according to travel time. Quite unrealistically it is assumed that everyone is travelling by car. On short distances the bicycle is favoured by more than 50% of the people (Onnen, 1983). However on short distances the travel times by car and bicycle within the city are not really dissimilar. In comparison to graph 2 it can be noticed that the pattern for both cities are again very alike and the curves are less peaked. Graph 4 will be better suited to fit a logarithmic function of the distance decay. But still there are peaks at about 6 minutes travel time and 15 minutes. The mean value for travel time is 13.5 minutes in Groningen and 9.9 minutes in Zwolle.

4. *CONCLUDING REMARKS.*

Evidently the method delivers a relatively cheap way to gather detailed spatial information. This certainly will be true in an era of increasing computerisation of many administrative files. There is no need to restrict the method to work trip analysis. Also data on customers of retailers and wholesalers are available, or patients of hospitals, subscribers of papers and magazines and so on. All these can be localised by their postcode. A sample of 10% will not always be sufficient in a regional break down. This is illustrated in appendix 2 in which a comparison is given of our figures and those of the authorities in Overijssel for commuting to Zwolle. It shows the weakness of social statistics in the Netherlands in their regional break down. Nevertheless those data are the quantitative basis to make policy.

This paper only monitored residential locations in relation to workplaces. It gave a method to analyze the real world. It did not give answers on questions how people choose their place of work and of residence, nor how they decide on their trip. On the basis of this analysis we can only hypothesize. The data give a lot of possibilities to deal with them with quantitative techniques based on assumptions of rational behaviour. But at the end there will be a need for a real explanation of the processes based on behavioral analysis. Both types of research will be needed to detect fundamental shifts in urban dynamics soon enough to react in a proper way by planning.

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Arithmetic mean distances
(between brackets the number of cases)

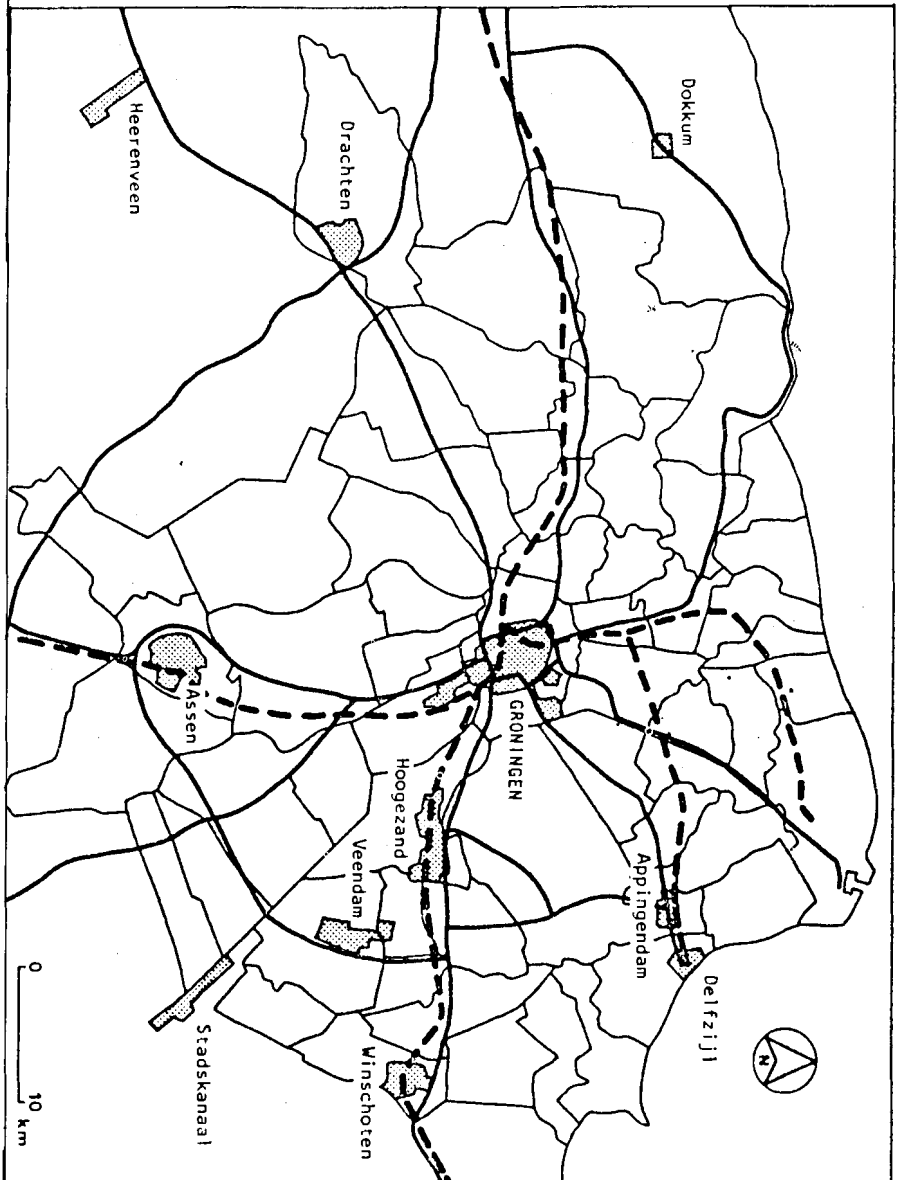
	Groningen	Zwolle
1. city in total	7,7 (5985)	7,6 (4345)
2. males	7,6 (1797)	4,8 (468)
females	5,4 (509)	4,2 (139)
3. companies contribution in travel costs	7,9 (4440)	8,3 (2856)
no contribution in travel costs	6,9 (1545)	7,3 (834)
4. city centre	6,6 (2368)	5,6 (1020)
station district	8,6 (1573)	7,3 (1411)
Eemskanaal resp. Vrolijkheid	8,4 (784)	10,3 (790)
Hoendiep resp. Voorst	8,2 (1260)	7,6 (1124)
5. industry	8,8 (1638)	10,3 (1227)
retailing	6,1 (875)	8,0 (166)
wholesale	9,5 (358)	9,0 (137)
services	7,3 (3100)	6,4 (2701)
6. walking distance to parking less than		
2 minutes	8,0 (2546)	7,7 (1941)
2-4 minutes	8,5 (1838)	8,8 (1318)
no parking in neighbourhood	6,1 (1597)	6,0 (1086)
7. years in service of the workforce		
less than 5 years	7,8 (1418)	9,1 (935)
5-10 years	8,4 (906)	8,2 (654)
10-15 years	7,7 (629)	8,2 (555)
more than 15 years	7,1 (1251)	6,6 (740)

Estimates of commuting to Zwolle from the ETIO and similar scaled estimates from the postcode research

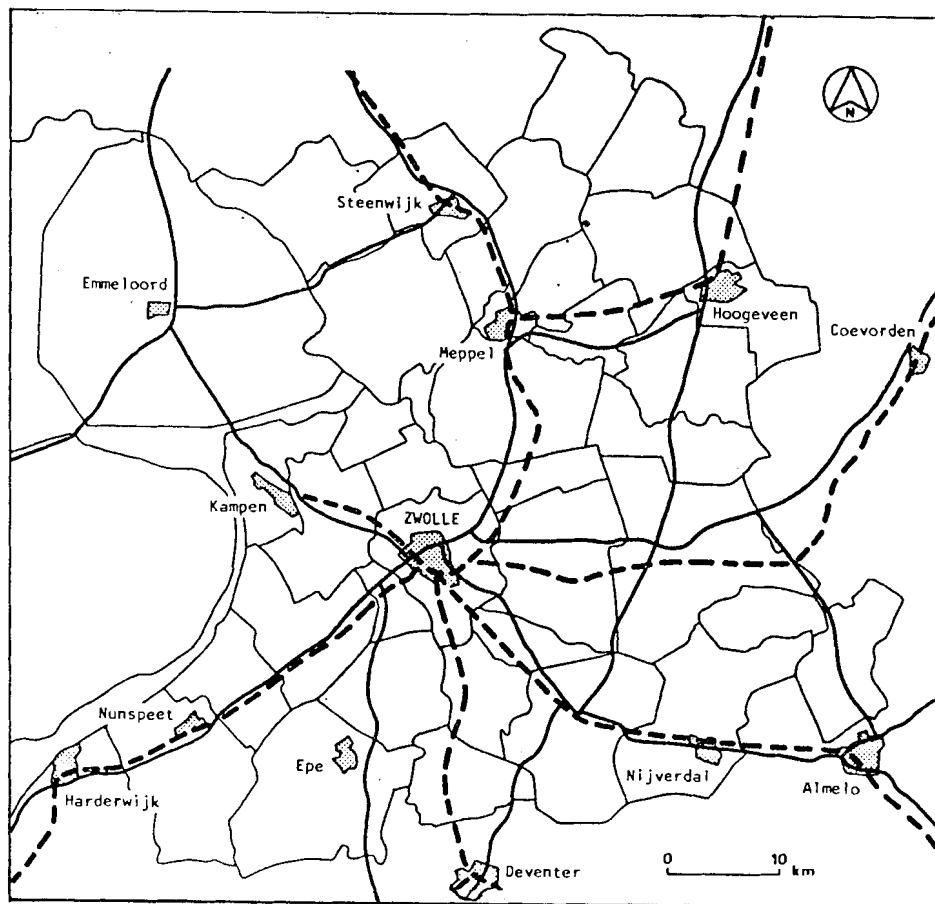
1	2	3	4	5
municipality	commuting according to ETIO	our estimate (1)	2 minus 3	4 as a percentage of 2
1. N.O. Polder	246	451	—205	—83%
2. Urk	10	0	10	—
3. Steenwijk	169	282	—113	—67%
4. IJsselham	19	42	— 23	—123%
5. Brederwiede	163	106	57	35%
6. Genemuiden				
Zwartsluis	342	205	137	40%
7. Kampen	856	854	2	0%
8. IJsselmuiden	494	544	— 50	—10%
9. Dalfsen	1239	1540	—301	—24%
10. Hasselt	575	685	—110	—19%
11. Heino	614	678	— 64	—10%
12. Nieuwleusen	637	501	136	21%
13. Staphorst	276	212	64	23%
14. Wijhe	340	402	— 62	—18%
15. Avereest	333	191	142	42%
16. Ommen	427	254	173	41%
17. Olst	68	64	4	6%
18. Raalte	402	494	— 92	—23%
19. Den Ham	31	28	3	10%
20. Vriezenveen	20	14	6	29%
21. Hellendoorn	174	184	— 10	— 5%
22. Hoogeveen	88	64	24	28%
23. Meppel	309	416	—107	—35%
24. Epe	182	190	— 8	— 5%
25. Hattem	1055	762	293	28%
26. Heerde	588	494	94	16%
	9657	9657	0	0% (2)

(1) The total of column 3 is made equal to 2. but the distribution is in accordance with our sample.

(2) Overall the deviation is plus or minus 11.45 or a mean value of 11.9%. 20 out of the 26 cases are beyond the 90% confidence limits as given in the report to the ETIO.

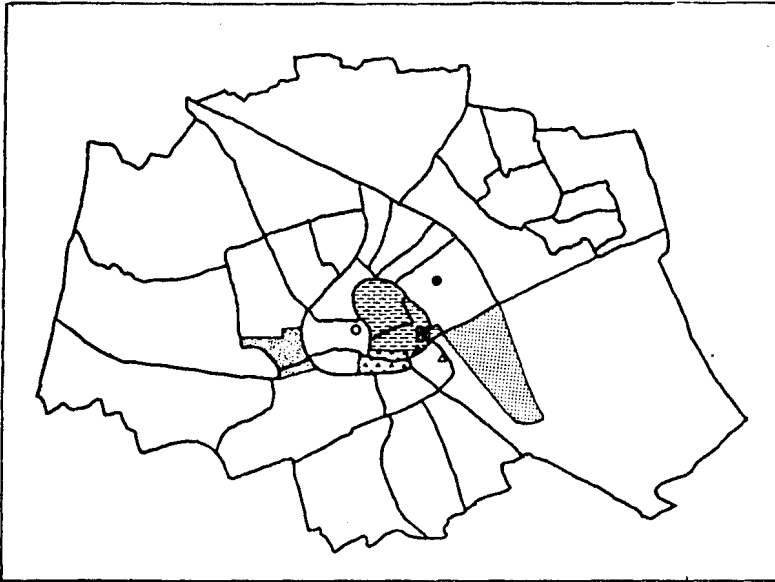


Map 1. The city region of Groningen municipalities under investigation

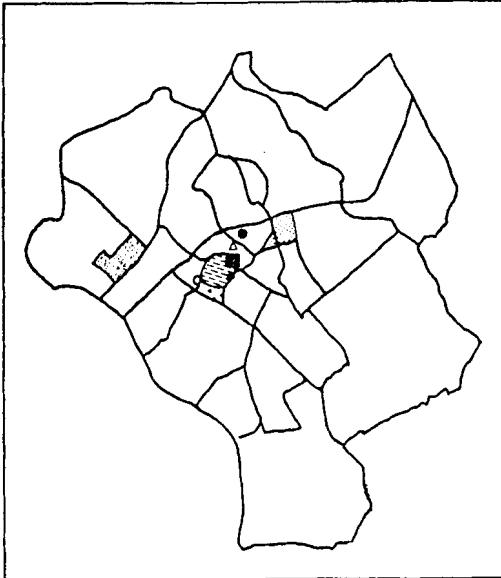


Map 2. The city region of Zwolle municipalities under investigation

GRONINGEN



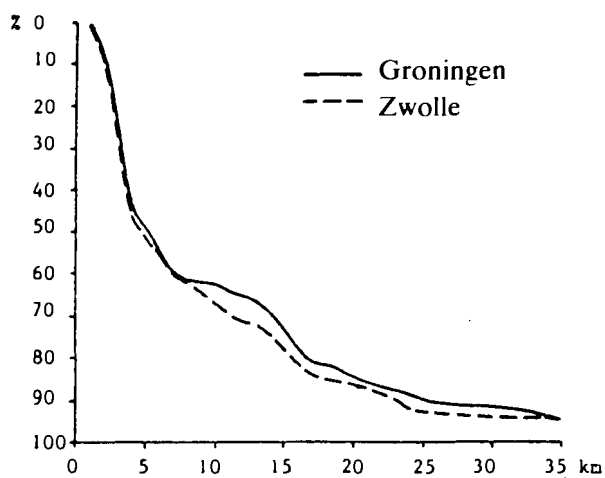
ZWOLLE



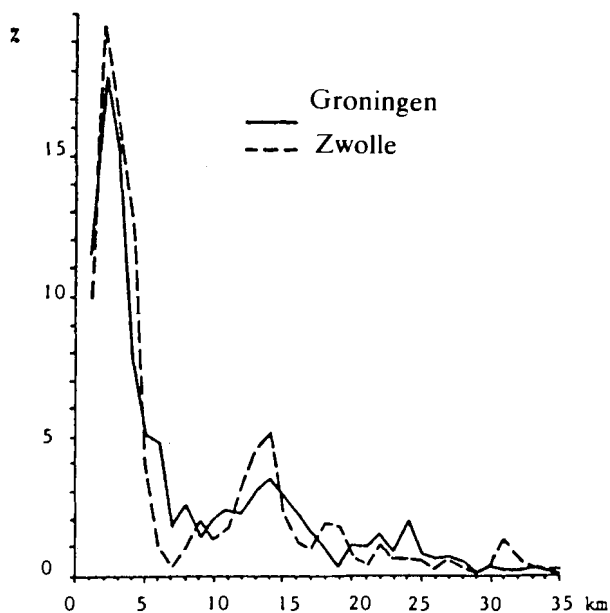
- overall figure city
- ▲  city centre
- △  station district
-  Eemskanaal/Vrolijkheid
-  Hoendiep/Voorst

Map 3. Work districts and points of gravity in Groningen and Zwolle

Graph 1. Cumulative percentages related to distance

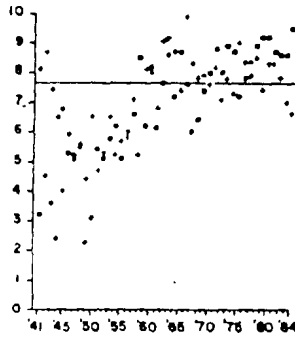


Graph 2. Percentages of employees related to distance



Graph 3. Mean distance for employees entering the firm at a certain year

Mean distances for employees entering
the firm at a certain year



- Groningen
- Zwolle

Graph 4. Percentages of employees related to travel time

