

Traffic system, space demand and urban structure.

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Summary:

Space demand is the one of the key problems of suburban development and traffic expansion. At first space demand is caused by tech-economic factors and by social changes. For example today we consume about 40 sqm. housing floor area per person than about 15 sqm. forty years ago. A similar expansion of specific space demands can also be seen for production, offices, retailing, leisure and other facilities. Secondly the expansion of space consumption for settlements and traffic facilities is caused, to a much greater extent, by car-based developments.

We compare the settlement space including streets and other traffic facilities of different parts of an European region. For Germany we can state: in the old high density built up and pedestrian-based area near the city centre about 90 sqm. per person are consumed, in new settlements in the suburban ring the figure is over six times as high (600 sqm. per person). One third of this 600 sqm. are streets.

The inter-relations between the traffic system and the urban structure can also be shown if we compare cities with different structures in Europa and in the USA.

Regulating space consumption and traffic levels can be seen as major components of strategies for a more sustainable urban development. The only solution which seems successful, should adopt a cohesive approach to both. Such strategies and regulatory instruments are subject of the second part of the presentation which is founded on Difu-investigations.

1. Traffic system and urban structure

Since several decades urban development is formed mainly by three trends:

- the expansion of settlement space,
- the separation of monofunctional areas and
- the growth of motor car traffic.

There is a strong connection between this trends. Particularly car traffic growth is cause of this development trends.

It is well known that motor car traffic is responsible for a great part of energy consumption and air pollution and that in the future it will be necessary as well as possible to reduce both to a great extent. Less well known however, is the fact that urban structures which provide for a high degree of access and mobility by car are inherently incompatible with structures served predominantly by other modes of transport. This is because car traffic requires much more space than other modes of transport, in fact ten times more space per person travelling (see figure 1). If we measure space demand by area time consumption including the parking spaces required at home and at destinations,

the difference between pedestrian (or rail user) and privat car user is much bigger: thirty times up to ninety times (see figure 2).

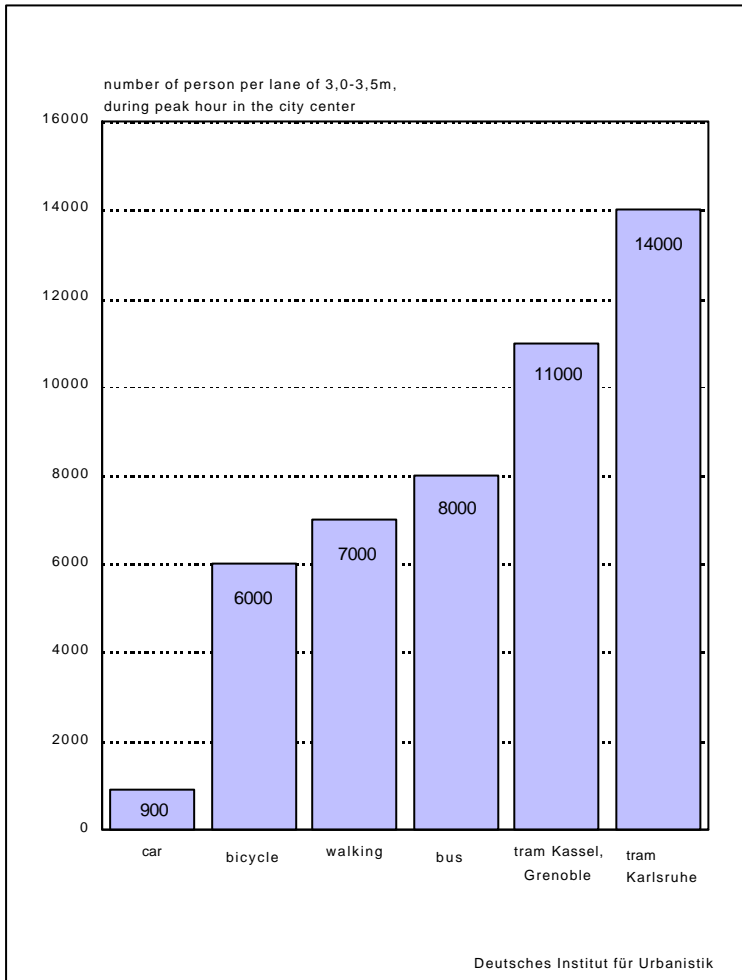


Figure 1: Road capacity by different modes of transport

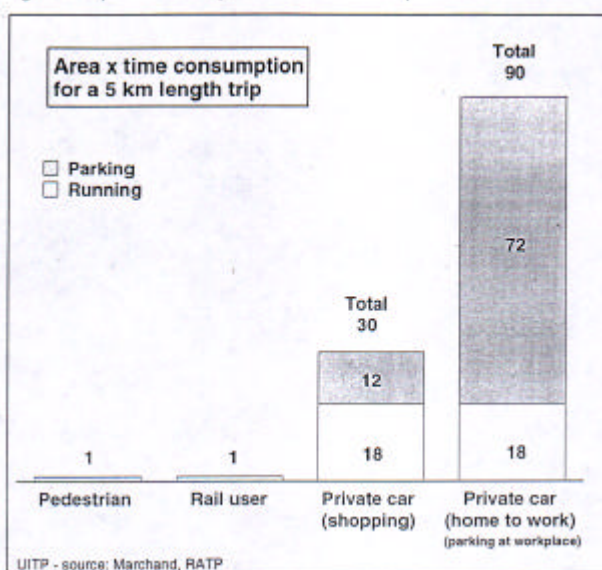


Figure 2: Space demand by different modes of transport

Space demand is one of the key problems of suburban development and traffic expansion. First space demand is caused by tech-economic factors and by social changes. For example today we consume about 40 sqm. housing floor area per person compared to 15 sqm. forty years ago. A similar expansion of specific space demands can also be seen in the fields of production, offices, retailing, leisure and other facilities. Secondly the expansion of space consumption for settlements and traffic facilities is caused, to a much greater extent, by car-based developments.

There are several reasons for it:

- car-orientation stimulates low density and dispersed development;
- car-orientation stimulates out-of-town shopping and similar developments with a high space consumption;
- car-based developments need much more space for traffic facilities than structures based on public transport, pedestrian and bicycle traffic (as we have already seen in figure 1 and 2).

The following figure is meant to compare the settlement space including streets and other traffic facilities of different parts of an European region. For Germany we can state: in the old high density built up and pedestrian-based area near the city centre about 90 sqm. per person are consumed, in new settlements of the suburban ring the figure is over six times as high (600 sqm. per person, see figure 3). One third of these 600 sqm. are streets. In the high density built up area only 20 sqm. per person are occupied by traffic. That is only one tenth of the traffic space in new settlements on peripheral sites.

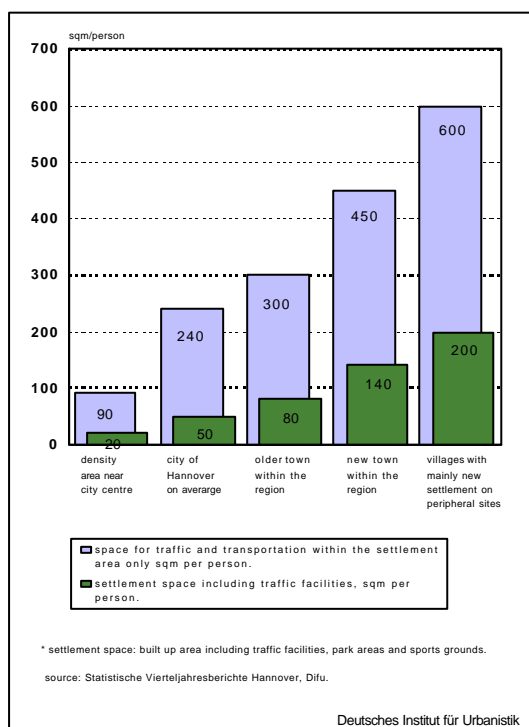


Figure 3: Settlement space person in different parts of the Hannover Region.

The inter-relations between traffic system, space demand, urban structure and traffic demand can also be illustrated by the following considerations, if we compare cities with different structures.

- The „City type Delft“ is characterised by high density, functional integration and is based on pedestrian, bicycle and public transport. Cycling is the dominant mode of travel. The number of bicycle trips made by the inhabitants of Delft is higher than the number of car trips. That is not only true for summer time, but for the average practice all year round.
- Secondly the „City type Oldenburg“ in the north of Germany is also a city with bicycle tradition. But during the last 50 years a much stronger car-based development took place in O. compared to Delft.
- Thirdly the City of Denver in the USA was chosen. The „City type Denver“ is characterised by low density and a full car-orientation.

The Figure 4 demonstrates the different space demands. The whole settlement space per person consumed for housing areas, social facilities, industrial areas and traffic facilities is nearly four times larger for the „City type Denver“ than for the „City type Delft“.

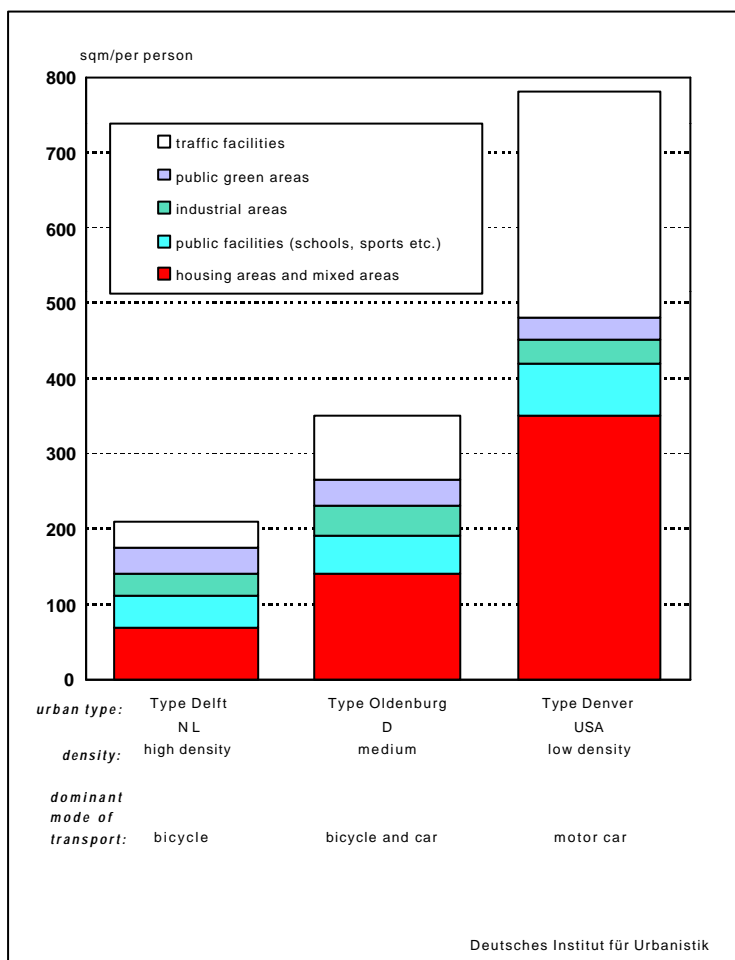


Figure 4: Settlement space by different type of city structures

Settlement space is not the only key problem of suburban development, this is also true for that type of space which is sealed off by buildings, streets, parking spaces etc. This sealed off space per person is in the city of Denver more than twice as much than in Delft (see table 1). Apart from that table 1 shows that nearly 50 per cent of all trips made by the people of Delft are non-motorized trips. Nearly two third of all trips are made by sustainable transport, in the city of Denver this are

Bern, too, the settlement space per person amounts only to one fourth of that in the city of Denver (see table 2).

urban type		type Delft NL high	type Oldenburg D medium	type Denver USA low
density			tram and car	motor car
dominant mode of transport		tram and walking		
housing, industrial, commercial areas	sqm. per person	120	150	450
streets and traffic facilities	sqm. per person	50	55	300
public green and sports	sqm. per person	20	20	30
settlement space together	sqm. per person	190	230	780
settlement space sealed off	sqm. per person	110	130	310
number of motor cars per 100 inhabitants		38 (1994)	49 (1994)	67 (1980)
number of daily trips per person		3,0-3,5	3,0-3,5	3,0-3,5
bicycle + walking	%	35	35	10
public transport	%	35	15	5
motor car	%	30	50	85
		450	175	50
number of cars per day per person		9	12	30

Table 2: Comparison of different types of city structures, part 2 (Apel, Difu 1999)

By this comparisons it becomes evident that in cities with high density, with compact forms and low rates of car ownership travel distances are relatively short and can mostly be made on foot, by bicycle or public transportation. In this case car traffic is only needed to a small extent. If the city stands up for the principles of car traffic domination, traffic and ecological problems will arise: traffic and ecological problems were produced which are not existing by a compact and car free city.

The finding is that car-based development concepts do not provide for a solution to traffic and environmental problems because they produce this problems.

2. Objectives, Strategies and Regulatory Instruments

Regulating space consumption and traffic levels can be seen as major components of strategies for a more sustainable urban development. Space consumption and growth of traffic are - as already shown - interdependent, therefore the only solution which seems successful, should adopt a common approach to both. Solutions in this field must also lend themselves to an integration within broader reform projects for an ecological restructuring of the economy.

So you ask first: Which kind of urban structures concerning urban development is qualified to reduce the need for new settlement space and the need to travel?

Important qualifying elements are:

- generally an urban structure with high density, mixed functions and a good environment. These elements are often to be found in old towns and city quarters with historical character. For this purpose it is necessary to reduce car traffic and the number of parked cars;
- a good balance between the number of dwellings and of jobs in towns and in quarters of larger cities;
- the concentration of new developments in locations accessible by a wide range of transport modes, not only the car;
- the concentration of traffic generating activities (major centres of employment, leisure facilities etc.) at locations with a high accessibility by public transport and the bicycle;
- higher densities in locations well served by public transport;
- the discouragement of low density and car-based developments on peripheral sites, especially out-of-town shopping centres and small, free-standing new dwellings in the countryside;
- better environmental conditions of streets and places (more space for walking, sitting, children and for trees);
- encouraging alternative means of travel which have less environmental impact and reducing reliance on the privat car.

There is a current discussion in Germany and other European countries on the question: „Can we influence the trends of development and how can we do it?“ There are two opinions on this question: The first opinion is, the current development of urban sprawl and growing motor car traffic is mostly a result of global trends and there is no chance to control it. The second opinion is, there are many regulations mostly at state level (for example in fiscal policy, housing policy, traffic policy, economic policy) with influence upon the urban and traffic development. Such „regulatory framework“ is mostly the result of political decisions and for this reason it could be changed. Indeed:

If we look at the various differences of urban development in European countries we see that cultural and political differences are important.

For example in the Netherlands there is a longer tradition of and larger importance given to land use planning on national and regional level than in Germany. In the Netherlands there is also a stronger control of land prices and land use. In the figure 5 we see the strong dispersal of settlement structure in the German region of Rhein/Main and the more compact structures of settlements in the Amsterdam region with its better protection of landscape.

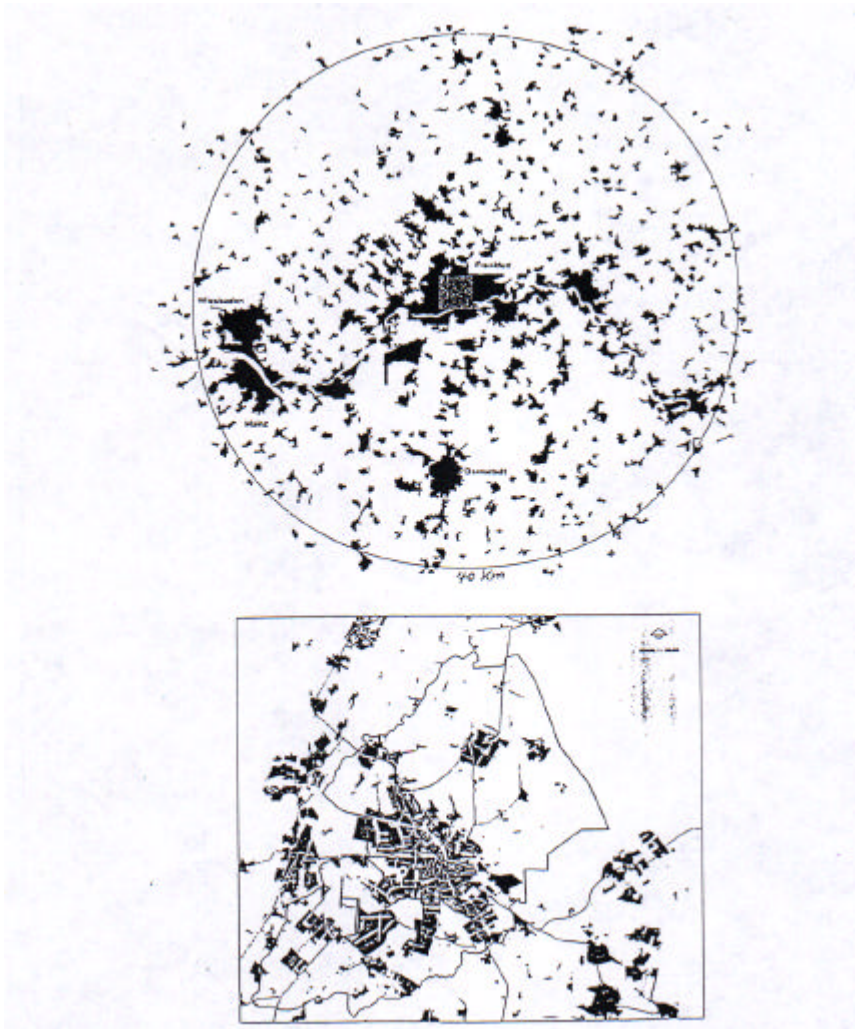


Figure 5: Dispersal of settlements - Region of Rhein-Main and Region of Amsterdam. (Source: Stefan Siedentop, Kumulative Landschaftsbelastungen durch Verstädterung, in: Natur und Landschaft, H. 4 (1999), S. 147. Regionaal Orgaan Amsterdam, Regionaal Structuurplan 1995-2005, Amsterdam 1995, S. 48.)

Another positive example of a compact city strategy in a polycentric urban region are the city and the Kanton of Bern in Switzerland. Basis of the urban and regional structure is a tram and a railway network. Urban development is mostly concentrated near the stations (figure 6 and figure 7). Figure 8 shows the long-term development of towns and villages with and without a railway station. The result of this successfully integrated transport and land use planning is a modal split with a high share

of public transport, walking and bicycle traffic that amounts to 70% of all trips. Motor car traffic reaches only 30% of all daily trips.

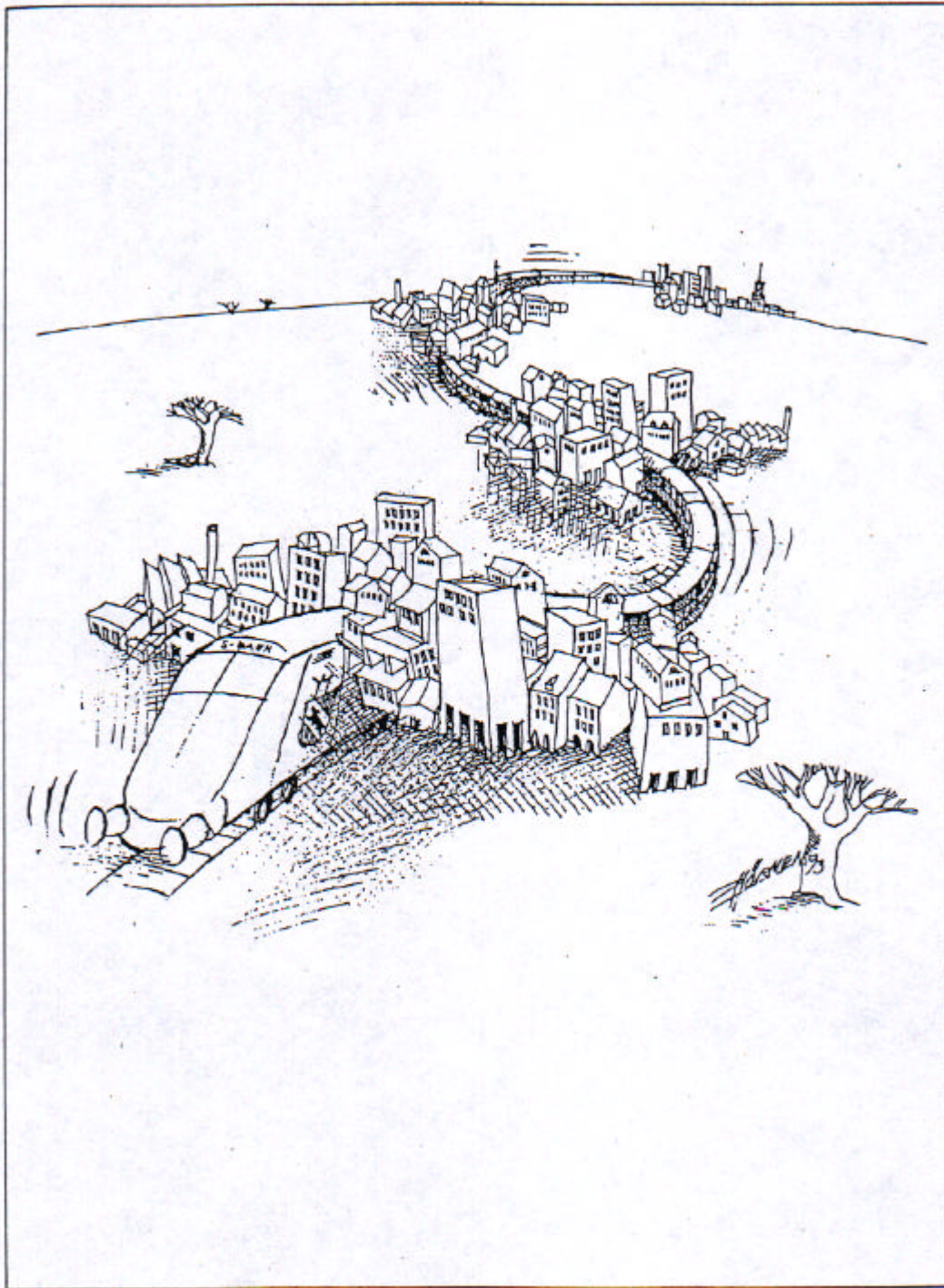


Figure 6: Concentration of urban development to the stations of the regional railway in the Kanton of Bern (Source: Amt für Gemeinden und Raumordnung des Kantons Bern. Arbeiten, Wohnen und S-Bahn, Bern 1994, S. 3.)

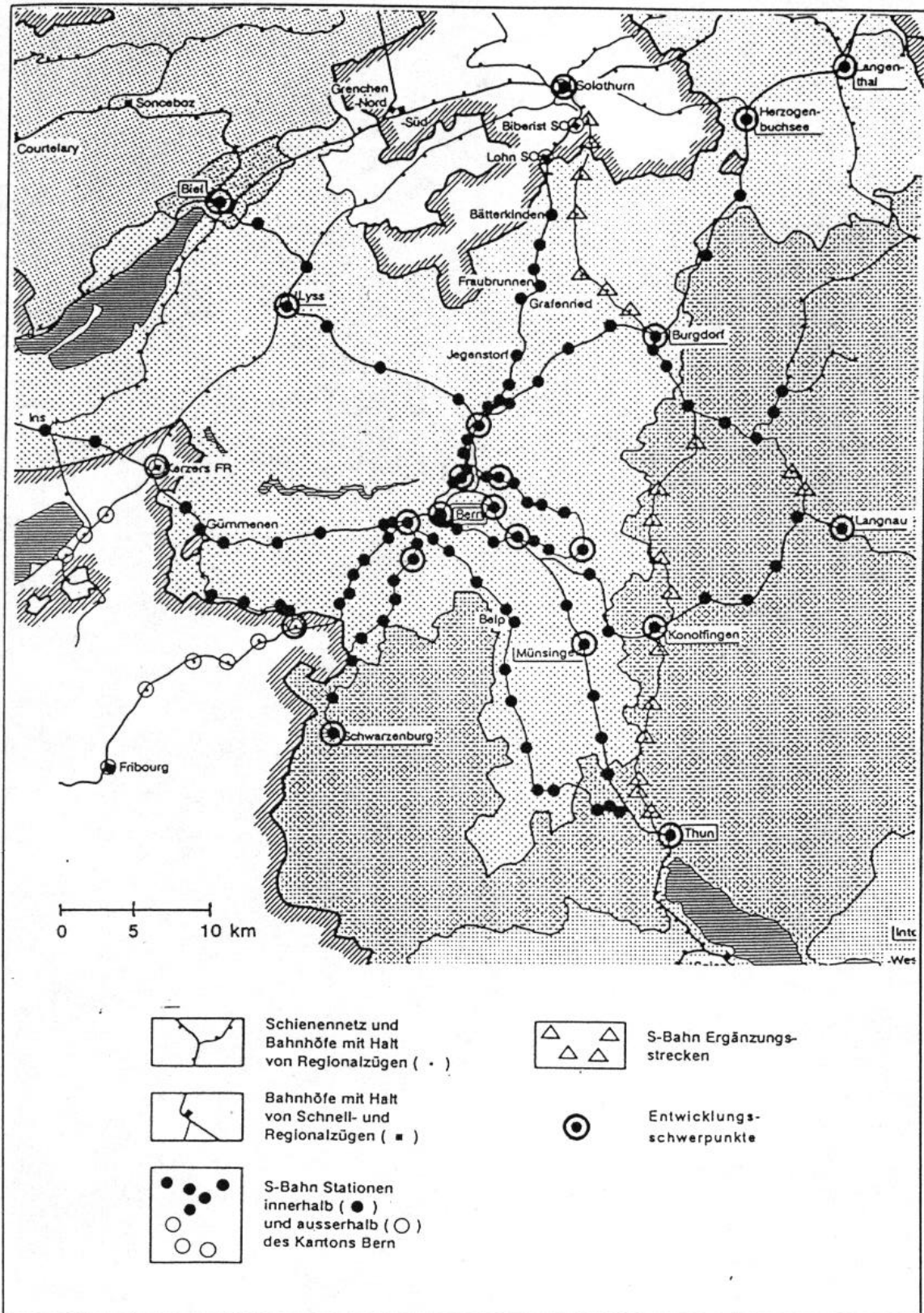


Figure 7: Planned concentration of urban development to main stations of regional railway in the Kanton of Bern (Source: Berner S-Bahn/Siedlung, Bericht des Regierungsrates an den Grossen Rat, Bern 1992, S. 9.)

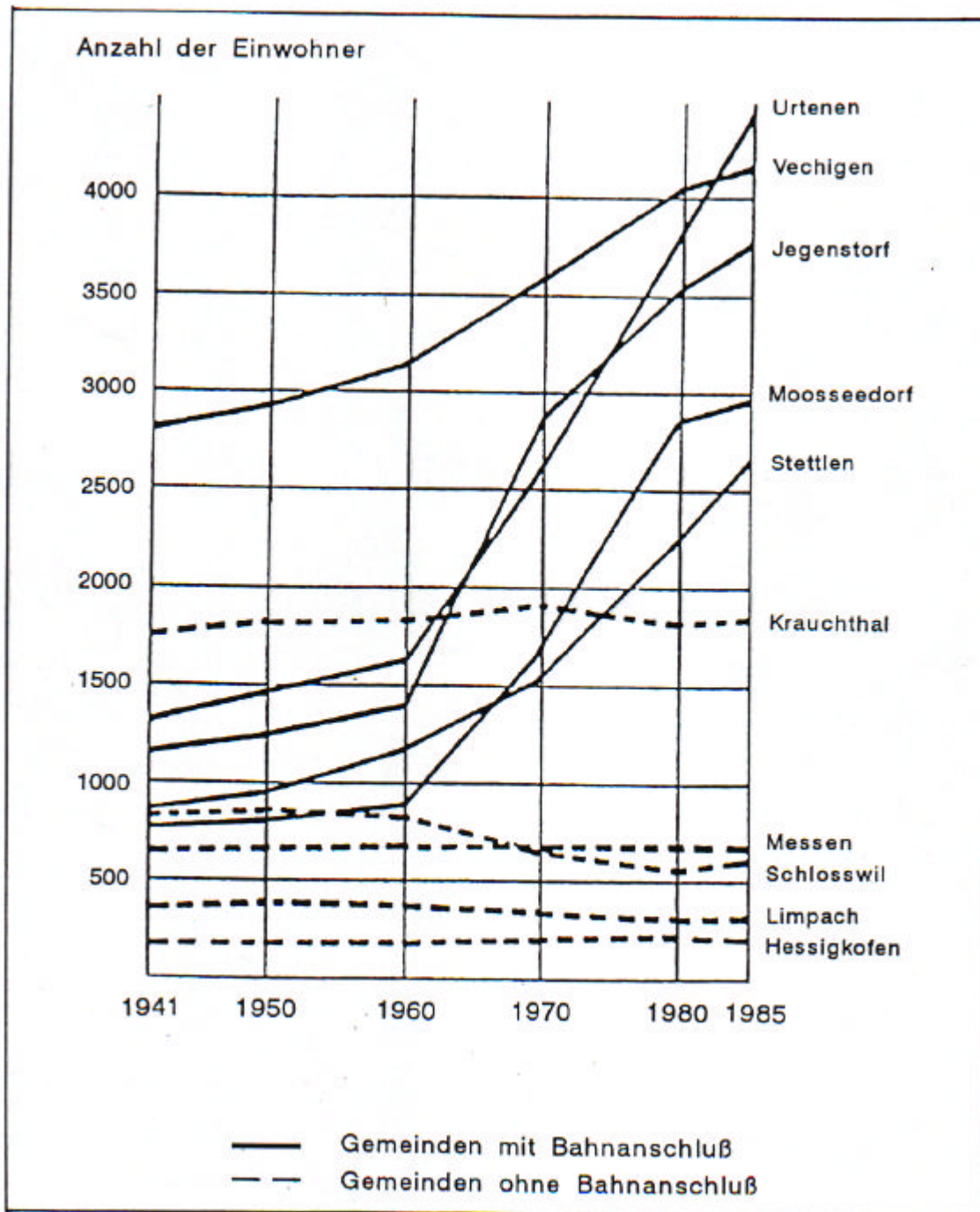


Figure 8: Development of communities with and without railway station in the Kanton of Bern (Source: M. Keller, *Siedlung/Verkehr/Umwelt*, Bern 1991, S. 13.)

Another example is the development of the city and the region of Copenhagen. Urban Development is mostly concentrated near the stations of the regional railway network like the situation in the Kanton Bern. But more than that: In Copenhagen city and Copenhagen region bicycle traffic has got still better conditions and reaches now a high share of all daily trips (see table 3). So motor car traffic in the city of Copenhagen has not increased during the last 25 years.

The reasons for this successful development are mostly to find in the regulatory framework:

- high taxes for owners of a motor car,
- encouraging public transport and bicycle traffic,
- an advanced planning system with strong regional planning,
- a progressive political and administrative system with a strong position of the regional institution, the „Amtskommune“.

City number of inhabitants		Walking	bicycle	public transport	auto
Groningen, NL 170 000	%	16	43	6	36
Delft, NL 92 000	%	16	37	13	34
Münster, D 265 000	%	22	32	10	37
Kopenhagen, DK 573 000	%	15-20	25-30	25	30
Amsterdam, NL 724 000	%	25	25	20	30
Bern, CH 140 000/300 000	%	22	13	35	30
Basel, CH 170 000	%	25	15	30	30
Zürich, CH 360 000	%	25	10	35	30
Stockholm, S 670 000	%	20	10	35	35
German cities between 400 000 and 900 000	%	25	10	20-25	40-45
German cities between 100 000 and 200 000	%	25	10-15	10-15	50

Table 3: Mode of travel by city residents - cities with high proportion of bicycle traffic or public transport (Apel, Difu 1999)

In my short report not even all important strategies and instruments can be mentioned. So we focus now on key regulations on a general level (state and regional level) which mark the „framework“ for local policy:

- The present land tax or property tax in most European countries solve neither the questions of increases in value nor the ecological problems posed by expanding settlement space. A property tax which is based on land value and on land space only (without the building) contributes towards an economic incentive for a lower rate of land take-up, for development inside the city instead of out-of-town sites.
- Secondly, it is important to internalise the external costs of traffic and transport: A long-term, continuous increase in energy prices is needed in all countries. For transport a higher petrol tax seems to be the most appropriate and simplest measure.
- Thirdly, I suppose it is essential to achieve more integrated urban development and transport policy at a regional level. Our proposal is to constitute urban regions within a distinct local authority framework. This means to create urban regions which would draw their authority and power from a directly elected assembly and assume responsibility for all matters which can only be solved at the regional level. They would also take over certain functions from the state government. The aim is not to create another tier of local government, as the regions should replace the districts or evolve from them. In my opinion, the Danish regions, the „Amtskommune“ in Denmark, are a good example for this proposal.

3. Concluding remarks

These were three important elements of a „framework“ which would provide better chances for a sustainable urban development. There are however, two more points which could enhance the chances for a compact city strategy with less motor car traffic:

1. In European cities there are many brownfield areas to- day. So urban development can mostly go on within the urban area instead of outside.
2. The current future changes in social structure, family structure and in jobs will lead to an urban life style for which in my opinion there are much better conditions in a compact city than in urban sprawl.

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