Bicycle traffic and settlement pattern

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1 Bicycle traffic and settlement pattern – a short introduction

Human settlement and travel patterns are closely interrelated. Several studies investigate the impact of settlement structure on public transport and private motorised transport. They show that compact settlement patterns as mostly given in centre areas of European cities are much more in favour of public transport than suburban settlement patterns. Because of the higher potential of people who want to travel in the same direction in the same time, public transport can operate more frequently and offers an attractive alternative to private motorised transport. Also, the short distances make it possible for the inhabitants of these areas to reach a lot of destination options (work place, shops, etc.) by foot.

The characteristics of centre areas of the European City are in general
- a high density of land use
- a high diversity of land use (mixed zoning) and
- attractive public spaces.

But what impact do settlement structures and patterns have on bike traffic? What are the special advantages of the bicycle? Which conclusions can we draw from these aspects for town planning and transportation planning to induce bike traffic?

A group of planners and bicycle experts from the joint Fachausschuss Radverkehr of ADFC (Allgemeiner Deutscher Fahrrad Club – a german cyclist organisation) and SRL (Vereinigung für Stadt-, Regional- und Landesplanung – a german interdisciplinary planner organisation) is interested in this subject, and this contribution reflects the discussion over the last year. As the Fachausschuss Radverkehr is working on a voluntary basis, the empirical investigation cannot go very deep and can only touch on certain aspects of the subject.

First, we will analyse the bike as a mode of transport. After that, we will present some theoretical aspects of the relation between settlement patterns and bike traffic – and take a look at some data. Finally, some recommendations for town planning and traffic planning are made. Considering the advantages of bicycle traffic related to settlement development, it is clear that it must be promoted much more than it has been up to now – so that cycling can do its job to better the quality of life in cities and elsewhere.

2 The bicycle as a mode of transport

The bicycle is a mode of transport for short distances which quadruples the action radius of pedestrians. In Germany, 80 % of all trips made using a bike are between 500 metres and 6 kilometres (see Figure 1). The bike needs only a somewhat larger travel corridor than a pedestrian. Further, it needs parking at the points of origin and destination. Its space requirement is much less than that of a car, also when parked. And although the bicycle is not adequate for all persons and all purposes, its specific advantages make it an important part of an integrated and sustainable transport system that cannot be replaced by any other mode of transport. We will talk more about this in Chapter 3.

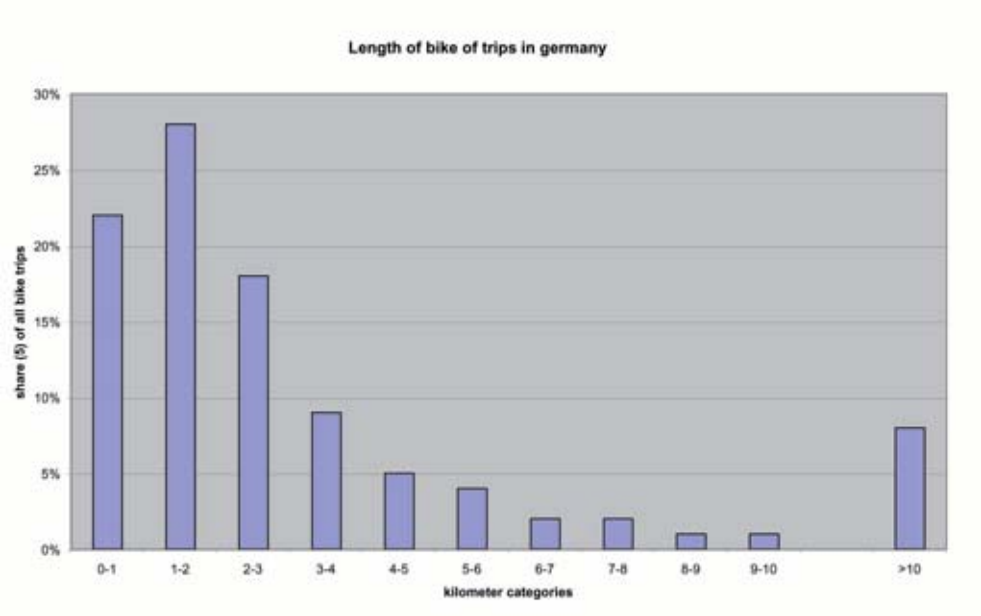

Figure 1: Length of bike trips in Germany (adapted from MiD 2002)

3 Settlement patterns and their impacts on bike traffic – theoretical approach

Compact settlement patterns (as urban areas) provide good conditions for pedestrians and public transport. They also provide a high accessibility and a multitude of destination options with the bike: one can reach many potential destinations (work place, shops, etc.; see Figure 2) within the bike-specific radius of 3 to 5 kilometres. Busy streets ensure social control. Compact settlement patterns in combination with mixed zoning open up the chance to choose from the options of walking, cycling and public transport (or combinations thereof). Compact settlement patterns create many "free-choice cyclists". Bicycle traffic as a part of an integrated and sustainable transport system can relieve the crowded public transport, which is often working at its limit at rush hour. And generally speaking, it is more economic to promote bike traffic than to extend the public transport system.

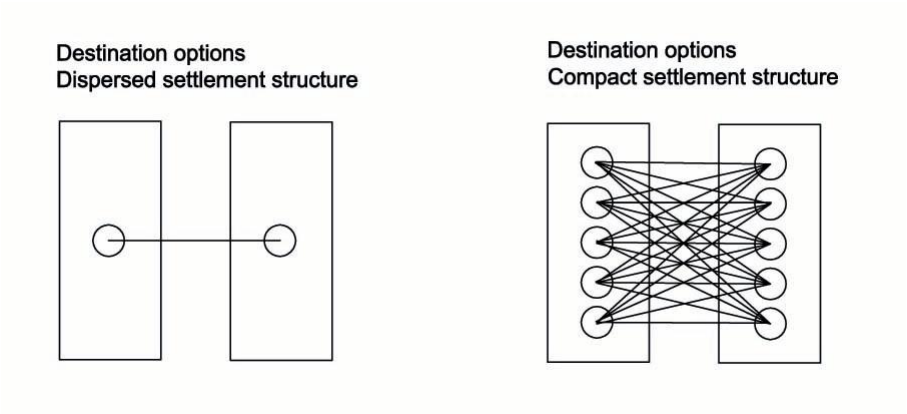

Figure 2: Destination options (adapted from Krug 2005)

Dispersed settlement patterns (as one-family house residential areas) generally provide good conditions for private motorised transport. Bicycle traffic can compete with the private automobile much better than walking or public transport. Considering the growth in dispersed suburban development caused by increasing motorisation, the bicycle plays an important role in compensating for this undesirable development. Dispersed settlement patterns often lead to “captive cyclists”. Bicycle traffic as a part of an integrated and sustainable transport system can offer a better alternative to car traffic than it can to the public transport. For longer distances, the best combination is bike and public transport (bike+ride and ride+bike). If we consider economic and ecological aspects, it is not possible to offer very attractive public transport in disperse areas.

The **connection of compact and dispersed settlement patterns** (for example cities and their surroundings) can be done best with the bicycle because it is suited to both compact and dispersed settlement patterns. Shorter distances can be covered by bike alone; in the case of longer distances, the bicycle can be augmented by public transport (bike+ride). Leading the public transport from urban to suburban areas (so that it can compete with the private motorised transport) would be neither economically nor ecologically sensible. Leading suburban car traffic to urban areas – as a mass phenomenon – threatens the quality of life in urban areas. Considering the need of space and ecological damages, car traffic destroys the high density of urban areas. Very similar is the problem of park+ride which diminishes urban quality around train stations and is very costly. As a part of an integrated and sustainable transport system, bicycle traffic and the combination of bike and ride are the ideal solutions to connect compact and dispersed settlement patterns.

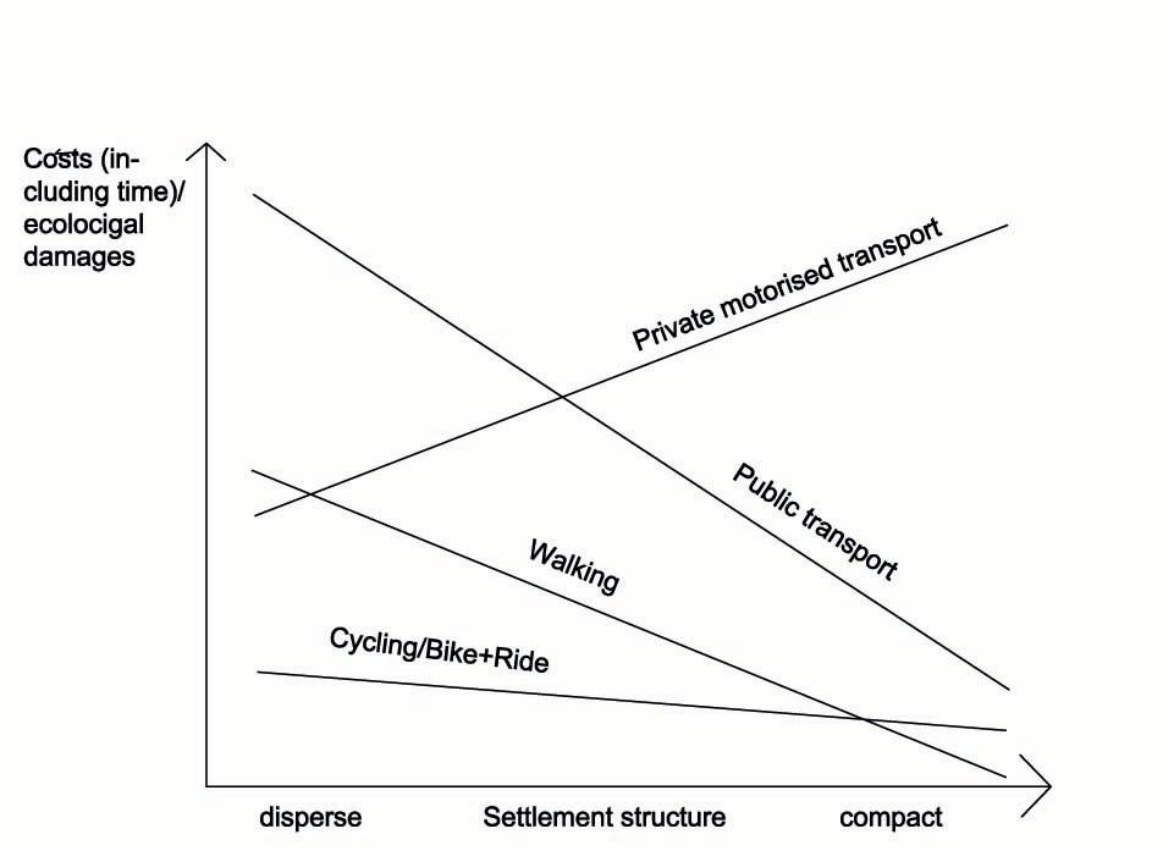

Figure 3: Settlement structure and transportation modes (adapted from Krug 2005)

4 Settlement patterns and their impacts on bike traffic – empirical approach

Now we will take a look at the share of bicycle traffic depending on settlement structure. Analysing this effect on a regional scale doesn't show big differences between the so-called "Regionstypen" (types of region) in Germany with agglomerations and rural areas (MiD 2002, p. 65). It is necessary to analyse the phenomena on a small scale – and it would be ideal to have small scale cells with an area of 500 by 500 metres (0.25 square kilometres, Krug 2005). As we don't have that, we analysed the districts of Munich having dimensions between about 3.2 and 34.1 square kilometres. Data on population density is available and is enough for a simplified analysis. It would be better, of course, to also consider the density of work places and shopping and leisure facilities. In general, a higher density of population is combined with more mixed zoning, and taking these additional aspects into consideration, the results would be the same – only more amplified.

In 2002, a large representative study called "Mobilität in Deutschland" (MiD 2002) was made. Approximately 3,600 households in Munich were questioned. (MiDMUC 2002). It is thus possible to compare the 25 districts (Stadtbezirke) based on data for 324 trips to 1,439 trips per district.

Comparing the maps of Figure 4 and 5, we cannot see very much. It is much more interesting to have a look at a diagram with the share of the bike and the other modes of transportation (modal split) and the population density (Figure 6). We can prove the theoretical approach with the facts that
- the higher population density is favourable for walking and public transport
- the lower population density is favourable for the private motorised transport
- the share of the bike is nearly independent of the population density.

In the appendix, you can see maps with the share of the other modes of transport relating to the 25 districts of Munich.

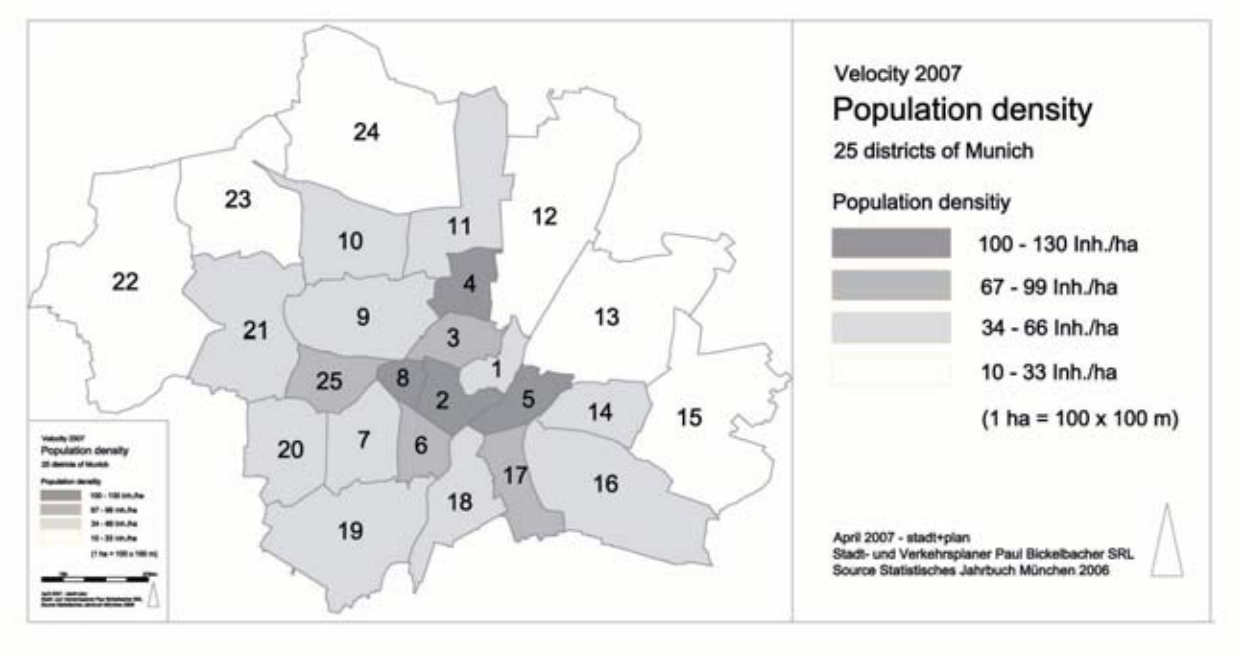

Figure 4: Population density in Munich

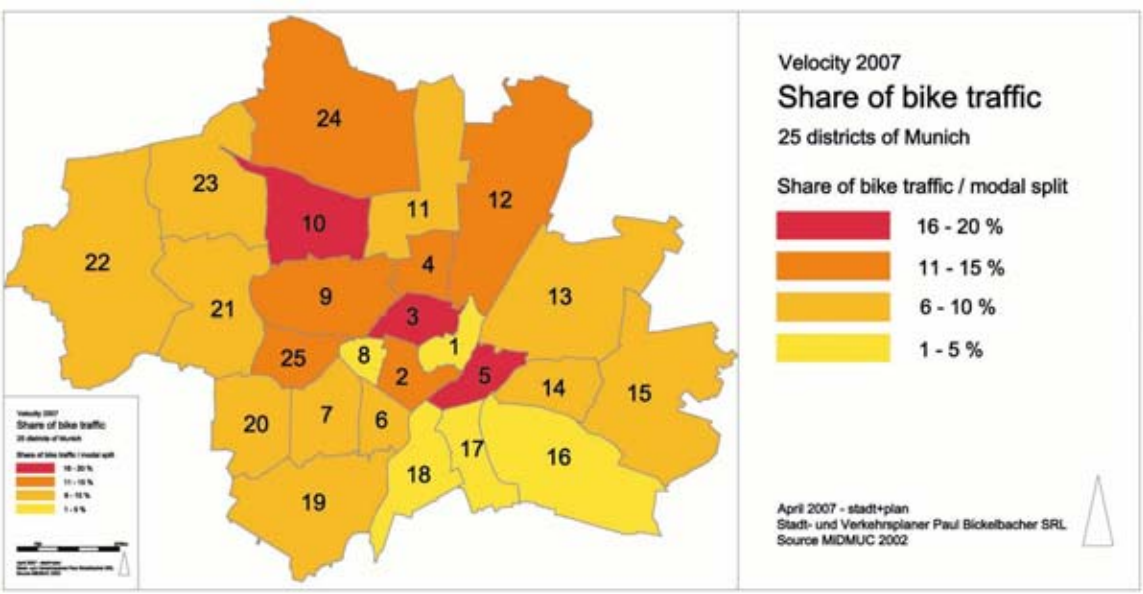

Figure 5: Share (modal split) of bike traffic in Munich

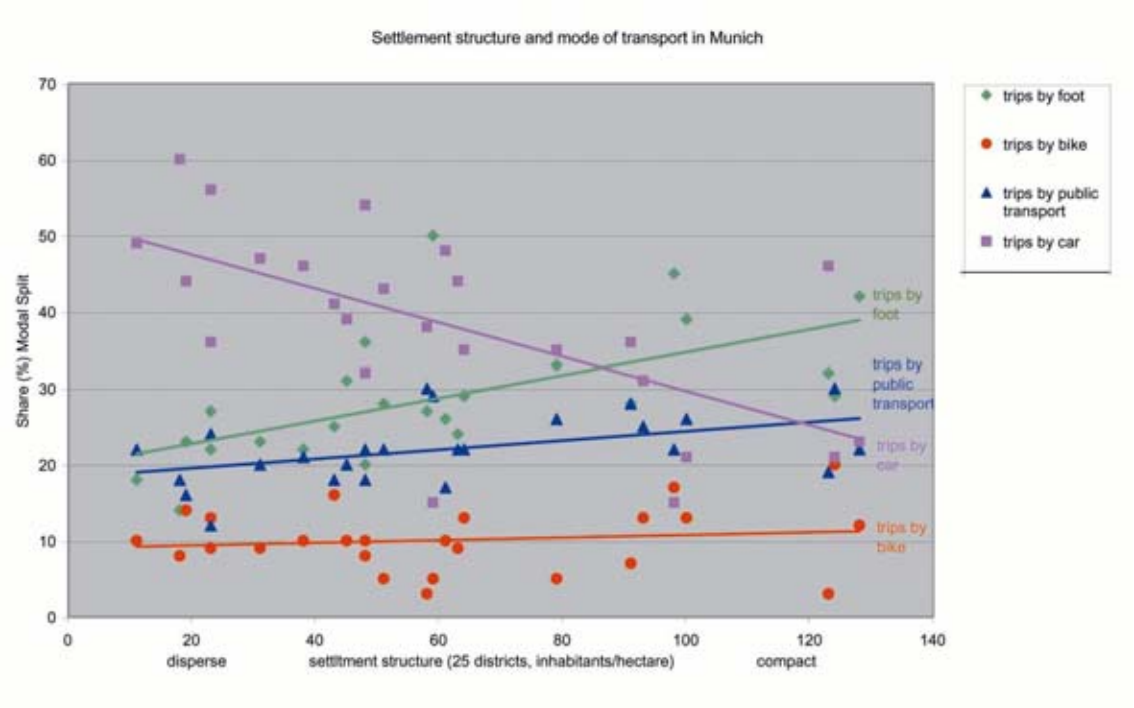

Figure 6: Modal split and population density in Munich

Other examples cities in Germany having an attractive, rail-bound public transport like Munich, the cities Cologne and Dresden show similar results (see appendix). The results of Kiel are different. There we can see a higher share of the bike than the share of public transport and also a higher share of the bike (modal split) in districts with a higher population density (see appendix).

Following the hypothesis of Chapter 3 that compact settlement patterns in combination with mixed zoning open up the chance to choose from the options of walking, cycling and public transport (or a combinations thereof), a more attractive cycling infrastructure should cause a higher share of bike trips within these settlement patterns. Kiel has no rail-bound public transport, and the cyclists of Kiel consider their city to be very attractive for cycling: Kiel got second place in the last German “Fahrradklimatest” (behind Münster, the German “bike capital”).

It would be very interesting to have more examples here and to compare with other European cities, especially countries with a very attractive cycling infrastructure as given in the Netherlands and in Denmark. Modal split data from Amsterdam (Apel and others 1997, page 98) and Copenhagen (Apel and others 2000, page 30) go in the same direction as the example of Kiel.

The most important result for further reflections is the confirmation that bike traffic is suited to both compact and dispersed settlement patterns.

5. Recommendations for town planning

Bike traffic must be promoted in all its various aspects so that it can play its important role as a part of an integrated and sustainable transport system. The financial and legislative frame should support bike-friendly town planning and traffic planning.

New development should be built along the main lines of public transport in high density and zoned for mixed functionality so that those living and working there have short trips for walking and cycling to their destinations and to connections for public transport. Existing developments along the main lines of public transport with a low population density should be developed in favour of higher intensity of land use. According to these reflections, Munich’s planning program is called “kompakt, urban und grün” – compact, urban and green. A good example of a city in a more rural area which has a planning program in favour of a city of short distances is Bocholt near Münster.

Another general bike-specific recommendation is that existing developments with no suitable supply infrastructure reachable by foot should at least receive a local supply structure reachable by bicycle. And the planning of housing and other buildings should always consider bicycle parking facilities.

6. Recommendations for traffic planning

In **compact settlement patterns** where space is scarce, the most important measures for cyclists are reduction of motorised traffic, citywide reduction in motorised traffic speeds and attractive parking facilities for bicycles at points of origin and destination – even if this means less parking for motorised vehicles.

In areas with a more **dispersed settlement pattern,** bicycle traffic can partially replace a less attractive public transport with the help of tangential primary cycle routes.

The **connection of compact and sparsely settled areas** can be attained with primary cycle routes radiating from the city centre to the outskirts as well as with attractive bike+ride facilities well integrated in the cycle route network. Following the results of our small investigation, the bike and bike+ride are the best solutions to connect compact and sparsely settled areas. Figure 7 shows how the catchment area of U and S-Bahn stations in Munich can be enlarged with bike+ride.

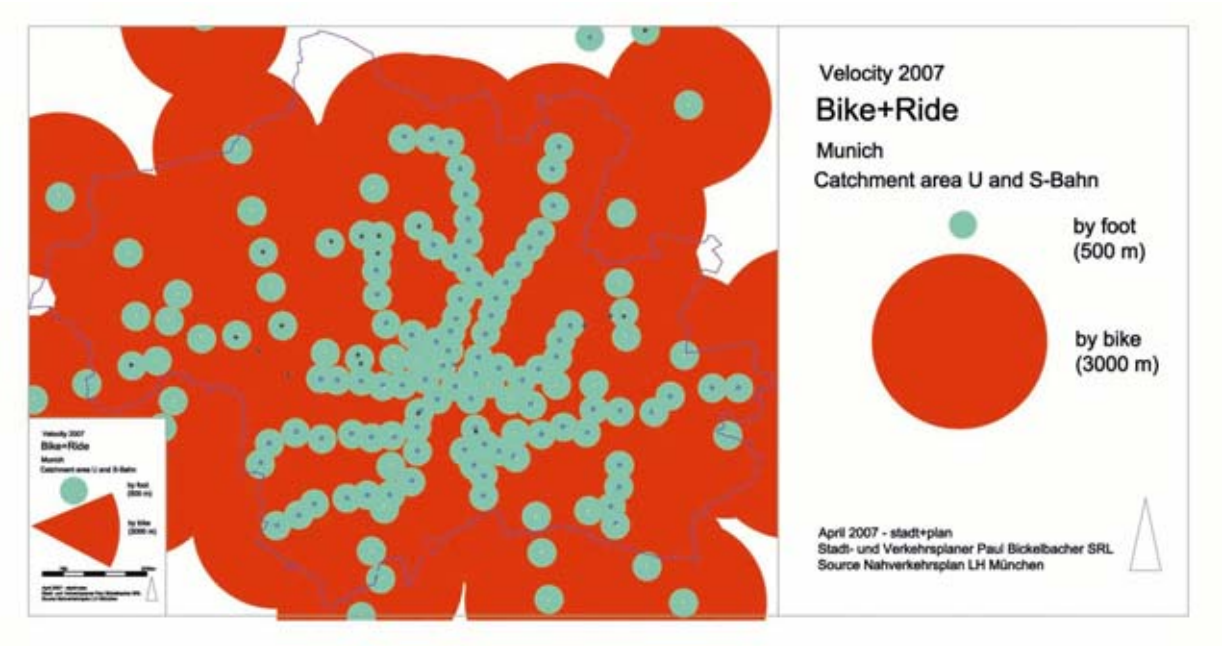

Figure 7: Catchment areas of U and S-Bahn in Munich

In eastern Germany, a lot of regions are confronted with a **decrease of population**. Fewer inhabitants could result in less private motorised transport which thus leaves more space for bike traffic in urban streets. In disperse areas with a lower population, the bike can, to a certain degree, compensate for a less attractive public transport when it is used as a shuttle to the stops.

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Appendix

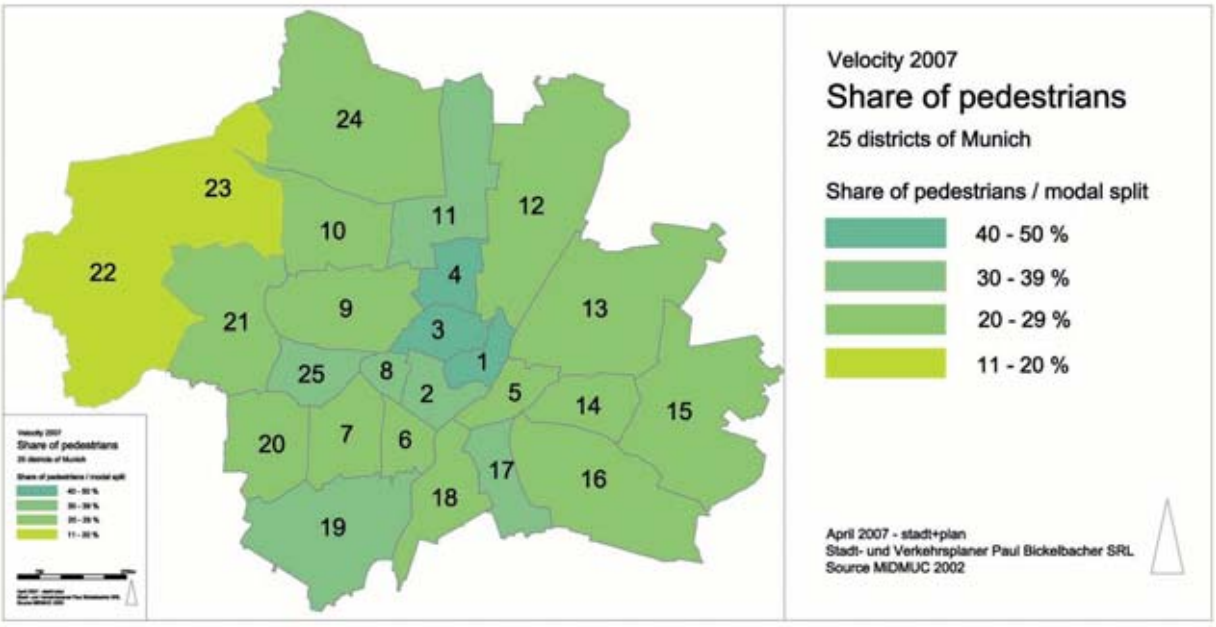

Figure 8: Share of walking (modal split) in Munich

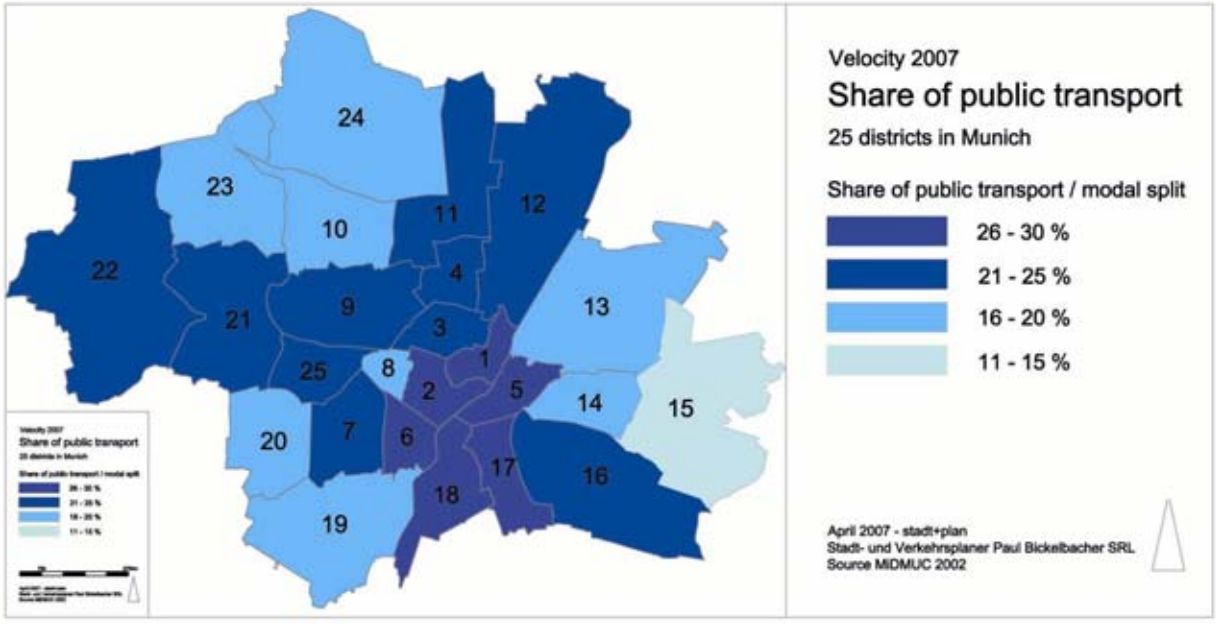

Figure 9: Share of public transport (modal split) in Munich

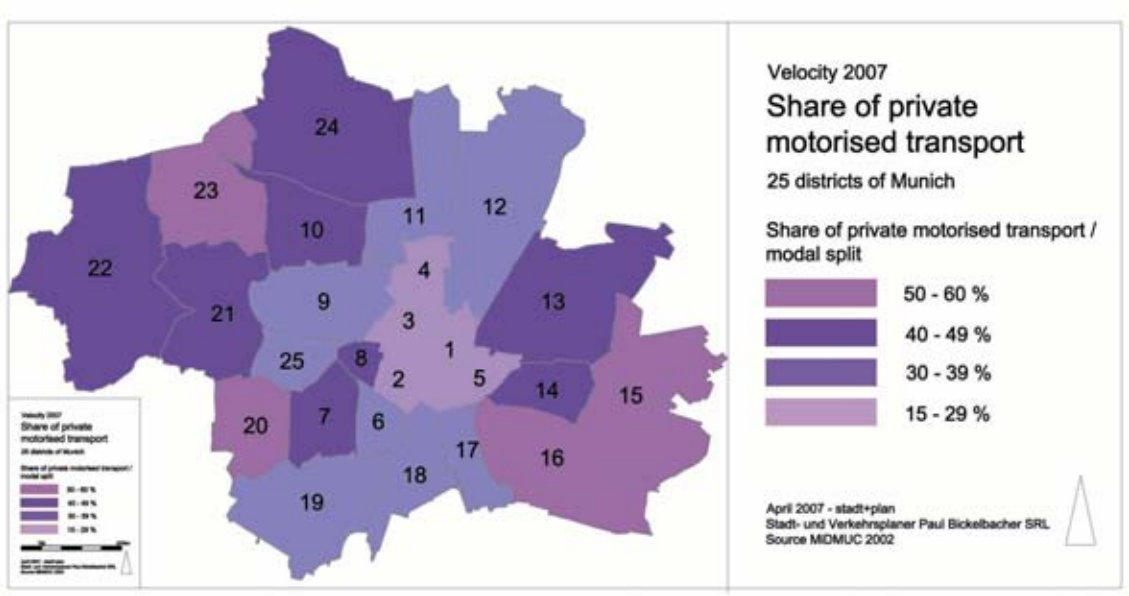

Figure 10: Share of private motorised transport (modal split) in Munich

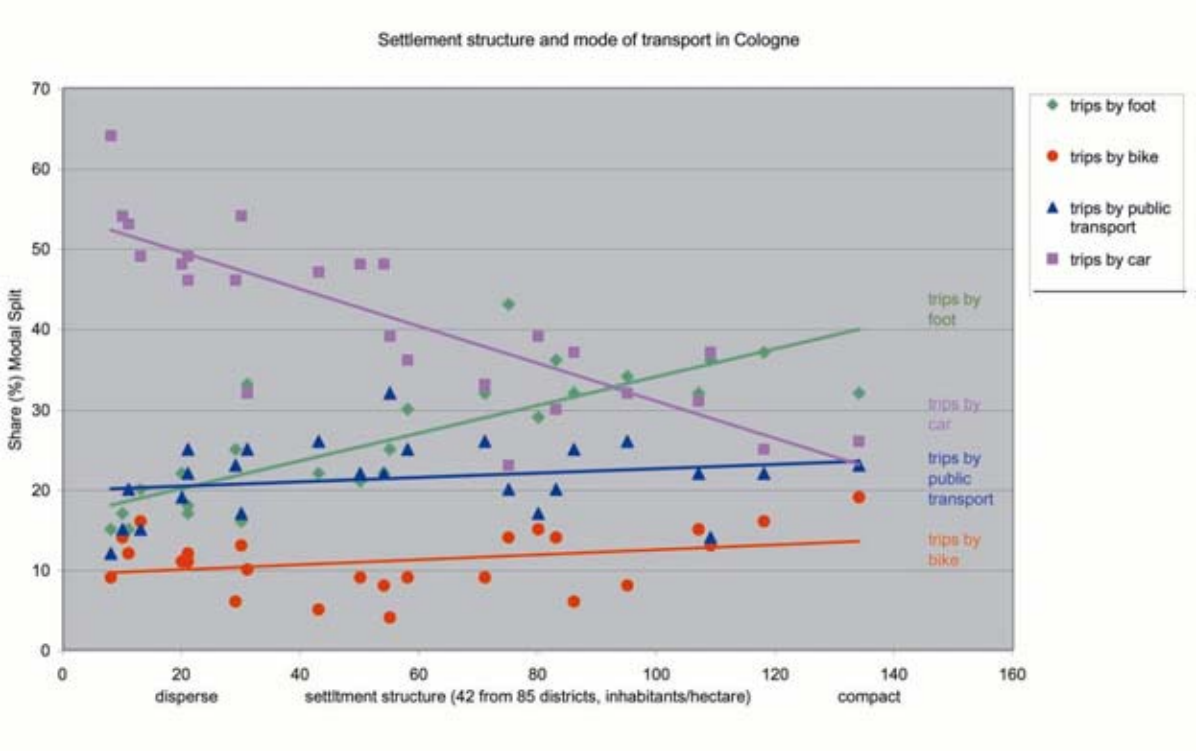

Figure 11: Modal split and population density in Cologne

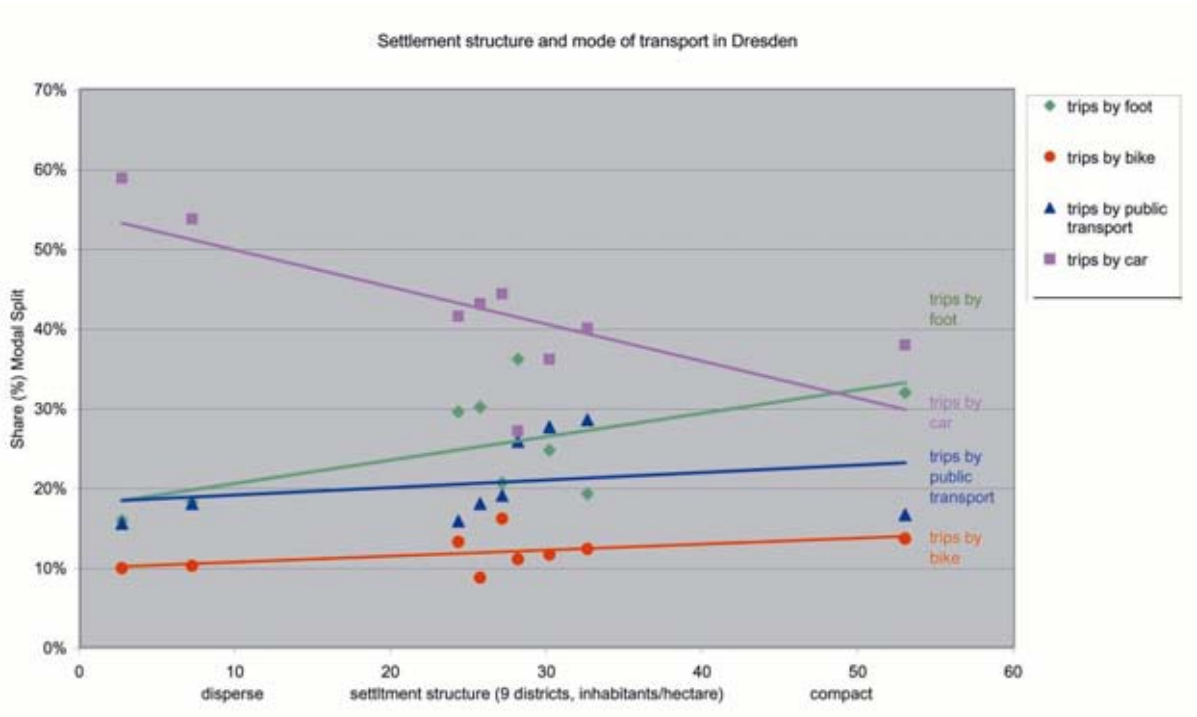

Figure 12: Modal split and population density in Dresden

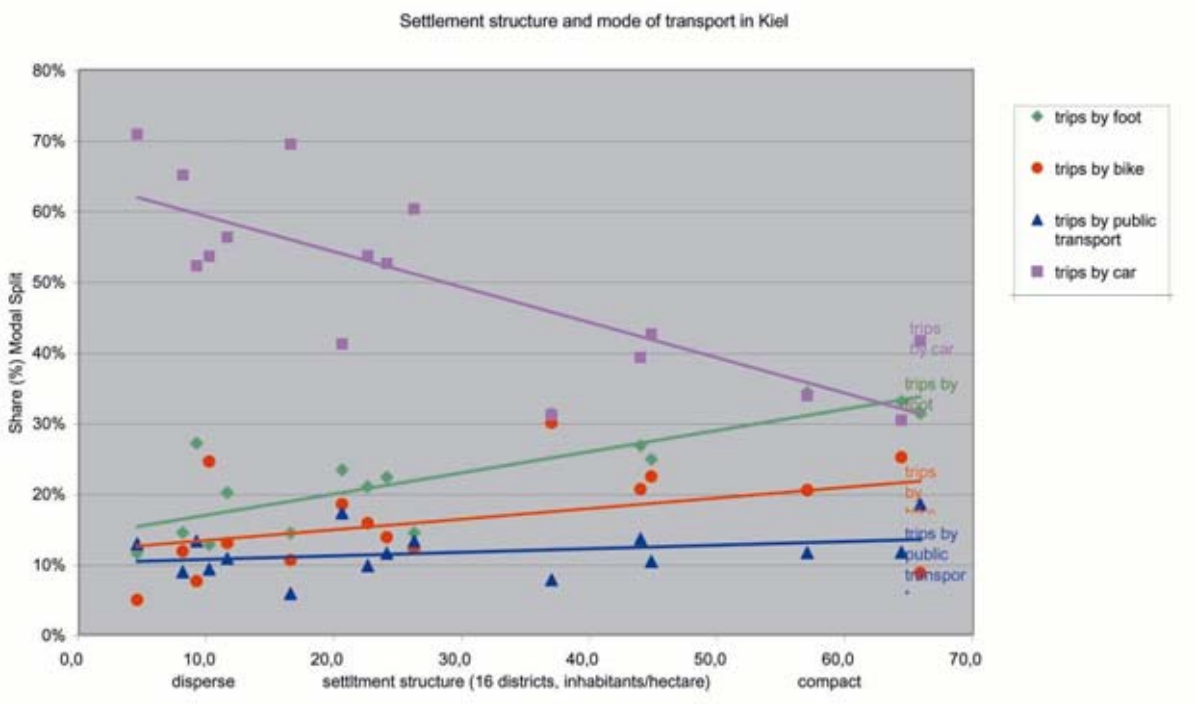

Figure 13: Modal split and population density in Kiel