

Manuskript für Publikation in:

Breuste, J., H. Feldmann, O. Uhlmann (Hrsg.): Urban Ecology
Berlin/Heidelberg: Springer 1998, S. 541 – 546 ISBN: 978-3-642-88585-3

The impact of land use patterns on mobility structures

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1. Introduction

In the context of the discussion about sustainable cities in the last few years, the idea of a concentrated decentralisation – which means putting more emphasis on developing central places of medium order – has been fairly often debated as a possible solution for regions within the catchment area of greater conurbations (*BfLR* 1996; *Empirica* 1996). It is expected that the realisation of this settlement structure concept will reduce the need for motorised traffic and therefore minimise the use of energy. Until now there is little empirical evidence of the role settlement structures are playing within the context of transport efficiency. Most of the time it is argued that on the level of common sense, a neighbourhood of different functions automatically induces functional interactions between these areas. In this paper I would like to discuss the question: what share of transport can be attributed to settlement structures? Southern Bavaria has been chosen as a case study, a region characterised by its interactions with the city of Munich.

2. Transport patterns and volumes in daily traffic

Within this region, according to categories established by the *Bundesforschungsanstalt für Landeskunde und Raumordnung* six types of communities (apart from centres of higher order) have been identified in order to cover the main types of settlement structures in the region:

Within the metropolitan area

- centres which are officially denominated for intense settlement activities
- communities with or without a low degree of centrality
- central places of medium order

Outside the metropolitan area

- central places of medium order
- communities without a low degree of centrality with a railway station
- communities with or without a low degree of centrality without a railway station

The aim of the survey was to obtain an estimation of the total traffic volume for each type of community, based on the whole spectrum of activities, their frequencies and the choice of the transport mode (For more details on the methodology of the research and the empirical findings cf. Kagermeier 1997).

As far as commuter traffic is concerned, a high degree of orientation towards Munich has been found. This orientation towards the city of Munich decreases only very gradually with longer distances from the city. Regarding the traffic volume, the various proportions of the orientations within the same community are of particular importance. In all communities with a low degree of centrality, and in centres which

are officially denominated for intensive settlement activities, the orientations within the same community represent less than one fifth of all orientations. Central places of medium order located near Munich have a binding quota of 40% whereas in the communities with a medium degree of centrality outside the metropolitan area barely 50% were found.

The amount of traffic caused by commuters is estimated by using the distance (as the crow flies) between source and target community. In total, the highest traffic volume is observed in communities with a low degree of centrality outside the metropolitan area. It is up to three times higher than the lowest value measured. In the communities within the metropolitan area the kilometre values are (in total) at a lower level, corresponding with their shorter distance from Munich. Thereby the differences between the communities with a low degree of centrality and the centres which are officially denominated for intensive settlement activities are relatively low because of the conformity concerning the remarkable outside orientation. This means, that in these cases the distance to the city determines the traffic volume.

As a second example for daily orientations the supply of convenience goods and services shall be outlined briefly. In most of the communities with a lower degree of centrality convenience goods are already bought outside the community to a great extent. The situation for the purchase of shopping goods is quite similar. In communities with a low degree of centrality, including the settlement centres, high degrees of orientations to other communities are dominant.

Tab. 1: Index of the monthly motorised daily traffic volumes per household member

community types	index of traffic output (south bavarian average = 100)				
	pro- fession	edu- cation	con- venience goods	shopping goods	services
inside the metropolitan area					
settlement centres	70	60	89	80	84
communities of low centrality	89	98	132	91	127
communities of medium centrality	66	90	72	73	64
outside the metropolitan area					
communities of medium centrality	95	114	48	107	73
communities of low centrality with railway	132	117	149	114	118
communities of low centrality without railway	111	108	110	105	118
relation between maximum and minimum	2,00	1,95	3,10	1,56	1,98

source: own survey

In table 1 the index values of the monthly amount of transport per household member are shown for various kinds of daily traffic. In order to eliminate the effects which are caused by different socio-demographic structures of the sample communities, the responses of each probationer are weighted in such a way that each community has the same proportions of socio-demographic groups. It is evident that the

communities with a low degree of centrality outside the metropolitan area have the highest amounts of transport. As far as the daily traffic in Southern Bavaria is concerned, it should be mentioned that specific relationships exist between the different types of settlements and the amount of traffic generated by them. On average, communities with a low degree of centrality, located far away from the city-centre, i.e. communities which recorded the highest population growth during the last few years, generated twice as much traffic as other communities. One reason for the steadily growing amount of private motorised traffic is that these communities recorded the highest population growth rates (c.f. Kagermeier 1997, p. 77fp.)

A considerable proportion of the amount of transport essentially depends on the interference between the factors "distance to the city-centre" and "part of the orientations outside the home community" (cf. fig. 1). Low traffic volumes in daily traffic are to be found in places located close to Munich or in communities with a well developed infrastructure. Therefore most needs can be satisfied at the place of residence. High traffic volumes for each journey made to the city-centre are compensated by a low intensity of interactions in these communities.

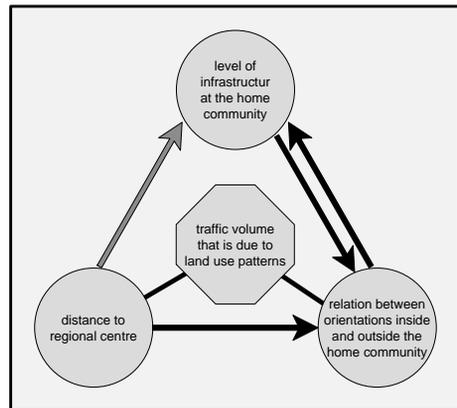
3. Leisure traffic volumes

The total traffic volume is determined considerably by leisure traffic as almost half of the traffic is due to leisure activities. In communities with a low degree of centrality sub-average transport volumes are produced. Thus high traffic volumes in the daily traffic contrast with lower ones in leisure traffic. This means that the interrelations are different from those in the daily traffic. The higher traffic volumes found in settlement centres and central places of medium order are not caused by longer distances per journey but by higher journey frequencies for visits and trips.

The availability of private outdoor recreation space is the real grade value which can measure the different frequencies between the various types of communities. Due to the higher portion of households with direct access to green space around the house, in communities with a low degree of centrality the traffic volumes of leisure traffic are adequately lower (similar results by Fuhrer/Kaiser 1994, p. 128 or Holz-Rau-Kutter 1996, p. 41).

However, lower leisure transport output in communities with a low degree of centrality is generally not able to compensate for the high daily traffic volumes. Regar-

Fig. 1: Scheme of the relationship between the impact of land use patterns on traffic volume and specific factors of influence



ding the extrapolation of the total energy consumption, shown in figure 2, communities with a low degree of centrality outside the metropolitan area still show the highest values. The lowest values have been found for communities with a medium degree of centrality and for settlement centres. Through compensatory effects of leisure traffic, the insufficient implementation of regional planning objectives for the development of settlements is responsible for a considerable part of the increase in traffic volumes.

In conclusion it should be mentioned that with the realisation of a concentrated, decentralised settlement structure a measurable reduction of traffic volume can be achieved. It also has to be stressed that a concentrated settlement structure is a good precondition for other traffic policies, for the reason that

- requirements for an increasing proportion of public transport are granted because of the relatively concentrated flow of traffic,
- already existing orientations within the same community allow for an effective promotion of non-motorised traffic,
- increasing the part of orientations within the same community is comparatively unproblematic and possible without causing serious social friction due to rising mobility costs.

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Fig. 2: Extrapolated monthly energy consumption for all traffic purposes

